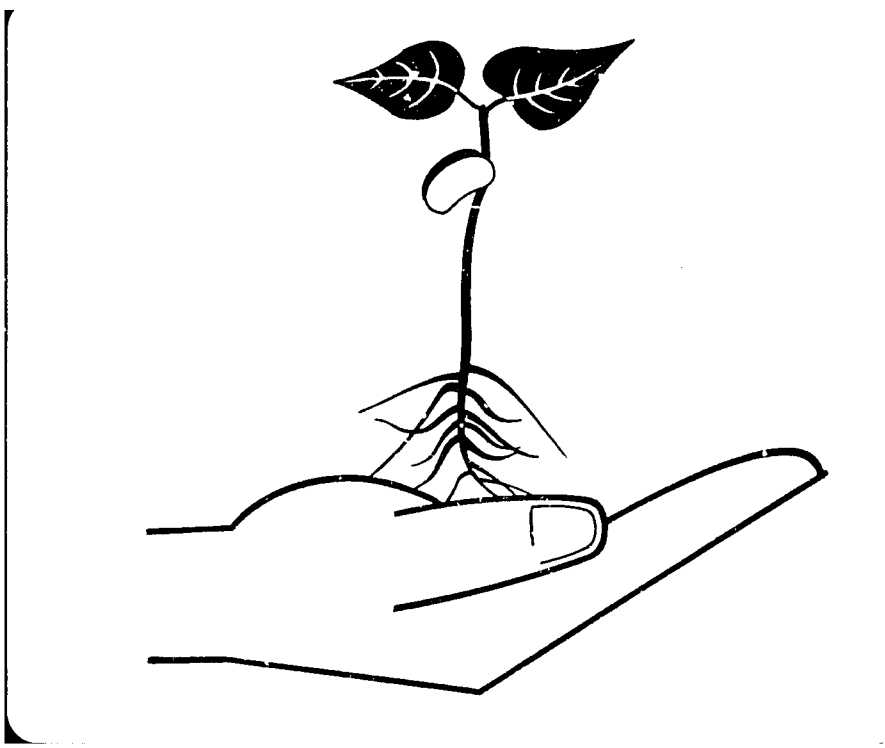
PN-AAN-082

Abstracts on Field Beans

Phaseolus vulgaris L.



Centro Internacional de Agricultura Tropical

CIAT is a nonprofit organization devoted to the agricultural and economic development of the lowland tropics. The government of Colombia provides support as host country for CIAT and furnishes a 522-hectare site near Cali for CIAT's headquarters. In addition, the Fundación para la Educación Superior (FES) makes available to CIAT a 184-hectare substation in Quilichao and a 73-hectare substation near Popayán. CIAT also co-manages with the Instituto Colombiano Agropecuario (ICA) the 22,000-hectare Carimagua Research Center in the Eastern Plains of Colombia, and carries out collaborative work on several of ICA's experimental stations in Colombia; similar work is done with national agricultural agencies in other Latin American countries. CIAT is financed by a number of donors represented in the Consultative Group for International Agricultural Research (CGIAR). During 1982 these CIAT donors are: the Rockefeller Foundation, the Ford Foundation, the International Bank for Reconstruction and Development (IBRD) through the International Development Association (IDA), the Inter-American Development Bank (IDB), the European Economic Community (EEC), the International Fund for Agricultural Development (IFAD), and the governments of Australia, Belgium, Canada, the Federal Republic of Germany, Japan, Mexico, the Netherlands, Norway, Spain, Switzerland, the United Kingdom, and the United States. In addition, special project funds are supplied by various of the aforementioned donors plus the Kellogg Foundation, the United Nations Development Programme (UNDP) and the International Development Research Center (IDRC).

Information and conclusions reported herein do not necessarily reflect the position of any of the aforementioned agencies, foundations or governments.

Publication of CIAT's
Bean Documentation Center

Documentalist: **Carlos Prío González G.**

PN-AAN-082 931/86/53

Abstracts on Field Beans

(*Phaseolus vulgaris* L.)

Vol. VII No. 1 April, 1982

CONTENTS

	FOREWORD	iii
	A GUIDE FOR USERS	v
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY	3
C00	PLANT PHYSIOLOGY	4
C01	Plant Nutrition	7
C02	Plant Development	9
C03	Chemical Composition, Methodology and Analyses	15
D00	AGRONOMY	18
D01	Soil Water, Climate and Fertilization	20
D02	Cultivation Practices: Planting, Weed Control and Harvesting	25
D03	Cultivation Systems: Intercropping, Rotational Crops	29
D04	Seed Production	31
D05	Varietal Trials	34
E00	PLANT PATHOLOGY	35
E02	Bacterioses	37
E03	Mycoses	41
E04	Viroses	48
E05	Nematodes	50
E06	Physiological Disorders	52

F00	PEST CONTROL AND ENTOMOLOGY	53
F01	Injurious Insects, Mites and their Control	58
G00	GENETICS AND PLANT BREEDING	61
G01	Breeding, Selection and Germplasm	66
G02	Cytogenetics	69
H00	NUTRITION	71
H01	Foods and Nutritive Value	74
I00	MICROBIOLOGY	80
I01	*Rhizobium* spp., Nitrogen Fixation and Nodulation	82
J00	ECONOMICS AND DEVELOPMENT	84
K00	FIELD PLOT TECHNIQUE	86
L00	GRAIN STORAGE	87
L01	Stored Grain Pests	88
Z00	GENERAL	89
	AUTHOR INDEX	90
	SUBJECT INDEX	92
	LIST OF ABBREVIATIONS	101

FOREWORD

CIAT's documentation activities are focused on three research areas: cassava (*Manihot esculenta* Crantz) production and utilization, field beans (*Phaseolus vulgaris* L.) as grown under tropical conditions, and tropical pasture species and their management. The goal of the Documentation Center is to disseminate research results and report ongoing activities in these three areas.

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide users with both an update service and a permanent record of information that contains essential data for their research activities. The abstracts are categorized in broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are subject and author indexed to enable more comprehensive consultation. When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users of this mechanized search service. The full text of every article abstracted by the Documentation Center is available, through the Center's photocopy service.

No one publication can cover the whole range of information needs. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include:

Pages of Contents - a current awareness reference to articles published in more than 500 scientific and technical journals. Every article indexed can be ordered through the Center's photocopy service.

Cassava Newsletter (Yuca - Boletín Informativo) - a technical newsletter that provides information regarding cassava research in progress throughout the tropics.

Pastos Tropicales - Boletín Informativo - a newsletter on pasture research and on new developments in the tropical pastures network.

Hojas de Fríjol - a newsletter on bean breeding, agronomy, and cropping systems, and on the activities within the bean researchers' network.

We believe that each of these types of information plays a key role in research aimed at increasing agricultural productivity in the tropics. It is our hope that this range of publications satisfies the various information needs of our users.

A GUIDE FOR USERS

Components of a reference

Sequential number in this journal

0001

1 ← 15869 VILHORDO, B.W.; MÜLLER, L.; EWALD, L.F.; LEÃO, M.L. 1980. Há-
2 ← bito de crescimento em feijão (*Phaseolus vulgaris* L.). (*Bean growth habits*). Agro- 4
3 ← nomia Sulriograndense (Porto Alegre) 16(1):79-98. Port., Sum. Port., Engl., 20
Refs., Illus. 5 6 7

8 ← *Phaseolus vulgaris*. Cultivars. Plant habit. Identification. Bush bean. Climbing bean. Brazil.

9 ← In order to define the types of growth habit of the common bean 45 cv. were studied, pertaining to the 9 commercial groups established for Brazil: Amarelo, Bico-de-Ouro, Manteigão, Mulatinho, Pardo, Preto, Rosinha, Roxinho, and Branco. The exptl. phase was carried out the Osorio Exptl. Station (Maquiné, Rio Grande do Sul) of the Secretary of Agriculture, during the agricultural yr 1976. Based on the data obtained, the following types of growth habit were established: I (determinate, bushy); II (undeterminate, with erect branching); III (undeterminate, with open branching); IV (undeterminate, prostrate, winding). Variance analysis of the length of the main stem, the length of the twine, and the no. of nodes of the main stem revealed significant differences among cv. However, when comparing the means of these parameters, no grouping of similar means was found which would permit to separate plants of the types II and III. (*Author's summary*) A00 B00
10 11

1- Accession number
2- Author(s)
3- Original title
4- Title translation
5- Source
6- Pages
7- Additional notes
8- Descriptors
9- Summary
10- Abstractor and/or translator
11- Subject categories

Note: The use of abbreviations in the abstracts has been standardized by the Information Center. A complete list of these abbreviations is included at the end of this journal.

Use of indexes

The author and subject indexes at the end of this journal were elaborated in collaboration with CIAT's Data Services Unit*. These indexes serve as guides for the user to carry out his own information searches.

* Special acknowledgments to María del Rosario Henao, Systems Eng.

Author index

Here you will find the complete list in alphabetical order of the authors of the documents summarized in this issue. The four-digit numbers at the right hand side of each author correspond to the sequential numbers of appearance of the documents herein (the number centered above the abstract).

Subject index

This index presents a list of terms in alphabetical order to which the user can translate his information needs on specific topics. To facilitate his search, most of these terms or general topics cover other subjects, and thus the user will find up to two more levels of specificity. The four-digit numbers under the terms correspond to the sequential number of the documents within this issue.

Photocopy requests

In some cases, the information contained in the abstract satisfies the needs of the user. However, if there is an interest in having the complete document, photocopies can be requested by indicating the access number that appears at the upper left corner of the reference. Send your request to:

Documentation Services Unit
Photocopies Section
CIAT
Apartado aéreo 6713
Cali, Colombia, S.A.

Payments can be made by check (in US dollars or Colombian pesos) payable to CIAT, or CIAT, AGRINTER or UNESCO coupons. For Colombia the cost of each photocopy is Col.$4.00 or US$0.10; for other countries, US$0.20. Payments should be made in advance.

A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0001

15869 VILHORDO, B.W.; MULLER . L.; EWALD, L.F.; LEÃO, M.L. 1980. **Hábito de crescimento em feijão (*Phaseolus vulgaris* L.). *(Bean growth habits).*** Agronomia Sulriograndense (Porto Alegre) 16(1):79-98. Port., Sum. Port., Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant habit. Identification. Bush bean. Climbing bean. Brazil.**

In order to define the types of growth habit of the common bean 45 cv. were studied, pertaining to the 9 commercial groups established for Brazil: Amarelo, Bico-de-Ouro, Manteigão, Mulatinho, Pardo, Preto, Rosinha, Roxinho, and Branco. The exptl. phase was carried out the Osorio Exptl. Station (Maquiné, Rio Grande do Sul) of the Secretary of Agriculture, during the agricultural yr 1976. Based on the data obtained, the following types of growth habit were established: I (determinate, bushy); II (undeterminate, with erect branching); III (undeterminate, with open branching); IV (undeterminate, prostrate, winding). Variance analysis of the length of the main stem, the length of the twine, and the no. of nodes of the main stem revealed significant differences among cv. However, when comparing the means of these parameters, no grouping of similar means was found which would permit to separate plants of the types II and III. *(Author's summary)* A00 B00

0002

16987 WEISETH, G. 1954. **Una variedad silvestre del poroto común (*Phaseolus vulgaris*), autóctona del noroeste argentino y su relación genética con variedades cultivadas. *(A wild bean variety. native in northeastern Argentina, and its genetic relationship with cultivated varieties).*** Revista Agronómica del Noroeste Argentino 1(2):71-81. Span., Sum. Span., 12 Refs.

Phaseolus vulgaris. Phaseolus spp. **Genes. Plant breeding. Plant anatomy. Taxonomy. Identification. Argentina.**

The genetic structure of a wild var. of *Phaseolus vulgaris*, present in NE Argentina (later described as *P. aborigineus*) was studied in crosses with different var. of *P. vulgaris*. As a result of these investigations, *P. aborigineus* is considered as a possible progenitor of *P. vulgaris* and as a source of new useful characters for introduction into cultivated species. *(Author's summary. Trans. by L.M.F.)* A00

0003

16965 BAKER, E.A.; HUNT, G.M. 1981. **Developmental changes in leaf epicuticular waxes in relation to foliar penetration.** New Phytologist 88(4):731-747. Engl., Sum. Engl., 42 Refs., Illus.

Phaseolus vulgaris. **Plant development. Leaves. Leaf area. Composition. Cell walls. Electron microscopy.**

Changes in surface properties during expansion of the leaves of 8 plant species, including beans, were examined in relation to the uptake of labelled NAA. The rate of wax production for adaxial/abaxial surfaces of bean leaves was 0.2/0.1 ng/cm^2/h. The rates of

synthesis of wax fractions and their constituent homologues varied with surface and with leaf age. The homologue distribution shifted towards components of longer chain length as the leaves expanded. Morphological changes in wax deposits were small and limited largely to increases or decreases in the density of the plate waxes. Rates of penetration of NAA varied between species, between leaf surfaces, and with age of tissue but the highest rates of uptake occurred when the leaves were expanding most rapidly. The decrease in penetration rate with increase in age of the tissue was common to most plants. *(Summary by Horticultural Abstracts)* A00 C02

See also 0022 0042

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY

0004

16433 JAFFE, M.J.; BIRO, R.; BRIDLE, K. 1980. **Thigmomorphogenesis: calibration of the parameters of the sensory function in beans.** Physiologia Plantarum 49(4):410-416. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Morphogenesis. Mechanical damage. Stems. Growth. Plant sensory function. Timing. Mathematical model.**

The construction of a thigmostimulator which reproducibly exerts measured amounts of force in an up-and-down rubbing motion on *Phaseolus vulgaris* stems is described. In the stress range used the amount of mechanical stress, MS, was related to the resulting plant elongation, E, by the equation: E = m ln MS + b where m is the slope of the line and b is the E intercept. The sensory function was saturated at very low forces (2 rubs at 3.59 N). Reciprocity between force and no. of stimuli only held when these were both low. No response occurred below a threshold of 0.5 N. Knowing the amount of force required to produce a given response it was calculated that two 1-cm rubs given by hand were equivalent to a force of 4.41 ± 0.60 N. *(Summary by Horticultural Abstracts)* B00

See also 0001 0006 0009 0076 0142

C00 PLANT PHYSIOLOGY

0005

16037 HARGREAVES, J.A. 1981. **Accumulation of phytoalexins in cotyledons of French bean (*Phaseolus vulgaris* L.) following treatment with Triton (T-octylphenol polyethoxyethanol) surfactants.** New Phytologist 87:733-741. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Plant injuries. Phytoalexins. Cotyledons. Plant tissues. Cytology. Biochemistry. Analysis.**

Triton surfactants induced accumulation of phytoalexins in cotyledons of French beans. The degree of accumulation was related to the phytotoxicity of the surfactant, which was dependant upon the length of the polyethoxyethanol side chain. Triton X-35, which induced the production of large amounts of phytoalexins, killed the outer epidermal cells and 2-3 layers of underlying subepidermal cells. Cells adjacent to these dead cells were affected but not killed by this treatment. The main group of isoflavonoids formed was the 5-hydroxyisoflavonoids (kievitone and licoisoflavone A). The 5-deoxyisoflavonoids (phaseollin, phaseollidin, and phaseollinisoflavan) were present only at low concn. When cotyledons treated with Triton X-35 were incubated in distilled water the major induced isoflavonoids were kievitone, which was located mainly in the cotyledons, and a compound tentatively identified as 2',4',5,7,-tetrahydroxyisoflavone, which was detected in the water medium. These results support the hypothesis that phytoalexin accumulation in the French bean is part of a wound response and involves an interaction between dead cells and their neighboring live cells. *(Author's summary)* C00

0006

16014 VAN ASSCHE, F.; CEULEMANS, R.; CLIJSTERS, H. 1980. **Zinc mediated effects on leaf CO_2 diffusion conductances and net photosynthesis in *Phaseolus vulgaris* L.** Photosynthesis Research 1(3):171-180. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. Zn. CO_2. Carbon fixation. Leaves. Stomata. Photosynthesis. Light. Nutrient solution. Plant tissues. Electron microscopy. Laboratory experiments.**

Supra-optimal levels of Zn in primary leaves of *Phaseolus vulgaris* increased the CO_2 compensation point and inhibited net photosynthesis. Leaf morphology was modified: mesophyll intercellular area, stomatal slit length, and interstomatal distance were reduced, but stomatal density increased. Internal and stomatal conductances to CO_2 diffusion decreased. These changes are discussed in relation to the observed effects on leaf gas exchange and to the previously reported inhibition of different photosynthetic and photorespiratory enzymes. *(Author's summary)* C00 B00

0007

16935 LINK, D.; COSTA, E.C.; PANICHI, J.A.V. 1980. **Efeito de desfolhamento artificial no rendimento de quatro variedades de feijoeiro (*Phaseolus vulgaris* L.). *(Effect of artificial defoliation on yields of four bean varieties).*** Revista do Centro de Ciências Rurais 10(4):329-333. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Abscission. Leaves. Yields. Experiment design. Field experiments. Brazil.**

Bean var. Tibagi, Cuva 168N, Preto Comum, and Vermelho Comum had 0, 1, and 2 leaflets of each leaf removed in order to determine the effect of different levels of artificial defoliation on yields. Defoliation was done 35 and 49 days from seedling emergence. The greatest reduction in yield occurred during the 2nd period of defoliation in all var. The remotion of one leaflet/leaf during the 1st period only reduced the yield of var. Vermelho Comum. *(Author's summary)* C00 D00

0008

16991 JURSINIC, P.A. 1977. **Photosystem II charge stabilization reactions in isolated chloroplasts.** Ph.D. Thesis. Urbana, University of Illinois. 200p. Engl., Sum. Engl., 165 Refs., Illus.

Phaseolus vulgaris. **Photosynthesis. Light. Chloroplasts. Chlorophyll. O. Plant physiological processes.**

The decay of delayed light emission and the rise in chlorophyll-*a* fluorescence was monitored in isolated chloroplasts from a no. of species including pea cv. Alaska and *Phaseolus vulgaris* beginning 6 μs after a 10 ns excitation light pulse. The results were consistent with the recombination of the primary charge couple as the source for delayed light emission. *(Summary by Field Crop Abstracts)* C00

0009

16973 GERSANI, M.; LIPS, S.H.; SACHS, T. 1980. **Effects of wounding on transport in the phloem.** Journal of Experimental Botany 31(122):783-789. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Plant injuries. Plant vascular system. Nutrient transport. Sugars. Plant-growth substances. Laboratory experiments.**

The nature of the mechanisms of the recovery of the phloem of *Phaseolus vulgaris* from the effects of wounds was studied. The influence of root removal on the transport of [^{14}C] sucrose and of fluorescein was followed both in the direction of the root and in the opposite direction, towards the intact shoot. The removal of the root was found to cause a sharp but temporary decrease in the transport of sucrose towards the shoot; this was interpreted as the direct influence of the wound on the transport system. Similar results were observed concerning fluorescein transport, which also showed that the resumption of transport was in the entire phloem and not only in newly differentiated elements. *(Author's summary)* C00 B00

0010

16978 McLAUGHLIN, S.B.; TAYLOR, G.E. 1981. **Relative humidity: important modifier of pollutant uptake by plants.** Science 211(4478):167-169. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. **Relative humidity. Air pollution. Plant assimilation. O. CO_2. Leaves.**

In lab. trials *Phaseolus vulgaris* was exposed to 350-1550 μg SO_2/m^3 or 100-375 μg O_3/m^3 with RH maintained at 35 or 75%. SO_2 uptake was increased by 250% and O_3 uptake by 400% with increased RH. Hourly O_3 uptake was max. (0.28 μg/cm^2) at 150 μg O_3/m^3 and SO_2 uptake was max. (0.80 μg/cm^2) at 800 μg SO_2/m^3. The rate of uptake of both pollutants decreased with increasing pollutant concn. Leaf conductances for O_3 or SO_2 were greater than these for CO_2. Conductance increased with RH and the pollutant; CO_2 conductance ratio decreased with increasing pollutant concn. Leaf resistance to O_3 increased 46% at high RH and 833% at low RH as O_3 concn. increased from 150 to 280 μg/m^3. Photosynthetic rate dropped very little over the same O_3 concn. range. It was concluded that leaves became more resistant to pollutant entry as the concn. increased but still allowed favorable entry of CO_2. *(Summary by Field Crop Abstracts)* C00

17304 PEIRSON, D.R.; ELLIOTT, J.R. 1981. **In vivo nitrite reduction in leaf tissue of *Phaseolus vulgaris* L.** Plant Physiology 68:1068-1072. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Nutrient absorption. N. Enzymes. Leaves. Plant physiological processes.**

Expt. were performed to establish a procedure for in vivo measurement of nitrite utilization by leaf tissue of bean cv. Top Crop. To measure light-dependent nitrite disappearance, a single disc of leaf tissue was exposed to light for 1 h at 30°C while immersed in incubation medium (approx. 0.11 ml/cm^2 of leaf area) in the bottom of a tall-form glass beaker. The incubation medium was 100 m*M* phosphate buffer (pH 7.5) with added wetting agent and nitrite. The wetting agent combination of 1% 1-propanol + 0.05% Neutronyx-600 was used in some expt. for compatibility with established in vivo nitrate reductase (NR) assays; however, 0.05% Neutronyx-600 alone was found to be a suitable substitute. Parallel assays run in the dark on related tissue are recommended as a means to determine the amount of nitrite synthesized within the tissue by the NR system. Adding the results of the 2 assays gives an estimate of total nitrite utilization by the leaf tissue. It was found that 20 m*M* nitrite in the incubation medium was the most suitable level of external nitrite for promoting light-dependent nitrite disappearance. This was also found to reduce, sometimes to 0, the rate of synthesis of nitrite by NR. NR activity declines steadily with advancing age. Except for very young tissue, the rate of nitrite disappearance was independent of age. Nitrite disappearance was completely blocked by diuron. *(Author's summary)* C00

See also 0051 0059

C01 Plant Nutrition

0012

16425 BORCHERS-ZAMPINI, C.; GLAMM, A.B.; HODDINOTT, J.; SWANSON, C.A. 1980. **Alterations in source-sink patterns by modifications of source strength.** Plant Physiology 65(6):1116-1120. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. Carbohydrate content. Leaves. Nutrient transport. Stems. Nutrient solution. Plant assimilation. Translocation. Plant vascular system. Seedlings.**

Phaseolus vulgaris cv. Black Valentine plants were trimmed to a simplified translocation system, the paired primary leaves serving as source and the paired lateral leaflets of the immature 1st trifoliate leaf as sink. This system was used to study the magnitude and short-term time course of change in the partition ratio of assimilates translocated from the labelled primary leaf to its resp. near- and far-leaflet sinks in response to an increase or decrease in the source strength of the opposite primary leaf which was used as a control. If the rates of net photosynthesis in the 2 primary leaves were similar, assimilates from the labelled source leaf partitioned to the leaflet sinks in the ratio of 5:1 or higher, the dominant sink being the leaflet 'nearer' to the labelled source leaf. If the rate of net photosynthesis in the control leaf was increased substantially above that of the labelled source leaf, the rate of translocation from the labelled source to either the near leaflet sink or far leaflet sink remained unaffected, despite a presumably higher translocation rate from the control leaf and hence a higher phloem pressure gradient (or increased cross sectional area) in the transport pathway from the control leaf to the leaflet sinks. If the control leaf was excised, thus reducing the source leaf area by approx. 50%, the translocation rate from the remaining source leaf rapidly doubled, the partition ratio becoming equal to unity. If the control leaf was darkened, the partition ratio adjusted to an intermediate value. Although export rates from the labelled source leaf were increased either by excising or darkening the control leaf, the rate of net photosynthesis in the labelled leaf remained constant. *(Author's summary)* C01

0013

16937 MALAVOLTA, E.; NOGUEIRA, F.D.; OLIVEIRA, I.P.; NAKAYAMA, L.; EIMORI, I. 1981. **Aluminum tolerance in sorghum and bean - methods and results.** Journal of Plant Nutrition 3(1-4):687-694. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **pH. Al. Host-plant resistance. P. Nutrient absorption. Dry matter.**

A summary is given of the results obtained in expt. designed to differentiate among 30 cv. of grain sorghum and 38 cv. of beans those less sensitive to high levels of Al in the medium, as well as to establish rapid methods for screening, and to determine the relationship between Al effect and mineral nutrition. Care was taken to separate Al from H ion effects. Preliminary trials showed that DM production by seedlings grown for short periods gave better indication of Al tolerance than other parameters. Very close correlations were found to exist between radiophosphate uptake either by excised roots or intact plants and Al tolerance. Al toxicity was associated to the reduction in Ca, K, and particularly Mg uptake in short-term expt. Although differences do exist among cv., it is concluded that this characteristic does not fully obviate the need for use of lime. *(Author's summary)* C01 D01

0014

15863 MALAVOLTA, E.; BRASIL SOBRINHO, M.O.C.; REZENDE, H.E.C.; VITTI, G.C.; AMARAL, F.A.L. 1980. **On the relationship between efficiency of utilization of nitrogen, phosphorus and potassium by several bean varieties** *(Phaseolus vulgaris* L.) and yield potential. Revista de Agricultura (São Paulo) 55(4):275-278. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Nutritional requirements. N. P. K. Cultivars. Nutrient solution. Nutrient absorption. Yields. Statistical analysis. Selection.**

Ninety bean var. were grown in nutrient solution till maturity. Grain production plant was converted in yield/ha and this was called "yield potential". By dividing the production/plant by the amount each of N, P, and K taken up/day, an estimate was obtained of the efficiency (E) of utilization of the 3 nutrients. Highly significant correlation coefficients were found to exist between E values and yield potential which suggests that this parameter may be useful in selection and breeding programs. *(Author's summary)* C01 G00

0015

16939 MURPHY, L.S.; ELLIS JUNIOR, R.; ADRIANO, D.C. 1981. **Phosphorus-micronutrient interaction effects on crop production.** Journal of Plant Nutrition 3 (1/4):593-613. Engl., Sum. Engl., 62 Refs., Illus.

Phaseolus vulgaris. **Nutritional requirements. Micronutrients. P. Fertilizers. Soil requirements. Plant nutrition. Plant physiological processes.**

Recent research in P-micronutrient interactions is summarized including both physiological, soil, and fertilizer formulation aspects. Recommendations for future areas of research along with the efficient use of P and micronutrients are included. *(Extracted from author's summary)* C01 D01

0016

16992 LINDEN, C.T.G. 1977. **The mist culture system in the study of growth in lettuce and beans at low salt concentrations.** Ph.D. Thesis. Ithaca, New York, Cornell University. 109p. Engl., Sum. Engl., 84 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. Culture media. Laboratory experiments. Osmotic potential. Growth. Roots. Stems. Leaves. Flowers. Salinity.**

Mist culture is defined and the development of the method is reviewed. The system used at Cornell U. (New York, USA) to study the growth of lettuce and *Phaseolus vulgaris* at 4 osmotic potentials (-0.25, -0.50, -0.75, and -1.00 atm.) of nutrient solutions is described. Growth in all mist treatments was superior to that of the controls in a peat mix, and neither max. growth nor water uptake followed simple osmotic gradients. Max. dry wt. of shoots and roots of *P. vulgaris* occurred at 0.50 atm., but max. root growth occurred at -0.25 atm. and lowest root and shoot dry wt. occurred at -1.0 atm. *(Summary by Field Crop Abstracts)* C01

C02 Plant Development

0017

15244 ISLAM, A.K.M.S.; EDWARDS, D.G.; ASHER, C.J. 1980. **pH optima for crop growth. Results of a flowing solution culture experiment with six species.** Plant and Soil 54(3):339-357. Engl., Sum. Engl., 67 Refs., Illus.

Phaseolus vulgaris. **Cassava. Nutrient solution. pH. Plant injuries. Nutrient absorption. Mineral content. Growth. Yields.**

Ginger, cassava, maize, wheat, french beans, and tomato were grown for periods up to 6 wk. in continuously flowing nutrient solutions at 7 constant pH values ranging from 3.3-8.5. All species achieved max. or near-max. growth in the pH range 5.5-6.5. However, there were substantial differences in the ability of species to grow outside this range. Ginger and cassava were the most tolerant species to low solution pH, while ginger and tomato were the only species to show no yield depression at the highest solution pH. Roots of all species at pH 3.3 and some species at pH 4.0 exhibited symptoms of H ion injury. In addition, the concn. of Mg in the tops of all 6 species, of N in the tops of tomato and cassava, and of Mn in the tops of maize at these pH values were inadequate for optimal growth. Growth depression at high solution pH was associated with Fe deficiency in maize and wheat and with N and/or Cu deficiency in cassava. The relevance of the present results to crop growth under field conditions is discussed. The complex interplay of plant and soil characteristics militates against precise definition of an optimum pH range for the growth of a particular crop unless the soil is also specified. *(Author's summary)* C02

0018

16012 EZE, J.M.O.; DUMBROFF, E.B.; THOMPSON, J.E. 1981. **Effects of moisture stress and senescence on the synthesis of abscisic acid in the primary** leaves of bean. Physiologia Plantarum 51:418-422. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Drought. Water stress. Leaves. Abscission. Plant-growth substances. Chlorophyll. Protein content. Plant physiological processes.**

The capacity for ABA synthesis during moisture stress of primary leaves of bean cv. Kinghorn was defined in terms of leaf age and associated changes in several physiological parameters. The leaves were fully expanded within 9 days after emergence. Fresh and dry wt./unit of leaf area fell during all 5 wk. of the study, from leaf expansion through advanced senescence. The most significant losses in wt. occurred during the 3rd and 4th wk. and coincided with a sharp drop in protein content that began immediately after full-leaf. Chlorophyll concn. declined rapidly during leaf expansion and then more slowly through the end of the 5th wk. when the leaves were ready to abscise. The ratio of chlorophyll *a* to *b* rose steeply over the 1st 4 wk. of the study. Although a rapid loss of protein provided the most definitive indication of the early stages of leaf senescence, a marked decline in the ability to synthesize ABA was more closely associated with the termination of rapid leaf growth. This relationship between leaf expansion and the capacity for ABA synthesis during moisture stress remained unchanged when ABA content was expressed on a per unit chlorophyll, protein or dry wt. basis. A water deficit between 5-10% of fresh wt., representing a drop in water potential of less than 150 kPa, was sufficient to initiate accumulation of ABA

in young leaves. Slightly more intensive levels of stress were required to stimulate ABA synthesis in senescent leaves, but total accumulation was < 1/10 of the amount recorded in the younger tissue. *(Author's summary)* C02 D01

0019

15872 GUTIERREZ, L.E.; BASSO, L.C.; BRANCALION, M.J. 1980. **Amina oxídase em plantas. II. Atividade durante a germinação de *Phaseolus vulgaris*.** *(Amine oxidase in plants. II. Activity in bean seedlings during germination).* Revista de Agricultura (São Paulo) 55(3):195-200. Port., Sum. Port., Engl., 13 Refs.

Phaseolus vulgaris. **Seeds. Seedlings. Germination. Enzymes. Epicotyls. Cotyledons. Plant physiological processes.**

Germination of bean seeds is followed by a decrease in protein and DM contents and an increase in amine oxidase activity reaching a max. in 5 days (epicotyls) and 6 days (cotyledons). The filtrated extract from epicotyls and cotyledons was able to oxidize putrescine and spermidine but not spermine. Light showed a positive stimulus in amine oxidase activity in cotyledons but a negative effect in epicotyls. *(Author's summary)* C02 C03

0020

16015 KENIS, J.D.; TRIPPI, V.S. 1981. **Actividad ribonucleasa y abscisión en explantos de *Phaseolus vulgaris*, y su regulación por luz, sacarosa y glicerol.** *(Ribonuclease activity and abscission in Phaseolus vulgaris explants and their regulation by light, sucrose and glycerol).* Phyton (Argentina) 40(2):147-158. Span., Sum. Engl., Span., 32 Refs., Illus.

Phaseolus vulgaris. **Leaves. Abscission. Nucleic acids. Enzymes. Sugars. Plant physiological processes. Light.**

RNAase activity was studied in proximal and distal zones of *Phaseolus vulgaris* leaf explants. In explants from young leaves that did not abscise during the course of the expt., red (R) and far red (FR) irradiation increased activity. In explants from mature leaves R inhibited abscission but increased RNAase activity, while FR had the opposite effect. In explants from older leaves, abscission in R was as high as in FR, but RNAases were stimulated only by R. Sucrose and glycerol stimulated abscission, but only sucrose increased RNAase activity.Thus, increases in RNAase activity, a characteristic of aging, may be found accompanying abscission, but both phenomena are independent. *(Author's summary)* C02

0021

16484 YEANG, H.Y.; HILLMAN, J.R. 1981. **Internodal extension in the first trifoliate leaf axillary bud of *Phaseolus vulgaris* L. following shoot decapitation.** Annals of Botany 48:25-32. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Plant development. Growth. Correlative inhibition. Buds. Leaves. Stems. Cytology.**

Phaseolus vulgaris L. decapitated at the 3rd internode showed accelerated growth of the uppermost axillary but remaining on the stem (the 1st trifoliate axillary bud) after a lag period of 3-5 h. Much of the initial growth increment could be attributed to cell expansion. *(Author's summary)* C02

0022

16432 KIGEL, J. 1980. **The role of the leaves in the regulation of internode elongation in *Phaseolus vulgaris*.** Physiologia Plantarum 49(2):161-168. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Stems. Leaves. Abscission. Auxins. Growth. Statistical analysis.**

Time-course patterns of leaf and internode elongation were studied in bean cv. Bulgarian plants. Each leaf started its main elongation period when the leaf below reached half its final length. Excision of young leaves increased the rate of stem elongation. IAA or NAA (1% in lanolin) suppressed the enhancing effects of leaf excision on leaf and internode elongation. The excision of a young leaf increased the final length of internodes located below it, and reduced the final length of the internodes located above it. The reduction was greater the younger the internode. *(Summary by Horticultural Abstracts)* C02 A00

0023

16791 CARMI, A.; HEUER, B. 1981. **The role of roots in control of bean shoot growth.** Annals of Botany 48(4):519-527. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Growth. Roots. Stems. Leaves. Plant-growth substances. Water content. Mineral content. Carbohydrate content. Dwarf bean. Water stress. Laboratory experiments.**

Restriction of root growth by growing bean plants in very small pots led to the development of dwarf plants. The leaves of those plants were smaller and their internodes shorter than those of control plants which were grown in larger pots and had developed a more extensive root system. A large quantity of starch - much more than in control plants - accumulated in the leaves and shoots of the dwarf plants. Increasing the amount of minerals which was supplied to the roots, enhanced leaf growth of the control plants but failed to affect the dwarf ones, in spite of the fact that in both cases the treatment increased the content of N, P, and K in all the plant organs. The leaf water content was similar in both treatments, but the leaf water potential was higher in the dwarf plants. Exogenous application of GA_3 to the dwarf plants overcame the reduction of stem growth completely, and that of the leaves partially. Application of the cytokinin, benzyladenine (BA) did not affect stem growth, but increased that of the primary leaves. A combined supply of GA_3 + BA restored completely the growth of the stem and the primary leaves, and partially that of the trifoliate leaves. It is concluded that a limited root system restricts shoot growth through an hormonal system in which at least gibberellins and cytokinins are involved, and that the dwarfing is not a consequence of mineral or assimilate deficiency, or due to water stress. *(Author's summary)* C02

0024

16727 PRAKASH, K.S.; RAM, H.H. 1981. **Path-coefficient analysis of morphological traits and developmental stages in French-bean.** Indian Journal of Agricultural Sciences 51(2):76-80. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Snap bean. Seed production. Yields. Yield components. Agronomic characters. Developmental stages. Statistical analysis.**

Observations on morphological traits and durations of vegetative and reproductive stages of 28 germplasm lines of French bean were subjected to path analysis assuming the yields of green pods and dry seed separately as final products. None of the vegetative intervals had a significant phenotypic correlation with seed yield. The same was true for the yield of green pods except for duration of vegetative stage V_5 (5 nodes on the main stem including primary leaf node), which had a significant negative correlation (−0.395). None of the intervals between the reproductive stages were correlated with the yield of green pods; but the no. of days in the reproductive state R_1 (pod 2.50-2.75 cm long at 1st blossom position) had a significant negative correlation (−0.462) with the yield of dry seed. The direct effect of V_5 and R_1 primarily accounted for the correlations. Green pod yield was highly associated with plant height, green pods/plant, and wt. of green pod. Dry seed yield was positively correlated with plant height, plant spread, dry pods/plant, and seeds/pod. The no. of pods/plant assumed a major role in determining green and dry seed yield simultaneously. The direct effect of seed wt. on dry seed yield was counterbalanced by its negative indirect effect via pods/plant and seeds/pod. *(Author's summary)* C02 D00

0025

16743 GEPSTEIN, S.; ILAN, I. 1980. **Evidence for the involvement of cytokinins in the regulation of proteolytic activity in cotyledons of germinating beans.** Plant and Cell Physiology 21(1):57-63. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Plant development. Germination. Cotyledons. Proteins. Enzymes. Cytokinins. Embryo. Seedlings.**

The proteolytic activity of an extract of cotyledons of *Phaseolus vulgaris* increased during the 1st 7 days of germination, both when casein and when the endogenous protein was the substrate. The increase was partially dependent on the presence of the embryo axis. The effect of the axis was replaceable by kinetin or zeatin, but not by GA or IAA. During 3-6 days after the beginning of incubation, the level of amino acids in cotyledons attached to the embryo axis was lower than in detached ones. No such difference could be detected in the 1st 2 days of incubation. The influence of the axis on protease activity was already clearly detectable on the 2nd day of germination. Application of casein hydrolysate to the seeds increased the concn. of amino acids in the cotyledons, but no simultaneous decrease in the protease level could be detected. The results did not confirm the hypothesis that the influence of the axis on proteolytic activity is due to its function as a sink for amino acids produced in the cotyledons. *(Author's summary)* C02

0026

16496 ARNISON, P.G. 1975. **Isoenzymatic characterization of cell cultures of bush bean (*Phaseolus vulgaris* cv. Contender).** Ph.D. Thesis. Montreal, Canada, McGill University. 241p. Engl., Sum. Engl., 358 Refs., Illus.

Phaseolus vulgaris. **Plant development. Tissue culture. Enzymes. Growth. Protein content. Plant tissues. Roots. Leaves. Seeds. Cotyledons. Proteins. Biochemistry. Analysis. Bush bean.**

Isoenzyme patterns of various enzymes were studied in callus and suspension cultures of root, hypocotyl, and cotyledon of bush bean. Isoenzyme patterns changed during the culture cycle and reflected the successive stages. Persistent differences in pattern were detected among the cultures and there was a correlation between cell expansion and peroxidase activity. Effects of 2,4-D and kinetin on growth, cell form, and the isoenzyme complements are reported. The isoenzyme patterns of stock and newly established cultures were compared with those of the mature plant and seedling parts. Often the isoenzyme patterns of cultured cells were most similar to those of root; however, persistent isoenzymatic differences were detected among the cultures and some of these differences could be attributed to the tissue of origin. The relevance of the results to the persistence and stability of characteristics in plant cell cultures and to differentiation is discussed. *(Author's summary)* C02

0027

16798 BINNIE, R.C.; CLIFFORD, P.E. 1981. **Flower and pod production in *Phaseolus vulgaris*.** Journal of Agricultural Science 97:397-402. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. **Flowering. Podding. Flowers. Pods. Abscission. Seeds. Cultivars. Yield components. Plant physiological processes.**

A series of glasshouse and growth-cabinet expt. were carried out to investigate aspects of flower and pod production in French beans. Abscission of flowers and immature pods varied between 45-80% in the 7 cv. tested, with flowers which opened 1st being most likely to produce mature pods. Seed yield was only slightly reduced and sometimes increased by the removal of opened flowers for periods of up to 15 days from the start of anthesis depending on the conditions under which plants are grown. It was demonstrated that plants compensated for flower removal by setting pods from flowers which opened later. Similarly, when opened flowers were removed from alternate nodes, plants compensated by setting pods

from flowers which opened on nodes not being deflowered. The physiological basis for premature abscission of reproductive structures in grain legumes is discussed. *(Author's summary)* C02

0028

16990 SUBHADRABANDHU, S. 1976. **Control of abscission of flowers and fruits of *Phaseolus vulgaris* L.** Ph.D. Thesis. East Lansing, Michigan State University. 184p. Engl., Sum. Engl., 196 Refs., Illus.

Phaseolus vulgaris. **Abscission. Flowers. Pods. Climatic requirements. Photoperiod. CO_2. Carbohydrate content. Starch content. Plant-growth substances. Plant development. Yields. Cultivars.**

Environmental conditions favorable to photosynthesis, including long days and CO_2 enrichment applied during the reproductive stage, increased vegetative growth and decreased pod abscission to a greater extent in *Phaseolus vulgaris* cv. Black Turtle Soup (BTS) than in cv. Seafarer which produced more flowers and flower and pod abscission. Long days or CO_2 enrichment also increased seed yield. Sugar and starch contents in vegetative parts were increased by long days or CO_2 enrichment and were higher in BTS than in Seafarer. Populations with high or low abscission potentials due to varying plant density showed no differences in ABA, phaseic acid, or dihydrophaseic acid in pods or pedicels, but populations with high pod abscission levels had higher ABA contents in pods. *(Summary by Field Crop Abstracts)* C02

0029

16957 KAWASE, M.; MATSUI, H. 1980. **Role of auxin in root primordium formation in etiolated Red Kidney bean stems.** Journal of the American Society for Horticultural Science 105(6):898-902. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Auxins. Plant development. Roots. Leaves.**

When hypocotyls of intact Red Kidney beans were wrapped with black plastic sheets visible root primordia appeared within 12 days, but no root primordium appeared in hypocotyls wrapped with clear plastic sheets. Etiolation did not stimulate root primordium formation when shoots above the cotyledons were removed before hypocotyl wrapping, but stimulated formation when severed shoots were replaced by lanolin containing 0.3-3% IAA, 0.3-3% IBA, or 0.1-1.0% NAA. Non-etiolated de-shooted hypocotyls produced root primordia when auxin concn. in the lanolin was high (1.0-3.0%). Etiolation was more effective in root primordium formation with a low (0.3%) auxin supply. Etiolation treatment did not significantly change the endogenous auxin concn. in the etiolated parts. These results suggest that etiolation stimulated root initiation by increasing the sensitivity of the stem to auxin. *(Summary by Horticultural Abstracts)* C02

0030

16967 DURBIN, M.L.; SEXTON, R.; LEWIS, L.N. 1981. **The use of immunological methods to study the activity of cellulase isozymes (B 1:4 glucan 4-glucan hydrolase) in bean leaf abscission.** Plant, Cell and Environment 4(1):67-73. Engl., Sum. Engl., 34 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Abscission. Leaves. Enzymes. Biochemistry. Analysis. Laboratory experiments.**

Changes in the levels of 2 isozymes of cellulose were followed during the abscission of the primary leaves of *Phaseolus vulgaris* cv. Red Kidney. The 9.5 form was indetectable prior to the induction of abscission. After a 12-h lag this isozyme increased in activity, the increase preceding a decrease in integrity of the abscission zone cell walls. The 4.5 isozyme was more widely spread throughout the plant, being most active in young tissues. During abscission the activity of this isozyme in the abscission layer fell. It is therefore not thought to be involved directly in the abscission process. *(Summary by Crop Physiology Abstracts)* C02

0031

16959 WALLACE, D.H.; ENRIQUEZ, G.A. 1980. **Daylength and temperature effects on days to flowering of early and late maturing beans (*Phaseolus vulgaris* L.).** Journal of the American Society for Horticultural Science 105(4):583-591. Eng[1] Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Climatic requirements. Plant development. Temperature. Photoperiod. Flowering. Timing. Cultivars. Adaptation. Genes. Statistical analysis. Growth-chamber experiments.**

Starting from daylength (DL) x temp. (T) environments combining short or intermediate DL with low or intermediate T, days to 1st flower (FF) of beans was progressively decreased as the duration of T was extended and/or as T was raised to intermediate levels. This universal temp. response caused 13-22 day decreases, under both 3 and 6°C night temp./day temp. (NT/DT) difference, for both early-and late-maturing lines. The decrease in days to FF that appeared to result from extending DL was due to the attendant and simultaneous extending of the duration of DT and decreasing of the duration of NT. Starting from environments combining intermediate to longest DLs with intermediate to highest Ts, which environments had the fewest days to FF, on the contrary, increases in days to FF occurred as DL was further extended and/or as T was further raised. This photoperiod-temp response (Pp-T response) caused 2-5 day increases in days to FF for early-maturing, photoperiod-insensitive lines, and 10-fold larger increases of 40-53 days for late-maturing, photoperiod-sensitive lines. The genes conditioning the late-maturing, photoperiod-sensitive phenotype, therefore, caused a 10-fold increase in the days of delay to FF. The Pp-T responses of the photoperiod insensitive and sensitive genotypes were 0-4 and 17-29 days, resp., when the NT/DT difference was 3 rather than 6°C; there was also a requirement for a higher T to activate the Pp-T response. This commonly called photoperiod response, was called the Pp-T response because it was altered as much by T as by DL. *(Author's summary)* C02 D01

0032

16739 POWLES, S.B.; CRITCHLEY, C. 1980. **Effect of light intensity during growth on photoinhibition of intact attached bean leaflets.** Plant Physiology 65(6): 1181-1187. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. CO_2. Light. Plant assimilation. Leaves. Photosynthesis. Chloroplasts.**

Phaseolus vulgaris cv. Hawkesbury Wonder was grown in 3 different light intensities to simulate sun and shade environments. The effects of photoinhibitory treatments on in vivo CO_2 assimilation rates and in vitro chloroplast electron transport reactions were investigated and the extent to which C metabolism served to prevent photoinhibition was characterized. It was shown that the photoinhibition which followed exposure of intact leaflets of low-light-grown *P. vulgaris* plants to high light intensity in normal air was essentially similar to that which occurred when leaflets of plants grown in full sunlight were illuminated in the absence of CO_2 at low O_2 partial pressures. *(Author's summary)* C02 D01

See also 0003 0063

C03 Chemical Composition, Methodology and Analyses

0033

16010 EDWARDS, C.A.; ARMSTRONG, D.J. 1981. **Citokinin-active ribonucleosides in *Phaseolus* RNA. II. Distribution in tRNA species from etiolated *P. vulgaris* L. seedlings.** Plant Physiology 67:1185-1189. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **RNA. Cytokinins. Seedlings. Biochemistry. Chromatography. Analysis. Identification.**

The distribution of cytokinin-active ribonucleosides in tRNA species from etiolated *Phaseolus vulgaris* seedlings has been examined. *Phaseolus* tRNA was fractionated by benzoylated diethylaminoethyl-cellulose and RPC-5 chromatography, and the distribution of cytokinin activity was compared with the distribution of tRNA species expected to correspond to codons beginning with U. *Phaseolus* $tRNA^{Cys}$, $tRNA^{Trp}$, $tRNA^{Tyr}$, a major peak of $tRNA^{Phe}$, and a large fraction of $tRNA^{Leu}$ were devoid of cytokinin activity in the tobacco bioassay. Cytokinin activity was associated with all fractions containing $tRNA^{Ser}$ species and with minor $tRNA^{Leu}$ species. In addition, several anomalous peaks of cytokinin activity that could not be directly attributed to U group tRNA species were detected. *(Author's summary)* C03

0034

16026 NOOR SALEH, A.; HEMBERG, T. 1980. **The effect of kinetin on the level of an indoleacetylaspartic acid like substance in germinating seeds and young plants of *Phaseolus vulgaris*.** Physiologia Plantarum 50:103-106. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Auxins. Indoleacetic acid. Seeds. Germination. Seedlings. Plant development. Biochemistry. Analysis.**

Kinetin treatment increased the level of an extractable IAA conjugate, apparently indoleacetylaspartic acid (IAAsp) in germinating seeds and young plants of *Phaseolus vulgaris* cv. Alabaster. The level of this substance in extracts of treated seeds was always higher than that from water-treated seeds irrespective of whether the seeds had been extracted 24, 48,or 72 h after the beginning of the treatment. In all parts of young bean plants treated with kinetin there was more of the substance than in the corresponding parts of water-treated plants. *(Author's summary)* C03

0035

16422 BALLANTYNE, D.J.; BLACK, M.W. 1980. **Sulphite stimulation of bean mitochondrial adenosine triphosphatase.** Phytochemistry 19(9):2021. Engl., 6 Refs.

Phaseolus vulgaris. **Hypocotyls. Cell structure. Mitochondria. ATP. Enzymes. Analysis.**

ATPase activity in mitochondria from hypocotyls of 1-wk.-old etiolated *Phaseolus vulgaris* seedlings was stimulated by Na_2SO_3 from 121% of the untreated control at 1 m*M* to 186% of the control at 15 m*M*, but was not affected by 10 m*M* Na_2SO_4. The conen. of Na_2SO_3 used (1-15 m*M*) were sufficient to inhibit ATP formation in the mitochondria. *(Summary by Field Crop Abstracts)* C03

0036

16027 NOOR SALEH, A.; HEMBERG, T. 1980. **The influence of kinetin on the endogenous content of indoleacetic acid in swelling seeds of *Phaseolus, Zea* and *Pinus* and young plants of *Phaseolus*.** Physiologia Plantarum 50:99-102. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris, Zea mays. **Seeds. Seedlings. Plant-growth substances. Auxins. Indoleacetic acid. Hypocotyls. Epicotyls. Cotyledons Leaves. Analysis. Laboratory experiments.**

Treatment of different plant materials, seeds of *Phaseolus vulgaris, Zea mays* and *Pinus silvestris,* and young plants of *Phaseolus,* with kinetin increased the level of extractable IAA. For seeds this increase was most pronounced in bean seeds, which contained the lowest amount of endogenous IAA and cytokinins, and lower in maize seeds with high endogenous content of IAA and cytokinins. For young bean plants the kinetin treatment significantly increased the extractable amounts of IAA from all parts of the plant, hypocotyls, cotyledons, epicotyls, and primary leaves, when the cut plants were placed for 24 h in kinetin solution. For plants sprayed with kinetin solution only the primary leaves showed a significantly higher level of extractable IAA which could be explained by the fact that the plants were growing very close together, so that the primary leaves received most of the kinetin during spraying. *(Author's summary)* C03

0037

16430 JOHN, W.W., CURTIS, R.W. 1980. **Anaerobiosis and ethane production in *Phaseolus vulgaris*.** Phytochemistry 19(11): 2461-2462. Engl., 14 Refs.

Phaseolus vulgaris. **Plant respiration. Buds. Plant tissues. Enzymes. Ethane production. O. Analysis. Laboratory experiments.**

Apical buds of bean were vacuum-infiltrated with H_2O and sealed in air, O_2 or N_2 for 22 h. There was no appreciable change in the contents of fatty acids, especially linolenic acid, following incubation in N_2; however, if N_2-incubated tissue was subsequently exposed to air for 30 min there was a marked decrease in the level of linolenic acid, occurring at the same time that ethane production was at its max. The net loss of linolenic acid during the 30-min exposure period was 5.5 nmol/g fresh wt., 2.48 nmol ethane being produced. *(Summary by Horticultural Abstracts)* C03

0038

16011 EDWARDS, C.A.; ARMSTRONG, D.J. 1981. **Cytokinin-active ribonucleosides in *Phaseolus* RNA. I. Identification in tRNA from etiolated *Phaseolus vulgaris* L. seedlings.** Plant Physiology 67:1181-1184. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Nucleic acids. RNA. Plant-growth substances. Cytokinins. Identification. Biochemistry. Analysis. Seedlings.**

The cytokinin-active ribonucleosides present in tRNA from etiolated *Phaseolus vulgaris* seedlings have been isolated and identified as *cis*-ribosylzeatin, 2-methylthio-ribosylzeatin, and N^6-(Δ^2-isopentenyl)-adenosine. The structures of the compounds were established on the basis of their chromatographic properties and the mass spectra of their permethylated and perdeuteromethylated derivatives. *Cis*-ribosylzeatin was the major cytokinin-active constituent of tRNA from this source. *(Author's summary)* C03

0039

16438 GUTIERREZ, L.E.; BASSO, L.C.; CROCOMO, O.J. 1979. **Amina oxidase em plantas. III. Extração, purificação e propriedades da enzima extraída de plantulas de feijão (*Phaseolus vulgaris*).** *(Amino oxidase in plants. III. Extraction, purification, and properties of the enzyme extracted from bean seedlings).* Arquivos de Biología e Tecnología 22(1):55-62. Port., Sum. Port., Engl., 15 Refs.

Phaseolus vulgaris. **Enzymes. Seedlings. Analysis. Biochemistry.**

A procedure is presented for the purification of amino oxidase from bean seedlings. The most efficient extraction was performed with either cold water or 0.05 *M* potassium phosphate at pH 7.0. The enzyme was purified 21.7-fold and showed a *Km* value of 2.49 x 10^{-5} *M* for putrescine at pH 7.4 and an optimum temp. of 35°C. *(Author's summary)* C03

0040

16936 RAUSER, W.E. 1981. **Entry of sucrose into minor veins of bean seedlings exposed to phytotoxic burdens of Co, Ni, or Zn.** Journal of Plant Nutrition 3(1/4): 319-328. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Plant vascular system. Plant physiological disorders. Sugars. Tracers. Leaves. Seedlings. Micronutrients. Translocation. Mineral content. Toxicity.**

Vein loading in unifoliate leaves of white beans was studied by incubating leaf discs in [^{14}C] sucrose and preparing autoradiograms. Control leaf tissues showed definite vein loading by accumulating most of the sucrose in the minor veins with little remaining in the surrounding mesophyll cells. In discs from seedlings exposed to excess Co, Ni, or Zn most of the radio-sucrose remained in the mesophyll without accumulating preferentially in the minor veins. This inhibition of vein loading was evident within 24 h after exposing seedlings to excess metal. Attempts to alleviate the inhibition of vein loading by treating leaf discs with EDTA or B were not successful. Reversal of the inhibition of vein loading in seedlings exposed to excess metal may be impossible. This view is reinforced by an ultrastructural study which Indicates that in seedlings exposed to excess Zn the phloem of minor veins is abnormal and disorganized. Control leaf discs were floated on solutions containing individual metal ions at concn. up to 210 times higher than those found in leaves of seedlings exposed to metals. No direct metal effect on vein loading was evident. The possibility remains that metal elicited compounds cause the observed inhibition of vein loading. *(Author's summary)* C03

0041

16480 WARDROP, A.J.; POLYA, G.M. 1980. **Co-purification of pea and bean leaf soluble auxin-binding proteins with ribulose-1,5-bisphosphate carboxylase.** Plant Physiology 66(1):105-111. Engl., Sum. Engl., 37 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Proteins. Auxins. Analysis. Biochemistry. Leaves. Plant physiological processes.**

The extensive purification of soluble auxin-binding proteins from pea and bean leaves is described and evidence for the identity of these proteins with ribulose-1,5-biphosphate carboxylase is given. *(Summary by Horticultural Abstracts)* C03

See also 0019 0047 0160

D00 AGRONOMY

0042

16477 IZQUIERDO, J.A.; HOSFIELD, G.L. 1981. **A collection receptacle for field abscission studies in common bean.** Crop Science 21(4):622-625. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Abscission. Flowers. Pods. Flowering. Podding. Timing. Seed production. Cultivars.**

A non tagging, non destructive, continuous, and inexpensive method was developed to evaluate abscission of reproductive organs in dry beans under field conditions. Abscission collection receptacles (ACR) were built, using sarran screen (1.5 x 2.0 mm mesh) and 2.5 x 5.0 cm redwood stock. Receptacles were placed in the field over a 1.25 m segment of row, and the floor was carefully fitted around competitively growing plants at the 2-3 true leaf stage. The method was tested on dry bean cv. Tuscola, NEP II, and Black Turtle Soup, selected because of their contrasting growth and flowering habits. Reproductive organs were collected every 4 days and taken to the lab. where the data were quantified. Samples required 3 min/ACR. Abscission could be broken down into flower and pod drop components. Pod abscission accounted for most of the shedding of reproductive organs. The abscission of pods under 10 mm accounted for 64-87% of all reproductive structures abscised. The ACR was useful to study the seasonal patterns of flowering, abscission, and pod retention of genotypes. Differences in these parameters were detected among the 3 cv. studied in this expt. Low coefficients of variation associated with data collection indicated a good degree of precision in the expt. Compared to unenclosed plants, the ACR had no significant effect on growth, vigor, yield, and yield components of enclosed plants. *(Author's summary)* D00 A00

0043

16444 ALMEIDA, L. D'A. DE; BULISANI, E.A. 1980. **Técnicas para aumentar a rentabilidade do feijoeiro.** *(Techniques to increase bean profitability).* Correio Agrícola 1:236-243. Port., Illus.

Phaseolus vulgaris. **Cultivation. Climatic requirements. Planting. Fertilizers. N. P. K. Mycoses. Bacterioses. Viroses. Symptomatology. Etiology. Pests. Harvesting. Storage. Brazil.**

Technical aspects of bean cultivation in Brazil are reported. High profitability is possible when adverse climatic conditions are overcome and adequate technology and production systems used, thus offering higher yields at lower costs. Factors regarding the climate and the 2 planting systems in bean-producing states are described along with the most important var. planted, growth cycle and nutrient uptake by the plant, and requirements of liming and fertilization (N, P, K, S, and micronutrients). A description is given of the symptomatology, etiology, and control measures of the major diseases (*Xanthomonas phaseoli, X. phaseoli* var. *fuscans, Colletotrichum lindemuthianum, Uromyces phaseoli* var. *typica, Isariopsis griseola, Nematospora coryli,* and viroses) and pests (*Tetranychus urticae, Polyphagotarsonemus latus, Mononychus planki, Empoasca* sp., *Elasmopalpus lignosellus, Agrotis* spp., *Bemisia tabaci, Aphis* sp., and *Myzus* sp.). Research on small-sized machinery for harvest and on seed storage is reported. *(Summary by I.B. Trans. by L.M.F.)* D00 E00 F00

0044

16741 FISHER, N.M. 1980. The effect of time of planting on four bean (*Phaseolus vulgaris*) genotypes in Kenya. Journal of Agricultural Science 95(2):401-408. Engl.. Sum. Engl.. 13 Refs.. Illus.

Phaseolus vulgaris. Cultivars. Cultivation. Planting. Timing. Drought. Temperature. Host-plant resistance. Yields. Kenya.

Four *Phaseolus vulgaris* genotypes were compared at 3 sowing dates during the 1st season (April-June 1976) and 4 sowing dates during a 2nd season (Nov. 1976-Jan. 1977). Yield declined with delay in sowing in both seasons, but in the 2nd season yields were lower at the 1st sowing and declined less rapidly. Canadian Wonder was the most stable-yielding genotype and had the highest mean seed yield though it may have been inferior to other genotypes at the 2 most favorable sowings. Its stability was attributed to drought escape and good field resistance to drought and disease. Mexican 142 was the least stable genotype. A black-seeded landrace yielded well in dry conditions in spite of its long duration. The most important components determining sowing date effects on yield were no. of pods/plant and seeds/pod. Canadian Wonder had markedly more stable no. of pods than any other genotype. Cooler temp. in July and Aug. retarded crop development in the 1st season. For 1 sowing of the 2nd season, flowering was retarded by 7-10 days in all genotypes and this was apparently an effect of water shortage. No effect of water was apparent on the time taken from flowering to maturity. *(Author's summary)* D00

See also 0007 0024 0131 0140 0153

CIAT ABSTRACTS ON CASSAVA

- World literature on *Manihot esculenta* Crantz
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- Also in Spanish

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

D01 Soil Water, Climate and Fertilization

0045

16035 BEN, J.R.; VIEIRA, S.A.; SCHERER, E.; BARTZ, H. 1981. **Efeito da adubação com esterco de galinha na cultura do feijoeiro.** *(Effect of fertilization with poultry manure on black beans).* Pesquisa Agropecuária Brasileira 16(2):165-170. Port., Sum. Port., Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Manures. Organic matter. Fertilizers. Costs. Income. Productivity. Yields.**

The effect of poultry manure on grain yield of black beans was assessed using 2 methods of application (in the row and broadcasted), with or without chemical fertilization. The effect of manure application in the row on 3 successive croppings and in the row and broadcasted on 1 crop were studied in 2 different trials. Results obtained evidenced the economic feasibility of utilizing poultry manure for black beans, with or without chemical fertilization. During the 1st crop year, broadcasting of manure showed greater efficacy than in row distribution. It was also possible to quantify doses of manure for the max. economic yield in terms of its cost and the revenue obtained with the sale of beans. *(Author's summary)* D01 J00

0046

16089 ARRUDA, F.B.; TUBELIS, A.; NASCIMENTO, F.J.L. DO 1980. **Efeito da temperatura média diária do ar na produtividade do feijoeiro.** *(Effect of daily mean air temperature on bean yield).* Pesquisa Agropecuária Brasileira 15(4):413-417. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris. **Climatic requirements. Temperature. Planting. Germination. Podding. Timing. Yields. Statistical analysis.**

The effect of the daily mean air temperature on bean yield was studied. The yield was linearly correlated to daily mean air temp. for different periods in the crop cycle. The general correlation equation found was Y = m (T - 21.7) + 1.213, where Y = yield of grain (kg/ha), T = daily mean air temp. (°C) for a given period of a crop cycle, m = characteristic coefficient for the period. The best periods for yield forecasting were located between the 10th and the 40th day of the crop cycle. The daily mean rates of bean yield increase/1°C elevation in daily mean air temp., varied through the crop cycle; the higher values occurring in a 30-40 day period. The thermal threshold of yield has been 20°C daily mean air temp. for the 1st 50 days of cycle and 19°C for the whole cycle. *(Author's summary)* D01

0047

16420 AHMED, A.M.; KEIKAL, M.M.; ZIDAN, M.A. 1980. **Effects of salinization treatments on growth and some related physiological activities of some leguminous plants.** Canadian Journal of Plant Science 60(2):713-720. Engl., Sum. Engl., Fr., 29 Refs.

Phaseolus vulgaris. **Salinity. Plant physiological processes. Growth. Plant development. Stomata. Photosynthesis. Plant pigments. Dry matter. Mineral content. Leaves. Stems. Roots. Cultivars.**

When subjected to salinity levels of 0, 20, 40, or 60 meq NaCl/*l* the kidney bean cv. Harvester and Contender and cowpea cv. Asmarly and Creamy 7 exhibited significant changes in their physiological activities. The trends and magnitudes of these changes depended on the cv. as well as on the level of salinity. Generally, stomatal frequency and transpiration rate were significantly reduced and water content was considerably increased. Biosynthesis of pigments and photosynthetic activity and consequently leaf area and DM accumulation were considerably reduced as the concn. of NaCl in the nutritive medium increased. Mineral composition also exhibited significant changes but the dominant feature was the high accumulation of Na in salinized plant tissues. *(Author's summary)* D01 C03

0048

16744 LEON, L.A.; FENSTER, W.E. 1979. **Management of phosphorus in the Andean countries of tropical Latin America.** Cali, Colombia, Centro Internacional de Agricultura Tropical. 26p. Engl., Sum. Engl., 16 Refs., Illus.

Also in Phosphorus in Agriculture 76:57-73. 1979.

Phaseolus vulgaris. **Soils. Mineral deficiencies. P. Soil fertility. Soil analysis. Fertilizers. Latin America.**

Crop responses of *Phaseolus vulgaris* and forage grass to P are reported for Andean countries where soils suffer from Al and Mn toxicity and low availability of P, N, K, S, B, Ca, and Mg. Triple superphosphate, basic slag, and Colombia phosphate rock were compared in broadcast, strip and banded applications, in combination, and with partially acidulated or minigranulated phosphate rock. Marked responses were obtained with 100 kg P_2O_5/ha, and often further increases as the rate was increased to 200 kg P_2O_5/ha, especially with mixtures containing the more reactive phosphate rocks. *(Summary by Field Crop Abstracts)* D01

0049

16481 QUAKENBUSH, L.S.; WILSON, R.G. 1981. **Effect of herbicide and manure applications on soil chemistry and growth of fieldbeans (*Phaseolus vulgaris*).** Weed Science 29:508-512. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Manures. Organic matter. Soil fertility. Analysis. Weeding. Herbicides. Soil analysis.** *Fusarium solani.* **Roots. Yields. USA.**

The influence of manure and herbicide applications on weed-free fieldbeans and root rot of fieldbeans was studied during 1978-79 at Scottsbluff, Nebraska (USA). Rates of cattle feedlot manure used were 0, 30,000, 56,000, 112,000, or 168,000 kg/ha. Preplant herbicide treatments used were alachlor at 3.4 kg/ha, EPTC at 3.4 kg/ha, EPTC + trifluralin at 2.2 + 0.6 kg/ha, or dinoseb at 6.7 kg/ha. Manure rates of 56,000 kg/ha or higher reduced fieldbean yields both years, but did not increase electrical conductivity or soil exchangeable Na enough to explain these yield reductions. In 1978, but not in 1979, height and yield of weed-free fieldbeans were reduced by EPTC, EPTC + trifluralin, and alachlor treatments. A significant interaction between manure and herbicide treatments was not detected and none of the treatments increased the severity of root rot in either year. *(Author's summary)* D01 D02 I 03

0050

16437 ARRUDA, F.B.; TUBELIS, A.; NASCIMENTO, F.J.L. DO 1980. **Efeito da precipitação pluviométrica na produtividade do feijoeiro.** *(Effect of rainfall on bean yields).* Revista do Centro de Ciencias Rurais 10(1):49-60. Port., Sum. Port., Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Rainfall data. Water requirements. Planting. Germination. Flowering. Podding. Timing. Yields. Statistical analysis.**

In trials conducted on the exptl. fields of the U. Federal de Viçosa, Minas Gerais (Brazil) in 1961-63, yield of *Phaseolus vulgaris* cv. Rico 23 was found to be related to rainfall during

various periods in the growing season. The closest correlations for estimating yield were those for 10-80 days and 20-70 days after sowing. The earliest estimate of yield was obtained from rainfall between 30-40 days after sowing. The greatest yield increase/mm increase in rainfall was 66 kg/ha during the period 30-40 days after sowing. *(Summary by Field Crop Abstracts)* D01

0051

16487 LIMA FILHO, J.M.P. 1979. **Possibilidades de reducir o consumo hídrico da cultura do feijão (*Phaseolus vulgaris*, L.).** *(Possibilities of reducing the water uptake of bean crops).* Salvador-BA, Brasil, Empresa de Pesquisa Agropecuária da Bahia. Comunicado técnico no. 040. 8p. Port., 21 Refs., Illus.

Phaseolus vulgaris. **Water stress. Host-plant resistance. Transpiration. Water requirements. Plant-growth substances. Leaves. Plant tissues. Experiment design. Statistical analysis. Laboratory experiments. Brazil.**

The possibility of reducing plant water consumption in bean crops by diminishing transpiration was examined. Bean cv. Vagem roxa plants grown in pots with sandy loam soil and with daily irrigation (field capacity) were treated with 5 concn. of an antitranspirant (Mobileaf of the Mobil Oil Co., Brazil) and 24 h later, irrigation was suspended. When plants showed symptoms of dehydration, samples of leaf tissue discs were taken. A random block exptl. design was used with 6 treatments and 4 replications in which each exptl. unit consisted of 4 plants. Only the plants treated with a 25% concn. did not present symptoms of water deficit. Soil moisture increased with the concn., indicating that the application of antitranspirants promotes more efficient water use as an indirect effect of reducing transpiration. *(Summary by I.B. Trans. by L.M.F.)* D01 C00

0052

15823 SANCHEZ C., G.E.; VELANDIA C., F.H.; QUINTERO Q., J. 1979. **Relación hierro-manganeso en tres suelos con características físico-químicas diferentes y su efecto en la absorción por fríjol Calima (*Phaseolus vulgaris*).** *(Iron-manganese relationship in three soils with different physico-chemical characteristics and its effect on absorption in Calima bean).* Suelos Ecuatoriales (Colombia) 10(1):19-25. Span., Sum. Span., 18 Refs., Illus.

Phaseolus vulgaris. **Soils. Soil fertility. Minerals and nutrients. Fe. Mn. Soil analysis. Leaves. Mineral content. Analysis. Nutrient absorption. Colombia.**

Under greenhouse conditions and using beans cv. Calima as indicator plants, the effect of adding Fe and Mn (0, 20, 40, 80, and 160 ppm) to the soil and Fe/Mn relationships (1/2, 1, 2, 4) were studied on 3 soils with characteristics that essentially differ in OM content, pH, texture, CEC, and base saturation. A marked effect of Fe addition on Mn absorption was found on one of the soils. *(Author's summary. Trans. by L.M.F.)* D01

0053

11638 SANTA CECILIA, F.C.; PRADO, E. DE C. 1977. **Efeito de níveis de nitrogênio na nodulação de duas variedades de feijão (*Phaseolus vulgaris*, L.).** *(Effect of levels of nitrogen on the nodulation of two bean varieties).* Ciência e Prática 1(1): 17-21. Port., 5 Refs., Illus.

Phaseolus vulgaris. **Nodulation. Fertilizers. N. Cultivars. Brazil.**

The results of an expt. conducted in a greenhouse at the U. Federal de Viçosa, Minas Gerais (Brazil) to determine the effect of levels of N (ammonium nitrate) on the nodulation of 2 bean var., Rico 23 and Rico baio 1014, are given. These were inoculated before planting. The levels of N used were 0, 10, 25, 50, 100, and 200 ppm. Plants were harvested 30 days after planting; nodules were placed in a drying chamber at a temp. of 60°C, and immediately weighted. Nodule wt. was different for both var., indicating a differential behavior. In

absence of N, nodules of var. Rico 23 had a higher dry wt. and as the level of N increased, nodulation decreased reaching 0 at levels of 200 ppm. Nodules of var. Rico baio 1014 reached their highest dry wt. at levels of 80 ppm; nodulation decreased notably after this level. Regression equations were linear for var. Rico 23 and quadratic for var. Rico baio 1014. *(Summary by C.P.G. Trans. by L.M.F.)* D01 I01

0054

16958 STANSELL, J.R.; SMITTLE, D.A. 1980. Effects of irrigation regimes on yield and water use of snap bean (*Phaseolus vulgaris* L.). Journal of the American Society for Horticultural Science 105(6):869-873. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. Green bean. **Irrigation. Osmotic potential. Evapotranspiration. Pods. Yields. Developmental stages. Water requirements. Income.**

Pod yield of Galagreen and Eagle snap bean cv. irrigated when the soil water tension reached 0.25 bar averaged 11.9 t/ha, and irrigation at tensions of 0.5 and 0.75 bar reduced this yield by 41 and 48%, resp. The reduction in water use was proportionately less than yield decreases, resulting in water use efficiencies of 0.62, 0.45, and 0.4 t of pods/cm of water with irrigation at 0.25, 0.5, and 0.75 bar, resp. Pod yield and water use efficiency were generally greater in Eagle than in Galagreen snap beans. A 0.75-bar stress applied preblossom, at flowering, or at pod development reduced pod yield by 25% in both cv. *(Summary by Horticultural Abstracts)* D01

0055

17303 SSALI, H. 1981. The effect of level of $CaCO_3$, inoculation and lime pelleting on the nodulation and growth of beans in five acid soils. Plant and Soil 62:53-63. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Agricultural lime. Al. Mn. pH. Nodulation. Dry matter. Protein content. Yields. Soils.**

The effect of level of $CaCO_3$, inoculation, and lime pelleting on the nodulation, DM yield, and % N content of common bean plants grown in 5 acid soils was investigated in a greenhouse study. The soils represented a range in pH from 3.9-5.1, in exchangeable Al from 0.0-4 meq/100 g, in exchangeable Mn from 0.35-2.32 meq/100 g, and in % C from 0.69-5.60. Nodule wt. decreased with increasing % C and for the soil with highest % C (5.60) no nodules were observed. In soils with low OM and low exchangeable Al and Mn, inoculation increased nodule wt., DM yield, and % N, especially at the lowest pH level. Where the seeds were not inoculated, nodule wt. and DM yield increased with soil pH. No such increases were observed where the seeds were inoculated. There was no apparent advantage in lime pelleting in such soils. In soils with low OM content and with substantial amounts of Al and/or Mn, liming increased nodule wt. and DM yield, and decreased exchangeable Al and/or Mn. Lime pelleting was superior to mere inoculation in increasing nodule wt., particularly at low lime rates. In soils with relatively high OM content, nodulation was very low or none at all. Low lime rates had little effect on exchangeable Al and Ca and DM yield. Higher lime rates, however, decreased exchangeable Al and DM yield but increased exchangeable Ca. *(Author's summary)* D01 I01

0056

17314 MENTEN, J.O.M.; MALAVOLTA, E.; SABINO, J.C.; VEIGA, A.A.; TULMANN NETO, A. 1981. Anomalia do feijoeiro (*Phaseolus vulgaris* L.) semelhante á virose, causada por toxidez de manganês. *(Virus-like abnormality in beans caused by manganese toxicity).* Fitopatologia Brasileira 6:179-185. Port., Sum. Port., Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Mineral deficiencies. Al. Mn. Plant physiological disorders. Symptomatology. Mineral content. Analysis. Developmental stages. Laboratory experiments. Field experiments.**

Several scattered affected areas were observed in a field planted with beans located at the Tietê Exptl. Station, São Paulo, Brazil. The plants showed symptoms similar to those caused by virus diseases: less growth, shortening of the internodes, development of lateral buds, small, crinkled leaves with downward curving, and chlorosis either uniform or interveinal always accompanied by necrotic spots. It was also observed that both blossoming and pod filling were delayed and markedly reduced. Leaf analyses revealed that affected plants had levels of Mn and Al > 4200 and 1100 ppm, resp., whereas samples from unaffected plants, grown in adjacent sites had about 500 ppm Al and 500 ppm Mn. Soil analyses also showed marked differences between affected areas and adjacent sites; in the former ones pH was around 4.0, and exchangeable Al reached 1.1 meq/100 g; on the other hand, soil with healthy and normal looking plants showed pH 5.2 and only 0.2 meq of exchangeable Al. Soil samples from the affected and unaffected areas were brought to the greenhouse, potted, and used for growing bean plants. Symptoms identical to those observed in the field developed only in the 1st case. *(Author's summary)* D01

0057

16968 VALLE JUNIOR, R. DEL; SCOTT, T.W.; LUGO-LOPEZ, M.A. 1981. **Variable response of food crops to banded and broadcast residual fertilizer P on an Ultisol.** Journal of Agriculture of the University of Puerto Rico 65(2):171-189. Engl., Sum. Engl., Span., 25 Refs., Illus.

Phaseolus vulgaris, Zea mays. **Fertilizers. P. Rotational crops. Yields. Soils. Soil analysis. Soil impoverishment.**

In a sequence of 10 crops on a Torres clay soil (Ultisol) variable responses to P were obtained. Rice and soybeans did not respond to P. In 3 maize crops out of 6, and in 2 field bean crops, there was response to banded fertilizer P but not to broadcast residual P. In the 1st maize crop, near max. yields were obtained with 90 kg banded P/ha and with 359 kg broadcast P/ha. The residual effect of large applications of broadcast P on succeeding crops was almost nil. In field expt., soil tests showed a sharp P drop in broadcast treatments after 3 yr, probably due to P fixation. Organic P mineralization is rather important in the highly weathered soils of the humid tropics. Apparently, P is mineralized more rapidly during summer months. *(Author's summary)* D01 L03

See also 0013 0015 0018 0031 0108

D02 Cultivation Practices: Planting, Weed Control and Harvesting

0058

16029 MAHATANYA, E.T. 1977. **The response of food beans (*Phaseolus vulgaris* L.) to spacing and phosphorus application.** East African Agricultural and Forestry Journal 43(2):111-119. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Spacing. Nutritional requirements. Fertilizers. P. Agronomic characters. Yield components. Yields. Maturation. Seed production.**

Bean var. Canadian Wonder and Leakey 138.139 were grown in the field under 3 levels of P application and 2 levels of plant density. The results show that plant height, LAI, pod no., pod wt., seed yield/plant, and seed yield/m^2 increased with the levels of P. An increase in seed yield/plant was attributed partly to an increased pod no. and partly to a larger LAI, which were positively and significantly correlated with seed yield. It was, therefore, suggested that in an endeavour to increase bean ' 's more attention should be directed towards treatments which might promote a greate. accumulation of pods/plant. Low plant density had a greater effect on all the above mentioned characters/plant than high plant density, except on plant height when the reverse was true. However, seed yield/m^2 at high plant density was significantly greater than at low plant density due to the greater no. of plants/unit area of land. The effect of high plant density was even greater when P was added to the soil. This shows that a competition for nutrients existed at this plant density. *(Author's summary)* D02

0059

16025 BRECKE, B.J.; DUKE, W.B. 1980. **Effect of glyphosate on intact bean plants (*Phaseolus vulgaris* L.) and isolated cells.** Plant Physiology 66:656-659. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Plant assimilation. Leaves. Plant tissues. Nutrient absorption. Tracers. Metabolism. Plant respiration. Cytology. ATP. Plant physiological processes. Plant injuries.**

Whole bean var. Eastern Butterwax plants and isolated cells were used to investigate possible mechanisms of action of glyphosate. Results showed that glyphosate was quickly absorbed by the whole plant but not by individual cells and that it caused a rapid reduction in leaf DM accumulation, leaf expansion, leaf angle, and stomatal aperture without affecting the water status of the plant. Glyphosate also caused a rapid reduction in cellular uptake of ^{86}Rb and ^{32}P which preceded its detrimental effects on photosynthesis, RNA and protein synthesis, and respiration of isolated cells. This reduction in i on absorption was not due to a loss of membrane integrity, decrease in energy supply or chelation of ions. It was concluded that glyphosate was directly inhibiting the ion absorption process of bean leaf cells. *(Author's summary)* D02 C00

0060

15852 VICTORIA FILHO, R.; GODOY JUNIOR, C. 1978. **Herbicidas na cultura do feijão (*Phaseolus vulgaris* L.): contrôle, fitotoxicidade e persistência no solo.** *(Herbicides in bean crop.. control, fitotoxicity, and persistance in soil).* Planta Daninha 1(1):25-37. Port., Sum. Port., Engl., 35 Refs.

Phaseolus vulgaris. **Herbicides. Weeding. Toxicity. Soil fertility. Timing.**

Two assays were conducted with the herbicides trifluralin, nitralin, and EPTC in 2 doses to verify weed control, to observe the possible phytotoxic effects on the crop after re-application during the same agricultural yr, and to determine the possible residues in the soil at the beginning of the next agricultural yr, that might affect susceptible subsequent crops. The determination of possible residues in the soil was made by root and shoot bio-assays using sorghum as check plant. There was a good weed control by the herbicides. The purple nutsedge (*Cyperus rotundus*) was controlled only by EPTC; Spanish needles (*Bidens pilosa*) and broom weed (*Sida* spp.) were not controlled by the herbicides. None of herbicides presented phytotoxic effects on the bean crops even after re-applications during the same agricultural yr, and residues were not found during the next agricultural yr after re-application in the prior yr. *(Author's summary)* D02

0061

15851 ALVES, A.; BERNARDI, J.B. 1968. **Contrôle de ervas daninhas em cultura de feijão-vagem pelo uso de herbicidas.** *(Control of weeds in snap beans with herbicides).* Bragantia 27(16):187-192. Port., Sum. Port., Engl., 2 Refs.

Phaseolus vulgaris. **Snap bean. Weeds. Weeding. Herbicides. Cultivation. Yields.**

Four herbicides for controlling weeds in snap bean crops were tested in preemergent conditions. EPTC and trifluralin were incorporated before planting whereas chloroxuron and DNBP were applied after planting without incorporation in the soil. A plot cultivated by usual practices was used as check. Under these exptl. conditions there was no appreciable increase on bean yields, but all the herbicides tested were efficient in controlling the weed. Those applied after planting showed better residual effects. Some toxicity of chloroxuron was noted on snap beans. *(Author's summary)* D02

0062

15871 DE MARINIS, G.; FERREIRA, A.A.A.; DOS SANTOS, R.F.; DELITTI, W.B.C. 1980. **Alguns efeitos do fluometuron sobre o crescimento inicial da raiz do feijoeiro** *(Phaseolus vulgaris* L.). *(Some effects of fluometuron on the early growth of the roots of Phaseolus vulgaris).* Revista de Agricultura (São Paulo) 54(4): 305-309. Port., Sum. Port., Engl., 6 Refs.

Phaseolus vulgaris. **Herbicides. Rooting. Roots. Growth. Plant injuries.**

The herbicide fluometuron applied at concn. varying between 5-625 ppm affected considerably the length of the main root and its hair zone as well as the length of the secondary roots of *Phaseolus vulgaris.* The expt. showed the need of a more detailed study of the effects of concn. between 0-5 ppm and 125 ppm. None of the observed effects can be attributed to biochemical lesions of the photosynthetic process. *(Author's summary)* D02

0063

16730 FAIGUENBAUM M., H. 1981. **Análisis del crecimiento y los rendimientos del frejol en relación a densidades poblacionales.** *(Analysis of growth and yield in beans in relation to population densities). In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. pp.30-57. Span., Sum. Span., 4 Refs.

Phaseolus vulgaris. **Spacing. Growth. Developmental stages. Cultivars. Leaf area. Plant habit. Agronomic characters. Yield components. Yields. Chile.**

An attempt is made to determine optimum density of plant population in bean crops. When plant density is high, LAI values are also increased but these do not always correlate positively with bean yield. When plant density is low, plants have higher LAI values which mean higher yields/plant. However, these higher yields/plant in many cases are not able to compensate the productive capacity of greater populations. When high densities are established, the no., and especially, the size of the leaves are important variables associated

with the yield. The different densities affect the no. of pods/plant while the no. of beans/pod, and especially, the wt. of 100 beans remain stable. Var. Tórtola Diana had the best response to high plant density (444,000 plants/ha) while Red Kloud and Apolo had better yields with av. densities; Orfeo Inia had no differences in yield regarding the different plant densities. *(Author's summary. Trans. by L.M.F.)* D02 C02

0064

16986 WETALA, M.P.E.; MOSHA, C.J.; MOLLEL, S.L.; SAMBAI, L.M. 1979. **Evaluation of pre-planting incorporated, pre-emergence and post-emergence herbicides in navy bean (*Phaseolus vulgaris*) in the Galapo area of Arusha region, Tanzania.** Arusha, Tanzania, Tropical Pesticides Research Institute. Miscellaneous Report no. 969. 10p. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris. **Weeds. Weeding. Herbicides. Plant damage. Field experiments. Tanzania.**

A herbicide evaluation was carried out in navy beans on deep red soil during the first rains of 1977 at a farm of the National Agricultural and Food Corporation, Galapo, Tanzania. All the presowing, incorporated herbicides, isoproturon at 1 and 2 kg, chloramben 1.5 and 2.4 kg, and pendimethalin 1 and 1.6 kg/ha, gave < 40% control of broad-leaved weeds and, with the exception of isoproturon at 2 kg/ha, > 70% control of grasses. Overall weed control was poor with the best result amounting to only 67% (pendimethalin, 1 kg). Among the pre-emergence herbicides which included oxadiazon 0.75 and 2 kg, dinoseb-alkanolamine 11.9 and 14.2 kg, isoproturon 0.5 and 1 kg, pendimethalin 1 and 1.6 kg, chloramben 1 and 2 kg, chloramben + linuron 1.8 + 0.6 and 2.4 + 0.8 kg and alachlor + linuron 2 + 0.5 and 2 + 1 kg/ha, best control of broad-leaved weeds (70%) was obtained with pendimethalin 1 kg and oxadiazon 2 kg/ha. The other treatments, together with postemergence application of isoproturon 0.5 and 1 kg and bentazone 0.72 and 0.96 kg, gave 60% control of broad-leaved weeds. Oxadiazon, pendimethalin at 1 kg, and alachlor + linuron gave at least 90% control of grasses. Oxadiazon, pendimethalin 1 kg and alachlor + linuron (2 + 1 kg/ha) gave fair overall weed control (65-78%). Oxadiazon scorched 80-90% of the crop, resulting in 20% mortality, while isoproturon presowing and preemergence caused temporary scorch of the unifoliate leaves. *(Summary by Weed Abstracts)* D02

0065

16969 MANGUAL-CRESPO, G.; GONZALEZ, A.L. 1981. **Preliminary evaluation of a snap bean harvester in southern Puerto Rico.** Journal of Agriculture of the University of Puerto Rico 65(2):138-141. Engl., Sum. Engl., Span., 7 Refs.

Phaseolus vulgaris. **Agricultural equipment. Harvesting. Pods. Labour. Crop losses. Field experiments. Puerto Rico.**

This study showed that there were no significant differences between yields of manually harvested and mechanically harvested snap bean. The time required to harvest 1 ha differed significantly being 395 and 100.7 man hours for manual and mechanical harvesting, resp. Although the % of trash harvested (mechanically) was high (32.8%) it could be reduced with adequate blower and reel calibration. *(Summary by Abstracts on Tropical Agriculture)* D02

0066

16966 ACEVEDO S., F.J. 1978. **Control de malas hierbas en el cultivo de caraota (*Phaseolus vulgaris*).** *(Weed control in beans).* CIARCO (Venezuela) 8(1/4):21-32. Span., Sum. Span., Engl.

Phaseolus vulgaris. **Weeds. Weeding. Herbicides. Field experiments.**

A series of expt. was carried out on a clay loam soil (1971-73) and on a loam soil in 1976 on bean crops in the state of Portuguesa, Venezuela. Best selective weed control was obtained with diuron at 1 kg/ha and linuron at 1.2 kg/ha, nitralin + tri-allate at 1.5 kg + 3 *l* or 2 kg + 2 *l*/ha and nitralin at 2 kg + alachlor at 3 *l*/ha, all preemergent. Excellent results

were also obtained with nitralin at 1 kg + dinitramine at 1.5 l/ha incorporated before sowing beans. Yields varied from year to year as a result of climatic and other factors, the highest yield of all being from the incorporated treatment. Weeds present at both sites are listed. *(Summary by Weed Abstracts)* D02

0067

16950 WETALA, M.P.E.; MOSHA, C.J.; MOLLEL, S.L.; SAMBAI, L.M. 1979. **A herbicide bean (*Phaseolus vulgaris* L.) trial on T.PR.I. farm during the first rains 1977.** Arusha, Tanzania, Tropical Pesticides Research Institute. Miscellaneous Report no. 968. 12p. Engl., Sum. Engl., 18 Refs.

Phaseolus vulgaris. **Weeds.Weeding. Herbicides. Field experiments. Tanzania.**

Trials were carried out on bean var. Canadian Wonder on sandy loam soils at the Tropical Pesticides Research Institute Farm, Arusha, Tanzania during the 1st rains of 1977. The weed flora consisted of about 40% broad-leaved species (with *Argemone mexicana* dominant), 50% grasses (mainly *Setaria* spp.),and < 10% *Cyperus* spp. Chloramben at 1.8 kg/ha + linuron 0.6 kg preemergence and butralin at 1.75 kg/ha presowing followed by chloramben 2 kg preemergence crontrolled broad-leaved weeds for only 4 wk. but grass weed control lasted longer. Crop yields from these treatments did not differ significantly from those of the hand-weeded control. Pendimethalin at 1.6 kg/ha incorporated before sowing gave satisfactory control of broad-leaved weeds and grasses but damaged the crop. Dinoseb-alkanolamine at 11.9 and 14.28 kg/ha preemergence controlled broad-leaved weeds for a limited period but grasses were resistant. The same herbicide at lower rates scorched the crop when applied at the unifoliate stage of the beans and there was no improvement in weed control. Oxadiazon at 0.75 and 2 kg/ha preemergence gave satisfactory weed control but proved toxic to the crop especially at the high rate. Postemergence sprays of bentazon at 0.75 and 1 kg and isoproturon at 0.5 and 1 kg at the trifoliate leaf stage generally gave unsatisfactory weed control with the 1 kg rate of the latter defoliating the crop. No treatment controlled *Cyperus* spp. *(Author's summary)* D02

0068

16703 RAMASWAMY, H.S.; RANGANNA, S.; GOVINDARAJAN, V.S. 1980. **A nondestructive test for determination of optimum maturity of French (green) beans (*Phaseolus vulgaris*).** Journal of Food Quality 3(1):11-23. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Developmental stages. Maturation. Pods. Harvesting. Composition. Agricultural equipment.**

Beans harvested at intervals of growth until over-maturity were examined by a trained sensory panel and sensory characteristics were related to the physicochemical features at each stage. The wt./length ratio was closely related to sensory character and could provide a simple test for optimal maturity. *(Summary by Horticultural Abstracts)* D02

See also 0049 0090 0121

D03 Cultivation Systems: Intercropping, Rotational Crops

0069

16772 IBARRA P., F.J. 1981. **Densidades de siembra de fríjol en relevo con maíz en la región tropical costera del Golfo de México.** *(Spacing of bean in relay cropping with maize in the tropical coastal region of the Gulf of Mexico). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.3, pp.L6-1-L6-9. Span., Sum. Span., 8 Refs., Illus.

Phaseolus vulgaris. Zea mays. Rotational crops. Planting. Spacing. Yields. Mexico.

In the Tuxtlas region, located in the southern part of the state of Veracruz, Mexico, beans were planted in traditional relay cropping with maize after it had been bent over to obtain av. yields of 580 kg/ha. In this system, 2 rows of beans were planted with 40 cm between plants, 2 beans/hill, resulting in a density of 100,000 plants/ha. In order to increase yields, the effects of spacing and topological arrangements of beans were studied, using this system as check. Var. Jamapa was used and 20 topological arrangements, corresponding to the combination of 4 spacings between rows, 6 distances between plants, and 3 amounts of beans/hill, were compared. There was a significant difference among topological treatments, the best being those that had spacings > 60 cm between rows and increased yield 28% (760 kg/ha) with respect to the check (50 cm). By increasing the spacing to 200,000 plants/ha with the traditional topological arrangement used in the region, yields were increased 18%; the lowest production was obtained at 40 cm between rows, indicating that yield decreases on closing bean rows. *(Author's summary. Trans. by L.M.F.)* D03

0070

16779 VALLE B., R. DEL; TURRENT F., A.; VOLKE H., V.; ALCALDE B., S. 1979. **El surco doble de maíz-fríjol asociados (0.4 m entre pares de surcos), una alternativa para intercalar trigo en las calles anchas de dos metros con genotipos adecuados para condiciones de agricultura de temporal con minifundio y escaso capital de inversión.** [*Double rows in maize/bean intercropping (0.4 m between pairs of rows), an alternative to intercrop wheat in the two meter wide spaces between rows with appropriate genotypes for the rainfed agricultural conditions on small farmsteads and with limited capital for investment*]. Agrociencia 38: 101-113. Span., Sum. Span., 10 Refs., Illus.

Phaseolus vulgaris. Zea mays. Triticum aestivum. Intercropping. Climbing bean. Spacing. Fertilizers. N. P. Productivity. Income. Guatemala.

Results of 21 expt. evaluated in 1977 on small farms in w. Chimaltenango, Guatemala are given. The study was part of the preliminary research on agrosocioeconomic conditions of farming in this region, begun in 1976 by the Instituto de Ciencia y Tecnología Agrícola (ICTA) in Guatemala in order to direct future research in the area. Since agriculture depends on the rainfall and is classified as subsistence farming, it was considered convenient to assess several factors under the traditional system of maize/bean intercropping and under a system of double rows (0.4 m between pairs of rows), but intercropping wheat in the 2 m wide space between the rows. Local var. of maize and beans and one improved var. of wheat were

used to evaluate the 2 systems in addition to the factors already assessed. A 1/8 lotted half replication of the 2^7 factorial was used as exptl. matrix. The most important result was that the conventional system produced the highest yields and consequently, the highest net income. However, yields of wheat intercropped in the system of double rows were high, considering the fact that they came from 42% of the total area under this system. *(Author's summary. Trans. by L.M.F.)* D03

0071

16788 SILVA, C.C. DA; VIEIRA, C. 1981. **Cultura associada de feijão e milho. 5. Avaliação de um sistema.** *(Bean and maize intercropping. 5. Evaluation of a system).* Revista Ceres 28(156):194-206. Port., Sum. Port., Engl., 9 Refs.

Phaseolus vulgaris. Zea mays. **Intercropping. Planting. Spacing. Soil analysis. Yields. Timing. Productivity. Income. Brazil.**

A system of associated cropping of beans and maize was evaluated in Ponte Nova, Patos de Minas, and Unaí, state of Minas Gerais, Brazil. Maize was planted at the beginning of the rainy season, in rows 1 m apart, with 20,000, 30,000 or 40,000 plants/ha. Bean cv. Manteigão Fosco 11 (determinate growth habit) was planted simultaneously with maize, in the same row, at the density of 120,000 seeds/ha. After the harvest of this bean cv., when the maize started to dry, climbing beans were planted in between the maize rows at the density of 140,000 seeds/ha. In Ponte Nova the expt. was repeated during 3 yr. Yields were: maize, 3200-5000 kg/ha in the best 2 yr; Manteigão Fosco 11, 400-600 kg/ha; climbing beans, 500-950 kg/ha. No significant effect of maize population on yield of both crops was found. In Patos de Minas the expt. was repeated during 2 yr. Maize yielded 5000 kg/ha and climbing beans, 600-700 kg/ha in one year and 200-300 kg/ha in another year. Maize population did not affect its own yield, but slightly affected the climbing bean yield. Manteigão Fosco 11 yield was low (200-600 kg/ha) and was affected by the higher maize plant populations. In Unaí the expt. was also repeated during 2 yr. At the density of 40,000 plants/ha maize yielded around 6000 kg/ha; with 30,000 plants/ha, 4300-4600 kg/ha; and with 20,000 plants/ha, 3100 kg/ha. Bean yields were: Manteigão Fosco 11, 500-800 kg/ha and climbing beans, 500 kg/ha, approx. In spite of the low bean yield, this associated cropping system is economically interesting to the small farmers since the bean price is much higher than the maize price. *(Author's summary)* D03

0072

16470 EMPRESA BRASILEIRA DE ASSISTENCIA TECNICA E EXTENSAO RURAL. 1980. **Sistemas de produção para feijão. (Revisão).** [*Bean production systems. (Review)*]. Santa Catarina-FL, Brasil. Serie Sistemas de Produção. Boletim no. 209. 55p. Port., Illus.

Phaseolus vulgaris. Zea mays. **Cultivation. Intercropping. Rotational crops. Planting. Spacing. Harvesting. Manures. Diseases and pathogens. Pests. Brazil.**

Two bean production systems (in monoculture and in association with maize), recommended for the state of Santa Catarina, Brazil, are described. The characteristics of bean-producing regions are given: area harvested, av. yields, total production, marketing channels, and climatic indexes. The characteristics of the producers for each one of the systems are given and technical recommendations are included on soil analysis and conservation, amendment of soil acidity and fertility, preparation, fertilization, planting, cv., cultural practices, pest and disease control, harvest, storage, precautions on using chemical products, and technical specifications of production for each system. Maize/bean intercropping in the northern region of the state and bean cultivation after tobacco cultivation are briefly discussed. Tables and annexes on the use of herbicides, fungicides, and other control products during storage and for seed conservation are included. *(Summary by I.B. Trans. by L.M.F.)* D03

See also 0073 0145

D04 Seed Production

0073

16018 OLUFAJO, O.O.; SCARISBRICK, D.H.; DANIELS, R.W. 1981. **The effect of pod removal on the reproductive development of *Phaseolus vulgaris* cv. Provider.** Journal of Agricultural Science 96:669-676. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Plant development. Pods. Abscission. Seed production. Harvesting. Developmental stages. Water content. Seed. Yield components. Yields. Cultivation systems.**

Phaseolus vulgaris cv. Provider was assessed as a vegetable and seed crop in SE England. Expt. were designed to simulate 'pick your own' harvest systems which are becoming increasingly popular. Edible pods were removed on either 1 or 2 occasions at varying developmental stages, remaining pods being left to produce seed. The yield of edible pods increased considerably as pod removal was delayed but subsequent seed yield was reduced. However, depodded plants showed compensatory increases in mean seed wt. so that seed yield reduction was less than expected. Results are discussed in relation to decline in seed MC and the dual use of this crop for vegetable pod and seed. It is concluded that dual use is not convenient for large-scale agricultural operations. 'Pick your own' programs utilize the potential of this crop more efficiently than present mechanical harvesting systems. *(Author's summary)* D04 D03

0074

15836 SALIH, F.A. 1981. **Influence of seed size on yield and yield components of dry beans *(Phaseolus vulgaris* L.).** Zeitschrift für Acker-und Pflanzenbau 150: 19-26. Engl., Sum. Engl., Germ., 23 Refs.

Phaseolus vulgaris. **Seed. Seed characters. Cultivars. Yields. Yield components. Timing.**

Crops grown in field trials during 1976-77 from seeds of 3 cv. of dry bean of 4 different size grades were compared to determine the influence of seed wt. (expressed as g/1000 seeds) on the resulting crop. Seed sizes were gradated in small, medium, large, and ungradated forms. Results from the 2 seasons showed that seed size did not significantly affect seed yield/ha. Therefore grading dry bean seeds would be of little or no economic value to the farmer. *(Author's summary)* D04

0075

16784 MENEZES, J.R.; MOHAN, S.K.; BIANCHINI, A.; SOUZA, G.L. 1981. **Qualidade sanitária de sementes de feijão (*Phaseolus vulgaris* L.) no Estado do Paraná. *(Health quality of bean seeds in the state of Paraná, Brazil).*** Fitopatologia Brasileira 6:497-508. Port., Sum. Port., Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Seeds. Seed quality. Mycoses. Geographical distribution. Brazil.**

In order to measure and describe the health quality of bean seeds utilized in the state of Paraná, Brazil, 434 samples of 43 var. from 124 counties were analyzed. Of the total of seeds analyzed, 13% were infected and 7% showed other abnormalities. Among the infected seeds, 45 different fungi were identified, some of them causing partial or total seed rot and

others, affecting the seedling during germination. The principal seed-transmitted fungal pathogens were found in seeds of all the var. analyzed and in samples from all the regions of the state studied, although in different %. In general, there was no difference in the quality of seeds from different sources. *(Author's summary)* D04

0076

16774 GIRALDO, G. 1981. **Metodología para la descripción varietal en fríjol común y maíz.** *(Methodology for varietal description in common beans and in maize). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.3, pp.L3-1-L-3-53. Span., 10 Refs., Illus.

Phaseolus vulgaris. **Seed production. Agronomic characters. Developmental stages. Germination. Seedlings. Flowering. Maturation. Timing. Cultivars. Colombia.**

Separate models are given to describe the characteristics of bean and maize var. in programs of seed certification. Conceptual aspects that should be taken into account when making an adequate description of a var. are discussed. In descriptive parameters of continuous distribution (e.g. plant height), the mean, standard deviation, and C.V. should be estimated in a min. of 20 observations; in those of direct distribution (e.g. color of grain), classify the predominant type and note the exceptions. The descriptive parameters are given and defined within a methodological background; the described parameters are studied for the stages of seedling, flowering, physiological maturity, and harvest, in reactions to diseases and pests, and in the var. that most resembles the character described. The form of measuring certain parameters is illustrated and models of formats are included for registering data. *(Summary by A.J.C. Trans. by L.M.F.)* D04 B00

0077

16499 BRASIL. SECRETARIA DE AGRICULTURA E ABASTECIMENTO. 1981. **Programa de feijão no estado de São Paulo-Pró-Feijão.** *(The bean program in the state of São Paulo-Pró-Feijao).* Campinas-SP, Brasil. 27p. Port., Illus.

Phaseolus vulgaris. **Plant breeding. Seed production. Legal aspects. Storage. Ecology. Soils. Geographic distribution. Brazil.**

The fundamental indications for the bean cultivation program, Pró-Feijão, in the state of São Paulo, Brazil are defined. This program tries to establish the bases that would assure, in the middle term, a standard supply of this legume, as well as improved seed which constitutes the main technological requirement of production. Indications on research consist of: production of improved seed, production technology, genetic improvement, phytosanitary control, technical assistance, storage, and agricultural policy. The areas indicated for bean cultivation are delimited and the municipalities that form part are specified. A map on the types of land use capacity and another on the administrative division of the state are annexed. *(Summary by I.B. Trans. by L.M.F.)* D04 J00

0078

16796 CUNHA, J.M. DA; GODOY, O.P.; RAMALHO, M.A.P.; FERNANDES, D. C. 1979. **Influência da densidade da semente sobre a produção do feijoeiro.** *(Effects of seed density on field bean yield).* Revista Brasileira de Sementes 1(3): 91-104. Port., Sum. Port., Engl., 16 Refs.

Phaseolus vulgaris. **Seeds. Seed characters. Soils. Planting. Germination. Yields. Statistical analysis. Brazil.**

Bean cv. Rico 23 seeds were separated into 4 classes according to their density using solutions of sucrose at densities of 1.225, 1.250, 1.275, 1.300, and 1.325. Seeds of the 4 density classes and those of the unselected, control treatment, were planted under different condi-

tions and soil types (in a sandy soil in Piracicaba, state of São Paulo; in a dark red latosol in Patos de Minas, and in a dark red latosol of the Cerrado phase in Sete Lagoas, state of Minas Gerais) to obtain data regarding production/area. The results of analyses carried out under the prevailing conditions led to the conclusion that higher productivity/unit of area may be obtained by using seeds with densities > 1.275. *(Author's summary)* D04

0079

16740 FOUAD, H.A. 1980. **The effect of cell configuration on length grading of beans.** Journal of Agricultural Engineering Research 25(4):391-406. Engl., 8 Refs., Illus.

Phaseolus vulgaris. **Agricultural equipment. Seed characters. Seed. Planting.**

Length grading of seeds may be required for precise planting, and is done with a cylinder internally indented with cells or pockets. The optimum cell design for accurate length separation was established and an improved cell form developed for *Phaseolus vulgaris* beans. *(Summary by Horticultural Abstracts)* D04

See also 0160

D05 Varietal Trials

0080

16780 TAY U., J.; PAREDES C., M.; KRAMM M., V.; GUGLIELMETTI M., H. 1981. Tórtola-INIA, variedad de poroto resistente a mosaico común y mosaico amarillo. *(Tórtola-INIA, a bean variety resistant to common and yellow mosaic).* Agricultura Técnica (Chile) 41(3):169. Span., Sum. Engl.

Phaseolus vulgaris. Cultivars. Plant introductions. Bean yellow mosaic virus. Bean common mosaic virus. Host-plant resistance. Agronomic characters. Chile.

A new bean var. Tórtola-INIA, resistant to BCMV and BYMV, created by the Edible Legumes Program at Quilamapu Exptl. Station (Instituto Nacional de Investigaciones Agropecuarias-INIA), Chillan, Chile, is described. This var. is adapted for the local Chilean market. *(Author's summary)* D05

E00 PLANT PATHOLOGY

0081

16095 ISSA, E.; CRUZ, B.P.B.; WATTANABE, K.; ARRUDA, H.V. 1980. **Danos produzidos por doenças do feijoeiro *Phaseolus vulgaris* L.** *(Damage caused by diseases in beans).* Biológico 46(7):135-140. Port., Sum. Port., Engl., 7 Refs.

Phaseolus vulgaris. **Cultivars.** *Uromyces phaseoli.* **Disease control. Chemical control. Experiment design.**

Five commercial bean cv. (Roxinho, Goiano Precoce, Rosinha, Bico de Ouro, and Carioca) were used in a split-plot exptl. design, with treated and untreated plots to establish the damage caused by diseases. A fungicide mixture was applied on the aerial part of plants composed of 1 kg of copper oxide + 1 kg of mancozeb + 1 kg of oxycarboxin + 0.25 kg of benomyl/ha. The soil of both treated and untreated plots received aldrin at 70 kg/ha, applied in the furrow. The plots were sprayed with 6 *l* malathion/ha in the 1st spraying and with 1.7 *l* dimethoate/ha in the other sprayings. Results showed, that in untreated plots, rust (*Uromyces appendiculatus*) induced a loss in yield of 29% in cv. Rosinha and up to 76% in cv. Roxinho. *(Author's summary)* E00

0082

16714 CAFATI K., C.; ALVAREZ A., M. 1981. **Análisis de las principales enfermedades del frejol en Chile.** *(Analysis of major bean diseases in Chile). In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. pp.122-140. Span., 5 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. Fusarium solani. Erysiphe polygoni. Uromyces phaseoli. Rhizoctonia solani. Macrophomina phaseoli. Xanthomonas phaseoli. **Bean yellow mosaic virus. Bean common mosaic virus. Symptomatology. Etiology. Epiphytology. Disease control. Chile.**

The symptoms, etiology, epidemiology, and control of the major diseases attacking beans in Chile are described: fungus: *Alternaria tenuis, Colletotrichum lindemuthianum, Fusarium solani, Erysiphe polygoni, Uromyces phaseoli, Rhizoctonia solani,* and *Macrophomina phaseoli;* virus: common mosaic and yellow mosaic; bacterias: *Xanthomonas phaseoli. (Summary by A.J.C. Trans. by L.M.F.)* E00

0083

16977 WOODWARD, M.D. 1980. **Detection and estimation of phaseollin and other 5-deoxyisoflavonoids in inoculation droplets by selected ion monitoring.** Physiological Plant Pathology 17(1):17-31. Engl., Sum. Engl., 23 Refs., Eus.

Phaseolus vulgaris. Sclerotinia fructicola. **Phytoalexins. Analysis. Biochemistry.**

Gas-liquid chromatography-mass spectrometry was used to detect and measure phaseollin and the proposed intermediates in its biosynthesis. Bean pod cavities were inoculated with a spore suspension of *Monilinia (Sclerotinia) fructicola* and the isoflavonoids produced were extracted from the inoculation droplets with ethyl acetate. Trimethylsilyl ethers were prepared and chromatographed on an OV-101 column with detection of 2 or 3 prominent ions

in the mass spectrum of each compound. Successive injections of a reference compound and a portion of the ethyl acetate extract were used to estimate the concn. of the components in the extract. Trimethylsilyl ethers of phaseollin, phaseollidin, coumestrol, 3,9-dihydroxypterocarpan, 7,2',4'-trihydroxyisoflavone, and 7,2'4'-trihydroxyisoflavan were detected and estimated in the ethyl acetate extract without additional purification. Isoliquiritigenin, daidzein, and phaseollinisoflavan required a TLC step prior to derivation and analysis. Concn. of the minor isoflavonoid components in the original inoculation droplets were 0.03-1.5 μM. The advantages of selected ion monitoring for the detection and estimation of post-infectionally formed isoflavonoids are discussed. *(Author's summary)* E00

See also 0043

E02 Bacterioses

0084

16737 WELLER, D.M.; SAETTLER, A.W. 1980. **Colonization and distribution of *Xanthomonas phaseoli* and *Xanthomonas phaseoli* var. *fuscans* in field-grown navy beans.** Phytopathology 70(6):500-506. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. Xanthomonas phaseoli var. *fuscans.* **Inoculation methods. Isolates. Leaves. Plant tissues. Epidemiology. Etiology. Symptomatology. Developmental stages.**

Rifampin-resistant mutants of *Xanthomonas phaseoli* (*Xp*) and *X. phaseoli* var. *fuscans* (*Xpf*) were used to study the multiplication and distribution of inoculum of bean blight bacteria in *Phaseolus vulgaris.* Increase of *Xp* and *Xpf* in bean leaves resembled standard bacterial growth curves in vitro. Mean doubling times of *Xpf* and *Xp* were 19.4 and 18.8 h, resp., during the exponential growth phase. No. peaked during the stationary phase and remained stable until leaf abscission; a slow death phase accompanied leaf decomposition on the soil surface. Symptom development on leaves required an inoculum density of at least 5 x 10^6 bacteria/20 cm^2 of leaf tissue, usually corresponding to the density in the early stationary phase. The multiplication of *Xp* and *Xpf* in the leaf canopy from seedling to reproductive phases of plant development was described by a series of growth curves displaced over time, with each curve representing bacterial multiplication on individual leaves of the main stem. Correlation of the sequence of symptom expression with the increase of the bacteria explained the late disease development that is characteristic of common and fuscous blights. Both *Xpf* and *Xp* spread throughout the canopy by rain, bud colonization, and systemic movement. At least 10% of the *Xpf* and *Xp* leaf population was removed as secondary inoculum during rainfall. Isolates *Xpf*R10 and *Xp*Ra were systemic in bean stems and roots, with doubling times of 22.8 and 23.8 h, resp., in stems. *(Author's summary)* E02

0085

16461 FIGUEROA, G. 1980. **Control genético de la resistencia al añublo de halo (*Pseudomonas phaseolicola*) en fríjol y la búsqueda por resistencia en variedades de Guatemala y otros países.** [*Genetic control of the resistance to halo blight (Pseudomonas phaseolicola) of beans and the research on resistance in varieties of Guatemala and other countries)*]. Cali, Colombia, Centro Internacional de Agricultura Tropical. 17p. Span., 33 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Host-plant resistance. Genes. Cultivars. Etiology. Symptomatology. Germplasm. Selection. Colombia.**

Aspects on the distribution, etiology, symptomatology, genetic, cultural, and chemical control of the halo blight of beans, caused by *Pseudomonas phaseolicola,* are given. The results obtained in previous assessments and in trials on plant survival under field and greenhouse conditions of 6 bacterial pathogens of beans are discussed, along with an inoculation test of *P. phaseolicola* on selected climbing bean cv. Selected small black-seeded bean cv. G 3272, G 6036, G 6034, G 6339, G 790, G 984, G 2338, and G 5272 were resistant to the pathogen; selections of different colored large-seeded bean cv. had intermediate/susceptible reactions. *(Summary by I.B. Trans. by L.M.F.)* E02

0086

16426 CAFATI K., C.; SAETTLER, A.W. 1980. **Inmovilización de *Xanthomonas phaseoli* (E.F. Smith) Dowson en hojas de frejol Tepary (*Phaseolus acutifolius*) resistente a la bacteriosis o tizón común.** [*Immobilization of Xanthomonas phaseoli Dowson on leaves of Tepary bean (Phaseolus acutifolius) resistant to bacteriosis or common blight*]. Agricultura Técnica (Chile) 40(2):58-62. Span., Sum. Span., Engl., 11 Refs., Illus.

Phaseolus vulgaris. Phaseolus acutifolius. Xanthomonas phaseoli. **Host-plant resistance. *Pseudomonas phaseolicola.* Inoculation. Leaves. Electron microscopy. Symptomatology.**

In inoculated leaves of the resistant *Phaseolus acutifolius* populations of *Xanthomonas phaseoli* remained stationary and then declined. In inoculated leaves of the susceptible Tuscola bean (*P. vulgaris*) populations exhibited the typical logarithmic, stationary, and decline phases. Transmission electron microscopy revealed that the bacterial cells were attached to the cell walls of *P. acutifolius* but not of *P. vulgaris*. Attachment appeared 18 h after inoculation, well before hypersensitivity became visible. *(Summary by Review of Plant Pathology)* E02

0087

16459 HAYWARD, A.C.; WATERSTON, J.M. 1965. *Xanthomonas phaseoli.* Kew, Surrey, England, Commonwealth Mycological Institute. Descriptions of Pathogenic Fungi and Bacteria no. 48. 2p. Engl., 4 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. **Symptomatology. Races. Disease transmission. Disease control.**

The causal agent of the common bacterial blight in beans, *Xanthomonas phaseoli*, is described with respect to its synonymy, characteristics, and chemical reactions for identification. It was noted that this pathogen is distinguishable from *X. phaseoli* var. *fuscans* by its failure to produce a brown diffusible pigment on an agar medium containing tyrosine. Its symptomatology, distribution, physiologic race variation, transmission, and control methods such as the use of healthy seed, crop rotation, resistant var., and sprays or dust are described. It was observed that no immune var. of bean exist but some show a degree of tolerance to this pathogen. *(Summary by I.B. Trans. by L.M.F.)* E02

0088

16068 SLUSARENKO, A.J.; WOOD, R.K.S. 1981. **Differential agglutination of races 1 and 2 of *Pseudomonas phaseolicola* by a fraction from cotyledons of *Phaseolus vulgaris* cv. Red Mexican.** Physiological Plant Pathology 18:187-193. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Races. Cultivars. Host-plant resistance. Cotyledons. Analysis. Biochemistry. Cytology.**

A fraction obtained from cotyledons of *Phaseolus vulgaris* cv. Red Mexican agglutinated cells of avirulent Race 1 isolates of *Pseudomonas phaseolicola* more actively than it agglutinated cells of virulent Race 2 isolates; it also agglutinated human erythrocytes. Carbohydrate in the fraction agglutinated the bacteria whereas haemagglutination was caused by protein. A fraction with similar properties could not be obtained from cotyledons of cv. Canadian Wonder, susceptible to Races 1 and 2. Agglutination of bacteria was assayed by a modification of a standard microhaemagglutination assay. *(Author's summary)* E02 G01

0089

16460 HAYWARD, A.C.; WATERSTON, J.M. 1965. *Xanthomonas phaseoli* var. *fuscans.* Kew, Surrey, England, Commonwealth Mycological Institute. Descriptions of Pathogenic Fungi and Bacteria no. 49. 1p. Engl., 3 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli var. *fuscans.* **Symptomatology. Geographical distribution. Disease transmission. Disease control.**

The causal agent of the fuscous blight in beans, *Xanthomonas phaseoli* var. *fuscans*, is described with respect to its synonymy, characteristics, chemical reactions for identification, disease symptoms, worldwide geographical distribution, transmission, control measures, and latest findings on this pathogen. It is noted that although this pathogen has a more limited distribution than *X. phaseoli*, it is more virulent in both Sudan and Canada. No information exists on race variation. *(Summary by I.B. Trans. by L.M.F.)* E02

0090

16953 CAFATI, C.R.; SAETTLER, A.W. 1980. **Role of nonhost species as alternate inoculum sources of *Xanthomonas phaseoli*.** Plant Disease 64(2):194-196. Engl., Sum. Engl., 20 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. Xanthomonas phaseoli var. *fuscans.* **Hosts and pathogens. Epiphytology. Races. Inoculation. Disease transmission.**

Rifampin-resistant mutants R 15-1 of *Xanthomonas phaseoli* (*Xp*, cause of bean common bacterial blight) and R 17 of *X. phaseoli* var. *fuscans* (*Xpf*, cause of bean fuscous bacterial blight) were used in studies on the role of weeds and other nonhost species in *Xp* and *Xpf* epidemiology. *Xp* grew epiphytically on leaves of various nonhost crop and weed species, and viable populations were recovered up to 21 days after bacteria were placed on leaf surfaces. Reciprocal secondary spread between susceptible bean and lambsquarters (*Chenopodium album*) and pigweed (*Amaranthus retroflexus*) occurred within 12 days after inoculation. *(Summary by Microbiology Abstracts)* E02 D02

0091

16960 CAFATI, C.R.; SAETTLER, A.W. 1980. **Effect of host on multiplication and distribution of bean common blight bacteria.** Phytopathology 70(7):675-679. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. Phaseolus acutifolius. Xanthomonas phaseoli. **Hosts and pathogens. Disease transmission. Host-plant resistance. Inoculation methods. Germplasm. Cultivars.**

Populations of rifampin-resistant *Xanthomonas phaseoli* were determined in and on leaves and pods of resistant (tepary bean, *Phaseolus acutifolius*), moderately resistant (breeding line MSU-51319 and Great Northern-type cv. Valley, both *P. vulgaris*), and susceptible bean hosts (cv. Seafarer and Tuscola, both *P. vulgaris*) by using a rifampin-containing medium. While bacterial multiplication patterns were similar for leaves and pods of moderately resistant and susceptible cv., max. bacterial populations were generally lower in the former, particularly during the reproductive stage of plant development. High bacterial populations were detected in and on uninoculated, symptom-free leaves of both susceptible and moderately resistant hosts, but not in or on those of the resistant genotype. Systemic colonization of plants throughout the growing season was greatest in the susceptible genotypes, intermediate in those with moderate resistance, and absent from *P. acutifolius*. *(Author's summary)* E02 G00

0092

17305 STADT, S.J.; SAETTLER, A.W. 1981. **Effect of host genotype on multiplication of *Pseudomonas phaseolicola*.** Phytopathology 71(12):1307-1310. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Hosts and pathogens. Host-plant resistance. Genes. Germplasm. Cultivars. Inoculation. Disease transmission.**

The multiplication of *Pseudomonas phaseolicola* (*Pp*) was studied in seedlings of halo blight susceptible Charlevoix and tolerant Montcalm and Seafarer bean cv. Strain R13 of *Pp*, which is resistant to rifampin, was used to facilitate isolation of the bacteria from field material. Dilutions of ground (total) and rinsed (surface) 1st, 3rd, or 5th trifoliolate leaves were plated on King's Medium B containing 50 μg/ml each of rifampin and cycloheximide. In-

crease of *Pp* R13 in leaves of cv. Charlevoix followed a typical bacterial growth curve. Populations of *Pp* in the stationary phase remained high for up to 15 days on all leaves of Charlevoix; on 3rd trifoliolate leaves, 27% of the total population was surface-borne. Lower no. of *Pp* R13 were detected in leaves of cv. Montcalm and 5% was surface-borne. Seafarer supported slightly higher no. of *Pp* R13 than Montcalm, and 8% of the total was surface-borne. Tolerant bean cv. may serve as carriers of *Pp*, and secondary spread from them may occur before visible symptoms develop. *(Author's summary)* E02

See also 0148 0155

E03 Mycoses

0093

16451 CARDOSO, E.J.B.N. 1968. **Contribuição ao estudo do contrôle biológico da murcha de *Fusarium oxysporum* f. *phaseoli* (Schlecht) Kendr. e Snyd. em *Phaseolus vulgaris* L.** *(Contribution to the study on the biological control of Fusarium yellows of Phaseolus vulgaris caused by Fusarium oxysporum f. phaseoli).* Tese Mag. Sc. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo. 58p. Port., Sum. Port., Engl., 47 Refs.

Phaseolus vulgaris. Fusarium oxysporum. **Soil population. Disease control. Biological control. Inoculation methodology.**

Six different soil series of Piracicaba were analyzed for their fungal populations. Some fungi of these soils, isolated from bean seedlings planted in the soils, were tested for their capacity in inhibiting *Fusarium oxysporum* f. sp. *phaseoli.* Some of these fungi, when they were used for soil infestation before sowing bean seeds, diminished the % of germination under exptl. conditions. Five isolates of *Chaetomium* spp., one of *Rhizoctonia* sp. and one of *Macrophomina* sp. were able to diminish the incidence of the Fusarium yellows of beans. Of the inoculation methods used in these expt., the infestation of the substrate was more efficient than the dipping of seedlings in the inoculum suspensions. Some different types of inhibition were obtained when *Fusarium* and the other fungi were cultivated in vitro on the same petri dish. The in vitro reactions do not correspond to the action of the fungi when inoculated in plants. *(Author's summary)* E03

0094

16782 MUCHOVEJ, J.J.; DHINGRA, O.D. 1980. **Acetone, benzene and ethanol for treating *Phaseolus* bean seeds in the dry state with systemic fungicides.** Seed Science and Technology 8(3):351-356. Engl., Sum. Engl., Fr., Germ., 12 Refs.

Phaseolus vulgaris. **Seed. Seed treatment. Disease control. Chemical control. Mycoses. Seed coat. Seed color. Seeds. Germination. Cultivars. Snap bean.**

Seeds of white- or brown-seeded snap bean and brown-or black-seeded dry bean cv. were immersed in acetone, benzene, or ethanol for 0.5, 1.0, 1.5, or 6 h. The viability of white-seeded snap beans was reduced significantly when they were soaked in acetone, benzene, and ethanol for more than 1.5, 1.0, or 0.5 h, resp. The viability of brown-seeded snap bean seeds was reduced if immersed in either acetone or benzene for > 1.5 h or in ethanol for > 0.5 h. Viability of dry bean seeds was not affected by immersion for up to 6 h in any solvent tested. The 3 solvents increased the uptake of the systemic fungicides benomyl, thiophanate-methyl, thiabendazole, and fenopronil (2-(imidazol-1-y 1-methyl)-2 phenyl hexamenitrile) in white-seeded snap bean seeds. However, in seeds of brown-seeded snap beans and dry bean cv. only benomyl and thiabendazole were carried into the seed coats. The concn. of the fungicides within seed coats did not rise with increased exposure time from 15 min to 6 h. Ethanol was superior to acetone and benzene for fungicide treatment of white-seeded snap bean seeds. In general, all solvents were equally efficient in carrying benomyl and thiabendazole into seeds of the other 3 cv. The use of acetone, benzene, or ethanol as fungicide solvent for treating bean seeds overcomes the disadvantages of treating seeds in aqueous fungicide suspension or with powder fungicides. *(Author's summary)* E03

0095

16093 IMHOFF, M.W.; MALS, C.E.; LEONARD, K.J. 1981. **Effect of temperature, dew period, and age of leaves, spores, and source pustules on germination of bean rust urediospores.** Phytopathology 71(6):577-583. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Etiology. Temperature. Relative humidity. Plant age. Leaves. Growth-chamber experiments. Statistical analysis.**

Urediospores of *Uromyces phaseoli* were incubated on wetted snap bean leaf disks resting on water agar in seed germination chambers. Minimal germination occurred at 10 and 25°C; none occurred at 4 and 27.5°C. Max. germination, 93%, occurred within 17.5-22.5°C. At 15-22.5°C, 90% of all germinations occurred within the 1st 6-8 h of wetness. Spores stored 14-21 days at 21°C in growth chambers showed little or no reduction in germinability. Spores from old leaves and old pustules germinated only ²/₃ as well as those from young leaves and young pustules. Germinability after interrupted wetting periods was reduced for well-spaced spores and increased for clumped spores. Spores wetted for at least 2 h continued germination if RH remained greater than 85%. Spores produced at 24-27°C germinated about half as well as those produced at 16 or 21°C. Equation describing temperature-dew period interactions were developed. Effects of all other treatments could be expressed as fractional responses of the max. germination at a given temp. and dew period. *(Author's summary)* F03 D01

0096

16434 CAMPBELL, C.L.; PENNYPACKER, S.P.; MADDEN, L.V. 1980. **Progression dynamics of hypocotyl rot of snapbean.** Phytopathology 70(6):487-494. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. Fusarium solani phaseoli. **Rots. Hypocotyls. Disease severity. Timing. Statistical analysis. Field experiments. USA.**

Severity of snap bean hypocotyl rot induced primarily by *Rhizoctonia solani* and in part by *Fusarium solani* f. sp. *phaseoli*, was evaluated in 22 fields in Pennsylvania, USA, in which snap beans were grown commercially in 1977-78. The 11 fields selected each yr were planted to 6 cv. in 1977 and 5 in 1978. Disease severity was estimated at weekly intervals for each field as the proportion of hypocotyl surface covered by lesions; the assessments were made on 50 arbitrarily selected plants from each field. The "simple interest" disease model was not appropriate for describing the epidemics as indicated by the shape parameter of the Weibull distribution function. Disease progress was, however, adequately described in all cases with a quadratic 1st-difference regression model and in some cases with only a linear term in the regression model. A hierarchical cluster analysis performed by using 6 disease progress curve elements identified the presence of at least 2 epidemic types for each yr. The 2 types could be differentiated largely on the basis of rate of disease progression. *(Author's summary)* F03

0097

16424 ANDEBRHAN, T.; WOOD, R.K.S. 1980. **The effect of ultraviolet radiation on the reaction of *Phaseolus vulgaris* to species of *Colletotrichum*.** Physiological Plant Pathology 17(1):105-110. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Races. Hypocotyls. Seedlings. Radiation. Host-plant resistance. Phytoalexins. Cultivars.**

Irradiation of etiolated bean hypocotyls with UV light for short periods immediately before inoculation greatly decreased resistance to races of *Colletotrichum lindemuthianum* otherwise avirulent, and to *C. lagenarium* and *C. coffeanum (Glomerella cingulata)*. Resistance was induced when susceptible hypocotyls were irradiated with UV light and inoculated 24 or 48 h later. This resistance was accompanied by accumulation of phytoalexins. *(Author's summary)* F03

0098

16094 DAVET, P.; RAVISE, A.; BAROUDY, C. 1980. **La microflore fongique des racines du Haricot au Liban.** *(The fungal microflora of bean roots in Lebanon).* Annales de Phytopathologie 12(3):235-252. Fr., Sum. Fr., Engl., 26 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. Fusarium oxysporum. Pythium aphanidermatum. Macrophomina phaseoli. Thielaviopsis basicola. **Isolates. Roots. Identification.**

Isolations were made from bean roots, collected at regular intervals from the main cultivated areas in Lebanon. The most serious parasites were: *Fusarium solani* f. sp. *phaseoli*, *Pythium aphanidermatum* and other *Pythium* spp., and *Rhizoctonia solani*. *Cylindrocarpon destructans*, *Macrophomina phaseoli*, *Phytophthora palmivora*, *Corticium rolfsii*, *Cephalosporium* sp. were detected less frequently and, as an exception, *Thielaviopsis basicola*, *Pyrenochaeta lycopersici*, a parasite of tomato, was also a bean root inhabitant. *F. oxysporum* and *F. roseum* var. *gibbosum* were frequently isolated. Located on the root surface, they penetrate the cortex following *F. solani* and *R. solani* (especially *F. oxysporum*) and *Pythium* spp. (especially *F. roseum*). *F. solani* occurs in all seasons; *R. solani* is favored by warmth and *Pythium* sp. by rainfalls. Inoculations were made in the greenhouse by sowing seeds in a sterilized, and then contaminated, soil. All the Lebanese cv. were susceptible, except Maltieh which was slightly tolerant to Fusarium root rot. Several cv. of Flageolet exhibited a good resistance towards *F. solani*, *R. solani*, and *Pythium* spp. *(Author's summary)* E03

0099

16066 SCHWARTZ, H.F.; CORREA V., F.; PINEDA D., P.A.; OTOYA, M.M.; KATHERMAN, M.J. 1981. **Dry bean yield losses caused by Ascochyta, angular, and white leaf spots in Colombia.** Plant Disease 65(6):494-496. Engl., Sum. Engl., 10 Refs.

Phaseolus vulgaris. Ascochyta sp. *Pseudocercosporella albida. Isariopsis griseola. Colletotrichum lindemuthianum.* **Inoculation methodology. Plant injuries. Spacing. Disease control. Host-plant resistance. Yields. Statistical analysis. Field experiments.**

Diseases caused by *Ascochyta* sp., *Pseudocercosporella albida*, and *Isariopsis griseola* reduced dry bean yields by 43, 47, and 80%, resp., in Colombia. White leaf spot, caused by *P. albida*, was controlled by foliar applications of benomyl or by plant resistance. *(Author's summary)* E03

0100

16799 CAMPOS A., J.; FUCIKOVSKY Z., L. 1980. **Estudio de algunas características de *Isariopsis griseola* Sacc., agente causal de la mancha angular del fríjol.** *(Study on several characteristics of Isariopsis griseola Sacc., causal agent of the angular leaf spot of beans).* Agrociencia 39:41-48. Span., Sum. Span., Engl., 23 Refs., Illus.

Phaseolus vulgaris. Isariopsis griseola. **Culture media. Laboratory experiments. Temperature. pH. Symptomatology. Mexico.**

Isariopsis griseola, causal agent of the angular leaf spot of beans, was isolated from diseased bean leaves by the transfer of conidia on potato dextrose agar culture medium. Later, it was observed in the lab. that the fungus grew best on V-8 juice-Agar (V8-A); the optimum temp. for growth was 24°C and max. sporulation took place at 16°C. Experimentally, the fungus incited the greatest no. of lesions on leaves of plants maintained for 56 h in a 95% RH moist chamber, following inoculation. In the greenhouse, var. VII-13, Amarillo-153, Jamapa, P-524, Negro Purísima, and Amapola showed tolerance to the angular leaf spot organism; Ojabra, Pinto Nacional, Delicias-71, F-F00004-18F$_6$, Chimbo, and Sesentanon, as well as *Phaseolus coccineus*, *P. angularis*, *P. lunatus*, *P. acutifolius*, *P. calcaratus*, and *P. vulgaris* were susceptible, whereas *Vigna sinensis*, *Cajanus cajan*, *Glycine max*, *Vicia faba*, *Medicago sativa*, *Pisum sativum*, and *Lupinus* sp. did not show any symptoms of the disease. *(Author's summary)* E03

0101

15838 DIEHL, J.A.; STEADMAN, J.R. 1981. **Influência do pH na podridão de ráizes do feijoeiro causada por *Fusarium solani* (Mart.) Appel. & WR. f. sp. *phaseoli* (Burk.) Snyd. & Hans.** *(Influence of pH on root rot of beans caused by Fusarium solani f. sp. phaseoli).* Fitopatologia Brasileira 6(1):93-99. Port., Sum. Port., Engl., 24 Refs.

Phaseolus vulgaris. Fusarium solani phaseoli. **Roots. Rots. pH. Soil fertility. Disease control. Plant injuries. Laboratory experiments.**

Root rot of beans caused by *Fusarium solani* f. sp. *phaseoli* was studied to determine the influence of pH on disease severity. In greenhouse studies, great Northern bean seeds were planted in sterilized and nonsterilized Judson silty clay loam soil at differen hydrogen ion (pH) concn. They were inoculated by placing a spore suspension of the fungus over the seeds. Root rot was reduced when the soil pH increased from 4.9 to 7.8, and was more severe in the sterilized than in the nonsterilized soil. Influence of pH on growth of *F. solani* f. sp. *phaseoli* was determined by growing the fungus in buffered Czapek Dox broth for 12 days at 22-25°C. The greatest mycelial growth was obtained at pH 6.1. The effects of pH on growth of this pathogen were not correlated with the effects of pH on bean root rot severity. *(Author's summary)* I 03

0102

15875 TU, J.C. 1981. **Anthracnose (*Colletotrichum lindemuthianum*) on white bean (*Phaseolus vulgaris* L.) in southern Ontario: spread of the disease from an infection focus.** Plant Disease 65(6):477-480. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Disease transmission. Climatic requirements. Rainfall. Temperature. Etiology. Timing. Field experiments.**

Spread of anthracnose (*Colletotrichum lindemuthianum*, race) from an initial infection focus was studied in 1978-79 in field plots planted with a susceptible white bean cv. Fleetwood. Splashing rain spread the disease for short distances, although some plants adjacent to diseased plants did not become infected. Long-distance spread, 3-4.6 m/rainstorm, was caused by splashing raindrops blown by gusting winds. Disease spread from the infection focus toward the NE quarter of plot followed the direction of prevailing winds. Disease severity was highest at or near the axis of the sector nearest the initial infection focus and decreased gradually toward the periphery of the sector. The fungus required about 10 mm of rain to establish infection. In s. Ontario, temp. was not a limiting factor for infection and disease spread, but temp. > 25°C appeared to restrict disease development. *(Author's summary)* I 03

0103

16435 CAMPBELL, C.L.; PENNYPACKER, S.P. 1980. **Distribution of hypocotyl rot caused in snapbean by *Rhizoctonia solani*.** Phytopathology 70(6):521-525. Engl., Sum. Engl., 27 Refs.

Phaseolus vulgaris. **Snap bean.** *Rhizoctonia solani.* **Hypocotyls. Rots.** *Fusarium oxysporum.* **Plant injuries. Etiology. Statistical analysis. Field experiments.**

Hypocotyl rot caused by *Rhizoctonia solani* is a potentially destructive disease wherever snap beans are grown. Six snap bean fields in central Pennsylvania, USA, were selected and a 0.4 ha section of each was divided into 100 contiguous 6 x 6 m quadrats. Plants were removed from each quadrat and hypocotyls were evaluated to determine the no. of infected plants/quadrat and no. of lesions induced by *R. solani*/quadrat. The presence of *R. solani* in lesions was verified by standard isolation and identification techniques. Variance-to-mean ratios of infected plants/quadrat were not significantly greater than unity for all samples, and data for each sample were adequately fitted by the Poisson distribution function which indicated a random dispersion of infected plants. Fungal lesions were clustered, as indicated by variance-to-mean ratios greater than unity for all samples and the goodness of fit of all data sets by the negative binomial distribution function. *(Author's summary)* I 03

0104

16723 HEATH, M.C. 1980. **Effects of infection by compatible species or injection of tissue extracts on the susceptibility of nonhost plants to rust fungi.** Phytopathology 70(4):356-360. Engl., Sum. Engl., 24 Refs.

Phaseolus vulgaris. Uromyces phaseoli. **Inoculation. Leaves. Hosts and pathogens. Cultivars. Host-plant resistance. Phytoalexins. Inhibitors. Cytology. Plant tissues.**

The closeness to colonies of *Uromyces phaseoli* var. *typica (U. appendiculatus)* bean rust, *U. phaseoli* var. *vignae (U. vignae)* cowpea rust, and *Puccinia helianthi* sunflower rust, in their resp. hosts, increased the no. of infection sites at which incompatible rusts produced haustoria from haustorial mother cells. Injection of extracts from susceptible, rust-infected leaves of *Phaseolus vulgaris* had no effect on subsequent haustorium formation by sunflower rust in bean or cowpea, or by cowpea rust in sunflower. However, these extracts did increase haustorium production by the bean rust in cowpea and by cowpea rust in bean; the effective component was of low mol. wt. and partially heat labile. In both double inoculation and injection expt., only in the cowpea rust and bean interaction did fungal growth continue beyond the formation of the 1st haustorium; such growth was also elicited by extracts from susceptible, infected cowpea leaves and by the closeness of growing colonies of cowpea rust induced to develop in bean by a pre-inoculation heat shock of the nonhost tissue. It is suggested that in susceptible, rusted French bean and cowpea leaves, and in interactions of French bean with cowpea rust, if fungal colonies are permitted to develop by giving the tissue a heat shock, a similar or identical factor is produced which, in French bean plants, specifically inhibits the expression of some, but not all, defense mechanisms which can prevent incompatible rusts from forming haustoria. However, growth of rusts in any plant beyond the formation of the 1st haustorium seems to depend on additional interactions between the 2 organisms. *(Author's summary)* F03 G00

0105

16036 PLOPER, L.D. 1979. **La mancha angular del poroto (*Phaseolus* spp.) en la Provincia de Tucumán.** *(Angular leaf spot of beans in the province of Tucumán).* Revista Industrial y Agrícola de Tucumán 56(2):119-124. Span., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Isariopsis griseola. **Symptomatology. Disease control. Chemical control. Climatic requirements.**

The symptoms of angular leaf spot of beans *(Isariopsis griseola)* in the province of Tucumán, Argentina are described and illustrated. The causal organism requires humid weather with moderate temp. Control measures are: 1) the use of disease-free seed; 2) crop rotation; 3) the use of var. resistant to angular leaf spot; and 4) spray applications of carbendazim, benomil, and triforine have been reported as giving good control. *(Author's summary)* F03

0106

16045 HEATH, M.C. 1981. **The suppression of the development of silicon-containing deposits in French bean leaves by exudates of the bean rust fungus and extracts from bean rust-infected tissue.** Physiological Plant Pathology 18:149-155. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Host-plant resistance. Inoculation methods. Leaves. Plant tissues. Cytology. Electron microscopy.**

Extracts of bean rust-infected French bean leaves, when injected into uninoculated French bean tissue, increased the frequency of haustoria subsequently produced by *Uromyces phaseoli* var. *vignae* (the cowpea rust fungus); in correlation, the incidence of Si-containing, electron-opaque deposits at infection sites decreased. The effect of these extracts on haustorium formation was influenced by the age of the leaves from which the extracts were made, and the age of the leaves into which they were injected. Exudates from infection structures of *U. phaseoli* var. *typica* (the bean rust fungus) also increased haustorium

production by *U. phaseoli* var. *vignae*, and in general, both extracts and exudates were less effective in older French bean leaves. Such leaves also were more resistant to bean rust infection, due at least in part to the increased no. of infection sites at which no haustoria developed; in these situations, there was a corresponding increase in the incidence of Si-containing deposits. Injection of extracts from susceptible, infected tissue increased the incidence of haustoria produced by *U. phaseoli* var. *typica* in these older leaves. These results support the previous suggestion that the ability of *U. phaseoli* var. *typica* to invade its host species successfully is initially determined by its ability to suppress the deposition of Si-containing deposits, which would otherwise prevent the development of the 1st haustorium. *(Author's summary)* E03

0107

16980 SINDHAN, G.S.; BOSE, S.K. 1979. **Perpetuation of *Phaeoisariopsis griseola* causing angular leaf spot of French beans.** Indian Phytopathology 32(2):252-254. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris, Isariopsis griseola. **Disease transmission. Seed transmission. Timing. Soil populations.**

The seed and soil-borne pathogen *Phaeoisariopsis griseola* was perpetuated through infected plant (*Phaseolus vulgaris*) debris from one season to the next, remaining viable under field conditions for > 10 mo. Viability of conidia on debris was 6 mo. in the lab. and 8 mo. in the field. In seeds the fungus remained viable for > 1 yr as dormant mycelium, this being important in the initiation and spread of the disease in new localities. *(Author's summary)* E03

0108

16963 BURKE, D.W.; MILLER, D.E.; BARKER, A.W. 1980. **Effects of soil temperature on growth of beans in relation to soil compaction and *Fusarium* root rot.** Phytopathology 70(11):1047-1049. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Soil temperature. Roots. Rots. Chemical control. Soil requirements. Soil air.**

Low soil temp. were more detrimental to both root and top growth of *Phaseolus vulgaris* plants when the soil was infested by *Fusarium solani* f. sp. *phaseoli* than when it was not infested. Bean roots penetrated compact (1.5 g/cm^3) *Fusarium*-infested or fumigated soil more readily when soil temp. during the night and day were 21 and 27°C, resp., than when they were 16 and 21°C. Root penetration of compact soil was also greater at a constant soil temp. of 21° than at 16°C with plant tops exposed to either 21 or 27°C. Soil temp. affected root growth less in loose (1.2 g/cm^3) soil than in compact soil. Air temp. affected both root and top growth less than soil temp. The amount of root growth in loose soil above compact soil generally was inversely related to the amount of root growth into the compact soil. Six cv. differing in field resistance to *Fusarium* root rot did not differ significantly in their ability to penetrate compact *Fusarium*-infested soil at high or low temp. *(Author's summary)* E03 D01

0109

16979 SATISHCHANDRA, K.M.; HIREMATH, R.V.; HEGDE, R.K. 1979. **Assaying inoculum density of *Rhizoctonia bataticola* causing root rot of bean, in soil by using seeds.** Indian Phytopathology 32(1):145-146. Engl., 4 Refs.

Phaseolus vulgaris. Macrophomina phaseoli. **Seed transmission. Inoculation methods. Seeds.**

Seeds of 7 crop plants were tested for colonization by *Rhizoctonia bataticola (Macrophomina phaseolina)* from beans in inoculated soil. The best bait was beet seed, followed by okra (*Hibiscus esculentus*). *(Summary by Review of Plant Pathology)* E03

0110

16962 MILLER, D.E.; BURKE, D.W.; KRAFT, J.M. 1980. **Predisposition of bean roots to attack by the pea pathogen, *Fusarium solani* f. sp. *pisi*, due to temporary oxygen stress.** Phytopathology 70(12):1221-1224. Engl., Sum. Engl., 5 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Soil populations. Soil air. O. Roots. Rots. Hypocotyls. Disease control.**

Bean plants were grown in cells containing field soil naturally infested with either bean or pea root pathogens and in fumigated soil, with or without reinfestation with *Fusarium solani* f. sp. *pisi* or *F. solani* f. sp. *phaseoli*. With normal aeration *F. solani* f. sp. *pisi* had a negligible effect on bean growth, whereas *F. solani* f. sp. *phaseoli* severely injured the plants. After a temporary imposition of low soil O_2 levels, however, the pea pathogen, alone or with other fungi, injured the bean roots and permanently reduced water absorption and plant growth. This injury was less than that caused by *F. solani* f. sp. *phaseoli* under the same conditions. *(Author's summary)* F03

0111

16901 ARAYA F., C.M. 1981. **Influência do número de focos de inóculo inicial de *Colletotrichum lindemuthianum* (Sacc & Magn) Scrib. no desenvolvimento de antracnose em folhas, vagens e sementes de *Phaseolus vulgaris* L.** *(Influence of the number of foci of the initial inoculum of Colletotrichum lindemuthianum on the development of anthracnose on leaves, pods, and seeds of Phaseolus vulgaris).* Mag. Sc. Thesis. Viçosa-MG, Universidade Federal de Viçosa. 40p. Port., Sum. Port., Engl., 43 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Inoculation methods. Disease transmission. Developmental stages. Cultivars. Experiment design.**

The effect of the foci of the initial inoculum of *Colletotrichum lindemuthianum* on the incidence of anthracnose on leaves, pods, and seeds of beans was studied in the plantings during the rainy and dry seasons in areas near the U. Federal de Viçosa, Minas Gerais, Brazil. The different no. of foci of the initial moculum were obtained by inoculating at random, 0.0, 1.5, 3.0, 4.5, 6.0, or 7.5% of the seedlings in each plot. The no. of foci of the initial inoculum was linearly related to disease incidence on leaves but not to that on pods. The incidence of anthracnose was higher on leaves in plantings during the rainy season, whereas in dry season planting disease incidence was higher on pods. More seeds were infected by *C. lindemuthianum* in dry season planting. The % of pods infected was highly correlated with the % of seeds infected ($r = 0.719$). *(Author's summary)* F03

See also 0049 0057 0132 0147 0150

E04 Viroses

0112

16030 MENTEN, J.O.M.; TULMANN NETO, A.; ANDO, A. 1980. **Avaliação de danos causados pelo virus do mosaico dourado do feijoeiro (WMDF).** [*Evaluation of damage caused by the bean golden mosaic virus (BGMV)*]. Turrialba 30(2):173-176. Port., Sum. Engl., Port., 23 Refs., Illus.

Phaseolus vulgaris. **Bean golden mosaic virus. Plant injuries. Crop loss. Developmental stages. Yields. Seed production. Seed characters.**

The quantitative evaluation of losses caused by BGMV is difficult under field conditions due to the difficulty in having plots completely free of the disease for comparison with infected plots. Research was carried out at Piracicaba, state of São Paulo, Brazil, in a field used for seed multiplication of line Carioca 6C, during the 1978 dry season, where BGMV incidence was not uniformily observed. Four 50 m length rows were chosen at random during flowering and apparently healthy plants and plants showing typical symptoms were tagged. After harvesting, production and seed characteristics were assessed. Results showed that productivity of infected plants had been reduced 64% in grain for consumption and by 71% in seed for multiplication as compared to healthy plants. Reduction in wt. of 100 seeds, germination, emergence, 1st counting of the germination test, rate of emergence, hypocotyl length, seedling height, and seed health were 36.8, 4.8, 5.3, 9.5, 7.4, 13.0, 17.4, and 63.6%, resp. Grain for consumption from infected plants showed a pronounced deterioration in quality, especially in color and format, which would cause a marked reduction in their commercial value. *(Author's summary)* E04

0113

16429 KITAJIMA, E.W.; NODA, H.; LIN, M.T.; PAHLEN, A. VAN DER 1979. **Levantamento preliminar de viroses de plantas cultivadas nos arredores de Manaus, Am.** *(Preliminary survey of virus diseases of plants grown on the outskirts of Manaus, Amazonas).* Acta Amazônica 9(4):633-640. Port., Sum. Port., Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Viroses. Virus transmission. Identification. Serology. Brazil.**

Viruses noted on tomato, *Capsicum annuum*, *Hibiscus esculentus*, beans, cucurbits, soybean, cowpea, and other crops in 1977 and identified by transmission, serology, and electron microscopy are listed. Aphid transmitted viruses are generally rare, presumably because of climatic conditions unfavorable to insects. *(Summary by Review of Plant Pathology)* E04

0114

16065 HOBBS, H.A. 1981. **Transmission of bean curly dwarf mosaic virus and bean mild mosaic virus by beetles in Costa Rica.** Plant Disease 65(6):491-492. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris. **Bean curly dwarf mosaic virus. Bean mild mosaic virus. Disease transmission. Virus transmission.** *Cerotoma ruficornis. Diabrotica balteata.* **Injurious insects.**

Bean curly dwarf mosaic virus and bean mild mosaic virus were isolated from bean plants

near Turrialba, Costa Rica. *Cerotoma ruficornis* subsp. *rogersi, Diabrotica balteata, D. adelpha, Paranapiacaba waterhousei* and *Gynandrobrotica variabilis* were able to transmit bean curly dwarf mosaic virus, white only *C. ruficornis, D. balteata,* and *G. variabilis* transmitted bean mild mosaic virus. *(Author's summary)* E04

0115

16728 TEAKLE, D.S.; MORRIS, T.J. 1981. Transmission of southern bean mosaic virus from soil to bean seeds. Plant Disease 65: 599-600. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. Bean southern mosaic virus. Seed transmission. Seed coat. Soils. Disease transmission. Hypocotyls. Roots. Plant tissues. Analysis. Laboratory experiments.

After 12-h exposure to virus-infested soil around the roots of bean plants infected with BSMV, some Bountiful bean seeds acquired the virus and produced systemically infected plants. The incidence of infection was higher in bean seeds with cracked coats than in those with intact coats. Results were similar when bean seeds were soaked in BSMV preparations from leaves. Apparently BSMV infected the germinating seedlings mechanically, without the aid of a vector. *(Author's summary)* E04

0116

16736 VEERISETTY, V.; SEHGAL, O.P. 1980. Proteinase K-sensitive factor essential for the infectivity of southern bean mosaic virus ribonucleic acid. Phytopathology 70(4):282-284. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. Bean southern mosaic virus. RNA. Proteins. Enzymes. Disease control. Inoculation methods. Leaves. Laboratory experiments.

Treatment with proteinase K reduced the infectivity of BSMV-RNA but not that of TMV-RNA. The structural integrity of the viral RNAs remained unaffected after the treatment. The proteinase K-sensitive moiety was associated intimately with the BSMV genome. *(Author's summary)* E04

0117

16787 TU, J.C. 1981. Identification of a severe bean strain of tobacco ringspot virus isolated from white beans *Phaseolus vulgaris* L. Phytopathologische Zeitschrift 101(2):153-162. Engl., Sum. Engl., Germ., 20 Refs., Illus.

Phaseolus vulgaris. Tobacco ring spot virus. Symptomatology. Serology. Electron microscopy. Isolates. Identification. Host range.

An isolate of a virus from severely diseased white beans in S. Ontario, Canada has been identified as a severe bean strain (SB) of tobacco ringspot virus (TRSV, cryptogram R/1: 2.2/40: S/S: S/Nc). The identification was based on symptomatology, indicator plants, physical properties, serology, mode of transmission, and electron microscopy. During the initial stage of infection, TRSV-SB caused bud blight in inoculated white beans. Plants which recovered from this initial shock produced deformed leaves with a mosaic. The virus produced typical ringspot in several species of tobacco and reacted positively to TRSV antiserum. The virus particles were discernible in the electron microscope by negative staining. Physical properties of the virus in crude sap were similar to those reported by others. The virus is not seed transmissible in white beans. The responses of the indicator plants to TRSV-SB suggest that this virus is different from the previously reported TRSV-B, which has a mild effect on white beans, and TRSV which severely affects soybeans. *(Author's summary)* E

See also 0138

E05 Nematodes

0118

16701 RIEDEL, R.M. 1978. **Final report. Nematode survey. Cali, Colombia, Centro Internacional de Agricultura Tropical. 45p. Engl.**

Phaseolus vulgaris. **Nematodes.** *Meloidogyne* **spp.** *Pratylenchus* **spp.** *Meloidogyne incognita.* **Pest damage. Crop loss causes. Nematode control. Herbicides. Soil temperature. Host-plant resistance. Geographical distribution. Survey methods. Colombia.**

A survey was conducted on 205 soil samples collected from 12 sites in Colombia of different crops, including beans on which the research was mainly focussed (132 soil samples from 10 sites), in order to characterize problems of nematodes in the different regions, make comparisons, and suggest research priorities and control measures. Results indicate that *Meloidogyne* spp. (*M. hapla* at higher elevations, *M. incognita* and *M. arenaria* at warmer temp., and *M. javanica* at very warm temp.) is the most limiting nematode for bean production and the most widespread. It is followed in importance by *Pratylenchus* spp. (*P. penetrans, P. crenatus, P. vulnus, P. zeae,* and *P. brachyurus*). In more restricted areas species of *Helicotylenchus, Ziphinema, Longidorus, Cacopaurus, Scutellonema,* and *Rotylenchus* were identified. Crop losses caused by *Meloidogyne* can be evaluated in field trials with nematocides like oxamyl (2-4 lb a.i./ac at planting and 1 lb a.i./ac after 3 wk. as foliar spray). Sources of var. resistance to *M. incognita* and *M. javanica* have been identified. Soil temp. alters plant resistance; therefore, this factor must be taken into account by breeding programs. Weed control with herbicides should be investigated as a means of controlling nematodes. Research programs on the control of *Meloidogyne* should be applicable to *Pratylenchus.* In the case of the rest of the genera mentioned, it is important to determine the economic damage they can cause. The results of another survey on the collection and identification of nematodes in soil and bean root samples from 8 sites in Colombia are included. *(Summary by A.J.C. Trans. by L.M.F.)* E05

0119

16956 WYATT, J.E.; FASSULIOTIS, G.; JOHNSON, A.W. 1980. **Efficacy of resistance to root-knot nematode in snap beans.** Journal of the American Society for Horticultural Science 105(6):923-926. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. Meloidogyne incognita. **Host-plant resistance. Nematode control. Cultivars. Yields. Field experiments. Experiment design. USA.**

Four snap bean breeding lines, resistant PI 165426, and 2 susceptible commercial cv. were tested for resistance to root galling and root knot nematode (*Meloidogyne incognita*) reproduction under greenhouse and field conditions. Root gall and reproduction indices, and no. of eggs/g of root were significantly less on resistant lines than on cv. White Seeded Provider in 2 greenhouse tests. In field tests, soil treatment with the nematicide DBPC resulted in significant control. In nontreated plots, resistant bean lines had less root galls than cv. Early Gallatin. Plots planted with resistant lines had fewer *M. incognita* larvae than those with cv. Early Gallatin. Mean yield of pods from resistant lines in nontreated soil was about 3 times the yield of cv. Early Gallatin. Yield of pods from treated and nontreated subplots were not significantly different. These results indicate that resistance is equivalent to soil fumigation for root-knot nematode control in snap beans. *(Author's summary)* E05

16981 LOPEZ, R. 1980. **Susceptibilidad comparativa de diez cultivares de frijol común (*Phaseolus vulgaris* L.) al ataque de *Meloidogyne incognita*.** *(Comparative susceptibility of ten common bean cultivars to the attack of Meloidogyne incognita).* Agronomía Costarricense 4(1):69-73. Span., Sum. Engl., Span., 6 Refs.

Phaseolus vulgaris. Meloidogyne incognita. **Nematodes. Cultivars. Host-plant resistance. Plant development. Plant anatomy. Growth analysis. Costa Rica.**

The susceptibility of bean cv. Mexico 80-R (M-80), Mexico 81-R (M-81), Mexico 27-N (M-27), Mexico 29-N (M-29), Alajuela 1-R (A-1), S-182-N (S-182), Porrillo No. 1 (P-1), Jamapa-N (J-N), Pavamor-N (Pa-N), and Turrialba 4-1 (T-4) to the attacks of *Meloidogyne incognita* was evaluated under greenhouse conditions. Sixty days after the inoculation of 10,000 eggs/plant, significant differences among cv. were found in the fresh wt. of tops, pods, and roots, and in the root-knot index. The reproduction rate of *M. incognita* was low in A-1, T-4, Pa-N, and P-1, moderate in S-182, M-27, J-N, M-29, and M-81, and relatively high in M-80. *M. incognita* significantly reduced the fresh wt. of tops of M-29, A-1, P-1, and Pa-N, the root wt. of Pa-N, and the pod wt. of A-1, but caused a significant increase in the fresh wt. of tops of M-80, the root wt. of M-80, M-27, M-29, and M-81, and the pod wt. of M-27 and P-1. *(Author's summary)* E05

E06 Physiological Disorders

0121

16971 SUKHADA, K.; JAYACHANDRA. 1980. **Pollen allelopathy – a new phenomenon.** New Phytologist 84(4):739-746. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Plant physiological disorders. Inhibition. Growth. Plant development. Abscission. Flowers. Weeds.**

The allelopathic effect of the pollen of *Parthenium hysterophorus* is discussed. In a lab. study, *P. hysterophorus* pollen or pollen extract inhibited pollen germination and pollen tube growth in several test species including *Crotalaria pallida* and *Desmodium heterocarpon.* Other effects included the withering of flowers and reduction of leaf chlorophyll content and shoot dry wt. in french bean. *P. hysterophorus* produced on av. 3375 million pollen grains/m^2 of stand. *(Summary by Field Crop Abstracts)* E06 D02

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

F00 PEST CONTROL AND ENTOMOLOGY

0122

16031 PERALTA J., F.; LOYA R., J.G. 1978. **Dosificación de insecticidas para control de las principales plagas del frijol en el estado de Morelos.** *(Insecticide dosage for controlling major pests in beans in the state of Morelos).* Chapingo 13/14:37-48. Span., Sum. Engl., Span., 6 Refs.

Phaseolus vulgaris. Bemisia tabaci. Empoasca sp. *Liriomyza* sp. *Trialeurodes vaporariorum.* **Insect control. Chemical control. Statistical analysis.**

During the dry season in the state of Morelos, Mexico, beans are attacked mainly by the whitefly (*Trialeurodes vaporariorum* y *Bemisia tabaci*), leafhoppers (*Empoasca* sp.), and leafminers (*Liriomyza* sp.). This study consisted in testing insecticide dosages for controlling the insects mentioned above. It was concluded that: (1) best treatments for adult whiteflies were methamidophos 0.427 *l*/ha and omethoate 0.641 *l*/ha; for immature stages, omethoate 0.641 and 0.427 *l*/ha; (2) the best treatments for adult leafhoppers were methamidophos 0.427 *l*/ha and omethoate 0.427 *l*/ha; for immature stages, omethoate 0.641 *l*/ha and methamidophos 0.641 *l*/ha; (3) the best treatments for adult leafminers were disulfoton 4 y 12 kg/ha; (4) according to performances obtained, the pest infestation did not affect bean yields; and (5) treatments with great residuality were all the doses of omethoate and methamidophos. The insecticide with less residual power was disulfoton at 4 and 8 kg/ha. *(Author's summary)* F00

0123

16019 DELL'ORTO T., H. 1981. **Infestación artificial de frejoles por medio de huevos y primeros estadios larvarios de bruco** *Acanthoscelides obtectus* **(Say) Coleoptera Bruchidae.** [*Artificial infestation of beans with eggs and first larval instars of the bean weevil Acanthoscelides obtectus (Say) Coleoptera Bruchidae*]. Agricultura Técnica (Chile) 41(2):103-104. Span., Sum. Span., Engl.

Phaseolus vulgaris. Acanthoscelides obtectus. **Oviposition. Population assesments. Survey methods.**

An easy method for infesting beans with the bruchid *Acanthoscelides obtectus* for studies under lab. conditions is described. This method permits the mass obtention of insects of uniform age, a condition desirable for investigations about its control. *(Author's summary)* F00

0124

16085 LEROI, B. 1980. **Regulation de la production ovarienne chez** *Acanthoscelides obtectus* **(Coleoptera: Bruchidae): influence de l'age des femelles lors de la fecondation et de la presence des grains.** [*Regulation of egg production in Acanthoscelides obtectus (Coleoptera: Bruchidae): the change in the stimulating effect of grain on females of different ages*]. Entomologia Experimentalis et Applicata 28: 132-144. Fr., Sum. Fr., Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Stored grain pests.** *Acanthoscelides obtectus.* **Oocytes. Oviposition. Seeds. Feeding stimulants. Insect biology. Timing.**

Females from a French strain of *Acanthoscelides obtectus* were mated soon after emergence, and after various lengths of time presented with host plant seeds. Even after a delay of 50 days, stimulation of the ovaries occurred as it did when females were presented with seeds as soon as copulation took place, but fewer eggs were produced. For insects of similar age, the stimulating effect of the seeds was greater if they were present when the females were 1st mated, than if they were presented after a delay. The stimulating effects were greatest in females aged between 20-30 days. This age corresponds to the end of the maturation period of the initial stock of ovocytes. This maturation would normally occur even in the absence of external stimuli. *(Author's summary)* F00

0125

15874 COSTA, E.C.; LINK, D. 1980. **Métodos de levantamento de insetos-pragas e predadores em feijoeiro.** *(Methods of surveying insect pests and predators on beans).* Revista do Centro de Ciencias Rurais 10(3):261-266. Port., Sum. Port., Engl., 7 Refs.

Phaseolus vulgaris. Injurious insects. *Diabrotica speciosa. Nezara viridula. Empoasca kraemeri.* Injurious mites. Survey methods. Brazil.

Three survey methods of arthropods associated with bean plants were tested at Santa Maria, Rio Grande do Sul, Brazil, during the growing season 1979/80 (Dec.-Jan.). The methods used were the ground cloth, the sweep net, and direct observation. The evaluation procedures used were the comparison of means and relative variation. The ground cloth method was the most efficient for the majority of the arthropods. The sweep net showed the highest precision for the bean leafhopper and spiders. *(Author's summary)* F00

0126

16933 HAGEL, G.T.; BURKE, D.W.; SILBERNAGEL, M.J. 1981. **Response of dry bean selections to field infestations of seedcorn maggot in central Washington.** Journal of Economic Entomology 74(4):441-443. Engl., Sum. Engl., 3 Refs.

Phaseolus vulgaris. Hylemya platura. Cultivars. Host-plant resistance. Agronomic characters. Seed color. USA.

Field comparisons of 64 and 96 selections of beans for response to seed corn maggot (SCM), *Hylemya platura,* were conducted in 1978 and 1979, resp. Black, red, pink, pinto, and certain white beans produced good stands despite severe infestation of SCM, but none were so resistant that they did not benefit from the protection provided by seed treatment with chlorpyrifos. The treatment even appeared to give complete protection to beans that were most sensitive to SCM attack. Selections most resistant to SCM in both years were black, dark red kidney, and pink types, and significant differences among these genotypes were few. Most white beans were severely damaged, but the class showed the greatest range in resistance to SCM. *(Author's summary)* F00

0127

16928 VARELA T., C.A.; CABRERA J., A.J. 1981. **Distribución del gorgojo del fríjol *Acanthoscelides obtectus* (Say), (Col., Bruchidae) y registro de hospedantes en el Depto. del Valle.** [*Distribution of the bruchid Acanthoscelides obtectus (Say), (Col., Bruchidae) and the register of host plants in the Cauca Valley*]. Tesis Ing. Agr. Palmira, Universidad Nacional de Colombia. Facultad de Ciencias Agropecuarias. 20p. Span., Sum. Span., Engl., Fr., 26 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. Zabrotes subfasciatus. Geographic distribution. Ecology. Host recognition. Population dynamics. Colombia.

A survey was conducted in 31 municipalities of Department of Valle. Colombia, in order to determine the distribution of the bruchid *Acanthoscelides obtectus,* which is currently the most important pest of stored beans in Colombia. A total of 370 samples were collected

from 29 host plants; 12 bruchids, one predator mite, and 3 parasitoid hymenopters of *A. obtectus* were found. The bruchid was found in all the plant formations studied (tropical very dry forest, premontane dry forest, tropical dry forest, premontane rain forest, premontane moist forest, lower montane moist forest, and lower montane rain forest) but higher populations of *A. obtectus* were found in premontane moist forests and in premontane rain forests. *(Author's summary)* F00

0128

16718 APPLEBAUM, S.W.; TADMOR, U.; PODOLER, H. 1970. **The effect of starch and of a heteropolysaccharide fraction from *Phaseolus vulgaris* on development and fecundity of *Callosobruchus chinensis* (Coleoptera: Bruchidae).** Entomologia Experimentalis et Applicata 13:61-70. Engl., Sum. Engl., Fr., 22 Refs.

Phaseolus vulgaris. Callosobruchus chinensis. **Stored grain pests. Host-plant resistance. Seed. Carbohydrate content. Enzymes. Analysis. Biochemistry. Insect biology. Insect control.**

A heteropolysaccharide fraction was isolated from *Phaseolus vulgaris* beans in which it comprises at least 1% of the dry wt. of the beans. This heteropolysaccharide increases larval mortality and decreases the rate of larval development and the no. of eggs deposited by females of *Callosobruchus chinensis*, when incorporated in artificial beans in which the larvae feed. It is composed of galactose, glucose, xylose, arabinose, and traces of rhamnose, as determined after acid hydrolysis. Of these individual sugars, arabinose and xylose affect adult fecundity as well. However, partial enzymic hydrolysis of the heteropolysaccharide fraction by *C. chinensis* larval midgut contents releases only glucose, galactose, and trace amounts of arabinose, and the integral structure of heteropolysaccharide may be necessary for biological activity. The incorporation of the starch granules of *Phaseolus vulgaris* beans into artificial beans increases larval mortality and decreases the rate of larval development of *C. chinensis*. It is suggested that the heteropolysaccharide fraction as well as the starch are part of a complex of natural components of *Phaseolus vulgaris* beans that make these beans resistant to *C. chinensis*. *(Author's summary)* F00

0129

16932 HILL, J.; SCHOONHOVEN, A.V. 1981. **Effectiveness of vegetable oil fractions in controlling the Mexican bean weevil on stored beans.** Journal of Economic Entomology 74(4):478-479. Engl., Sum. Engl., 6 Refs.

Phaseolus vulgaris. Zabrotes subfasciatus. **Stored grain pests. Storage. Insect control. Laboratory experiments. Colombia.**

Vegetable oil at a dosage of 1 ml/kg bean seed showed insecticidal effectiveness against *Zabrotes subfasciatus* infesting stored beans. The active oil fraction appeared to be the triglyceride component. Oleic acid appeared to be the only effective fatty acid of the ones tested. Linolenic and arachidonic acids showed some insecticidal effect. *(Author's summary)* F00

0130

16715 CAMPOS S., L. 1981. **Plagas de las leguminosas de grano en el contexto nacional y latinoamericano.** *(Pests of grain legumes in Chile and Latin America). In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. pp.96-121. Span., 8 Refs.

Phaseolus vulgaris. Agrotis ipsilon. Aphis fabae. Nezara viridula. Heliothis zea. Acanthoscelides obtectus. Myzus persicae. **Pests. Geographical distribution. Latin America.**

A general analysis is given of insect pests affecting grain legumes (beans, lentil, peas, chickpeas, and broad beans) in L.A., especially bean cultivation in Chile. A table is included on the most important pests found in the soil, sap, foliage, pods, and grains of legumes in Chile, Colombia, Peru, and Brazil. The major pests of grain legumes in Chile are analyzed: (a) soil insects: *Hylemya cilicrura, H. trichodactyla, Agrotis ipsilon, Feltia* spp., *Euxoa* and other subterranean larvae (Escarabeidae, Tenebrionidae, Curculionidae, and Elateridae); (b)

sap insects: *Empoasca curveola, Aphis fabae, A. craccivava, Acyrtosiphon pisum, Myzus persicae, Tetranychus urticae, T. cinnabarinus, T. ludeni, Thrips tabaci, Frankliniella cestrum*, and *Nezara viridula;* (c) foliage insects: *Liriomyza huidobrensis, L. quadrata, Rachiplusia nu, Syngrapha gammoides, Pseudaletia impuncta, Pseudoplusia includens, Spodoptera eridania, Urbanus proteus*, and *Dichroplus maculipennis;* and (d) pod and grain insects: *Epinotia aporema, Heliothis zea, Bruchus pisorum*, and *Acanthoscelides obtectus. (Summary by A.J. C. Trans. by L.M.F.)* F00

0131

17307 SCHOONHOVEN, A. VAN; CARDONA, C.; GARCIA, J.; GARZON, F. 1981. **Effect of weed covers on *Empoasca kraemeri* Ross and Moore populations and dry bean yields.** Environmental Entomology 10(6):901-907. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. Empoasca kraemeri. **Population dynamics. Timing. Insect control. Biological control. Weeds. Weeding. Yields.**

Field studies were conducted at the Centro Internacional de Agricultura Tropical, Cali, Colombia during 4 seasons to de ermine the effect of weed covers on *Empoasca kraemeri* populations and bean yields. Live stands of the broadleaf weed *Amaranthus dubius* did not have a significant effect on adult leafhopper populations, whereas the grass *Leptochloa filiformis* reduced adult populations throughout the crop cycle. This effect decreased when the weed was killed with paraquat. Live grass weed covers obtained with a mixture of *L. filiformis* and *Eleusine indica* effectively reduced nymphal and adult populations on both a susceptible and a leafhopper-tolerant var. Pure stands of *L. filiformis* reduced adult leafhopper populations significantly more than *E. indica.* Yields of the leafhopper-susceptible var. increased with the use of weed covers in unprotected plots. For the tolerant var. G 02146, only paraquat-treated weeds increased yields. *E. indica* was more competitive to the leafhopper-susceptible var. than *L. filiformis*, and both species of grasses affected yields of the leafhopper tolerant var. to the same degree. A search for less competitive weeds or plant species with economic value, capable of reducing leafhopper populations in beans, is suggested. *(Author's summary)* F00 D00

0132

16996 COSTA, E.C.; LINK, D.; MARIO, J.L. 1980. **Danos causados por *Nezara viridula* (L.) em feijoeiro (*Phaseolus vulgaris* L.).** *(Damage caused by Nezara viridula on bean plants).* Revista do Centro de Ciências Rurais 10(4):335-341. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris. Nezara viridula. Nematospora coryli. **Population dynamics. Plant injuries.**

A study was conducted to determine the damage of the southern green stink bug, *Nezara viridula*, on bean var. "mourinho" in cages at São Sepé, Rio do Sul, Brazil. The infestation levels were 0, 2, 4, 6, 8, and 12 non sexed adults/cage and one natural level of infestation, uncaged. The increase of the infestation level produced more empty pods and reduced seed no. and yields. The attack of this pentatomid reduced the germination rate of the harvested seeds and increased the incidence of the yeast spot disease, *Nematospora coryli*, with the increase of the infestation level. *(Author's summary)* F00 I03

0133

17313 BECQUER H., A.; FERRANDIZ P., R. 1981. **Dinámica de las poblaciones de áfidos en plantaciones de fríjol (*Phaseolus vulgaris* L.).** *(Population dynamics of aphids on bean fields).* Ciencias de la Agricultura 8:23-28. Span., Sum. Span., Engl., 9 Refs., Illus.

Phaseolus vulgaris. Aphis craccivora. Aphis gossypii. **Population dynamics. Timing. Field experiments. Cuba.**

Population dynamics of aphids on bean expfl. fields was studied during 1969-1970 and 1974-1976 at the Instituto de Investigaciones Fundamentales en Agricultura Tropical, Santiago de las Vegas (Cuba). Av. occurrence of aphids was persistently low through the year; the highest monthly mean (aphids/plant) occurring in Nov. Winged individuals were most frequently found on this cultivation. Population means and data on climatic factors were correlated, and a negative significance was found between population and RH. The most frequently found species were: *Aphis craccivora, A. gossypii,* and *Tetraneura nigriabdominalis. (Author's summary)* F00

See also 0043 0133

F01 Injurious Insects, Mites and their Control

0134

16067 ESKAFI, F.M.; SCHOONHOVEN, A. VAN 1981. **Interactions of leafhopper population, varietal resistance, insecticide treatment, and plant growth on dry bean yields in a tropical environment.** Journal of Economic Entomology 74(1): 7-12. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. Empoasca kraemeri. **Host-plant resistance. Insect control. Chemical control. Plant injuries. Climatic requirements. Temperature. Light. Rainfall data. Yields.**

Six var. of beans, planted in the dry and rainy seasons in a tropical middle-altitude of Colombia, varied in dry bean production within and between the seasons, with or without insecticides against *Empoasca kraemeri.* Dry season yields were reduced by 96% for the susceptible var. and as much as 75% for the resistant one in the absence of insecticide in irrigated fields. Use of insecticides decreased the leafhopper population and increased plant growth and yield significantly. Plant height in insecticide-treated and untreated plots was approx. twice in mid-growing cycle in the wet season as compared to the dry season. Dry to wet season ratio was 3:1 for adults and 5:1 for leafhopper nymphs in mid-growing season. Ratio of adult *E. kraemeri* to cm plant height in mid-growing cycle of the wet season was 0.17 on the susceptible var. but was 1.20 in the dry season. The means of the solar radiation and C° in the 2 seasons were ca. equal, but max. C°,% RH, and mm rainfall were different. It is suggested that in the dry season, leafhopper populations build up earlier on the susceptible var., and the effect of high solar radiation on injured plant reduces plant productivity, while higher N content in the plant may be the reason for a higher *E. kraemeri* fecundity. *(Author's summary)* F01

0135

16972 LEONG, K.L.H.; CANO, R.J.; KUBINSKI, A.M. 1980. **Factors affecting *Bacillus thuringiensis* total field persistence.** Environmental Entomology 9(5): 593-599. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. Trichoplusia ni. **Insect control. Biological control.** *Bacillus thuringiensis.* **USA.**

The persistence and survival of *Bacillus thuringiensis* were studied in order to evaluate statistically abiotic influences under field conditions in California (USA). Viable and total endospores, and bioassay with *Trichoplusia ni* were assessed. Abiotic factors were measured on leaves of beans, brocoli, and cabbage. The data suggested there were no apparent differences in the survival or persistence of endospores among the crops. Solar radiation, leaf temp.,and vapor pressure deficit affected *B. thuringiensis* endospore viability and pathogenicity. Bioassay was the best indicator of total field persistence of *B. thuringiensis. (Author's summary)* F01

0136

16976 TAYLOR, R.W.D.; EVANS, N.J. 1980. **Laboratory evaluation of pirimiphos methyl and permethrin dilute dust for control of bruchid beetles attacking stored pulses.** International Pest Control 22(5):108-110. Engl., Sum. Engl., 3 Refs.

Phaseolus vulgaris. Acanthoscelides obtectus. Callosobruchus sinensis. **Stored grain pests. Insect control. Chemical control. Timing. Laboratory experiments.**

In warm climates, pulse crops are susceptible to attacks by bruchid beetles (e.g. *Callosobruchus chinensis* and *Acanthoscelides obtectus*) prior to harvest, the infestation continuing when the crop is brought into store. In the past control has been achieved by admixing lindane or synergized pyrethrin dusts. Alternative insecticides are now necessary since lindane is no longer acceptable due to its long persistence and harmful residues and pyrethrins are difficult to obtain or expensive. Pirimiphos-methyl, an organophosphorus compound, and permethrin, a synthetic pyrethroid, both as dust formulation, proved to be very effective in protecting pigeon peas and haricot beans for up to 24 wk. at application rates of 5 mg a.i./kg seed. *(Author's summary)* F01 L01

0137

16954 OLIVEIRA, J.V. DE; BATISTA, G.C. DE 1979. **Uso de computador em ensaios biológicos com defensivos agrícolas.** *(Use of a computer in biological tests with pesticides).* Fitossanidade 3(1/2):54. Port., Sum. Engl., 1 Ref.

Phaseolus vulgaris. Callosobruchus maculatus. Zabrotes subfasciatus. Acanthoscelides obtectus. **Insect control.**

Some details are given of a computer program (written in FORTRAN IV) developed by R.J. Daum in the USA for the analysis of the results of tests with insecticides. The program, which permits the calculation of values between LD_{10} and LD_{99} with ease, was tested in Brazil to determine the relative toxicities of insecticides to *Callosobruchus maculatus, Zabrotes subfasciatus,* and *Acanthoscelides obtectus,* important pests there of stored beans. *(Summary by Review of Applied Entomology)* F01

0138

16769 ALDANA DE LEON, L.F.; MASAYA S., P.; YOSHII, K. 1981. **La tolerancia al mosaico dorado del fríjol común y el combate químico del vector, (*Bemicia tabaci,* Genn) como medio de control.** [*Bean tolerance to the golden mosaic virus and chemical control of the vector (Bemisia tabaci)*]. *In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.3, pp.L9-1-L9-29. Span., 10 Refs.

Phaseolus vulgaris. **Bean golden mosaic virus. Host-plant resistance. Cultivars.** *Bemisia tabaci.* **Insect control. Chemical control. Guatemala.**

The chemical control of *Bemisia tabaci,* vector of BGMV, was studied as a control measure of the disease in Guatemala. Six treatments of chemical control were applied to 3 bean var. in a split plot design with 4 replications in 4 sites of the SE region of the country (Quesada, Jutiapa, Asunción Mita, and Monjas), during the planting season Aug. Nov. 1979. Treatments included: (1) carbofuran 5G, 20 kg/ha to the soil at planting; (2) carbofuran 5G, 40 kg/ha at planting; (3) carbofuran 4F applied to the seed; (4) 5 leaf applications of powdered milk (2 kg/ha); (5) carbofuran 5G (20 kg/ha) + 5 weekly applications of methamidophos (1 kg/ha); (6) check with no application. Var. included were ICTA-Jutiapán (tolerant to BGMV), Suchitán (moderate tolerance), and Rabia de Gato (susceptible). BGMV infection was high in 3 of the 4 sites, except in Asunción Mita. In all the sites, the lowest no. of infected plants was observed in treatment 5, with little difference between treatments 1 and 3. The effect of var. tolerance to BGMV was observed in both the no. of infected plants and in yields; ICTA-Jutiapán being superior in yield to Suchitán and this, in turn, to Rabia de Gato. Treatment 5 minimizes differences in tolerance between ICTA-Jutiapán and Suchitán and in Quesada, produced the highest yields with 3443 and 3535 kg/ha, resp. compared with 1960 kg/ha for Rabia de Gato. At some sites toxicity was observed in the seed with treatment 3. The lack of rainfall in Asunción Mita did not allow a high incidence of BGMV, therefore no statistical differences were found between treatments and

var. Treatment 4 was similar to the check treatment. It was concluded that there are several alternatives for controlling BGMV with chemical products and tolerant var.; their combination is more stable and economical than the use of chemical control alone. *(Summary by A.J.C. Trans. by L.M.F.)* F01 E04

G00 GENETICS AND PLANT BREEDING

0139

16406 FOZDAR, B.S. 1962. **Cytological investigation of parents, offspring and backcross derivatives involved in the interspecific cross *Phaseolus lunatus* L. x. *P. polystachyus* (L.).** B.S.P. Gainesville, University of Florida. 113p. Engl., Sum. Engl., 54 Refs., Illus.

Phaseolus spp. *Phaseolus lunatus. Phaseolus polystachyus.* **Backcrossing. Cytology. Chromosomes. Pollen. Flowers. Pods. Morphogenesis.**

Cytological investigations of the backcross, F_1, fertile and sterile F_2, and amphidiploid derivatives of the interspecific cross *Phaseolus lunatus* x *P. polystachyus* were conducted at the U. of Florida as a supplement to the interspecific hybridization program in the genus *Phaseolus*. Plant material consisted of *P. lunatus* var. Fordhook, *P. polystachyus*, their F_1 hybrids and backcross (*P. lunatus* recurrent), and amphidiploid derivatives. Acetocarmine squashes of the pollen-mother-cells were prepared according to a modified schedule suggested by Hyde and Gardella, using $Fe(OH)_3$ as a mordant. Root tips were obtained from germinating seedlings and IBA-treated cuttings. They were then prepared according to Fuelgen technique following pretreatment with 8-hydroxiquinoline and employing pectinase after staining to facilitate dispersion of cells and spreading of the chromosomes. Karyotypes of the species *P. lunatus* and *P. polystachyus* were studied and idiograms prepared. The 2 species appear to agree in morphological characters of several chromosome pairs while others are distinctly different. There is a significant difference in the pollen grain ϕ of the 2 species, suggesting a possible correlation of a greater total length of the *P. polystachyus* chromosomes with increased pollen grain size. The chromosome no. of $2n = 22$, for both species, was confirmed. The irregularity of meiosis in the F_1 hybrid was also confirmed by observance of univalents at metaphase I, and of laggards, chromosome bridges,and apparent fragments. Stages interpreted as concerned with the formation of restitution nuclei were observed immediately following metaphase I in the almost completely sterile hybrid. The chromosome no. was established as $2n = 44$ for the single fertile amphidiploid F_2 plant and most of its derived F_3 and F_4 progenies with the exception of a single aneuploid plant. One F_3 individual apparently had $2n = 42$ chromosomes, but in view of the comparatively large no. of chromosomes involved, this no. is not positively established. Some meiotic irregularity in the amphidiploids was associated with the formation of quadrivalents which involves allosyndetic homologies between chromosomes as suggested by a comparison of the karyotypes of the 2 species. The occurrence of one essentially amphidiploid F_4 individual with white flowers is genetic evidence that amphidiploidy is not absolute and that the recombination of genes from the 2 species is possible for at least some homologous units in the respective *lunatus* and *polystachyus* genomes. Individual characteristics of both species and their amphidiploid derivatives are compared. All changes in the chromosome no. were accompanied by a corresponding change in the size of pollen grains. All backcross derivatives studied had $2n = 22$ no. of chromosomes. Segregation of characters was observed with respect to vine habit and seed coat color. Some of the plants were fertile while the others were sterile. Essentially *P. lunatus* types have been obtained but have some *P. polystachyus* derived characters concerned principally with seed coat color and plant habit determination. The fertility of the amphidiploids was found to be high enough to permit easy maintenance of several lines and it would appear likely that later generations could result in the development of fully fertile lines capable of competing in the wild with the native *P. polystachyus.*

Frequency distribution studies of pollen grain ϕ indicated a fairly constant pollen size in *P. polystachyus*, nearly the same degree of uniformity in *P. lunatus* but exhibited a greater increase in the range of variability in the amphidiploids. *(Author's summary)* G00

0140

16412 EMPRESA PERNAMBUCANA DE PESQUISA AGROPECUARIA. 1977. Projeto feijão: principais resultados de pesquisas 1977. *(Bean program; principal results of research in 1977)*. Recife, Pernambuco, Brasil, Convenio SUDENE-IPA. 22p. Port.

Phaseolus vulgaris. Developmental research. Plant breeding. Cultivars. Diseases and pathogens. Pests. Host-plant resistance. Intercropping. Productivity. Fertilizers. Brazil.

The most important results obtained in research conducted by the Empresa Pernambucana de Pesquisa Agropecuária (Brazil) in 1977 on bean crops under conditions of excess rainfall and high RH are given. Results include evaluations on breeding, sanitary conditions, maize/bean intercropping, plant nutrition, management of soil fertility in bean-producing areas and of the nutritional quality of seeds. Production vol. was higher than that of 1976, causing a reduction in product price. A total of 207 new lines of beans, resistant to rust (*Uromyces phaseoli*) and with greater productivity than IPA-74-19, and 25 exptl. lines with a productivity 22% greater than that of IPA-74-19 and resistant to rust, anthracnose (*Colletotrichum lindemuthianum*), and *Rhizoctonia* sp. were selected. Selected cv. were distributed by zones according to their resistance to major diseases. Spatial arrangements of plants had marked effects on maize/bean intercropping, independently of the level of soil fertility. The employment of maize as a prop of a climbing bean var. introduced from CIAT did not affect its productive capacity. Total land productivity in the associated system was higher in 1977. Different methods for chemically analyzing soil with respect to P were revised. The need of soil conservation practices (Lithosol of irregular topography) and the efficiency of the current system of soil management in Caruaru were noted. *(Summary by I.B. Trans. by L. M.F.)* G00 D00

0141

16467 MIRANDA C., S. 1965?. Mejoramiento del fríjol en México. *(Bean improvement in Mexico)*. México, Instituto Nacional de Investigaciones Agrícolas. 34p. Span., 48 Refs., Illus.

Phaseolus vulgaris. Agronomic characters. Host-plant resistance. *Colletotrichum lindemuthianum*. *Uromyces phaseoli*. *Pseudomonas phaseolicola*. Viroses. Hybridizing. Backcrossing. Selection. Plant anatomy. Mexico.

Some techniques to obtain improved bean var. in Mexico are described. The presentation of these techniques is based on a description of morphological aspects and of crossing techniques, in addition to the variability in *Phaseolus vulgaris* regarding the color of the leaves, stem, and flowers, characteristics of the pod, seed color and wt., and reaction to diseases. The objects of plant breeding in Mexico are discussed: high yields, disease and pest resistance, and seed characteristics. A general description is given of plant breeding methods by introduction, mass selection, individual selection, hybridization, selection by pedigree, mass planting, backcrossing, multiple crossing, and irradiation. The methods currently used in Mexico (individual selection and hybridization, and selection by pedigree) are described along with the plant breeding methods suggested for this country: mass selection and HIMSI (hybridization, mass planting, and individual selection). *(Summary by A.J.C. Trans. by L.M. F.)* G00

0142

16734 BASCUR B., G. 1981. Enfoque del programa de mejoramiento de frejoles y análisis de las principales variedades. *(Objectives of the bean improvement program and analysis of the principal varieties)*. *In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. 29p. Span.

Phaseolus vulgaris. **Cultivars. Agronomic characters. Yields. Adaptation. Selection. Chile.**

The Grain Legumes Program of the Instituto Nacional de Investigaciones Agropecuarias (INIA) conducts research at the exptl. stations La Platina and Quilamapu in the areas of plant breeding and agronomy on the basis of analysis of the problems affecting bean crops in Chile. Plant breeding concentrates on the obtainment of var. for local consumption and exportation, resistant especially to BCMV, including the strain that causes necrosis. The characteristics that the 4 types of var. sought (green pods, red pods, dry grain for local consumption, and dry grain for exportation) should have are described. Bean var. released by the Program and available to farmers, are given including a description on origin, plant characteristics, planting date, areas under cultivation, disease resistance, yield, and uses. The var. described include Apolo, Bayos Titan, Suaves, Tórtola Diana, Tórtola INIA, Hallados Alemanes 114, Hallados Dorados, Arroz-3, Seaway, Cristal Blanco-Fenix, Negro Argel, Orfeo-INIA, Redkloud, Araucano-INIA, Blanco-INIA, Frutilla-INIA, and Red-Mexican-INIA. *(Summary by A.J.C. Trans. by L.M.F.)* G00 B00

0143

16478 SHII, C.T.; MOK, M.C.; TEMPLE, S.R.; MOK, D.W.S. 1980. **Expression of developmental abnormalities in hybrids of *Phaseolus vulgaris* L. Interaction between temperature and allelic dosage.** Journal of Heredity 71:218-222. Engl., Sum. Engl., 4 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Hybridizing. Backcrossing. Genes. Lethal genes. Symptomatology. Growth. Leaves. Chlorosis. Developmental stages. Plant anatomy. Timing. Colombia.**

The occurrence of abnormal F_1's in crosses of *Phaseolus vulgaris* was found to be conditioned by 2 independent heterozygous loci, tentatively designated as DL_1 (for dosage dependent lethal) and DL_2. The expression of morphological abnormalities of F_1's was influenced by temp.; the abnormal phenotype being accentuated by high temp. The severity of the developmental derangement was dependent on the allelic dosage. Plants homozygous dominant at both loci were lethal and plants that were homozygous dominant at one locus and heterozygous at the other also perished but at a slower rate. As the presence of dominant alleles DL_1 and DL_2 affects many aspects of growth, it appears that the 2 loci may be related to the regulation of key processes of normal development. However, the specific physiological changes associated with the morphological abnormalities are presently unknown. *(Author's summary)* G00

0144

16428 KRETCHMER, P.J.; LAING, D.R.; WALLACE, D.H. 1979. **Inheritance and morphological traits of a phytochrome-controlled single gene in bean.** Crop Science 19(5):605-607. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Agronomic characters. Plant habit. Genes. Dwarf bean. Climbing bean. Light. Backcrossing. Selection. Photoperiod. Flowering.**

Three bean lines that changed from indeterminate nonclimbing bush to indeterminate climbing, with control by the red/far-red light ratio, were crossed with a line which remained an indeterminate nonclimbing bush under all red/far-red ratios. The climbing trait was found to be controlled by 1 major gene based on segregation data in F_2 and backcross progeny from crosses to both parents. Red light stimulated the activity of this dominant allele and far-red light retarded it. As climbing occurred, internode elongation was greater in climbing than nonclimbing plants. Genetic control of flowering sensitivity to long-day photoperiod was independent of the gene for climbing vs. nonclimbing growth habits. It was concluded that flowering and climbing are 2 genetically independent phytochrome-controlled response. *(Author's summary)* G00

0145

16929 DAVIS, J.H.C. 1978. **Mejoramiento de fríjoles volubles para sistemas de siembra de asociación con maíz.** *(Climbing bean breeding for associated cropping systems with maize).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 14p. Span., Sum. Span., 4 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Climbing bean. Plant habit. Yields. Productivity. Field experiments. Colombia.**

Maize and climbing beans are traditionally planted in association in the sierra regions of L.A. with alt. higher than 1500 m. The system has shown a series of advantages: low incidence of certain pests and diseases, less root lodging in maize, and less risk for the farmers. The types of climbing bean and maize used in associated cropping systems were studied. In general, maize and bean yields were negatively related and it was found that yields of tall maize genotypes were less affected by beans than short maize genotypes. Root lodging of tall maize genotypes was notably reduced in association. Stem lodging of short maize genotypes was due to the vigorous growth of some climbing bean var. Very vigorous bean var. could not reach their own yield potential with short maize genotypes due to the poor support system. In yield trials with climbing bean breeding material, both relay and associated cropping systems with maize had lower costs than beans in monoculture as well as being the most representative system used by farmers. Yields of bean genotypes in association were generally lower and had less significant differences than in monoculture. It was concluded that with an appropriate management of plot size and border effects, climbing bean yields were higher in association and were favorably assessed from an economic standpoint. *(Author's summary. Trans. by L.M.F.)* G00 D03

0146

16999 KORBAN, S.S.; COYNE, D.P.; WEIHING, J.L. 1981. **Evaluation, variation, and genetic control of seed-coat whiteness in dry beans (*Phaseolus vulgaris* L.).** Journal of the American Society for Horticultural Science 106(5):575-579. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Seed coat. Seed color. Genes. Inheritance. Adaptation. Heterosis. Statistical analysis.**

A Hunter Color Difference meter and a white-paint color chart were used to determine the degree of whiteness among 8 white-seeded Great Northern (GN) cv. of *Phaseolus vulgaris.* A correlation coefficient of + 0.84 was found between the 2 methods. The former method provided better separation of cv. for degrees of whiteness than the latter method. Two genetic studies were conducted, with seed-coat whiteness determined by use of the white-paint color strip. Cv. GN Emerson had the whitest seed-coat. The inheritance of seed-coat whiteness was investigated in 1978 using parents, F_2s of the crosses Plant Introduction (PI) 165078 (bright white) with GN Emerson (moderately bright white), GN Valley (dull white), and GN UI 59 (dull white) and in the reciprocal cross Bulgarian White (brightest white) x GN UI 59 (dull white). A quantitative pattern of inheritance was observed. Broad sense heritability estimates for this trait ranged from 46-57%. The Gardner and Eberhart model, Analysis II, was used in 1979 to estimate genetic effects for the trait in a 6 parent diallel cross involving GN Emerson, GN UI 59, Bulgarian White, GN Star, GN 1140, and GN D-88 (the last 3 all dull white). Additive genetic effects were predominant; but heterosis effects were also important, including significant effects for specific combining ability and reciprocal crosses. Cv. Bulgarian White showed high combining ability for brighter whiteness. The genetic data indicate that improvement of seed-coat whiteness in dry beans should be relatively easy to accomplish. *(Author's summary)* G00

0147

16998 MUHALET, C.S.; ADAMS, M.W.; SAETTLER, A.W.; GHADERI, A. 1981. **Genetic system for the reaction of field beans to beta, gamma, and delta races of *Colletotrichum lindemuthianum.*** Journal of the American Society for Horticultural Science 106(5):601-604. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. Races. **Host-plant resistance. Genes. Plant breeding.**

Five cv. and one breeding line of field beans were evaluated for their differential reactions to β, γ, and δ races of anthracnose (*Colletotrichum lindemuthianum*). Parental, F_1, and F_2 plants from 10 crosses involving anthracnose resistant and susceptible parents were inoculated with the 3 races. Inoculated plants were maintained in a mist chamber for 8-10 days until plants could be classified into resistant and susceptible groups on the basis of their reactions to the pathogen. The F_2 segregation patterns suggested that independent and complementary gene action at 1 or 2 different loci produced a resistant reaction to all races of the pathogen. In addition, an allelomorphic series of 3 alleles was assumed to be controlling resistance to the β race. A breeding scheme, involving alternate generations of backcrossing to the recurrent parent and selfing, is an effective method to develop resistant cv. *(Author's summary)* G00 E03

See also 0091 0104

G01 Breeding, Selection and Germplasm

0148

16006 MOHAN, S.T. 1981. **Breeding dry beans (*Phaseolus vulgaris* L.) for common bacterial blight resistance: relation of days to flowering to blight reaction.** Turrialba 31(2):109-112. Engl., Sum. Span., Engl., Port., 6 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. **Host-plant resistance. Flowering. Timing. Agronomic characters. Cultivars. Plant breeding.**

The days to flowering and blight resistance were analyzed for certain commercial bean var. and blight resistant lines obtained from the crossing of these var. with Great Northern Nebraska no. 1, Sel. 27. Commercial var. were susceptible to blight, while the crosses of these var. with Great Northern Nebraska 1, Sel. 27 resulted in segregants with higher levels of blight resistance than the progenitors and in general maintained the flowering period similar to the parental commercial var., though a few segregants were recovered with early or late flowering. Results indicate that there is no correlation between days to flowering and blight rating. Further evidence of this comes from the study of F_2 population of a cross between precocious blight susceptible x normal blight resistant breeding lines where the correlation between time of flowering and blight rating was nonsignificant. Precocious, blight resistant segregants were obtained suggesting that these 2 characters can be combined. Such a combination will help evolving bean var. suited for crop rotation. *(Author's summary)* G01 E02

0149

16482 SMARTT, J. 1981. **Gene pools in *Phaseolus* and *Vigna* cultigens.** Euphytica 30:445-449. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. Phaseolus **spp.** *Vigna* **sp. Genes. Hybridizing. Identification.**

The nature and extent of the gene pools in cultigens of the genera *Phaseolus* and *Vigna*, as indicated by studies of exptl. interspecific hybridization, are reviewed. In all cases a primary gene pool exists comprising conspecific wild and cultivated forms. Secondary gene pools have been established for *P. vulgaris - P. coccineus, Vigna radiata - V. mungo* and *V. angularis - V. umbellata* but not for *V. unguiculata* and for *Voandzeia subterranea*. Tertiary gene-pools apparently exist for all *Phaseolus* cultigens and the Asiatic grams but not for *V. unguiculata* and *V. subterranea* as far as is known. *(Author's summary)* G01

0150

15849 BEEBE, S.E.; BLISS, F.A.; SCHWARTZ, H.F. 1981. **Root rot resistance in common bean germ plasm of Latin American origin.** Plant Disease 65(6):485-489. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. Rhizoctonia solani. Fusarium solani. Sclerotium rolfsii. Pythium **spp. Host-plant resistance. Experiment design. Cultivars. Symptomatology. Plant injuries. Yields. Germplasm. Latin America.**

Resistances of common bean to *Fusarium solani, Rhizoctonia solani, Sclerotium rolfsii,* and *Pythium* spp. were studied. N203 (PI 203958) displayed only intermediate field resistance

to *F. solani*, whereas Cornell 2114-12 and several tropical cv. were highly resistant. Resistance to *Pythium* spp. was common among color-seeded tropical materials. Resistances to *R. solani* and *S. rolfsii* were measured by plant survival, because hypocotyl lesions and disease severity had little effect on plant yield. Resistance to *R. solani* was comparable to that of other L.A. bean cv. Many tropically adapted cv. demonstrated resistance to the pathogens superior to that of previously reported sources. *(Author's summary)* G01 E03

0151

16766 IBARRA P., F.J.; LOPEZ S., E. 1981. Parámetros de estabilidad para evaluar la adaptación de variedades de fríjol en la región tropical del sureste de México. *(Parameters of stability to assess the adaptation of bean varieties in the tropical region of southeastern Mexico). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.3, pp.L25-1-L25-16. Span., Sum. Span., 19 Refs., Illus.

Phaseolus vulgaris. Cultivars. Adaptation. Stability. Statistical analysis. Field experiments. Mexico.

In order to develop bean var. with a broad range of adaptation in SE Mexico, 20 bean var. and lines were evaluated during 1978 and 1979 in 22 similar trials in 12 sites, representative of the humid tropics. Although there was no significant difference in yields between var., 11 of them were considered as stable var. according to the methodology used. The character of stability can be used in crosses with genotypes that have a high yield potential, but low stability. *(Author's summary. Trans. by L.M.F.)* G01

0152

17302 MUKUNYA, D.M.; KEYA, S.O. 1978. Yield performance and selection for resistance in beans (*Phaseolus vulgaris* L.) to common diseases in Kenya. East African Agricultural and Forestry Journal 43(4):390-396. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. Germplasm. Cultivars. Yields. *Colletotrichum lindemuthianum. Uromyces phaseoli. Pseudomonas phaseolicola.* Host-plant resistance. Selection. Kenya.

A collection of 1250 indigenous and introduced *Phaseolus* bean accessions was evaluated for yield and resistance to important bean diseases under field and greenhouse conditions for a period of 3 yr at the Kabete Faculty of Agriculture Field Station, Nairobi (Kenya). Considerable variation was found among the lines regarding yield and reactions to anthracnose (*Colletotrichum lindemuthianum*), halo blight (*Pseudomonas phaseolicola*), and rust (*Uromyces phaseoli*). Anthracnose and halo blight resistance seemed to be consistently associated with the small black and small red bean types. Most collections which fell among the large or variegated seed types were found to be highly susceptible to anthracnose and halo blight. Except for some introduced lines which showed high susceptibility to rust, many lines, particularly those of local origin, contained considerable resistance to rust. The best performing lines constituting 5% of the total collection have been reported. Of these, NB16, NB84, NB86, NB248, NB278, NB563, NB627, NB259, NB649, and NB1181 combine a high yield potential with resistance to the 3 diseases. *(Author's summary)* G01 E00

0153

16403 RIOS M., E.E. 1976. El rendimiento y los componentes del fríjol común (*Phaseolus vulgaris* L.) en el oriente de Guatemala. *(Bean yield and components in eastern Guatemala).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala. Facultad de Agronomía. 52p. Span., 27 Refs.

Phaseolus vulgaris. Cultivars. Yields. Yield components. Seed characters. Plant habit. Adaptation. Stability. Ecology. Guatemala.

Trials were conducted in Monjas, Ipala, and Jalpatagua, Guatemala, using a random block exptl. design with 4 replications and 17 treatments to evaluate the yield and ecological adaptability of 16 introduced promissory *Phaseolus vulgaris* var. from the Centro Internacional de Agricultura Tropical (CIAT), Colombia as well as yield correlations and yield components of beans in monoculture or intercropped with maize. In the localities of Monjas and Ipala, yields were stable for var. 6589-1-T-T, 150-1-1, 141-1-M-1, 6530, and 6540-1-T-T. The no. of pods/branch was not affected by environmental conditions. HI, grain size, the no. of pods/plant, and the no. of grains/pod had var. differences and were not affected by environmental conditions. In Jalpatagua, the no. of branches/plant had significant differences, unlike the situation in Ipala. The stability of the correlation in yields with the different components shows the var. stability of the tested lines. The components that most influenced bean yields were HI, the no. of pods/plant, and the no. of grains/pod. *(Summary by I.B. Trans. by L.M.F.)* G01 D00

0154

16756 CENTRO DE INVESTIGACIONES FITOTECNICAS DE PAIRUMANI. BOLIVIA. 1980. Fríjol. *(Beans). In* ——. Informe anual de actividades correspondiente a 1980. Cochabamba. pp. 38-44. Span.

Phaseolus vulgaris. **Research. Plant breeding.** *Colletotrichum lindemuthianum.* **Host-plant resistance. Germplasm. Selection. Agronomic characters. Nitrogen-fixing bacteria. Field experiments. Yields. Bolivia.**

A summary of the activities of the Bean Program of the Centro de Investigaciones Fitotécnicas, Bolivia, during 1980 is given. The selection of progenies from crossings between germplasm adapted to the environmental conditions but susceptible to *Colletotrichum lindemuthianum* and resistant germplasm continued. In yield trials, the following var. were outstanding: Type I (early maturing, dwarf) var. P-402 (3285 kg/ha), ICA-Tui (3252 kg/ha), and Pairumani FI-27 (3101 kg/ha); Type II (early maturing, climbing) var. Pairumani FI-125 (2528 kg/ha), Pairumani FI-69 (2472 kg/ha), P-386 (2472 kg/ha), P-524 (2389 kg/ha), and P-259 (2250 kg/ha); and Type III (late maturing, climbing) var. Pairumani CF-39. Research evaluating the introduced and local germplasm as to green pod consumption was initiated; the material collected locally was outstanding. For the 1st time an inoculation trial was conducted with 10 introduced strains of *Rhizobium* and 1 strain isolated locally, and compared with a check with no inoculant nor fertilizer and one with N fertilization but no inoculant. No significant differences were observed between strains but favorable differences were observed with strain CIAT-904 regarding plant color, no. of nodules, and grain protein content. *(Summary by A.J.C. Trans. by L.M.F.)* G01

0155

16742 COYNE, D.P.; NULAND, D.S.; SCHUSTER, M.L.; ANDERSON, F.N. 1980. 'Great Northern Harris' dry bean. HortScience 15(4):531. Engl., 2 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. **Cultivars. Germplasm. Host-plant resistance.**

The new cv. of *Phaseolus vulgaris*, Great Northern Harris, developed from bulk selections of cv. GN Valley, shows tolerance of blight (*Xanthomonas phaseoli*) and high yielding ability equal to that of the latter cv. *(Summary by Review of Plant Pathology)* G01 E02

See also 0088

G02 Cytogenetics

0156

16713 SRIVASTAVA, H.K. 1981. **Chiasma frequency and heterosis in common beans (*Phaseolus vulgaris* L.).** Turrialba 31(2):147-151. Engl., Sum. Engl., Span., 12 Refs.

Phaseolus vulgaris. Heterosis. Cytogenetics. Chromosomes. Cytology. Hybridizing. Genotypes. Yields. Agronomic characters.

Chiasmata frequency distribution in relation to heterosis for key morphological and physiological traits employing 10 geographically diverse inbred lines and their 5 resp. F_1 hybrid lines in common bean has been extensively studied. The hybrid populations exhibited chiasma heterosis and it was further reflected in phenotypic superiority of the hybrids with regard to 5 quantitative measurements: bean yield (g/plant), total DM (g/plant), HI (%), bean yield efficiency (g/day), and total DM efficiency (g/day). Relative genetic heterosis in a couple of hybrid lines (F_1 b and F_1 c) reached a range of 40-50% for bean yield efficiency and total DM efficiency. The results were interpreted from the point of view that chiasmata heterosis is genetically associated to overall heterosis phenomenon by way of promoting higher levels of genetic variation and heterozygous advantages in hybrid individuals. The hypothesis that chiasmata heterosis is governed by genetic factors and is most likely due to dispersed genes on the chromosomes possessing combined overdominance and epistatic interactions is discussed. *(Author's summary)* G02

0157

16931 SAHAI, S.; RANA, R.S. 1980. **Homology and differentiation in *Phaseolus*.** Indian Journal of Genetics and Plant Breeding 40(2):311-315. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus spp. Taxonomy. Cytology. Chromosomes. Cell division. Pollen. Seed. Proteins. Analysis. Biochemistry. Identification.

Based on chromosome cytology, pollen and nuclear size, and seed proteins, it is suggested that the species *Phaseolus aureus* and *P. mungo* should be considered distinct. These together with distinct morphological features like differences in pod and seed-hilum characteristics and the markedly reduced crossability, provide conclusive evidence that while *P. aureus* and *P. mungo* are closely related, they are nevertheless clearly distinct and merit separate specific status. *(Author's summary)* G02

0158

16476 CHENG, S.S.; BASSETT, M.J.; QUESENBERRY, K.H. 1981. **Cytogenetic analysis of interspecific hybrids between common bean and Scarlet runner bean.** Crop Science 21(1):75-79. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Hybridizing. Chromosomes. Brigde frequencies. Pollen. Cytogenetics. Selection.

Meiotic analyses in F_1 hybrids between 3 lines of common bean, and 2 lines of Scarlet runner bean, *Phaseolus coccineus*, were conducted to study the degree of similarity between

the 2 genomes. The quantitative data indicated that meiosis in the 3 F_1 hybrids studied was abnormal. At least 2 pairs of chromosomes were differentiated by inversions. Data on bridge and laggard frequencies taken from anaphase I and II pollen mother cells (PMCs) were interpreted to mean that cross-over within these inverted segments was responsible for 20-40% of the 58-79% pollen abortion observed in the interspecific hybrids. The identical frequency of PMCs with bridge-laggards in anaphase I and II indicated that the inversions were located at the end of the differentiated chromosomes. *(Author's summary)* G02

0159

17311 YANKULOV, M.T.; ISASI, E.M.; ABREU F., S. 1980. **Algunos aspectos sobre la sensibilidad y mutabilidad de dos variedades de fríjol por influencia de rayos gamma Co^{60} y etil-metan-sulfonato (EMS).** [*Some aspects of the sensitivity and mutability of two bean varieties influenced by ^{60}Co gamma rays and ethyl-methane-sulfonate (EMS)*]. Ciencias de la Agricultura 7:59-64. Span., Sum. Span., Engl., 11 Refs.

Phaseolus vulgaris. Mutation. Plant breeding. Irradiation. Plant-growth substances. Seed treatment. Laboratory experiments.

Results obtained with the mutagenic treatment of 2 bean var. showed an inverse correlation between dose and survival, and a direct correlation between dose and % of chlorophyll mutations with both mutagens. An inverse correlation between survival of M_1 plants and chlorophyll mutation % in M_2 was also proved. Differences in sensibility and mutability of var. were observed as well as a decrease of the mutagenic effectivity as the dose increases. These facts prove that a direct correlation between dose and mutation %does not mean that it is possible to obtain a high % of mutations by increasing the dose,because it depends on the sensibility of the var. used and the lesser effectivity of the higher doses. *(Author's summary)* G02

H00 NUTRITION

0160

16090 FERNANDEZ, R.; ELIAS, L.G.; BRESSANI, R. 1981. **Variabilidad genética y ambiental en inhibidores de tripsina y hemaglutininas, observadas en cultivares de fríjol común (*Phaseolus vulgaris*) proveniente de Centroamérica y Colombia.** *(Genetic and environmental variability of trypsin inhibitors and hemagglutinin, observed in common bean cultivars from Central America and Colombia).* Turrialba 31(2):153-161. Span., Sum. Engl., Span., 21 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Seed color. Toxicity. Ecology. Digestibility. Amino acids. Human nutrition. Central America.**

The effects of environment and the color of seed coat on the concn. of trypsin inhibitors and hemagglutinin compounds in bean seeds were studied. A total of 20 cv. obtained from the Centro Internacional de Agricultura Tropical, Colombia was planted at the same time in Colombia, El Salvador, and Honduras. These samples were then sent to the Instituto de Nutrición de Centro América y Panamá (INCAP), Guatemala and were classified into 4 color types: black, white, red, and brown. Samples were analyzed for trypsin inhibitors and hemagglutinin compounds and the results were statistically analyzed through a factorial analysis of variance. This indicated a significant effect of environment on trypsin inhibitors $P \leq 0.05$), with samples from Honduras having higher concn. than those from the other localities. Seed color and the interaction between environment and color had no effect on TIA. The concn. of hemagglutinin activity was significantly affected by environment, with samples from Honduras having lower activities than those from the other localities. In this case, seed color influenced statistically the activity of hemagglutinin compounds with values for color seed higher than those found in white seeds. The interaction between environment and color did not affect hemagglutinin content in the seed. TIA was highly correlated with mot. concn. Because of this, it would be of practical interest to determine the influence of specific environmental factors on TIA such as water availability and mineral composition of the soil. *(Author's summary)* H00 C03 D04

0161

16436 IYER, V.; SALUNKHE, D.K.; SATHE, S.K.; ROCKLAND, L.B. 1980. **Quick-cooking beans (*Phaseolus vulgaris* L.): II. Phytates, oligosaccharides, and antienzymes.** Qualitas Plantarum 30(1):45-52. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. **Cooking. Nutritive value. Enzymes. Trypsin. Inhibitors. Human nutrition. Human physiology.**

Effects of the quick-cooking processes on phytate and oligosaccharide levels, and on trypsin and chymotrypsin inhibitors, were investigated in 3 bean var. (Great Northern, red kidney, and pinto). Beans soaked in distilled water had lower levels of phytate-P than those soaked in a mixed salt solution. Leaching losses of oligosaccharides were nearly the same in different soaking treatments for all the beans except kidney beans. Residual TIA in cooked quick-cooking beans were about 10% compared with about 20% for chymotrypsin inhibitor activities (CTIA) in the same bean products. γ-Irradiation was more effective in reducing TIA than CTIA and paralleled destruction by moist heat. *(Author's summary)* H00

0162

4623 LITZENBERGER, S.C. 1975. **El mejoramiento de las plantas leguminosas de grano comestible como contribución a una mejor nutrición humana.** *(Improvement of edible grain legumes as a contribution to improved human nutrition). In* Seminario sobre el potencial del fríjol y de otras leguminosas de grano comestible en América Latina, Cali, 1973. Trabajos presentados. Cali, Colombia, Centro Internacional de Agricultura Tropical. Serie CS-2. pp.3-12. Span., 10 Refs.

Also in English.

Phaseolus vulgaris. **Human nutrition. Nutritive value. Amino acids. Protein content. Toxicology. Production. Latin America.**

The possible role of food legumes, including beans, in alleviating the protein deficiency of a great sector of mankind and the opportunities to increase their production are examined. The sources of vegetable protein, its limitations, classes of legumes according to climatic requirements, and data on production and on av. yields are discussed. The need of further research on the development of higher-yielding cv. with greater resistance to diseases and insect pests, the improvement of protein % and amino acid balance, and the development of improved soil management and production practices is highlighted. *(Summary by I.B. Trans. by L.M.F.)* H00

0163

16421 BRESSANI, R. 1981. **El significado alimentario y nutricional del endurecimiento del fríjol.** *(Nutritional and alimentary importance of bean hardness). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, 1981. Memoria. Santo Domingo, República Dominicana, Secretaría de Estado de Agricultura. v.I-A pp.SEFI-I-SEFI-26. Span., 15 Refs., Illus.

Phaseolus vulgaris. **Seed. Deterioration. Storage. Nutritive value. Cooking. Food quality.**

On the basis of considerations of consumer acceptability, as well as the nutritional type, the importance of beans in diets, its consumption, and the protein contribution it represents is discussed. The effect of cooking on the nutritive value of beans is analyzed. A general hypothesis of the process of bean hardening and the possible role of the different seed structures in this process (which according to observations is intensified by the deficient storage) are studied. The greater part of the information is presented in form of tables and illustrations. *(Summary by I.B. Trans. by L.M.F.)* H00

0164

16783 PUSZTAI, A.; CLARKE, E.M.W.; GRANT, G.; KING, T.P. 1981. **The toxicity of *Phaseolus vulgaris* lectins. Nitrogen balance and immunochemical studies.** Journal of the Science of Food and Agriculture 32:1037-1046. Engl., Sum. Engl., 39 Refs., Illus.

Phaseolus vulgaris. **Proteins. Toxicity. Animal nutrition. Diets. Phytohaemagglutinins. Biochemistry.**

Inclusion of pure lectins isolated from the seeds of kidney bean cv. Processor in diets for rats increased both faecal and urinary losses of N and resulted in a negative N balance for the animals. The relationship between total body N change [y (mg)] and lectin concentration [x (g/kg)] of the diet was: $y = 421.5 - 75.1\ x$, which was statistically significant ($P = 0.05$). These rats developed circulating antibodies of low avidity to the dietary lectins, while no other proteins of the diet elicited a similar antibody response. Additionally, in several serum samples from rats which had been fed raw beans, the presence of small amounts of a protein reactive with rabbit anti-lectin antibodies was detected. This protein was isolated from the immune precipitate and was shown by SDS-gel electrophoresis to contain a protein subunit of 30,000, which was very similar to that of pure lectins. It is tentatively suggested

that lectin toxicity results from the combined effects of the interference with normal intestinal digestion and/or absorption of N through the damaged enterocytes and of systemic immune (and other) responses of the rat to the internalized lectin. *(Author's summary)* H00

0165

16738 WILSON, K.A. 1980. **The release of proteinase inhibitors from legume seeds during germination.** Phytochemistry 19(12):2517-2519. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Trypsin. Enzymes. Inhibitors. Seeds. Plant toxins. Germination.**

Data are tabulated on the release of trypsin inhibitor during germination for seeds of 12 legumes, including *Phaseolus coccineus, P. lunatus* cv. Fordhook 242, *P. vulgaris* cv. Great Northern, *Pisum sativum* cv. Oregon Sugar Pod, and *Vicia faba* cv. Windsor. This release corresponded to about 1-13% of the total TIA of the seed, *P. vulgaris* releasing 2.8% . In most species the amount released increased until 24-48 h of germination had elapsed and then remained much the same or decreased slightly by 72 h. Five species, including *P. lunatus* and *P. vulgaris,* were also examined for chymotryptic inhibitory activity and this was shown to be released in a manner similar to that for the trypsin inhibitor. *(Summary by Horticultural Abstracts)* H00

0166

16948 INSTITUTO CENTROAMERICANO DE INVESTIGACION Y TECNOLOGIA INDUSTRIAL. GUATEMALA. 1978. **Granos comerciales: fríjol. Determinación del tiempo de cocción.** *(Commercial grains: beans. Determination of cooking time).* Guatemala. Norma Centroamericana ICAITI 34 052 h8. 2p. Span.

Phaseolus vulgaris. Cooking. Timing. Human nutrition. Guatemala.

A total of 500 g clean beans are placed in 1500 ml boiling water. After boiling for 90 min (water vol. in the cooking vessel being maintained by addition of further boiling water as required), 50 beans are removed and tested for degree of cooking, by squeezing between the thumb and forefinger. If ≥ 90% of the beans are cooked, the required cooking time is taken as 90 min; if not, batches of 50 beans are taken and tested at 20-min intervals until ≥ 90% are cooked. The time taken to achieve this is taken as the cooking time of the bean sample. *(Summary by Food Science and Technology Abstracts)* H00

0167

16951 LOZANO, E.; RUIZ, M.E.; RUIZ, A. 1980. **Desarrollo de sub-sistemas de alimentación de bovinos a base de rastrojo de fríjol (*Phaseolus vulgaris,* L.). 3. Producción de carne.** *(Development of bovine feeding subsystems using bean residues. 3. Meat production).* Turrialba 30(2):153-159. Span., Sum. Engl., Span., 22 Refs., Illus.

Phaseolus vulgaris. **Nutritive value. Animal nutrition. Protein content. Costs. Economics. Experiment design. Costa Rica.**

Cattle feeding expt. with bean residues supplemented with various amounts of molasses or CP were carried out. Wt. gain was significantly increased by the protein supplements but not by the molasses, and was intimately related to N retention. In contrast to other favorable nutritional features of bean residues, conversion to beef was poor. It cannot be recommended under present conditions for commercial fattening operations in Costa Rica. However, the appropriate use of bean residues by the small farmer may be useful in preventing large losses in cattle productivity during the dry season, provided protein supplements are also given. *(Summary by Abstracts on Tropical Agriculture)* H00

H01 Foods and Nutritive Value

0168

16419 IYER, V.; SALUNKHE, D.K.; SATHE, S.K.; ROCKLAND, L.B. 1980. **Quick-cooking beans (*Phaseolus vulgaris* L.): I. Investigations on quality.** Qualitas Plantarum 30(1):27-43. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Cooking. Food technology. Digestibility. Nutritive value. Phenolic content.

Soaking 3 bean cv. (Great Northern, kidney, and pinto) in mixed salt solution (sodium chloride 2.5% + sodium bicarbonate 1.5% + sodium tripolyphosphate 1.0% + sodium carbonate 0.5%) resulted in 80-85% reduction in cooking time over corresponding controls. Irradiation (γ-rays) at 500 krads of soaked and dehydrated beans caused a reduction of nearly 50% in cooking time. Water uptake and leaching losses for each treatment during soaking at 22, 37, and 45°C were investigated. High temp. (37 and 45°C) and pH (9.0) caused greater water imbibition and total solid loss than at room temp. (22°C). Organoleptic evaluation revealed that quick-cooking Great Northern beans appear to be more acceptable than kidney and pinto beans. Quick-cooking cooked beans had better in vitro protein digestibility than conventionally cooked beans. Phenolic content was found to be inversely related to in vittro digestibility. *(Author's summary)* H01

0169

16017 ALLI, I.; BAKER, B.E. 1981. **Constitution of leguminous seeds. The effect of some physico-chemical factors on the yield of proteins isolated from *Phaseolus* beans.** Journal of the Science of Food and Agriculture 32:503-507. Engl., Sum. Engl., 6 Refs.

Phaseolus vulgaris. Phaseolus lunatus. Seed. Protein content. Analysis. pH. Temperature. Nutritive value.

The yields of acid-soluble proteins isolated from white kidney beans, navy beans, and baby lima beans (*Phaseolus lunatus*) were determined under different conditions of extraction. Highest yields of protein material were obtained when malic acid solutions [0.4 *M* (pH 3.5) white kidney bean and navy bean; 0.05 *M* (pH 3.5) baby lima bean] were used and under the following conditions; shaking time 20-30 min; extraction temperature 40-45°C; particle size 0.50-1.00 mm. *(Author's summary)* H01

0170

15479 ROCKLAND, L.B.; ZARAGOSA, E.M. 1979. **Process for preparing mixed bean salads.** United States Patent 4,159,351. 2p. Sum. Engl.

Phaseolus vulgaris. Cultivars. Food technology. Cooking. Human nutrition. USA.

Mixed bean salad is prepared by a process wherein different var. of beans are independently rendered quick-cooking and then independently precooked for a period of time sufficient to remove extractable pigments therefrom. The precooked beans, again independently, are cooled rapidly and then mixed together in a marinating liquid. Finally, the beans are finish-cooked in the marinating liquid. *(Author's summary)* H01

0171

16096 KOEHLER, H.H.; BURKE, D.W. 1981. **Nutrient composition, sensory characteristics, and texture measurements of seven cultivars of dry beans.** Journal of the American Society for Horticultural Science 106(3):313-318. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. **Cultivars. Nutritive value: Composition. Protein content. Ash content. Fat content. Mineral content. Vitamin content. Analysis. Food technology. Cooking. USA.**

Seven cv. representing 5 principal types of dry beans produced commercially in the state of Washington, USA, were analyzed chemically for content of moisture, fat, ash, total protein, Ca, Fe, K, Zn, thiamin, riboflavin, and amino acids when raw or when freeze-dried following cooking. Samples of cooked beans were subjected to sensory evaluation and shear-force measurement. Protein quality was evaluated using *Tetrahymena pyriformis.* Results are being used for comparison with values for new cv. produced later in the breeding program. The 7 cv. contained significant %s of the United States Recommended Daily Allowances (USRDA)for Fe, Ca, K, thiamin, and riboflavin. The nutritional quality of their protein was $^1/_2$ - $^1/_3$ that of casein. All cv. were judged to be acceptable in flavor and texture. Pinto UI-114 was outstanding for both nutritional content and sensory quality. *(Author's summary)* H01

0172

16016 ALLI, I.; BAKER, B.E. 1981. **Constitution of leguminous seeds. A note on protein-phytic acid interactions during isolation of acid-soluble protein from *Phaseolus* beans.** Journal of the Science of Food and Agriculture 32:588-592. Engl., Sum. Engl., 20 Refs.

Phaseolus vulgaris. **Seed. Protein content. Phytic acid. Analysis.**

Acid-soluble proteins isolated from 3 types of *Phaseolus* beans (white kidney beans, navy beans, and lima beans) were found to contain phytic acid. The amount of phytic acid complexed by the proteins was unaffected by the phytic acid content of the bean extracts from which the proteins were isolated but depended on the no. of positively charged basic groups which were available for reaction with the phytate anion. It was found that the Neuberg formula for phytic acid ($C_6H_{24}O_{27}P_6$) represents more accurately the mol. formula of phytic acid associated with the isolated proteins, than does the Anderson formula ($C_6H_{18}O_{24}P_6$). *(Author's summary)* H01

0173

16431 LIENER, I.E.; THOMPSON, R.M. 1980. **In vitro and in vivo studies on the digestibility of the major storage protein of the navy bean (*Phaseolus vulgaris*).** Qualitas Plantarum 30(1):13-25. Engl., Sum. Engl., 39 Refs., Illus.

Phaseolus vulgaris. **Proteins. Digestibility. Enzymes. Heat treatment. Inhibitors. Analysis. Animal nutrition. Laboratory experiments.**

Fraction G1, the main storage protein of navy bean, was resistant to digestion with pepsin, trypsin, and chymotrypsin unless autoclaved. True digestibility estimated with rats was 57% and, after heating, 92% . G1 had almost no trypsin inhibitory activity but enlarged the pancreas significantly; this was partly prevented by heating. It was concluded that the poor nutritive value of unheated beans was mainly caused by resistance of the main storage protein to proteolysis in the intestine. *(Summary by Nutrition Abstracts and Reviews)* H01

0174

15831 KOBAYASHI, M.; HARASHIMA, K. 1979. **Method and apparatus for granulating hydrated materials including food stuffs.** United States Patent 4,177,574. 6p. Sum. Engl.

Phaseolus vulgaris. **Food technology. Food products. Paste. USA.**

Hydrated materials such as bean paste are controlled as to their MC to an intermediate MC such as 12-40% on dry basis and higher than their plastic limit, and are then extruded into strips under vacuum, followed by the granulation of said strips under vacuum by applying thereto mechanical shearing force to produce granules of desired sizes. *(Author's summary)* H01

0175

16100 CILLARD, J., CILLARD, P.; DELAGE, E. 1979. **Etude qualitative et quantitative de la répartition des tocophérols dans les graines de légumineuses.** *(Study of the qualitative and quantitative distribution of tocopherols in leguminous seeds).* Plantes Médicinales et Phytothérapie 13(4):278-291. Fr., Sum. Fr., Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Seed. Composition. Analysis. Chromatography. Identification.**

In all 10 leguminous species tested the seeds contained α-tocopherol, γ-tocopherol, δ-tocopherol, and traces of ε-tocopherol in various ratios. Pea cv. Kelvedon Wonder, bean, and broad bean seeds contained the least total tocopherol (ca. 10 mg/100 g fresh wt.) but *Cercis siliquastrum* seeds contained the highest tocopherol level (60 mg/100 g fresh wt.). *(Summary by Horticultural Abstracts)* H01

0176

17778 ORTEGA D., M.L.; RUIZ G., J.L. 1979. **Efecto térmico en las globulinas de fríjol negro Mecentral (*Phaseolus vulgaris* L.).** *(Heat effect on globulins of Mecentral black beans).* Agrociencia 37:3-15. Span., Sum. Span., Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Proteins. Toxicity. Cooking. Heat treatment. pH. Nutritive value. Mexico.**

The effects of pH and heat denaturation were studied in the globulin fraction of seeds of Mecentral black beans. This protein consists of 4 major components: α, β, γ, and δ, with different electrophoretic mobility. The electrophoretic pattern remained constant between pH 6.0-10.6; at pH 12.5 the α and β bands were diffused and at pH 13.5 one single band was formed. The heat effect (93°C) on dissolved globulins at different pH values and different times of heating was observed. At pH 6.0 there was a slight reduction of α and β fractions; whereas at pH 7.6 there was a 90% reduction of the α fraction in only 20 min of heating. The β fraction was resistant to the thermic effect. The denaturation was greater when the pH of the solution or the time of heating increased. A reduction of solubility was also observed. At pH 13.5 there was a partial hydrolysis and irreversible denaturation of proteins. Heat effects at pH 6.0 and 7.6 in relation to digestibility are discussed. *(Author's summary)* H01

0177

16777 ORTEGA D., M.L.; RODRIGUEZ C., C. 1979. **Estudio de azúcares solubles en semillas de fríjol (*Phaseolus vulgaris* L.).** *(Research on soluble sugars in bean seeds).* Agrociencia 37:17-24. Span., Sum. Engl., Span., 15 Refs., Illus.

Phaseolus vulgaris. **Seed. Composition. Carbohydrate content. Sugars. Analysis. Biochemistry. Mexicc.**

The composition of soluble sugars in 24 common bean var. belonging to 4 groups of the infraspecific classification, was studied. Sugars were eluted from paper chromatograms and quantitatively determined by the phenol-sulfuric acid colorimetric method. Stachyose, raffinose, melibiose, maltose, sucrose, glucose, fructose, and xylose were identified. The distribution of each sugar among the genotypes was variable, but in all the cases, the quantity of oligosaccharides was greater than the monosaccharides. The most constant sugar in all genotypes was stachyose. A classification of beans on the basis of stachyose content was made. *(Author's summary)* H01

0178

16776 ORTEGA D., M.L.; RODRIGUEZ C., C. 1979. **Estudio de carbohidratos en variedades mexicanas de fríjol (*Phaseolus vulgaris* L. y *Phaseolus coccineus* L.).** [*Research on carbohydrates in Mexican bean varieties (Phaseolus vulgaris and Phaseolus coccineus)*]. Agrociencia 37:33-49. Span., Sum. Engl., Span., 17 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Cultivars. Seed characters. Composition. Starch content. Carbohydrate content. Protein content. Biochemistry. Analysis. Mexico.**

A total of 68 genotypes, classified in 7 groups, 6 belonging to *Phaseolus vulgaris* and one to *P. coccineus* (Ayocote group) were analyzed. In raw seeds, determinations of starch, direct, indirect, and total reducing sugars were made. *P. vulgaris* has less soluble sugars and starch than *P. coccineus*. Starch represents more than half of the N-free extract and correlates with seed size. The Bayo and Ayocote groups present the highest soluble sugar content. The characteristics of each group are discussed. *(Author's summary)* H01

0179

16947 INSTITUTO CENTROAMERICANO DE INVESTIGACION Y TECNOLOGIA INDUSTRIAL. GUATEMALA. 1978. **Granos comerciales: fríjol. Métodos de ensayo y análisis.** *(Commercial grains: beans. Test and analytical methods).* Guatemala. Norma Centroamericana ICAITI 34 052 h4. Sp. Span.,, 4 Refs.

Phaseolus vulgaris. **Seeds. Deterioration. Marketing. Storage. Legal aspects. Guatemala.**

This standard, which replaces the standard of the same no. issued in 1976, specifies methods for the initial sensory inspection of bean samples; and for the determination of moisture, total impurities, proportions of insect-infested, damaged, split, or broken grains, and proportion of grains differing in color from the majority of the batch. *(Summary by Food Science and Technology Abstracts)* H01 L00

0180

16949 INSTITUTO CENTROAMERICANO DE INVESTIGACION Y TECNOLOGIA INDUSTRIAL. GUATEMALA. 1978. **Granos comerciales: fríjol en grano.** *(Commercial grains: beans).* Guatemala. Norma Centroamericana ICAITI 34 048. 6p. Span., 5 Refs.

Phaseolus vulgaris. **Seeds. Marketing. Deterioration. Storage. Legal aspects. Guatemala.**

This standard, which supersedes the standard of the same no. issued in 1969, covers the following aspects regarding bean grain: definition of the product; definition of quality-related terms; classification into 4 grades on the basis of color; nomenclature; classification into 4 quality grades on the basis of MC, cooking time, and proportions of impurities or damaged or infested seeds; sampling; test methods; and packaging. An appendix gives max. tolerances for aflatoxins in beans in various importing countries. *(Summary by Food Science and Technology Abstracts)* H01 L00

0181

16940 BRESSANI, R.; ELIAS, L.G.; ESPAÑA, M.E. DE 1981. **Posibles relaciones entre medidas físicas, químicas y nutricionales en fríjol común (*Phaseolus vulgaris*).** *(Possible relationships among physical, chemical, and nutritional characteristics in common beans).* Archivos Latinoamericanos de Nutrición 31(3):550-570. Span., Sum. Span., Engl., 24 Refs.

Phaseolus vulgaris. **Cultivars. Seed size. Seed color. Seed coat. Protein content. Amino acids. Toxicity. Digestibility. Cooking. Diets.** *Zea mays.* **Human nutrition. Guatemala.**

The present study was carried out in order to establish relationships among physical, chemical, and nutritional characteristics in 5 black, 2 red, and 2 white-seeded common bean cv. of local consumption. Physical characteristics were grain wt. and size, color, seed coat %, hydration coefficient, cooking time, and seed hardness. Chemical characteristics studied

included protein, met. and cystine, lysine and tryptophan, trypsin inhibitors, tannins and in vitro protein digestibility. Nutritional properties were determined by assaying protein quality of the beans alone, with 0.3% met., or in 90:10 or 70:30 maize:bean mixtures using the PER. The results indicated that grain color plays an important role regarding some physical properties. Cooking time for white-seeded beans was less than for black- and red-seeded ones. Color is also related to some chemical properties, such as tannins, which are found in lower content in white beans. On the other hand, seeds of a high wt. and vol. tend to have a lower protein concn. Large seeds absorbed less water than smaller seeds and seed coat % is a variable that may influence this parameter. Protein digestibility varied from 66-75%. A significant relationship was found between protein and DM digestibility. Data confirmed the high lysine content and low sulfur amino acids content in beans. Supplementation with 0.3% met. improved protein quality of all cv.; the improvement, however, was not proportional to the initial value. Improvement in quality was also observed when the protein value of the bean cv. was tested in association with maize; however, the supplementary value was not proportional to the value of the beans tested alone. By statistical analysis it was established that in maize:bean mixtures, the important amino acids are lysine, met., and cystine. The results, therefore, illustrate that the quality of beans is determined by many factors intervening in different degrees. *(Author's summary)* H01

0182

16729 TELES, F.F.F.; BATISTA, C.M.; GIUDICE, M. DE L.P. DEL; SANTANA, B.F.; LEAL, T.L. 1980. Carboidratos ácido-digeríveis e medidas físicas de sete feijões (*Phaseolus vulgaris* L.) consumidos em Viçosa, Minas Gerais. *(Acid-digestible carbohydrates and physical measurements in seven types of bean consumed in Viçosa, Minas Gerais).* Revista Ceres 27(151):320-324. Port., Sum. Engl., 7 Refs.

Phaseolus vulgaris. Composition. Carbohydrate content. Seed. Cultivars. Human nutrition. Analysis. Brazil.

Seven types of beans grown in the state of Minas Gerais, Brazil, were analyzed for acid-digestible carbohydrates (ADC). Statistical analysis (F-test and Tukey's test at 0.05) showed significant differences among types. ADC values were found to vary from 36.72-51.30% [illegible] material. Physical measurements and a general description of the types were made, but no apparent correlation was found among types. *(Author's summary)* H01

0183

16765 MOSCOSO, W. 1981. Efecto del almacenamiento a alta temperatura y alta humedad sobre algunas características físicas y químicas del fríjol. *(Effect of storage at high temperatures and high humidity on some chemical and physical characteristics of beans).* *In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.1-A, pp.SEF5-1-SEF5-36. Span., 28 Refs., Illus.

Phaseolus vulgaris. Seed characters. Storage. Water content. Temperature. Cooking. Timing. Dominican Republic.

A technical analysis of literature on the effect of high temp. and RH during storage on bean seed water absorption, culinary properties (cooking time, coloring, and flavor), and on chemical changes associated with pectic substances, phytic acid, and minerals is given. It was concluded that: (1) the problem of hard hulls is more evident in dry beans with a water content < 15%, in addition to var. and climatic factors and those related to cultural practices; (2) storage under conditions of high RH and temp. favors water permeability of the hulls; (3) storage under these conditions results in a reduction of the causes of softening; (4) dissolution of pectic substances during cooking follows 1st order kinetic reactions; (5) storage under these conditions causes a reduction in phytic acid content; (6) under the mentioned storage conditions, grain has a greater loss of solutes of low mol. wt. during soaking; (7) the causes of softening and the dissolution of pectic substances show a high

correlation with the causes of monovalent to bivalent cations; (8) beans stored at high RH and temp. lose their property of quick cooking. *(Summary by A.J.C. Trans. by L.M.F.)* H01

0184

16961 ANTUNES, P.L.; SGARBIERI, V.C.; GARRUTI, R.S. 1979. **Nutrification of dry bean (*Phaseolus vulgaris,* L.) by methionine infusion.** Journal of Food Science 44(5):1302-1305. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Seeds. Nutritive value. Amino acids. Methionine. Seed treatment. Diets. Analysis.**

Soaking for 1 h at 50°C with 5% met. increased the met. content of dry beans from 1.2 to 24% of protein and absorbed water was 40% of wt. Such beans, dried and mixed with original beans (1:7), and cooked with the soaking water contained 3% met. in protein. Soaking with 1% met. increased the PER of beans from 0.9 to 2.6 and the efficiency of a 10% bean diet from 9.4 to 26.6%. *(Summary by Nutrition Abstracts and Reviews)* H01

I00 MICROBIOLOGY

0185

16800 BEZDICEK, D.F.; VIGUE, G.T.; BURKE, D. 1981. **Effect of soil fumigation on N_2-fixation and yield of field bean when grown on *Fusarium*-infested soils.** Agronomy Journal 73:1062-1065. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Nitrogen fixation. Nodulation. Nodules. Rots.** *Fusarium solani phaseoli.* **Disease control. Soil fertility.** *Rhizobium phaseoli.* **Strains. Yields. Timing. Field experiments. USA.**

Nodulation in field beans is poor in root-rot infested soils of the Columbia Basin of central Washington (USA). Studies were initiated to determine if nodulation and N_2-fixation rate were improved after fumigation and reduction in root rot. The effect of fumigation on nodulation and bean yield was studied in the field where N and 3 strains of *Rhizobium phaseoli* were applied to field beans grown in a Warden fine sandy loam soil (Xerollic Camborthids) infested with root rot (*Fusarium solani* f. sp. *phaseoli*). Early nodulation with 1 strain but not yield, increased significantly with inoculation. Fumigation with 400 kg chloropicrin/ha significantly increased shoot wt., root wt., and total N uptake throughout the season and decreased the incidence of root rot. Fumigation increased seed yields by an av. of 1800 kg/ha in 1975 and 900 kg/ha in 1976. In general, $N_2(C_2H_2)$-fixation rate was not significantly increased by either inoculation or fumigation. Only after adding a high rate of inoculum to the fumigated plots was the $N_2(C_2H_2)$-fixation rate increased at one of 4 sampling dates. It would appear that the major increase in plant growth and seed yield following fumigation was due to a reduction in root rot rather than from an increase in nodulation or $N_2(C_2H_2)$-fixation rate. The application of 112 kg N/ha in 1975 and 135 kg N/ha in 1976 did not increase yields in either fumigated or nonfumigated soils. *(Author's summary)* I00

0186

16964 LENNOX, L.B.; ALEXANDER, M. 1981. **Fungicide enhancement of nitrogen fixation and colonization of *Phaseolus vulgaris* by *Rhizobium phaseoli*.** Applied and Environmental Microbiology 41(2):404-411. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. Nodulation. Nitrogen fixation. Protozoa. Soil population. Chemical control. Seed treatment.**

The no. and wt. of pods and the wt. and N content of the tops of *Phaseolus vulgaris* derived from seeds inoculated with a thiram-resistant strain of *Rhizobium phaseoli* were increased if the seeds were treated with thiram before sowing in soil. A greater % of the nodules on 21-day-old plants were derived from the resistant strain, more nodules were formed, and these nodules were more effective in the presence of the fungicide than in its absence. These differences in no. were no longer present in 56-day-old plants, and only a small % of the nodules contained the resistant strain. The abundance of the fungicide-tolerant *R. phaseoli* increased rapidly soon after planting the seed and subsequently fell markedly, but the rate of decline was less if the seeds had been treated with the chemical. Protozoa also proliferated if thiram had not been applied to the seed, but their no. were deleteriously influenced by thiram. The results suggest that a suppression of protozoa, and possibly the

ciliates, accounts for the enhanced growth of beans and the greater initial frequency of nodules formed by the thiram-resistant *R. phaseoli* in the presence of this fungicide. Thiram applied to uninoculated seed enhanced bean growth if thiram-resistant *R. phaseoli* were present in soil. *(Summary by Microbiology Abstracts)* I00

CIAT ABSTRACTS ON
TROPICAL PASTURES

- Tropical grasses and forage legumes
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- ONLY AVAILABLE IN SPANISH

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation

0187

15822 GALOMO R., T.; RAMOS S., A.; LEPIZ I., R. 1980. **Respuesta de la inoculación y fertilización de 4 variedades de frijol *Phaseolus vulgaris* L. en la región de la Chontalpa, Tab.** *(Response of 4 bean varieties to inoculation and fertilization in the Chontalpa - Tabasco region).* Agricultura Tropical (México)2(1):19-27. Span., Sum. Span., Engl., 11 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Inoculation. Cultivars. Nutritional requirements. Fertilizers. Yields.**

Two expt. were conducted to study the effect of the inoculation with *Rhizobium phaseoli* isolates (Nitragin) in 4 var. of beans. The 1st expt. was conducted using a mechanized system. Best treatments were: (1) var. 3 Meses with inoculant Nitragin and the application of fertilizer (40-40-00) with yields of 1564.72 kg/ha; (2) var. Jamapa, inoculant CSAT-74 and application of fertilizer with yields of 1543.83 kg/ha; the same var. without inoculant and the application of fertilizer with yields of 1481.55 kg/ha; (3) var. Mantequilla Tropical with inoculant Nitragin and the application of fertilizer with yields of 1504.27 kg/ha. In the 2nd expt. (the traditional system) the treatments were: (1) var. 3 Meses, inoculant Nitragin and the application of fertilizer with yields of 1797.33 kg/ha; the same var. with Nitragin and without the application of fertilizer with yields of 1705.11 kg/ha; the same var. with the inoculant CSAT-74 and the application of fertilizer with yields of 1538.69 kg/ha; and the same var. without inoculant and with the application of fertilizer with yields of 1532.44 kg/ha; (2) var. Jamapa with Nitragin and the application of fertilizer with yields of 1756.94 kg/ha; this var. without the inoculant and with the application of fertilizer with yields of 1725.33 kg/ha; and the same var. with inoculant Nitragin and without the application of fertilizer with yields of 1552.22 kg/ha; (3) var. Mantequilla Tropical without inoculant and the application of fertilizer with yields of 1639.83 kg/ha; this var. with the inoculant Nitragin and the application of fertilizer with yields of 1636.94 kg/ha. Results were better with the traditional system and considering its yield, it is recommended to inoculate seeds of var. 3 Meses and Jamapa with *Rhizobium phaseoli* without the application of fertilizer. *(Author's summary)* I01

0188

16427 TJEPKEMA, J.D.; WINSHIP, L.J. 1980. **Energy requirement for nitrogen fixation in actinorhizal and legume root nodules.** Science 209(4453):279-281. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. Rhizobium. **Roots. Nodules. Nodulation. Enzymes. CO_2. Nitrogen fixation.**

The ratio of respiration to nitrogenase activity was measured in 5 species of actinorhizal root nodules (on *Alnus rugosa, Ceanothus americanus, Comptonia peregrina, Elaeagnus umbellata*, and *Myrica gale*) and 8 species of legume nodules (on plant species which included *Phaseolus vulgaris* and *Robinia pseudo-acacia*). The 2 types of nodule could not be distinguished on the basis of this ratio, indicating that the energy cost of N fixation was similar for both. *(Summary by Horticultural Abstracts)* I01

0189

16726 FERRERA-CERRATO, R. 1980. **Inoculación de *Rhizobium phaseoli* a diferentes especies del género *Phaseolus* originarias de México.** *(Inoculation of Rhizobium phaseoli in different species of the genus Phaseolus, originating from Mexico).* Revista Latinoamericana de Microbiología 22(4):175-180. Span., Sum. Span., Engl., 9 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Phaseolus **spp.** *Rhizobium phaseoli.* **Strains. Inoculation. Nitrogen fixation. Mexico.**

An inoculation study with 3 different strains of *Rhizobium phaseoli* was carried out on beans under greenhouse conditions. Strains used were *R. phaseoli* CP 10, CP 16, and CP A, isolated from *Phaseolus vulgaris* in the lab. of the Colegio de Postgraduados, Chapingo, Mexico. The 1st 2 strains were considered highly efficient, while the CP A strain had a low level of efficiency. The 7 *Phaseolus* species tested were *P. dumosus, P. coccineus* (wild, cultivated, and semicultivated), *P. vulgaris* (wild and cultivated), *P. acutifolius, P. lunatus* (wild and cultivated), *P. oligospermus,* and *P. leiosepalus* (wild). A good level of nodulation was observed in *P. vulgaris, P. dumosus,* and *P. leiosepalus.* No nodulation was observed on *P. oligospermus.* The other 3 species showed low levels of nodulation. Efficiency of N fixation was noted in *P. vulgaris, P. leiosepalus,* and to a lower degree in the wild form of *P. vulgaris* through the intense green color of the leaves. *(Author's summary)* 101

0190

16930 AWONAIKE, K.O.; LEA, P.J.; DAY, J.M.; ROUGHLEY, R.J.; MIFLIN, B. J. 1980. **Effects of combined nitrogen on nodulation and growth of *Phaseolus vulgaris.*** Experimental Agriculture 16:303-311. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. Rhizobium. **Strains. Nitrogen-fixing bacteria. Nitrogen fixation. N. Fertilizers. Roots. Stems. Seeds. Dry matter. Yields. Colombia.**

The effect of a *Rhizobium* strain and low levels of N on growth and N fixation was studied on 5 seedlines of *Phaseolus vulgaris.* All plants responded to irrigation when low levels of N were supplied throughout each expt. during vegetative growth, but the final seed yield was not significantly affected. All strains induced less nodule tissue and lower nitrogenase activity/plant when N was applied; some strains were less sensitive than others. The proportion of the plant N estimated to be derived from fixation (based on acetylene reduction) and fertilizer was affected by host genetics. Nodulated plants had nitrogenase activities comparable with other grain legumes and responded to combined N during vegetative growth, but this was not reflected in grain yield. *(Author's summary)* 101

0191

16997 AWONAIKE, K.O.; LEA, P.J.; MIFLIN, B.J. 1981. **The location of the enzymes of ammonia assimilation in root nodules of *Phaseolus vulgaris* L.** Plant Science Letters 23:189-195. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Nitrogen fixation. Enzymes. N. Plant assimilation. Nodulation. Roots.** *Rhizobium phaseoli.* **Laboratory experiments.**

The location of the enzymes potentially involved in ammonia assimilation in N-fixing root nodules of *Phaseolus vulgaris* was examined by sucrose density gradient separation of the bacteroids from plant organelles. Glutamine synthetase is almost entirely present in the plant cytoplasm, glutamate dehydrogenase (GDH) is in the mitochondria. The results also show that there is little evidence for the presence of significant proportions of the total glutamine synthetase and glutamate synthase activity being present in the bacteroid. In contrast however, the greater proportion of the total nodule GDH activity was found in the bacteroid. The problems encountered by previous workers in assaying and localizing glutamate synthase and GDH in legume root nodules are discussed. *(Author's summary)* 101

See also 0053 0055

J00 ECONOMICS AND DEVELOPMENT

0192

16415 EMPRESA DE ASSISTÊNCIA TECNICA E EXTENSÃO RURAL DO ESTADO DE MINAS GERAIS. 1978?. **Principais problemas com a cultura do feijão a nível estadual.** *(Major problems of bean cultivation on a statewide level).* Belo Horizonte-MG. 37p. Port.

Phaseolus vulgaris. **Seed production. Cultivation. Storage. Marketing. Spacing. Climatic requirements. Rotational crops. Productivity. Economics. Brazil.**

Information from different sources on problems of bean cultivation in Minas Gerais, Brazil is given along with suggestions on the research and policies to follow in the programming of the 1978-79 crop yr by the Bean Program (Empresa de Assistência Técnica e Extensão Rural of Minas Gerais) as well as the information sent by different regional offices. Data on area harvested, production obtained, and av. yield of upland and irrigated bean crops throughout the state, obtained from the regional offices, are summarized in table form as follows: upland beans, 337,833 ha, 150,636 t/ha, and 446 kg/ha, resp.; irrigated beans, 260,627 ha, 132,724 t/ha, and 509 kg/ha, resp. The names of the technicians belonging to the local programs are included. *(Summary by I.B. Trans. by L.M.F.)* J00

0193

16500 GUAZZELLI, R.J. 1982. **A pesquisa de feijão no Brasil, situação atual e perspectivas.** *(Research on beans in Brazil, current situation and prospects).* Goiânia-GO. Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa Arroz, Feijão. 19p. Port.

Phaseolus vulgaris. **Developmental research. Production. Seed production. Cultivation. Plant breeding. Selection. Economics. Brazil.**

Several problems regarding the system of bean cultivation in Brazil are described: (1) beans are seldom considered the major components of cropping systems; (2) it is mainly cultivated by small farmers; (3) beans are cultivated in soils of low fertility; (4) diseases reduce its cultivation; (5) lack of improved cv.; (6) a need to offer incentives to the more promising crops exists; (7) producers lack incentives; (8) areas apt for bean cultivation should be delimited ; and (9) seed production. The advances in research during different periods, and after 6 yr under the new system, the creation of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) are highlighted along with the most outstanding research conducted at the Centro Nacional de Pesquisa Arroz, Feijão (CNPAF) in the areas of plant breeding and others, such as studies on economically important diseases, seed pathology, fertilization, cropping systems, harvest, biological fixation of N, and transfer of technology. *(Summary by I.B. Trans. by L.M.F.)* J00

0194

16488 BRASIL. MINISTÉRIO DA AGRICULTURA. COMISSÃO DE FINANCIAMENTO DA PRODUÇÃO. 1977. **Feijão.** *(Beans). In* ——. Fixação de preços mínimos para a safra 1976/77 das regiões norte e nordeste. Brasília. pp.89-103. Port., Illus.

Phaseolus vulgaris. **Production. Marketing. Costs. Income. Productivity. Economics. Brazil.**

The domestic market situation of beans in Brazil (1974-75) is described regarding supply, evolution of real and wholesale prices and payments to producers, the evolution of production, system of commercialization, production, and production costs. Min. prices offered for beans in the NE area were intended to be incentives since it was confirmed that the bean-producing regions grew poorer year by year at the same time the availability of beans for consumption was reduced. The deficient system of commercialization in the NE due to the lack of cooperative organization was observed. On the other hand, surveys revealed that the bean-producing areas still used traditional technology and that av. productivity varied notably depending on if beans were cultivated in monoculture or in association with maize or cotton. Tables and diagrams are included. *(Summary by I.B. Trans. by L.M.F.)* J00

See also 0045 0077

K00 FIELD PLOT TECHNIQUE

0195

16955 CERVELLINI, A.; RUSCHEL, A.P.; MATSUI, E.; SALATI, E.; ZAGATTO, E.A.G.; FERREYRA, H.F.F.; KRUG, F.J.; BERGAMIN, H.; REICHARDT, K.; MEIRELLES, N.M.F.; LIBARDI, P.L.; VICTORIA, R.; SAITO, S.M.T.; NASCIMENTO, V.F. 1980. **Fate of ^{15}N applied as ammonium sulphate to a bean crop.** *In* Meeting on Soil Nitrogen as Fertilizer or Pollution, Piracicaba, Brazil, 1978. Proceedings and report. Vienna, Austria, International Atomic Energy Agency. Panel Proceedings series. pp.23-36. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Ammonium sulphate. Fertilizers. N. Planting. Timing. Soil water. Water requirements. Field experiments.**

An instrumented 10 x 10 m site was used to study the fate of ^{15}N-labeled $(NH_4)_2SO_4$ (3.289 atom ^{15}N % excess) applied at the rate of 100 kg N/ha with P and K supplements. Data were collected for Jan.-Dec. 1977. The 1st bean crop was planted in March, followed by the fertilizer, and harvested 3 mo. later. The plot was left fallow for 3 mo. when a 2nd bean crop was planted without further fertilizer. Data indicated that the total drainage (22 cm) represented approx. 16% of the total water input (precipitation + irrigation). It was estimated that NO_3 leaching below the 120 cm depth was equivalent to approx. 16 kg N/ha of which < 10% was derived from the labeled fertilizer. The low recovery of labeled fertilizer (30%) by the 1st total harvest of straw and grain, and < 2.5% further recovery of initial labeled fertilizer by the 2nd crop, suggest high immobilization by the soil-plant residue system. *(Author's summary)* K00 D01

0196

16970 BADILLO-FELICIANO, J.; LUGO-LOPEZ, M.A. 1981. **An attempt to evaluate the effect of varying time intervals between liming and cropping on an Oxisol.** Journal of Agriculture of the University of Puerto Rico 65(2):83-89. Engl., Sum. Engl., Span., 6 Refs.

Phaseolus vulgaris. **Agricultural lime. Soils. pH. Cultivation. Planting. Timing. Yields. Yield components. Plant development. Puerto Rico.**

Field trials were carried out at the Isabela Substation farm, NW Puerto Rico, to study the effects of liming on acid soil at 2 mo. intervals starting from July 1975-May 1976 on 2 field bean cv. (White Bonita and Red Kidney 27R) and on 2 succeeding maize cv. (Pioneer X306B and Diente de Caballo). The treatments had no significant effects on yield, yield components, and plant characters of field bean and maize. However, plants of field bean cv. Red Kidney 27R in plots limed 10 mo. prior to sowing were smaller than those in plots limed just before sowing. It is indicated that the effectiveness of liming an Oxisol with pH 5 is not dependent on the period that elapses between liming and planting. *(Summary by Abstracts on Tropical Agriculture)* K00 D01

L00 GRAIN STORAGE

0197

16795 FONSECA, J.R.; FREIRE, A. DE B.; FREIRE, M.S.; ZIMMERMANN, F.J. P. 1980. **Conservação de sementes de feijão sob três sistemas de armazenamento.** *(Conservation of bean seed under three storage systems).* Revista Brasileira de Sementes 2(1):19-27. Port., Sum. Port., Engl., 8 Refs., Illus.

Phaseolus vulgaris. **Seeds. Storage. Temperature. Deterioration. Germination. Statistical analysis. Brazil.**

The objective of this study was to determine how long bean seeds remain viable, when stored under the following conditions: ordinary storage room, cold and dry storage room (12°C and 30% RH), and dry storage room (30% RH). Seeds were kept in cloth bags during a 4-yr period. Storage conditions were not significantly different for short periods. However, for long term storage, means of germination and vigor exhibited significant differences among treatments and ordinary storage room conditions were inferior as compared to controlled conditions. *(Author's summary)* L00

0198

16761 MOLINA, M.R.; RIZZO, M.E.; BATEN, M.A.; BRESSANI, R. 1981. **Prevención del endurecimiento del fríjol y aprovechamiento del grano endurecido.** *(Prevention of bean hardening and utilization of hardened grain). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.1-A, pp.SEF9-1-SEF9-43. Span., 30 Refs., Illus.

Phascolus vulgaris. **Seed. Storage. Deterioration. Food quality. Cooking. Human nutrition. Animal nutrition. Guatemala.**

A critical literature review is given on available technologies on the prevention of hardness and biodeterioration of stored bean grain in order to assure its cooking quality and/or for processing; the techniques applicable on a rural communal level, especially for Central American and Caribbean countries, are highlighted. The following technological alternatives are discussed: low storage temp. and/or low water content of grain; heat treatment; treatment in saline solution (NaCl); modified atmospheres (> CO_2 concn.); precooking of the whole grain; and storage of pods with their grains. Technological alternatives to the use of beans hardened under storage conditions are discussed: in human (canned and extrusion cooking) and animal nutrition (extrusion cooking). It is concluded that heat treatment for short periods, soaking in 15% saline solutions, and storage of pods with their grains are the best alternatives to prevent the hardening of stored grain. *(Summary by A.J.C. Trans. by L. M.F.)* L00 H01

See also 0179 0180

L01 Stored Grain Pests

0199

17308 SZENTESI, A. 1981. **Pheromone-like substances affecting host-related behaviour of larvae and adults in the dry bean weevil,** *Acanthoscelides obtectus.* Entomologia Experimentalis et Applicata 30:219-226. Engl., Sum. Engl., Fr., 30 Refs.

Phaseolus vulgaris. Acanthoscelides obtectus. **Insect biology. Behavior. Biochemical control. Seed treatment. Seeds.**

Males and females of the dry bean weevil, *Acanthoscelides obtectus,* deposit chemically unknown substances on beans during various activities (most probably during defecation), under lab. conditions. The marking results in avoidance of these beans by other females for oviposition. Also, 1st-instar larvae are influenced to disperse more by the deposited substances, so that they are more likely to find unmarked beans to enter. No specific marking behavior by adults was noted. It is improbable that the deterring substances might originate from microorganism activity after deposition has occurred. Possible explanations for sources of marking substances and the significance of the corresponding behavior in this species are discussed. *(Author's summary)* L01

See also 0136

Z00 GENERAL

0200

16975 CATALDO, D.A.; GARLAND, T.R.; WILDUNG, R.E.; THOMAS, J.M. 1980. **Foliar absorption of transuranic elements: influence of physicochemical form and environmental factors.** Journal of Environmental Quality 9(3):364-369. Engl., Sum. Engl., 24 Refs.

Phaseolus vulgaris. **Tracers. Plant assimilation. Leaves. Translocation. Climatic requirements. Ecology.**

The accumulation of ^{238}Pu and ^{241}Am in seeds and roots of *Phaseolus vulgaris* was investigated following foliar interception. Under controlled conditions, plants were exposed to well-characterized aerosols of fresh and aged Pu-dioxide, fresh Am-oxides, and Pu-nitrate and Pu-citrate complexes to assess the influence of chemical form and long-term weathering on foliar absorption and subsequent translocation to other plant parts. Mean values of Pu and Am accumulated in seeds and roots 28 days after foliar exposure ranged from 9-427 x 10^{-4}% of that deposited on foliage. The levels of Pu and Am in seeds and roots resulting from foliar absorption and translocation from foliage were significantly affected by simulated rainfall and by the size of particles to which foliage was exposed. The influence of RH and solution-aging of oxides was less definite, but results suggested that either or both might influence foliar absorption and subsequent translocation of Pu and Am to seeds and roots. *(Summary by Crop Physiology Abstracts)* Z00

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

AUTHOR INDEX

Acevedo S., F.J. 0066
Ahmed, A.M. 0047
Aldana de León, L.F. 0138
Alli, I. 0169 0172
Almeida, L. D'A. de 0043
Alves, A. 0061
Andebrhan, T. . 0097
Antunes, P.L. 0184
Applebaum, S.W. 0128
Araya F., C.M. 0111
Arnison, P.G. 0026
Arruda, F.B. 0046 0050
Awonaike, K.O. 0190 0191

Badillo-Feliciano, J. 0196
Baker, E.A. 0003
Ballantyne, D.J. 0035
Bascur B., G. 0142
Becquer H., A. 0133
Beebe, S.E. 0150
Ben, J.R. 0045
Bezdicek, D.F. 0185
Binnie, R.C. 0027
Borchers-Zampini, C. 0012
Brasil. Ministerio da Agricultura. Comissão de Financiamento da Produção 0194
Brasil. Secretaría de Agricultura e Abastecimento 0077
Brecke, B.J. 0059
Bressani, R. 0163 0181
Burke, D.W. 0108

Cafati K., C. 0082 0086 0090 0091
Campbell, C.L. 0096 0103
Campos A., J. 0100
Campos S., L. 0130
Cardoso, E.J.B.N. 0093
Carmi, A. 0023
Cataldo, D.A. 0200
Centro de Investigaciones Fitotécnicas de Pairumani. Bolivia 0154
Cervellini, A. 0195
Cheng, S.S. 0158
Cillard, J. 0175
Costa, E.C. 0125 0132
Coyne, D.P. 0155
Cunha, J.M. da 0078

Davet, P. 0098
Davis, J.H.C. 0145
Dell'orto T., H. 0123
De Marinis, G. 0062
Diehl, J.A. 0101
Durbin, M.L. 0030

Edwards, C.A. 0033 0038
Empresa Brasileira de Assistência Técnica e Extensão Rural 0072
Empresa de Assistência Técnica e Extensão Rural do Estado de Minas Gerais 0192
Empresa Pernambucana de Pesquisa Agropecuária 0140
Eskafi, F.M. 0134
Eze, J.M.O. 0018

Faiguenbaum M., H. 0063
Fernández, R. 0160
Ferrera-Cerrato, R. 0189
Figueroa, G. 0085
Fisher, N.M. 0044
Fonseca, J.R. 0197
Fouad, H.A. 0079
Fozdar, B.S. 0139

Galomo R., T. 0187
Gepstein, S. 0025
Gersani, M. 0009
Giraldo, G. 0076
Guazzelli, R.J. 0193
Gutiérrez, L.E. 0019 0039

Hagel, G.T. 0126
Hargreaves, J.A. 0005
Hayward, A.C. 0087 0089
Heath, M.C. 0104 0106
Hill, J. 0129
Hobbs, H.A. 0114

Ibarra P., F.J. 0069 0151
Imhoff, M.W. 0095

Instituto Centroamericano de Investigación y Tecnología Industrial. Guatemala 0166 0179 0180
Islam, A.K.M.S. 0017
Issa, E. 0081
Iyer, V. 0161 0168
Izquierdo, J.A. 0042

Jaffe, M.F. 0004
John, W.W. 0037
Jursinic, P.A. 0008

Kawase, M. 0029
Kenis, J.D. 0020
Kigel, J. 0022
Kitajima, E.W. 0113
Kobayashi, M. 0174
Koehler, H.H. 0171
Korban, S.S. 0146
Kretchmer, P.J. 0144

Lennox, L.B. 0186
León, L.A. 0048
Leong, K.L.H. 0135
Leroi, B. 0124
Liener, I.E. 0173
Lima Filho, J.M.P. 0051
Linden, C.T.G. 0016
Link, D. 0007
Litzenberger, S.C. 0162
López, R. 0120
Lozano, E. 0167

McLaughlin, S.B. 0010
Mahatanya, E.T. 0058
Malavolta, E. 0013 0014
Mangual-Crespo, G. 0065
Menezes, J.R. 0075
Menten, J.O.M. 0056 0112
Miller, D.E. 0110
Miranda C., S. 0141
Mohan, S.T. 0148
Molina, M.R. 0198
Moscoso, W. 0183
Muchovej, J.J. 0094
Muhalet, C.S. 0147
Mukunya, D.M. 0152
Murphy, L.S. 0015

Noor Saleh, A. 0034 0036

Oliveira, J.V. de 0137
Olufajo, O.O. 0073
Ortega D., M.L. 0176 0177 0178

Peirson, D.R. 0011
Peralta J., F. 0122
Ploper, L.D. 0105

Powles, S.B. 0032
Prakash, K.S. 0024
Pusztai, A. 0164

Quakenbush, L.S. 0049

Ramaswamy, H.S. 0068
Rauser, W.E. 0040
Riedel, R.M. 0118
Ríos M., E.E. 0153
Rockland, L.B. 0170

Sahai, S. 0157
Salih, F.A. 0074
Sánchez C., G.E. 0052
Santa Cecilia, F.C. 0053
Satishchandra, K.M. 0109
Schoonhoven, A. van 0131
Schwartz, H.F. 0099
Shii, C.T. 0143
Silva, C.C. da 0071
Sindhan, G.S. 0107
Slusarenko, A.J. 0088
Smartt, J. 0149
Srivastava, H.K. 0156
Ssali, H. 0055
Stadt, S.J. 0092
Stansell, J.R. 0054
Subhadrabandhu, S. 0028
Sukhada, K. 0121
Szentesi, A. 0199

Tay U., J. 0080
Taylor, R.W.D. 0136
Teakle, D.S. 0115
Teles, F.F.F. 0182
Tjepkema, J.D. 0188
Tu, J.C. 0102 0117

Valle B., R. del 0070
Valle Junior, R. del 0057
Van Assche, F. 0006
Varela T., C.A. 0127
Veerisetty, V. 0116
Victoria Filho, R. 0060
Vilhordo, B.W. 0001

Wallace, D.H. 0031
Wardrop, A.J. 0041
Weiseth, G. 0002
Weller, D.M. 0084
Wetala, M.P.E. 0064 0067
Wilson, K.A. 0165
Woodward, M.D. 0083
Wyatt, J.E. 0119

Yankulov, M.T. 0159
Yeang, H.Y. 0001

SUBJECT INDEX

ABSCISSION
0073
FLOWERS
0027 0028 0042 0121
LEAVES
0007 0018 0020 0022 0030

ACANTHOSCELIDES OBTECTUS
0123 0124 0127 0130 0199
INSECT CONTROL
0136 0137

ADAPTATION
0146
CULTIVARS
0031 0142 0151 0153

AFRICA
0064 0067 0152

AGRICULTURAL EQUIPMENT
HARVESTING
0065 0068
PLANTING
0079

AGRICULTURAL LIME
FERTILIZERS
0055 0196
PH
0055 0196

AGRONOMIC CHARACTERS
0024 0058 0063 0076 0080 0126 0141
0142 0144 0145 0148 0153 0154 0156

AGROTIS IPSILON
0130

AIR POLLUTION
0010

ALUMINIUM
0056
PH
0013 0055
PHOSPHORUS
0013

AMINO ACIDS
ANALYSIS
0184
SEED
0160 0181

AMMONIUM SULPHATE
FERTILIZERS
0195

ANIMAL NUTRITION
0164 0167 0173 0198

APHIS GRACCIVORA
0133

APHIS FABAE
0130

APHIS GOSSYPII
0133

ARGENTINA
0002

ASH CONTENT
0171

ATP
0035 0059

AUXINS
0036 0041
GROWTH
0022
PLANT DEVELOPMENT
0029 0034

BACTERIOSES
0043 0084
DISEASE CONTROL
0087 0089
HOST-PLANT RESISTANCE
0085 0088 0091 0092 0141 0152 0155
INOCULATION
0090 0091 0092

BEAN COMMON MOSAIC VIRUS
0082
HOST-PLANT RESISTANCE
0080
PLANT BREEDING
0080

BEAN GOLDEN MOSAIC VIRUS
0112
HOST - PLANT RESISTANCE
0138

BEAN SOUTHERN MOSAIC VIRUS
DISEASE CONTROL
0116
VIRUS TRANSMISSION
0115

BEAN YELLOW MOSAIC VIRUS
0082
HOST-PLANT RESISTANCE
0080

BEMISIA TABACI
HOST-PLANT RESISTANCE
0138
CHEMICAL CONTROL
0122 0138

BOLIVIA
0154

BIOCHEMISTRY
0005 0026 0030 0033 0034 0038 0039
0041 0083 0088 0128 0157 0164 0177
0178

BRAZIL
0001 0007 0043 0051 0053 0071 0072
0075 0077 0078 0113 0125 0140 0182
0192 0193 0194 0197

BUDS
0021 0037

CALLOSOBRUCHUS MACULATU
INSECT CONTROL
0137

CARBOHYDRATE CONTENT
LEAVES
0012 0023
PODS
0028
SEED
0128 0177 0178 0182
STEMS
0012 0023

CARBON DIOXIDE
0010 0028 0188
LIGHT
0006 0032
PHOTOSYNTHESIS
0006 0032

CARBON FIXATION
0006

CELL STRUCTURE
0003 0035

CHILE
0063 0080 0082 0142

CHLOROPLASTS
0008 0032

CHLOROSIS
0143

CHROMOSOMES
0139 0156 0157 0158

CLIMATIC REQUIREMENTS
0043 0105 0192 0200
PHOTOPERIOD
0028 0031
TEMPERATURE
0031 0044 0046 0102 0108 0134 0183
0197

CLIMBING BEANS
0061 0070 0144 0145

COLEOPTERA
0123 0124 0127 0129 0130 0136 0137
0199
SEED
0128

COLLETOTRICHUM LINDEMUTHIANUM
0102 0111
DISEASE CONTROL
0082 0099
HOST-PLANT RESISTANCE
0097 0099 0141 0147 0152 0154
PLANT BREEDING
0141 0147 0154
RACES
0097 0147

COLOMBIA
0052 0076 0085 0118 0127 0129 0143
0145 0190

COMPOSITION
0003 0013 0068 0175 0190
ASH CONTENT
0171
CARBOHIDRATE CONTENT
0023 0028 0128 0177 0178 0182
FAT CONTENT
0171
MINERAL CONTENT
0023 0040 0047 0171
PROTEIN CONTENT
0018 0026 0160 0169 0171 0178 0181
VITAMIN CONTENT
0171
WATER CONTENT
0023 0073 0183

COOKING
0161 0163 0166 0168 0170 0171 0176
0181 0183 0198

COSTA RICA
0120 0167

COSTS
0045 0167 0194

COTYLEDONS
0005 0026 0036 0088 0096
GERMINATION
0019 0025

CROP LOSS
0065 0118
PLANT INJURIES
0112 0132 0150

CUBA
0133

CULTIVARS
0014 0027 0028 0042 0044 0047 0053
0058 0063 0074 0076 0081 0088 0094
0097 0104 0111 0119 0120 0126 0138
0140 0148 0160 0170 0171 0178 0181
0182 0187
ADAPTATION
0031 0142 0151 0153
GERMPLASM
0085 0091 0092 0150 0152 0155
IDENTIFICATION
0001
PLANT INTRODUCTIONS
0080

CULTIVATION SYSTEMS
0057 0069 0070 0071 0072 0073 0140
0145

CULTURE MEDIA
0016 0100

CYTOGENETICS
0156 0158

CYTOKININS
0025 0033 0038

CYTOLOGY
0003 0005 0021 0059 0088 0104 0106
0139 0156 0157

DETERIORATION
0163 0179 0180 0197 0198

DEVELOPMENTAL STAGES
0012 0024 0040 0054 0056 0062 0063
0073 0084 0097 0111 0112 0143
FLOWERING
0027 0031 0042 0050 0076
GERMINATION
0019 0025 0034 0046 0050 0076 0078
0094 0197
MATURATION
0068 0076
PODDING
0027 0042 0046 0050

DIABROTICA BALTEATA
0114

DIETARY VALUE
0173

DIGESTIBILITY
0160 0168 0173 0181

DIPTERA
0126

DISEASE CONTROL
BACTERIOSES
0087 0089
MYCOSES
0081 0082 0093 0099 0101 0105 0110
0185
VIROSES
0082 0116

DISEASE TRANSMISSION
0087 0089 0090 0091 0092 0102 0111
SEED TRANSMISSION
0107 0115
VIROSES
0113 0114 0115

DOMINICAN REPUBLIC
0183

DROUGHT
0018 0044

DRY MATTER
0013 0047 0055 0190

DWARF BEANS
0023 0144

ECOLOGY
0077 0127 0153 0160 0200

ECONOMICS
0045 0167 0192 0193 0194

EMPOASCA KRAEMERI
0125
HOST-PLANT RESISTANCE
0134
BIOLOGICAL CONTROL
0131
CHEMICAL CONTROL
0134

ENZYMES
0011 0019 0020 0025 0026 0030 0035
0037 0039 0041 0116 0128 0161 0165
0173 0188 0191

EPIPHYTOLOGY
0082 0090

ERYSIPHE POLYGONI
DISEASE CONTROL
0082

EXPERIMENT DESIGN
0007 0051 0081 0111 0119 0150 0167

FAT CONTENT
0171

FERTILIZERS
0015 0043 0045 0048 0053 0055 0057
0058 0070 0140 0187 0190 0195 0196

FLOWERING
0027 0042 0056 0076 0148
GENETICS
0031 0144
PHOTOPERIOD
0031 0144
TEMPERATURE
0031

FUSARIUM OXYSPORUM
0098 0103
DISEASE CONTROL
0093

FUSARIUM SOLANI PHASEOLI
0096 0098 0108
DISEASE CONTROL
0082 0101 0110 0185

GENES
0002 0031 0085 0092 0143 0144 0146
0147 0149

GERMPLASM
0085 0091 0092 0150 0152 0154 0155

GROWTH
0004 0012 0014 0017 0017 0021 0022
0023 0026 0062 0121 0143
LIGHT
0006
SALINITY
0016 0047
SPACING
0063

GUATEMALA
0070 0138 0153 0166 0179 0180 0181
0198

HARVESTING
0043 0065 0068 0072 0073

HEAT TREATMENT
0173 0176

HELIOTHIS ZEA
0130

HEMIPTERA
0130 0132

HERBICIDES
0060 0061 0064 0066 0067 0118
DISEASES AND PATHOGENS
0049
PLANT INJURIES
0059 0062

HETEROSIS
0146 0156

HOMOPTERA
0125 0130 0133
INSECT CONTROL
0131 0134 0138

HUMAN NUTRITION
0160 0161 0166 0169 0170 0181 0182
0183 0184 0198

HUMAN PHYSIOLOGY
0161

HYBRIDIZING
0141 0143 0149 0156 0158

INCOME
0045 0054 0070 0071 0194

INDOLEACETIC ACID
0034 0036

INHIBITORS
0104 0161 0165 0173

INJURIOUS INSECTS
0114
COLEOPTERA
0123 0124 0127 0128 0129 0130 0136
0137 0199
DIPTERA
0126
HEMIPTERA
0130 0132
HOMOPTERA
0125 0130 0131 0133 0134 0138
LEPIDOPTERA
0130 0135

INJURIOUS MITES
0125 0130

INOCULATION
0086 0090 0091 0092 0104 0109 0111
0187 0189

INTER-CROPPING
0140
ZEA MAYS
0070 0071 0072 0145

IRON
LEAVES
0052

IRRADIATION
0159

IRRIGATION
0054

ISARIOPSIS GRISEOLA
0100 0107
DISEASE CONTROL
0099
CHEMICAL CONTROL
0105
HOST-PLANT RESISTANCE
0099

LATIN AMERICA
0048 0130 0150

LEAF AREA
0003 0063

LEAVES
0003 0006 0007 0010 0011 0012 0016
0018 0020 0021 0022 0023 0025 0026
0029 0030 0032 0036 0040 0041 0047
0051 0059 0063 0086 0095 0143 0200
DISEASES AND PATHOGENS
0084 0104 0106 0116
MINERALS AND NUTRIENTS
0052

LEPIDOPTERA
0130
INSECT CONTROL
0135

LIGHT
0006 0008 0020 0032 0134
PHOTOPERIOD
0144

MACROPHOMINA PHASEOLI
0098 0109
DISEASE CONTROL
0082

MANGANESE
0055 0056

MANURES
0045 0049 0072

MATURATION
0058 0068 0076

MECHANICAL DAMAGE
0004

MELOIDOGYNE INCOGNITA
HOST-PLANT RESISTANCE
0118 0119 0120

METABOLISM
0059

METHIONINE
0184

MEXICO
0069 0100 0141 0151 0176 0177 0178
0189

MICRONUTRIENTS
0006 0015 0040 0052

MINERAL CONTENT
0017 0023 0040 0047 0052 0056 0171

MINERAL DEFICIENCIES
0048 0056

MINERALS AND NUTRIENTS
ALUMINIUM
0013 0055 0056
IRON
0052
MANGANESE
0055 0056
NITROGEN
0053 0190 0191 0195
OXIGEN
0110
PHOSPHORUS
0013 0057

MITOCHONDRIA
0035

MORPHOGENESIS
0004 0139

MUTATION
0159

MYCOSES
0043 0075 0081 0082 0083 0093 0096
0099 0103 0105 0107 0141 0147 0150
0152 0154
INOCULATION
0104 0104 0106 0109 0111
LEAVES
0104 0106
SEED
0094
SEEDLINGS
0097 0110
ROOTS
0049 0098 0101 0108 0110 0185
TEMPERATURE
0100 0102 0108

MYZUS PERSICAE
0130

NEMATODES
0118 0119 0120

NITROGEN
FERTILIZERS
0043 0053 0070 0190 0195

NUTRIENT ABSORPTION
0011 0014
PLANT ASSIMILATION
0011 0014 0191

NITROGEN FIXATION
0185 0186 0188 0189 0190 0191

NITROGEN-FIXING BACTERIA
0154 0190 0191

NODULATION
0185 0186 0188
MINERALES AND NUTRIENTS
0055
NITROGEN
0053 0191

NORTH AMERICA
0049 0096 0119 0126 0135 0171 0189

NOXIUS ANIMALS
0118 0119 0120 0123 0124 0125 0126
0127 0128 0129 0130 0131 0132 0133
0134 0135 0136 0137 0138 0199

NUCLEIC ACID
0020
RNA
0038 0116

NUTRIENT ABSORPTION
0011 0013 0014 0017 0052 0059

NUTRIENT SOLUTION
0006 0012 0014 0017

NUTRIENT TRANSPORT
0009 0012

NUTRITIONAL REQUIREMENTS
0014 0015 0043 0045 0049 0053 0055
0057 0058 0187 0195 0196

NUTRITIVE VALUE
0161 0163 0167 0168 0169 0171 0176
0184

OSMOTIC POTENTIAL
0016 0054

PH
0013 0017 0100 0169 0176
AGRICULTURAL LIME
0055 0196

PHASEOLUS ACUTIFOLIUS
0086 0091

PHASEOLUS COCCINEUS
0143 0158 0178 0189

PHASEOLUS LUNATUS
0139 0169

PHENOLIC CONTENT
0168

PHOSPHORUS
0015 0043 0057 0058 0070
MINERAL DEFICIENCIES
0048
NUTRIENT ABSORPTION
0013 0014
PLANT ASSIMILATION
0013 0014

PHOTOPERIOD
0028 0031 0144

PHOTOSYNTHESIS
0006 0008 0032 0047

PHYTOALEXINS
0005 0083 0097 0104

PHYTOHEMAGGLUTININS
0164

PLANT ANATOMY
0002 0003 0006 0007 0009 0012 0016
0018 0025 0027 0028 0029 0040 0042
0051 0062 0063 0073 0075 0084 0101
0104 0106 0115 0120 0139 0141 0143
0188 0190

PLANT ASSIMILATION
0010 0011 0012 0013 0014 0032 0052
0059 0191 0200

PLANT BREEDING
0002 0077 0080 0140 0146 0147 0148
0159
BACKCROSSING
0139 0141 0143 0144
HYBRIDIZING
0141 0143 0156 0158
SELECTION
0141 0144 0154 0158 0193

PLANT DEVELOPMENT
0003 0004 0016 0017 0021 0023 0025
0026 0028 0029 0031 0034 0046 0047
0050 0062 0063 0068 0073 0120 0121
0196

PLANT - GROWTH SUBSTANCES
0009 0018 0023 0028 0029 0034 0036
0038 0041 0051 0159

PLANT HABIT
0001 0023 0063 0144 0145 0153

PLANT INJURIES
0005 0009 0017 0099 0101 0103 0112
0132 0150
HERBICIDES
0059 0062
TEMPERATURE
0134

PLANT NUTRITION
0006 0012 0015 0016

PLANT PHYSIOLOGICAL DISORDERS
0017 0040 0056 0121

PLANT PHYSIOLOGICAL PROCESSE
0015 0019 0041
ABSCISSION
0007 0018 0020 0027 0030
NUTRIENT TRANSPORT
0009 0012
PHOTOSYNTHESIS
0006 0008 0032 0047
PLANT ASSIMILATION
0010 0011 0012 0013 0014 0032 0052
0059 0191 0200
PLANT RESPIRATION
0059

PLANT PIGMENTS
0008 0018 0047

PLANT RESPIRATION
0037 0059

PLANT TISSUES
0005 0006 0051 0059 0084 0104 0106
0115
ENZYMES
0026 0037

PLANT TOXINS
0165

PLANT VASCULAR SYSTEM
0009 0012 0040

PLANTING
0043 0044 0046 0050 0078 0195 0196
AGRICULTURAL EQUIPMENT
0079
SPACING
0069 0071 0072
PRODUCTIVITY
0071

PODDING
0027 0042 0046 0050

PODS
0027 0028 0042 0054 0065 0068 0073
0139

POLLEN
0139 0157 0159

POTASSIUM
0043
NUTRIENT ABSORPTION
0014
PLANT ASSIMILATION
0014

PRODUCTION
0193 0194

PRODUCTIVITY
0045 0070 0071 0140 0145 0192 0194

PROTEIN CONTENT
0018 0026 0055 0167 0171 0184
SEED
0160 0169 0172 0178 0181

PROTEINS
0025 0116 0164 0176
ANALYSIS
0026 0041 0157 0173
DIGESTIBILITY
0173

PSEUDOMONAS PHASEOLICOLA
HOST-PLANT RESISTANCE
0085 0086 0088 0092 0141 0152

PYTHIUM APHANIDERMATUM
0098

RADIATION
0097

RAINFALL DATA
0050 0134

RESEARCH
0006 0007 0051 0102 0115 0136 0140
0145 0150 0151 0154 0185 0193

RHIZOBIUM
0185 0186 0188 0190 0191
INOCULATION
0187 0189

RHIZOBIUM PHASEOLI
0185 0186 0187 0189 0191

RHIZOCTONIA SOLANI
0090 0103
DISEASE CONTROL
0082
HOST-PLANT RESISTANCE
0150

RNA
0033 0038 0116

ROOTING
0062

ROOTS
0016 0023 0026 0029 0047 0049 0062
0098 0101 0108 0110 0115 0185 0188
0190 0191

ROTS
0096 0101 0103 0108 0110

SALINITY
GROWTH
0016 0047

PLANT DEVELOPMENT
0016 0047

SAVANNAS
0045

SCLEROTIUM ROLFSII
HOST-PLANT RESISTANCE
0150

SEED
0157 0175 0177 0182
AMINO ACIDS
0160 0181
CHARACTERS
0074 0079 0146 0153 0160 0178 0181
0183
DISEASES AND PATHOGENS
0094
GENETICS
0146
GERMINATION
0094
INJURIOUS INSECTS
0128
PROTEIN CONTENT
0160 0169 0172 0178 0181
STORAGE
0163 0183 0198
YIELDS
0073 0074 0153

SEED CHARACTERS
0074 0078 0079 0112 0153 0178 0181

SEED COLOR
0126 0146 0160 0181

SEED COAT
0094 0181
ANALYSIS
0115
INHERITANCE
0146

SEED COLOR
0094 0126 0146 0160 0181

SEED PRODUCTION
0015 0024 0042 0058 0073 0076 0077
0112 0192 0193

SEED TRANSMISSION
0107 0109 0115

SEED TREATMENT
0094 0159 0184 0186 0199

SEEDS
0019 0025 0026 0027 0034 0036 0075
0078 0094 0109 0115 0124 0165 0179
0180 0184 0190 0197 0199

SELECTION
0014 0085 0142 0152

PLANT BREEDING
0141 0144 0154 0158 0193

SOIL ANALYSIS
0048 0049 0052 0057 0071

SOIL FERTILITY
0048 0049 0052 0060 0101 0185

SOIL IMPOVERISHMENT
0057

SOIL POPULATION
0093 0107 0110 0186

SOIL REQUIREMENTS
0015 0052 0108

SOIL TEMPERATURE
0108 0118

SOIL WATER
0195

SOILS
0048 0052 0055 0057 0077 0078 0115
0196

SPACING
0058 0072
PRODUCTIVITY
0070 0071 0192
YIELDS
0063 0069 0071 0099

STARCH CONTENT
0028 0178

STATISCAL ANALYSIS
0014 0022 0024 0031 0046 0050 0051
0078 0095 0096 0099 0103 0122 0146
0151 0197

STEMS
GROWTH
0004 0016 0021 0022 0023 0047
MINERALS AND NUTRIENTS
0190
TRANSLOCATION
0012

STOMATA
0006 0047

STORAGE
0077 0163 0179 0180 0192 0198
DISEASES AND PATHOGENS
0043
INJURIOUS INSECTS
0129
TEMPERATURE
0183 0197

STORED GRAIN PESTS
0124 0128 0129 0136 0199

SUGARS
0009 0020 0040 0177

SYMBIOSIS
NODULATION
0186
MINERALS AND NUTRIENTS
0053 0055 0191

SYMPTOMATOLOGY
0043 0056 0082 0084 0085 0086 0087
0089 0100 0105 0117 0143 0150

TAXONOMY
0002 0157

TEMPERATURE
0031 0095 0100 0102 0108 0169 0183
0197
PLANT INJURY
0134
YIELDS
0044 0046 0134

THIELAVIOPSIS BASICOLA
0098

TIMING
0004 0031 0042 0044 0046 0050 006.
0071 0074 0076 0096 0102 0107 0124
0131 0133 0136 0143 0148 0166 0183
PLANT INJURIES
0185 0195 0196

TISSUE CULTURE
0026

TOXICITY
0040 0160 0164 0176 0181
HERBICIDES
0060

TRACERS
0040 0059 0200

TRANSLOCATION
0012 0040 0200

TRANSPIRATION
0051

UROMYCES PHASEOLI
DISEASE CONTROL
0082
CHEMICAL CONTROL
0081
ELECTRON MICROSCOPY
0106
ETIOLOGY
0082 0095
HOST-PLANT RESISTANCE
0104 0106 0141 0152
HOSTS AND PATHOGENS
0104

USA
0049 0096 0119 0126 0135 0170 0171
0174 0185

VIROSES
0043 0080 0082 0112 0113 0114 0115
0116 0117 0138 0141

VIRUS TRANSMISSION
0087 0089 0090 0091 0092 0102 0111
0113 0114
SEED TRANSMISSION
0107 0115

VITAMIN CONTENT
0171

WATER CONTENT
0023 0073 0183

WATER REQUIREMENTS (PLANT)
0050 0051 0054 0102 0195

WATER STRESS
0018 0023 0051

WEEDING
0049 0060 0061 0064 0066 0067

WEEDS
0121 0131
HERBICIDES
0061 0064 0066 0067

XANTHOMONAS PHASEOLI
0084 0090
DISEASE CONTROL
0082 0087
HOST-PLANT RESISTANCE
0086 0091 0148 0155
PLANT BREEDING
0148

XANTHOMONAS PHASEOLI VAR FUSCANS
0084 0090
DISEASE CONTROL
0089

YIELD COMPONENTS
0024 0027 0058 0063 0073 0074 0153
0196

ZABROTES SUBFASCIATUS
0127 0129 0137

ZEA MAYS
0036 0057 0069 0181
INTERCROPPING
0070 0071 0072 0145

ZINC
0066

LIST OF ABBREVIATIONS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
a.i.	Active ingredient
alt.	Altitude
CAMD	Cassava African mosaic disease
CAMV	Cassava African mosaic virus
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxygen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter
COD	Chemical oxygen demand
concd.	Concentrated
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
expt.	Experiment
exptl.	Experimental
°F	Degrees Fahrenheit
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
govt.	Government
govtl.	Governmental
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
IAA	Indoleacetic acid
IBA	Indolebutyric acid
in.	Inches
i.e.	That is
IU	International unit
J	Joule
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilogram-calorie(s)
kg	Kilogram(s)
Kj	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate

kR	Kiloroentgen(s)
l	Liter(s) (only in combination with no.)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio
LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol.wt.	Molecular weight
m.p.	Melting point
NAA	α-Naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
P	Probability
Pa	Pascal(s)
PAN	Pexoxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pphm	Parts per hundred million
PPI	Pre-planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar.
resp.	Respective(ly)
R*f*	Retardation factor-chromatography
RGRs	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
S	Svedberg unit of sedimentation coeff. (10^{-13} s)
s	Second
$S_{20,w}$	Sedimentation coefficient corrected to water at 20°C
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
sp.	Specie
spp.	Species
SSL	Sodium stearyl-2-lactylate
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with *N*-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
W	West
wk.	Week
WP	Wettable powder
wt.	Weight
YFEL	Youngest fully expanded leaves
yr	Year(s)
α	*alpha*
β	*beta*
γ	*gamma*
δ	*delta*
ε	*epsilon*
λ	*lambda*
π	*pi*
ψ	*psi*
/	Per
μ	Micro
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus
ϕ	Diameter
≪	Much less than
≫	Much greater than

DOCUMENTATION SERVICES

(Personnel involved in documentation activities from January to April, 1982)

Susan C. Harris, *MLS, Information Specialist, Library and Documentation Services Unit, Head*
Fabiola Amariles, *BA, Documentalist, Production Supervisor*
Marlene Cárdenas, *Bibliographer*
Manuelita de Chacón, *Typesetting*
Rommel Durán, *Layout*
Carlos P. González, *Ing. Agr., Documentalist-Beans*
Francy González, *Ing. Agr., Documentalist-Cassava*
Jorge López, *Bibliographic Services (Supervisor)*
Mariano Mejía, *BA, Documentalist-Tropical Pastures*
Lynn Menéndez, *Editing and Translation*
Keyttel de Prieto, *Information input*
Gladys de Ramos, *Proofreader*
Guillermo Solís, *Layout*

BEAN PROGRAM

(as of April, 1982)

Aart van Schoonhoven, *PhD, Coordinator*
Stephen Beebe, *PhD, Central America Bean Project*
* César Cardona, *PhD, Entomology (Visiting Scientist)*
Marcial Pastor Corrales, *PhD, Plant Pathology*
Jeremy H. C. Davis, *PhD, Agronomy*
* Ramiro de la Cruz, *PhD, Physiology (Visiting Scientist)*
Michael Dessert, *PhD, Plant Breeding (Postdoctoral Fellow)*
Guillermo E. Gálvez, *PhD, Coordinator, Central America Bean Project*
Peter H. Graham, *PhD, Microbiology*
Francisco Morales, *PhD, Virology*
James Nienhuis, *PhD, Plant Breeding (Postdoctoral Fellow)*
Silvio H. Orozco, *MS, Central America Bean Project*
Douglas Pachico, *PhD, Economics*
Federico Scheuch, *MS, Peru/CIAT Bean Project*
Shree P. Singh, *PhD, Plant Breeding*
Steven R. Temple, *PhD, Plant Breeding (on sabbatical leave)*
Michael D. Thung, *PhD, Agronomy stationed at CNPAF, Goiania, Brazil*
Oswaldo Voysest, *PhD, Agronomy*
Jonathan Woolley, *PhD, Cropping Systems Agronomy*

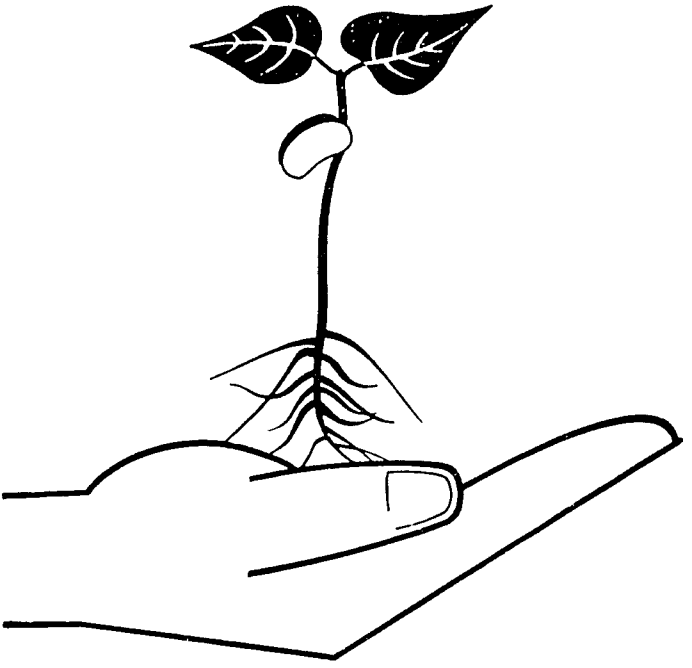
---

* Left during this period.

PN-AAN-082 ... 29695

Abstracts on Field Beans

Phaseolus vulgaris L.



Centro Internacional de Agricultura Tropical

CIAT is a nonprofit organization devoted to the agricultural and economic development of the lowland tropics. The government of Colombia provides support as host country for CIAT and furnishes a 522-hectare site near Cali for CIAT's headquarters. In addition, the Fundación para la Educación Superior (FES) makes available to CIAT a 184-hectare substation in Quilichao and a 73-hectare substation near Popayán. CIAT also co-manages with the Instituto Colombiano Agropecuario (ICA) the 22,000-hectare Carimagua Research Center in the Eastern Plains of Colombia, and carries out collaborative work on several of ICA's experimental stations in Colombia; similar work is done with national agricultural agencies in other Latin American countries. CIAT is financed by a number of donors represented in the Consultative Group for International Agricultural Research (CGIAR). During 1982 these CIAT donors are: the Rockefeller Foundation, the Ford Foundation, the International Bank for Reconstruction and Development (IBRD) through the International Development Association (IDA), the Inter-American Development Bank (IDB), the European Economic Community (EEC), the International Fund for Agricultural Development (IFAD), and the governments of Australia, Belgium, Canada, the Federal Republic of Germany, Japan, Mexico, the Netherlands, Norway, Spain, Switzerland, the United Kingdom, and the United States. In addition, special project funds are supplied by various of the aforementioned donors plus the Kellogg Foundation, the United Nations Development Programme (UNDP) and the International Development Research Center (IDRC).

Information and conclusions reported herein do not necessarily reflect the position of any of the aforementioned agencies, foundations or governments.

Publication of CIAT's
Bean Documentation Center

Documentalist: Carlos Prío González G.

Abstracts on Field Beans

(*Phaseolus vulgaris* L.)

Vol. VII No. 2 August, 1982

CONTENTS

FOREWORD iii

A GUIDE FOR USERS v

A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION 1

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY 3

C00 PLANT PHYSIOLOGY 5

C01 Plant Nutrition 9
C02 Plant Development 12
C03 Chemical Composition, Methodology and Analyses 16

D00 AGRONOMY 20

D01 Soil Water, Climate and Fertilization 22
D02 Cultivation Practices: Planting, Weed Control and Harvesting 27
D03 Cultivation Systems: Intercropping, Rotation Crops 32
D04 Seed Production 36
D05 Varietal Trials 40

E00 PLANT PATHOLOGY 43

E01 General Descriptive Studies
E02 Bacterioses 43
E03 Mycoses 49
E04 Viroses 55
E05 Nematodes 58
E06 Physiological Disorders

F00 PEST CONTROL AND ENTOMOLOGY 60

F01 Injurious Insects, Mites and their Control 63

G00 GENETICS AND PLANT BREEDING 65

G01 Breeding, Selection and Germplasm 69
G02 Cytogenetics 73
G03 Polyploidy

H00 NUTRITION 74

H01 Foods and Nutritive Value 75

I00 MICROBIOLOGY 76

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation 76

J00 ECONOMICS AND DEVELOPMENT 80

K00 FIELD PLOT TECHNIQUE 84

L00 GRAIN STORAGE 86

L01 Stored Grain Pests 88

Z00 GENERAL 90

AUTHOR INDEX 91

SUBJECT INDEX 100

LIST OF ABBREVIATIONS 110

FOREWORD

CIAT's documentation activities are focused on three research areas: cassava (*Manihot esculenta* Crantz) production and utilization, field beans (*Phaseolus vulgaris* L.) as grown under tropical conditions, and tropical pasture species and their management. The goal of the Documentation Center is to disseminate research results and report ongoing activities in these three areas.

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide users with both an update service and a permanent record of information that contains essential data for their research activities. The abstracts are categorized in broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are subject and author indexed to enable more comprehensive consultation. When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users of this mechanized search service. The full text of every article abstracted by the Documentation Center is available, through the Center's photocopy service.

No one publication can cover the whole range of information needs. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include:

Pages of Contents - a current awareness reference to articles published in more than 500 scientific and technical journals. Every article indexed can be ordered through the Center's photocopy service.

Cassava Newsletter (Yuca - Boletín Informativo) - a technical newsletter that provides information regarding cassava research in progress throughout the tropics.

Pastos Tropicales - Boletín Informativo - a newsletter on pasture research and on new developments in the tropical pastures network.

Hojas de Fríjol - a newsletter on bean breeding, agronomy, and cropping systems, and on the activities within the bean researchers' network.

We believe that each of these types of information plays a key role in research aimed at increasing agricultural productivity in the tropics. It is our hope that this range of publications satisfies the various information needs of our users.

A GUIDE FOR USERS

Components of a reference

Sequential number in this journal

0001

1 ← 15869 VILHORDO, B.W.; MÜLLER, L.; EWALD, L.F.; LEÃO, M.L. 1980. Há-
2 ← bito de crescimento em feijão (*Phaseolus vulgaris* L.). (*Bean growth habits*). Agro- → 4
3 ← nomia Sulriograndense (Porto Alegre) 16(1):79-98. Port., Sum. Port., Engl., 20
Refs., Illus. 5 6 7

8 ← *Phaseolus vulgaris*. Cultivars. Plant habit. Identification. Bush bean. Climbing bean. Brazil.

9 ← In order to define the types of growth habit of the common bean 45 cv. were studied, pertaining to the 9 commercial groups established for Brazil: Amarelo, Bico-de-Ouro, Manteigão, Mulatinho, Pardo, Preto, Rosinha, Roxinho, and Branco. The exptl. phase was carried out the Osorio Exptl. Station (Maquiné, Rio Grande do Sul) of the Secretary of Agriculture, during the agricultural yr 1976. Based on the data obtained, the following types of growth habit were established: I (determinate, bushy); II (undeterminate, with erect branching); III (undeterminate, with open branching), IV (undeterminate, prostrate, winding). Variance analysis of the length of the main stem, the length of the twine, and the no. of nodes of the main stem revealed significant differences among cv. However, when comparing the means of these parameters, no grouping of similar means was found which would permit to separate plants of the types II and III. (*Author's summary*) A00 B00
10 11

1- Accession number
2- Author(s)
3- Original title
4- Title translation
5- Source
6- Pages
7- Additional notes
8- Descriptors
9- Summary
10- Abstractor and/or translator
11- Subject categories

Note: The use of abbreviations in the abstracts has been standardized by the Information Center. A complete list of these abbreviations is included at the end of this journal.

Use of indexes

The author and subject indexes at the end of this journal were elaborated in collaboration with CIAT's Data Services Unit . These indexes serve as guides for the user to carry out his own information searches.

Author index

Here you will find the complete list in alphabetical order of the authors of the documents summarized in this issue. The four-digit numbers at the right hand side of each author correspond to the sequential numbers of appearance of the documents herein (the number centered above the abstract).

Subject index

This index presents a list of terms in alphabetical order to which the user can translate his information needs on specific topics. To facilitate his search, most of these terms or general topics cover other subjects, and thus the user will find up to two more levels of specificity. The four-digit numbers under the terms correspond to the sequential number of the documents within this issue.

Photocopy requests

In some cases, the information contained in the abstract satisfies the needs of the user. However, if there is an interest in having the complete document, photocopies can be requested by indicating the access number that appears at the upper left corner of the reference. Send your request to:

Documentation Services Unit
Photocopies Section
CIAT
Apartado aéreo 6713
Cali, Colombia, S.A.

Payments can be made by check (in US dollars or Colombian pesos) payable to CIAT, or CIAT, AGRINTER or UNESCO coupons. For Colombia the cost of each photocopy is Col.$4.00 or US$0.10; for other countries, US$0.20. Payments should be made in advance.

A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0201

16074 KAPLAN, L. 1956. **The cultivated beans of the prehistoric Southwest.** Annals of the Missouri Botanical Garden 43:189-251. Engl., Sum. Engl., 82 Refs., Illus.

Phaseolus vulgaris, Phaseolus acutifolius, Phaseolus coccineus, Phaseolus lunatus. **Cultivars. Taxonomy. Plant geography. Ecology. Climatic requirements. Seed characters. USA.**

Collections of cultivated beans from contemporary SW Indian peoples and bean remains from prehistoric sites in the same area in the USA were studied. On the basis of external seed morphology and anatomy a series of cultivated bean types is described in tabular and graphic forms. The types have about the same taxonomic significance as named horticultural var. Thirty-two common bean types are recognized and described for the SW. Of these, 13 have been found only among prehistoric remains, 10 occur only in contemporary collections, and 9 have been found among both prehistoric and contemporary collections. Eight tepary bean (*Phaseolus acutifolius* var. *latifolius*) types are recognized from prehistoric and contemporary collections, and 5 lima bean (*Phaseolus lunatus*) and 2 runner bean (*Phaseolus coccineus*) types are recognized and described from contemporary collections only. Bean areas are defined on the basis of distribution of the types; prehistoric and contemporary divisions are made according to temporal distribution. The areas outlined correspond to Indian cultural divisions and to climatic conditions. It is suggested that parching and grinding of mature bean seeds was an early method of food preparation and that the role of beans in the diet was as a source of protein to supplement animal and complement maize protein. *(Author's summary)* A00

0202

16020 KAPLAN, L. 1981. **What is the origin of the common bean?.** Economic Botany 35(2):240-254. Engl., Sum. Engl., 38 Refs., Illus.

Phaseolus vulgaris **History. Plant geography. Seed characters. Seed size. Cultivars. Central America. South America. Maps.**

Two interpretations of archaeological findings are suggested: independent origin in Central America (CA) and Andean America (AA), or primary origin in South America (SA). Some land races have been found only in the archaeological record of CA and others only in AA but there is no overall distinction between the CA and AA forms. Archaeological evidence in CA, although relatively extensive in time and geographic coverage, revealed no wild forms, calling into question the putative wild ancestors of the French bean in CA and suggesting that *Phaseolus vulgaris* was domesticated in SA and diffused later into CA. Regional diversity and large seed size distinguish domesticated from wild forms. Exptl. and archaeological evidence are presented suggesting that human selection may have been indirect and only complementary to natural selection, which could have operated independently in CA and SA. *(Summary by Plant Breeding Abstracts)* A00

0203

16920 SOLORZANO V., R. 1982. **Clasificación de hábitos de crecimiento en** *Phaseolus vulgaris* L. *(Classification of growth habits in beans).* Tesis Mag. Sc. Chapingo, México, Colegio de Postgraduados. 72p. Span., Sum. Span., 30 Refs., Illus.

Phaseolus vulgaris. **Plant habit. Agronomic characters. Growth. Climatic requirements. Temperature. Plant architecture. Identification. Phenology. Ecology. Plant anatomy. Cultivars. Mexico. Colombia.**

The most important characters used to classify the different growth habits originating from the evolutive process of *Phaseolus vulgaris* were identified. The effect of the environment on some growth habit components was also observed. A total of 289 genotypes, differing in their growth habit and planted without competition in Chapingo, Mexico, were studied and 29 characteristics were observed. Classification methods were: (1) the morphological traditional taxonomic method (qualitative classification); (2) the numeric taxonomic method, a statistical method that measures the % of similitude among characters and among genotypes. With the former method, genotypes were classified in 4 types of growth habit: I, II, III, and IV. Moreover, 3 subtypes were identified for type III: IIIa, IIIb, and IIIc. Subtype IIIa is characterized as being a non-climber, IIIb, as being a climber, and IIIc, by long internodes and a reduced no. of branches. Classification by numeric taxonomy grouped the genotypes into 5 groups by both the method of Euclidean distance (ind) and by the correlation coefficient method (rc). When the relationship between these 2 methods and qualitative classification was established, it was found that with the 3 methods, the majority of the genotypes (97%) were classified into 4 large groups. Regarding the effect of the environment, some growth habit components of genotypes planted in June in Chapingo (av. annual temp. 16°C, alt. 2240 m.a.s.l.) were compared with those of the same genotypes planted in Palmira, Colombia (24°C, 1000 m.a.s.l.). Comparisons were also made with beans planted in Dec. in Iguala, Mexico (23°C, 724 m.a.s.l.). Major changes observed were, that of the 85 tested genotypes from Palmira, 4.5% changed their determinate growth habit in Palmira to indeterminate in Chapingo, and 3.5% changed from indeterminate to determinate. Of the genotypes observed in Iguala, 22 genotypes (24.1% of the total) of indeterminate growth habit in Chapingo changed to determinate growth in Iguala and 2 (2.2%) of determinate growth in Chapingo changed to indeterminate in Iguala. Av. plant height was higher in Palmira and Iguala for types I and II and lower for types III and IV. The no. of days to flowering was greater in Chapingo for the 4 growth habits. *(Extracted from author's summary. Trans. by I.M.E.)* A00

0204

16075 STEINMETZ, F.H.; ARNY, A.C. 1932. **A classification of the varieties of field beans,** *Phaseolus vulgaris.* Journal of Agricultural Research 45(1):1-50. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Identification. Plant habit. Yield components. Seed characters. Seedlings. Seeds. Pods. Plant anatomy. Taxonomy. Plant geography. USA.**

A practical basis for the classification of bean var. is established and a key based on stable characters under varying climatic conditions is given and illustrated. The var. found under the environmental conditions of the U. of Minnesota Agricultural Expt. Station (USA) are described. Characters useful in classification and description of bean var. include seedling characters, characters of well-developed plants (growth habit, plant height, color of leaves and stems, size and shape of leaves, color of flowers, time to maturity, productivity, and disease resistance), pod characters (color, shape, texture, length, width, apex, and spur), and dry-seed characters (size, shape, and color). Selected bean var. are described. *(Summary by A.J.C. Trans. by I.M.E.)* A00 B00

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY

0205

16490 MUJEEB, K.A. 1970. **Gamma radiation effects on *Phaseolus vulgaris* L. and seed radiosensitivity determinations for other species.** Ph.D. Thesis. Manhattan, Kansas State University. 134p. Engl., Sum. Engl., 184 Refs., Illus.

Phaseolus vulgaris. **Mutation. Irradiation. Seeds. Chromosomes. Leaves. Chlorophyll. Seedlings. Plant development. Timing.**

Gamma radiation effects on *Phaseolus vulgaris* cv. Blue Lake were evaluated. Studies involved initial dose estimation based upon 100% lethality, X_1 greenhouse study, X_2 field study with selection of macromutants, and evaluation of these macromutants until X_4 in the greenhouse. Four macromutants were selected in the X_2: SDM-1, SDM-2, PSHy, and LfHy. Agronomic characteristics of each macromutant are discussed. The yield in the 4 macromutants is primarily effected by the total no. of pods. All differences are significant. It was concluded that radiation increased genetic variability of quantitative characters in a population. The spectrum of induced variation was observed to be fairly wide, particularly regarding polygenic and economic characters (no. of pods and seeds, yield and wt./100 seeds). The 2nd phase of this study dealt with radiosensitivity estimations using 3 approaches: morphological (seedling performance), physiological (total chlorophyll content of primary leaves), and cytological (normal anaphase). Advantages and disadvantages of each approach are given. *(Extracted from author's summary)* B00 G00

0206

17373 ANDREWS, D.J.; HARDWICK, R.C. 1981. **The effects of temperature and other variables on the contribution of lateral branches to yield in *Phaseolus vulgaris* L.** Annals of Botany 48(1):15-23. Engl., Sum. Engl., 26 Refs.

Phaseolus vulgaris. **Temperature. Branching. Stems. Growth. Plant-growth substances. Yield components. Yields.**

At low temp. (15/15°C day/night) in controlled environments the growth of lateral branches at the cotyledonary node of *Phaseolus vulgaris* is suppressed. The suppression can be overcome by raising the temp. of the buds by approx. 6°C with small electric heaters. In order to test the practical significance of the induction of branching for yields of the commercial crop seedlings were raised in contrasted regimes and then transplanted to the field. The effects of pretreatment regime on final yield were small; changes in the yield from axillary branches tended to be balanced by compensatory changes in the yield from the main stem. In another field expt., synthetic growth substances were applied in order to suppress or enhance branching. Changes in the amount of yield carried on branches were again offset by compensatory changes in the yield from the main stem. Compensatory effects between branches and main stem were also found in a variety trial. However, in an expt. on a single cv. and various levels of N fertilizer, compensatory effects were not found; here, branch and main stem yields were positively, rather than negatively, correlated. These results are discussed in relation to the intrinsic factors that govern yield in *P. vulgaris.* *(Author's summary)* B00

0207

16408 GONZALEZ W., M.E. 1979. **Determinación de características fenotípicas relacionadas con el potencial de rendimiento en la planta de frejol (*Phaseolus vulgaris* L.).** *(Determination of phenotypic characteristics related to yield potential in bean plants).* Tesis Ing. Agr. Santiago, Pontificia Universidad Católica de Chile, Facultad de Agronomía. 68p. Span., Sum. Span., Engl., 64 Refs., Illus.

Phaseolus vulgaris. **Agronomic characters. Yield components. Yields. Cultivars. Harvest index. Leaf area. Dry matter. Pods. Seeds. Stems. Statistical analysis. Chile.**

The relationship existing between 16 phenotypic characteristics of plant morphology and physiological processes and yields in 5 bean cv. (Titán, Hallados Pinto 114, Negro Argel, Tórtola Corriente, and Cristal Blanco Fénix) was studied in a trial conducted at the expt. station, U. Católica de Chile, Pirque during 1976-77. Variables were arranged hierarchically to make an index of bean plant selection based on the most important characteristics. The most relevant variables were seeds/plant, total plant dry wt., pods/plant, and total dry wt./day; correlation coefficients were significant for the 5 cv. studied. However, it was determined that yield components compensate each other; therefore, characteristics that individually do not bear a close relationship with yield, as a whole affect the final product. To elaborate a selection index, new variables should be incorporated into the system since the results obtained do not fully explain the yields. *(Author's summary. Trans. by L.M.E.)* B00 D05

0208

17342 SILVA, H.T. DA 1981. **Caracterização morfológica, agronômica e fenológica de cultivares de feijão (*Phaseolus vulgaris* L.) comumente plantadas em diversas regiões do Brasil.** *(Morphological, agronomic, and phenologic characterization of bean cultivars commonly planted in different regions of Brazil).* Goiânia-GO, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa-Arroz e Feijão. Circular Tecnica,no. 15. 51p. Port., 14 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant anatomy. Agronomic characters. Germplasm. Plant habit. Seed color. Seeds. Climatic requirements. Phenology. Developmental stages. Timing. Brazil.**

A description is given of the morphological, agronomic, and phenological characteristics of 35 black and colored bean cv. (improved and native) from the Banco Ativo de Germoplasma of the Centro Nacional de Pesquisa-Arroz, Feijão (CNPAF) in Goiânia, GO, Brazil. To evaluate these cv. plantings were conducted during Feb. March, July (irrigated), and Sept. 1977 on a dark red distrophic clay loam Latosol soil, moderately acid with a low % of base-saturation and low OM content. Exptl. plots consisted of 4 rows 5 m long with 0.70 m between rows and 0.20 m between plants of growth habits I and II, and 0.30 m between plants of growth habits III and IV. The described cv. belong to the groups Preto, Rosinha, Mulatinho, Manteigão, Pardo, Roxinho, Bico-de-Ouro, Amarelo, and Branco. Illustrations on seed color and size in the groups under study and monthly climatic data on temp. and rainfall in the region are given. *(Summary by CPG. Trans. by L.M.E.)* B00 D05 G01

See also 0204 0209 0218 0226 0228 0335

C00 PLANT PHYSIOLOGY

0209

16710 PETERS, J.E.; SHARP, W.R.; CROCOMO, O.J. 1975. **Exogenous alkaloid control of growth and root morphogenesis in *Phaseolus vulgaris* tissue cultures.** *In* Sharp, W.R.; Crocomo, O.J. Growth and developmental physiology of *Phaseolus vulgaris* (A Report). Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz. Centro de Energia Nuclear na Agricultura. pp.1-17. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Growth. Roots. Morphogenesis. Plant tissues. Culture media. Indoleacetic acid. Plant-growth substances. Laboratory experiments.**

The effects of alkaloids, nicotine and caffeine, on cellular growth and root morphogenesis were studied in *Phaseolus vulgaris* var. Bico de Ouro. Leaf section explants were cultured on a bean medium (BM) supplemented with 2 mg IAA (I)/*l* and 0.2 mg kinetin (K)/*l*. Expt. were designed using 4 variations of this medium (BM, BM-K, BM-I, and BM-IK) supplemented with nicotine or caffeine concn. ranging between 0-500 mg/*l*. Addition of exogenous nicotine concn. (1-200 mg/*l*) to the BM had a stimulatory effect on callus cell growth which reached an optimal level of growth at the 200 mg/*l* concn. Abundant root induction occurred in all cultures grown on the nicotine-supplemented medium; however, the addition of nicotine at a concn. of 500 mg/*l* to the culture medium was extremely inhibitory to root induction. The removal of kinetin from the medium BM-K caused a drastic reduction in both callus cell growth and root induction. Although the addition of exogenous nicotine (1-500 mg/*l*) to the BM-K cultures caused no recovery of growth, root induction recovered to levels equivalent or higher than that obtained on BM. Optimal amounts of root induction occurred at the concn. 50 mg nicotine/*l*. Cultures grown on either BM-I or BM-IK had minimal amounts of callus cell growth and failed to undergo root induction. This situation did not change with the addition of exogenous nicotine to the culture medium. Caffeine supplements to BM, unlike nicotine, were antagonistic to callus cell growth and root induction. *Author's summary:* C00 B00

0210

17328 ABBOUD, S.; ROY, R.M. 1979. **The effects of X-irradiation on respiration and cation accumulation by isolated mitochondria of *Phaseolus vulgaris*.** Environmental and Experimental Botany 19(4): 277-283. Engl., Sum. Engl., 26 Refs.

Phaseolus vulgaris. **Irradiation. Plant respiration. Ca. Nutrient absorption. Plant tissues. Hypocotyls. Laboratory experiments.**

Mitochondria isolated from 7-day-old dark-grown bean hypocotyls, consumed 42 ± 5 nmoles O_2/min/mg protein at 20 C in the presence of succinate, phosphate, and ADP and normally had respiratory control ratios between 2.0-4.2. These mitochondria accumulated approx. 0.11 μmol Ca^{2+} and 0.13 μmol Sr^{2+}/mg mitochondrial protein in the presence of phosphate and succinate. Exposure of isolated mitochondria to 10, 25, and 50 krad of 260 kVp X-rays had no detectable effect on the respiration rate or respiratory control ratio up to 1 h postirradiation. No immediate inhibition of Ca^{2+} and Sr^{2+} accumulation by isolated mitochondria was detected after 50 krad X-irradiation, but approx. 30% inhibition of that accumulation was observed 1 h postirradiation; lower exposure (10, 25 krad) had no

significant effect on ion accumulation. The X-ray-induced inhibition of mitochondrial Ca^{2+} and Sr^{2+} accumulation was studied in the presence of inhibitors of mitochondrial electron transport or with uncoupling agents. The radiation-induced inhibition of mitochondrial Ca^{2+} and Sr^{2+} accumulation was related to impairment of both the energy-dependent and energy-independent components of that uptake; however, the effect was most pronounced in the latter. *(Author's summary)* C00

0211

16498 NOLAN, W.G. 1980. **Effect of temperature on electron transport activities of isolated chloroplasts.** Plant Physiology 66(2):234-237. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Chloroplasts. Photosynthesis. Temperature. Plant physiological processes.**

Temp. induced changes in electron transport activities of chloroplasts isolated from chilling-sensitive and chilling-resistant plants were examined. Using methylviologen as electron acceptor, temp.-induced changes occurred at 15°C in the photosystem II + photosystem I activities of chloroplasts isolated from chilling-resistant pea cv. Alaska plants. A similar change also occurred in photosystem I at approx. 13°C. These results indicated that temp. had a general effect on the functioning of thylakoid membranes. Chloroplasts isolated from chilling-sensitive *Phaseolus vulgaris* cv. Blue Lake 141 showed a temp.-induced change in ferricyanide reduction at approx. 12°C. The presence of temp.-induced changes in chloroplast activity assayed in vitro was not apparently correlated with chilling sensitivity. *(Summary by Field Crop Abstracts)* C00

0212

16442 CATTINI, M.A. 1974. **Contribuição ao estudo do papel fisiológico e bioquímico do potássio em plantas de feijão** *(Phaseolus vulgaris* **L., cultivar Goiano Precoce).** *(Contribution to the study of the physiological and biochemical role of potassium in bean cultivar Goiano Precoce plants).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 67p. Port., Sum. Port., Engl., 61 Refs., Illus.

Phaseolus vulgaris. **Minerals and nutrients. K. Plant development. Nutrient solution. Amino acids. Leaves. Mineral content. Analysis. Mineral deficiencies. Symptomatology. Brazil.**

The role of K in the physiology and biochemistry of the bean cv. Goiano Precoce plants was studied. Bean leaves were analyzed regarding visual symptoms of K deficiency, DM yield, ionic interaction in nutrient absorption, variation in the level of certain amino acids and derived amines, protein levels, metabolism of lysine-^{14}C, and possible correlations between amino acid levels and the doses of K applied to the plants. Bean plants were grown in nutrient solutions which had 0, 1, 2, 4, 6, 8, and 10 m*M* K/*l*; the 6 m*M* solution corresponded to the complete Hoagland and Arnon no. 2 solution. In K-deficient solutions, KNO_3 was substituted by NH_4NO_3 in the ratio 2:1. In the excess-K solutions, KCl was added to the complete solution. Material was collected at weekly intervals up to the 8th wk., covering the vegetative cycle of the plant. The amino acids and amines were extracted with 80% ethanol, fractionated on the cation exchange resin AG 50W-X8, H^+, 200-400 mesh, separated by paper chromatography, and determined quantitatively by a colorimetric method. Proteins were extracted by 0.1 N NaOH and estimated by the micro-biuret method. N, P, K, Ca, and Mg were analyzed in the dry-leaf extract. To study the metabolism of lysine-^{14}C, the extract of fresh material was fractionated by the automatic amino acid analyzer and radioactivity was determined in a liquid scintillation system. Data showed that protein synthesis was not different when K was replaced by NH_4^+ in K-deficient solutions. In conditions of extreme K deficiency, total N and several soluble N compounds (aspartic acid, asparagine, ornithine, citrulline, N-carbamylputrescine, and putrescine) had higher levels. Variables like height and water content showed a direct correlation with the K concn. Other variables, like P, Mg, and arginine content, showed an inverse correlation with the K concn. The concn. of K sufficient for the normal bean development varies between 1-2 m*M*. *(Author's summary)* C00

0213

16486 LIMA FILHO, J.M.P.; COSTA, J.A. 1979. **Influência da aplicação de um antitranspirante sobre a transpiração e crescimento de feijoeiros** *(Phaseolus vulgaris,* L.). *(Influence of anti-transpirant application on bean transpiration and growth).* Salvador-BA, Brasil, Empresa de Pesquisa Agropecuária da Bahia. Comunicado técnico no. 026. 12p. Port., 22 Refs., Illus.

Phaseolus vulgaris. **Evapotranspiration. Plant-growth substances. Nutrient solution. Growth. Leaves. Leaf area. Water content.**

Expt. were conducted under greenhouse conditions to study the effect of a film anti-transpirant (Mobileaf-Mobiloil) on the transpiration and growth of bean var. Vagem Roxa seedlings. Plants were sown in pots containing 1 kg sandy loam soil with daily irrigation to field capacity and the application of standard nutritive solution. When the 1st trifoliate leaf appeared, seedlings were divided into 6 groups for leaf application of the resp. treatments (0, 5, 10, 15, 20, and 25% anti-transpirant) in a randomized complete block design with 4 replications. Relative transpiration was measured 24 h after the treatment; leaf area and plant height were determined 1 day before and 10 days after the treatment. Final dry wt. was also determined. The anti-transpirant notably reduced transpiration with significant differences regarding the check at 20 and 25%, without significantly reducing plant growth. This indicated that the anti-transpirant does not interfere with photosynthesis. (No significant statistical differences were detected in plant height and dry wt.). A significant linear effect was noted between anti-transpirant concn. and leaf area, which increased with increasing concn. It was concluded that the anti-transpirant efficiently reduced transpiration without negative effects on growth. It is recommended to carry out expt. to verify these results in bean crops, especially in regions with poor or low raintall distribution. *(Summary by A.J.C. Trans. by L.M.F.)* C00

0214

14895 GREEF, J.A. DE; PROFT, M. DE 1977. **Ethylene release by germinating bean seeds as influenced by the presence of the seed coat.** Archives Internationales de Physiologie et de Biochimie 85(1):164-165. Engl., 4 Refs.

Phaseolus vulgaris. **Seed. Germination. Ethylene. Seed coat. Timing.**

In intact germinating seeds of *Phaseolus vulgaris* cv. Limburg, ethylene production started to increase after 21 (± 1) h; max. amounts (1550 pl/h seed) were reached at 64 (± 1) h. Where the seed coat was removed after 12 h of imbibition, ethylene production began to increase after 15 (± 1) h and reached a max. of 3300 pl/h seed after 27 (± 1) h. After 4 days the decoated seeds were producing 300 pl ethylene/h seed and were better developed (170 mg/embryo) than intact seeds (420 pl/h seed, 80 mg/embryo). Development of the embryo was closely related to the time of ethylene production. *(Summary by Field Crop Abstracts)* C00 D04

0215

15897 ANDRADE, A.G. DE; CROCOMO, O.J. 1980. **Incorporation of $^{14}CO_2$ by illuminated intact leaves of bean (*Phaseolus vulgaris*) plants.** Energia Nuclear e Agricultura (Brasil) 2(1):38-49. Engl., Sum. Port., Engl., 23 Refs.

Phaseolus vulgaris. **Photosynthesis. Carbon fixation. CO_2. Light. Leaves. Chlorophyll. Enzymes. Cultivars. Growth-chamber experiments.**

Bean plants were grown in hydroponic nutrient solution, maintained in controlled environment. Measurements of the photosynthetic activity using the method of $^{14}CO_2$ incorporation in intact leaves with portable equipment were made on the central leaflet of the 1st trifoliate leaf except when the effect of leaf age was studied (all central leaflets of the same branch were used). Data obtained indicated differences in the photosynthetic efficiency of bean cv. Relative differences in ribulose-diphosphate carboxylase activity in the crude extracts of leaves, leaf area, and leaf chlorophyll content were also observed. Rates of $^{14}CO_2$ incorporation at saturating light varied from 14.94-22.96 mg CO_2/dm^2/h and the 6

studied cv. could be divided into 2 classes: class 1 (> 20 mg $CO_2/dm^2/h$)-Piratã-1, Rosinha G-2, and Pintadinho Precoce; class 2 (< 20 mg $CO_2/dm^2/h$)-Carioca, Rosinha Precoce,and Pintado. Plants of the same cv. showed a relatively high variability and a strong dependence regarding environmental conditions. Differences among cv. in relation to RuDP carboxylase activity, leaf area, and leaf age were correlated to photosynthetic rate. *(Author's summary)* C00

0216

17371 JENKINS, G.I.; WOOLHOUSE, H.W. 1981. **Photosynthetic electron transport during senescence of the primary leaves of *Phaseolus vulgaris* L. II. The activity of photosystems one and two, and a note on the site of reduction of ferricyanide.** Journal of Experimental Botany 32(130):989-997. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Photosynthesis. Chloroplasts. Leaves. Plant physiological processes. Inhibitors. Biochemistry.**

The activity of photosystems one and two (PS I and PS II) was measured in chloroplasts isolated from the primary leaves of *Phaseolus vulgaris.* During foliar senescence, the rates of electron transport through PS I and PS II declined by approx. 25 and 33%, resp. These losses of activity could not account for the decrease of 80% in the rate of coupled, noncyclic electron transport during senescence. It is therefore suggested that an impairment of electron flow between the photosystems limited noncyclic electron transport in chloroplasts from older leaves. The activity of PS II was measured using oxidized *p*-phenylenediamine as the electron acceptor, and trifluralin as an inhibitor of electron transport between PS II and PS I. In chloroplasts from young leaves the reduction of ferricyanide was a measure of noncyclic electron transport, but in preparations from older leaves ferricyanide received a large proportion of electrons from PS II. *(Author's summary)* C00

See also 0261 0276

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

C01 Plant Nutrition

0217

16069 SUHET, A.R.; NEPTUNE, A.M.L. 1979. **Efeito do ferro (^{59}Fe) e do zinco (^{65}Zn) e da natureza de três tipos de solos na produção de matéria seca e na composição química do feijoeiro (*Phaseolus vulgaris* L.) cv. carioca e na fixação de nitrogênio atmosférico por esta leguminosa.** *(Effects of ^{59}Fe, ^{65}Zn, and three soil types on dry matter yield, chemical composition, and nitrogen fixation in Phaseolus vulgaris cv. Carioca).* Anais da Escola Superior de Agricultura Luiz de Queiroz 36:1-42. Port., Sum. Port., Engl., 47 Refs.

Phaseolus vulgaris. **Micronutrients. Zn. Fe. Tracers. Nutrient solution. Composition. Analysis.** *Rhizobium phaseoli.* **Nodulation. Nitrogen fixation. Brazil.**

The effects of 2 levels of Fe and Zn on the yield and chemical composition of common beans and on atmospheric N fixation were studied under greenhouse conditions on 3 soils (Terra Roxa Estruturada, Latossol Vermelho Escuro, and Podzólico Vermelho Amarelo). The coefficient of utilization of these micronutrients and their distribution in the canopy and roots were also assessed. The rates for Fe were 1.5 and 3.0 ppm, and for Zn, 2.5 and 5.0 ppm. Plants were harvested at 60 days and N, P, K, Fe, and Zn contents were determined. Immediately after harvesting, symbiotic N fixation was assessed by the acetylene reduction method. The detection of ^{59}Fe and ^{65}Zn radioactivity was carried out on a nitric perchloric extract using γ ray spectrometry. The behavior of common bean presented high variation among the 3 soils, for all the variables. There was no influence of Fe and Zn treatments on the DM content of the canopy and roots nor on the wt. and no. of nodules. The rate of 3.0 ppm Fe decreased the capacity of the nodules to fix atmospheric N in comparison with the rate of 1.5 ppm; the rate of 5.0 ppm Zn increased this capacity in comparison with the rate of 2.5 ppm. There was a significative effect of the treatments on N, K, and Zn contents in the canopy and on the N and Zn contents in the roots. Zn absorption and the % of Zn in the plant were directly influenced by the rate of Zn fertilizer applied. The highest coefficient of utilization of Zn was 4.0%. *(Author's summary)* C01 C03

0218

16021 PATRICK, J.W.; TURVEY, P.M. 1981. **The pathway of radial transfer of photosynthate in decapitated stems of *Phaseolus vulgaris* L.** Annals of Botany 47: 611-621. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Photosynthesis. Sugars. Nutrient transport. Stems. Plant vascular system. Cytology. Tracers.**

[^{14}C] Sucrose was found to be the predominant component of the ^{14}C-photosynthates that accumulated in the free space of decapitated stems of *Phaseolus vulgaris* plants. The ^{14}C-photosynthates appeared to occupy the entire free-space vol. of the stems at total sugar concn. in the range of 3-12 m*M*. The free-space sugar levels rapidly declined once photosynthate transfer to the stems was halted. Moreover, it was found that estimates of the rate of in vitro sucrose uptake by the stems could account fully for the decline in free-space sugar levels. Overall, the evidence indicated that at least part of the radial pathway of photosynthate transfer in bean stems involved the stem apoplast. It is tentatively proposed that, based on cell and tissue distribution of ^{14}C-photosynthates, the apoplastic pathway extends

from the membrane boundary of the sieve element/companion-cell complex to all other cells of the stem. *(Author's summary)* C01 B00

0219

16732 AMARAL, F. De A.L. DO. 1975. **Eficiência de utilização de nitrogênio, fósforo e potássio de 104 variedades de feijoeiro** *Phaseolus vulgaris* **L.).** *(Efficiency of nitrogen, phosphorus, and potassium utilization in 104 bean varieties).* Tese Doutorado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 111p. Port., Sum. Port., Engl., 32 Refs.

Phaseolus vulgaris. **Minerals and nutrients. N, P, K. Nutrient absorption. Nutrient solution. Leaves. Roots. Stems. Mineral content. Analysis. Dry matter. Cultivars. Brazil.**

An expt. was conducted at the Centro de Energia Nuclear na Agricultura (CENA) of the Escola Superior de Agricultura Luiz de Queiroz, U. of São Paulo, Brazil in order to study the mineral requirements of 104 commercial bean var. The concept of nutritional efficiency was defined and the possibility of using this concept as additional information in var. selection was verified. Var. were grown under greenhouse conditions in nutrient solution at normal concn. or diluted 5 times. Plants were harvested at the end of the cycle (70 days for early-maturing and 90 days for the remaining var.); roots, stem, leaves, hulls, and beans were separated and dry wt. determined. Ground samples were then analyzed for total N, P, and K. The following conclusions were reached: (1) When grown in full strength solution all var. gave higher yields than when cultivated in the diluted substrate, except var. Vi 1010, Preto 143, San Fernando, México 266, Rosinha CIA -63, Franguinho, Venezuela 350, Carioca 1030, Rosinha, and Jalo suggesting that these var. were adapted for low levels of soil fertility. (2) Yields obtained in full strength solution ranged between 5.1 - 0.145 t/ha, var. being classified according to yields. (3) Yields obtained in diluted solution varied between 1.775 - 0.285 t/ha. (4) In the several plant parts, N, P, and K contents were lower in plants grown in diluted solution. N concn., however, did not present significant differences among var. or among treatments. (5) In full strength nutrient solution the values of nutritional efficiency varied from 0.2775 - 0.0081, 1.8270 - 0.0513, and 0.7895 - 0.0070 for N, P, and K, resp. (6) Positive correlations, significant at the 1% level, were found between the efficiency of utilization of NPK and yield. (7) Higher efficiency values were usually found in plants grown in diluted solution since the amount of elements absorbed was reduced by the treatment. This suggests that efficiency of utilization should be determined using a full strength solution. (8) For N and P, positive correlations were also found between total efficiency and the efficiency of certain parts. (9) The efficiency of NPK utilization is a useful parameter in var. selection since high efficiency means high yields. *(Author's summary)* C01

0220

17361 WALLACE, A.; ROMNEY, E.M.; ALEXANDER, G.V. 1981. **Multiple trace element toxicities in plants.** Journal of Plant Nutrition 3(1/4):257-263. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Micronutrients. Plant nutrition. Plant assimilation. Nutrient solution. Mineral content. Leaves. Toxicity.**

The effects of excess Cu, Ni, or Co, or their combinations, on yields of trifoliate leaves, stems, and roots were studied in *Phaseolus vulgaris* cv. Improved Tendergreen grown in solution culture. Yields of trifoliate leaves were reduced by 72, 42, and 68%, resp., when they contained 89 μg Cu, 76 μg Ni, and 54 μg Co/g DM. The Colby technique of multiplication of relative yields was used to determine the nature of the effects of combinations of excess Cu, Ni, and Co. With excess Cu + Ni, actual yield was 7% of that of the control; the calculated relative yield was 16% , indicating a possible synergistic effect. The combination also induced a chlorosis which was not given by Ni or Cu alone. Strictly additive effects were given by Cu + Co, Ni + Co, and Ni + Co + Cu which gave actual relative trifoliate leaf yields of 10, 19, and 4%, resp.,and calculated relative yields of 9, 19, and 5%. Ni + Co + Cu

decreased leaf Fe content and induced Fe deficiency. Similar results were given for root and stem yields but primary leaves were less affected. *(Summary by Soils and Fertilizers)* C01

0221

17364 SARKAR, A.N.; JONES, R.G.W. 1980. **Influence of the application from diverse sources of nitrogen and phosphorus on growth and nutrients uptake of dwarf beans.** Indian Journal of Plant Physiology 23(3):248-256. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. N. P. Nutrient absorption. Roots. Rhizosphere. Plant nutrition. Mineral content. Experiment design. Statistical analysis.**

Dwarf *Phaseolus vulgaris* seedlings grown in homogenized brown soil (pH 7 and 8) were given N and P as Ca phosphoryl choline chloride (CPCC), choline phosphate (CP), choline chloride (CC) + KH_2PO_4 and Ca nitrate (CN) + KH_2PO_4 with controls for P (CC and CN) and N (KH_2PO_4). Analysis of shoot, root, and soil (both rhizosphere and non-rhizosphere) showed different effects of the treatments on N, P, K, Mg, Ca, Fe, Mn, Zn, and Cl uptake and biomass accumulation in the rhizosphere; CP and CPCC showed highest growth response. The accompanying N induced higher translocation of P from root to the shoot. K^+ and NO_3^- in the ambient solution inhibited P uptake. The growth response and the rhizospheric biomass were correlated. Shoot P, Ca, K, Mn, and root K and Fe were significantly correlated with rhizosphere soil parameters. *(Author's summary)* C01 D01 I00

See also 0246 0250 0360 0361

C02 Plant Development

0222

16022 THOMPSON, A.; MACLEOD, R.D. 1981. **Lateral root anlage development in excised roots of *Vicia faba* L., *Pisum sativum* L., *Zea mays* L. and *Phaseolus vulgaris* L.** Annals of Botany 47:583-594. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Roots. Rooting. Plant tissues. Culture media. Plant development.**

The development of lateral root primordia has been investigated in excised roots of *Vicia faba, Pisum sativum, Zea mays,* and *Phaseolus vulgaris* cultured in White's medium supplemented with 2% sucrose and compared with previously published data on such development in primary roots of the corresponding intact plants (control roots). Primordia were produced in each batch of excised roots over the 6 day culture period but at a lower rate (no./day) than in the controls. Such primordia in cultured roots of *Zea* and *Phaseolus* completed their development and grew out as lateral roots over a period similar in length to that found in the controls, but with a cell no. of only about 33% of that attained at the time of secondary emergence in the primary roots of the latter roots. These lower cell no. were at least partly a reflection of increases in mean cell doubling time over the period of anlage development investigated in the excised roots relative to the corresponding values found in the controls. It has also been demonstrated in the course of these investigations that lateral root primordium development in all 4 species is at least biphasic and possibly triphasic. *(Author's summary)* C02

0223

14889 GREEF, J. DE; PROFT, M. DE; VEROUSTRAETE, F. 1976. **Ethylene production and its relation to growth in 8-day-old, etiolated bean seedlings.** Archives Internationales de Physiologie et de Biochimie 84(5):1062-1063. Engl., 3 Refs.

Phaseolus vulgaris. **Plant-growth substances. Plant development. Cotyledons. Seedlings.**

Ethylene production was monitored in 8-day-old etiolated *Phaseolus vulgaris* cv. Limburg seedlings grown under standardized conditions. Ethylene production/intact seedling was about 30 pl/*l*. Removal of the apical meristem, cotyledons and/or leaves did not affect ethylene release from the remaining part of the stem. When the embryonic axis was cut just below the hook region the upper part of the plant produced about 300 pl ethylene/*l* while the basal part produced only 15 pl/*l*, and growth was minimal. When cuts were made closer to the apical region or to the stem base a gradual decrease in ethylene production was observed. Where the upper part of the stem had a high rate of ethylene evolution, the cotyledons were still attached. A close relationship also appeared to exist between growth of the embryonic axis and ethylene production. *(Summary by Horticultural Abstracts)* C02

0224

14822 BRIARTY, L.G. 1980. **Stereological analysis of cotyledon cell development in *Phaseolus*. 2. The developing cotyledon.** Journal of Experimental Botany 31(124):1387-1398. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Plant development. Cell division. Cell structure. Cotyledons. Plant respiration.**

Quantitative changes in organelle vol., no., and area during cotyledon cell development in *Phaseolus vulgaris* are described during the early period of reserve protein synthesis. Rough endoplasmic reticulum underwent a 400-fold increase in area/cell and also changed in shape; changes in mitochondrial vol. did not parallel the changes which occurred in respiration rate; nuclear vol. increased. Relationships between cell and nuclear vol., DNA content, and cell wt. are discussed. Plastid division appeared to occur in steps. *(Author's summary)* C02

0225

17340 POZSAR, B.I. 1980. **Peak levels of endogenous cytokinins after decapitation in leaves of leguminous plants: increase of protein and chlorophyll contents and photosynthetic $^{14}CO_2$ fixation.** Acta Agronomica Academiae Scientiarum Hungaricae 29(1/2):47-50. Engl., 21 Refs.

Phaseolus vulgaris. **Cytokinins. Seedlings. Leaves. Protein content. Chlorophyll. Carbon fixation. Plant development.**

Two wk. after the decapitation of plants, the endogenous cytokinins in *Phaseolus vulgaris* leaves increased 8-fold compared with the level in intact plants, total N increased by 28%, protein N by 65%, chlorophyll by 35%, and photosynthetic CO_2 by 97%. The C:N ratio decreased from 1.65 to 1.2 due to increased protein synthesis. Mechanisms responsible for these changes are discussed in the light of earlier work. *(Summary by Field Crop Abstracts)* C02

0226

16706 PETERS, J.L.; SHARP, W.R.; CROCOMO, O.J. 1975. **The culture of *Phaseolus vulgaris* leaf explants.** *In* Sharp, W.R., Crocomo, O.J. Growth and developmental physiology of *Phaseolus vulgaris* (A report). Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz, Centro de Energia Nuclear na Agricultura. pp.1-16. Engl., 7 Refs., Illus.

Phaseolus vulgaris. **Leaves. Plant tissues. Culture media. Indoleacetic acid. Auxins. Morphogenesis. Growth. Growth-chamber experiments.**

Latin square expt. were conducted with 10 replications treatment to induce and control both seedling and root morphogenesis from leaf sections of bean var. Bico de ouro, sterilized and cultivated in 10 ml of modified Veliky and Martin's vitamin and salts agar medium, supplemented with 20 g/*l* sucrose, 100 mg/*l* inositol, 2 g/*l* casein hydrolysate, 1% agar, and varying concn. of interacting growth factors (auxins and cytokinins) at a pH of 4.5. The following interactions between different concn. of growth factors were tested: (1) 0-100 mg IAA/*l* vs. 0-10 mg kinetin/*l*; (2) 0-10 mg NAA/*l* vs. 0-10 mg kinetin/*l*; and (3) 0-10 mg IAA/*l* vs. 0-4 mg zeatin/*l*. All cultures were placed in controlled environmental chambers during 3 wk., after which callus growth (visual scale of 0-7) and root induction (visual scale of 1-3) were assessed. Means were determined for these parameters and were termed callus growth index (GI) and root morphogenesis index (MI), resp. The absence of IAA or kinetin induced min. callus growth (GI approx. 1); optimal callus growth was obtained with 10 mg IAA/*l* + 1 mg kinetin (GI = 4.69). No significant inhibition was observed with high concn. of either of these factors. No root induction was observed with 0-0.2 mg kinetin/*l* independent of IAA concn.; the same was observed in absence of IAA at all concn. Best root induction occurred with 0.4-1.0 mg kinetin/*l* and 7.5-10.0 mg IAA/*l*; kinetin appeared to be inhibitory at concn. > 1 mg/*l*. In general, at all kinetin concn. callus growth increased with increasing NAA concn.; optimal root morphogenesis was obtained with 10 mg/*l* of both kinetin and NAA. Although excellent callus and root growth was obtained at almost all IAA and zeatin concn., optimum growth occurred in both cases with 0.01-0.5 mg and 7.5-10.0 mg/*l*, resp. The expt. demonstrated the control of bean callus growth and root morphogenesis by auxin and cytokinin concn. in the medium tested. Zeatin was more effective than kinetin; it also showed higher geotrophic root induction. The induction of chlorophyll production in the callus cells by zeatin was considered to be an important step towards seedling growth induction. *(Summary by A.J.C. Trans. by L.M.F.)* C02 B00

0227

16005 YOKOYAMA, M.; NAITO, K.; SUZUKI, H. 1981. **Benzyladenine-enhanced cell proliferation and -suppressed greening in attached young bean leaves.** Plant and Cell Physiology 22(4):623-627. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Cytokinins. Plant tissues. Leaves. Cell division. Chlorophyll. Nucleic acids. Proteins.**

Changes in fresh wt., cell no., and size, and constituents were studied during the growth of attached young bean leaves after benzyladenine (BA) treatment. BA brought about the increase in DNA, RNA, and protein contents and fresh wt. as well as the temporary inhibition of chlorophyll accumulation in growing leaves. After a lag period for approx. 12 h, BA stimulated cell division but not cell expansion. An increase in RNA content occurred during the lag period of BA-induced cell division growth. *(Author's summary)* C02 C03

0228

16028 WHATLEY, J.M. 1980. **Plastid growth and division in *Phaseolus vulgaris.*** New Phytologist 86:1-16. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Plant development. Leaves. Chloroplasts. Cell structure. Cell division. Cytology. Electron microscopy.**

The sizes and no. of plastids were determined in the cells of the upper epidermal and upper palisade layers during development of the primary leaf of *Phaseolus vulgaris.* Plastids of both epidermal and palisade cells divide at all stages of plastid development, but division ceases soon after the plastids become mature. The process of plastid division involves both extension growth and fission. During growth of the primary leaf within a seed developing on the parent plant, plastids in both the epidermal and the palisade cells show little overall growth in size. During germination epidermal cell plastids remain small but plastids in palisade cells increase considerably in size as the leaf expands. Populations of potentially dividing plastids can be identified by the characteristic distribution of their size classes which, when set out graphically, give curves of distinctive shape. Cell division takes place during development of the primary leaf both prior to and following dormancy. Plastid division also occurs during these 2 periods. However, within each cell the plastids do not divide in synchrony. Nor are the periods of cell and plastid division synchronized, for the plastids continue to divide during the phase of max. leaf expansion, when cell division has ceased but while cell extension continues. In the primary leaf of *Phaseolus* the overall no. of cycles of plastid division exceeds that of cell division by between 2 and 3 cycles. *(Author's summary)* C02 B00

0229

15867 CASTRO, P.R.C.; ENOK, H. 1977. **Efeitos da aplicação de retardador (CCC) e acelerador (GA) de crescimento na morfologia e produtividade do feijoeiro (*Phaseolus vulgaris* L. cv. Carioca).** [*Effects of a growth retardant (CCC) and a growth promoter (GA) on morphology and productivity of bean cv. Carioca*]. Anais da Escola Superior de Agricultura Luiz de Queiroz 34:281-293. Port., Sum. Port., Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Gibberellins. Plant development. Plant anatomy. Yields. Greenhouse experiments.**

The effects of (2-chloroethyl) trimethylammonium chloride (CCC) and GA on bean cv. Carioca were studied at 3 different concn. of CCC (500, 2000, and 4000 ppm) and one concn. of GA (50 ppm). Treatment with CCC 500 ppm + GA 50 ppm increased bean plant height and CCC 4000 ppm + GA 50 ppm reduced height. Application of CCC 500 ppm + GA 50 ppm or CCC 2000 ppm + GA 50 ppm increased plant leaf no. CCC 500 ppm + GA 50 ppm promoted an increase in the internode length and CCC 4000 ppm + GA 50 ppm reduced the length of internodes. Application of CCC 500 ppm + GA 50 ppm or CCC 2000 ppm + GA 50 ppm increased the leaf length 5 days after the treatment. CCC 500 ppm + GA 50 ppm promoted higher flowering in relation to the check. *(Author's summary)* C02

14984 O'LEARY, J.W.; KNECHT, G.N. 1981. **Elevated CO_2 concentration increases stomate numbers in *Phaseolus vulgaris* leaves.** Botanical Gazette 142(4): 438-441. Engl., Sum. Engl., 33 Refs.

Phaseolus vulgaris. **Stomata. Leaves. CO_2. Seedlings. Nutrient solution. Growth-chamber experiments.**

Beans were grown under a constant CO_2 concn. of either 400 or 1200 µl/l. There was no significant difference in stomate density on the adaxial surface, but there was a significantly lower stomate density on the abaxial surface of leaves in the higher CO_2 concn. The leaf area was significantly greater at the higher CO_2 concn. and total no. of stomates/leaf, calculated from the density and leaf area, was significantly greater for both surfaces of the leaf. It was concluded that the observed CO_2 effect on stomatal density is the result of the large change in leaf area. *Author's summary* CO2

See also 0234 0239 0258

C03 Chemical Composition, Methodology and Analyses

0231

16489 WARDROP, A.J.; POLYA, G.M. 1980. **Ligand specificity of bean leaf soluble auxin-binding protein.** Plant Physiology 66(1):112-118. Engl., Sum. Engl., 34 Refs., Illus.

Phaseolus vulgaris. **Proteins. Auxins. Leaves. Indoleacetic acid. Inhibitors. Cytokinins. Growth. Analysis. Biochemistry. Plant physiological processes.**

The soluble bean leaf auxin-binding protein (ABP) had a high affinity for a range of auxins, including IAA, NAA, phenylacetic acid, and 2,4,5-trichlorophenoxyacetic acid. Bean ABP had a high affinity for auxin transport inhibitors and antiauxins. The specificity of pea ABP for representative auxins was similar to that found for bean ABP. Qualitative similarities between the ligand specificity of bean ABP and the specificity of auxin-induced bean leaf hyponasty provided further evidence that ABP could bind auxins in vivo. The high incidence of ABP in bean leaves and the high affinity of this protein for auxins and auxin transport inhibitors suggested possible functions for ABP in auxin transport and/or auxin sequestration. *(Extracted from author's summary)* C03

0232

15899 MUNSON, R.D.; NELSON, W.L. 1973. **Principles and practices in plant analysis.** *In* Walsh, L.M.; Beaton, J.D., eds. Soil testing and plant analysis. Madison, Wisconsin, Soil Science Society of America. pp.223-248. Engl., 77 Refs., Illus

Phaseolus vulgaris. **Yields. Nutritional requirements. Minerals and nutrients. Plant assimilation. Growth. Soil water. Cultivation. Experiment design.**

The basic principles of plant analysis are discussed with reference to crop yields in relation to nutrient concn. and supply, yield (growth relationships), physiological crop maturity and to cv., interrelationship with other factors (soil moisture, temp.); and in relation to a multiple regression approach. The plant analysis practices discussed include the determination of the total nutrient uptake of crops. These relationships are illustrated by reference to studies on brome grass, lucerne, Italian ryegrass, grain maize, soybeans, wheat, cotton, rice, groundnuts, potatoes, snap beans, Starr millet, and sugar beet. *(Summary by Field Crop Abstracts)* C03 D01

0233

17323 DERBYSHIRE, E.; MULLER, H.P.; CARVALHO, M.T.V.; CROCOMO, O.J. 1981. **Protein profiles of Brazilian beans (*Phaseolus vulgaris*) obtained by electrophoresis in slabs of polyacrylamide gel.** Energia Nuclear e Agricultura 3(2): 100-109. Engl., Sum. Engl., Port., 26 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Proteins. Seed. Analysis. Composition. Biochemistry.**

Profiles of the protein compositions of 6 samples of Brazilian beans were prepared by use of discontinuous electrophoresis in slabs of polyacrylamide gel. No difference was detected between the profiles of closely related samples; however, the profiles of samples from

different var. were not identical. The possible relevance of these observations to bean improvement programs is discussed. *(Author's summary)* C03 H00

0234

16013 WILHELM, J.; WILHELMOVA, N. 1981. **Accumulation of lipofuscin-like pigments in chloroplasts from senescent leaves of *Phaseolus vulgaris*.** Photosynthetica 15(1):55-60. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Maturation. Leaves. Chloroplasts. Plant pigments. Light.**

The contents of lipofuscin-like pigments in chloroplasts from 8 and 36 day-old primary leaves of *Phaseolus vulgaris* were compared. An accumulation of these pigments was observed in extracts from senescent leaves. Lipofuscin-like pigments from chloroplasts had similar fluorescence properties with pigments from animal tissues, but they behaved differently to changes in pH (acid-base). The accumulation of lipofuscin-like pigments in chloroplasts of senescent leaves is apparently a consequence of aging processes. *(Author's summary)* C03 C02

0235

16473 BOLLINI, R.; VITALE, A. 1981. **Genetic variability in charge microheterogeneity and polypeptide composition of phaseolin, the major storage protein of *Phaseolus vulgaris*, and peptide maps of its three major subunits.** Physiologia Plantarum 52:96-100. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Phaseolins. Proteins. Biochemistry. Analysis. Enzymes. Protein content. Seed.**

Mol. polymorphism of phaseolin, the major storage protein of *Phaseolus vulgaris*, and structural homology of its subunits were investigated. A high degree of charge heterogeneity was evidenced by isoelectric focusing. Comparison among phaseolins isolated from 7 different cv. showed genetic variability both in isoelectric focusing pattern and subunit composition. However, tryptic peptide maps of these phaseolins were very similar. The 3 phaseolin subunits isolated from cv. Greensleeves were compared by peptide mapping after limited enzymatic digestion, having very similar primary structures. *(Author's summary)* C03 H01

0236

16081 MUJEEB, K.A.; GREIG, J.K. 1978. **Effects of gamma irradiation and periodic sampling on primary-leaf amino-acid composition of *Phaseolus vulgaris* L. cv. Blue Lake.** Pakistan Journal of Botany 10(1):107-111. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Seed. Irradiation. Plant development. Leaves. Amino acids. Composition. Analysis.**

Phaseolus vulgaris seeds exposed to acute γ-radiation dosages of 0.5, 1.0, 1.5, 3.0, 4.5, 6.0, and 7.5 kR from a ^{60}Co 4500 Ci source were grown in a glasshouse. Primary leaf samples collected at 10 and 15 days after 50% germination in the control group were used to estimate biochemical stimulation based on amino acid compositions. Radiation and the developmental stage significantly influenced the amino acid compositions. Increases were significant for histidine, threonine, serine, and isoleucine at some exposures. Lysine, tyrosine, phenylalanine, and proline decreased. Changes in valine were erratic. Aspartic and glutamic acid increases and the arginine decrease were consistent. Most amino acids decreased from 10-15 days after 50% germination, except lysine, aspartic acid, and phenylalanine which increased. Biochemical processes mediated by enzymatic activities and irradiation are thought to relate to amino acid variations. *(Summary by Crop Physiology Abstracts)* C03

0237

15873 DIXON, R.A.; BROWNE, T.; WARD, M. 1980. **Modulation of L-phenylalanine ammonia-lyase by pathway intermediates in cell suspension cultures of dwarf French bean (*Phaseolus vulgaris* L.).** Planta 150:279-285. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Plant physiological disorders. Enzymes.** *Colletotrichum lindemuthianum.* **Host-plant resistance. Biochemistry. Analysis. Plant tissues. Culture media. Laboratory experiments.**

The increase in extractable phenylalanine ammonia-lyase (PAL;EC 4.3.1.5) activity induced in French bean cell suspension cultures in response to treatment with autoclaved ribonuclease A was inhibited by addition of the phenylpropanoid pathway intermediates cinnamic acid, 4-coumaric acid, or ferulic acid. The effectiveness of inhibition was in the order cinnamic acid > 4-coumaric acid > ferulic acid. Cinnamic acid also inhibited the PAL activity increase induced by dilution of the suspensions into an excess of fresh culture medium. Addition of low concn. (10^{-5} M) of the pathway intermediates to cultures at the time of application of ribonuclease gave variable responses ranging from inhibition to 30-40% stimulation of the PAL activity measured at 8 h. Following addition of pathway intermediates to cultures 4-5 h after ribonuclease treatment, rapid increases followed by equally rapid declines in PAL activity were observed. The cinnamic acid-stimulated increase in enzyme activity was unaffected by treatment with cycloheximide at a concn. which gave complete inhibition of the ribonuclease-induced response. However, cycloheximide completely abolished the subsequent decline in enzyme activity. Treatment of induced cultures with α-aminooxy-β-phenylpropionic acid resulted in increased but delayed rates of enzyme appearance when compared to controls not treated with the phenylalanine analogue. The results are discussed in relation to current views on the regulation of enzyme levels in higher plants. *Author's summary* C03

0238

16790 FULLER, C. 1981. **In vitro stability and inactivation of peptide hydrolases extracted from *Phaseolus vulgaris* L.** Plant and Cell Physiology 22(6):1095-1104. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Proteins. Amino acids. Enzymes. Leaves. Cotyledons. Germination. Seed. Plant physiological processes. Biochemistry. Analysis. Laboratory experiments.**

Endopeptidase activity against azocasein had a higher temp. optimum (50°C) in leaf extracts than in cotyledon extracts (37°C). The temp. optima for aminopeptidase (46°C) and for carboxypeptidase (53°C) were similar in leaf and cotyledon extracts. The endopeptidase activity showed an excellent stability in crude extracts from leaves even at 37°C, while the endopeptidase in cotyledon extracts was less stable. Carboxypeptidase was very stable in both leaf and cotyledon extracts. Aminopeptidase was the least stable of the enzymes investigated and its inactivation rate depended on the source of the extract. A moderate stability was observed in extracts of leaves or of ungerminated seeds, but this enzyme was rapidly inactivated in cotyledon extracts at pH 5.4. At pH 7.5 aminopeptidase remained active longer than at pH 5.4. From expt. with mixed extracts it was concluded that in cotyledons an aminopeptidase inactivating factor was formed during germination. This factor was heat-sensitive, excluded by Sephadex G-25, precipitated by 75% ammonium sulfate, and inhibited by tosyl-L-lysine chloromethyl ketone. These data suggest that the factor is a protein and considering the similar properties it appears possible that it is the endopeptidase formed during germination. *Author's summary* C03

0239

16472 DAVIES, H.M.; DELMER, D.P. 1981. **Two kinds of protein glycosylation in a cell-free preparation from developing cotyledons of *Phaseolus vulgaris.*** Plant Physiology 68:284-291. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Seed. Proteins. Enzymes. Cotyledons. Metabolism. Analysis. Biochemistry. Phaseolin. Tracers. Plant physiological processes. Laboratory experiments.**

Membrane preparations from developing cotyledons of red kidney bean transferred radioactive mannose from GDP-mannose to endogenous acceptor proteins. The transfer was inhibited by the antibiotic tunicamycin, suggesting the involvement of lipid-oligosaccharide intermediates typical of the pathway for glycosylation of asparagine residues. This was supported by the similarity of the linkage types of radioactive mannose in lipid-oligosaccharide and glycoprotein products; both contained labeled 2-linked mannose, 3,6-linked and terminal mannose typical of glycoprotein "core" oligosaccharides. As expected for "core" glycosylation, the transfer of labeled N-acetylglucosamine (GlcNAc) from UDP-GlcNAc to 4-linkage in endogenous glycoproteins could also be demonstrated. However, most of the radioactive GlcNAc was incorporated into terminal linkage, in a reaction insensitive to tunicamycin. The proteins receiving "core" oligosaccharide in vitro were heterogeneous in size, in contrast to those receiving most of the GlcNAc (which chiefly comprised the seed reserve proteins phaseolin and phytohemagglutinin). It is suggested that following "core" glycosylation, single GlcNAc residues are attached terminally to the oligosaccharides of these seed proteins, without the involvement of lipid-linked intermediates. Phaseolin from mature seeds does not possess a significant amount of terminal GlcNAc and so it is possible that these residues are subsequently removed in a processing event. *(Author's summary)* C03 C02

0240

17374 NAGARAJA, K.V.; PATWARDHAN, M.V. 1981. **In vitro effect of thiabendazole on enzymes of plant tissues.** Indian Journal of Plant Physiology 24(2): 104-108. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. **Plant-growth substances. Plant physiological processes. Plant tissues. Culture media. Mitochondria. Cell structure. Enzymes. Biochemistry.**

Thiabendazole, a systemic fungicide (which extends the storage life of fruits at chilling temp.), at 0.5 mM concn. inhibited mitochondrial succinate dehydrogenase activity by 20-60% in *Cicer arietinum*, *Vitis vinifera*, *Lycopersicon esculentum*, and *Phaseolus vulgaris*. The mitochondrial succinoxidase and phosphorylating capacity were inhibited by the compound only in *P. radiatus*. The compound inhibited mitochondrial NADH-cytochrome *c* reductase of *C. arietinum* to an extent of 50%. The compound, however, had no effect on mitochondrial succinate-cytochrome *c* reductase, malate dehydrogenase, ATPase, L-aspartate: 2-oxoglutarate aminotransferase and cytoplasmic phosphorylase, peroxidase, catalase, and polyphenol oxidase. *(Author's summary)* C03

0241

17389 WRONA, A.E.; VANDERMOLEN, G.E.; DEVAY, J.E. 1981. **Trifluralin-induced changes in hypocotyls of *Phaseolus vulgaris* in relation to lesion development caused by *Rhizoctonia solani* Kuhn.** Physiological Plant Pathology 18(1): 99-106. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances.** *Rhizoctonia solani.* **Plant injuries. Hypocotyls. Leaves. Cell structure. Electron microscopy. Laboratory experiments.**

Treatment of sandy soil with 1.12 kg trifluralin/ha before planting seeds of *Phaseolus vulgaris* cv. Sutter Pink resulted in an increased size and no. of hypocotyl lesions caused by *Rhizoctonia solani*. The overall appearance of seedlings was also changed by trifluralin (T) treatment. Cortical cells developed isotropically instead of elongating as they did in untreated (N) seedlings; trichomes on T-hypocotyls never fully developed. Phosphate buffer extracts of lesions from both N- and T-hypocotyls showed max. pectolytic activity at pH 4.0 on a pectin substrate. Cross-sectioned discs of N- and T-hypocotyls exposed to these lesion extracts exhibited increased maceration with time. Maceration of N-hypocotyls (measured with spectrophotometric readings of turbidity at 475 nm, light microscopy, and electron microscopy) proved greater than that of T-hypocotyls, even though T-hypocotyls are more susceptible to lesion development. *(Author's summary)* C03 F03

See also 0217 0227

D00 AGRONOMY

0242

17333 ESCALANTE E., L.E. 1982. **Efecto de la densidad de población sobre el rendimiento en grano y sus componentes en dos variedades de fríjol (*Phaseolus vulgaris* L.).** *(Effect of plant density on yield and its components in two bean varieties).* Tesis Ing. Agr. Iguala, Guerrero, México, Instituto Superior Agropecuario del Estado de Guerrero. 81p. Span., Sum. Span., 48 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant habit. Spacing. Yield components. Yields. Dry matter. Stems. Seeds. Pods. Abscission. Leaf area. Developmental stages. Mexico.**

In exptl. fields of the Instituto Superior Agropecuario of the state of Guerrero (Mexico) from Dec. 1980-March 1981, the performance of bean var. Canario 107 (determinate growth habit) and Michoacán 12-A-3 (indeterminate, small vine), cultivated at different plant densities, was studied using yield and yield components as parameters. A split-plot exptl. design was used with 5 replications and 10 treatments that combined the 2 var. and 5 plant densities (17.6, 21.3, 26.6, 35.5, and 53.3 plants/m^2). Var. Canario 107 and Michoacán 12-A-3 were harvested 87 and 101 days after planting, resp. Results indicated that Michoacán 12-A-3 had higher yields/plant and per m^2 than Canario 107; changes in plant density did not affect yield/m^2 for these var. A mechanism of compensation between yield/plant and the no. of plants/m^2 worked in such a way that at lower no. of plants/m^2, yield/plant was higher. Yield and total DM production/plant showed highest values at low plant densities, tending to decrease as density increased. HI, av. NAR, and av. RGR showed a similar trend. Yield components that showed the highest correlations with yield were the no. of filled pods ($r = 0.86$), the no. of normal grains ($r = 0.84$), and the total no. of inflorescences ($r = 0.81$). Total dry wt./plant and HI showed coefficients of correlation with yields of 0.96 and 0.74, resp. *(Author's summary. Trans. by L.M.F.)* D00

0243

15898 PONS, A.L.; BARRETO, B.A.; SECCHI, V.A.; MARTINOTTO, V. 1980. **A cultura do feijoeiro no RS.** *(Bean cultivation in Rio Grande do Sul).* Porto Alegre, Brasil, Departamento Técnico da Federação das Cooperativas Brasileiras de Trigo e Soja. Serie Trigo e Soja. Boletim Técnico no. 48. 31p. Port., 17 Refs., Illus.

Phaseolus vulgaris. **Cultivation. Climatic requirements. Soils. Soil fertility. Soil analysis. Nutritional requirements. Agricultural lime. Diseases and pathogens. Disease control. Injurious insects. Insect control. Stored grain pests. Nutritive value. Brazil.**

The different factors and steps involved in bean cultivation in Rio Grande do Sul, Brazil, are described. Climatic and soil conditions required are given and aspects on soil conservation, fertilization (organic and inorganic), soil amendment, and symbiotic N fixation are described. Recommended cv. that are available, planting times, soil preparation, planting and cultural practices are discussed along with weeds and weed control (mechanical and chemical), pests and their control (*Caliothrips phaseoli, Empoasca kraemeri, Agrotis ipsilon, Elasmopalpus lignosellus, Epinotia aporema, Diabrotica speciosa,* and *Tetranychus* spp.), diseases and their cultural control (especially *Colletotrichum lindemuthianum, Uromyces phaseoli, Isariopsis griseola, Xanthomonas phaseoli, X. phaseoli* f. *fuscans, Pseudomonas phaseolicola*, BCMV, and BGMV), harvest, storage and control of stored grain pests (*Acanthosceli-*

des obtectus). Aspects on crop association and rotation are given. The current situation of production and its perspectives and the major problems of cultivation and their possible solutions are analyzed. Finally, nutritional aspects of beans are discussed. *(Summary by A.J. C. Trans. by L.M.F.)* D00 F00 E00

0244

17355 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. CENTRO NACIONAL DE PESQUISA ARROZ, FEIJÃO. 1981. Recomendações técnicas para o cultivo do feijoeiro. *(Technical recommendations for bean cultivation).* Goiânia, GO. Circular Técnica, no. 13. 43p. Port., 13 Refs., Illus.

Phaseolus vulgaris. **Climatic requirements. Soil requirements. Cultivars. Planting. Nutritional requirements. Bacterioses. Mycoses. Viroses. Disease control. Chemical control. Injurious insects. Insect control. Harvesting. Agricultural equipment. Storage. Brazil.**

Practical and technical recommendations, elaborated by the Centro Nacional de Pesquisa - Arroz, Feijão (CNPAF), Goiânia, GO, Brazil are given for bean growers. Aspects described are : climate, land preparation (plowing, pH correction, and fertility), selection of cv. for the different states in Brazil, seed treatment, planting time in monoculture and in association, weed control and NPK fertilization, *Leucaena leucocephala* as green manure, major pests and diseases and their control, harvesting (by hand, mechanical, hand-mechanical), types of cv. recommended for each state, and storage conditions. *(Summary by C.P.G. Trans. by L.M.F.)* D00 E00 F00

See also 0329 0342

D01 Soil Water, Climate and Fertilization

0245

16712 URBEN FILHO, G.; CARDOSO, A.A.; VIEIRA, C.; FONTES, L.A.N.; THIEBAUT, J.T.L. 1980. **Doses e modos de aplicação do adubo nitrogenado na cultura do feijão (*Phaseolus vulgaris* L.).** *(Rates and methods of application of nitrogen fertilizers on beans).* Revista Ceres 27(151):302-312. Port., Sum. Port., Engl., 15 Refs.

Phaseolus vulgaris. **N. Fertilizers. Timing. Climatic requirements. Cultivation. Yields. Field experiments. Brazil.**

Two expt. with dry beans were carried out during the rainy and dry seasons at Viçosa, state of Minas Gerais (Brazil). Treatments included 5 levels of N (0, 40, 80, 120, and 160 kg/ha), each level applied as followed: (A) the whole level of N fertilizer applied as side dressing, approx. 20 days after bean emergence; (B) the whole level applied in the furrow at planting; (C) 1/3 in the furrow at planting and 2/3 as side dressing 20 days after emergence; and (D) 2/3 in the furrow at planting and 1/3 as side dressing 20 days after emergence. Cv. Ricobaio 1014, an indeterminate, short vine plant type, was utilized. Urea was used as the N source. Both expt. received the following uniform fertilization: 500 kg simple superphosphate and 40 kg potassium chloride/ha. No significant effect of application methods on seed and straw yields was found. During the rainy season, bean and straw yields increased with increasing N levels. During the dry season, N fertilizer also affected the yields, but no significant difference was found among the treatments that received from 40-160 kg N/ha. The highest levels of N, and in particular application method B, can negatively affect the stand. High levels can also cause bean plant lodging. *(Author's summary)* D01

0246

16443 SOBRAL, L.F. 1975. **Fixação de fósforo e adubação do feijoeiro (*Phaseolus vulgaris* L.) em um cambisol do estado de Sergipe.** *(Phosphorus fixation and fertilization in beans on a Cambisol of the state of Sergipe).* Tese Mestrado, Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 45p. Port., Sum. Port., Engl., 50 Refs., Illus.

Phaseolus vulgaris. **Minerals and nutrients. P. Soil fertility. Soil impoverishment. Soils. Fertilizers. Micronutrients. Yields. Experiment design. Brazil.**

P fixation and the effects of N, P, K, S, and a composite mixture of micronutrients (Zn, Cu, B, and Mo) on the production of common bean var. Mulatinho Vagem Roxa were studied. A Cambisol soil, representative of the municipality of Poço Verde, SE (Brazil), was used as substrate. The Waugh and Fitts method was used to determine soil capacity of P fixation and to determine and test the "X" value (the approx. amount of P required to control the effect of P fixation). The effects of NPK on bean yield were studied using a 3^3 factorial, incomplete block design. The expt. was conducted at the same site for 2 subsequent yr. Rates of nutrient application were: 0, 20, and 40 kg urea/ha; 0, 50, and 100 kg triple superphosphate/ha; and 0, 20, and 40 kg potassium chloride/ha. All plots received a uniform application of 60, 4, 4, 1, and 0.2 kg/ha of $CaSO_4$, $ZnSO_4$, $CuSO_4$, borax, and sodium molibdate. A no. of subtreatments were planted with the main field trial to study the effect of S and micronutrients. The same rates indicated above were used. Treatments were:

check, without S, without micronutrients, and NPK + S + micronutrients. These treatments were analyzed in a random block expt. It was concluded that the absolute values of P fixation increased with the rate of added P while the relative fixed values decreased (%). The expt. confirmed the selected "X" value of 100 ppm. Yields of common beans were significantly affected by P application during the 2-yr expt. No significant effects of N, K, S, and the composite mixture of micronutrients on bean yields were observed. *(Author's summary)* D01 C01 K00

0247

17348 SARTORATO, A.; ANTUNES, I.F.; KLUTHCOUSKI, J.; ROCHA, J.A. M.; TEIXEIRA, M.G.; YOKOYAMA, M.; SILVEIRA, P.M. DA; GUAZZELLI, R. J. 1981. **Sistema de produção para cultivo de feijão no inverno.** *(Production system for bean cultivation in winter).* Goiânia-GO, Empresa Brasileira de Pesquisa Agropecuaria. Centro Nacional de Pesquisa de Arroz, Feijão. Circular Técnica, no. 12 21p. Port., Illus.

Phaseolus vulgaris. **Timing. Temperature. Cultivars. Planting. Irrigation. Water requirements. Mycoses. Disease control. Productivity. Costs. Income. Brazil.**

Appropriate regions for *Phaseolus vulgaris* production in winter are outlined and general agronomic factors are considered. These include soil preparation, sowing rate and plant population, fertilizer application, sowing methods and dates, irrigation, control of pests and diseases, and choice of cv. The ratio of production costs of irrigated beans/ha is also given. *(Summary by Field Crop Abstracts)* D01 D03 J00

0248

16793 ARAYA V., R.; VIEIRA, C.; MONTEIRO, A.A.T.; CARDOSO, A.A.; BRUNI, W. 1981. **Adubação nitrogenada da cultura do feijão (*Phaseolus vulgaris* L.) na Zona da Mata de Minas Gerais.** *(Nitrogen fertilization in beans in the Zona da Mata area of Minas Gerais).* Revista Ceres 28(156):134-149. Port., Sum. Port., Engl., 27 Refs., Illus.

Phaseolus vulgaris. **N. Fertilizers. Timing. Soils. Soil analysis. Growth. Seed. Protein content. Methionine. Yields. Field experiments. Statistical analysis. Brazil.**

Three studies on N fertilization of beans were carried out in the Zona da Mata area, MG, Brazil. The 1st expt. was conducted in Viçosa and included 2 trials with the following treatments: no fertilizer; with only simple superphosphate (60 kg P_2O_5/ha), with the same amount of superphosphate + 80 kg N/ha applied entirely in the row at planting time; with the same amount of superphosphate + 40 kg N/ha placed in the row during planting; and 40 kg N/ha as side dressing 15, 22, 29, 36, 43, or 50 days after bean emergence. Urea was used as the source of N. In one trial the best method was the application of half of the N fertilizer at planting and the rest 15, 22, or 29 days after emergence. In the other trial, however, it was found that the parcelling of the N fertilization was not advantageous to the crop. In the 2nd study, expt. were conducted in 6 localities. The treatments were 0, 30, 60, 90, and 120 kg N/ha as urea. Every plot received simple superphosphate at the amount of 60 kg P_2O_5/ha. In Viçosa, Ponte Nova, and Leopoldina bean response to N was linear and positive; in Coimbra the response was quadratic and the estimated max. yield would be reached with 133 kg N/ha, while in Rio Pomba and Raul Soares no response to N fertilization was obtained. The 3rd study was carried out in Viçosa and included a factorial of 4 urea levels (0, 40, 80, and 120 kg N/ha) x 3 bean lines (732521, 732501, and Ricobaio 1014). Every plot received simple superphoshate (60 kg P_2O_5/ha). Bean yield and protein content of the seeds increased as urea levels increased. The correlation coefficient between % of protein and met. (as g/16 g N) in bean seeds was negative (r = -0.78**). The av. response of the 3 lines to the highest level of urea was an increase of the % of protein from 24.2 to 27.5, and a decrease in the amount of met. from 1.20 to 1.07 g/16 g N. *(Author's summary)* D01 C03

0249

14448 SUGE, H. 1980. **Dehydration and drought resistance in *Phaseolus vulgaris* as affected by mechanical stress.** Reports of the Institute for Agricultural Research, Tohoku University 31:1-10. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Drought. Host-plant resistance. Cultivars. Adaptation. Soil water. Water requirements. Leaves. Plant injuries. Epicotyl. Hypocotyls. Plant-growth substances. Evapotranspiration.**

Dehydration and drought resistance as affected by mechanical stress were examined in *Phaseolus vulgaris* var. Taisho-Kintoki, Kentucky Wonder, and Shirotane-Kinugasa under greenhouse conditions at the Institute for Agricultural Research, Tohoku U. (Japan). Water loss by detached leaves was greatly reduced by mechanical stress. The amount of relative transpiration was also reduced, especially after detaching leaves. Growth retardants also reduced water loss by detached leaves. Drought resistance increased in stressed plants. In some var. the effect of water restriction 1st appeared in the cracking of epicotyl region and resulted in the death of the apical meristems. Mechanical stress was found to reduce both the cracking and death of apical meristems. No plants survived when water supply was restricted for 22 days, whereas all the stressed plants survived after rewatering. Morphological changes caused by mechanical stress, in turn, contribute to plant survival as one of their adaptive strategies under severe environmental conditions. *(Author's summary)* D01 G01

0250

16446 MUZILLI, O. 1974. **Desenvolvimento do feijoeiro (*Phaseolus vulgaris* L.) cultivar Goiano Precoce e absorção de nutrientes em função da acidez do solo Latosol Roxo distrófico.** *(Plant growth of bean cultivar Goiano Precoce and nutrient absorption regarding soil acidity in distrophic Latosol Roxo).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 76p. Port., Sum. Port., Engl., 81 Refs., Illus.

Phaseolus vulgaris. **Plant development. Soils. Plant nutrition. Soil analysis. Soil fertility. pH. Agricultural lime. N. P. K. Ca. Mg. Nutrient absorption. Al. Soil amendments. Brazil.**

Bean cv. Goiano Precoce plants were grown in pots until florescence in a greenhouse of the Escola Superior de Agricultura Luiz de Queiroz, U. of São Paulo (Brazil) in order to study the influence of soil acidity of a distrophic Latosol Roxo from w. Paraná on bean growth and N, P, K, Ca, and Mg absorption. Data for studies on the amendment of soil acidity were also supplied. Treatments, besides the control, consisted of partial and total amendment of exchange acidity and increasing soil pH to 6.5, with or without mineral fertilization. The amount of amendment was determined by the incubation method. Two t limestone/ha were applied for each equivalent mg of exchangeable Al^{+3} to completely neutralize the exchange acidity of the soil, or 12 t/ha were applied to increase soil pH to 6.5. Levels of liming and fertilization affected soil acidity and the availability of soil nutrients. Increasing soil pH to 6.5 was shown to be the most suitable way to impreve bean cv. Goiano Precoce development and the capacity to absorb available P, K, Ca, and Mg. The effects of fertilization on nutrient absorption by bean plants verified P, K, and Ca deficiencies in the soil studied. The fact that N absorption was not favored by fertilization may be explained by the high OM content in the soil or by a possible symbiotic fixation of the nutrient by the plants. P and/or K fertilizers negatively affected Mg absorption by bean plants. *(Author's summary)* D01 C01

0251

17353 FAGERIA, N.K.; KLUTHCOUSKI, J. 1980. **Metodología para avaliação das cultivares de arroz e feijão, para condições adversas de solo.** *(Methodology for evaluating rice and bean cultivars under adverse soil conditions).* Goiânia-GO, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa-Arroz e Feijão. Circular Técnica, no. 8. 22p. Port., Sum. Port., Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Nutritional requirements. Soil fertility. Soil impoverishment. Nutrient absorption. pH. Al. Salinity. Mineral deficiencies. Host-plant resistance. Selection.**

Nutrient deficiency and toxicity are some of the main obstacles to obtain high yield of rice and beans. These mineral stresses can be alleviated by selecting and breeding rice and bean cv. suited to the different adverse soil conditions. Therefore, reliable, rapid, and convenient screening methods are necessary. Detailed screening methodology for N, P, K, Ca, Mg, and Zn deficiency and Al, Fe, and salinity toxicities are discussed. *(Author's summary)* D01 C01

0252

14032 DELAZARI, P.C. 1981. **Rendimento econômico de três cultivares de feijão (*Phaseolus vulgaris* L.) em função da aplicação de nitrogênio e fósforo.** *(Economic yield of three bean cultivars as a function of nitrogen and phosphorus application).* Revista Brasileira de Ciência do Solo 5(1):46-50. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. N. P. Productivity. Yields. Prices. Income. Cultivars. Brazil.**

In order to determine the levels of N and P allowing max. economic efficiency of bean cv. Cornell 49-242, Manteigão Fosco 11, and Ricobaio 1014, a field expt. was carried out on a Distrophic Red Yellow Latosol in the municipality of Domingos Martins, ES (Brazil) using 4 levels of N (0, 50, 100, and 150 kg/ha) and 4 levels of P (0, 100, 200, and 300 kg/ha). The application of N and P had a significant effect on cv. yields, with the highest increase for cv. Cornell 49-242 (mainly as a result of the addition of P). The most economical amounts of N and its resp. profits were determined only for cv. Ricobaio 1014. The 3 cv. showed slight variation in the max. economic efficiency with the different doses of P_2O_5. Profitwise, cv. Cornell 49-242 was the best, followed by Ricobaio 1014 and Manteigão Fosco 11. *(Author's summary)* D01 J00

0253

16989 DIAZ D., A.; CASTILLO L., J.J. 1981?. **Aplicación de riego al fríjol de acuerdo con las diferentes fases de desarrollo.** *(Irrigating beans according to different growth stages).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 16p. Span., Illus.

Phaseolus vulgaris. **Cultivation. Water requirements. Irrigation. Developmental stages. Yields. Experiment design. Colombia.**

The effect of irrigating by gravitation on yields of bean var. ICA-Palmar, applied during different growth stages, was studied. A randomized block design was used with 7 replications and 7 treatments in an area of 1.5 ha with furrows at 0.60 m (240,000 plants/ha). The system of irrigating by gravitation using gated pipes was utilized. Agronomic practices were done for pest and disease control. Rainfall during the crop cycle modified the treatment. Treatments II, V, and VI used a water depth of 262, 275, and 287 mm and yielded 1874, 1872, and 1831 kg/ha, resp. Treatments I and III used 239 and 231 mm and produced 1652 and 1520 kg/ha, resp. The control only yielded 689 kg/ha and received only 175 mm with irrigation at germination and rainfall during the crop cycle. It was concluded that: (1) Five waterings supplying an usable water depth of 270 mm (an applied water depth of approx. 350 mm) gave the highest bean yield. (2) Irrigation at germination up to a depth of 30 cm allows the crop to develop until 20 days after planting. (3) During flowering (28-30 days) and fructification (48-50 days) soil moisture tension should not be higher than 35 centibars. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0254

15859 SILVEIRA, P.M. DA; STONE, L.F.; AJIMURA, G.M.; OLIVEIRA, F.T. DE. 1978. **Projeto de irrigação por sulcos na cultura do feijão.** *(Project of furrow irrigation in bean crops).* Goiânia-GO, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa-Arroz, Feijão. Comunicado Técnico no. 2. 22p. Port., 4 Refs., Illus.

Phaseolus vulgaris. **Irrigation. Water requirements. Soil water. Agricultural equipment. Brazil.**

A project of furrow irrigation in a 15-ha area planted to beans on the Fazenda Capivara, exptl. area of the Centro Nacional de Pesquisa - Arroz, Feijão (Brazil), during the dry season (June-Sept.) is presented. Information on soils, climate, and available resources is included. Calculation of the required parameters were given including potential and actual evapotranspiration, available water, infiltration and curve of advancing, and the calculation of basic parameters: water depth, application time, no. of changes, frequency, irrigated area, area irrigated/day, area irrigated/change, area of application, no. of furrows/change, applied water flow/furrow, vol./furrow, water vol. of canal, water vol. of pipe system, size of the motorpump, pressure head, motorpump potential, size of irrigation canal and water tap. The materials required are indicated. *(Summary by A.J.C. Trans. by L.M.F.)* D01

See also *0221* *0232* *0263* *0356* *0361* *0363* *0367* *0372* *0374*

D02 Cultivation Practices: Planting, Weed Control and Harvesting

0255

17319 KAHN, B.A.; STOFFELLA, P.J.; SANDSTED, R.F.; HYMES, W.L. 1981. **Effects of between-row spacing, cultivation, and genotype on growth and yield of black beans.** Journal of the American Society for Horticultural Science 106(6): 719-723. Engl., Sum. Engl., 18 Refs.

Phaseolus vulgaris. **Cultivars. Spacing. Cultivation. Developmental stages. Timing. Yields. Experiment design.**

Two lines of black bean, 70001 and Strain 39, were grown at between-row spacings of 76, 61, and 46 cm. Cultivation treatments included an uncultivated check and a single cultivation at 1 of 3 plant growth stages: 1st trifoliolate leaf fully expanded, anthesis, or pod elongation. Root and shoot wt., and shoot: root ratio of individual plants decreased linearly as between-row spacing decreased. Biological yield increased linearly as between-row spacing decreased, but seed yield and HI did not show significant responses to spacing. None of the measured parameters gave a significant response when the uncultivated control was compared with the av. of the 3 treatments. Root wt. of individual plants and biological yield gave quadratic responses within the 3 treatments, both decreasing most markedly with cultivation at the pod elongation stage. Plants of line 70001 were larger and lodged less compared to those of Strain 39. Seed yields of both lines were similar. Results suggest that a single shallow cultivation may be used for black beans grown in narrow rows through anthesis. Although cultivation at the pod elongation stage was generally not detrimental to seed yield, it is not recommended. *(Author's summary)* D02 K00

0256

16724 KOGAN A., M. 1981. **Competencias de malezas y su control en frejol y otras leguminosas de grano.** *(Weed competition and their control in beans and other grain legumes). In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. pp.58-95. Span., 10 Refs., Illus.

Phaseolus vulgaris. **Weeds. Weeding. Photosynthesis. Light. Plant development. Composition. Cultivars. Yields. Herbicides. Chile.**

The concepts of competition and critical period of competition between legume crops and weeds (regarding the factors light and water) are reviewed and the results are given of a study on bean cv. Seaway and Red Kidney (growth habit I) and Tórtola (growth habit II) in competition with weeds *Datura stramonium, Convulvulus arvensis, Solanum nigra, Chenopodium album, Brassica campestris, Amaranthus deflexus,* and *Portulaca oleracea.* Tables are included on: production and variation of DM/plant in the leaves and stem, leaf area (dm^2/plant), LAI, and yields of the 3 bean cv. weeded or unweeded. After 50 days under competitive conditions, Tórtola was the less affected, the LAI of Red Kidney and Seaway were almost always higher than that of Tórtola, which could represent an advantageous photosynthetic efficiency/surface unit. Yields (kg/ha) of weeded and unweeded treatments, resp. for the 3 cv. were: Red Kidney (1410 and 3481), Seaway (2364 and 4284), and Tórtola (449 and 3327). A list of chemical products and their rates for controlling weeds in different legume crops is also included. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0257

16733 COSTA, J.G.C. DA 1981. **Efecto de la densidad de población en la morfología, asignación de la materia seca y de la energía, y eficiencia en la producción de semilla, en el fríjol (*Phaseolus vulgaris* L.).** *(Effect of plant density on the morphology, distribution of dry matter and energy, and efficiency of seed production in beans).* Tesis Ph.D. Chapingo, México, Escuela Nacional de Agricultura. Colegio de Postgraduados. 221p. Span., Sum. Span., 54 Refs., Illus.

Phaseolus vulgaris **Cultivars. Plant habit. Spacing. Yield components. Yields. Plant anatomy Seed production. Dry matter. Leaf area. Food energy. Research. Mexico.**

At exptl. fields of the U. Autónoma de Chapingo, Mexico, bean var. with different growth habits were used to (1) study the influence of plant density on the changes in morphology and yield parameters and the distribution of DM and the radiant energy fraction absorbed by the canopy and (2) determine indexes and relationships in order to evaluate bean plant efficiency regarding yields. Var. used were: Canario 107 (determinate, type I); Michoacán 12-A-3 (indeterminate, type II); Negro 150 and Flor de Mayo X-16441 (indeterminate, type III). Results indicated that: (1) type III var. had greater plasticity in comparison with types I and II; (2) the var. showed differences in the distribution of wt. (%) in aerial organs; (3) the laminae (senescent) and petiole had lower energy values than branches, pericarp, and seeds; (4) there was a difference in the % distribution among aerial organs when expressed as dry wt. or energy; (5) modified HI (including laminae and petiole) could be a better parameter to estimate plant efficiency when assigning canopy dry wt. to seeds; (6) the energy index (EI) could be useful to express plant efficiency in using net energy absorbed during seed production. *(Summary by C.P.G. Trans. by L.M.E.)* D02

0258

16452 DI UBER, R. 1976. **Influência do EPTC na absorção e no teor de macronutrientes na cultura do feijão (*Phaseolus vulgaris* L. var. Carioca).** *(Influence of EPTC on macronutrient absorption and content in bean var. Carioca crops).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz, da Universidade de São Paulo. 107p. Port., Sum. Engl., Port., 112 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Nutrient absorption. N. P. K. Ca. Mg. Protein content. Mineral content. Seeds. Leaves. Plant physiological processes. Brazil.**

Research was conducted to determine the effect of EPTC on the absorption of macronutrients at the beginning of the flowering stage, the macronutrient concn. in seeds and pods, and protein concn. in seeds ready for harvest. Two field expt. were conducted at the Centro Exptl. de Campinas, of the Instituto Agronómico do Estado de São Paulo, Brazil, with beans cv. Carioca. The 1st expt. was planted in Nov. 1973, on a clay Latosol roxo, and the 2nd, in Oct. 1974, on a dark-red orto loam Latosol. EPTC was applied preplanting, incorporated at rates of 0, 1, 2, 4, 8, and 16 kg/ha in both expt. The effect of the herbicide on crop growth was evaluated by the fresh and dry wt. of leaves, stems, and pods at different intervals during the crop cycle and by the grain and seed production at harvest. In both expt. N, P, K, Ca, Mg, and S concn. were analyzed in leaves and stems at the beginning of flowering. The concn. of these same nutrients were determined in seeds and pods at harvest. The protein content of seeds was based on N concn. Rates of 1, 2, or 4 kg EPTC/ha did not affect crop growth, the absorption or concn. of macronutrients in leaves or stems at the beginning of flower setting nor did it affect the stand, seed production, or macronutrient concn. in pods at harvest. The rates of 8 and 16 kg EPTC/ha reduced plant growth, nutrient absorption, stand, and seed production, but the nutrient concn. was enhanced in leaves, stems, and pods. With these rates K content in pods was significantly higher due to a more intense absorption. The applied rates of EPTC in both expt. did not change macronutrient concn. in seeds at harvest. Therefore, no change in protein content was found in seeds. *(Author's summary)* D02 C00

0259

16725 LUGO-LOPEZ, M.A.; BADILLO-FELICIANO, J.; SCOTT, T.W. 1977. **Performance of red kidney and native white beans at three planting distances on an Oxisol in northwestern Puerto Rico.** Nouvelles Agronomiques des Antilles et de la Guyane 3(3/4):558-563. Engl., Sum, Engl., Span., 6 Refs.

Phaseolus vulgaris. **Cultivars. Planting. Spacing. Soils. Yields. Field experiments. Puerto Rico.**

The effect of planting distance on yields and yield components of 2 field bean var., 27R, a red kidney bean imported from Trinidad, and Bonita, a selected native white bean, was evaluated in a Coto clay, Tropeptic Haplorthox at the Isabela Substation. Planting distances included 30, 45, and 60 cm between rows. Mean yield differences between var. and between planting distances were not significant. However, an av. yield of approx. 2200 kg/ha was obtained, considered satisfactory under the prevailing conditions. Plant and pod wt. did not differ between var. but with the 60 cm distance between rows, they were heavier than at 30 cm and 45 cm. Var. Bonita produced more pods than 27R; the lowest no. occurring at 30 cm. Var. Bonita produced an av. of 5.5 seeds/pod; var. 27R, only 3.8. Both var. appeared to be resistant to insects and disease in the Isabela area. *Author's summary* D02

0260

14115 MANGUAL C., G. 1981. **Effect of two planting systems on density and yield of snap beans (*Phaseolus vulgaris* L.).** Journal of Agriculture of the University of Puerto Rico 65(4):313-316. Engl., Sum. Engl., Span., 5 Refs.

Phaseolus vulgaris. **Planting. Spacing. Yields. Field experiments. Puerto Rico.**

The double row planting system was compared with the single row planting system, currently used in Puerto Rico, in a trial conducted with snap bean commercial var. Blue Lake 47 at the Isabela Agricultural Expt. Substation. A Latin square design was used with 7 treatments and 7 replications. Planting in double rows increased plant stand in all treatments, registering a 48% increment over the conventional single row planting. Optimum planting distance in the double row system was 0.30 m between double rows and 0.60 m between pairs of double rows. With this system, yields of 6464 kg/ha are obtained in a simulated once-over harvest. *Author's summary* D02

0261

14560 CROWLEY, J.; PRENDEVILLE, G.N. 1980. **Effects of herbicides of different modes of action on leaf-cell membrane permeability in *Phaseolus vulgaris*.** Canadian Journal of Plant Science 60(2):613-620. Engl., Sum. Engl., Fr., 39 Refs.

Phaseolus vulgaris. **Herbicides. Plant injuries. Leaves. Cell walls. Plant tissues. Symptomatology. Laboratory experiments.**

Leakage of electrolytes from leaf discs of treated *Phaseolus vulgaris* plants was used to study the effects of several herbicides of different modes of action on leaf-cell membrane permeability. Linuron, prometryne, bromacil, sodium azide, and dalapon increased leaf-cell permeability at 24 h after treatment and this occurred without appearance of leaf necrosis. Glyphosate increased leaf-cell permeability at 96 h and this was always associated with visible injury, including wilting. Paraquat at 10^{-5} M increased leaf-cell permeability 48 h after treatment, without apparent leaf damage, but at higher concn. increased permeability was always associated with visible effects. Chlorpropham, picloram, and 2,4-D did not alter cell permeability even though epinastic symptoms in leaves became evident 24 h after treatment with picloram and 2,4-D. *Author's summary* D02 C00

0262

16407 PEÑA G., M.A. 1979. **16 alternativas de producción de fríjol (*Phaseolus vulgaris*) en ciclo tardío, en el Ejido colectivo Rinconada, Municipio de Villa de García, N.L.** *(Sixteen alternatives to bean production during the second cycle at the communal farm of Rinconada, municipality of Villa de García, N.L.).* Tesis

Ing. Agr. Monterrey, N.L. México, Universidad Autónoma de Nuevo León. Facultad de Agronomía. 60p. Span., Sum. Span., 20 Refs., Illus.

Phaseolus vulgaris. **Cultivation. Planting. Cultivars. Fertilizers. N. P. Production. Pest control. Disease control. Yields. Experiment design. Statistical analysis. Mexico.**

A study was carried out to determine the best alternative to production in beans and recommend high-yielding var., adequate plant density, and optimum levels of N and P fertilization. A randomized block design was used with plots of 4 rows, 7 m long and 80 cm wide (total area = 22.4 m^2). During harvest, only the central rows were harvested and 1 m at the headlands was eliminated. Useful plot area consisted of 2 rows, 5 m long (8 m^2). Variables studied were bean yield useful plot, straw yield/useful plot, no. of plants harvested/useful plot, no. of pods/10 plants, and total no. of beans/10 plants. Var. Ciateño gave the highest av. yield (1318.75 kg/ha) followed by var. Delicias 71 (1185 kg/ha). Best plant density was 146,000 plants/ha. *(Author's summary. Trans. by I.M.E.)* D02

0263

16454 AGUILERA A., M.R. 1981. **Epocas de siembra en el cultivo del frejol** *Phaseolus vulgaris* **(L.).** *(Planting time in bean cultivation).* Tesis Ing. Agr. Santa Cruz de la Sierra, Bolivia, Universidad Boliviana Gabriel René Moreno. Facultad de Ciencias Agrícolas. 52p. Span., Sum. Span., 38 Refs., Illus.

Phaseolus vulgaris. **Planting. Harvesting. Timing. Cultivars. Climatic requirements. Agronomic characters. Seed characters. Maturation. Experiment design. Statistical analysis. Bolivia.**

An expt. was conducted during 1979-80 in Bolivia using a split-plot exptl. design with 7 treatments (planting times), 4 replications, and 2 bean var. = ICA Tui (black beans) and Ex-Rico 23 (white beans) = in an area located at 11°42'11" south lat. and 63°08'52" west longitude, with an av. temp. of 24.6 °C and annual rainfall of 1141 mm. Planting took place between Nov. 15-Feb. 13 at 15 day intervals. Phenological and agronomic characteristics of both var. and pest and disease incidence were evaluated. Summer plantings are not recommended due to the intense rainfall and the incidence of fungal diseases. Time elapsed between planting and florescence was 32-40 days for ICA-Tui and 32-39 days for Ex-Rico 23. ICA-Tui and Ex-Rico 23 reached physiological maturity between 60-73 and 60-69 days, resp. The total cycle fluctuated between 74-110 days and 71-111 days for ICA-Tui and Ex-Rico 23, resp. Yields were 1.58-3.54 and 1.08-1.96 t/ha for ICA-Tui and Ex-Rico 23, resp. Highest pest incidence was observed during the hot dry season, *Empoasca* and *Diabrotica* sp. being major pests. Major pathogens during the hot rainy season were *Mustia hilachosa* and *Alternaria* sp., causing the complete loss of the last 3 plantings. It was observed that var. ICA-Tui has not been improved and is tolerant to intense rainfall and diseases, while Ex-Rico 23 is very susceptible. *(Author's summary. Trans. by I.M.E.)* D02 D01

0264

16914 BARRETO P.D. 1982. **Plantio em leirões, densidade e arranjo populacional no rendimento do feijoeiro.** *(Effect of planting on ridges and plant arrangement and density on bean yield).* Pesquisa Agropecuária Brasileira 17(1):93-98. Port., Sum. Port., Engl., 5 Refs., Illus.

Phaseolus vulgaris. **Planting. Spacing. Yields. Experiment design. Statistical analysis. Field experiments. Brazil.**

Research was carried out in Araruna, Arara y Lagoa Seca, PB, Brazil, in order to study the following aspects of the *Phaseolus vulgaris* crop: planting system (on ridges and on the flat), plant spacing, and plants/hill. The treatments were combined in a 2 x 4 x 3 factorial expt. in a randomised complete block design with 4 replications. Data on final stand, grain production (kg/ha), av. no. of pods/plant, av. no. of seeds/pod, and wt. of 100 seeds were collected. The "ridge planting system" outyielded the conventional "flat planting system"

in 200 kg/ha and appeared to have a more stable production over the different plant populations tested. The best treatment combination was the ridge planting with 3 plants/hill spaced 20 cm, with a production of 1164 kg/ha. At this spacing, the flat system also gave the highest yield (1045 kg/ha). *(Author's summary)* D02 K00

See also 0335

CIAT ABSTRACTS ON CASSAVA

- World literature on *Manihot esculenta* Crantz
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- Also in Spanish

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

D03 Cultivation Systems: Intercropping, Rotation Crops

0265

17341 HEDGE, D.M. 1981. **Intercropping in medicinal yam with short-duration cowpea, clusterbean and kidney-bean.** Indian Journal of Agricultural Sciences 51 (4):262-265. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris, Vigna unguiculata, Dioscorea floribunda, Cyamopsis tetragonoloba. **Intercropping. Yields. India.**

A 2-yr study at the Indian Institute of Horticultural Research, Bangalore (India), indicated that on irrigated lands it is feasible to intercrop medicinal yam (*Dioscorea floribunda*) with short-duration cowpea, clusterbean (*Cyamopsis tetragonoloba*), and kidney bean without affecting the tuber yield of medicinal yam. An additional return of Rs 1500-2500/ha was obtained due to intercropping. All the legume intercrop combinations responded to N fertilization, and intercropping with kidney bean and cowpea reduced the N requirement of medicinal yam by 30-95 kg/ha. *(Author's summary)* D03

0266

16746 EMPRESA DE ASSISTÊNCIA TÉCNICA E EXTENSÃO RURAL DO ESTADO DE ALAGOAS. 1981. **Sistemas de produção para os consórcios feijão-milho e feijão-milho-algodão.** *(Production systems of bean/maize and bean/maize/cotton in association).* Maceió, Brasil. Serie Sistemas de Produção. Boletim no. 285. 29p. Port., Illus.

Phaseolus vulgaris. **Cultivation systems. Intercropping.** *Zea mays.* **Fertilizers. Planting. Harvesting. Storage. Brazil.**

Technical recommendations for bean/maize and bean/maize/cotton intercropping systems are given for the area of the state of Alagoas (Brazil) presenting a high production of these crops and irregular climatic conditions. The systems suggested cover 11 municipalities and include selection of area, soil sampling and analysis, land preparation, soil preparation and conservation, fertilization, planting, cultural practices, harvesting and threshing, and product storage and conservation. Technical coefficients and a list of pesticides are included. *(Summary by I.B. Trans. by I.M.E.)* D03

0267

16916 RIHENEN, H.A. VAN; HASSELBACH, O.E.; MUIGAI, S.G.S. 1981. **The effect of growing beans together with maize on the incidence of bean diseases and pests.** Netherlands Journal of Plant Pathology 87:193-199. Engl., Sum. Engl., Dutch, 16 Refs.

Phaseolus vulgaris, Zea mays. **Intercropping.** *Pseudomonas phaseolicola, Colletotrichum lindemuthianum, Xanthomonas phaseoli, Elsinoe phaseoli, Phoma exigua* **var.** *diversispora, Erysiphe polygoni, Whetzelinia sclerotiorum, Isariopsis griseola, Uromyces appendiculatus, Heliothis armigera, Systates pollinosus, Aphis fabae.* **Disease control. Kenya.**

Compared with monocultures, beans grown in association with maize generally showed less incidence of the following diseases and pests in Kenya: halo blight *(Pseudomonas phaseoli-*

cola), bean common mosaic, anthracnose *(Colletotrichum lindemuthianum)*, commom blight *(Xanthomonas phaseoli)*, scab *(Elsinoe phaseoli)*, black node disease *(Phoma exigua* var. *diversispora)*, mildew *(Erysiphe polygoni)*, bolworm *(Heliothis armigera)* and to a lesser extent, angular leaf spot *(Phaeoisariopsis griseola)*. For white mold *(Sclerotinia sclerotiorum)* and the black beetle *Systates* the opposite was observed. Rust *(Uromyces appendiculatus* var. *appendiculatis)* and aphids *(Aphis fabae)* were erratic in this respect. Apparently a kind of cultural control of the major bean diseases in Kenya is effected by growing beans in association with maize. *(Author's summary)* D03 F00 F00

0268

16938 SERPA, J.F.S.; FONTES, L.A.N.; GALVÃO, J.D.; CONDE, A.R. 1981. **Comportamento do milho e do feijão em cultivos exclusivos, consorciados e em faixas alternadas.** *(Performance of maize and beans in monoculture, in association, and in alternating strips).* Revista Ceres 28(157):236-252. Port., Sum. Port., Engl., 13 Refs.

Phaseolus vulgaris, Zea mays. **Intercropping. Timing. Spacing. Yields. Productivity. Brazil.**

A field expt. was conducted in Viçosa, MG (Brazil) during 1976-77 in order to evaluate the performance of maize and dry beans in monoculture, intercropped in the same row, and in alternating strips. Treatments were established with 2 population levels of maize (20,000 and 40,000 plants/ha) and 2 of dry beans (120,000 and 200,000 plants/ha). The systems and no. of trials were: maize in monoculture (2); dry beans in monoculture in both wet and dry seasons (2), or in the dry season only (2); maize/dry bean intercropping in both wet and dry seasons (4), or in the dry season only (4); 2 rows of maize alternated with 4 rows of dry beans (4); and 4 rows of maize alternated with 4 rows of dry beans (4). Maize yields were not reduced when maize was planted in association with dry beans. The larger population of maize reduced dry bean yields in the wet season intercropping system. Maize population had no effect on dry bean production in the dry season intercropping or the dry season alternating strip crops. The alternating strip crop of 2 rows of maize and 4 rows of dry beans was equivalent to the dry season maize/dry bean intercrop and was superior to the wet and dry season maize/dry bean intercrop. The land use efficiency increased in the intercropping and alternating strip systems, demonstrating their potential for food production. The alternating strip cropping systems gave better land use efficiency when compared with maize in monoculture or maize/dry bean intercropping systems of equivalent areas. *(Author's summary)* D03

0269

12453 LAZARTE S., W.H. 1980. **Ensayo de asociación de yuca (*Manihot esculenta* Crantz) con fríjol (*Phaseolus vulgaris*).** *(Cassava/bean intercropping trial).* Tesis Ing. Agr. Lima, Perú, Universidad Nacional Agraria La Molina. 59p. Span., 15 Refs., Illus.

Phaseolus vulgaris. **Cassava. Intercropping. Planting. Timing. Plant development. Yields. Productivity. Income. Field experiments. Peru.**

An expt. was conducted at the Campo Agrícola Exptl. of the U. Nacional Agraria La Molina (Peru) on sandy loam soils from recent alluvial sediments (Entisols) with neutral pH, low OM content, and deficient in total N to: (1) determine the feasibility of bean/cassava intercropping and (2) determine the most adequate time to intercrop. Cassava cv. Negra Mochera and Caraota beans were used in a randomized complete block design with 9 treatments and 4 replications: F_1 (beans in monoculture - check), Y_1 (cassava in monoculture - check); F_1 Y_1 (planted at the same time); F_{30} Y_1 (beans planted 30 days after cassava planting); F_{45} Y_1 (beans planted 45 days after cassava planting); F_{60} Y_1 (beans planted 60 days after cassava planting); F_1 Y_{30} (cassava planted 30 days after bean planting); F_1 Y_{45} (cassava planted 45 days after bean planting); F_1 Y_{60} (cassava planted 60 days after bean planting). Planting date affected both cassava and bean production. The shade produced by bean plants affected cassava growth during the initial stages. Root wt. did not var. due to planting or intercropping date. The F_1 Y_{60} treatment gave greater land use efficiency, productivity, and total

profit/ha; there was a difference of 8844 kg as compared with beans and cassava in monoculture. The highest economic returns/ha/mo. were obtained with treatment $F_{45}Y_1$. *(Summary by I.B. Trans. by I.M.F.)* D03

0270

17391 GUAMAN J., R.W. 1981. **Rendimiento físico y económico de fríjol (*Phaseolus vulgaris* L.) y maíz (*Zea mays* L.) sembrados solos y en asociación.** *(Yield and net income of beans and maize in monoculture and in association).* Tesis Mag. Sc. Chapingo, México, Colegio de Postgraduados. 122p. Span., Sum. Span., 55 Refs.

Phaseolus vulgaris, Zea mays. **Intercropping. Yields. Productivity. Cultivars. Developmental stages. Agronomic characters. Income. Mexico.**

The efficiency of land use, regarding the total yield and net income (NI) produced by 9 exptl. maize/bean associations and the effect of intercropping on certain agronomic characteristics were determined. Three bean var., Canario 107, Negro 150, and Michoacan 150, and 3 maize var., Zacatecas 58 SM9, H.28, and Mexico 208, were planted in monoculture or in association, with or without fertilization, on April 22, 1980 at the Campo Exptl. Chapingo of the U. Autónoma Chapingo, Mexico. Harvesting took place when both crops reached physiological maturity. In the bean var. used, the duration of flowering and physiological maturity were reduced during intercropping. The no. of pods/plant had a low relative heritability and was modified by the effect of intercropping, mainly with maize var. H.28 and Mexico 208. The no. of seeds/pod had a high relative heritability. The no. of seeds/plant were drastically modified by the effect of intercropping and fertilizer application. The wt. of 100 seeds showed a relatively high degree of heritability, indicating the absence of consistent effects of intercropping and fertilizer application. Data indicate that yield is modified in varying degrees by intercropping and fertilizer application. The 3 maize var. in monoculture and in association responded to the application of fertilizer. Intercropping with or without fertilizer produced higher incomes than monocrops. The best associations regarding NI were: Mexico 208-Negro 150, Mexico 208-Michoacan 150, H.28-Negro 150, and Zacatecas 58-Negro 150. Only the intercrops Zacatecas 58-Negro 150, Mexico 208-Negro 150, H.28-Negro 150, and Mexico 208-Michoacan 150 showed LER and income equivalent ratio values higher than 1. *(Extracted from author's summary. Trans. by I.M.F.)* D03 J00

0271

16097 SERPA, J.L.S.; BARRETO, A.C. 1981. **Avaliação de populações de plantas de milho e de arranjos espaciais no consorcio com o feijão (*Phaseolus vulgaris* L.).** *(Evaluation of maize plant populations and spatial arrangements in association with beans).* Araçaju-SE, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Comunicado Técnico no. 5. 7p. Port.

Phaseolus vulgaris, Zea mays. **Intercropping. Spacing. Productivity. Prices. Costs. Brazil.**

The effect of several plant populations of maize var. Centralmex in different spatial arrangements in association with bean var. IPA 74/19 on maize productivity in the municipalities of Poço Verde and Porto da Folha, Brazil was analyzed. The design included 2 spatial arrangements with 3 treatments each: **Arrangement 1:3** (1 row of maize and 3 of beans) - a. 4 maize plants/m for densities of 20,000 and 150,000 maize and beans plants/ha, resp.; b. 5 maize plants/m with 25,000 and 150,000 plants/ha; and c. 6 maize plants/m with 30,000 and 130,000 plants/ha. **Arrangement 1:4** (1 row of maize and 4 of beans) - a. 4 maize plants/m with 16,000 and 160,000 plants/ha; b. 5 maize plants/m with 20,000 and 160,000 plants/ha; and c. 6 maize plants/m with 24,000 and 160,000 plants/ha and 2 checks (50,000 and 200,000 maize and bean plants/ha, resp. in monoculture). Treatments received basal fertilization of N and P. Both crops gave higher yields in Poço Verde, since rainfall was less and soil texture less appropriate for nutrient retention in Porto da Folha. Bean productivity in the 1:3 spatial arrangement was higher with the lowest maize density; this did not occur with the 1:4 arrangement, possibly due to the greater competition of maize in the 1:3 arrangement. Bean yield obtained in the 1:4 arrangement were 10% higher than that obtained in the 1:3 arrangement due to increased bean population. Beans in monoculture were

superior in association, except in Porto da Folha, possibly due to the fact that BGMV attacks are greater in monoculture than in association. When comparing gross profitability and the land use efficiency index, the superiority of intercropping compared with monoculture was observed, especially in Porto da Folha. It was concluded that both in the 1:3 and 1:4 arrangements, maize population in association with beans should be equal to that of monoculture (5 plants/m). *(Summary by A.J.C. Trans. by L.M.F.)* D03

0272

14151 GARDINER, T.R.; CRAKER, L.E. 1981. **Bean growth and light interception in a bean-maize intercrop.** Field Crops Research 4:313-320. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris, Zea mays. **Intercropping. Leaves. Leaf area. Canopy. Light. Growth. Podding. Yields. USA.**

Bean cv. Soldier and maize cv. Wis 335A were planted in an expt. conducted at the U. of Massachusetts Exptl. Farm in South Deerfield (USA) to monitor light interception, canopy light relations, leaf area development, and growth of bush beans under both monocrop and intercrop conditions. Bean-maize intercrop plantings increased light interception and decreased light reflection as compared with bean monocrop plantings. However, the quantity of light available to the bean canopy is decreased as the maize population is increased. Growth and yield of bean plants were reduced on the intercrop as compared with bean monocrop. Reductions in LAI, growth rate, and NAR of beans were found under high maize populations as compared with bean monocrop. *(Author's summary)* D03

See also 0247

D04 Seed Production

0273

16453 STERLING R., F. 1981. **Estudio sobre la calidad de semilla y otros factores limitantes de la producción de fríjol (*Phaseolus vulgaris* L.) en el cantón de Pérez Zeledón.** *(Study on seed quality and other limiting production factors in bean crops in the Pérez Zeledón canton).* Tesis Ing. Agr. San José, Universidad de Costa Rica. Facultad de Agronomía. 60p. Span., Sum. Span., 38 Refs.

Phaseolus vulgaris. **Cultivation systems. Seed quality. Seed production. Germination. Yield components. Yields. Storage. Diseases and pathogens. Pests. Costa Rica.**

In 1979 a survey was conducted in the Pérez Zeledón canton (Costa Rica) using a stratified sampling method in order to determine the prevailing cropping systems in the area, bean crop management practices, and the quality of the seed used. The 'tapado' system is used by 43.50% of the producers with 18-28 kg seed/ha (seed from commercial grain the farmer has kept from the previous harvest). No fertilizers are used and pests and diseases are not controlled. Cultivated land is on slopes and weed-infested; yields vary between 180-300 kg/ha with an av. of 290 kg/ha. Beans are planted in monoculture in 45.20% of the area; 3.3% of these farmers protect their crops with fungicides and insecticides, and fertilizers are applied. However, there is a high incidence of diseases caused by *Tanatephorus cucumeris* and *Isariopsis griseola;* yields vary between 400-900 kg/ha with an av. of 584.17 kg/l. . Maize/beans in association were found in 11.30% of the cultivated area, yields oscillating between 400-825 kg/ha with an av. of 469 kg/ha. Analysis of the representative samples of seed used in the area gave the following av. values: MC, 17.79% (± 2.26); pureness, 90.63% (± 12.0); germination, 77.50% (± 11.10). Farmers' seed gave an emergence between 66.5-73.75%; an av. no. of pods/plant between 4.30-5.22; an av. no. of beans/pod between 4.89-5.59; and the wt. of 100 seeds between 15.72-17.26 g. Total production/plot was between 146-232 g/m². The seed produced at the Estación Exptl. Agrícola Fabio Baudrit was of superior quality compared with the farmers'. *(Author's summary. Trans. by L.M.F.)* D04

0274

16404 ABRAHAO, J.T.M. 1971. **Contribuição ao estudo de efeitos de danificações mecânicas em sementes de feijoeiro (*Phaseolus vulgaris* L.).** *(Contribution to the study on the effects of mechanical damage on bean seed).* Tese Doutorado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 112p. Port., Sum. Port., Engl., 42 Refs.

Phaseolus vulgaris. **Seeds. Cultivars. Seed. Mechanical damage. Germination. Plant injuries. Statistical analysis. Brazil.**

Two expt. were carried out in the Seed Lab. of the Agriculture and Horticulture Department of the Escola Superior de Agricultura Luiz de Queiroz, Piracicaba (Brazil) in order to observe the effect of mechanical injury on germination and vigor of bean seed under different storage conditions. The 1st expt., established in 1968, used a factorial design with 5 observation intervals regarding the germination and vigor of var. Goiano Precoce and Rosinha Brilhante. Seeds were dropped 1, 2, or 3 times and subjected to intervals with 2 levels of RH (approx. 30 and 85%). The 2nd expt. in 1969 also used a factorial design with observations made at 6 different intervals regarding germination and vigor

of var. Goiano Precoce, Rosinha Brilhante, and Roxinho. Seeds were dropped 0, 1, 2, or 3 times and subjected to intervals with 3 levels of RH (approx. 35, 65, and 85%). It was concluded that the intensity of the damage imposed on the seeds caused enough variation to be analyzed statistically; the effects of mechanical damage on germination and vigor depended on the var. and for each var., damage depended on the no. of impacts; immediate effects were observed on the germination and vigor of the 3 var. and the level of RH also affected these characteristics. In general, the duration of the intervals did not alter germination. *(Author's summary)* D04

0275

16495 MARCOS FILHO, J. 1971. **Efeitos de radiações gama do ^{60}Co na conservação da semente e na produtividade do feijoeiro** *(Phaseolus vulgaris* L.). *(Effects of ^{60}Co gamma radiation on seed conservation and on bean productivity).* Tese Eng. Agr. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 91p. Port., Sum. Port., Engl., 64 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. **Seeds. Irradiation. Seed. Germination. Plant injuries. Storage. Deterioration. Productivity. Statistical analysis. Brazil.**

Seeds of the field bean var. Goiano Precoce were subjected to various radiation doses (^{60}Co) in a series of expt. in order to study different aspects of seed behavior. Radiation doses, comprising 6 treatments, varied from 0.0-6.4 krad of γ radiation. Their effect on seed germination and seedling dry wt. was studied in a factorial expt. conducted under controlled lab. conditions at the Escola Superior de Agricultura Luiz de Queiroz, SP (Brazil). Observations were made on plants from irradiated seeds during 9 time intervals. Seed vigor was determined by the rate of seedling emergence when planted in small field plots during 6 intervals by using a factorial design. The effect of seed irradiation on yield was evaluated in 2 randomized block design field expt. Infestation by the bean weevil *(Acanthoscelides obtectus)* was observed in irradiated seeds stored under normal conditions after seed vigor tests were conducted. This indicated a relationship between radiation dose and insect damage. This effect was analyzed during 14 time intervals according to a factorial scheme. It was concluded that seed germination was adversely affected by all radiation doses. This effect, however, decreased significantly with storage time. Seed vigor was higher for those treated with 0.4, 0.8, and 1.6 krad compared with nonirradiated seeds. Pod and seed wt. decreased with doses of 1.6 and 6.4 krad and infestation by the bean weevil was significantly controlled by all radiation treatments. The 0.4, 0.8, and 3.2 krad doses were the most favorable treatments regarding the effects of radiation on bean seed behavior and conservation, yield, and the control of bean weevil infestation. *(Author's summary)* D04

0276

17326 KORBAN, S.S.; COYNE, D.P.; WEHING, J.L. 1981. **Rate of water uptake and sites of water entry in seeds of different cultivars of dry bean.** HortScience 16(4):545-546. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Seed characters. Water requirements. Germination. Plant assimilation. Seeds. Cotyledon cracking. Water content. Cultivars.**

The rate of water uptake of seeds of *Phaseolus vulgaris* differed between cv.; Pinto UI 111 had the highest and Bulgarian White the lowest water uptake in 24 h. Water entered through the micropyle in cv. Great Northern but through the raphe and hilum in Pinto UI 111. Little or no water uptake occurred through the seed coat. Other cv. tested were Great Northern Emerson, Great Northern 1140, Great Northern D-88, and Great Northern UI 59. *(Summary by Seed Abstracts)* D04 C00

0277

17352 VIEIRA, R.F.; SARTORATO, A. 1980. **Recomendações técnicas para produção de sementes de feijão (*Phaseolus vulgaris* L.) de alta qualidade.** *(Technical recommendations for the production of high quality bean seed).* Goiânia-GO, Em-

presa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa-Arroz e Feijão. Circular Técnica, no. 10. 20p. Port., 17 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. Pseudomonas phaseolicola. Colletotrichum lindemuthianum. Isariopsis griseola. **Bean common mosaic virus. Disease transmission. Seed transmission. Disease control. Seed production. Climatic requirements. Harvesting. Storage. Brazil.**

The etiology, symptomatology, manner of dissemination, and survival of the causal agent of major seed-borne diseases of beans in Brazil are described: common bacterial blight (*Xanthomonas phaseoli*), halo blight (*Pseudomonas phaseolicola*), anthracnose (*Colletotrichum lindemuthianum*), angular leaf spot (*Isariopsis griseola*), and BCMV. Technical recommendations aimed at obtaining disease-free seeds are indicated, such as: seed origin, land selection, soil preparation, crop rotation, planting, irrigation, weed control, field inspections, phytosanitary treatments for seeds and plants, harvesting, seed drying and cleaning, storage, and germination trials. Sites for seed production should have an annual rainfall < 300 mm, daily RH < 60%, daily temp. between 25-35°C, and facility to irrigate by gravitation. Major recommendations include: (1) the use of cv. recommended for the region, produced in appropriate localities, which have not been planted to beans at least during the previous 2 yr, isolated from other bean crops, and with a flat topography, (2) sowing during the dry season at low plant density; (3) the elimination of diseased plants from the crop; (4) harvesting after the crop has reached physiological maturity; (5) removal of abnormal seeds; and (6) application of insecticides and fungicides to seeds. *(Summary by C.P.G. Trans. by L.M. F.)* D04 E00

0278

16708 AESCHLIMANN A., J. 1981. **Producción y comercialización de semillas de leguminosas secas en Chile.** *(Dry legume seed production and commercialization in Chile). In* Seminario de Leguminosas de Grano, 2o., Santiago, Chile, 1981. Trabajos. Santiago. pp.141-148. Span.

Phaseolus vulgaris. **Seeds. Cultivars. Seed production. Trade. Chile.**

The demand, production, and commercialization of certified seed of beans, lentils, chickpeas, and peas in Chile are analyzed. It is indicated that certified bean seed production is only done for a few var., especially due to the low demand. For the periods 1977-78, 1978-79, 1979-80, 1980-81, and 1981-82 the availability of certified bean seed compared with the total demand of bean seed in Chile only reached 4.4, 5.0, 1.9, 1.4, and 2.3%, resp. Certified seed consumption will not increase even though adequate purity and germination are guaranteed, and a reasonable price is maintained, until var. with characteristics superior to those of traditional materials used by farmers exist. *(Summary by A.J.C. Trans. by L.M. F.)* D04

0279

16445 KRZYZANOWSKI, F.C. 1974. **A técnica de envelhecimento precoce na avaliação do vigor de lotes de sementes de feijoeiro (*Phaseolus vulgaris* L.).** *(An accelerated aging technique for evaluating vigor in bean seed lots).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo. 104p. Port., Sum. Port., Engl., 101 Refs.

Phaseolus vulgaris. **Seeds. Seed characters. Seed vigor. Analysis. Storage. Germination. Seed production. Brazil.**

A study was conducted at the Agriculture and Horticulture Department of the Escola Superior de Agricultura Luiz de Queiroz, SP (Brazil) to evaluate the applicability of accelerated aging as a vigor test for bean seeds. A literature review showed the necessity of an efficient vigor test for the control program of seed quality. The accelerated aging test was demonstrated to be the best study method for evaluating the level of deterioration in bean seeds. It was concluded that this method when applied at 42°C and 100% RH for 72 h to bean seed

lots stored without temp. and moisture control was efficient in showing differences in vigor among the seed lots. When seed lots were stored under controlled temp. and moisture conditions, accelerated aging at 42°C and 100% RH should be kept for 96 h in order to demonstrate differences in vigor among the seed lots. The results obtained with this technique gave a general idea on the av. performance of bean seed lots under field conditions. *(Author's summary)* D04

See also 0215 0365

D05 Varietal Trials

0280

16492 HERNANDEZ V., C. 1981. **Evaluación y selección de genotipos de fríjol (*Phaseolus vulgaris* L.) bajo condiciones de temporal en el norte de Gto.** *(Evaluation and selection of bean genotypes under rainfed conditions in northern Guanajuato).* Tesis Ing. Agr. Chapingo, Mexico, Universidad Autónoma Chapingo. 107p. Span., Sum. Span., 25 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Adaptation. Selection. Yields. Yield components. Planting. Weeding. Harvesting. Field experiments. Statistical analysis. Mexico.**

A series of expt. were established on fields of the Campo Agrícola Exptl. del Norte de Guanajuato (Mexico) and in other localities of the region during 1975-78 in order to adapt, evaluate, and select common bean genotypes with high yield potential. The performance of the exptl. and commercial material was studied in comparison with regional var. under rainfed conditions and using the farmers' technology. Advanced bean lines type Canario, Negro Opaco, and improved var. were used. Checks were Bayomex, Canario 101 and 107, Jamapa, Villa Guerrero, and native var. in a simple 5 x 5 lattice design with 4 replications in random distribution for Canario and Negro Opaco types; a random block design was used with improved var. Trials were planted with no fertilizer in adequately prepared land and at the beginning of the rainy season (June-July) in slightly moist soil. Plant density was approx. 90,000 plants/ha (40 kg seed). Differences in leaf development and the degree of pest and disease incidence were established. The date of 50% flowering, plant height, pest and disease attack, pod setting, date of maturity, length and no. of seeds/pod, and seed wt./useful plot area were registered. Variance analysis for yield was estimated in all trials, per yr and per locality. Combined analysis was used in trials with improved var., confirming the hypothesis of being the highest yielders. Duncan's Test was applied to all the expt. to determine the best treatments. Disease-resistant, high-yielding lines and var. with good adaptation were: Canario type, II-386-Mr-Mr-20-M; II-R-10-70-1-2-3X-1-V-39-1; II-R-6-M-M-M-15-M; Negro Opaco type, II-748-M-M-1-2; II-748-M-M-1-3; CC-III-54-1-CC; commercial var., Canario 101 and 107; Bayomex; Canario Guanajuato 43, and Negro Querétaro-78. *(Author's summary. Trans. by L.M.F.)* D05 K00

0281

16456 ROMAN, A.; DAVIS, J.; GARCIA, S.; GRAHAM, P.; TEMPLE, S. 1979. **Informe de trabajos 1979; programa de fríjol.** *(Research report 1979; bean program).* La Selva, Antioquia, Convenio ICA/ CIAT. 52p. Span., Sum. Span., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Rotational crops. Germplasm. Selection. Plant habit. Seed. Seed characters. Cultivars. Yields. Nitrogen fixation.** *Rhizobium phaseoli. Colletotrichum lindemuthianum.* **Host-plant resistance. Colombia.**

Different assays on climbing beans in relay cropping or associated with maize, N fixation and *Rhizobium* inoculation, and bush beans in monoculture are reported. These were conducted in La Selva, Antioquia (Colombia), through a collaborative project between the Instituto Colombiano Agropecuario (ICA) and CIAT. A total of 56 materials were selected from 723 from Spain, Portugal, Peru, Ecuador, and Colombia for productivity and disease-re-

sistance, especially to anthracnose (*Colletotrichum lindemuthianum*). In a previous study, 9 large-grained var. were selected (> 40 g/100 seeds) with higher yields in relay cropping (> 1937 kg/ha) than Cargamanto, and among these, var. E 1056 (No. CIAT G 12488) is specially recommended for Colombia. Best planting densities for maize and beans in association are 30-40,000 maize plants/ha and 20-40,000 bean plants/ha pocket drilled in a 90-100 cm x 90-100 cm square planting. In trials with advanced lines up to F_4 and F_6, 12 were selected from an original lot of 32,680 plants yielding > 1631 kg/ha, the majority with black- or brown-colored seed. Four red-seeded var. (V 7916, V 7918, V 79115, and V 79116) were selected for productivity, early maturation, and resistance to major diseases. In trials of N fixation 3 strains of *Rhizobium*, that allowed yields similar to those obtained when treated with N fertilizer, were identified. The soil application of PCNB reduced root rot and the toxicity of *Rhizobium* by the fungicide decreased when the inoculum was applied in granules below the seed. *(Extracted from author's summary. Trans. by I.M.F.)* D05 G00 I01

0282

16922 POMPEU, A.S. 1980. **Produtividade de linhagens de feijoeiro** *(Phaseolus vulgaris)* **dos grupos Rosinha e Roxinho resistentes ao fungo da antracnose** *(Colletotrichum lindemuthianum)*. [*Productivity of bean lines belonging to Rosinha and Roxinho groups, resistant to the anthracnose fungus (Colletotrichum lindemuthianum)*]. Bragantia 39:89-97. Port., Sum. Port., Engl., 5 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Germplasm. Host-plant resistance. Cultivars. Yields. Productivity. Experiment design. Field experiments. Brazil.**

During the rainy seasons of 1977 and 1978, 16 trials were carried out at the Centro Exptl. de Campinas, SP (Brazil) to determine the yield capacity of dry bean lines belonging to the Rosinha and Roxinho groups, resistant to anthracnose *(Colletotrichum lindemuthianum)*. A randomized complete block design was used with Rosinha G and Roxo-Minas as controls. None of the Rosinha lines outyielded Rosinha G although av. yields of approx. 1830 kg/ha were obtained by some of them in the absence of the pathogen. Eight lines of the Roxinho group (av. yields between 1490-2027 kg/ha) were superior to those observed for the control Roxo-Minas (yields between 880-1367 kg/ha), in the absence of *C. lindemuthianum*. The interaction line x year was not significant; however, the effect of the year was significant. The best lines will be included in regional trials and the seeds of several lines will be increased for release to farmers in the region. *(Author's summary)* D05 E03 G01

0283

17390 PESSANHA, G.G.; VIEIRA, C.; SILVA, C.C. DA; CARDOSO, A.A.; SILVA, J.C.; SEDIYAMA, C.S. 1981. **Adaptabilidade e estabilidade de comportamento de variedades e misturas de variedades de feijão na Zona da Mata de Minas Gerais.** *(Adaptability and stability of the performance of bean varieties and varietal mixtures in the Zona da Mata area, state of Minas Gerais)* Pesquisa Agropecuária Brasileira 16(5):683-691. Port., Sum. Port., Engl., 26 Refs.

Phaseolus vulgaris. **Cultivars. Adaptation. Yields. Field experiments. Statistical analysis. Brazil.**

Bean var. Ricopardo 896, Ricobaio 1014, Costa Rica 1031, Manteigão Fosco 11, Manteigão 977, Jalo, and 2 mixtures of these var., Ricopardo 896 + Ricobaio 1014 + Costa Rica 1031 and Manteigão Fosco 11 + Manteigão 977 + Jalo, which consisted of equal proportions of each component, were studied. These were tested in 8 environments in the Zona da Mata area, MG, Brazil. No significant difference in yield was found among the mixtures and their components, but it appears that mixing var. can have some yield advantage. Ricopardo 896 and Costa Rica 1031 were the most responsive var. to environmental improvement; Ricobaio 1014 and Manteigão 977 were the least responsive. The mixtures and the other var. remained at an intermediate position. Ricobaio 1014 was the only treatment that showed stability of performance in the various environments. Moreover, it was generally the

dominant component in the mixture, while other dominant var. were Manteigão 977 or Jalo. The same study, replicated in 8 simulated environments (4 levels of fertilization x 2 planting seasons) at Viçosa, MG, gave results that were somewhat different. *(Author's summary)* D05 G01

See also *0207* *0208* *0287* *0303* *0345* *0349*

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

E00 PLANT PATHOLOGY

See also 0243 0267 0277

E02 Bacterioses

0284

16751 ALVAREZ C., F.; VANEGAS G., G.; VICTORIA K., J.I. 1979. **Transmisión por semilla de bacterias fitopatógenas del fríjol (*Phaseolus vulgaris* L.) en Colombia.** *(Seed transmission of bacterial phytopathogens in beans in Colombia).* Acta Agronómica 29(1/4):11-20. Span., Sum. Span., Engl., 11 Refs.

Phaseolus vulgaris, Xanthomonas ph. scoli. **Seeds. Cultivars. Disease transmission. Seed transmission. Statistical analysis. Laboratory experiments. Colombia.**

Three different methods were used to determine the % of bean seed infection by *Xanthomonas phaseoli.* Evaluations were made on 21 samples with an av. seed infection of 19.9, 5.4, and 24.4% as determined by visual analysis of abnormal symptoms on seed coats, the most probable number technique (MPN), and induction of symptoms on bean seedlings, resp. Results obtained with visual analysis presented a highly significant correlation coefficient (0.82) with symptoms produced by *X. phaseoli* on bean seedlings. However, the results obtained by the MPN technique showed a high variation coefficient and low correlation coefficient with the other 2 methods. Best results were obtained by sowing bean seed samples on sterile sandy soil and later incubating 8 day-old seedlings under 100% RH at 26°C for 48 h. *(Author's summary)* 1 02

0285

15853 NAKAMURA, K.; KIMATI, H. 1967. **Crestamento foseo do feijoeiro no Estado de São Paulo.** *(Fuscous blight in beans in the state of São Paulo).* Revista da Sociedade Brasileira de Fitopatología 1(1):40-48. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris, Xanthomonas phaseoli **var.** *fuscans, Phaseolus acutifolius.* **Host range. Analysis. Identification. Host-plant resistance. Cultivars. Brazil.**

In Jan. 1965, during a survey of bacterial blights in Cravinhos, state of São Paulo, a bacterium, not yet reported in Brazil, was found in bean crops. The morphological and physiological characteristics of the bacterium were studied and 17 bean var. and 12 different plant species were inoculated. The organism was identified as *Xanthomonas phaseoli* var. *fuscans.* It was concluded that besides *Phaseolus vulgaris,* only *P. coccineus* was considered as a host of this bacterium. All bean var. were susceptible with little variation in the degree of susceptibility. *(Author's summary)* 1 02

0286

17306 RUDOLPH, K., RASCHE, I. 1981. **Purification of the chlorosis inducing toxin from *Pseudomonas phaseolicola* (Burkh.) Dowson.** Phytopathologische Zeitschrift 101:298-313. Engl., Sum. Engl., Al., 23 Refs., Illus.

Phaseolus vulgaris, Pseudomonas phaseolicola. **Toxins. Isolation. Analysis. Biochemistry. Laboratory experiments.**

Several methods to purify the chlorosis inducing toxin from *Pseudomonas phaseolicola* were

compared in order to find possible explanations for the conflicting results on toxin structure from different lab. The toxin was completely adsorbed by charcoal (pH 10.0), but not by diatomaceous earth or bentonite, from the raw culture filtrate, and it could be eluted from charcoal with 7.5% NH_3 in 70% ethanol. The procedure of charcoal adsorption and elution could be speeded up by using a charcoal column. The toxin could not be extracted with organic solvents from water; dissolving it in 90% methanol resulted in some loss of activity and it also passed a dialysis membrane and a filter. Good separation of the toxin from other constituents in the culture filtrate was obtained by mol. sieve chromatography on Sephadex G-15, followed by Bio-Gel P6 and controlled-pore glass. On both latter columns a fast moving toxin peak and a slower moving peak with a much higher toxin activity could be detected. Considerable loss of toxin activity occurred on the anion exchange resin Dowex 2 x 8 and some losses were observed on CM-cellulose, although this cation exchanger allowed a good separation from other constituents with water as eluant. Less toxin inactivation occurred on DEAE-cellulose (elution with 0.01 N Tris, pH 7.5) and QAE-Sephadex (elution with 0.1-0.15 M $(NH_4)HCO_3$). Several adsorbents and solvent systems were compared for T.L.C. Least toxin inactivation occurred on cellulose plates in basic solvents. Purification through columns with cellulose or Sephadex LH-20 was not satisfactory, and on silica gel columns the toxin was partially inactivated. Applying the best suited purification procedures resulted in only one pure compound, indicating the existence of only one major toxin. (*Author's summary*) 102

0287

16905 VICTORIA, J.I., BASTIDAS, G., AGUDELO, O. 1981. **Resistance to bacterial common blight** *Xanthomonas campestris* **pv.** *phaseoli* **in beans.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.476-481. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris *Xanthomonas phaseoli*, *Uromyces phaseoli* **var.** *typica*. **Bean common mosaic virus. Host-plant resistance. Cultivars. Germplasm. Plant breeding. Field experiments. Colombia.**

In 1969 several bean var. were evaluated for their level of resistance to artificial inoculation of *Xanthomonas campestris* pv. *phaseoli*, BCMV, and *Uromyces phaseoli* var. *typica*, main diseases of dry beans in the Valle del Cauca (Colombia). Sources of resistance were selected and included in a bean breeding program of commercial var. Diacol Calima, Diacol Nima, ICA Guali, ICA Duva, ICA Tui, and ICA Huasanó. In 1974 several progenies were evaluated for agronomic characteristics and level of resistance to bacterial common blight, BCMV, bean rust, and some other constraints of beans. Since 1977, selected lines have been included in yield expt. in comparison with commercial var. in different sites of the Valle del Cauca, and Caribbean countries. Finally a line (ICA L-23) has been selected and will soon be released as a new commercial var. The level of resistance of L-23 has recently been increased by crossing to Jules var. and backcrossing to the original line. (*Author's summary*) 102 G01 D05

0288

16909 ALANADOR, L. 1981. **Specificity of Elisa to** *Xanthomonas campestris* **pv.** *phaseoli* **identification.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.113-121. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris *Xanthomonas phaseoli*. **Identification. Analysis. Biochemistry. Antisera. Colombia.**

Rabbit antisera were produced against glycoprotein bacterial extracts and whole cell of *Xanthomonas campestris* pv. *phaseoli* isolate xp-5-51 and *Xanthomonas* spp., *Pseudomonas* spp., and *X. campestris* pv. *phaseoli* isolates from different sites were determined by Ouchterlony double diffusion (ODD) test and indirect ELISA method (IEM). Better

antiserum specificity was obtained with HM and glycoprotein as antigens than with ODD and whole cells as antigens. Sensitivity for the former combination was estimated in 5 x 10^5 cells/ml of antigen and 20 ng/ml of antiserum as min. for good reaction. *(Author's summary)* 1:02

0289

16904 PASTOR C., M.A.; BEBBE, S.E.; CORREA, F.J. 1981. **Comparing 2 inoculation techniques for evaluating resistance in beans to *Xanthomonas campestris* pv. *phaseoli*.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.493-503. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris *Xanthomonas phaseoli*. **Inoculation methods. Host-plant resistance. Cultivars. Timing. Temperature. Growth-chamber experiments. Field experiments. Colombia.**

Two inoculation techniques were compared for efficacy in screening resistance to common bacterial blight (CBB) caused by *Xanthomonas campestris* pv. *phaseoli* (Xp). Bean cv. Jules, BAT 93, ICA L24, BAT 47, BAT 76, and Porrillo Sintetico, with known reactions to the blight in Colombia were inoculated in the field and in the greenhouse with Colombian isolate Xp-123. A razor blade procedure and a modification of it using surgical blades were compared. In all cases plants were inoculated in the 1st trifoliate 31 days after planting and evaluated 8 and 12 days after inoculation. In the field and greenhouse, the ranking of the cv. based on their CBB reactions was the same with both inoculation techniques. However, the surgical blade was less effective in eliciting the expected CBB reaction from cv. ranked as intermediate. The uniformity of CBB reaction was greater with the surgical blade procedure. It was also easier to use and faster. Both procedures are excellent methods for the evaluation of CBB resistance in beans in the field and both allow the simultaneous evaluations of other characters such as adaptation, architecture, and resistance to other diseases. *(Author's summary)* 1:02

0290

16471 CAFATI K., C. 1971. **Reação de variedades de feijoeiro a *Xanthomonas phaseoli* (E. F. Sm.) Dows. e *Xanthomonas phaseoli* var. *fuscans* (Burk) Starr & Burk.** *(Reaction of bean varieties to Xanthomonas phaseoli and Xanthomonas phaseoli var. fuscans).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 59p. Port., Sum. Port., Engl., 46 Refs., Illus.

Phaseolus vulgaris. *Xanthomonas phaseoli*. *Xanthomonas phaseoli* var. *fuscans*. **Host-plant resistance. Germplasm. Plant introductions. Cultivars. Inoculation. Isolates. Statistical analysis. Brazil.**

The behavior of commercial bean var. and introduced germplasm with resistance to different isolates of *Xanthomonas phaseoli* and *X. phaseoli* var. *fuscans* was studied at the Escola Superior de Agricultura Luiz de Queiroz, U. of São Paulo (Brazil) between June 1970-July 1971. Tests of var. resistance were conducted under controlled greenhouse conditions. The same inoculum preparation and the method of inoculation were used in all the assays. The appearance of the 1st symptoms of disease development was noted. Plants were rated for disease reaction 40 days after inoculation. On the basis of the results and observations it was concluded that tepary bean (*Phaseolus acutifolius* var. *latifolius*) was resistant to the isolates of *X. phaseoli* and to the *X. phaseoli* var. *fuscans* isolate. Great Northern Nebraska no. 1 selection 27 was highly tolerant to the same isolates and could be used as a source of resistance for obtaining national var. resistant to the bacteria. Var. Rosinha-4005, Pintado, Prêto G-1, Jalo, Mulatinho, Bico de Ouro, Roxinho, Tenderlong, Plentiful, and Pinto 72 were highly susceptible to both diseases. Idaho 1, Opaquinho, Chumbinho 3000, Arroz, Rico 23, and Goiano Precoce showed a lower degree of susceptibility. Isolate X-2 of *X. phaseoli* (Chile) was less aggresive than isolates X-1 and X-3 (Brazil) and X-4 of *X. phaseoli* var. *fuscans* (Brazil). No changes in pathogenicity were detected in *X. phaseoli* even after 3 successive inoculations of the highly tolerant host. *(Author's summary)* 1:02 G01

0291

16908 KINYUA, G.K.; MUKUNYA, D.M.; BREUKELEN, F.M.VAN 1981. **Studies on genetic resistance of beans to *Pseudomonas phaseolicola* in Kenya.** *In* Lozano, J.C.,ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.352-357. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris, Pseudomonas phaseolicola. **Host plant resistance. Isolates. Races. Leaves. Symptomatology. Chlorosis. Cultivars. Genes. Plant breeding. Kenya.**

Halo blight of beans caused by *Pseudomonas phaseolicola* is one of the most important diseases of beans in Kenya. It is widely distributed, resulting in very low yields from early infected beans. Thirty isolates of *P. phaseolicola* were obtained from 12 bean-growing districts. Seven belonged to Race 1 while 23 belonged to Race 2. The predominating Race 2 caused severe drooping of primary leaves in Red Mexican UI 3 seedlings. Two lines, GLP 16 and GLP x92 resistant to Race 2, were crossed with susceptible lines and their F_2 progeny analyzed for resistance of susceptibility reactions. Resistant bean seedlings reacted mainly with necrotic spots and partial chlorosis to *P. phaseolicola* Race 2. Large water-soaked lesions and entire chlorosis constituted the major symptoms on leaves of susceptible seedlings. Resistance to *P. phaseolicola* Race 2 in GLP 16 and GLP x92 was found to be governed by one recessive gene. A ratio of 1 (resistant) to 3 (susceptible) was obtained in the F_2 seedlings. *(Author's summary)* 102

0292

16911 BURUCHARA, R.A., PASTOR C., M.A. 1981. **Variation, virulence of *Pseudomonas syringae* pv. *phaseolicola* on beans in Colombia.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.341-351. Engl., Sum. Engl., 32 Refs., Illus.

Phaseolus vulgaris, Pseudomonas syringae. **Races. Isolates. Virulence. Inoculation. Pods. Leaves. Symptomatology. Statistical analysis. Colombia.**

Thirty isolates of *Pseudomonas syringae* pv. *phaseolicola* from Colombia were separated into race 1 and 2 on the basis of their pathogenicity for *Phaseolus vulgaris* cv. Red Mexican UI-3. Race determination was based on both leaf and pod reaction. Standard isolates of race 1 and 2 were used for comparison. Twenty Pasto isolates were classified as race 2, whereas 7 isolates from Popayan, 1 from Palmira, and 2 from Tenerife were identified as race 1. The isolates were also classified in their order of virulence, by the ϕ of watersoaking lesions caused on pods during a period of 5 days on cv. Seminole, G.N. Nebraska no. 1 Sel. 27, and Wisc HBR 72 upon inoculation using a needle. The most virulent isolates were from Pasto. Cv. Wisc HBR 72 (with high foliar resistance) had a susceptible pod reaction (mean lesion ϕ 3.1 mm, dispersion 0.5-5.3 mm) comparable to the susceptible cv. Seminole (mean lesion ϕ 2.8 mm, dispersion 0.5-4.8 mm). G.N. Nebraska no. 1 Sel. 27 had a mean lesion ϕ of 1.8 mm and a dispersion between 0.4-2.8 mm. The order of the isolates in virulence was similar in all 3 cv. and gave a correlation coefficient of 0.87 between the 3 cv. *(Author's summary)* 102

0293

16910 OGUCHI, F., GANTOTTI, B.V.; HO, G.K.H.; PATIL, S. 1981. *Phaseolus vulgaris - Pseudomonas syringae* **pv. *phaseolicola* system: role of host tissue age and pathogenic toxin in establishment of pathogen in host.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th. Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp. 288-294. Engl., Sum. Engl., 20 Refs.

Phaseolus vulgaris, Pseudomonas syringae. **Races. Toxins. Analysis. Symptomatology. Inoculation. Plant age. Plant tissues. Leaves. Cultivars. Host-plant resistance. Laboratory experiments.**

Pseudomonas syringae pv. *phaseolicola*, the causal agent of bean halo blight, produces an extracellular nonspecific toxin in culture and in inoculated plants. Both toxigenic and nontoxigenic strains of the pathogen multiply in inoculated tissues of young plants of susceptible cv. and induce watersoaking, but only toxigenic strains induce systemic chlorosis and stunting, indicating that the toxin is a virulence factor and is not required for pathogenicity of the bacterium in such tissues. However, in previous studies the toxin has been shown to specifically suppress hypersensitive resistance to *P. syringae* pv. *phaseolicola* in genetically resistant bean cv., suggesting a role for the toxin in the pathogenicity of the bacterium. Additional data support the role of the toxin in pathogenic establishment. Tissues of a susceptible cv. Red Kidney (RK), which are susceptible to certain of both toxigenic and nontoxigenic strains of pv. *phaseolicola* gradually become resistant to them as they mature and eventually react to the pathogen in a manner similar to that of tissues of a resistant cv., GN Nebraska no. 27. In mature tissues, bacterial proliferation is severely restricted, and instead of watersoaking, a hypersensitive response is produced. Further, as in the reaction of genetically resistant tissues, toxin content of inoculated mature tissues is drastically reduced as compared to young tissues of the same susceptible cv. Thus the manifestations of the resistance reaction of mature susceptible tissues are similar to those of tissues of genetically resistant cv. It is proposed that the reason why nontoxigenic strains of pv. *phaseolicola* grow in young RK tissues is that the specific resistance of RK to the pathogen is not expressed in such tissues, and bacteria grow passively. When toxigenic strains are used to inoculate young RK tissues, the toxin produced during the passive growth prevents subsequent expression of resistance as the tissues mature. A model to explain the role of the toxin in pathogenic establishment in the host is presented. *(Author's summary)* E02

0294

16907 SZABO, L.J.; VOLPE, J.; MILLS, D. 1981. **Identification of F'-like plasmids of *Pseudomonas syringae* pv. *phaseolicola*.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp. 403-411. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Pseudomonas syringae. **Races. Nucleic acid. Chromosomes. Identification. Analysis. Biochemistry. Electron microscopy. Colombia.**

The phytopathogenic bacterium *Pseudomonas syringae* pv. *phaseolicola* strain LR700 harbors a single indigenous 98 x 10^6 dalton (Mdal) cryptic plasmid, pMC7105. A "plasmidless" derivative of this strain, LR719, has been shown to have pMC7105 integrated into the bacterial chromosome. Preliminary results indicated that pMC7105 could be partially excised from the chromosome of LR719 when 3 colonies bearing excision plasmids of 35, 50, and 58 Mdal were detected. EcoRI and BamHI fingerprint analyses confirm that these plasmids are essentially comprised of a subset of fragments from pMC7105. More recently, 11 additional colonies have been isolated from LR719 which harbor a single excision plasmid. These plasmids vary in size from approx. 20-180 Mdal. A BamHI restriction analysis of a 145 Mdal excision plasmid, pLX8050, revealed that it contains essentially all of pMC7105 and an additional 47 Mdal of DNA which is chromosomal in origin. The episomal nature of pMC7105 may be exploited in developing a genetic system for phytopathogenic pseudomonads analogous to the Hfr system of *Escherichia coli*. *(Author's summary)* E02

0295

16906 QUANT, R.; MILLS, D. 1981. **DNA homologies among plasmids of *Pseudomonas syringae* pv. *phaseolicola*.** *In* Lozano, J.C., ed. International Conference on Plant Pathogenic Bacteria, 5th., Cali, Colombia, 1981. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.412-419. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. Pseudomonas syringae. **Races. Identification. Analysis. Biochemistry. Electron microscopy. Nucleic acid.**

Pseudomonas syringae pv. *phaseolicola* is the bacterial agent responsible for halo blight on beans. Five strains of *P. syringae* pv. *phaseolicola*, isolated from regions of the USA as Idaho and New York, were analyzed for plasmid no., size, and relatedness. EcoRI and BamHI restriction digests of total plasmid DNA suggest that a large degree of homology exists among these plasmids. Strain PP612 harbors 2 plasmids which are 1.4 and 96 megadaltons in size. Restriction analysis of total plasmid DNA revealed that 36 of 39 EcoRI bands and 16 of 22 BamHI bands were in common with those of a single 97 megadalton plasmid present in strain PP622. The EcoRI fingerprints indicate that the plasmids of these 2 strains have at least 90% sequence homology. Two other strains, designated PP601 and PP631, contain in addition to a 73 megadalton plasmid, a 29 and a 27 megadalton plasmid, resp. EcoRI digests indicate that there is at least 93% sequence homology between total plasmid DNA of these strains. Strain PP652 contains 2 plasmids that are 70 and 33 megadaltons in size. EcoRI fingerprints indicate that PP652 has at least 62% sequence homology with PP601 and 58% sequence homology with PP631. Thirty-four % sequence homology is seen in EcoRI digests among all 5 strains. Solution hybridization has also confirmed a high level of sequence homology among these plasmids. *(Author's summary)* E02

0296

15891 SCHUSTER, M.L.; COYNE, D.P. 1981. **Biology, epidemiology, genetics and breeding for resistance to bacterial pathogens of *Phaseolus vulgaris* L.** Horticultural Reviews 3:28-58. Engl., 25 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. Pseudomonas phaseolicola. Corynebacterium flaccumfaciens. **Soil populations. Seeds. Epiphytology. Plant injuries. Host-plant resistance. Germplasm. Genetics.**

A literature review is given on the biology and epidemiology of important bacterial pathogens of beans, emphasizing *Xanthomonas phaseoli, Pseudomonas phaseolicola,* and *Corynebacterium flaccumfaciens* regarding their variability, inoculation methods and evaluation of disease reactions, bacterial populations, and survival mechanisms (seeds, plant residues, plant organs that sustain an epiphytic bacterial flora, soil, and other nonhost materials). The nature of resistance, sources of tolerant germplasm, and genetics and breeding of the 3 bacterial pathogens are discussed. Breeding methods used and bacterial disease-resistant cv. are also given. Genetic vulnerability of available resistant bean var. is discussed. *(Summary by A.J.C. Trans. by L.M.F.)* E02 G01

E03 Mycoses

0297

14638 SATISCHANDRA, K.M.; HIREMATH, R.V.; HEGDE, R.K. 1979. **Effect of organic amendments and fungicides on the saprophytic activity of *Rhizoctonia bataticola* causing root rot of beans.** Indian Phytopathology 32(4):543-546. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris, Macrophomina phaseolina. **Rots. Disease control. Chemical control. Soil amendments. Soil populations.**

Wheat straw and rice hull reduced the saprophytic activity of *Rhizoctonia bataticola* (*Macrophomina phaseolina*), causing root rot in *Phaseolus vulgaris*, in the soil but FYM and green grass had little effect. Quintozene and captan very effectively reduced saprophytic activity but carbendazim and mancozeb were ineffective. *(Author's summary)* E03

0298

14903 MENTEN, J.O.M.; GIACOMELLI, W.J.; TULMANN NETO, A.; ANDO, A. 1979. **Ocorrência de *Ashbya gossypii* (Ashbya & Nowell) Guilliermond causando manchas de levedura em sementes de feijão (*Phaseolus vulgaris* L.) no Estado de São Paulo.** *(Occurrence of Ashbya gossypii causing yeast spot in bean seeds in the state of São Paulo).* Summa Phytopathologica 5(3/4):173-177. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris, Nematospora coryli, Ashbya gossypii. **Isolates. Symptomatology. Seeds. Brazil.**

In a seed sample of bean cv. Rosinha G-2 with 38% infection by yeast spot, *Nematospora coryli* and *Ashbya gossypii* were found, the latter less often and occasionally associated with the former. The 2 species differed morphologically and culturally but on inoculating seeds no differences were seen in the symptoms. Pathogenicity of *A. gossypii* was confirmed by reisolation. *(Summary by Review of Plant Pathology)* E03

0299

16023 KENNING, L.A.; HANCHEY, P. 1980. **Ultrastructure of lesion formation in *Rhizoctonia*-infected bean hypocotyls.** Phytopathology 70(10):998-1004. Engl., Sum. Engl., 40 Refs., Illus.

Phaseolus vulgaris, Rhizoctonia solani. **Hypocotyls. Inoculation. Cell structure. Cell walls. Plant tissues. Plant injuries. Electron microscopy.**

Hypocotyls of *Phaseolus vulgaris* cv. Red Kidney were inoculated with *Rhizoctonia solani*, a fungus known to produce endopolygalacturonase and other enzymes capable of degrading cell wall polymers. Young, intermediate, and mature lesions together with the tissue adjacent to lesions were examined by electron microscopy. Hyphae within infection cushions were surrounded by a moderately dense material, tentatively described as mucilaginous. Penetration did not involve swelling or changes in staining properties of the cuticle. Epidermal and cortex cell walls near the pathogen were swollen and their cytoplasm was collapsed. At a distance of 2-4 cells from the pathogen, the cytoplasm accumulated

toward the infection. Walls of these cells were moderately swollen and the middle lamella was densely stained and granulated. The plasmalemma was retracted from the walls and other subtle cytoplasmic changes were evident. Cytoplasmic changes also were found in cells with densely stained walls showing no obvious swelling. Changes in fungal ultrastructure were uncommon except in mature lesions. The results suggest that changes in host structure and physiology associated with this disease are not caused solely by wall degradation and the consequent osmotic bursting of protoplasts. *(Author's summary)* I:03

0300

16044 DIXON, R.A.; DEY, P.M.; MURPHY, D.L.; WHITEHEAD, I.M. 1981. **Dose responses for *Colletotrichum lindemuthianum* elicitor-mediated enzyme induction in French bean cell suspension cultures.** Planta 151:272-280. Engl., Sum. Engl., 32 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Phytoalexins. Culture media. Hypocotyls. Plant tissues. Enzymes. Analysis. Plant physiological processes.**

The induction of L-phenylalanine ammonialyase (PAL, EC 4.3.1.5) and flavanone synthase in French bean cell suspension cultures in response to heat-released elicitor from cell walls of the fungus *Colletotrichum lindemuthianum* is highly dependent upon elicitor concn. The elicitor dose-response curve for PAL induction shows 2 maxima at approx. 17.5 and 50 µg elicitor carbohydrate/ml culture, whereas the flavanone synthase response shows one maximum at approx. 100 µg/ml. The PAL response is independent of the elicitor concn. present during the lag phase of enzyme induction; if the initial elicitor concn. is increased after 2 h by addition of extra elicitor, or decreased by dilution of the cultures, the dose response curves obtained reflect the concn. of elicitor present at the time of harvest. PAL induction is not prevented by addition of methyl sugar derivatives to the cultures; α-methyl-D-glucoside, itself a weak elicitor of PAL activity, elicits a multiphasic PAL response when increasing concn. are added in the presence of *Colletotrichum* elicitor. Eight fractions with different monosaccharide compositions, obtained from the crude elicitor by gel-filtration, each elicit different dose-responses for PAL induction: the response to unfractionated elicitor is not the sum of the responses to the isolated fractions. There is no correlation between the ability of the fractions to induce PAL in the cultures and their ability to act as elicitors of isoflavonoid phytoalexin accumulation in bean hypocotyls. *(Author's summary)* I:03

0301

16704 MORRIS, A.J.; SMITH, D.A. 1978. **Phytoalexin formation in bean hypocotyls induced by cell-free mycelial extracts of *Rhizoctonia* and *Fusarium*.** Annals of Applied Biology 89(2):344-347. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. Fusarium solani phaseoli. **Hypocotyls. Inoculation methods. Phytoalexins. Host-plant resistance. Laboratory experiments.**

In French bean hypocotyls naturally infected with *Rhizoctonia solani* kievitone accumulated rapidly and to higher levels than phaseollin for at least 96 h after infection, while in tissues infected with *Fusarium solani* f. sp. *phaseoli* only trace amounts of kievitone were found by 96 h while phaseollin accumulated up to 120 h. In inoculated tissues kievitone reached a level exceeding 100 µg/g fresh wt. in *R. solani* infections; phaseollin accumulated more rapidly than in natural infection, reaching approx. 80 µg/g 96 h after inoculation. In artificial *F. solani* infections kievitone again only attained very low levels and phaseollin never exceeded trace amounts, possibly owing to extensive browning and colonization by the pathogen. When cell free extracts of *R. solani* were applied to bean hypocotyls kievitone accumulated to greater amounts than those present in naturally or artificially infected tissues but phaseollin levels were comparable to those induced by fungal infection. Mycelial extracts of *F. solani* failed to induce more than trace amounts of kievitone but phaseollin accumulated. The results are discussed but no definite conclusions may be reached regarding the mechanisms accounting for the differential accumulation of kievitone in these infections. *(Summary by Review of Plant Pathology)* I:03

0302

17322 SCHWARTZ, H.F.; KATHERMAN, M.J.; THUNG, M.D.T. 1981. **Yield response and resistance of dry beans to powdery mildew in Colombia.** Plant Disease 65(7):737-738. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. Erysiphe polygoni. **Disease control. Chemical control. Crop losses. Yields. Colombia.**

An epidemic of powdery mildew (*Erysiphe polygoni*) reduced dry bean yields 17-69%, depending on the cv. or breeding line, in a trial conducted in Popayan (Colombia). The pathogen was controlled by benomyl, and several resistant cv. and breeding lines were identified. *(Author's summary)* F03

0303

16915 TU, J.C.; BEVERSDORF, W.D. 1982. **Tolerance to white mold** *(Sclerotinia sclerotiorum* **(Lib.) De Bary) in Ex Rico 23, a cultivar of white bean** *(Phaseolus vulgaris* **L.).** Canadian Journal of Plant Science 62:65-69. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Cultivars. Host-plant resistance. Germplasm. Disease control. Chemical control. Crop losses. Yields. Field experiments. Canada.**

Ex Rico 23, a white bean cv. introduced into Canada from Colombia, showed tolerance to white mold *(Sclerotinia sclerotiorum)* in an Ontario White Bean Variety Test at a site having severe white mold infection in 1978. Other entries, including the recommended cv. Fleetwood, Kentwood, and Seafarer, suffered severe white mold infection and yield loss. The tolerant characteristic of Ex Rico 23 was confirmed experimentally in 1980 in both small-plot and large-scale plantings. In a field with severe white mold infection in Fleetwood, Ex Rico 23 had consistently lower disease incidence and a slower rate of disease spread. The yield loss in 1980 for Ex Rico 23 was minimal, but for Fleetwood was approx. 25 and 50% in a small-plot and a large-scale planting, resp. The application of benomyl for disease control did not significantly increase the yield of dry beans. *(Author's summary)* F03 G01 D05

0304

16913 PFENDER, W.F.; HAGEDORN, D.J. 1982. *Aphanomyces euteiches* **f. sp.** *phaseoli,* **a causal agent of bean root and hypocotyl rot.** Phytopathology 72(3): 306-310. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. Aphanomyces euteiches phaseoli. **Rots. Roots. Hypocotyls. Identification. Host range. Host-plant resistance. Cultivars. USA.**

A previously unrecognized strain of *Aphanomyces* was found that caused severe root and hypocotyl rot of snap beans. It is proposed that 2 special forms of *A. euteiches* be recognized: *A. euteiches* f. sp. *pisi,* which infects peas and beans, and *A. euteiches* f. sp. *phaseoli,* which infects beans but not peas. A sample of isolates of the former had radial growth rates on cornmeal agar of $\geq$ 10 mm/day at 32°C, and a difference between oogonium and oospore ϕ of $\leq$ 6 µm, whereas the latter grew 1-3 mm/day at 32°C, and the resp. ϕ differences were $\geq$ 8 µm. *A. euteiches* f. sp. *phaseoli* causes more severe damage to beans than does *A. euteiches* f. sp. *pisi.* Both special forms infect alfalfa. Although all bean cv. and breeding lines tested were susceptible to infection by *A. euteiches* f. sp. *phaseoli,* Wis. (RRR) 46 showed little damage, whereas all commercial cv. tested were severely damaged by the pathogen. *(Author's summary)* F03

0305

14573 TU, J.C.; McNAUGHTON, M.E. 1980. **Isolation and characterization of benomyl-resistant biotypes of the delta race of** *Colletotrichum lindemuthianum.* Canadian Journal of Plant Science 60(2):585-589. Engl., Sum. Engl., Fr., 11 Refs., Illus.

Phaseolus vulgaris, Colletotrichum lindemuthianum. **Isolates. Races. Disease control. Culture media. Seed transmission. Seed treatment. Cultivars. Host-plant resistance.**

Thirteen biotypes resistant to benomyl and which were capable of radiating mycelial growth on Mathur's agar (MA) containing 500 μg/ml of benomyl were isolated from race δ of bean anthracnose (*Colletotrichum lindemuthianum*). The resistance was of a persistent type, resistant characteristics being retained after several subculturings on benomyl-free MA. Several biotypes lost virulence totally or partially while the others increased in virulence. In addition, individual biotypes differed in pathogenicity towards various susceptible cv. in tests conducted on *Phaseolus vulgaris* cv. Black Turtle, Fx Rico 23, Fleetwood, Kentwood, Pinto, Sanilac, Seafarer, and Stenben. The cultural characteristics, sporulation and growth differed among the biotypes and also from the original δ race. Pathogenicity generally was correlated positively for the virulent biotypes, with the amount of sporulation. The significance of the development of the resistant biotypes and the use of benomyl in seed treatment to control bean anthracnose is discussed. *(Author's summary)* E03

0306

16750 PLAUT, J.L.; BERGER, R.D. 1981 **Infection rates in three pathosystem epidemics initiated with reduced disease severities.** Phytopathology 71(9):917-921. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris, Uromyces phaseoli, Botrytis cinerea. **Inoculation. Epidemiology. Field experiments. Statistical analysis.**

The progress of bean rust (*Uromyces phaseoli*), groundnut early leaf spot (*Cercospora arachidicola*) [*Mycosphaerella arachidis*], and begonia grey blight (*Botrytis cinerea*) was monitored in epidemics initiated with high, medium, and low levels of inoculum. Polycyclic grey blight and bean rust epidemics, developed in replicated glasshouse chambers equipped to simulate field weather conditions, and bean rust and early leaf spot epidemics were studied in buffered field plots. The Gompertz transformation of the disease proportions consistently provided a better statistical fit than did the logistic transformation when both were tested by simple linear regression. Polynomial models were inferior to the simple linear regression models. When the disease proportions were transformed with the logistic equation, rapid, nonlinear disease increases were aberrantly projected for initial epidemic stages. Regardless of the transformation, model, pathosystem or exptl. location, the calculated rates of disease increase were greatest for epidemics starting from the lowest initial disease severity in 73% of all cases. Low initial disease was apparently compensated for by accelerated rates of disease increase. Sanitation measures in the management of compound interest diseases may therefore be less effective than previously supposed. *(Author's summary)* E03 K00

0307

17369 GARCIA-ARENAL, F.; FRAILE, A.; SAGASTA, E.M. 1980. **Les phytoalexines dans l'interaction *Phaseolus vulgaris-Botrytis cinerea*. *(Phytoalexin accumulation in the interaction Phaseolus vulgaris-Botrytis cinerea).*** Annales de Phytopathologie 12(4):329-334. Fr., Sum. Fr., Engl., 14 Refs., Illus.

Phaseolus vulgaris, Botrytis cinerea. **Isolates. Virulence. Host-plant resistance. Phytoalexins. Hypocotyls. Laboratory experiments.**

Phytoalexin accumulation was studied in hypocotyls of 2 bean cv. with different degrees of susceptibility to *Botrytis cinerea*, after infection by isolates of this fungus differing in virulence. The 4 isoflavonoid phytoalexins, phaseollin, phaseollidin, phaseollinisoflavan, and kievitone were detected in the lesions produced. As shown histochemically, isoflavonoid accumulation is an early response to inoculation and occurs in cells still metabolically active. The accumulation of phytoalexins was quantitated in the different interactions *Phaseolus vulgaris-B. cinerea*; the combined yield of phytoalexins being always higher in the less susceptible cv. Resistance of bean cv. to *B. cinerea* infection appears to be correlated with high phytoalexin accumulation. The level of phytoalexins depended on the infecting isolate, and it was inversely correlated with its virulence. There was no correlation between viru-

lence and sensitivity to the phytoalexins, nor between virulence and phytoalexin degrading ability, the isolate being able to metabolize the 4 compounds. Phytoalexin accumulation in response to $HgCl_2$ treatment was also studied. When challenged with $HgCl_2$ the yield of phytoalexins was the same in both cv., and the accumulation patterns were different from those of the *B. cinerea* infections. This indicates that plants with the same capacity for phytoalexin accumulation do not react in the same way to the different elicitors, and that the amount of phytoalexins accumulated depends on both the plant and the inducer agent. *(Author's summary)* E03 G01

0308

17375 ABAWI, G.S.; PROVVIDENTI, R.; CROSIER, D.C.; HUNTER, J.E. 1978. **Inheritance of resistance to white mold disease in *Phaseolus coccineus*.** Journal of Heredity 69:200-202. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Backcrossing.** *Whetzelinia sclerotiorum.* **Host-plant resistance. Genes. Cultivars. Growth-chamber experiments.**

A white-seeded selection of *Phaseolus coccineus* (P.I. 175829) from Turkey was found to be highly resistant to *Whetzelinia sclerotiorum*. Intraspecific crosses and backcrosses made with susceptible *P. vulgaris* germplasm indicate that a single completely dominant gene governs this high level of resistance. The symbol *Ws* is proposed for this gene. The inoculation procedure used to evaluate bean germplasm simulated natural disease occurrence in commercial bean fields. Plants at the susceptible blossom stage were sprayed with a suspension of ascospores obtained from aseptically produced apothecia. Immediately after inoculation, plants were placed in a mist chamber at 21-25°C for 1 wk. before final evaluation. *(Author's summary)* E03 G01

0309

17395 IMHOFF, M.W.; LEONARD, K.J.; MAIN, C.E. 1982. **Analysis of disease progress curves, gradients, and incidence-severity relationships for field and phytotron bean rust epidemics.** Phytopathology 72(1):72-80. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli var. *typica.* **Epidemiology. Inoculation. Disease transmission. Experiment design. Statistical analysis. Field experiments.**

Six bean rust field epidemics in 1979 and 1980 were monitored for disease severity, disease incidence, hourly temp., hourly leaf wetness, leaf area/plant, and no. of leaves/plant. These epidemics were initiated by artificially inoculating 1.83 x 1.83 m areas at the centers of 44 x 44 m plots of *Phaseolus vulgaris* cv. Bountiful with race 34 of *Uromyces phaseoli* var. *typica*. Disease gradient patterns over time were unique to each epidemic and reflected the pattern of the disease progress curves for the central inoculated area. Disease progress curves appeared to depend more on the frequency and length of wetting period than on temp. Incidence vs. severity relationships differed for each epidemic and were too variable within an individual epidemic to be of practical use for estimating disease severity from disease incidence data. Under controlled phytotron conditions, 5 epidemics under different environmental regimes, initial inoculum levels, and inoculation dates produced similar-shaped disease progress curves that varied in time displacement. Incidence vs. severity relationships reflected the rate of the epidemic, the time of disease onset, and the rate of host growth. These field and phytotron epidemics can serve as verification tools for future disease simulator development. *(Author's summary)* E03

0310

17368 VERDUGO G., F.; FUCIKOVSKY Z., L. 1980. **Algunos factores relacionados con el control de *Whetzelinia sclerotiorum* (Lib.) Korf y Dumont, agente causal del moho blanco del fríjol.** *(Some factors related to the control of Whetzelinia sclerotiorum, causal agent of white mold in beans).* Agrociencia (Mexico) 39:3-8. Span., Sum. Span., Engl., 4 Refs.

Phaseolus vulgaris. Phaseolus coccineus. Phaseolus lunatus. Whetzelinia sclerotiorum. **Disease transmission. Seed transmission. Inoculation. Cultivars. Host-plant resistance. Disease control. Chemical control. Laboratory experiments. Field experiments. Mexico.**

Transmission of *Whetzelinia sclerotiorum* by the seed of bean cv. Michoacan 12A-3 was estimated both in the greenhouse and in the lab. Results indicated that approx. 50% of the seed was infected by this fungus. In tests for resistance, 52 bean cv. of the species *Phaseolus vulgaris, P. coccineus, P. acutifolius,* and *P. lunatus* were inoculated under moist chamber conditions. Several plants of 3 *P. coccineus* cultivars (Puebla 890, F-444, and Hidalgo 45-A) remained healthy, suggesting that they probably possess a high degree of resistance. Six fungicides, benomyl, dicloran, thiabendazole, captafol, PCNB and maneb, were compared in a chemical control expt. Dicloran as seed treatment and foliage spray, in both cases at a dosage of 1000 ppm, gave the best results. *(Author's summary)* F03

0311

17360 HEATH, M.C. 1981. **Resistance of plants to rust infection.** Phytopathology 71(9):971-974. Engl., Sum. Engl., 34 Refs.

Phaseolus vulgaris, Uromyces phaseoli, Puccinia helianthi. **Host range. Host-plant resistance.**

Examples are given of cytological investigations on *Uromyces phaseoli* in cowpea, French bean, and cabbage, on *Puccinia coronata* in oats, on *P. striiformis* in wheat, *Melampsora lini* in flax, and *P. helianthi* in French bean, which have contributed to the understanding of prehaustorial and posthaustorial resistance. Evidence is presented for the existence of multiple resistance mechanisms and for the capacity of the pathogen to induce susceptibility (to circumvent, disorganize, or break down resistance mechanisms). In general, the expression of cv. resistance is detectable only after the penetration of haustoria, whereas nonhost resistance acts at an earlier stage, through a range of mechanisms, to prevent haustorium penetration. The natural process of selection for gene-for-gene resistance begins to operate automatically only after the fundamental compatibility between host and pathogen has been established. No evidence exists that this process can lead to the creation of a new nonhost-type resistance mechanism. It seems invariably to act by interfering with the host/fungus relationship which exists after the penetration of haustoria. *(Summary by Plant Breeding Abstracts)* F03 G01

0312

17387 CARRIJO, I.V.; CHAVES, G.M.; PEREIRA, A.A. 1980. **Reação de vinte e cinco variedades de *Phaseolus vulgaris* a trinta e nove raças fisiológicas de *Uromyces phaseoli* var. *typica* Arth, em condições de casa-de-vegetação.** *(Response of twenty-five varieties of Phaseolus vulgaris to thirty-nine physiological races of Uromyces phaseoli var. typica under greenhouse conditions).* Fitopatologia Brasileira 5:245-255. Port., Sum. Port., Engl., 11 Refs.

Phaseolus vulgaris, Uromyces phaseoli. **Strains. Host-plant resistance. Cultivars. Isolates. Inoculation. Greenhouse experiments.**

Under greenhouse conditions, the reaction of 25 bean var. to 39 races of *Uromyces phaseoli* var. *typica* were studied. In a survey to identify races, various pathotypes were detected in a very small area. Several races, with different frequencies, were found to infect the same plant. Var. BGF no. 1458 showed resistance to all of the races tested. *(Author's summary)* F03 G01

See also 0241 0282 0319 0347 0348 0375

E04 Viroses

0313

16794 FERRAZ, H. DE M.; FORNASIERI FILHO, D.; SANCHEZ, A.L. 1980. **Efeitos do ataque de viroses transmissíveis pela mosca branca na germinação e vigor o de sementes de feijoeiro.** *(Effects of the attack of whitefly-transmitted viruses on the germination and vigor of common bean seed).* Revista Brasileira de Sementes 2 (1):29-34. Port., Sum. Port., Engl., 8 Refs.

Phaseolus vulgaris. Bemisia tabaci. **Viroses. Vectors. Seeds. Disease transmission. Seed. Germination. Plant injuries. Cultivars. Brazil.**

Two seed lots from 8 common bean cv., one obtained from plants infected by whitefly-transmitted viruses (*Bemisia tabaci*) and the other from healthy plants, were submitted to seed germination and vigor tests in order to compare the effects of virus attack on these characteristics. Virus attack decreased the values of the mentioned characteristics; there was also variability in the general behavior of the cv. Highest reductions occurred in the wt. of 100 seeds and in seed germination (38%); however, reductions in the length of the canopy and root system, and also in the DM wt. of these parts were lower and more varied. Cv. Carioca was the most susceptible; cv. Aroana, Rosinha G-2, and Roxão Lustroso were highly susceptible. *(Author's summary)* E04

0314

15868 WESTPHALEN, S.L.; NUNES, J.C.; BERGAMASCHI, H. 1980. **Ocorrência de mosaico dourado do feijão (*Phaseolus vulgaris*, L.) no Rio Grande do Sul.** *(Occurrence of the bean golden mosaic in Rio Grande do Sul).* Agronomia Sulriograndense (Porto Alegre) 16(1):155-160. Port., Sum. Port., Engl., 5 Refs.

Phaseolus vulgaris. **Bean golden mosaic virus. Symptomatology. Identification. Host-plant resistance. Cultivars. Irrigation. Brazil.**

The occurrence of BGMV in dry beans is reported for the 1st time in the state of Rio Grande do Sul, Brazil. A table is included on disease severity in bean cv. Rico 23, Turrialba 4, Rio Tibagi, and Carioca with different treatments (T_1, no irrigation; T_2, soil moisture maintained < 1 atm. until the initiation of flowering; T_3, T_2 from the initiation of flowering until physiologic maturity; T_4, T_2 during the entire crop cycle). *(Author's summary)* E04

0315

14126 LIN, M.T.; GAMEZ, R.; KITAJIMA, E.W. 1981. **Bean mosaico-em-desenho virus is a member of the bean rugose mosaic virus serogroup.** Fitopatologia Brasileira 6:293-298. Port., Sum. Port., Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Bean rugose mosaic virus. Strains. Identification. Serology. Brazil.**

Bean "mosaico-em-desenho" virus, an isometric virus previously considered as a member of the BSMV group, was identified by serology as a comovirus belonging to the BRMV serogroup and should be regarded as a strain of this virus. *(Author's summary)* E04

0316

17392 HAMPTON, R.; BECZNER, L.; HAGEDORN, D.; BOS, L.; INOUYE, T.; BARNETT, O.; MUSIL, M.; MEINERS, J. 1978. **Host reactions of mechanically transmissible legume viruses of the northern temperate zone.** Phytopathology 68: 989-997. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. **Viroses. Host range. Host-plant resistance. Isolates. Inoculation. Symptomatology. Identification. Greenhouse experiments.**

Reactions of 23 plant hosts to inoculation with each of 38 legume viruses, and a key to aid in the diagnosis of these viruses, are presented. The virus isolates, investigated at locations where they are indigenous, were either type cultures or had been equivalently characterized. Each of the hosts was derived from standardized seedstocks. Therefore, specific viruses were tested against identical host germplasm. The key is based on some 1700 symptomatological data and virus host ranges obtained from selected plant hosts. The final key formulation was derived from evaluations of all possible combinations and hierarchies of plant hosts. Assuming that each virus will infect and induce characteristic symptoms when inoculated into defined cv. under suitable conditions, the key is an aid to identification for each of the 38 viruses tested. Evaluations of 2-4 separate isolates of certain viruses supported the diagnostic value of the key. *(Author's summary)* I 04 G01

0317

15858 QUINTERO C., R. 1975. **Enfermedades virosas que atacan el fríjol (*Phaseolus vulgaris*) en el área centroamericana.** *(Viral diseases that attack beans in the Central American region).* Managua, Nicaragua, Escuela Nacional de Agricultura y Ganadería. 11p. Span., 7 Refs.

Phaseolus vulgaris. **Bean common mosaic virus. Bean golden mosaic virus. Bean rugose mosaic virus. Bean southern mosaic virus. Symptomatology. Identification. Nicaragua.**

A brief description is given of the symptoms, etiology, and epidemiology of viral diseases affecting beans in Central America, including BSMV, BRMV, and bean chlorotic mottle virus. *(Summary by A.J.C. Trans. by I.M.E.)* I 04

0318

17362 DAVIS, R.F.; WEBER, Z.; POSPIESZNY, H.; SILBERNAGEL, M.; HAMPTON, R.O. 1981. **Seedborne cucumber mosaic virus in selected *Phaseolus vulgaris* germ plasm and breeding lines in Idaho, Washington, and Oregon.** Plant Disease 65(6):492-494. Engl., Sum. Engl., 20 Refs.

Phaseolus vulgaris. **Cucumber mosaic virus. Seed transmission. Germplasm. Plant introductions. Seed. Disease transmission. Analysis. Biochemistry. Selection.**

In 1978 and 1979, 259 bean plants from principal bean breeding lines in Idaho, Washington, and Oregon (USA) were tested for seed-borne cucumber mosaic virus. All plants were free of seed-borne cucumber mosaic virus as determined by ELISA, bioassay, or serology. By the same methods, the virus was detected in one of 32 plant introduction bean accessions of international origin. Future monitoring for seed-borne cucumber mosaic virus may be desirable in view of current international exchanges of bean germplasm, which may disseminate this virus. *(Author's summary)* I 04 G01

E05 Nematodes

0319

14653 REDDY, P.P.; SINGH, D.B.; SHARMA, S.R. 1979. **Interaction of *Meloidogyne incognita* and *Rhizoctonia solani* in a root rot disease complex of French bean.** Indian Phytopathology 32(4):651-652. Engl., 2 Refs.

Phaseolus vulgaris. Meloidogyne incognita. Rhizoctonia solani. **Inoculation. Plant development.**

In pot tests combined inoculations of *Meloidogyne incognita* and *Rhizoctonia solani* caused greater damage to French beans than either pathogen inoculated alone, reducing plant height and fresh wt. *(Summary by Review of Plant Pathology)* I 05 I 03

0320

14883 GINOUX, J.P.; JACQUA, G.; FOUGEROUX, A.; MESSIAEN, C.M. 1979. **Sélection de variétés de Haricot résistantes à *Meloidogyne incognita.*** *(Selection of bean varieties resistant to Meloidogyne incognita).* Annales de l'Amelioration des Plantes 29(6):709-713. Fr., Sum. Fr., Engl., 6 Refs.

Phaseolus vulgaris. Meloidogyne incognita. **Host-plant resistance. Germplasm. Hybridizing. Selection.**

Climbing bean var. resistant to *Meloidogyne incognita* were obtained from a cross between G8.1.2.m x Manoa Wonder in Guadeloupe. They are high-yielding and well adapted to local conditions. Semidwarf, resistant beans were obtained from a subsequent cross with Constant. The study of segregating generations agrees with a birecessive heredity of resistance. On the contrary, Manoa Wonder and the new resistant var. were very susceptible to *Meloidogyne arenaria* in SE France. *(Author's summary)* I 05 G01

E06 Physiological Disorders

0321

17347 COYNE, P.I.; BINGHAM, G.E. 1978. **Photosynthesis and stomatal light responses in snap beans exposed to hydrogen sulfide and ozone.** Journal of the Air Pollution Control Association 28(11):1119-1123. Engl., Sum. Engl., 26 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Photosynthesis. Air pollution. Ozone. Light. Stomata. Plant physiological disorders.**

Apparent photosynthesis and leaf stomatal conductance were measured in well watered, field grown snap bean cv. GV50 fumigated with various levels of H_2S alone and in the presence of 0.072 ppm ozone. Mean concn. of H_2S were 0, 0.74, 3.25, and 5.03 ppm. Plants were fumigated each day beginning at the 1st trifoliate leaf stage. The youngest fully expanded leaves were sampled after 18 ± 2 days of fumigation. The plants had 10-11 leaves and were flowering with approx. 80% of the flowers open. Hydrogen sulfide at 0.74 ppm increased max. stomatal conductance ($C_{max.}$) by 25% and max. apparent photosynthesis ($P_{max.}$) by 10%. Higher concn. of H_2S depressed stomatal opening and CO_2 uptake, and O_3 + H_2S depressed stomatal and photosynthetic response more than H_2S alone. At the highest H_2S concn. + O_3, $C_{max.}$ was 41%, and $P_{max.}$ was 52% of the control. Both $C_{max.}$ and $P_{max.}$ responded similarly to the 8 treatments but the difference between max. and min. responses was greater for conductance. As pollutant stress increased, photosynthesis ceased to respond linearly to increasing conductance at lower conductance values indicating that mesophyll resistance to CO_2 transfer was more limiting than CO_2 diffusion through the stomata at higher light intensities. The initial slope of the curves of both conductance and photosynthesis as a function of irradiance decreased with increasing stress, suggesting decreased sensitivity to light. This indicates an increased sluggishness in the guard cells, which could be related to induced leaf senescence caused by the pollutants. It also indicates a loss of photochemical conversion efficiency resulting from loss of chlorophyll and development of necrotic areas on the leaves of the more stressed plants. *(Author's summary)* 1-06

0322

16024 METZLER, J.T.; PELL, E.J. 1980. **The impact of peroxyacetyl nitrate on conductance of bean leaves and on associated cellular and foliar symptom expression.** Phytopathology 70(10):934-938. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Plant physiological disorders. Stomata. Leaves. Plant tissues. Symptomatology. Plant injuries. Cytology.**

Phaseolus vulgaris cv. Provider seedlings were cultured in sand in a growth chamber. Beginning at 1100 h 6 days after emergence, plants were exposed to one of the following dosages of PAN: subthreshold ~271 $\mu g/m^3$ for 1 h; split threshold ~405 $\mu g/m^3$ for 0.5 h (subthreshold) or 405 $\mu g/m^3$ for 1 h (above threshold); or threshold ~360 $\mu g/m^3$ for 1 h. Stomatal conductance of primary leaves was measured at 1200 h and 2100 h on 3 consecutive days beginning 1 day before exposure to PAN. Plants exposed to subthreshold dosages showed no macroscopic symptoms and stomatal conductance for these plants remained similar to that of controls. Dosages above or at threshold levels produced abaxial glazing; stomatal conductance of these plants was higher at 2100 h each night after exposure and

lower at 1200 h 1 day after exposure. A histological study was conducted on primary leaf tissue of plants exposed to an above-threshold dosage of PAN. Cross sections of tissue samples taken 3 h after exposure showed small no. of plasmolyzed abaxial epidermal and spongy mesophyll cells. Larger no., but similar %, of epidermal and mesophyll cells were collapsed 6 and 9 h after exposure. Proximity to stomata was directly correlated with cellular injury. Guard cells remained intact and normal in appearance. *(Author's summary)* 106

0323

17330 MILLER, C.A.; DAVIS, D.D. 1981. **Effect of temperature on stomatal conductance and ozone injury of pinto bean leaves.** Plant Disease (65(9)) 750-751. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Stomata. Leaves. Ozone. Plant injuries. Temperature. Growth-chamber experiments.**

Phaseolus vulgaris var. Pinto 111 unifoliolate leaves exposed to 0.10 ppm (196 $\mu g/m^3$) of ozone at 15, 24, and 32°C developed 25, 3, and 24% foliar injury, resp. Stomatal conductance of both exposed and unexposed leaves was lowest at 15°C, intermediate at 24°C, and greatest at 32°C. Exposure to ozone significantly reduced stomatal diffusion at 32°C but not at 24 or 15°C. *(Author's summary)* 106

CIAT ABSTRACTS ON
TROPICAL PASTURES

- Tropical grasses and forage legumes
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- ONLY AVAILABLE IN SPANISH

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

F00 PEST CONTROL AND ENTOMOLOGY

0324

17324 DURON A., F.; PEAIRS, F.; MAZIER, C.; LOPEZ, R. 1981. **Control de la babosa (*Vaginulus* spp.) y otras plagas del fríjol con aplicaciones de Mesfolán (Cytrolane 2 G) al suelo.** [*Controlling slugs (Vaginulus spp.) and other bean pests with soil applications of mephostolan (Cytrolane 2 G)*]. Tegucigalpa, Honduras, Secretaría de Recursos Naturales. Programa Nacional de Investigación Agropecuaria. 31p. Span., Sum. Span., 9 Refs.

Phaseolus vulgaris. *Vaginulus* **spp.** *Empoasca* **spp. Insect control. Chemical control.** *Zea mays*. **Intercropping. Yields. Field experiments. Honduras.**

Six expt. were conducted on bean cv. Acacia-4 in 6 localities of the state of Olancho, Honduras during the 2nd planting season in 1980-81 to assess the control of slugs (*Vaginulus* spp.) with mephostolan (Cytrolane 2 G). A 5 x 5 Latin square design was used with the following treatments: (A) check; (B) 1/4 g mephostolan/site without contacting the seed, (C) 1/4 g mephostolan/site contacting the seed; (D) 1/2 g mephostolan/site without contacting the seed; and (E) 1/2 g mephostolan/site contacting the seed. The following observations were registered: the no. of plants at 7 and 21 days of germination; *Empoasca* nymphs/trifolium at flowering; leaf damage;% damage by *Apion godmani*; and yield in kg/ha. It was found that treatments with mephostolan, at 0.5 kg a.i./ha without contacting the seed, gave significant plant protection regarding the no. of slug-defoliated plants and attacks of *Empoasca* spp. up to 45 days. Treatments with mephostolan showed a higher no. of undamaged plants. Best results were obtained when the insecticide was applied without contacting the seed, since the treatments in which the seeds had direct contact with the product showed toxicity problems which reduced germination (particularly with treatment E, 1 kg a.i./ha). Plant population increased with the rate of 1/4 g/site (0.5 kg a.i./ha). Levels of *Empoasca* varied among localities. All treatments with mephostolan showed a lower no. of nymphs/trifolium, with treatment E (1 kg a.i./ha) as outstanding. Yieldwise, best treatments were D and B yielding 39 and 29%, resp. over the check. The product showed no effect in controlling *A. godmani*. [*Author's summary. Trans. by I.M.E.*] I 00

0325

16921 OLIVEIRA, J.V. DE; SILVA, I.P. DA; FERNANDES, M.B.D. 1981. **Dinâmica populacional da cigarrinha verde** *Empoasca kraemeri* **Ross & Moore, 1957, em cultivares de feijão.** [*Population dynamics of the leafhopper Empoasca kraemeri on bean cultivars*]. Anais da Sociedade Entomológica do Brasil 10(1):21-26. Port., Sum. Engl., Port., 7 Refs.

Phaseolus vulgaris. *Vigna unguiculata*. *Empoasca kraemeri*. **Population dynamics. Cultivars. Insect biology. Timing. Planting. Developmental stages. Brazil.**

Population dynamics of *Empoasca kraemeri* on cowpea and bean cv. was studied. Weekly samplings of insects in nymphal and adult stages were made for the periods of 20-75 and 20-78 days after planting during the dry and rainy seasons, resp. Results demonstrated that nymph population tends to increase after 20 days, reaching the highest population density 47-54 and 35-50 days during the dry and rainy seasons, resp. Nevertheless, *Phaseolus vulgaris* cv. IPA-1 showed the highest density at 43-63 days during the rainy season. Adult

population did not present the same tendency due to its ability to move among cv., thus making it impossible to collect uniform data. Therefore, the sampling of nymphs was more suitable for the study of population dynamics of *E. kraemeri*. *(Author's summary)* F00

0326

16032 CAVALCANTE, R.D. 1975. *Lytta dimidiata* **(Fisch, 1827), praga de feijoeiro (*Phaseolus vulgaris* L.) em São Paulo.** *(Lytta dimidiata, a bean pest in the state of São Paulo).* Fitossanidade 1(2):56. Port., Sum. Engl., 3 Refs.

Phaseolus vulgaris. Lytta dimidiata. **Identification. Taxonomy. Brazil.**

The attack of adult *Lytta dimidiata* (Coleoptera, Meloidae) on bean crops in the state of São Paulo (Brazil) is reported. *(Author's summary)* F00

0327

14648 CASTAÑERA, P.; ARROYO, M. 1979. **Influencia del nivel de infestación de la araña roja, *Tetranychus cinnabarinus* (Boisduval), en judias enanas de verdeo.** *(Influence of the level of infestation of the red spider mite, Tetranychus cinnabarinus, on dwarf French beans).* Anales del Instituo Nacional de Investigaciones Agrarias. Serie Protección Vegetal 11:93-102. Span., Sum. Span., Fr., Engl., 21 Refs., Illus.

Phaseolus vulgaris. Tetranychus cinnabarinus. **Population dynamics. Plant injuries. Symptomatology. Dry matter. Leaves. Pods. Analysis. Plant development.**

An expt. was carried out under greenhouse conditions to study the effect of 3 different levels of infestation of the carmine spider mite, *Tetranychus cinnabarinus*, on the yield of dwarf French bean var. Prince. Uncontrolled infestations of 6, 20, and 60 females/plant were used at the trifoliate stage. Yield reduction was directly related to the initial level of infestation. A significant reduction in yield was observed for infestations of 60 and 20 females/plant. *(Author's summary)* F00

0328

14852 PIERRE, D. 1980. **Influence des graines ou des gousses mûres de la plante-hôte (*Phaseolus vulgaris*) sur l'activité reproductrice de *Zabrotes subfasciatus* Boh. (Coléoptère bruchidae).** [*Influence of the seeds and ripe pods of Phaseolus vulgaris on the reproductive activity of Zabrotes subfasciatus (Coleoptera: Bruchidae)*]. Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. Serie D. 290(14):1007-1010. Fr., Sum. Fr., Engl., 8 Refs., Illus.

Phaseolus vulgaris. Zabrotes subfasciatus. **Insect biology. Oviposition. Seeds. Pods.**

The influence of seeds or ripe pods of *Phaseolus vulgaris* on the fecundity and ovarian production of *Zabrotes subfasciatus* was examined in virgin or inseminated females. The presence of ripe pods has reduced influence; however, the presence of seeds favors mating, induces egg-laying, and stimulates oogenesis. *(Author's summary)* F00

0329

17357 LOPEZ G., R. 1980. **La producción del fríjol (*Phaseolus vulgaris* var. Turrialba I) con defoliación simulando ataque por la tortuguilla *Diphaulaca wagneri* Harold (Chrysomelidae: Alticinae).** [*Production of bean var. Turrialba I with defoliation simulating an attack by Diphaulaca wagneri (Chrysomelidae: Alticinae)*]. Tesis Lic. Biol. Guatemala, Universidad del Valle, Facultad de Ciencias y Humanidades. 59p. Span., Sum. Span., 31 Refs., Illus.

Phaseolus vulgaris. Diphaulaca wagneri. **Insect biology. Plant injuries. Crop losses. Leaf area. Leaves. Experiment design. Statistical analysis. Guatemala.**

Defoliations of 20, 40, 60, and 80% were practiced on bean var. Turrialba I to simulate the

type of damage caused by *Diphaulaca wagneri*. A hand borer with one round hole 0.59 cm in ϕ was used, repeating defoliation 3 times before florescence. The expt. was conducted in Guatemala (Guatemala) at 1500 m.a.s.l. in July-Sept. 1978 and in Managua (Nicaragua) at 800 m.a.s.l. in Oct.-Dec. 1979. Results at both sites indicate that this bean var. tolerates between 40-60% defoliation without affecting yields. Plant yield with 20% defoliation was greater than that of non-defoliated plants, probably due to the increased growth after defoliation. Adult *D. wagneri* fed on bean leaves at 0.17 ± 0.013 cm^2/day regardless of the no. of insects/plant or the no. of days the expt. lasted. The no. of insects that defoliate up to the min. % needed to reduce yields was calculated on the basis of the results obtained in both expt. This is part of the basis used to estimate the level of economic damage of the pest, which indicates the relationship between the value of the yield obtained and the invested control costs. *(Author's summary. Trans. by L.M.F.)* F00 D00

0330

16918 KATUNDU, J.M. 1980. **Agromyzid leaf miner - a new insect pest to Tanzania.** Tropical Grain Legume Bulletin 20:8-10. Engl., 1 Ref.

Phaseolus vulgaris. Liriomyza trifolii. **Identification. Insect biology. Host range. Plant injuries. Tanzania.**

A species of Agromyzid fly was found in 1979 infesting beans. The insect was identified as *Liriomyza trifolii*. This is probably a new record for Tanzania. Description (egg, larva, pupa, and adult), life cycle, host plants, and economic importance of the insect are discussed. *(Summary by Abstracts on Tropical Agriculture)* F00

0331

17367 HUGHES, P.R.; POTTER, J.F.; WEINSTEIN, L.H. 1981. **Effects of air pollutants on plant-insect interactions: reactions of the Mexican bean beetle to SO_2-fumigated pinto beans.** Environmental Entomology 10(5):741-744. Engl., Sum. Engl., 22 Refs.

Phaseolus vulgaris. Epilachna varivestis. **Air pollution. Plant assimilation. Leaves. Insect biology. Oviposition. Plant injuries. Laboratory experiments.**

Larvae of the Mexican bean beetle, *Epilachna varivestis*, were fed on foliage from pinto beans that were exposed to SO_2 at 390 $\mu g/m^3$ for 7 days. No differences in growth, development time, or survivorship were observed when compared with larvae fed on control foliage. The no. of eggs mass was higher for females fed fumigated foliage, but the time between deposition of eggs was longer, resulting in no difference between treatments in the mean no. of eggs laid/female in 10 days. In tests of adult feeding preference, females showed a significant preference for fumigated tissue. *(Author's summary)* F00

See also 0243 0267 0378

F01 Injurious Insects, Mites and their Control

0332

16771 YOUNG, S.S.Y.; WRENSCH, D.L. 1981. **Relative influence of fitness components on total fitness of the two-spotted spider mite in different environments.** Environmental Entomology 10(1):1-5. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. Tetranychus urticae. **Mite biology. Population dynamics. Statistical analysis. Leaves. Laboratory experiments.**

Net fitness in *Tetranychus urticae*, defined as the no. of adult offspring/female, is a function of the no. of eggs produced and the survival rates of eggs, larvae, protonymphs, and deutonymphs. The relationships between fitness and its components were estimated in some lab. studies on leaves of *Phaseolus vulgaris*. It was found that egg production overwhelmingly determined female fitness. Since the fitness components completely determine the net fitness, the relationship may be considered as a closed system of interacting components. A method of analyzing such a system is also introduced. *(Author's summary)* F01

0333

16719 RODRIGUEZ F., M.T. 1980. **Alto, al avance de la babosa.** *(Controlling slugs)*. Recursos (Honduras) 2(6):3-7. Span., Illus.

Phaseolus vulgaris. Vaginulus **spp. Plant injuries. Noxious animals. Pest control. Legal aspects. Honduras.**

Slug (*Vaginulus plebeius*) attacks reduced the area planted to beans in Honduras up to 30% in 1979. The pest was reported for the 1st time in El Salvador in 1967 and as of 1972, it is considered a pest in Honduras. Recommendations on how to improve the control of slugs are given. The 4 stages of the campaign of the Secretaria de Recursos Naturales to avoid its propagation are described: (1) initiation of the campaign, (2) progressive development by creating committees to disseminate the campaign; (3) dissemination of information on pest control; and (4) evaluation of the results. An economical method of control consists in surrounding the crop with strips of lime and salt during the dry season. Carbaryl baits gave an av. mortality of 81-90% of the slugs. Mephosfolan applied at planting gave a 90% control of slugs and controlled *Empoasca* spp. for 45 days, these being 2 major bean pests in Honduras. *(Summary by C.P.G. Trans. by L.M.E.)* F01

0334

17335 WADDILL, V.; SHEPARD, M. 1975. **A comparison of predation by the pentatomids, *Podisus maculiventris* (Say) and *Stiretrus anchorago* (F.), on the Mexican bean beetle, *Epilachna varivestis* Mulsant.** Annals of the Entomological Society of America 68(6):1023-1027. Engl., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris. Epilachna varivestis. **Insect control. Biological control. Predators. Laboratory experiments.**

Predation by *Podisus maculiventris* and *Stiretrus anchorago* on the Mexican bean beetle (*Epilachna varivestis*) was studied in the lab. and field cages. *P. maculiventris* accepted a wider range of *E. varivestis* stages as prey than did *S. anchorago*. Both predaceous penta-

tomid species responded to a rise in temp. with an increase in prey consumption. However, *P. maculiventris* responded more acutely to the increase in temp. than did *S. anchorago*. Prey consumption by each species increased at a negatively accelerating rate as prey density increased. *S. anchorago* had a distinct preference for *E. varivestis* to velvetbean caterpillar, *Anticarsia gemmatalis*, while *P. maculiventris* took approx. equal no. of each. Field cage data substantiated findings from lab. studies in that *E. varivestis* larval populations were significantly reduced by both pentatomid species. *(Author's summary)* F01

G00 GENETICS AND PLANT BREEDING

0335

17320 KORBAN, S.S.; COYNE, D.P.; WEHING, J.L.; HANNA, M.A. 1981. **Testing methods, variation, morphological and genetic studies of seed-coat cracking in dry beans (*Phaseolus vulgaris* L.).** Journal of the American Society for Horticultural Science 106(6):821-828. Engl., Sum. Engl., 32 Refs., Illus.

Phaseolus vulgaris. **Cotyledon cracking. Seed coat. Genes. Inheritance. Heterosis. Seeds. Harvesting. Mechanical damage. Resistance. Selection. Statistical analysis. Field experiments. Cultivars. USA.**

Seed-coat cracking injury was determined in Great Northern (GN) dry bean lines in 1977-78 and Pinto beans in 1978 using 3 methods as follows: Vogel small plot thresher (field), seed dropping, and a controlled rotating impact disk machine. Differences in susceptibility for seed coat cracking were observed within each testing method. Overall, GN Emerson, near-isogenic determinate GN Nebraska no. 1, and Pinto UI 111 had the best resistance to seed-coat cracking. A genotype x year interaction for seed injury occurred with the Vogel thresher but not with the other 2 methods. These gave consistent results but the rotating disk machine method was preferred because of ease, rapidity of operation, and standardization of the rotation speed. The early- and late-maturing determinate near-isogenic lines of GN Nebraska no. 1 had less seed-coat injury than the early and late indeterminate lines using the Vogel and rotating impact disk method. The early determinate line had the least amount of seed-coat injury for all 3 methods. Pinto UI 111, Bulgarian White, and GN D-88, which exhibited the best resistance to seed-coat cracking in the 7 parent diallel crossing study, had the most uniform seed-coat thickness as well as having thick seed coats. The cv. which had thin or thick but nonuniformly thick seed coats were susceptible to seed-coat cracking. Differences in thickness in macrosclerid, osteosclerid, and parenchyma cell layers of the seed coat were observed between cv., but no relationship between these cell layers and the seed-coat cracking response was established. Seed-coat cracking was quantitatively inherited. Bulgari White, Pinto UI 111, and GN D-88 showed high combining ability for resistance to seed-coat cracking. The estimates of the genetic effects indicated that additive effects were mainly involved. *(Author's summary)* G00 B00 D02

0336

16946 GEPTS, P. 1980. **Introducción a las hibridaciones interespecíficas con el fríjol común, *Phaseolus vulgaris* L. *(Introduction to interspecific hybridizations of common beans).*** Cali, Colombia, Projecto CIAT-U. de Gembloux (Bélgica). 50p. Span., 60 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Phaseolus acutifolius. Phaseolus lunatus. **Hybridizing. Backcrossing. Germplasm. Taxonomy. Hybrids. Colombia.**

Studies conducted on interspecific hybridizations in the genus *Phaseolus*, with special reference to the crosses with *P. vulgaris*, as part of a project carried out by the Centro Internacional de Agricultura Tropical (CIAT) in collaboration with the U. of Gembloux (Belgium) are synthesized. The stages of the program of interspecific crossbreeding are discussed and the difficulties of crossbreeding and the possibility of overcoming them are highlighted. These stages include: (1) the definition of general and specific objectives; (2) studies on taxonomy

and crossbreeding; (3) establishment and assessment of germplasm collections; (4) studies on crossbreeding that involve the rate of efficiency, embryo cultures, and the possible causes of low efficiency; (5) viability and fertility of progeny (lethal dwarf, deformed dwarf, and normal plants), use of backcrossing, and the production of tetraploids to restore fertility; (6) morphological characteristics and segregation in F_1, F_2, and successive progenies, emphasizing cross-pollination, resistance to lodging, branches with long peduncles and a high no. of pods, leaf size and direction, frequency of chiasmas in *P. vulgaris* x *P. coccineus* crosses, and the use of backcross progeny. Criteria for parental selection in an interspecific crossbreeding project are given. It is recommended to increase F_2 populations due to their low fertility. The facility of crossbreeding, viability and fertility of the progeny, and segregation and transference of genes to progeny are 3 parameters that describe the crossbreeding relationship between species. On the basis of these 3 parameters, each wild species is classified in one of the 3 gene-pools (GP_1, GP_2, and GP_3) of the cultivated *P. vulgaris* sp. GP_1, where crossbreeding is easy, includes cultivated and wild forms of *P. vulgaris;* GP_2 includes *P. coccineus* and crossbreeding is more difficult. In GP_3 crossbreeding is difficult and requires special techniques such as embryo culture. Species such as *P. acutifolius, P. filiformis, P. ritensis,* and *P. lunatus* are included. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0337

16039 DRION, A. 1981. **Evaluation d'hybrides interspecifiques realisés à partir de *Phaseolus lunatus* L.: possibilités d'introgression de caractères utiles.** *(Evaluation of interspecific hybrids produced from Phaseolus lunatus: possibilities of introgression of useful characters).* Thèse Ing. Agr. Gembloux, Belgique, Faculté des Sciences Agronomiques de l'Etat. 185p. Fr., Illus.

Phaseolus lunatus. Phaseolus polystachyus. Phaseolus metcalfei. **Hibridizing. Hybrids. Agronomic characters. Plant anatomy. Yields. Selection. Belgium.**

A detailed evaluation of the results of interspecific hybridization with *Phaseolus lunatus* is given including a summary of preliminary research. General considerations on breeding and hybridization programs are made. Botanical, morphological, ecological, agronomic, pathologic, taxonomic, and phytogenetic information of the species under study is included along with the exptl. conditions of research conducted with *P. lunatus* x *P. metcalfei, P. lunatus* x *P. polystachyus* , *P. lunatus* x *Phaseolus* sp. 402.Possible solutions to problems occurring in both hybrid production and in using the variability obtained are given. On the basis of these results the possibility of improving *P. lunatus,* by using interspecific hybrids in low alt., humid tropical regions, is studied. *(Summary by I.B. Trans. by L.M.F.)* G00

0338

17332 BEIBE, S.; SALGUERO, V. 1982. **Evaluación de resistencia del fríjol al *Apion godmani* en Jutiapa Guatemala.** *(Evaluation of bean resistance to Apion godmani in Jutiapa, Guatemala).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 9p. Span., Sum. Span., 3 Refs.

Paper presented at Reunión Anual de PCCMCA, 28a., San José, Costa Rica, 1982.

Phaseolus vulgaris. Apion godmani. **Host-plant resistance. Germplasm. Plant introduction. Selection. Cultivars. Guatemala.**

At the Apion nursery, Asunción Mita, Jutiapa, several entries from the Guatemalteco Germplasm Bank (some formerly reported as resistant), entries from CIAT preliminary yield trials (EP-81), and individual selections from Línea 17 and from the International Apion Nursery were assessed for resistance to the bean pod weevil, *Apion godmani.* Cv. were planted in rows 3 m long with 3 replications. Plants were artificially infested during flowering by adults captured in the Golden Mosaic Nursery. After most of the cv. reached physiological maturity, 30 pods/row/var. were collected and evaluated to determine the % of damaged seed. Línea 17 from El Salvador was used as resistant check. At the 1981 International Nursery, Línea 17 had 3% damaged grain; and several of its descendent lines

(bright red-seeded) were equally resistant. At this nursery, the most susceptible cv. had 36% damaged seed. Guate and EP-81 entries had greater pressure from *Apion* as indicated by the 11% damage in Línea 17 seed. The best Guate entry was Guate-989 with 6% damage. The best EP-81 entry was a Brazilian var., CATU, with 8% damage. EP-81 entries also showed resistance to common bacterial blight (*Xanthomonas phaseoli*), *Empoasca*, rust (*Uromyces phaseoli*), web blight (*Thanatephorus cucumeris*), and anthracnose (*Colletotrichum lindemuthianum*). Tamazulapa, a BGMV-tolerant var. from ICTA, also presented a low % of damage. *(Author's summary. Trans. by L.M.F.)* G00 F00

0339

16781 MEINERS, J.P. 1981. **Genetics of disease resistance in edible legumes.** Annual Review of Phytopathology 21:189-209. Engl., 124 Refs.

Phaseolus vulgaris. Phaseolus lunatus. Vigna unguiculata. **Bean common mosaic virus. *Colletotrichum lindemuthianum.* Host-plant resistance. Genes. Genetics. Plant breeding.**

A literature review is given on the genetics of disease resistance in *Cajanus cajan, Cicer arietinum, Lablab purpureus, Lens culinaris, Phaseolus lunatus, P. vulgaris, Pisum sativum, Vicia faba, Vigna mungo, V. radiata,* and *V. unguiculata.* Regarding *P. vulgaris,* it is indicated that this has been the species most thoroughly investigated to this respect. There is information available on the genetics of disease resistance to 6 viral diseases: BCMV, BYMV, curly top virus (CTV), BSMV, pod mottle virus (PMV), and BRMV, with special reference to BCMV. The following fungal pathogens are discussed: *Isariopsis griseola, Colletotrichum lindemuthianum, Erysiphe polygoni, Uromyces phaseoli, Fusarium solani* f. sp. *phaseoli, F. oxysporum* f. sp. *phaseoli, Pythium ultimum, Rhizoctonia solani, Thielaviopsis basicola,* and *Sclerotinia sclerotiorum.* The inheritance of resistance has been studied for the bacterial pathogens *Pseudomonas phaseolicola, Xanthomonas phaseoli,* and *Corynebacterium flaccumfaciens. (Summary by A.J.C. Trans. by L.M.F.)* G00 E00

0340

16722 BURNS, R. 1976. **Bean production systems. Germplasm discipline. A status report.** Cali, Colombia, Centro Internacional de Agricultura Tropical. 23p. Engl., Illus. .

Phaseolus vulgaris. **Germplasm. Plant introductions. Selection. Agronomic characters. Seed production. Seeds. Colombia.**

A report is given on the organization of CIAT's bean germplasm bank, which main objectives are: (1) assemble the world's available genetic resources of beans for the basic and applied research to raise bean production in the tropics; (2) characterize systematically each entry and record its morpho-agronomic traits to make such information available to interested researchers; and (3) produce and preserve enough seed of each entry to supply bean researchers. The no. of seed samples obtained in 1970-76 from different countries is indicated, the operating system of the germplasm bank is described, and the morpho-agronomic parameters used to characterize each entry are defined. These are recorded for the computer using the Statistical Analysis System (SAS). Seed handling is described and future plans and needs are discussed. *(Summary by A.J.C. Trans. by L.M.F.)* G00 D04

0341

15820 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1980. **Vivero internacional de rendimiento y adaptación de fríjol *(Phaseolus vulgaris* L.) IBYAN 1977:fríjol de grano negro, fríjol de grano de diversos colores. *(International Bean Yield and Adaptation Nursery, IBYAN 1977: black beans, different colored beans).*** Cali, Colombia. Serie 20 SB2-77. 241p. Span., Illus.

Phaseolus vulgaris. **Plant introductions. Cultivars. Yields. Adaptation. Seeds. Selection. Agronomic characters. Field experiments. Colombia.**

The 1977 IBYAN, composed of materials from CIAT's germplasm bank, was grouped into

black-grained var. and var. with different colored grains (20 in each trial and 5 local checks). These were distributed among 23 countries for a total of 108 expt.; data was obtained on 55 trials. At the different sites, a triple lattice design was used in a 6 m^2 useful plot area in order to determine: bean yield, no. of harvested plants, days to flowering, growth habit, plant height, lodging, dehiscence, no. of pods/plant, wt. of 100 seeds, seed quality, days to physiological maturity, harvest time, and diseases. The results of the statistical analyses of the data obtained from the trials are given and discussed. In the group of black beans (data from 33 of the 58 trials), Línea 29 (P 738), Línea BAT 2 from CIAT, Jamapa and Porrillo Sintetico (2 var. from IBYAN-1976), and Pecho Amarillo, S-182-N, and 51052 (3 Central American var.) were outstanding. The highest av. yield was obtained in Graneros, Chile with 4436 kg/ha and the highest individual yield (5214 kg/ha) was obtained with P 498 at the same site. In the group of different colored beans (data from 22 of the 50 allotted trials), the performance of Ex Rico 23 (P 756), Brazil (P 402), and S-630-B (P 524) was highlighted. The highest av. yield (2693 kg/ha) and the highest individual yield (3248 kg/ha) were both obtained in Culiacán, Mexico with Pintado (G 4826). *(Summary by A.J.C. Trans. by I.M.F.)* G00

0342

16033 FUNDAÇÃO INSTITUTO AGRONOMICO DO PARANA. 1980. **Programa Feijão.** *(Bean program)* In ___. Relatório Técnico Anual 1979. Londrina-PR, Brasil. pp.87-109. Port., Illus.

Phaseolus vulgaris. **Plant breeding. Adaptation. Host-plant resistance. Cultivars.** *Colletotrichum lindemuthianum. Empoasca kraemeri.* **Bean golden mosaic virus. Yields. Planting. Spacing. Timing. Agricultural lime. Weeding. Research. Brazil.**

Results of the bean program of the Fundação Instituto Agronómico do Parana (Brazil) during 1979 are given. Main objectives were to develop high-yielding cv., resistant to major diseases [BGMV; anthracnose (*Colletotrichum lindemuthianum*), bacterioses] and pests (*Empoasca kraemeri*, thrips) and to develop agronomic practices aimed at increasing yields. Losses caused by anthracnose were assessed (48.6% in var. Araona, 16.5% in var. Carioca). Eleven fungicides were tested; thiram (or thiram + benomyl), chlorothalonil, and triphenyltin acetate were recommended. Two mutants were also studied to improve plant architecture. Several chemical products were assessed for pest control along with the adaptation and yield of lines and cv., spacing and density for cv. of different growth habits. Research on planting time, liming and N fertilization, and weed control was also included. *(Summary by I.B. Trans. by I.M.F.)* G00 D00

0343

17366 BASSETT, M.J. 1981. **Inheritance of a lanceolate leaf mutation in the common bean.** Journal of Heredity 72(6):431-432. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Mutation. Leaves. Genes. Genetics. Hybridizing. Agronomic characters. Seed production. Plant reproduction.**

A monogenetic dominant leaf mutant derived from the common bean stock, FF 336, is described. In homozygous condition the dominant allele has deleterious effects that prevent reproduction. The heterozygote usually segregates 2 lanceolate-leaf to 1 normal-leaf plant although aberrant ratios such as 3:1 and 1:1 also may occur. The name lanceolate leaf and the gene symbol *Lan* are proposed for the mutant. *(Author's summary)* G00

See also 0205 0353 0357

G01 Breeding, Selection and Germplasm

0344

17329 AL-MUKHTAR, F.A.; COYNE, D.P. 1981. **Inheritance and association of flower, ovule, seed, pod, and maturity characters in dry edible beans (*Phaseolus vulgaris* L.).** Journal of the American Society for Horticultural Science 106(6):713-719. Engl., Sum. Engl., 22 Refs.

Phaseolus vulgaris. **Agronomic characters. Flowers. Ovules. Seeds. Pods. Maturation. Inheritance. Genes. Statistical analysis. Plant breeding.**

The accessions, PI 255960 (P_1) (purple flowers, colored seed, curved pod tip, large seed) and G-19007 (P_2) (white flowers, straight pod tip, white seed) of *Phaseolus vulgaris*, both late maturing with many ovules and seeds/pod, were crossed with each other and with 2 early maturing, white flowered and seeded, straight pod tip, low ovule no./pod parents, Great Northern (GN) Emerson (P_3) and GN UI 59 (P_4). P_1 and P_2 appeared to possess the same genes for high ovule no./pod. The continuous distributions of ovule no./pod, seed no./pod, and seed wt. in the F_2 generations of the other crosses indicated quantitative inheritance. However, segregation data in their F_3 generations suggested that ovule no./pod may be determined by additive action of the alleles of a single major gene. Moderately high broad sense heritability estimates were obtained for these traits. Purple flower color and seed-coat color were controlled by 2 different complementary dominant genes. Striped pod color and curved pod tip shape were each controlled by different single dominant genes. Days to flowering was controlled by a single completely dominant gene; pod maturity was controlled by a single incompletely dominant gene for lateness. Linkage occurred between genes for flower color and pod color pattern, flower color and pod tip shape, and flower color and maturity. High seed no./pod was associated with purple flowers, colored seeds, and late maturity in the F_2 of $P_3 \times P_1$. Late maturity and high seed no./pod were also associated in the F_2 of $P_4 \times P_1$, $P_3 \times P_2$, and $P_4 \times P_2$. Moderately large negative correlations were found between no. of seeds/pod and seed wt. in all crosses involving P_1 and P_2. High ovule no./pod was associated with indeterminate growth habit and moderately late flowering in the F_2 progeny from the indeterminate cv. G.N. Nebraska no. 1, crossed with a determinate isoline. No association between seed wt. and seed-coat color was observed in the F_2 of $P_3 \times P_1$, and $P_4 \times P_1$, but there was association between large seed and both late maturity and flower color. *(Author's summary)* G01

0345

12360 LYNAM, J. 1980?. **Estudios sobre adaptación y mejoramiento del fríjol *Phaseolus lunatus*. *(Adaptation and breeding studies on the lima bean, Phaseolus lunatus).*** Cali, Colombia, Centro Internacional de Agricultura Tropical. Serie Seminarios Internos. Span., Sum. Span., 42 Refs., Illus.

Phaseolus vulgaris. **Plant breeding. Adaptation. Cultivars. Germplasm. Selection. Hybridizing. Climatic requirements. Host-plant resistance. Diseases and pathogens. Pests. Yields. Colombia.**

Research on lima beans (*Phaseolus lunatus*) was conducted regarding adaptation, resistance to common bacterial blight (*Xanthomonas phaseoli*), resistance to leafhoppers (*Empoasca kraemeri*), and cyanide conen. in lima bean seed. In adaptation studies 36 climbing lima

bean lines were selected from the CIAT collection on the basis of yield and freedom from diseases and planted with 6 climbing *P. vulgaris* lines at 5 different sites in Colombia. Av. yield of lines in all 5 sites was 2640 kg/ha. Palmira was the site with highest yields, averaging 4734 kg/ha and Monteria had the lowest yields, averaging 1646 kg/ha. Max. yield (Palmira, line G 25105) was 6121 kg/ha. Adaptation indices were calculated to compare sites and classify accession behavior. In the bacterial blight study, 189 lines were evaluated for response to inoculation in the screenhouse; 89% were classified as tolerant. A resistant and a susceptible line were chosen for crossing. When evaluating F_2 plants a continuous segregation was found, suggesting a genetic control of a quantitative nature as in *P. vulgaris*. Analysis of the results was complicated due to the resistant reaction in one of the parents and to difficulties in the readings of the evaluation. However, most F_2 hybrids were classified as tolerant and some plants as resistant. In the leafhopper study, 185 lines were evaluated under field conditions. Most were classified as susceptible and others as tolerant; 4 lines showed marked resistance. These lines showed presence of pubescence and the correlation of the no. of trichomes with leafhopper damage was negative and highly significant. Eighty-five *P. lunatus* lines were analyzed for cyanide content of the seed; 2 lines with relatively high concn. (> 200 ppm) were identified, the others had low concn. Regression analysis indicated a correlation coefficient of 0.39 ($P = 0.05$) between cyanide content and yield. To avoid the selection of lines with high cyanide content in yield trials, this component should be analyzed in improvement programs with *P. lunatus*. Continuous segregation was observed in F_2 hybrids indicating genetic control of a quantitative nature. Recommendations for future research on *P. lunatus* at CIAT are given; germplasm evaluation, agronomic problems, and analysis of consumer preferences to realize the potential of beans in L.A. are emphasized. *(Extracted from author's summary. Trans. by L.M.F.)* G01 D05 K00

6346

16455 ROMAN V., A.; DAVIS, J. 1980. **Informe de trabajos 1980; programa de frijol.** *(Research report 1980, bean program).* La Selva, Antioquia, Convenio ICA/CIAT. 34p. Span., Sum. Span.

Phaseolus vulgaris. **Climbing bean. Germplasm. Selection. Agronomic characters.** *Colletotrichum lindemuthianum. Ascochyta* **spp.** *Isariopsis griseola.* **Host-plant resistance.** *Zea mays.* **Rotational crops. Yields. Dwarf beans. Cultivars. Field experiments. Colombia.**

In 1980 the collaborative program Instituto Colombiano Agropecuario/Centro Internacional de Agricultura Tropical at the regional headquarters in La Selva, Antioquia (Colombia) released 2 promissory climbing bean var., F. 1056 and G 4727 (Ancash 66), for on-farm trials in the municipality of El Carmen de Viboral. In 1981 2 advanced lines (V 3230 and V 3227), resulting from crosses with Cargamanto, were also included for on-farm trials. New var. are resistant to anthracnose (*Colletotrichum lindemuthianum*). Eighteen promissory var. were identified for further testing and inclusion in crossbreeding; 2 var. notable for their type of grain, production, and disease-resistance, Frijola (Mexican) and G 12417 (Ecuadorian), were selected. The selection of individual plants in the F_2 and more advanced generations has mainly been directed towards plants of growth habit IV A, less aggressive and more early-maturing than traditional var. In F_2 and F_3 1094 individual plants were selected for testing in 1981; best parents for resistance to anthracnose and adaptation have been AB 136, Cornell 49-242, Rojo 70, G 2025, G 4356, and Ecuador 299. As a result of trials with families in F_3 and F_5, 138 promissory lines with commercial-type grain were selected in Colombia; these resulted from commercial var. such as Cargamanto, Liborino (climbing), Calabozo, and Bola Rojo. Four promissory red and red-speckled lines were selected from advanced generations for multiplication. A Peruvian var. superior to the check, Apurimac 29 (G 7300) with commercial-type grain, was identified from international trials at CIAT (VIRAF, International Yield and Adaptation Nursery for beans in L.A.). In trials on planting distances in maize/climbing bean relay cropping, it was concluded that the traditional 0.92 x 0.92 m square planting is the best distance with 4 maize plants/hill. The optimum density for beans at this distance is 6 seeds/hill (71,000 seeds/ha), which represents a planting distance 3-fold that of the farmers. Fifteen promissory var. as parental lines,

16 individual F_2 plants, 3 F_3 lines, and 8 mass selections were selected for bush beans. Eleven promissory lines (Preliminary Trial, EP) were selected from advanced material for further observation in 1981. *(Author's summary, Trans. by L.M.E.)* G01 D05 K00

0347

16919 HUNTER, J.E.; DICKSON, M.H.; BOETTGER, M.A.; CIGNA, J.A. 1982. **Evaluation of plant introductions of *Phaseolus* spp. for resistance to white mold.** Plant Disease 66(4):320-322. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. Whetzelinia sclerotiorum. Phaseolus coccineus. **Host-plant resistance. Inoculation methods. Hybridizing. Plant introductions. Growth-chamber experiments.**

Higher levels of resistance to white mold *(Sclerotinia sclerotiorum)* than previously known in *Phaseolus vulgaris* were detected under growth chamber conditions using a limited-term inoculation method. Fifty percent or higher survival occurred in only 13 of 310 lines from Europe, whereas 16 of 139 introductions with tolerance to root rot survived the white mold test. Most of these originated in Central or S. America, although 2 lines from Turkey had a high level of resistance. A group of F_5 plants derived from *P. vulgaris* x *P. coccineus* crosses had a comparatively high survival ratio. The 8 lines of *P. coccineus* subsp. *polyanthus* from Mexico that were tested all had a high level of resistance. A change in the limited-term inoculation method is described that makes it easier and faster to use for large-scale testing. *(Author's summary)* G01 F03

0348

17354 GONZALEZ A., M.; ALADRO, R.; MARRERO, H. 1981. **Correspondencia entre el contenido de antocianina del hipocótilo de distintos tipos de frijoles y la infección por *Macrophomina phaseolina*.** *(Correspondence between the anthocyanin content of the hypocotyl in different types of beans and infection by Macrophomina phaseolina).* Ciencias de la Agricultura 9:79-83. Span., Sum. Span., Engl., 15 Refs., Illus.

Phaseolus vulgaris. Macrophomina phaseolina. **Host-plant resistance. Cultivars. Seed color. Hypocotyls. Plant pigments. Cuba.**

During 1976-77 lab. expt. were performed in order to determine the influence that bean hypocotyl pigmentation has on *Macrophomina phaseolina*, in different bean varieties. Higher susceptibility was determined in red and white bean var., while the black var. were more resistant. A modified Harborner method to determine anthocyanin content was applied using hypocotyls of several var. Correspondence between resistance to infection and anthocyanin content in the different bean var. was established. *(Author's summary)* G01 E03

0349

17325 ALFARO M., R. 1981?. **Vivero centroamericano de adaptación y rendimiento (VICAR) no. 1 de granos rojos y no. 2 de granos negros.** [*Central American Yield and Adaptation Nursery (VICAR) no. 1 of red beans and no. 2 of black beans*]. Costa Rica, Ministerio de Agricultura y Ganadería. 32p. Span.

Phaseolus vulgaris. **Germplasm. Adaptation. Yields. Selection. Seed color. Cultivars. Statistical analysis. Costa Rica.**

Results of the Central American Yield and Adaptation Nursery (VICAR)-1981 conducted with red-colored materials at 2 sites in Costa Rica, 3 in El Salvador, 2 in Honduras, and 1 in Nicaragua, and with black-colored materials at 2 sites in Costa Rica, 3 in El Salvador, and 4 in Guatemala are given. In both trials a significant effect (P = 0.01) was observed for sites and var. The interaction site x var. was only significant for red-colored materials. Black-colored var. showed a higher stability in yield among sites. The highest av. yields of red var. were obtained in Las Acacias, Honduras (1569 kg/ha), Alajuela, Costa Rica (1359 kg/ha), and Carazo, Nicaragua (1043 kg/ha); var. Rojo 70, MCS 97R, Rojo de Seda, and Honduras

46 were outstanding with an av. of 1054 kg/ha. Highest av. yields of black var. were obtained in San Jerónimo, Guatemala (2086 kg/ha), Alajuela (1509 kg/ha), and Nueva Guadalupe, El Salvador (1196 kg/ha); ICTA Quetzal, D-145, BAT 304, and Porrillo Sintético had the best adaptation with an av. yield of 1212 kg/ha. Yields of tested materials are given in table form for each site. *(Summary by A.J.C. Trans. by I.M.F.)* G01 D05

0350

17356 VOYSEST, O. 1982. **Comportamiento en ambientes de diversos niveles de productividad de genotipos de fríjol negro desarrollados en Colombia.** *(Performance of black bean genotypes developed in Colombia under environmental conditions of different levels of productivity).* Cali, Colombia, Centro Internacional de Agricultura Tropical. Serie Seminarios Internos no. SI-7-82. 23p. Span., 2 Refs.

Phaseolus vulgaris. **Cultivars. Adaptation. Yields. Field experiments. Experiment design. Statistical analysis. Plant introductions. Selection. Colombia.**

The genetic changes occuring in av. productivity, adaptation, and response to environments with different levels of yield for black-colored grain material selected by CIAT during 1976-79 are examined. Data from 124 expt. of the International Bean Yield and Adaptation Nursery (IBYAN) of black beans, conducted at 80 sites in 20 countries, were used in a randomized complete block design with 4 replications in 1976 and 1977 and 3 replications in 1978 and 1979. Var. Jamapa, Porrillo Sintético, and ICA Pijao were used as international checks to estimate the av. increase in yield of the tested lines; the coefficient of regression (b_i), the coefficient of determination (r^2), and the standard deviation of regression (S_d) were estimated by a simple linear regression analysis and the component of genotype/environment interaction (σ^2_{GA}) was measured by the Plaisted methodology, successively omitting one of the lines. Av. yields of the 5 best lines were higher than the av. of international checks by 1-22%. The range of b_i varied between 0.84-1.08 and 0.93-1.17 for high- and low-yielding lines, resp. In the exptl. lines, a high correlation of the S^2_d and σ^2 parameter array was found. The highest yielding lines showed b_i values closer to those of Porrillo Sintético (= 1) than those of Jamapa (< 1). High correlation of b with the ranges of yield variation of ev. (considered individually or in general) among select and nonselect environments, allows the response of the lines to environments with different levels of productivity to be estimated. Results of analyses are discussed and summarized in table form. *(Summary by C.P.G. Trans. by I.M.F.)* G01

0351

16926 BURNS, R. 1975. **Genetic resources in beans, *Phaseolus vulgaris,* and CIAT's germplasm bank.** Cali, Colombia, Centro Internacional de Agricultura Tropical. 23p. Engl., 21 Refs.

Paper presented at the Workshop on Genetic Improvement of Dry Beans, *Phaseolus vulgaris* and Germplasm Resources, CIAT, 1975.

Phaseolus vulgaris. **Plant breeding. Germplasm. Selection. Cultivars. Agronomic characters. Colombia.**

The availability of genetic variation in beans in the world is analyzed, emphasizing the activities and objectives of CIAT's bean germplasm bank. A list of the institutions with bean collections is included with emphasis on the need for new explorations and collections. Factors affecting the multiplication, evaluation, and documentation of the existing collections are analyzed. CIAT's germplasm bank and its manner of operation are briefly described; a list of agronomic characteristics evaluated on each entry to the bank is included. *(Summary by A.J.C. Trans. by I.M.F.)* G01

See also 0208 0249 0282 0283 0287 0290 0296 0303 0307 0308 0311 0312 0316 0318 0320

G02 Cytogenetics

0352

16709 PETERS, J.E.; CROCOMO, O.J.; SHARP, W.R.; PADDOCK, E.F.; TEGENKAMP, L.; TEGENKAMP, T. 1975. **Development of haploid callus cells from pollen of** *Phaseolus vulgaris*. *In* Sharp, W.R.; Crocomo, O.J. Growth and developmental physiology of *Phaseolus vulgaris* (A report). Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz. Centro de Energia Nuclear na Agricultura. pp.1-9. Engl., 6 Refs.

Phaseolus vulgaris. **Anthers. Pollen. Plant tissues. Culture media. Polyploidy. Chromosomes. Plant-growth substances. Cytology.**

A method to screen for haploidy in callus cultures derived from bean anthers by Giemsa staining was developed. The method produced an excellent staining of the chromosomes and allowed tentative ploidy discrimination in the early prophase. The medium used for induction and maintenance of haploid callus from bean var. Bico de Ouro anthers included Veliky and Martin's salts and vitamins, inositol (100 mg/*l*), IAA (2 mg/*l*), NAA (1 mg/*l*), kinetin (0.2 mg/*l*), and Difco purified agar (8 g/*l*). A test of the effect of adding 2,4-D (1 mg/*l*) to the medium was also conducted. Removed anthers of single flowers were placed on top of the culture medium in aseptic conditions and kept in constant environmental growth chambers (200 ft.-ca. illumination, 12 h photoperiod, at 25 and 30°C). Following 3 wk. in culture, callus growth was recorded. Callus were then transferred to fixative, hydrolyzed, and stained with Giemsa for microscopic observation. Although callus induction was excellent at 25°C with or without 2,4-D (57 and 56% of the anthers produced callus, resp.), the amount of callus produced was almost twice as much as when 2,4-D was added to the medium. At 30°C both callus induction and growth were inhibited. The staining method allowed ploidy to be classified in 75% of the cells. It was not established if the method of staining Giemsa-positive regions is dependent on the species used. It is indicated that the development of clones of hyploid bean callus cell lines and the induction of morphogenesis in these lines still remain to be solved. (*Summary by A.J.C. Trans. by L.M.E.*) G02

H00 NUTRITION

0353

15201 McGINNIS, J. 1978. **Nutritional evaluation of varieties and breeding lines of dry beans (*Phaseolus vulgaris*) and studies on improvement in the nutritional value of beans by gamma irradiation. A report.** Pullman, Washington State University. 119p. Engl.

Phaseolus vulgaris. **Cultivars. Seeds. Irradiation. Nutritive value. Plant breeding. Cooking. Amino acids. USA.**

A series of reports is given on expt. conducted by 4 projects of the Department of Animal Sciences, Washington State University (USA) on the nutritional values of bean cv., breeding lines, and genetic crosses and on the improvement in the nutritional value of beans and other grain legumes by γ irradiation. The results of different growth trials in poultry with different levels of beans in the diet showed that beans at a 50% level decreased growth and feed efficiency. Results showed marked variability in the nutritional value of the different bean cv. and breeding lines, indicating that plant breeders can improve the nutritional value of beans through genetic crossing and selection. Various cv. and breeding lines were subjected to γ irradiation and fed to chicks and rats. Gamma irradiation improved chick growth in comparison with nonirradiated beans; results also showed that cv. and breeding lines were improved by approx. the same magnitude, indicating that all the tested materials contained the same factor that was being inactivated or destroyed by irradiation. Even after cooking and γ irradiation, bean growth and feed efficiency was inferior to that of the control diet (SBM and glucose). In other trials on the effects of different processing methods on the nutritional value of beans, it was found that salt-soaked beans gave better chick growth than beans soaked only in water. In additional studies no effects were observed of the frequency of irrigation and location of the crop on bean protein content. Separate progress reports with detailed results are included. *(Summary by A.J.C. Trans. by L.M.F.)* H00 G00

See also 0233

H01 Foods and Nutritive Value

0354

14665 ANTUNES, P.L.; SGARBIERI, V.C. 1980. **Effect of heat treatment on the toxicity and nutritive value of dry bean (*Phaseolus vulgaris* var. Rosinha G2) proteins.** Journal of Agricultural and Food Chemistry 28(5):935-938. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Seed. Protein content. Proteins. Amino acids. Enzymes. Inhibitors. Phytohaemagglutinins. Heat treatment. Analysis. Toxicity.**

Proximate composition, amino acid pattern, and toxicity of an unheated dry bean flour and of 6 other materials obtained by fractionation of the flour were studied. When fed to weanling rats the flour and all 6 fractions were toxic. Most of the toxicity was eliminated by heating the soaked beans 2.5 min at 97 °C, but max. PER was attained after 10 min at the same temp. Not all trypsin inhibitor and phytohaemagglutinin activities had been eliminated by any of these treatments. Autoclaving (121 °C, 15 min) decreased the availability of lysine in the whole flour and in the water-insoluble solids by 36.7 and 29.3%, resp., whereas it did not affect significantly that of the other fractions. Heating at 121 °C for 7.5 min was deleterious to the nutritive value of the isolated protein fractions. (*Author's summary*) H01

See also 0235 0377

I00 MICROBIOLOGY

See also 0221

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation

0355

16458 VICTORIA, R.L. 1975. **Uso de $^{15}N_2$ com baixo enriquecimento para testes de fixação simbiótica.** *(Use of a low enrichment of $^{15}N_2$ to evaluate symbiotic fixation).* Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 93p. Port., Sum. Port., Engl., 58 Refs., Illus.

Phaseolus vulgaris. **Nitrogen fixation.** *Rhizobium phaseoli.* **Seed. Inoculation. Nodulation. Laboratory experiments.**

Gaseous atmospheres containing a low enrichment of $^{15}N_2$ were used to test symbiotic N fixation in beans. Plants were placed inside a specially constructed growth chamber and assessed for N fixation in nodulated roots and in the whole plant. Positive results were obtained suggesting that the methodology used can be helpful in more detailed studies on symbiotic fixation. Samples of atmospheric air were purified by 2 methods of O_2 and CO_2 absorption. The purified N_2 obtained was analyzed and the results were compared. Samples of bean plant material were collected under natural conditions and analyzed for ^{15}N natural variation. Several samples were prepared for ^{15}N isotopic analysis using 2 methods. The results obtained were compared. All samples were analyzed in an Atlas-Varian Ch-4 model mass spectrometer. Results were given in $\delta^{15}N^0/_{00}$ variation in relation to a standard gas. *(Author's summary)* I01

0356

16491 SUNDSTROM, F.J. 1980. **Developing techniques for improved nitrogen fixation and growth of legumes in minesoils.** Ph.D. Thesis. Blacksburg, Virginia Polytechnic Institute and State University. 74p. Engl., Sum. Engl., 96 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Inoculation. Symbiosis. Nitrogen-fixing bacteria. Soils. Enzymes. Nitrogen fixation. Nodulation. Acetylene reduction. Fertilizers. Growth-chamber experiments.**

The influence of delayed inoculation and N fertilization on minesoil $N_2(C_2H_2)$-fixation rates by snap beans is described. Beans were seeded in minesoil-filled pots placed in growth chambers and in the field. Fertilizer (NH_4NO_3) treatments were 0, 25, 50, and 100 kg/ha applied at 21 days or at planting. A peat culture of *Rhizobium phaseoli* was inoculated at 21 days or at planting. Nitrogenase activity as determined by reduction of C_2H_4 was assayed over a 6-h period at 7, 21, 35, and 49 days in chamber-grown beans. Nitrogenase (C_2H_2)-activity depended on the interaction between N fertilizer rate and treatment sequence. A 25 kg N/ha rate significantly stimulated $N_2(C_2H_2)$-fixation while greater rates of N were found to be depressive. Seasonal $N_2(C_2H_2)$-fixation activity profiles indicate N applied at 21 days is not as inhibitory, but no more stimulatory than N applied at planting. Data suggest a supply of 25 kg inorganic N/ha is sufficient to develop initial vigorous legume growth, but after 21 days is nearly exhausted. Consequently, inoculation with *Rhizobium* at this time does not result in N-depressed nitrogenase activity, but rather is stimulated by increased photosynthate supplies. Because nearly abiotic minesoil offers little indigenous *Rhizobium* competition or microbial antagonism, delayed symbiont introduction is able to

benefit from increased host vigor; therefore, resulting in significantly greater N_2 (C_2H_2)-fixation rates. *(Author's summary)* I01 D01

0357

17331 FELIX, J.F.; OBATON, M.; MESSIAEN, C.M.; SALSAC, L. 1981. **Nitrate reductase and nitrogenase activities of common beans (*Phaseolus vulgaris* L.) from different geographic locations.** Plant and Soil 63:427-438. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. Nitrogen fixation. Nitrogen-fixing bacteria. Enzymes. Nodulation. Climatic requirements. Cultivars. N. Fertilizers. France.**

Cv. of *Phaseolus vulgaris* from contrasting geographic locations were cultivated under field conditions for measurements of nitrogenase and nitrate reductase activities. A 1st trial with 2 cv. indicated that a tropical cv., B-789, has a higher nitrogenase activity than a temperate one, Elsa. The converse was true for the nitrate reductase activity. When a postflowering application was made, a renewal of nitrate reductase activity occurred. Further similar comparisons of both enzymatic activities upon 8 tropical and temperate cv. of equivalent vegetative cycles indicated, on the av., that tropical cv. have a higher level of C_2H_2 reduction and a lower nitrate reductase activity than temperate cv. These observations suggest that there exists an inverse relationship between the 2 enzymatic activities in common beans, and there probably exists genetic variability for a possible improvement of N-fixation ability. An early application of N fertilizer upon the Elsa and B-789 plots promotes later nitrogenase activity while a postflowering application shows a renewal of nitrate reductase activity. Thus, analyses of nitrate reductase and nitrogenase activities of a common bean crop at different physiological stages may indicate the best time to apply supplementary N fertilization to common beans to increase seed yield. *(Author's summary)* I01 G00

0358

15845 SAITO, S.M.T.; RUSCHEL, A.P. 1978. **Influência da calagem, adubação fosfatada e micronutrientes na nodulação natural do feijoeiro (*Phaseolus vulgaris* L.).** *(Effect of liming, phosphorus fertilization, and micronutrients on the natural nodulation of beans).* Anais da Escola Superior de Agricultura Luiz de Queiroz 35: 545-556. Port., Sum. Port., Engl., 9 Refs.

Phaseolus vulgaris. Rhizobium. **Strains. Nodulation. Fertilizers. P. N. K. Micronutrients. Agricultural lime. Soils. Brazil.**

A glasshouse expt. was carried out in order to test the effects of P (150 ppm), basic amendment (150 ppm P_2O_5, 50 ppm K_2O, and micronutrients), and lime (1 t $CaCO_3$/ha) on the nodulation in dry bean cv. Carioca by natural strains of *Rhizobium* in 4 different soils of the state of São Paulo (Brazil): Mediterraneo, Podzolizado, and 2 Terra Roxa Estruturada. Nodule dry wt. increased in 2 soils (Mediterraneo and Podzolizado) due to the addition of P, and in Terra Roxa Estruturada due to the addition of P + lime. The treatment PK + micronutrients provided better plant development, even in the absence of lime, indicating an effect of micronutrients and K in the soils studied. However, in Terra Roxa soils, the addition of P was sufficient to increase the foliage dry wt. and total N. Total N increased in plants treated with the basic fertilization. The addition of P contributed to a better nodulation (nodule dry wt. and no.) by natural strains of *Rhizobium*. *(Author's summary)* I01

0359

16479 BENNETT, R.J.; KEMP, G.A. 1981. **Dinitrogen fixation in pea beans (*Phaseolus vulgaris*) as affected by growth stage and temperature regime.** Canadian Journal of Botany 59(7):1181-1188. Engl., Sum. Engl., Fr., 22 Refs., Illus.

Phaseolus vulgaris. **Nitrogen fixation. Plant habit. Cultivars. Climatic requirements. Temperature. Growth. Nodules. Acetylene reduction.** *Rhizobium phaseoli.* **Canada.**

Tolerance of beans to low temp. is essential for growth under Canadian growing conditions.

At air temp. typical of a southern Alberta growing season (10-23°C), cv. Aurora fixed 433 mg N/plant, more than cv. Sanilac and Comtesse, which averaged 307 mg N/plant, and Kentwood, which fixed the least (214 mg N/plant). At a higher temp. regime (15-23°C), typical of a southern Ontario growing season, Aurora again fixed the most N_2 (456 mg N/plant), while the other 3 cv. fixed an av. of 370 mg N/plant. The amount of N_2 fixed increased as the time to reach max. acetylene (C_2H_2) reducing activity lengthened. This suggested that it may be advantageous to select beans that have a longer vegetative stage to prolong the time of active N_2 fixation within the limits of acceptable season length to ensure maturity. Aurora was not affected by the lower temp. regime, and although these temp. delayed the initiation of N_2 fixation by 21 days, Aurora compensated by producing 26% greater nodule dry wt. and 40% higher max. C_2H_2-reducing activity than that observed at the higher temp. regime. Growth and N_2 fixation of the other 3 cv. were adversely affected by the lower temp. regime, not because of lower nodule no. or mass but because of lower nodule activity. The good root growth of cv. Aurora at low temp. may explain its superiority for N_2 fixation at lower temp. C_2H_2 reduction and nodule dry wt. were acceptable indicators of N_2 fixation only during early plant growth when all nodules were new and uniformly active. The ideal time to select the bean cv. for N_2-fixing ability was just before the peak of max. C_2H_2-reducing activity and corresponded to the stage from buds-near-breaking to anthesis for both temp. regimes. Molar ratios of C_2H_2 reduced to N_2 fixed suggested that the relative efficiency of N_2 fixation varied with temp. and growth stage but not with bean cv. *(Author's summary)* 101

0360

16902 LEIDI, E.O.; GOMEZ, M. 1980. **Estudio de la influencia de nitratos sobre el crecimiento y fijación simbiótica de nitrógeno en plantas de judía** *(Phaseolus vulgaris* L.). *(Study of the influence of nitrates on growth and symbiotic nitrogen fixation in bean plants).* Anales de Edafología y Agrobiología 39(11/12):2175-2197. Span., Sum. Engl., Span., 32 Refs., Illus.

Phaseolus vulgaris. **Minerals and nutrients. N. Growth. Nitrogen fixation.** *Rhizobium.* **Mineral content. Leaves. Stems. Roots. Nutrient solution.**

The N necessary for the growth of beans was supplied by combined forms present in the culture and by symbiotic fixation of atmospheric N. Nodulated and non-nodulated bean plants were grown in hydroponic culture with different nitrate concn. in order to evaluate the effect of the treatments on both the growth of the plants and the effectivity of the symbiotic fixation involved. Such effectivity was determined by the acetylene reduction method. The different growth parameters showed a common increase with the increasing levels of nitrate tested. The effectivity of the symbiotic fixation increased as nitrate concn. decreased and plant age resp. increased. Nutritive parameters and interactions among different macronutrients were also determined. *(Author's summary)* 101 C01

0361

16485 WESTERMANN, D.T.; KLEINKOPF, G.E.; PORTER, L.K.; LEGGETT, G.E. 1981. **Nitrogen sources for bean seed production.** Agronomy Journal 73: 660-664. Engl., Sum. Engl., 26 Refs., Illus.

Phaseolus vulgaris. **N. Fertilizers. Nitrogen fixation. Nodulation. Soil requirements. Nutrient absorption. Developmental stages. Cultivars. Seed production. Mineral content. Analysis.**

The relative contribution of the symbiotic-nonsymbiotic N sources was evaluated by studying the effects of N fertilization on the symbiotic N_2 fixation and seed yields under field conditions in southern Idaho (USA). Expt. were conducted on silt loam soils belonging to the Portneuf series (Xerollic Calciortnids). An acetylene reduction (AR) method was used to determine the effect of N fertilization treatments on the relative seasonal N_2 (AR) fixation. The symbiotic N_2 fixation was also estimated by the equation, $N_2 = N_{up} - (N_i + N_m - N_h) - \alpha N_f$, where N_{up} is the accumulated N uptake measured near physiological maturity, N_i and N_h are the amounts of soil NO_3-N in the root zone before planting and near physiological maturity, N_m is the N mineralized from soil organic N sources, and α is

the recovery of the N fertilizer (N_f) applied. Estimates of the N fertilizer recoveries were obtained from 2 expt. using ^{15}N-depleted $(NH_4)_2SO_4$. The symbiotic N_2 relationship contributed up to 90 kg N/ha, which was 40-50% of the total N found in bean plants near physiological maturity. The amount of symbiotic N_2 fixed decreased as the available soil N or fertilizer N increased, and increased as the N required by the individual cv. increased. The response to N fertilization depended upon the cv., as well as on the N available from soil sources. Measured fertilizer N recoveries ranged from 7-33%. An av. of 52% of the total N uptake near physiological maturity was taken up after the max. symbiotic N_2(AR) rate occurred; while the seed contained an av. of 60% of the total N uptake. A low N fertilization rate (< 50 kg N/ha) when the soil N_i was low (< 50 kg N/ha) ensured an early vigorous plant growth but did not always increase seed yields. Higher N fertilization rates may be required on soils with lower amounts of mineralizable N. *(Author's summary)* I01 D01 C01

0362

17365 VIGUE, G.T.; PEPPER, I.L.; BEZDICEK, D.F. 1981. **The effect of cadmium on nodulation and $N_2(C_2H_2)$-fixation by dry beans (*Phaseolus vulgaris* L.).** Journal of Environmental Quality 10(1):87-90. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. **Minerals and nutrients. Cd. Toxicity. Nutrient solution. Nitrogen fixation. Nodulation. Plant development. Roots. Stems. Mineral content. N. Dry matter. Analysis. Statistical analysis.**

Expt. were conducted to determine the toxicity of Cd on the nodulation, $N_2(C_2H_2)$-fixation, and growth of dry beans. Plants were grown in the greenhouse with hydroponic solutions to which 0-500 μm Cd/*l* had been added. The total N content of shoots, nodule wt., nodule no., and $N_2(C_2H_2)$-fixation were significantly decreased at 10 μm Cd/*l*. Nodulation was completely inhibited at 500 μm Cd/*l*. Nodulation and the $N_2(C_2H_2)$-fixation rate were negatively correlated with solution Cd concn. ($r = -0.97$). Cd uptake and translocation were slow; therefore, Cd levels were highest in the roots, much lower in the nodules, and lowest in the shoot tissue. For example, at 20 μm Cd/*l*, resp. tissue Cd levels averaged 431, 80, and 35 μg Cd/g, on a dry wt. basis. Cd levels in roots or shoots from comparable Cd treatments were essentially the same whether the plants obtained their N by fixation or from nutrient solution NO_3. Root Cd concn. were exponentially correlated with nodule no., nodule wt., and acetylene reduction, with correlation coefficients of -0.99, -0.99, and -0.97, resp. Shoot Cd concn. were logarithmically correlated with nodule no., nodule wt., and acetylene reduction, with correlation coefficients of -0.89, -0.91, and -0.84, resp. *(Author's summary)* I01 C02

0363

17377 TRINCHANT, J.C.; RIGAUD, J. 1981. **Acetylene reduction and respiration of bacteroids isolated from French-beans receiving nitrate.** Physiologia Plantarum 53(4):511-517. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. Nodules. Acetylene reduction. Enzymes. O. Culture media. N. Fertilizers. Roots. Nodulation. Laboratory experiments.**

The competition between combined N and N fixation in legumes was studied after a 24 h exposure of nodulated French beans to nitrate. Acetylene reduction by bacteroids was significantly inhibited, and even nitrogenase extracted from nitrate-treated plant nodules showed reduced activity. Sensitivity to nitrate was directly related to nodule age and also increased with increasing O_2 tensions in the bacteroid incubations with or without a gas phase: it was particularly marked when glucose was used in place of succinate as energy-yielding substrate. Bacteroid respiration was also depressed by nitrate treatment of the plants, leading to diminished acetylene reduction, and this effect increased with increasing O_2 concn. Added oxyleghemoglobin partly restored O_2 consumption and acetylene reduction by bacteroid suspensions. *(Author's summary)* I01 D01

See also 0281

J00 ECONOMICS AND DEVELOPMENT

0364

14765 FEIJÃO TEM diretrizes para plantio e comercialização. *(Guidelines for bean planting and commercialization).* 1978. Planejamento e Desenvolvimento 5:18-31. Port., Illus.

Phaseolus vulgaris. Marketing. Trade. Economics. Production. Brazil.

A national program for the planting and commercialization of bean crops in Brazil is reported including research priorities, technical assistance to the producer, use of improved seed, min. price policies, storage, regionalization of the product, rural credit, farm insurance and subsidies through the joint action of the Ministry of Agriculture and the Bank of Brazil. Hopefully this will assure the supply of beans between harvests since in the past, beans have been imported during times of shortage. Research aimed at increasing productivity should be oriented towards obtaining pest- and disease-free certified seed and var. that can be mechanically harvested to reduce labor contingency. Characteristics of the crop, prices, productivity, use of improved seed, and diverse problems regarding storage and marketing are discussed. The index of av. productivity of approx. 620 kg/ha could increase 25% with the use of improved seed *(Summary by I.B. Trans. by L.M.F.)* J00

0365

16416 SÃO PAULO. SECRETARIA DE AGRICULTURA E ABASTECIMENTO. 1980. Diagnóstico do feijão no Estado de São Paulo. *(Technical description of bean cultivation in the state of São Paulo).* São Paulo, Brasil. 75p. Port., Illus.

Phaseolus vulgaris. Developmental research. Economics. Production. Technology. Seed production. Plant breeding. Diseases and pathogens. Pests. Host-plant resistance. Storage. Brazil.

The following aspects of bean cultivation in São Paulo (Brazil) are analyzed: (1) Agricultural economics that includes the international situation of the product, the situation of Brazil, and the evolution of bean production in São Paulo, price behavior, economic results and operational costs, min. prices, and rural credit. (2) Production technology that consists of climatic conditions, soil conservation, harvest time, soil preparation and planting, planting distance, and amount of seed. (3) Seed production. (4) Plant improvement including the introduction of cv., lines, and species, resistance to common *(Xanthomonas phaseoli)* and fuscous blights *(X. phaseoli* var. *fuscans)*, anthracnose *(Colletotrichum lindemuthianum)*, BGMV, BCMV, and rust *(Uromyces phaseoli)*; improvement of plant growth habit, protein content, and regional trials conducted. (5) Phytosanitary control including a description of major diseases and pests and their control. (6) Technical assistance; the importance of additional technical assistance in the traditional bean-growing regions to enable improved phytosanitary control is highlighted. The training of technicians in winter bean cultivation under irrigation in recent bean-producing areas (highest production and low incidence of pests) is recommended. (7) Storage; the factors affecting the storage of beans during lengthy periods in Brazil are discussed; and (8) Aspects of production consisting of crop zonation, price and credit policies, supply of improved seed, phytosanitary control, soil management, and human resources and materials. *(Summary by I.B. Trans. by L.M.F.)* J00 D04

0366

15879 SÃO PAULO. SECRETARIA DE AGRICULTURA E ABASTECIMENTO. 1981. **Programa de feijão no Estado de São Paulo -Pró-feijão.** *(Bean program in the state of São Paulo -Pró-feijão).* São Paulo, Brasil. Port., Illus.

Phaseolus vulgaris. **Seed production. Planting. Timing. Storage. Legal aspects. Production. Economics. Brazil.**

A description is given of the assistance offered by the bean program (Pró-feijão) in the state of São Paulo (Brazil) in the following areas: production of improved seed, production technology, genetic breeding, phytosanitary control measures, technical assistance, storage, and agricultural policies. The production of improved seed, programmed for 1981, will reach a total of 250,000 sacks (50 kg each). The release of new cv. with higher yields and greater resistance (Aroana 80, Aroana, Moruna 80, Moruna, Carioca 80, and Aysó) is planned. Cultivated areas (beans during tl rainy season, the dry season, and winter) are determined and criterias for agricultural policies in the area are suggested. A list of the municipalities constituting the 3 areas indicated is given along with a map of the types of land use capacity and another on the area planted to beans cultivated during the rainy season. *(Summary by I.B. Trans. by L.M.F.)* J00

0367

16943 SÃO PAULO. SECRETARIA DE AGRICULTURA E ABASTECIMENTO. 1981. **Profeijão: programa de feijão irrigado.** *(Profeijão: irrigated bean program).* Campinas-SP, Coordenadoria de Assistência Técnica Integral. Documento Técnico no. 38. 64p. Port., Illus.

Phaseolus vulgaris. **Agricultural projects. Production. Cultivation. Climatic requirements. Irrigation. Timing. Brazil.**

Basic guidelines for bean cultivation under irrigation during the rainy season in the state of São Paulo (Brazil) are given along with the credit facilities required to establish the program in order to: (1) increase seed production; (2) increase areas cultivated under irrigation; (3) increase crop productivity from 0.6 to 3.0 t/ha/yr. The area covered, technical feasibility, phytosanitary control, socio-economic feasibility, required resources, conditions of financing, technical assistance, and the operational model are also included. A map on the area planted to beans during winter, the presentation of financing, a description of the technical project, and a list of the agricultural cooperatives of the state are annexed. *(Summary by I.B. Trans. by L.M.F.)* J00 D01

0368

17359 ALFARO A., G.; SALAZAR M., O.; VILLALOBOS M., C.L.; RODRIGUEZ G., A.G.; ALVARADO J., M.; ROJAS M., M. 1982. **Análisis económico de la producción de fríjoles en los cantones de La Cruz, Liberia y Bagaces 30 fincas, Noviembre-Diciembre a Enero-Febrero de 1982.** *(Economic analysis of bean production in the regions of La Cruz, Liberia, and Bagaces, 30 farms, November-December to January-February 1982).* San José, Costa Rica, Ministerio de Agricultura y Ganadería. Departamento de Economía y Estadísticas Agropecuarias. Boletín Técnico no. 81-82. 26p. Span., Illus.

Phaseolus vulgaris. **Production. Productivity. Costs. Income. Economics. Statistical analysis. Costa Rica.**

A survey was conducted in the regions of La Cruz, Liberia, and Bagaces in Costa Rica during 1981-82 on 30 different farms at the end of the rainy season in order to assess the advantages of the cropping system (irrigated covered beans) during the dry season. Of the whole group under study, 15 farms were cultivated by tenants and the rest by their owners. Production costs were similar - 4834 and 4836 colones, resp. Av. profit/ invested colon was 1.63 colones. Statistical analysis did not show correlation between the use of insecticides and fungicides and production. Av. yield/farm was 727 kg/ha. Selling price/kg was 17.50 colones and production cost, 6.72 colones. Tables are included on the area cultivated, type

of land tenancy, land value, av. cost of cultural operations/farm, invested capital and interests, summary of costs, income, profits, and production factors. It is indicated that Costa Rica can produce beans with less risk if they are cultivated during the dry season, taking advantage of irrigation in the province of Guanacaste. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0369

16945 SEMINARIO DE PRODUCCION DE FRIJOL EN LA REGION NOR-ORIENTAL, CATACAMAS, HONDURAS. 1978. **Informe del Seminario y recomendaciones de mesas de trabajo.** *(Workshop report and recommendations of discussion groups).* Tegucigalpa, Programa Nacional de Maíz y Fríjol del Sector Agrícola. 26p. Span.

Phaseolus vulgaris. **National programs. Developmental research. Technology. Pests. Pest control. Plant introductions. Honduras.**

On August 17-18, 1978 a workshop on bean production in the NE region was held in Honduras with the participation of delegates from 3 institutions (Secretaría de Recursos Naturales, Instituto Nacional Agrario, and the Banco Nacional de Fomento) of the public agricultural sector, responsible for carrying out the Programa Nacional de Maíz y Fríjol del Sector Agrícola (PROMYFSA), in order to (1) provide the program's personnel with updated knowledge on bean cultivation, emphasizing limiting factors; (2) inform on advances in research on a national and international level; (3) determine the advantages of new technologies compared with traditional technology, including production costs and economic analyses; and (4) select areas to initiate the program, clarify objectives, and update the needs of inputs for each region planted to beans from Sept.-Dec. Recommendations resulting from the round tables are given: (1) transfer of technology - work areas, land preparation and input requirements (improved seed, herbicides, and insecticides), observation and control of slugs, and specific recommendations (credit, inputs, personnel, and others); (2) verification of technology - definition of variables (national red bean line nursery, N-P fertilization and inoculation, chemical and mechanical weed control, assessment of production factors, CIAT-IBYAN, international climbing bean nursery, insect control, and a simple demonstrative trial comparing technologies; (3) farm credit - coordination to grant credit, control and recovery of credit, and grain storage and commercialization; (4) promotion, organization, and training of groups of the sector covered by the agrarian reform and those not covered. *(Summary by A.J.C. Trans. by L.M.F.)* J00 D00

0370

15615 WANDERLEY, M. DE N.B.; SILVA, J.F.G. DA 1981. **Cambio técnico en el sector de pequeños productores campesinos en Brasil. Diferenciación campesina y cambios tecnológicos: el caso de los productores de fríjol en São Paulo.** *(Technical change in the sector of small farm producers in Brazil. Farm discrimination and technological changes: the case of bean producers in São Paulo).* San José, Costa Rica. Instituto Interamericano de Cooperación para la Agricultura. 56p. Span., 23 Refs., Illus.

Paper presented at Proyecto Cooperativo de Investigación sobre Tecnología Agropecuaria en América Latina (PROTAAL). Documento no. 66.

Phaseolus vulgaris. **Production. History. Economics. Prices. Labour. Technology. Brazil.**

A historical analysis of the importance of small farm production in Brazil and its characteristics are given. The named socioeconomic status predominantly occupied by small farmers are analyzed, especially the one selected as the subject of future research: bean cultivation in the state of São Paulo, in particular the region of Itararé which recently underwent a process of modernization. Its location in terms of global typology, characteristics of bean production in São Paulo, agrarian structure, required labor, and organization of production are given. A methodological approach on how to conduct a case study is made, and the institutions involved and final products expected are determined. This should

contribute to reorientating agronomic research institutes pressured by the need of sudden new technological changes. *(Summary by I.B. Trans. by L.M.F.)* J00

0371

16944 SEMINARIO DE PRODUCCION DE FRIJOL EN LA REGION CENTRO-ORIENTAL, DANLI, HONDURAS. 1978. **Informe del Seminario y recomendaciones de mesas de trabajo.** *(Workshop report and recommendations of discussion groups).* Tegucigalpa, Programa Nacional de Maíz y Fríjol del Sector Agrícola. 15p. Span.

Phaseolus vulgaris. Zea mays. **Development research. Technology. Cultivation. Costs. Trade. Honduras.**

The papers presented by each discussion group of the workshop on bean production in the Central East region of Honduras are given along with work plans and specific recommendations. Objectives of the workshop were: (1) to provide the personnel of the Programa de Maíz y Fríjol del Sector Agrícola (PROMYFSA) with updated information on production constraints; (2) inform on advances in research, verification, and bean production on a national and international level; (3) inform on the advantages of new technology (production costs and economic analysis); (4) select area to initiate the program, define objectives, and update information on input requirements for each region. Recommendations of the following discussion groups are given: transfer of technology, technology verification, farm credit and promotion, organization and training of the groups covered by the agrarian reform. *(Summary by A.J.C. Trans. by L.M.F.)* J00

See also 0247 0252 0270

K00 FIELD PLOT TECHNIQUE

0372

16731 IGUE, T. 1968. **Interações em grupos de experimentos de adubação do feijoeiro com N, P e K, segundo o esquema fatorial 3 x 3 x 3.** *(Interactions in groups of NPK fertilization trials in beans using a 3 x 3 x 3 factorial design).* Tese Mag. Sc. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 82p. Port., Sum. Port., Engl., 19 Refs.

Phaseolus vulgaris. **Minerals and nutrients. N. P. K. Manures. Soils. Experiment design. Brazil.**

The importance of the interactions between N, P, and K was studied in a series of 50 fertilization trials in bean var. Creme using 3 x 3 x 3 factorial design. Trials were conducted in different sites of the state of São Paulo (Brazil) and consequently, on different soil types. These were distributed into 5 groups, classified according to soil types. Other groups were formed with trials that showed significant responses to NPK application. Each nutrient was applied in 3 doses (0, 1, and 2) expressed as 0, 30, and 60 kg N/ha; 0, 60, and 120 kg P_2O_5/ha; and 0, 45, and 90 kg K_2O/ha. All the interaction components between 2 nutrients were studied. The linear x linear component was studied for doses 0 and 1, and 0 and 2. Av. interactions were estimated for the soil groups and also for the entire series of trials at a 5% level of probability. The effects of N_1, N_2, P_1, an. P_2 were estimated for all the trials. It was concluded that interactions between 2 nutrients varied considerably among trials of the same soil group, resulting in low av. interaction. The confidence intervals for av. interactions were broad. Interaction was not significant in most cases. Significant interactions were more common when the trials were grouped according to the significant response to nutrient application. This suggests that under the current conditions of the state of São Paulo, the formation of groups of trials conducted on fertilized and unfertilized soils would be a good way of studying interactions. Significant interactions were found more frequently between P and NK. Under these exptl. conditions, which used low rates of nutrient application, interactions are not significant. *(Author's summary)* K00 D01

0373

15880 FREIRE, M.S.; ZIMMERMANN, M.J. DE O.; ZIMMERMANN, F.J.P.; OLIVEIRA, I.P. DE; SEIJAS, C.A.R.; COSTA, J.G.L. DA; FAGERIA, N.K.; WILLOX, G.E. 1976. **Manual de métodos de pesquisa em feijão.** *(Handbook of research methods in beans).* Goiania-GO, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa-Arroz, Feijão. 80p. Port., 11 Refs., Illus.

Phaseolus vulgaris. **Research. Development research. Pests. Crop losses. Soil fertility. Plant nutrition. Seed production. Brazil.**

A team of investigators of the Centro Nacional de Pesquisa de Arroz y Feijão of the EMBRAPA (Brazil) elaborated a handbook in an intent to standardize research methodologies and trials in rice and beans, thus facilitating the comparison and analysis of the results obtained. This handbook covers the general topics of exptl. procedures (exptl. design and statistical analysis), plant breeding, evaluation of diseases and crop losses, soil

fertility and plant nutrition, studies on seed technology, and expt. recording. The aspects included under these topics are discussed in detail. *(Summary by A.J.C. Trans. by L.M.F.)* K00

0374

16003 NUÑEZ C., G.; VALVERDE S., C. 1981. **Eficiencia de uso del nitrógeno y fósforo por el cultivo del fríjol, con fertilizantes isotópicamente marcados.** *(Efficiency of the use of nitrogen and phosphorus by bean crops with labelled fertilizers).* Lima, Perú, Ministerio de Agricultura. Estación Experimental Agrícola La Molina. Informe Especial no. 11. 21p. Span., 17 Refs., Illus.

Phaseolus vulgaris. N. P. Trace: **Fertilizers. Yields. Mineral content. Analysis. Experiment design. Peru.**

Expt. were conducted at the Estación Exptl. Agrícola La Molina (Peru) during the 1973-74 planting cycles in order to study the efficiency of bean var. Canario Divez 8120 in using N and P fertilizers. In expt. 1, a randomized complete block design was used with 6 replications and 9 treatments to study the efficiency of P utilization (simple superphosphate labelled with P^{33}) with different methods of application at rates of 80 kg/ha and the effect of N (urea labelled with N^{15}) at low rates (30 and 100 kg/ha) on P utilization and viceversa. In expt. 2, a randomized complete block design was used with 5 replications and 13 treatments to study the effects of N rates (urea labelled with N^{15}) of 15, 30, 60, and 120 kg/ha, applied at planting and in different growth stages on the efficiency of fertilizer utilization and on yield. In the former expt. it was observed that N did not cause significant effects on bean yield regarding the different methods of applying P. The efficiency of P utilization was higher for the treatment where N and P were broadcasted and incorporated at a depth of 8 cm. P absorption was min. even for the best treatment (9.02%). In the latter expt. inoculation produced a nonsignificant increase in yield but, on the other hand, economically positive. N application at high rates (120 kg/ha) at planting with or without inoculum caused a rapid recovery of N in the bean and canopy (11.69 and 12.33 kg/ha and 8.86 and 7.94 kg/ha,resp.) but a low efficiency in N utilization (9.74 and 10.27% and 7.38 and 6.62%, resp.) compared with low rates (15 and 30 kg N/ha) at flowering with low recovery (4.12 and 5.0 kg/ha and 1.28 and 2.51 kg/ha, resp.) but a higher efficiency of utilization (27.46 and 16.67% and 8.53 and 8.37%, resp.). The absorption of N was directly related to the rate applied. At higher rates of N, inoculation was less effective. *(Summary by A.J.C. Trans. by L.M.F.)* K00 D01

See also 0246 0255 0264 0280 0306 0345

L00 GRAIN STORAGE

0375

16785 TANAKA, M.A.S.; CORREA, M.U. 1981. **Influência de *Aspergillus* e *Penicillium* no armazenamento de sements de feijão (*Phaseolus vulgaris* L.).** *(Influence of Aspergillus and Penicillium on stored bean seeds).* Fitopatologia Brasileira 6:451-456. Port., Sum. Fort., Engl., 7 Refs.

Phaseolus vulgaris. Aspergillus sp. *Penicillium* sp. **Inoculation. Disease control. Storage. Seed.**

The influence of *Aspergillus* spp. and *Penicillium* spp. on the germination and vigor of bean seeds stored for 16 mo. and the effects of seed treatment with captan and carbendazim before storage were studied. The results of germination tests taken at 60-day intervals showed no differences among the treatments until 4 mo. of storage. After 6 mo. the best treatment was obtained with seeds treated before inoculation with *Penicillium*. Results of vigor tests showed that conditions were excessively adverse to the seeds (high moisture and high temp.), and differences among treatments were detected only during the 4th mo. of storage. At the end of the storage period, all the treatments had the same 0 (zero) germination value and emergence decreased 16 and 21% in seeds inoculation with *Aspergillus* or *Penicillium*, resp. whereas emergence increased 33 and 31% in seeds treated with *Penicillium* + carbendazim and *Penicillium* + captan, resp. For treatments *Aspergillus* + captan and *Aspergillus* + carbendazim emergence were increased 25 and 18%, resp. These observations showed that *Aspergillus* and *Penicillium* may cause deterioration of stored bean seeds, and that seed treatment with captan and carbendazim before storage may be favorable. *(Author's summary)* L00 F03

0376

16764 VALLE DE MEJIA, I. DEL 1981. **Efecto de diferentes condiciones de almacenamiento sobre el desarrollo de la dureza del fríjol.** *(Effect of different storage conditions on the development of bean hardness).* *In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.1-A, pp.SFF6-1-SFF6-20. Span., 23 Refs., Illus.

Phaseolus vulgaris. **Storage. Seeds. Deterioration. Seed color. Temperature. Timing. Tannin content. Water content. Enzymes. Cooking.**

The effect of storage in black bean var. Suchitán and red bean Rojo de Seda (MC of 9, 13, and 17%) during 2, 4, and 6 mo. at 4, 20, and 36°C and different mixtures of CO_2 and O_2 on bean hardness, bean MC, and water absorption, cooking time, tannin content, and polyphenol oxidase enzyme activity is studied. Storage time increased both bean hardness and cooking time. However, hardness and cooking time do not correlate significantly, suggesting that these 2 characteristics are of different nature: the 1st, related to the seed coat and the 2nd, to biochemical factors of the endosperm. At higher temp. and higher storage moisture, bean cooking time was longer; moreover, high humidity (17%) favored fungal development. There was a negative and significant correlation between bean hardness and the coefficient of water absorption. Beans required longer cooking time when stored in

an O_2-enriched atmosphere in comparison with a CO_2 atmosphere, indicating that hardness is an oxidative process. Tannin content decreased with storage time, especially at high temp. In the case of black beans, this decrease occurred along with an increase in polyphenol oxidase activity. Observations showed that red var. underwent more changes during storage. It is recommended to: (1) store beans with the lowest MC possible; (2) the storage site should be dry and ventilated; and (3) when possible, the exposure of stored beans to O_2 should be avoided. *(Summary by A.J.C. Trans. by L.M.F.)* L00

0377

17321 MORA C., M. 1980. **Efecto de la humedad y temperatura sobre el endurecimiento de fríjol (*Phaseolus vulgaris* L.) almacenado durante seis meses.** *(Effect of moisture and temperature on the cooking time of beans stored for six months).* Agronomía Costarricense 4(2):195-197. Span., Sum. Engl., 3 Refs.

Phaseolus vulgaris. Storage. Water content. Cooking. Timing. Laboratory experiments. Costa Rica.

Cooking times for dry black beans stored during 6 mo. at 15, 20, and 25°C and 9.3, 13.0, and 15.4% MC were measured. Except for a slight increase in cooking time for beans stored at 25°C and 15.4% MC after 6 mo. storage, no other change was noted. A fairly constant difference between the time needed to reach 90 and 100% soft beans was found during the cooking tests. Under the tested conditions, cooking time was considerably reduced when samples were soaked overnight. More research is required to establish safe storage conditions for different bean cv. and storage time. *(Author's summary)* L00 H01

L01 Stored Grain Pests

0378

16912 LEROI, B.; JARRY, M. 1981. **Relations d'*Acanthoscelides obtectus* avec différentes espèces de *Phaseolus*: influence sur la fécondité et possibilités de développement larvaire.** *(Relationships between Acanthoscelides obtectus and different species of Phaseolus: influence on fecundity and possibilities of larval development).* Entomologia Experimentalis et Applicata 30(1):73-82. Fr., Sum. Fr., Engl., 20 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Acanthoscelides obtectus. **Host-plant resistance. Seeds. Seed coat. Plant injuries. Insect biology. Host range. Statistical analysis. Laboratory experiments.**

The presence of pods and seeds of 6 species of *Phaseolus* induced significant egg-laying in *Acanthoscelides obtectus* and strongly stimulated ovarian production. However, the best performances were not observed with *P. vulgaris*, the common host, but with *P. coccineus*. For all 6 species, the seed testa was an important barrier against larval penetration. For some wild species, it gave total protection of the seed, but this protection was reduced with domestication in *P. vulgaris*. For all species, when the seeds were artificially perforated, larvae (1/seed) penetrated easily. Most of the larvae could complete their development in seeds of *P. coccineus* and *P. vulgaris*, but only a small proportion of the larval population could develop in seeds of *P. metcalfei* and *P. acutifolius*. Thus certain Phaseolinae seeds stimulate egg-laying without allowing larval growth. F_1 females reared in *P. coccineus* had a superior reproductive capacity than those reared in *P. vulgaris*. *P. coccineus* could be considered as one of the original host plants of *A. obtectus*. *(Author's summary)* L01 F00

0379

16493 WIENDL, F.M. 1969. **Alguns usos e efeitos das radiações gama em *Zabrotes subfasciatus* (Boh., 1833)** *(Coleoptera, Bruchidae).* [*Some uses and effects of gamma radiation on Zabrotes subfasciatus (Coleoptera, Bruchidae)*]. Tese Eng. Agr. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 167p. Port., Sum. Port., Sk., Engl., 241 Refs., Illus.

Phaseolus vulgaris. Zabrotes subfasciatus. **Insect control. Irradiation. Seeds. Plant injuries. Laboratory experiments. Brazil.**

The sterilizing and lethal effects of γ radiation on *Zabrotes subfasciatus* were studied. With a dose rate of 19.5 krad/h, eggs did not hatch if irradiated with 2 krad nor did larvae and pupae with 5 and 10 krad, resp. In adults 10 krad caused total sterilization. With a dose rate of 105 krad/h, the lethal dose for adults was 350 krad, causing death within 24 h. A method denominated the "sterile part technique" was used. It consisted of irradiating part of the grains (and consequently sterilizing the existent insects); after mixing these with nonirradiated grains, a reduction or extinction of the reproductive capacity of the insects occurred. The dose rate used in this technique was 35 krad/h. Infestation was stabilized between the 20-30th day, in a mixture of 75 and 25% irradiated and nonirradiated grains, resp. The "sterile male technique" was also assessed. It was concluded that this method is not adequate for controlling *Z. subfasciatus*. *(Author's summary)* L01

16494 WALDER, J.M.M. 1974. **Alguns efeitos da radiação gama em *Callosobruchus maculatus* (Fabr., 1792) (Coleoptera, Bruchidae).** [*Some effects of gamma radiation on Callosobruchus maculatus (Coleoptera, Bruchidae)*]. Tese Eng. Agr. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 69p. Port., Sum. Port., Engl., 37 Refs., Illus.

Phaseolus vulgaris. Callosobruchus maculatus. **Irradiation. Insect biology. Insect control. Oviposition. Laboratory experiments. Brazil.**

The effect of γ radiation from a Co^{60} source on *Callosobruchus maculatus* was studied. Expt. showed that at a dose rate of 9820 ± 300 rad/h the LD_{100} of embryos, larvae, and pupae were 2.2, 3.0, and 22.8 krad, resp. Total sterilization of adults resulted when irradiated at the pupal stage at 5 krad. The sterilizing dose for adults was 8 krad at a calculated dose rate of 57,630 ± 5000 rad/h; whereas the LD_{100} was 330 krad at a dose rate of 63,650 ± 1500 rad/h. The no. of eggs laid decreased with the radiation dose. Longevity tended to increase in females and diminish in males as a result of radiation. *(Author's summary)* L01 F00

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

Z00 GENERAL

0381

16483 EVANS, L.S.; CURRY, T.M.; LEWIN, K.F. 1981. **Responses of leaves of *Phaseolus vulgaris* L. to simulated acidic rain.** New Phytologist 88:403-420. Engl., Sum. Engl., 33 Refs., Illus.

Phaseolus vulgaris. **Air pollution. pH. Leaves. Nutrient loss. Plant injuries. Rainfall.**

Relative rates of nutrient penetration, nutrient leaching, and cell permeability of 1st trifoliate leaves of *Phaseolus vulgaris* cv. U. of Idaho 111 were examined after exposure to simulated acidic rain. In buffer solutions $^{35}SO_4^{2-}$ penetrated leaves faster at pH 2.7 than at 5.7. In contrast, $^{86}Rb^+$ pervaded fastest at pH 5.7, and ^3H_2O entered foliage at similar rates at all pH levels tested. When plants were exposed to simulated rains of various pH levels, Ca, nitrate, and sulphate were preferentially leached from whole leaves by rainfalls of low pH, whereas K and chloride leached more at pH 5.7 and 3.4 compared with 2.7 and 2.9. Isotope tests indicated that cells within leaves were more permeable to $^{35}SO_4^{2-}$ and ^3H_2O and less permeable to $^{86}Rb^+$ at pH 2.7 than at higher pH levels. These results suggest a wide diversity of leaf and cell permeability responses to various ions after exposure to acidic rain. In general, an increased rate of nutrient leaching at more acidic levels was correlated with a lower adaxial leaf resistance during leaf development. *(Author's summary)* Z00

0382

15817 ABRAHÃO, I.O. 1975. **Cristalogênese do cloreto de cobre: efeito de extratos de sementes de feijoeiro (*Phaseolus vulgaris* L.).** *(Crystallization of copper chloride: effect of bean seed extracts).* Anais da Escola Superior de Agricultura Luiz de Queiroz 32:695-704. Port., Sum. Port., Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Seeds. Analysis.**

Crystallization models of copper chloride obtained in the presence of bean seed extracts in 11 crystallization series, replicated 5 times, are studied and compared. The sources of variation considered are 3 bean var. (Roxinho, Pintado, Preto), 2 sources (soil and nutrient solution), 2 extracting procedures (dry and wet seeds), and 3 concn. of copper chloride (0.05:0.5, 0.025:0.5, and 0.025:0.75). Copper chloride yields specific and characteristic crystallization models for bean seed extracts. The effects of var. and source were less pronounced, allowing some characters to be observed. *(Author's summary)* Z00

AUTHOR INDEX

BAWI, G.S.
0308

ABBOUD, S.
0210

ABRAHAO, I.O.
0382

ABRAHAO, J.I.M.
0274

ALESCHLIMANN A., J.
0278

AFANADOR, E.
0289

AGUDELO, D.
0287

AGUILERA A., M.R.
0263

AJIMURA, G.M.
0254

AL-MUKHTAR, F.A.
0344

ALADRO, R.
0348

ALEXANDER, G.V.
0220

ALFARO A., G.
0368

ALFARO M., R.
0349

ALVARADO J., M.
0368

ALVAREZ C., E.
0284

AMARAL, F. DE A.L. DO
0219

ANDO, A.
0298

ANDRADE, A.G. DE
0215

ANDREWS, D.J.
0206

ANTUNES, I.F.
0247

ANTUNES, P.L.
0354

APAYA V., R.
0248

ARNY, A.C.
0204

ARROYO, M.
0327

BADILLO-FELICIANO, J.
0259

BARNETT, D.
0316

BARRETO, A.C.
0271

BARRETO, B.A.
0243

BARRETO, P.D.
0264

BASSETT, M.J.
0343

BASTIDAS, G.
0287

BECZNER, L.
0316

BEEBE, S.
0339

BEEBE, S.E.
0289

BERGAMASCHI, H.
0314

BERGER, R.D.
0306

BEVERSDORF, W.D.
0303

BEZDICEK, D.F.
0362

BINGHAM, G.E.
0321

BOETTGER, M.A.
0347

BOLLINI, R.
0235

BOS, L.
0316

BREUKELEN, E.M. VAN
0291

BRIARTY, L.G.
0224

BROWNE, T.
0237

BRUNE, W.
0248

BURNS, R.
0340 0351

BURUCHARA, R.A.
0292

CAFATI K., C.
0290

CARDOSO, A.A.
0245 0248 0283

CARRIJO, I.V.
0312

CARVALHO, M.T.V.
0233

CASTANEDA, P.
0327

CASTILLO L., J.J.
0253

CASTRO, P.R.C.
0229

CATTINI, M.A.
0212

CAVALCANTE, R.D.
0326

CENTRO INTERNACIONAL
DE AGRICULTURA TROPICAL
0341

CHAVES, G.M.
0312

CIGNA, J.A.
0347

CONDE, A.R.
0268

CORREA, F.J.
0269

CORREA, M.U.
0375

COSTA, J.A.
0213

COSTA, J.G.C. DA
0257

COSTA, J.G.L. DA
0373

COYNE, D.P.
0276 0296 0335 0344

COYNE, P.I.
0321

CRAKER, L.F.
0272

CROCOMO, O.J.
0209 0215 0226 0233 0352

CROSIER, D.C.
0308

CROWLEY, J.
0261

CURRY, T.M.
0391

DAVIES, H.M.
0239

DAVIS, D.D.
0323

DAVIS, J.
0291 0346

DAVIS, R.F.
0318

DELAZARI, P.C.
0252

DELMER, D.P.
0239

DERBYSHIRE, E.
0235

DEUBER, R.
0258

DEVAY, J.E.
0241

DEY, P.M.
0300

DIAZ D., A.
0253

DICKSON, M.H.
0347

DIXON, R.A.
0237 0300

DRION, A.
0337

DURON A., E.
0324

EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA.CENTRO NACIONAL DE PESQUISA-ARROZ,FEIJAO
0244

EMPRESA DE ASSISTENCIA TECNICA E EXTENSAO RURAL DO ESTADO DE ALAGOAS
0266

ENOK, H.
0229

ESCALANTE E., L.E.
0242

EVANS, L.S.
0381

FAGERIA, N.K.
0251 0373

FELIX, J.F.
0357

FELLER, U.
0238

FERNANDES, M.I.D.
0325

FERRAZ, H. DE M.
0313

FONTES, L.A.N.
0245 0268

FORNASIERI FILHO, D.
0313

FOUGEROUX, A.
0320

FRAILE, A.
0307

FREIRE, M.S.
0373

FUCIKOVSKY Z., L.
0310

FUNDACAO INSTITUTO AGRONOMICO DO PARANA
0342

GALVAO, J.D.
0268

GAMEZ, R.
0315

GANTOTTI, B.V.
0293

GARCIA-ARENAL, F.
0307

GARCIA, S.
0281

GARDINER, T.R.
0272

GEPTS, P.
0336

GIACOMELLI, W.J.
0298

GINOUX, J.P.
0320

GOMEZ, M.
0360

GONZALEZ A., M.
0348

GONZALEZ W., M.F.
0207

GRAHAM, P.
0281

GREEF, J. DE
0223

GREEF, J.A. DE
0214

GREIG, J.K.
0236

GUAMAN J., R.W.
0270

GUAZZELLI, R.J.
0247

HAGEDORN, D.
0316

HAGEDORN, D.J.
0304

HAMPTON, R.
0316

HAMPTON, R.D.
0318

HANCHEY, P.
0299

HANNA, A.A.
0335

HARDWICK, R.C.
0206

HASSELBACH, D.L.
0267

HEATH, M.C.
0311

HEDGE, D.M.
0265

HEGDE, R.K.
0297

HERNANDEZ V., C.
0260

HIREMATH, R.V.
0297

HU, G.K.H.
0273

HUGHES, P.R.
0331

HUNTER, J.
0308 0347

HYMES, W.L.
0255

IGUE, T.
0372

INHOFF, M.W.
0309

INOUYE, T.
0316

JACQUA, G.
0320

JARRY, M.
0376

JENKINS, J.I.
0216

JONES, R.G.W.
0221

KAHN, B.A.
0255

KAPLAN, L.
0201 0202

KATHERMAN, M.J.
0302

KATUNDU, J.M.
0339

KEMP, G.A.
0359

KENNING, L.A.
0299

KIMATI, H.
0265

KINYUA, G.K.
0291

KITAJIMA, E.W.
0315

KLEINKOPF, G.E.
0361

KLUTHOUSKI, J.
0247 0251

KNECHT, G.N.
0232

KOGAN A., M.
0256

KORBAN, S.S.
0276 0335

KRZYZANOWSKI, F.C.
0279

LAZARTE S., W.H.
0269

LEGGETT, G.E.
0361

LEIDI, E.O.
0360

LEONARD, K.J.
0309

LEROI, B.
0378

LEWIN, K.F.
0381

LIMA FILHO, J.M.P.
0213

LIN, M.T.
0315

LOPEZ G., R.
0329

LOPEZ, R.
0324

LUGO-LOPEZ, M.A.
0259

LYNAM, J.
0345

MACLEOD, R.D.
0222

MAIN, C.E.
0309

MANGUAL C., G.
0260

MARCOS FILHO, J.
0275

MARRERO, H.
0348

MARTINOTTO, V.
0243

MAZIER, C.
0324

MCGINNIS, J.
0353

MCNAUGHTON, M.E.
0305

MEINERS, J.
0316

MEINERS, J.P.
0339

MENTEN, J.O.M.
0298

MESSIAEN, C.M.
0320 0357

METZLER, J.T.
0322

MILLER, C.A.
0323

MILLS, D.
0294 0295

MONTEIRO, A.A.T.
0248

MORA C., M.
0377

MORRIS, A.J.
0301

MUIGAI, S.G.S.
0267

MUJEEB, K.A.
0205 0236

MUKUNYA, D.M.
0291

MULLER, H.P.
0233

MUNSON, R.D.
0232

MURPHY, D.L.
0300

MUSIL, M.
0316

MUZILLI, O.
0250

NAGARAJA, K.V.
0240

NAITO, K.
0227

NAKAMURA, K.
0285

NELSON, W.L.
0232

NEPTUNE, A.M.L.
0217

NOLAN, W.G.
0211

NUNEZ C., G.
0374

NUNES, J.C.
0314

O'LEARY, J.W.
0230

OHATON, M.
0357

OGUCHI, T.
0293

OLIVEIRA, E.T. DE
0254

OLIVEIRA, I.P. DE
0373

OLIVEIRA, J.V. DE
0325

PADDICK, L.F.
0352

PASTOR C., M.A.
0289 0292

PATIL, S.
0293

PATRICK, J.W.
0219

PATWARDHAN, M.V.
0240

PENA G., M.A.
0262

PEAIRS, F.
0324

PELL, E.J.
0322

PEPPER, I.L.
0362

PEREIRA, A.A.
0312

PESSANHA, G.G.
0283

PETERS, J.F.
0209 0226 0352

PFENDER, W.F.
0304

PIERRE, D.
0328

PLAUT, J.L.
0306

POLYA, G.M.
0231

POMPEU, A.S.
0282

PONS, A.L.
0243

PORTER, L.K.
0361

POSPIESZNY, H.
0318

POTTER, J.E.
0331

POZSAR, B.I.
0225

PRENDEVILLE, G.M.
0261

PROFT, M. DE
0214 0223

PROVVIDENTI, R.
0308

QUANT, R.
0295

QUINTERO C., R.
0317

RASCHE, F.
0286

REDDY, P.P.
0319

RENNIE, R.J.
0359

RHEENEN, H.A. VAN
0267

RIGAUD, J.
0363

ROCHA, J.A.M.
0247

RODRIGUEZ F., M.T.
0333

RODRIGUEZ G., A.G.
0368

ROJAS K., M.
0368

ROMAN V., A.
0346

ROMAN, A.
0281

ROMNEY, E.M.
0220

ROY, R.M.
0210

RUDOLPH, K.
0286

RUSCHEL, A.P.
0350

SAGASTA, E.M.
0307

SAITO, S.M.T.
0358

SALAZAR M., O.
0368

SALGUERO, V.
0338

SALSAC, L.
0357

SANCHEZ, A.L.
0313

SANDSTED, R.F.
0255

SAO PAULO.SECRETARIA DE
AGRICULTURA E ABASTECIMIENTO
0365 0366 0367

SARKAR, A.N.
0271

SARTORATO, A.
0247 0277

SATISCHANDRA, K.M.
0297

SCHUSTER, M.L.
0296

SCHWARTZ, H.F.
0302

SCOTT, T.W.
0259

SECCHI, V.A.
0243

SEDIYAMA, C.S.
0283

SEIJAS, C.A.R.
0373

SEMINARIO DE PRODUCCION DE FRIJOL
EN LA REGION CENTRORIENTAL,
DANLI,HONDURAS
0371

SEMINARIO DE PRODUCCION DE FRIJOL
EN LA REGION NORORIENTAL,
CATACAMAS,HONDURAS
0369

SERPA, J.E.S.
0268 0271

SGARBIERI, V.C.
0354

SHARMA, S.R.
0319

SHARP, W.R.
0209 0226 0352

SHEPARD, M.
0334

SILBERNAGEL, M.
0318

SILVA, C.C. DA
0283

SILVA, H.T. DA
0208

SILVA, I.P. DA
0325

SILVA, J.C.
0283

SILVA, J.F.G. DA
0370

SILVEIRA, P.M. DA
0247 0254

SINGH, D.B.
0319

SMITH, D.A.
0301

SOBRAL, L.F.
0246

SOLORZANO V., R.
0203

STEINMETZ, F.H.
0204

STERLING R., F.
0273

STOFFELLA, P.J.
0255

STONE, L.F.
0254

SUGE, H.
0249

SUHET, A.R.
0217

SUNDSTROM, F.J.
0356

SUZUKI, H.
0227

SZABO, L.J.
0294

TANAKA, M.A.S.
0375

TEGENKAMP, I.
0352

TEGENKAMP, T.
0352

TEIXEIRA, M.G.
0247

TEMPLE, S.
0261

THIEBAUT, J.T.L.
0245

THOMPSON, A.
022

THUNG, M.D.T.
0302

TRINCHANT, J.C.
0363

TU, J.C.
0303 0305

TULMANN NETO, A.
0298

TURVEY, P.M.
0216

URBEN FILHO, G.
0245

VALLE DE MEJIA, E. DEL
0376

VALVERDE S., C.
0374

VANDERMOLEN, G.E.
0241

VANEGAS G., G.
0284

VERDUGO G., F.
0310

VERDUSTRAETE, F.
0223

VICTORIA K., J.I.
0284

VICTORIA, J.I.
0237

VICTORIA, R.L.
0355

VIEIRA, C.
0245 0248 0283

VIEIRA, R.F.
0277

VIGUE, G.T.
0362

VILLALOBOS M., C.L.
0368

VITALE, A.
0235

VOLPE, J.
0294

VUYSEST, O.
0350

WADDILL, V.
0334

WALDER, J.M.M.
0380

WALLACE, A.
0220

WANDERLEY, M. DE N.B.
0370

WARD, M.
0237

WARDROP, A.J.
0231

WEBER, Z.
0313

WEIHING, J.L.
0276 0335

WEINSTEIN, L.H.
0331

WESTERMANN, D.T.
0361

WESTPHALEN, S.L.
0314

WHATLEY, J.M.
0221

WHITEHEAD, I.M.
0101

WIENOL, F.M.
0379

WILHELM, J.
0234

WILHELMOVA, N.
0234

WILLOX, G.E.
0373

WOOLHOUSE, H.W.
0216

WRENSCH, D.L.
0332

WRONA, A.F.
0241

YOKOYAMA, M.
0227 0247

YOUNG, S.S.Y.
0332

ZIMMERMANN, F.J.P.
0373

ZIMMERMANN, M.J. DE O.
0373

SUBJECT INDEX

ABSCISSION
LEAVES
0242

ACANTHOSCELIDES OBTECTUS
0275
HOST-PLANT RESISTANCE
0378

ADAPTATION
CULTIVARS
0249 0280 0283 0341 0342 0345 0349
0350

AFRICA
0267 0291 0330

AGRICULTURAL EQUIPMENT
0254
HARVESTING
0244
PLANTING
0244

AGRICULTURAL LIME
0243 0342
FERTILIZERS
0250 0358
PH
0250

AGRICULTURAL PROJECTS
0367

AGRONOMIC CHARACTERS
0203 0204 0207 0208 0242 0257 0263
0270 0281 0337 0340 0341 0343 0344
0346 0351 0359

AIR POLLUTION
PLANT INJURIES
0331 0361
OZONE
0321

ALUMINIUM
PH
0250 0251
PHOSPHORUS
0250

AMINO ACIDS
0353
ANALYSIS
0212 0236 0238 0354
LEAVES
0212 0236 0238
SEED
0236 0238 0248 0354

ANIMAL NUTRITION
0353

APHIS FABAE
0267

APION GODMANI
HOST-PLANT RESISTANCE
0338

APION SP
0338

ASIA
0265

ASPERGILLUS SP
0375

AUXINS
GROWTH
0209 0226 0231
PLANT DEVELOPMENT
0209 0226

BACTERIOSES
0284 0288 0294 0295 0367
DISEASE CONTROL
0244 0267 0277
HOST-PLANT RESISTANCE
0285 0287 0289 0290 0291 0293 0296
0342
INOCULATION
0289 0290 0292 0293
ISOLATION
0286

BEAN COMMON MOSAIC VIRUS
0317
HOST-PLANT RESISTANCE
0287 0339
PLANT BREEDING
0287 0339
VIRUS TRANSMISSION
0277

BEAN GOLDEN MOSAIC VIRUS
0317
HOST - PLANT RESISTANCE
0314 0342

BEAN RUGOSE MOSAIC VIRUS
0315 0317

BEAN SOUTHERN MOSAIC VIRUS
0317

BEMISIA TABACI
0313

BOLIVIA
0263

BIOCHEMISTRY
0216 0231 0233 0235 0237 0238 0239
0240 0286 0288 0294 0295 0318

BRAZIL
0208 0212 0217 0219 0243 0244 0245
0246 0247 0248 0250 0252 0254 0258
0259 0264 0266 0268 0271 0274 0275
0277 0279 0282 0283 0285 0290 0298
0313 0314 0315 0325 0326 0342 0358
0365 0366 0367 0370 0372 0373 0379
0380

CALCIUM
0210 0250
LEAVES
0258

CALLOSOBRUCHUS MACULATU
INSECT BIOLOGY
0380
INSECT CONTROL
0380

CANOPY
0272

CARBON DIOXIDE
0230
LIGHT
0215
PHOTOSYNTHESIS
0215

CARBON FIXATION
0215 0225

CELL STRUCTURE
0224 0228 0240 0241 0261 0299

CHILE
0207 0256 0278

CHLOROPLASTS
0211 0216 0228 0234

CHLOROSIS
0291

CHROMOSOMES
0205 0294 0352

CLIMATIC REQUIREMENTS
0201 0208 0215 0243 0244 0245 0263
0272 0277 0345 0357 0367
TEMPERATURE
0203 0206 0211 0247 0359

CLIMBING BEANS
0346

COLEOPTERA
0267 0326 0334 0338 0378 0379 0380
LEAVES
0329 0331
PODS
0328
SEED
0275

COLLETOTRICHUM LINDEMUTHIANUM
0300
DISEASE CONTROL
0267 0277 0305
HOST-PLANT RESISTANCE
0237 0281 0282 0305 0339 0342 0346
PLANT BREEDING
0281 0282 0339 0342 0346
RACES
0305

COLOMBIA
0203 0253 0281 0284 0287 0288 0289
0292 0294 0302 0336 0340 0341 0345
0346 0350 0351

COMPOSITION
0217 0233 0242 0256 0257 0327
MINERAL CONTENT
0212 0219 0220 0221 0258 0360 0361
0362 0374
PHENOLIC CONTENT
0376
PROTEIN CONTENT
0212 0225 0235 0236 0238 0248 0258
0353 0354
WATER CONTENT
0213 0376 0377

COOKING
0353 0376 0377

CORYNEBACTERIUM FLACCUMFACIENS
HOST-PLANT RESISTANCE
0296

COSTA RICA
0273 0349 0368 0377

COSTS
0247 0271 0368 0371

COTYLEDONS
0223 0224 0239
GERMINATION
0238

CROP LOSS
0302 0303 0373
PLANT INJURIES
0241 0249 0261 0274 0299 0313 0327
0329 0330 0331 0333

CUBA
0348

CULTIVARS
0201 0202 0207 0215 0219 0233 0242
0244 0247 0251 0252 0255 0256 0257
0259 0262 0263 0270 0274 0276 0278
0284 0289 0291 0293 0305 0308 0310
0312 0313 0325 0335 0348 0353 0357
0359 0361
ADAPTATION
0249 0280 0283 0341 0342 0345 0349
0350
GERMPLASM
0208 0281 0282 0287 0290 0303 0338
0345 0346 0349 0351
IDENTIFICATION
0203 0204 0285 0304 0314
PLANT INTRODUCTIONS
0290 0338 0341 0350

CULTIVATION SYSTEMS
0266 0267 0268 0269 0270 0271 0272
0273 0281 0346

CULTURE MEDIA
0209 0222 0226 0237 0240 0303 0305
0352 0363

CYTOGENETICS
0352

CYTOKININS
0225 0227 0231

CYTOLOGY
0218 0224 0227 0228 0240 0241 0261
0299 0322 0352

DEFICIENCIES
MINERAL DEFICIENCIES
0212 0251

DETERIORATION
0275 0376

DEVELOPMENTAL STAGES
0205 0208 0230 0242 0253 0255 0270
0325 0361
BRANCHING
0206
GERMINATION
0274 0275 0313
MATURATION
0344

DIPTERA
0313 0330

DISEASE CONTROL
0243 0262 0324
BACTERIOSES
0244 0267 0277
MYCOSES
0244 0247 0267 0277 0297 0302 0303
0305 0310 0375
VIROSES
0244 0277

DISEASE TRANSMISSION
SEED TRANSMISSION
0277 0284 0310 0318
VIROSES
0277 0313 0318

DROUGHT
0249

DRY MATTER
0207 0219 0242 0257 0327 0362

DWARF BEANS
0346

ECOLOGY
0201 0203 0204 0281 0356 0357 0358
0359 0363

ECONOMICS
0247 0252 0262 0269 0270 0271 0365
0366 0367 0368 0370

EMPOASCA KRAEMERI
HOST-PLANT RESISTANCE
0342
INSECT BIOLOGY
0325

ENZYMES
0215 0235 0237 0238 0239 0240 0300
0354 0356 0357 0363 0376

EPILACHNA VARIVESTIS
INSECT BIOLOGY
0331
BIOLOGICAL CONTROL
0314

EPIPHYTOLOGY
0296

ERYSIPHE POLYGONI
DISEASE CONTROL
0267

CHEMICAL CONTROL
0322

EUROPE
0337 0357

EXPERIMENT DESIGN
0241 0242 0246 0253 0255 0262 0263
0264 0292 0329 0350 0372 0374

FERTILIZERS
0231 0245 0246 0248 0250 0252 0262
0266 0356 0357 0358 0361 0363 0374

FOOD CROPS
0257

FUSARIUM SOLANI PHASEOLI
HOST-PLANT RESISTANCE
0361

GENES
0291 0308 0335 0339 0343 0344

GERMINATION
0214 0238 0273 0274 0275 0276 0279
0313

GERMPLASM
0279 0281 0282 0287 0290 0296 0303
0318 0320 0336 0338 0340 0345 0346
0349 0351

GIBBERELLINS
0279

GROWTH
0209 0213 0213 0220 0226 0230 0231
0360 0360
LIGHT
0276
MINERALS AND NUTRIENTS
0212 0217 0219 0232 0248 0362
TEMPERATURE
0203 0206 0359

GUATEMALA
0329 0334

HARVESTING
0244 0263 0266 0277 0280 0335

HEAT TREATMENT
0354

HERBICIDES
0256 0353
PLANT INJURIES
0261

HETEROSIS
0335

HISTORY
0202 0373

HOMOPTERA
0325 0342

HONDURAS
0324 0333 0369 0371

HUMAN NUTRITION
0243

HYBRIDIZING
0321 0336 0337 0343 0345 0347

HYBRIDS
0335 0337

INCOME
0247 0252 0269 0270 0368

INDOLEACETIC ACID
0229 0226 0231

INHIBITORS
0216 0354
GROWTH
0231

INJURIOUS INSECTS
0243 0244 0334
COLEOPTERA
0267 0275 0326 0328 0329 0331 0334
0339 0378 0379 0380
DIPTERA
0313 0355
HOMOPTERA
0325 0342
LEPIDOPTERA
0257

INJURIOUS MITES
0327
TETRANYCHUS TELARIUS
0332

INOCULATION
0289 0290 0292 0293 0299 0301 0306
0311 0312 0316 0319 0347 0355 0356
0375

INTER-CROPPING
0265
CASSAVA
0269
ZEA MAYS
0266 0267 0268 0270 0271 0272 0281
0324

IRON
0217

IRRADIATION
0295 0210 0236 0275 0353 0379 0380

IRRIGATION
0247 0251 0254 0314 0367

ISARIOPSIS GRISEOLA
DISEASE CONTROL
0267 0277
HOST-PLANT RESISTANCE
0346
PLANT BREEDING
0346

LEAF AREA
0207 0213 0242 0257 0272 0329

LEAVES
0205 0211 0213 0215 0216 0220 0223
0224 0225 0226 0227 0228 0230 0231
0234 0236 0238 0239 0242 0249 0261
0272 0322 0323 0327 0332 0343 0360
0381
DISEASES AND PATHOGENS
0241 0291 0292 0293
INJURIOUS INSECTS
0329 0331
MINERALS AND NUTRIENTS
0212 0219 0258

LEPIDOPTERA
0267

LIGHT
0215 0234 0256 0321
GROWTH
0272

MACROPHOMINA PHASEOLI
DISEASE CONTROL
0297

MAGNESIUM
PLANT ASSIMILATION
0250 0258

MANURES
0372

MATURATION
0234 0263 0344

MECHANICAL DAMAGE
0274 0335

MELOIDOGYNE INCOGNITA
0319
HOST-PLANT RESISTANCE
0320

METABOLISM
0239

METHIONINE
0248

MEXICO
0203 0242 0257 0262 0270 0280 0310

MICRONUTRIENTS
0217 0220 0246 0358

MINERAL CONTENT
0212 0219 0220 0221 0258 0360 0361
0362 0374

MINERAL DEFICIENCIES
0212 0251

MINERALS AND NUTRIENTS
0232
ALUMINIUM
0230
CALCIUM
0210 0250 0258
IRON
0217
MAGNESIUM
0250 0258
NITROGEN
0219 0221 0243 0250 0252 0258 0358
0361 0362 0363 0372 0374
OXIGEN
0363
PHOSPHORUS
0219 0221 0250 0252 0258 0358 0372
0374
POTASIUM
0212 0219 0250 0258 0358 0372
ZINC
0217

MITOCHONDRIA
0240

MORPHOGENESIS
0209 0226

MUTATION
0205 0343

MYCOSES
0237 0244 0267 0277 0282 0287 0297
0298 0302 0303 0305 0307 0311 0319
0342 0346 0367
EPIDEMIOLOGY
0306
INOCULATION
0241 0299 0301 0306 0310 0312 0347
0375
LEAVES
0241
SEED
0375
SEEDLINGS
0241 0300 0301
ROOTS
0304
TEMPERATURE
0247

NEMATODES
0319 0320

NICARAGUA
0317

NITROGEN
0360 0362 0372
FERTILIZERS
0221 0245 0248 0250 0252 0262 0357
0358 0361 0363 0374
NUTRIENT ABSORPTION
0219 0221 0250 0258 0361
PLANT ASSIMILATION
0219 0221 0250 0258 0361
PROTEIN CONTENT
0248 0258

NITROGEN FIXATION
0217 0281 0355 0356 0357 0359 0360
0361 0362

NITROGEN-FIXING BACTERIA
0356 0357

NODULATION
0355 0356 0357
MINERALES AND NUTRIENTS
0217
NITROGEN
0358 0361 0362 0363
PHOSPHORUS
0358

NORTH AMERICA
0201 0204 0242 0257 0303 0304 0335
0353 0359

NOXIOUS ANIMALS
0243 0244 0267 0275 0313 0319 0320
0324 0325 0326 0327 0328 0329 0330
0331 0332 0333 0334 0338 0342 0378
0379 0380

NUCLEIC ACID
0227 0294 0295

NUTRIENT ABSORPTION
0218 0219 0221 0250 0251 0258 0361

NUTRIENT LOSS
0381

NUTRIENT SOLUTION
0212 0213 0217 0219 0220 0230 0360
0362

NUTRIENT TRANSPORT
0218

NUTRITIONAL REQUIREMENTS
0221 0232 0243 0244 0245 0246 0248
0250 0251 0252 0266 0356 0358 0361
0363 0372 0374

NUTRITIVE VALUE
0243 0353

OZONE
AIR POLLUTION
0321

PLANT INJURIES
0323

PENICILLIUM SP
0375

PERU
0269 0374

PH
0251 0381
AGRICULTURAL LIME
0250

PHASEOLINS
ANALYSIS
0235 0239

PHASEOLUS ACUTIFOLIUS
0201 0285 0336

PHASEOLUS COCCINEUS
0201 0308 0310 0336 0347 0378

PHASEOLUS LUNATUS
0201 0310 0336 0337 0339 0345

PHENOLIC CONTENT
0376

PHENOLOGY
0203 0208

PHOSPHORUS
0246 0252 0262 0358 0372 0374
NUTRIENT ABSORPTION
0219 0221 0250 0258
PLANT ASSIMILATION
0219 0221 0250 0258

PHOTOSYNTHESIS
0211 0215 0216 0218 0256 0321

PHYTOALEXINS
0239 0300 0301 0307 0307

PHYTOHEMAGGLUTININS
0354

PLANT ANATOMY
0203 0204 0205 0206 0208 0209 0218
0219 0221 0222 0226 0228 0229 0230
0242 0249 0257 0258 0261 0299 0300
0304 0323 0335 0337 0343 0344 0352
0362 0381

PLANT ASSIMILATION
0219 0220 0221 0232 0250 0251 0258
0276 0331 0361

PLANT BREEDING
0208 0282 0283 0287 0290 0291 0296
0303 0339 0342 0344 0353 0365
BACKCROSSING
0308 0336

HYBRIDIZIN
0320 0336 0337 0343 0345 0347
SELECTION
0281 0318 0320 0335 0337 0340 0345
0346 0349 0350 0351

PLANT DEVELOPMENT
0203 0205 0209 0212 0213 0222 0223
0224 0225 0226 0228 0229 0232 0236
0248 0250 0256 0258 0269 0272 0276
0319 0327 0359 0360 0362

PLANT GEOGRAPHY
0201 0202 0204

PLANT - GROWTH SUBSTANCES
0206 0209 0213 0223 0225 0226 0227
0229 0231 0240 0241 0249 0352

PLANT HABIT
0203 0204 0208 0247 0257 0281 0359

PLANT INJURIES
0241 0274 0275 0296 0299 0313 0322
0327 0329 0330 0333 0378 0379
AIR POLLUTION
0331 0381
HERBICIDES
0261
TEMPERATURE
0323
WATER REQUIREMENTS
0249 0381

PLANT NUTRITION
0220 0221 0250 0373

PLANT PHYSIOLOGICAL DISORDERS
0237 0276 0321 0322 0335

PLANT PHYSIOLOGICAL PROCESSE
0231 0234 0237 0238 0239 0240 0300
NUTRIENT TRANSPORT
0216
PHOTOSYNTHESIS
0211 0215 0216 0218 0321
PLANT ASSIMILATION
0219 0220 0221 0250 0258 0276
PLANT RESPIRATION
0210

PLANT PIGMENTS
0205 0215 0234 0348

PLANT REPRODUCTION
0343

PLANT RESPIRATION
0210 0224

PLANT TISSUES
0209 0210 0222 0226 0227 0261 0293
0299 0322 0352
ENZYMES
0237 0240 0300

PLANT VASCULAR SYSTEM
0218

PLANTING
0262 0263 0266 0280 0325 0366
AGRICULTURAL EQUIPMENT
0244
SPACING
0259 0260 0264 0342
PRODUCTIVITY
0247 0269

PUDDING
0272

PODS
0204 0207 0242 0327 0344
DISEASES AND PATHOGENS
0292
INJURIOUS INSECTS
0328

POLLEN
0352

POLYPLOIDY
0352

POTASSIUM
0358 0372
MINERAL DEFICIENCIES
0212
NUTRIENT ABSORPTION
0219 0250 0258
PLANT ASSIMILATION
0219 0250 0258

PRICES
0252 0271 0370

PRODUCTION
0262 0365 0366 0367 0368 0370

PRODUCTIVITY
0247 0252 0268 0269 0270 0271 0275
0282 0368

PROTEIN CONTENT
0212 0225 0258 0353
SEED
0235 0236 0238 0248 0354

PROTEINS
0227
AMINO ACIDS
0238 0354
ANALYSIS
0231 0233 0235 0238 0239 0354

PSEUDOMONAS PHASEOLICOLA
0286
DISEASE CONTROL
0267 0277
HOST-PLANT RESISTANCE
0291 0296

PSEUDOMONAS SYRINGAE
0292 0294 0295
HOST-PLANT RESISTANCE
0293

RESEARCH
0209 0219 0232 0255 0257 0289 0324
0329 0332 0335 0341 0342 0346 0356
0365 0373 0377 0379 0380

RHIZOBIUM
0217 0281 0359 0360
INOCULATION
0355 0356
STRAINS
0357 0358 0363

RHIZOBIUM PHASEOLI
0217 0281 0355 0356 0357 0359 0363

RHIZOCTONIA SOLANI
0241 0299 0319
HOST-PLANT RESISTANCE
0301

RHIZOSPHERE
0221

ROOTING
0222

ROOTS
0209 0217 0221 0222 0304 0360 0362
0363

RUTS
0297 0304

SALINITY
0251

SEED
0233 0239 0348 0355
AMINO ACIDS
0236 0238 0248 0354
CHARACTERS
0202 0208 0263 0273 0276 0281 0349
0376
DISEASES AND PATHOGENS
0273 0313 0318 0375
GERMINATION
0214 0238 0273 0274 0275 0278 0313
INJURIOUS INSECTS
0275 0313
PROTEIN CONTENT
0235 0236 0238 0248 0354
STORAGE
0273 0275 0375 0376

YIELDS
0248 0273 0281 0349

SEED CHARACTERS
0201 0202 0204 0263 0273 0276 0279
0281

SEED COLOR
0208 0349 0376

SEED COAT
0214 0376
INHERITANCE
0335

SEED COLOR
0208 0348 0349 0376

SEED PRODUCTION
0246 0257 0273 0277 0278 0279 0340
0343 0361 0361 0365 0366 0373

SEED TRANSMISSION
0277 0284 0305 0310 0318

SEED TREATMENT
0305

SEEDS
0204 0205 0207 0208 0242 0258 0274
0275 0276 0278 0279 0284 0296 0298
0313 0328 0335 0340 0341 0344 0353
0376 0378 0379 0380

SELECTION
0251 0260 0338 0341
PLANT BREEDING
0281 0318 0320 0335 0337 0340 0345
0346 0349 0350 0351

SOIL ANALYSIS
0243 0248 0250

SOIL FERTILITY
0243 0246 0250 0251 0373 0373 0373

SOIL IMPOVERISHMENT
0246 0251

SOIL POPULATION
0296 0297

SOIL REQUIREMENTS
0244 0246 0250 0251 0361

SOIL WATER
0232 0249 0254

SOILS
0243 0246 0248 0250 0259 0356 0358
0372

SPACING
PRODUCTIVITY
0268 0271

YIELDS
0242 0255 0257 0259 0260 0264 0266
0342

STATISCAL ANALYSIS
0207 0241 0243 0262 0263 0254 0274

0275 0280 0283 0284 0290 0292 0306
0329 0332 0335 0344 0349 0350 0362
0368 0378

STEMS
0207 0218 0242
GROWTH
0296 0360
MINERALS AND NUTRIENTS
0219 0362

STOMATA
0230 0321 0322 0323

STORAGE
0266 0279 0366 0377
DISEASES AND PATHOGENS
0244 0273 0277 0365 0375
INJURIOUS INSECTS
0244 0275
TEMPERATURE
0376

STORED GRAIN PESTS
0243 0373 0379

SUGARS
0216

SYMBIOSIS
0281 0359 0360
NODULATION
0356 0357
MINERALS AND NUTRIENTS
0217 0358 0363
PHOSPHORUS
0354

SYMPTOMATOLOGY
0212 0261 0275 0292 0293 0295 0314
0316 0317 0322 0327

TAXONOMY
0201 0204 0326 0336

TECHNOLOGY
0365 0369 0370 0371

TEMPERATURE
0289 0376
GROWTH
0283 0285 0337
PHOTOSYNTHESIS
0211
PLANT INJURIES
0323
PRODUCTIVITY
0247
YIELDS
0289

TETRANYCHUS TELARIUS
0332

TIMING
0205 0208 0214 0245 0247 0248 0255
0263 0268 0269 0289 0325 0342 0366
0367 0376 0377

TOXICITY
0220 0354
MINERALS AND NUTRIENTS
0362

TRACERS
0217 0218 0239 0374

TRADE
0278 0371

UROMYCES PHASEOLI
0306
DISEASE CONTROL
0267
HOST-PLANT RESISTANCE
0311 0312

USA
0201 0204 0272 0304 0335 0353

VECTORS
0313

VIRUSES
0244 0277 0287 0313 0314 0315 0316
0316 0316 0316 0316 0316 0317 0318
0339 0342 0367

VIRUS TRANSMISSION
VECTORS
0313
SEED TRANSMISSION
0277 0284 0310 0318

WATER CONTENT
0213 0276 0376 0377

WATER REQUIREMENTS (PLANT)
0247 0249 0253 0254 0276 0381

WEEDING
0256 0258 0261 0280 0342

WEEDS
HERBICIDES
0256

WHETZELINIA SCLEROTIORUM
0303 0347
DISEASE CONTROL
0267
CHEMICAL CONTROL
0303 0310
SEED TRANSMISSION
0310

XANTHOMONAS PHASEOLI
0296
DISEASE CONTROL
0267 0277

HOST-PLANT RESISTANCE
0287 0289 0290 0296
PLANT BREEDING
0287 0290 0296
SEED TRANSMISSION
0277 0284

XANTHOMONAS PHASEOLI VAR FUSCANS
0265 0290

YIELD COMPONENTS
0224 0236 0237 0242 0257 0273 0280

ZAGREUS SUBFACIATUS
0324 0379

ZEA MAYS
0346 0371
INTERCROPPING
0266 0267 0268 0270 0271 0272 0281
0324

ZINC
0217

LIST OF ABBREVIATIONS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
CAMD	Cassava African mosaic disease
CAMV	Cassava African mosaic virus
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxygen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter
COD	Chemical oxygen demand
concd.	Concentrated
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
expt.	Experiment
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
govt.	Government
govtl.	Governmental
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
IAA	Indoleacetic acid
IBA	Indolebutyric acid
Illus.	Illustrated

in.	Inches
i.e.	That is
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilogram-calorie(s)
kg	Kilogram(s)
Kj	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s) (only in combination with no.)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio
LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	α-Naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced from
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pphm	Parts per hundred million
PPI	Pre-planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGRs	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
Russ.	Russian
S	Svedberg unit of sedimentation coeff. (10^{-13} S)
s	Second
$S_{20,w}$	Sedimentation coefficient corrected to water at 20°C
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Specie
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with N-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
W	West
wk.	Week
WP	Wettable powder
wt.	Weight

YFEL	Youngest fully expanded leaves	μ	Micro
yr	Year(s)	%	Percent(age)
α	*alpha*	$>$	More than, greater than
β	*beta*	$<$	Less than
γ	*gamma*	$\leq$	Equal to or less than
δ	*delta*	$\geq$	Equal to or greater than
ϵ	*epsilon*	$\pm$	Plus or minus
λ	*lambda*	ϕ	Diameter
π	*pi*	$\ll$	Much less than
ψ	*psi*	$\gg$	Much greater than
/	Per		

DOCUMENTATION SERVICES

[redacted]

Susan C. Harris, *MLS, Information Specialist, Library and Documentation Services Unit, Head*
Fabiola Amariles, *BA, Documentalist, Production Supervisor*
Marlene Cárdenas, *Bibliographer*
Manuelita de Chacón, *Typesetting*
Rommel Durán, *Layout*
Carlos P. González, *Ing. Agr., Documentalist-Beans*
Francy González, *Ing. Agr., Documentalist-Cassava*
Jorge López, *Bibliographic Services (Supervisor)*
Mariano Mejía, *BA, Documentalist-Tropical Pastures*
Lynn Menéndez, *Editing and Translation*
Keyttel de Prieto, *Information input*
Gladys de Ramos, *Proofreader*
Guillermo Solís, *Layout*

BEAN PROGRAM

[redacted]

Aart van Schoonhoven, *PhD, Coordinator*
Stephen Beebe, *PhD, Central America Bean Project*
* **César Cardona**, *PhD, Entomology (Visiting Scientist)*
Marcial Pastor Corrales, *PhD, Plant Pathology*
Jeremy H. C. Davis, *PhD, Agronomy*
* **Ramiro de la Cruz**, *PhD, Physiology (Visiting Scientist)*
Michael Dessert, *PhD, Plant Breeding (Postdoctoral Fellow)*
Guillermo E. Gálvez, *PhD, Coordinator, Central America Bean Project*
Peter H. Graham, *PhD, Microbiology*
Francisco Morales, *PhD, Virology*
James Nienhuis, *PhD, Plant Breeding (Postdoctoral Fellow)*
Silvio H. Orozco, *MS, Central America Bean Project*
Douglas Pachico, *PhD, Economics*
Federico Scheuch, *MS, Peru - IAT Bean Project*
Shree P. Singh, *PhD, Plant Breeding*
Steven R. Temple, *PhD, Plant Breeding (on sabbatical leave)*
Michael D. Thung, *PhD, Agronomy (stationed at CNPAF, Goiania, Brazil*
Oswaldo Voysest, *PhD, Agronomy*
Jonathan Woolley, *PhD, Cropping Systems Agronomy*

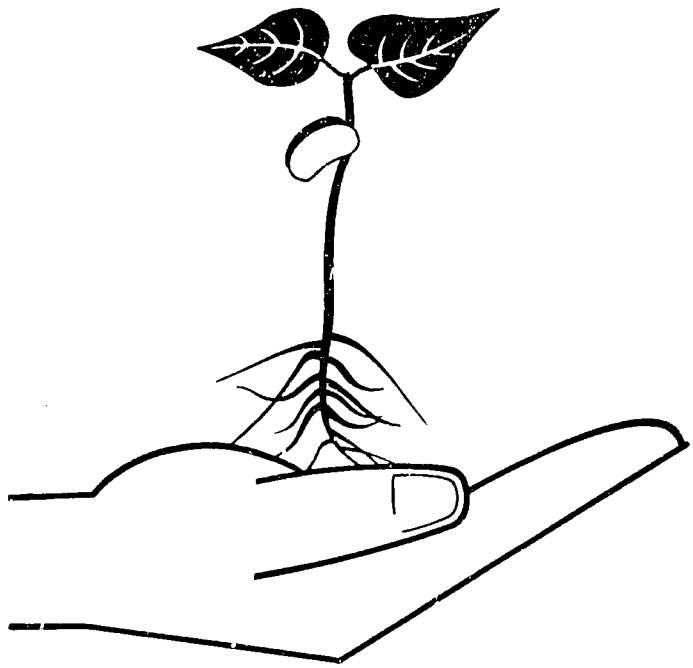
---

* Left during this period.

PN-AAN-082

Abstracts on Field Beans

Phaseolus vulgaris L.



Centro Internacional de Agricultura Tropica

CIAT is a nonprofit organization devoted to the agricultural and economic development of the lowland tropics. The government of Colombia provides support as host country for CIAT and furnishes a 522-hectare site near Cali for CIAT's headquarters. In addition, the Fundación para la Educación Superior (FES) makes available to CIAT a 184-hectare substation in Quilichao and a 73-hectare substation near Popayán. CIAT also co-manages with the Instituto Colombiano Agropecuario (ICA) the 22,000-hectare Carimagua Research Center in the Eastern Plains of Colombia, and carries out collaborative work on several of ICA's experimental stations in Colombia; similar work is done with national agricultural agencies in other Latin American countries. CIAT is financed by a number of donors represented in the Consultative Group for International Agricultural Research (CGIAR). During 1982 these CIAT donors are: the Rockefeller Foundation, the Ford Foundation, the International Bank for Reconstruction and Development (IBRD) through the International Development Association (IDA), the Inter-American Development Bank (IDB), the European Economic Community (EEC), the International Fund for Agricultural Development (IFAD), and the governments of Australia, Belgium, Canada, the Federal Republic of Germany, Japan, Mexico, the Netherlands, Norway, Spain, Switzerland, the United Kingdom, and the United States. In addition, special project funds are supplied by various of the aforementioned donors plus the Kellogg Foundation, the United Nations Development Programme (UNDP) and the International Development Research Center (IDRC).

Information and conclusions reported herein do not necessarily reflect the position of any of the aforementioned agencies, foundations or governments.

Publication of CIAT's
Bean Documentation Center

Documentalist: Carlos Prío González G.

PD-AAA-099 930865/58

Abstracts on Field Beans

(*Phaseolus vulgaris* L.)

Vol. VII | No. 3 | December, 1982

CONTENTS

FOREWORD iii

A GUIDE FOR USERS v

A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION 1

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY 2

C00 PLANT PHYSIOLOGY 3

- C01 Plant Nutrition 6
- C02 Plant Development 11
- C03 Chemical Composition, Methodology and Analyses 13

D00 AGRONOMY 16

- D01 Soil, Water, Climate and Fertilization 18
- D02 Cultivation Practices: Planting, Weed Control and Harvesting 26
- D03 Cultivation Systems: Intercropping, Rotational Crops 31
- D04 Seed Production 38
- D05 Varietal Trials 39

E00 PLANT PATHOLOGY 42

- E02 Bacterioses 43
- E03 Mycoses 45
- E04 Viroses 51
- E05 Nematodes 54
- E06 Physiological Disorders 56

F00 PEST CONTROL AND ENTOMOLOGY 57

F01 Injurious Insects, Mites and their Control 61

G00 GENETICS AND PLANT BREEDING 64

G01 Breeding, Selection and Germplasm 66
G02 Cytogenetics –
G03 Polyploidy –

H00 NUTRITION 73

H01 Foods and Nutritive Value 74

I00 MICROBIOLOGY 77

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation 77

J00 ECONOMICS AND DEVELOPMENT 82

K00 FIELD PLOT TECHNIQUE 85

L00 GRAIN STORAGE 86

L01 Stored Grain Pests 88

Z00 GENERAL –

LIST OF ABBREVIATIONS 89

CUMULATIVE AUTHOR INDEX 91

CUMULATIVE SUBJECT INDEX 115

FOREWORD

CIAT's documentation activities are focused on three research areas: cassava (*Manihot esculenta* Crantz) production and utilization, field beans (*Phaseolus vulgaris* L.) as grown under tropical conditions, and tropical pasture species and their management. The goal of the Documentation Center is to disseminate research results and report ongoing activities in these three areas.

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide users with both an update service and a permanent record of information that contains essential data for their research activities. The abstracts are categorized in broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are subject and author indexed to enable more comprehensive consultation. When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users of this mechanized search service. The full text of every article abstracted by the Documentation Center is available, through the Center's photocopy service.

No one publication can cover the whole range of information needs. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include:

Pages of Contents - a current awareness reference to articles published in more than 500 scientific and technical journals. Every article indexed can be ordered through the Center's photocopy service.

Cassava Newsletter (Yuca - Boletín Informativo) - a technical newsletter that provides information regarding cassava research in progress throughout the tropics.

Pastos Tropicales - Boletín Informativo - a newsletter on pasture research and on new developments in the tropical pastures network.

Hojas de Fríjol - a newsletter on bean breeding, agronomy, and cropping systems, and on the activities within the bean researchers' network.

We believe that each of these types of information plays a key role in research aimed at increasing agricultural productivity in the tropics. It is our hope that this range of publications satisfies the various information needs of our users.

A GUIDE FOR USERS

Components of a reference

Sequential number in this journal

0001

1 ← 15869 VILHORDO, B.W.; MÜLLER, L.; EWALD, E.F.; LEÃO, M.L. 1980. Há-
2 ← bito de crescimento em feijão (*Phaseolus vulgaris* L.). (*Bean growth habits*). Agro- → 4
3 ← nomia Sulrograndense (Porto Alegre) 16(1):79-98. Port., Sum. Port., Engl., 20
Refs., Illus. 5 6 7

8 ← *Phaseolus vulgaris*. Cultivars. Plant habit. Identification. Bush bean. Climbing bean. Brazil.

9 ← In order to define the types of growth habit of the common bean 45 cv. were studied, pertaining to the 9 commercial groups established for Brazil: Amarelo, Bico-de-Ouro, Manteigão, Mulatinho, Pardo, Preto, Rosinha, Roxinho, and Branco. The exptl. phase was carried out the Osorio Exptl. Station (Maquiné, Rio Grande do Sul) of the Secretary of Agriculture, during the agricultural yr 1976. Based on the data obtained, the following types of growth habit were established: I (determinate, bushy), II (undeterminate, with erect branching); III (undeterminate, with open branching), IV (undeterminate, prostrate, winding). Variance analysis of the length of the main stem, the length of the twine, and the no. of nodes of the main stem revealed significant differences among cv. However, when comparing the means of these parameters, no grouping of similar means was found which would permit to separate plants of the types II and III. (*Author's summary*) A00 B00
10 11

1- Accession number
2- Author(s)
3- Original title
4- Title translation
5- Source
6- Pages
7- Additional notes
8- Descriptors
9- Summary
10- Abstractor and/or translator
11- Subject categories

Note: The use of abbreviations in the abstracts has been standardized by the Information Center. A complete list of these abbreviations is included at the end of this journal.

Use of indexes

The author and subject indexes at the end of this journal were elaborated in collaboration with CIAT's Data Services Unit . These indexes serve as guides for the user to carry out his own information searches.

Author index

Here you will find the complete list in alphabetical order of the authors of the documents summarized in this issue. The four-digit numbers at the right hand side of each author correspond to the sequential numbers of appearance of the documents herein (the number centered above the abstract).

Subject index

This index presents a list of terms in alphabetical order to which the user can translate his information needs on specific topics. To facilitate his search, most of these terms or general topics cover other subjects, and thus the user will find up to two more levels of specificity. The four-digit numbers under the terms correspond to the sequential number of the documents within this issue.

Photocopy requests

In some cases, the information contained in the abstract satisfies the needs of the user. However, if there is an interest in having the complete document, photocopies can be requested by indicating the access number that appears at the upper left corner of the reference. Send your request to:

Documentation Services Unit
Photocopies Section
CIAT
Apartado aéreo 6713
Cali, Colombia, S.A.

Payments can be made by check (in US dollars or Colombian pesos) payable to CIAT, or CIAT, AGRINTER or UNESCO coupons. For Colombia the cost of each photocopy is Col.$4.00 or US$0.10; for other countries, US$0.20. Payments should be made in advance.

A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0383

17748 ADAMS, M.W.; PIPOLY III, J.J. 1978. **Biological structure, classification and distribution of economic legumes.** *In* Summerfield, R.J.; Bunting, A.H., eds. International Legume Conference, Kew, England, 1978. Advances in legume science. Proceedings. Kew, England, Royal Botanical Gardens. v.1 pp.1-16. Engl., Sum. Engl., 56 Refs.

Phaseolus vulgaris. P. acutifolius. P. coccineus. P. lunatus. Vicia faba. Vigna unguiculata. **Plant geography.**

Characteristics of population structures typical of predominantly self-fertilized, normally cross-fertilized and often cross-fertilized species are illustrated by reference to the representative species *Phaseolus vulgaris, Medicago sativa, M. falcata,* and *Cajanus cajan,* resp. A summary is presented in tabular form of information on the principal areas of diversity and ancestral relationships of the principal economic legumes. *(Summary by Plant Breeding Abstracts)* A00

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY

0384

16002 LEBARON, M.J. 1974. **A description; developmental stages of the common bean plant.** Moscow, University of Idaho. Cooperative Extension Service. Agricultural Experiment Station. Current Information Series no. 228. 2p. Engl., Illus.

Phaseolus vulgaris. **Developmental stages. Plant anatomy. Plant habit. USA.**

A general description is given of the different developmental stages of *Phaseolus vulgaris* grown in the south central area of Idaho, USA, according to a system proposed by W.H. Fehr and others (1971) for *Glycine max.* Plant development is divided into vegetative (V) and reproductive (R) stages. V stages are determined by counting the no. of nodes on the main stem including the primary leaf node. R stages are described with pod and seed characters in addition to nodes. The no. of nodes (Vn) present when the 1st flower appears will vary with the var. and depends on plant type (growth habit) and maturity. *(Summary by C. P.G. Trans. by L.M.F.)* B00

0385

17712 PRIETO B., V.; KOHASHI S., J. 1981. **El orden de antesis y la ubicación de las flores: su relación con el rendimiento y sus componentes en fríjol,** ***Phaseolus vulgaris*** **L., de hábito determinado cv. Cacahuate 72.** *(Order of anthesis and flower location: their relationship with yield and yield components of determinate growth bean cv. Cacahuate 72).* Chapingo 29/30:34-37. Span., Sum. Span., 5 Refs., Illus.

Phaseolus vulgaris. **Abscission. Flowers. Pods. Branching. Plant development.**

The dynamics of flowering in determinate growth bean cv. Cacahuate 72, were studied in order to determine the factors related to the abscission of reproductive organs. Plants were cultivated in hydroponic solution in the greenhouse (max. temp. 29°C and min. 14°C) without competition. Flowers were tagged to determine the day and the position in which anthesis occurred. It was proved that in the var. used, a relationship occurs between the location of the flowers and priority in the order of anthesis, having precedence: a) the branches of nomophyllous over those of prophylla; b) the apical inflorescences regarding the axillary bud; c) in a same inflorescence those of the base regarding the top (acropetal). As the anthesis of flowers occurs more days after the initiation of florescence, the % of flowers that are transformed into normal pods at harvest decreases and the % of flowers that are transformed into fallen and empty pods increases and normal pods at harvest reduces the no. of normal seeds/pod and increases the no. of aborted seeds/pod. *(Author's summary)* B00 C02

See also 0409 0530

C00 PLANT PHYSIOLOGY

0386

17454 VAN VOLKENBURGH, E.; CLELAND, R.E. 1981. **Control of light-induced bean leaf expansion: role of osmotic potential, wall yield stress, and hydraulic conductivity.** Planta 153(6):572-577. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Water stress. Growth. Leaves. Light. Cell structure. Cell walls.**

The role of 3 turgor-related cellular parameters, the osmotic potential (Ψ_S), the wall yield stress (Y), and the apparent hydraulic conductivity (L'p), in the initiation of light-induced expansion of bean leaves was determined. Although light increased the total solute content of leaf cells, the water uptake accompanying growth resulted in a slight increase in Ψ_S. Y was ca. 4 bar, and was unaffected by light.L'p, as calculated from growth rates and isopiestic measurements of leaf water potential, was only slightly greater in rapidly-growing leaves. The turgor pressure of growing cells was ca. 35% lower than that of the controls. It was concluded that light does not induce cell enlargement in the leaf by altering any of the above parameters, but does so primarily by increasing wall extensibility. *(Author's summary)* C00

0387

17764 MENGEL, K.; ARNEKE, W.-W. 1982. **Effect of potassium on the water potential, the pressure potential, the osmotic potential and cell elongation in leaves of *Phaseolus vulgaris*.** Physiologia Plantarum 54:402-408. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. K. Plant physiological processes. Leaves. Water content. Osmotic potential. Osmotic pressure (soil water). Mineral deficiencies. Nutrient solution. Laboratory experiments.**

The effect of K on the water potential, the osmotic potential, and the pressure potential in younger and older leaves of *Phaseolus vulgaris* grown in hydroponic culture was studied. Inadequate K supply resulted in an increase of the osmotic potential. In the older leaves the water potential was raised, in the younger leaves the pressure potential was depressed in the treatment insufficiently supplied with K as compared with leaves with an adequate K supply. Cell size of the younger leaves was smaller in the treatment with the low K^+ supply in comparison with the leaves well supplied with K^+. K had a beneficial effect on plant growth, especially on fresh matter production. The water status of leaves (water content, pressure potential, osmotic potential) responded more sensitively to K supply than DM production. Besides organic N and organic anions, K^+ was the most abundant solute found in the press sap of the leaves. From the results it is concluded that K^+ is indispensible for attaining an optimum potential (turgor) in young leaves which in turn has an impact on plant growth. *(Author's summary)* C00 D01

0388

17793 NAYLOR, A.W.; GILES, L.J. 1982. **Growth, pigment synthesis, and ultrastructural responses of *Phaseolus vulgaris* L. cv. Blue Lake to intermittent and flashing light.** Plant Physiology 70:257-263. Engl., Sum. Engl., 40 Refs., Illus.

Phaseolus vulgaris. **Seedlings. Light. Illumination. Growth. Chlorophyll. Leaf area. USA.**

Growing bean plants cv. Blue Lake on cycles of 1 min light-1 min dark or 5 min light-5 min dark, providing an integrated 12 h light-12 h dark/day for each set of plants, led to production after 21 days of new leaves low or lacking in chloroplast pigments. Subsequently, dry wt. increase was sharply cut. Leaf area was affected by the light regimes after the 2nd week of growth. By the 4th wk., plants on the 1 min light-1 min dark cycle showed about 0.5 the leaf area of the controls. Shoot growth was favored over root growth to the greatest degree on the 1 min light-1 min dark regimes. Chlorophyll *a/b* ratios were close to 3.0 in all of the intermittent light regimes, but the total amounts of chlorophyll in mg/primary leaf were higher from day 9 to day 23 for the 12 h light-12 h dark controls than for other plants. Although they produced chlorophyll, the plants receiving 1 or 2 ms/s of light continued to lose wt. at the same rate as the dark controls; thus, it is assumed there was no net photosynthesis. Plants receiving flashing light allocated significantly more food reserves from the seed to roots than did dark controls. Total chlorophyll formation was significantly accelerated by 2 ms/s light. With 1 ms/s light, it took 5 days longer to achieve the same level of chlorophyll. After the 18th day, there was a steady decline in chlorophyll, *b* degrading more rapidly than *a*. It is thought that several light-driven reactions are involved in the observed pigment synthesis, photosynthesis, food allocation, and growth of bean. Some of these reactions may be cyclic and others linear. Collectively, they must reach a harmonic point for normal metabolism and development to occur. Because time courses for each of these reactions are different, the intermittent and flashing light technique offers the possibility of individually studying some of the key light-driven reactions. *(Author's summary)* C00

0389

16049 SUNDARESAN, R.V.S.; KIMMINS, W.C. 1981. **Effect of coumarin on the synthesis and composition of cell walls in *Phaseolus vulgaris* (L.).** Annals of Botany 47:283-285. Engl., 4 Refs.

Phaseolus vulgaris. **Cell walls. Inhibitors. Leaves. Stems. Composition. Sugars.**

The study was undertaken to determine quantitatively, by wt., the total cell wall yield and the various components of the cell wall isolated and fractionated from leaves treated with coumarin. In addition, the sugar linkages and composition in the cell wall were determined by methylation analysis. Primary leaves of 10-day-old plants of bean var. Prince were used to obtain cell wall material. Leaves were treated with a solution containing 1000 ppm coumarin or water (control) by vacuum infiltration during 40 min. The stems of 10-day-old plants along with their leaves were immersed in coumarin solution or water contained in a 1000 ml beaker. The beaker was kept inside a large desiccator which was connected to a vacuum pump and the air drawn out. Percentage yield of cell wall/fresh wt. and dry wt. of leaves was considerably more in the coumarin-treated leaves than in the control. Coumarin significantly inhibits the synthesis of hydroxyproline-rich glycoprotein (48%), lignin (58%), and hemicellulose-I (51%). A notable stimulation in the synthesis of pectin (58%) and α-cellulose (21%) was observed. Although no new sugar linkages were revealed, the (1 → 4) and (1 → 5) linked glucose content in the cell wall of coumarin-treated leaves was 80% higher than in the control. There is a 65% increase in the content of terminally-linked galactose in the coumarin-treated leaves compared with the control. *(Summary by F.G. Trans. by L.M. F.)* C00

0390

17775 HATZIOS, K.K.; PENNER, D. 1980. **Localizing the action of two thiadiazolyl herbicidal derivatives.** Pesticide Biochemistry and Physiology 13(3): 237-243. Engl., Sum. Engl., 14 Refs.

Phaseolus vulgaris. **Leaves. Herbicides. Photosynthesis. Proteins. RNA. Inhibitors.**

Enzymatically isolated leaf cells from navy bean cv. Tuscola were used to study the effect of buthidazole and tebuthiuron on photosynthesis and on protein, RNA, and lipid synthesis.

The incorporation of $NaH^{14}CO_3$, ^{14}C-uracil and ^{14}C-acetic acid as substrates for the resp. metabolic processes was measured. Time-course and concn. studies included incubation periods of 30, 60, and 120 min and concn. of 0.1, 1, 10, and 100 μM of both herbicides. Photosynthesis was very sensitive to both buthidazole and tebuthiuron and was inhibited in 30 min by 0.1-μM concn. RNA and lipid syntheses were inhibited 50 and 87%, resp., by buthidazole and 42 and 64%, resp., by tebuthiuron after 120 min at 100 μM concn. Protein synthesis was not affected by any herbicide at any concn. or any exposure time period. The inhibitory effects of buthidazole and tebuthiuron on RNA and lipid syntheses may be involved in the ultimate herbicidal action of these chemicals. *(Author's summary)* C00

C01 Plant Nutrition

0391

17725 OLIVEIRA, I.P. DE; MALAVOLTA, E. 1982. **Efeitos do aluminio e do manganês no feijoeiro.** *(Effects of aluminum and manganese on beans).* Pesquisa Agropecuária Brasileira 17(4):549-557. Port., Sum. Port., Engl., 24 Refs.

Phaseolus vulgaris. **Al. Mn. Toxicity. Nutrient solution. Dry matter. Roots. Yields. Laboratory experiments. Statistical analysis.**

Thirty-eight bean cv. were grown in nutrient solution under a factorial treatment using 4 levels of Al (0, 6, 12, 18, and 24 ppm) and 4 levels of Mn (0, 30, 60, 90, and 120 ppm) to study their behavior in presence of Al and Mn. By applying regression analysis to DM yield data it was possible to classify these var. regarding the effect of Al in tolerant (cv. whose max. yield appeared at 14-16 ppm Al), Jalo, Mulatinho Paulista, Ricobaio 1014, and Roxo 760; moderately sensitive (cv. whose min. yield occurred in solutions having between 14-15 ppm Al), Jamapa and Porrillo Sintético; sensitive (cv. whose yield showed a min. when the nutrient solution ranged between 2-9 ppm Al), Carioca, Costa Rica, Costa Rica 1031, Cuva 168 N, Goiano Precoce, Rico Pardo, Rio Tibagi, and Tambó. Mn toxicity regression analysis allowed the following classification: moderately sensitive (cv. showing min. yield when the nutrient solution contained from 102-118 ppm Mn), Carioca, CR 911, Cuva 168 N, Rico Pardo, and Rio Tibagi; sensitive (cv. showing min. yield when the nutrient solution presented from 72-99 ppm Mn), Costa Rica 1031, Goiano Precoce, Jamapa, Porrillo Sintético, and Rosinha. The remaining cv. could not be classified because the estimated values of Al or Mn levels which would allow max. or min. growth fell outside the exptl. concn. (0 > Al > 24 and 0 > Mn > 120). *(Author's summary)* C01

0392

17741 ATMOWIDJOJO, S.; OZBUN, J.L.; LUDFORD, P.M. 1980. **Photosynthetic response of the so-called potassium-efficient and potassium-inefficient varieties of bean (*Phaseolus vulgaris* L.) to low potassium nutrition.** Annales Bogorienses (Indonesia) 7(2):51-61. Engl., Sum. Engl., In., 38 Refs.

Phaseolus vulgaris. **Plant nutrition. K. Mineral deficiencies. Cultivars. Host-plant resistance. Photosynthesis. Plant development. Growth-chamber experiments.**

Two K-efficient bean var.,P.I. 177760 and P.I. 180761, and two K-inefficient var., P.I. 136691 and P.I. 203958, were compared for their response to K stress in terms of photosynthetic rate and other related characteristics. The plants were grown in sand culture in a growth chamber, and supplied with nutrient solution containing low (0-0.5 m*M*) or high (5.0 m*M*) levels of K. Measurements of leaf K content, photosynthetic and transpiration rates, leaf area and plant dry wt. were taken when the 1st trifoliolate leaves had just reached full expansion. Mean K contents of the 1st trifoliolate leaves ranged from 0.29-0.46 and 2.36-2.77% under low and high K nutrition, resp. All other measurements were also significantly lower under the former than the latter. The depressing effects of K stress on leaf area and expansion period and on DM production were smaller in P.I. 177760 than in the other var., whereas no significant differences were found with regard to photosynthetic and transpiration rates. Some low K leaves had measurements falling within the control range. A higher % of such leaves were found with respect to transpiration rate (25.83%)

than for photosynthetic rate (10.83%) and leaf area (6.67%), suggesting that the latter are more sensitive to K stress than the former. Under low K nutrition, a higher % of leaves (40%) showed zero rate of photosynthesis than zero rate of transpiration (1.67%), suggesting again a higher sensitivity to K stress in photosynthetic rate than transpiration rate. *(Author's summary)* C01

0393

17482 THUNG, M. 1979. **Requerimiento de los elementos nutricionales en fríjol.** *(Nutritional requirements of beans).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 53p. Span., 60 Refs., Illus.

Phaseolus vulgaris. **Nutritional requirements. N. P. K. Ca. S. Al. Mn. Mg. Agricultural lime. Soil reactions. Nutrient absorption. Mineral deficiencies. Soil analysis. Colombia.**

Aspects on mineral nutrition of bean plants and the nature of each nutrient in the soil and in the plant are described. The need for fertilization is briefly justified and the physico-chemical form, mobility, and dynamics of the nutrients in the soil and their availability to plants are explained. Several methods to determine nutritional requirements (plant analysis, soil analysis, yield trials) are given and the role, assimilable forms, symptoms of deficiency and toxicity of N, P, K, Ca, Al, Mn, Mg, and S are discussed. The interaction of soil lime with Al, Mn, P, and Mg and other factors such as temp. and salinity are briefly discussed as well as the interaction between P and Zn, resistance to herbicides, micronutrient absorption, and O_2 deficiency. Application methods and the time of fertilization are described along with some methods that evaluate the efficiency of fertilizer use. Among these are the simple method (requiring fertilizers with radioactive elements), the classical method (Mitscherlich), and the economic biological method that includes cost analysis and is applied mainly in developed countries. Graphics and tables illustrating the concepts discussed are included. *(Summary by C.P.G. Trans. by I.M.F.)* C01 D01

0394

17777 MALAVOLTA, E., DAMIAO FILHO, C.F.; VOLPE, C.A.; MACHADO JUNIOR, G.R.; VELHO, L.M.S.; ROSA, P.R.F.; LAURENTIZ, S. DE. 1980. **Deficiências e excessos minerais no feijoeiro (*Phaseolus vulgaris* L., cv. carioca).** *(Mineral deficiencies and excess in bean cultivar Carioca).* Anais da Escola Superior de Agricultura Luiz de Queiroz 37:701-718. Port., Sum. Port., Engl., 21 Refs.

Phaseolus vulgaris. **Laboratory experiments. Mineral deficiencies. N. P. K. Ca. Mg. S. B. Fe. Al. Mn. Growth. Micronutrients. Nutrient solution. Plant nutrition. Dry matter. Mineral content. Leaves.**

Some aspects of mineral nutrition of bean var. Carioca were studied, including the effects of macronutrient (N, P, K, Ca, Mg, and S) and B and Fe deficiencies and the excess of Al and Mn. Some changes in plant height, no. of leaves, DM yield, and mineral composition of leaves and roots were observed. Bean plants were grown under controlled conditions. Ca deficiency had the greatest depressive effect on plant height, no. of leaves, and DM wt. It was possible to induce symptoms of mineral deficiency and excess in beans grown in nutrient solution in the absence or excess of some elements. DM production was affected, in increasing order by the following treatments: check, - S, - K, + Al, - B, + Mn, - Mg, - Fe, - P, - N, and - Ca. The main interactions among the leaf elements detected during this trial were K x Ca x Mg and Fe x Mn. The absence of an element decreases its content in the leaves when compared with the check. *(Author's summary)* C01 D01

0395

15020 AMARAL, L.A.L.; REZENDE, H.E.C. DE; BRASIL SOBRINHO, M.O.C.; MALAVOLTA, E. 1980. **Exigências de nitrogênio, fósforo e potássio de alguns cultivares de feijoeiro (*Phaseolus vulgaris* L.).** *(Nitrogen, phosphorus, and potassium requirements of some bean cultivars).* Anais da Escola Superior de Agricultura Luiz de Queiroz 37:223-239. Port., Sum. Port., Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Laboratory experiments. Nutrient solution. Cultivars. Plant nutrition. N. P. K. Mineral content. Nutritional requirements. Brazil.**

Ninety bean cv. were grown until maturity in full strength nutrient solution and after harvesting, organs were analyzed for N, P, and K contents. Yield potential and N, P, and K requirements were estimated by assuming a population of 250,000 plants/ha. There were marked differences in the mineral composition of the cv. Bean protein contents varied from 20.6-34.4% , with an av. of 27.3%,and nutrient extraction from 50-425, 20-15, and 100-262 kg N, P, K/ha, resp. The export of K was the lowest (50%). Yield potential varied from less than 500 kg/ha to more than 5000. Higher requirements are not necessarily associated with higher yield potential, indicating differences in the nutritional efficiency of the various cv. *(Author's summary)* C01

0396

17449 KHAN, A.; SOLTANPOUR, P.N. 1978. **Factors associated with Zn chlorosis in dryland beans.** Agronomy Journal 70(6):1022-1026. Engl., Sum. Engl., 29 Refs.

Phaseolus vulgaris. **Field experiments. Chlorosis. Mineral deficiencies. Yields. Bean root rots. Zn. P. Nutrient absorption. Plant nutrition. Soil moisture. USA.**

The cause of chlorosis of beans was investigated in dryland pinto beans San Juan cultivated in the San Juan Basin, Colorado (USA). Paired plots, one chlorotic and the other relatively green, were selected on 18 farms in 1975 and 1976. The soils of the exptl. sites belong to Ackmen, Witt, and Pulpit series of Fine-silty, mixed, mesic family; the Ackmen series belonging to the Cumulic Haplustolls and the Witt and Pulpit series to the Ustollic Haplargids. Yield, root rot, soil factors, and plant composition were compared for the chlorotic and the green plots. In 1976 the chlorotic plots were divided into 2 subplots, one receiving Zn spray to confirm the results of regression analysis that suggested Zn deficiency was the cause of chlorosis. Chlorotic plots had significantly higher mean levels of soil moisture and pH, and lower OM than the green plots. The chlorotic leaves had higher mean levels of P and P/Zn, and lower Zn than the green leaves. The chlorotic plants had a higher incidence of root rot than the green plants. Mean soil P and soil Zn availability indexes were not different in the chlorotic and the green plots. Soil Zn levels in all plots except one were < 0.5 ppm. Chlorotic areas were situated lower on the slope than the green areas, with a marked demarcation between them. Regression analysis suggested that 72% of the variability in yield was due to leaf P/Zn ratio, root rot, and their positive interaction. Other measured variables did not significantly contribute to the coefficient of determination. Spraying the chlorotic plants with a solution containing 1% Zn sulfate removed chlorosis and increased the yield by 18-92%. In general, the yield of the chlorotic plants sprayed with Zn solution did not increase to the level of the green plants. This difference was attributed to the higher root rot index of the chlorotic plants. Data suggested that higher soil moisture in low lying areas increased the P availability and thus caused a P-induced Zn deficiency in the bean plants growing in these soils of marginal Zn availability. *(Author's summary)* C01

0397

17753 SAWADA, S.; IGARASHI, T.; MIYACHI, S. 1982. **Effects of nutritional levels of phosphate on photosynthesis and growth studied with single, rooted leaf of dwarf bean.** Plant and Cell Physiology 23(1):27-33. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Dwarf beans. Nutrient solution. P. Mineral deficiencies. Photosynthesis. Growth. Japan.**

When a single rooted leaf of dwarf bean (*Phaseolus vulgaris* var. *humilis*) was grown in a phosphate-deficient condition in light, expansion of the leaf stopped earlier than the increase in the root vol. Apparently, the use of the assimilate for leaf expansion stops early

in comparison with the transport of the assimilate to the roots, when the external supply of phosphate is discontinued. After transfer to the phosphate-deficient condition, the photosynthetic capacity increased for several days, then decreased. On the 12th day after transfer, the photosynthetic capacity reached its lowest level. When phosphate was added to the roots at an early age of P deficiency, photosynthesis showed little recovery during the 1st 3 h after the addition, but it recovered largely between 3-48 h. At a later deficient stage, it was restored largely during the 1st 3 h, as well as being maintained between 3-48 h. This immediate recovery of photosynthesis within 3 h after the addition of phosphate increased largely in spite of decreasing photosynthesis in the plants subjected to progressive P-deficient stress. *(Author's summary)* C01 C02

0398

17799 ADRIANO, D.C. 1970. Phosphorus-zinc interactions in *Zea mays* and *Phaseolus vulgaris*. Ph.D. Thesis. Manhattan, Kansas State University. 89p. Engl., Sum. Engl., 78 Refs., Illus.

Phaseolus vulgaris. Cultivars. Laboratory experiments. Nutrient solution. Zn. P. Nutrient absorption. Nutrient transport. Translocation. Mineral deficiencies. USA.

Investigations were conducted in the field and in the growth chamber with maize and navy beans to evaluate: 1) the influence of ammonium polyphosphates on yield and P-Zn-Mn composition of irrigated maize; 2) the effect of mineral nutrition on P-Zn and P-Fe relationships in maize seedlings, and 3) the uptake and translocation of Zn^{65} as affected by P concn. within the plant and in the growth medium using navy bean seedlings. Regarding navy beans, 2 var., Saginaw and Sanilac, were grown for 2 wk. in nutrient solutions supplied with low and high P rates and dosed for 70 h with ^{65}Zn-labeled $ZnSO_4$ solution. The high P treatment usually increased the Zn concn. of plants of both var., as well as the P concn. of the tissues. Zn deficiency symptoms were induced in the Saginaw var. by a high rate of P but this deficiency was not associated with low Zn concn. in plant tissues. Chemical and autoradiographic results suggest that P-Zn interactions are not always restricted to the roots but could occur also in other plant parts. The occurrence of Zn deficiency symptoms in the presence of high P and Zn concn. in the bean tissues further suggests that Zn may be made less available for plant metabolism by a mechanism not yet well understood. *(Extracted from author's summary)* C01

0399

17797 BROWN, J.C. 1979. Effect of zinc stress on factors affecting iron uptake in navy bean. Journal of Plant Nutrition 1(2):171-183. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. Nutrient absorption. Nutrient solution. Zn. Fe. Mineral deficiencies. Chlorosis. USA.

Phaseolus vulgaris cv. Sanilac (Zn-inefficient and Zn-intolerant) and Saginaw (Zn-efficient and Zn-tolerant) were grown in both soil and nutrient solutions and various levels of Zn nutrition were provided. Zn deficiency stress enhanced the Fe-stress response in both cv., but more Fe was taken up by Sanilac than by Saginaw. Sanilac developed Zn-deficiency symptoms but Saginaw did not. Zn toxicity (excess Zn) led to the development of Fe chlorosis in Sanilac alone. Zn toxicity induced Fe deficiency stress response in Saginaw. The additional Fe available to Saginaw counteracted some of the toxic effects of Zn. *(Summary by Field Crop Abstracts)* C01

0400

17821 BUSADA, C.J.; JONES JUNIOR, J.B.; MILLS, H.A. 1982. Major element uptake by snap bean grown in nutrient culture with varying nitrogen solution treatments. Journal of Plant Nutrition 5(1):63-71. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. Snap beans. Nutrient solution. Nutrient absorption. N.

Snap bean cv. Blue Lake was grown for 6 wk. in nutrient solutions containing equal rates of N as $Ca(NO_3)_2$ and $(NH_4)_2SO_4$. When the N supply was 75 ppm for the 1st 3 wk. and 150 ppm thereafter, a marked preference for NO_3 was noted, especially after the N rate was increased. When the N supply was inadequate, however, (35-75 ppm) the preference for NO_3 was small. The % increase in NO_3 uptake over NH_4 uptake with increasing N supply was similar to the increase in K content of the plants at 6 wk. Absorption of both forms of N peaked in week 4. *(Summary by Field Crop Abstracts)* C01

0401

17820 BIENFAIT, H.F.; DUIVENVOORDEN, J.; VERKERKE, W. 1982. **Ferric reduction by roots of chlorotic bean plants: indications for an enzymatic process.** Journal of Plant Nutrition 5(4/7):451-456. Engl., Sum. Engl., 4 Refs., Illus.

Phaseolus vulgaris. **Seedlings. Nutrient solution. Chlorosis. Fe. Mineral deficiencies. Netherlands.**

Reduction of chelated ferric ions by the roots of Fe-stressed bean plants showed kinetics characteristic for reactions catalyzed by matrix-bound enzymes. Assays for Fe-reducing compounds in the medium in which those plants had been standing for 1 day failed to yield indications for soluble reductants produced by Fe-stressed plants. The results suggest that the capacity to reduce chelated Fe by the roots of Fe-stressed bean plants is due to a membrane-bound enzyme in the root cortex. *(Author's summary)* C01

0402

17729 WALLACE, A.; EL-GAZZAR, A.M.; KHADR, A.H. 1979. **Ammonia vs. nitrate in the induction of iron deficiency and growth of bush bean plants.** Alexandria Journal of Agricultural Research 27(1):131-134. Engl., Sum. Engl., Ar., 7 Refs.

Phaseolus vulgaris. **Nutrient solution. Growth. Mineral deficiencies. Fe. N. Nutrient absorption.**

The relationship between the development of Fe-deficient bean plants and NH_4^+-N and NH_3^--N nutrient solutions was studied. A level of 0.02 N NH_4^+ applied in the presence of $CaCO_3$ as the sole source of Ca greatly restricted growth, caused leaf burn due to NH_4OH toxicity, and had Ca-deficient trifoliate leaves without depressed Fe uptake. A level of 0.005 N NH_4^+ with adequate Fe produced plants free of Fe deficiency; at a low Fe level this level of NH_4^+ resulted in Fe deficiency while a similar level of NO_3^- (at low Fe) produced plants free of Fe deficiency. *(Author's summary)* C01 C02

0403

17818 WALLACE, A. 1982. **Effect of liming on two trace element stresses including induced iron deficiency on bean plants.** Journal of Plant Nutrition 5(4/7): 737-740. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. **Dwarf beans. Mn. Cu. Co. Ni. Cd. Agricultural lime. Nutrient absorption.**

Bush bean plants were grown in Yolo loam soil with excess levels of Mn, Cu, Co, Ni, and Cd and with combinations of Mn and the other 4 trace elements. Without liming, the effect of 2 trace elements on yield was synergistic. With liming, however, the effect of 2 elements tended towards protective. The lime decreased the effect of all added trace elements by decreasing their uptake. The effect of the trace elements on Ca concn. in leaves closely paralleled that of yields. A portion of the 2-element interaction was Fe chlorosis which contributed to the synergism. Ni + Mn in nonlimed soil decreased Fe concn. of leaves most and the effect was synergistic. Liming and combined trace elements also decreased Si concn. of leaves. *(Author's summary)* C01

See also 0428 0429 0433 0435 0438 0443 0543

C02 Plant Development

0404

17478 YEANG, H.Y.; HILLMAN, J.R. 1982. **Lateral bud growth in *Phaseolus vulgaris* L. and the levels of ethylene in the bud and adjacent tissue.** Journal of Experimental Botany 33(132):111-117. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Growth. Buds. Stems. Inhibitors. Indoleacetic acid. Laboratory experiments.**

Ethephon and the ethylene inhibitors Ag^+ and aminoethoxyvinyl glycine (AVG) inhibited outgrowth of the axillary bud of the 1st trifoliate leaf in decapitated plants of *Phaseolus vulgaris*. Endogenous ethylene levels decreased in the stem upon decapitation although it is not conclusive that a causal relationship exists between this decrease and the release of axillary buds from inhibition. The proposition that auxin-induced ethylene is responsible for the suppression of axillary bud growth in the decapitated plant when the apical shoot is replaced by auxin is not borne out in this study. Application of IAA directly to the axillary bud of intact plants gave rise to a transient increase in bud growth. This growth increment was annulled when AVG was supplied with IAA to the bud despite the fact that the dosage of AVG used did not affect the normal slow growth rate of the bud of the intact plant or bud outgrowth resulting from shoot decapitation. *(Author's summary)* C02

0405

17765 SILVEIRA, M.A.V.; HELL, K.G. 1977. **Gibberellic acid effect on the growth of *Phaseolus vulgaris* L. plantlets from gamma irradiated seeds.** Boletim de Botânica 5:53-56. Engl., Sum. Engl., Port., 15 Refs.

Phaseolus vulgaris. **Seed treatment. Irradiation. Gibberellins. Germination. Growth. Hypocotyls. Epicotyls. Seedlings. Brazil.**

Seeds of *Phaseolus vulgaris* cv. Bico-de-Ouro were irradiated with γ-rays ranging from 1.2-80 krad, then sterilized and germinated on filter paper soaked in water or GA at 10 mg/*l*. After 48 h germinated seeds were transferred to vermiculite boxes and grown in the dark for 5 days and then harvested. Hypocotyl length was not affected by irradiation with 1.2, 2.5, or 10 krad, was increased by the 5 krad treatment, and inhibited at doses $\geq$ 20 krad. GA increased hypocotyl growth compared with nonirradiated and irradiated controls in seeds treated with up to 10 krad. At higher irradiation doses growth was greater on GA than water-soaked filter paper but still significantly reduced compared with nonirradiated seeds. Epicotyl length was not affected by irradiation up to 5 krad and decreased by higher doses. Germination on GA increased epicotyl growth compared with irradiated and nonirradiated controls at all irradiation doses. *(Summary by Field Crop Abstracts)* C02

0406

17396 GEPSTEIN, S.; ILAN, I. 1981. **Does osmotic regulation of amylase activity in bean cotyledons exist?** Physiologia Plantarum 53(2):188-190. Engl., Sum. Engl., 8 Refs., Illus.

Phaseolus vulgaris. **Plant development. Seedlings. Seed. Germination. Cotyledons. Embryo. Enzymes. Carbohydrate content. Analysis.**

The hypothesis that the promotive effect of the embryo axis of germinating bean seed on amylase activity in the cotyledons is mediated by an osmoregulative mechanism was examined. After 2 days of germination the action of the axis on amylolytic activity was already clearly revealed, whereas at the same time it had no influence on osmotic pressure in the cotyledons. When the axis was attached to 1 cotyledon during 4 days of incubation, osmotic pressure in the cotyledon was lower than its value in the cotyledons of the intact seedling, whereas amylolytic activity was similar in both treatments. It was concluded that the tested hypothesis is not valid for bean seedlings. External osmotic agents decreased the level of amylase in the cotyledons, but this did not prove that osmotic changes brought about by production of internal metabolites were involved in the regulation of amylase synthesis. *(Author's summary)* C02 C03

0407

17782 CHAUDHURY, K.G.; BASU, R.N. 1980. **Autoradiographic studies with the ^{14}C-IAA in relation to synergism between auxin & non-auxin chemicals in the rooting of bean (*Phaseolus vulgaris* L.) cuttings.** Indian Journal of Experimental Biology 18(5):543-545. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Indolacetic acid. Rooting.**

Indole and α-naphthol, each at 10^{-3} M, synergized IAA-induced rooting of *Phaseolus vulgaris* cuttings, the synergism between IAA and indole being the greater. There was no synergism, however, when indole was applied 12 h after IAA treatment. *(Summary by Horticultural Abstracts)* C02

See also 0385 0397 0402 0427

C03 Chemical Composition, Methodology and Analyses

0408

16469 McDOUGALL, J.; HILLMAN, J.R. 1978. **Analysis of indole-3-acetic acid using GC-MS techniques.** *In* Hillman, J.R., ed. Isolation of plant growth substances. New York, Cambridge University Press. Society for Experimental Biology Seminar Series, v.4. 25p. Engl., 64 Refs., Illus.

Phaseolus vulgaris. **Indoleacetic acid. Auxins. Plant-growth substances. Analysis. Biochemistry.**

A description is given of the procedures for isolating and measuring free IAA from plant tissues by using the combined techniques of gas-liquid chromatography (GC) and mass spectrometry (MS). These include 6 stages: extraction, preliminary purification, column chromatography, TLC, gas-liquid chromatography, and mass spectrometry. A worked example of IAA analysis of a sample of 500 g fresh wt. of shoot tissues of *Phaseolus vulgaris* seedlings is given. The extract contained 800 ng IAA. *(Summary by A.J.C. Trans. by L.M. F.)* C03

0409

17708 DIAZ M., F.; KOHASHI S., J. 1982. **Distribución de materia seca en el fríjol (*Phaseolus vulgaris* L.) bajo condiciones de campo.** *(Dry matter distribution in beans under field conditions).* Turrialba 32(1):19-27. Span., Sum. Engl., Span., 12 Refs., Illus.

Phaseolus vulgaris. **Spacing. Cultivars. Plant habit. Developmental stages. Dry matter. Roots. Seeds. Stems. Mexico.**

The effect of plant density on the distribution of DM in the aerial parts was determined using 4 bean var.: Zacatecas 21-1-2-1, Michoacán 12-A-3, and 18-X-Chapingo 72 (indeterminate growth) and Cacahuate 72 (determinate growth), planted at 8900 and 100,000 plants/ha in the Chapingo area, Mexico. Seven samples were taken at different physiological stages to determine DM. It was found that plant density did not markedly affect the % distribution of DM in the aerial parts of these var. However, the total dry wt. and the dry wt. of different aerial parts were significantly different ($P < 0.01$) when var. were planted at 8900 plants/ha. *(Author's summary)* C03 B00

0410

17769 STEPHEN, N.H.; COOK, G.T.; DUNCAN, H.J. 1980. **Mode of action of thiocyanate and iodide in relation to IAA metabolism.** Weed Research 20(6):333-340. Engl., Sum. Engl., Germ., Fr., 32 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Toxicity. Plant physiological processes. Metabolism. Indoleacetic acid. Enzymes. Plant physiological disorders. Analysis. Biochemistry.**

Whole plant studies on *Phaseolus vulgaris* have reaffirmed that of the halides and pseudohalide thiocyanate, only iodide and thiocyanate possess defoliant properties. Established work has indicated their possible involvement with IAA. In vitro studies have suggested that IAA destruction is not through a direct interaction between IAA and the halides

and pseudohalide but depends on their conversion to the halogen or pseudohalogen which can then destroy IAA. This may be accomplished by the peroxidase enzyme system for iodide only and does not provide a mechanism for thiocyanate activity. Both iodide and thiocyanate, however, have chemical oxidation potentials suitable for their conversion to the halogen or pseudohalogen, resp., via the photosynthetic apparatus. Hence, this would provide an explanation for their activity and the apparent inactivity of bromide, chloride, and fluoride which would be oxidized very slowly or not at all. *(Author's summary)* C03 E06

0411

17766 NAITO, K.; UEDA, K.; TSUJI, H. 1981. **Differential effects of benzyladenine on the ultrastructure of chloroplasts in intact bean leaves according to their age.** Protoplasma 105(3/4):293-306. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Leaves. Chloroplasts. Chlorophyll. Age. Protein content. Cytokinins.**

Primary leaves of intact bean plants were treated with benzyladenine (BA) at different stages of growth. Changes in the ultrastructure of chloroplasts and chlorophyll, carotenoid, and protein (soluble and insoluble) contents in leaves with different treatments were followed and compared. When BA was applied from an early stage, it increased the chloroplast size and the no. of grana/chloroplast without any pronounced effect on the grana size. When BA treatment finished at the early stage, these effects remained during a short period and then diminished. When BA treatment was begun at a late stage such marked effects were not observed, suggesting that only young leaves respond to BA. The late treatment, however, efficiently prevented the process of the last stage of leaf senescence, characterized by disintegration of thylakoids with concomitant increase in the plastoglobule size. Chlorophyll, carotenoid, and insoluble protein contents/leaf followed similar changes in chloroplast length and no. of grana/chloroplast section. *(Author's summary)* C03

0412

17770 SATHE, S.K.; SALUNKHE, D.K. 1981. **Isolation, partial characterization and modification of the Great Northern bean (*Phaseolus vulgaris* L.) starch.** Journal of Food Science 46(2):617-621. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Seed characters. Starch content. Composition. Analysis. Bean starch.**

The yield of *Phaseolus vulgaris* seed starch was 18.23%. Starch granule size ranged from 12 x 12 μm - 58 x 40 μm (length x width). The shape of starch granules was round to oval to elliptical, and in some cases, concave as well. Lamellae were present on all the starch granules observed. Amylose content of the starch was 10.2% (starch basis). The starch had good water and oil absorption capacities at 21°C and formed a stable gel at concn. > 7%. The viscoamylographic studies of the isolated starch indicated its restricted-swelling characteristics. *(Extracted from author's summary)* C03

0413

16767 TELEK, L.; FREYTAG, G.F. 1981. **Componentes fenólicos de las testas del fríjol común (*Phaseolus vulgaris* L.).** *(Phenolic components of the seed coats of bean).* Mayagüez, Puerto Rico, Instituto Mayagüezano de Agricultura Tropical. pp.L15-1-L15-8. Span., 7 Refs.

Paper presented at the Reunión Anual del PCCMCA, 27a., Santo Domingo, República Dominicana, 1981.

Phaseolus vulgaris. **Seed coat. Phenolic content. Seed color. Phaseollin. Analysis. Puerto Rico.**

A method of horizontal paper chromatography was used for the preliminary study on the phenolic components of the seed coat of *Phaseolus vulgaris* and an attempt was made to list the phenolic components of black-, red-, and white-seeded beans. The reactivity of some of these components with a bean protein (phaseollin) and egg albumin was also determined. Using simple chromatography, polyphenolic compounds were isolated and identified in seed coats of red- and black-seeded bean. No significant amounts of polyphenols were found in seed coats of white-seeded beans. The reaction of extracts in methanol of total phenolic components with the phaseollin and egg albumin removed procyanidins to which they are strongly linked. These trials show that bean seed coat procyanidins are superior to bean protein. *(Summary by F.G. Trans. by L.M.F.)* C03

0414

17760 MANCINI FILHO, J.; LAJOLO, F.M. 1981. **Fatores antinutricionais em diferentes variedades de feijões (*Phaseolus vulgaris* L.).** *(Toxic factors in different Phaseolus vulgaris varieties).* Ciência e Cultura 33(1):94-97. Port., Sum. Engl., Port., 13 Refs.

Phaseolus vulgaris. **Cultivars. Phytohaemagglutinins. Toxicity. Amino acids. Inhibitors. Analysis. Laboratory experiments. Brazil.**

In a study of hemagglutinins and trypsin and amylase inhibitors in 15 *Phaseolus vulgaris* var., there was a close positive correlation between agglutination of bovine red blood cells and toxicity in mice. Trypsinization of red cells affected sensitivity to agglutination differently according to var. Var. were placed in 4 groups according to their agglutinating ability and toxicity. No hemagglutinins and no trypsin or amylase inhibitors were found in the one *Vigna unguiculata* var. used. *(Summary by Nutrition Abstracts and Reviews)* C03 G01

0415

17709 BRAIN, K.R.; LINES, D.S. 1982. **Consistency of metabolism of aldrin and dieldrin in suspension cultures from *Phaseolus vulgaris* root.** Plant Cell Reports 1: 176-179. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Roots. Tissue culture. Insecticides. Metabolism. Inhibitors. Plant physiological processes.**

Reproducibility of metabolism of aldrin and dieldrin in cell suspension cultures from French bean roots, and the effects of variations in hormonal supplementation and light, were studied. Aldrin always converted to dieldrin, aldrin-trans-dihydrodiol, and other unidentified more polar metabolites, but not to dihydrochlordane-dicarboxylic acid. Dieldrin always converted to photodieldrin and more polar metabolites, but not to aldrin-trans-dihydrodiol. Metabolism were reasonably consistent from one subculture to the next, basically unaffected by alterations in medium tested, or by the presence or absence of light. The variations observed quantitatively rather than qualitatively supported the validity of use of tissue culture in metabolic studies on xenobiotics. Photodieldrin was shown to be a direct product of dieldrin metabolism and not the result of microbial or environmental interference. *(Author's summary)* C03

See also 0406 0431 0538 0552 0555 0569

D00 AGRONOMY

0416

17481 LEPIZ I., R. 1982. **Logros y aportaciones de la investigación agrícola en el cultivo del fríjol.** *(Advances and contributions of agricultural research in beans).* México, Secretaría de Agricultura y Recursos Hidráulicos. Instituto Nacional de Investigaciones Agrícolas. Publicación Especial no. 83. 68p. Span., Illus.

Phaseolus vulgaris. **Production. Cultivation. Cultivars. Adaptation. Climatic requirements. Water requirements. Agronomic characters.** *Zea mays.* **Intercropping. Diseases and pathogens. Plant breeding. Research. Mexico.**

Results of agricultural research in beans obtained on different exptl. fields of the Instituto Nacional de Investigaciones Agrícolas (INIA) in Mexico through research centers are given. The situation of bean crops and the major problems found in each region are briefly described for each one of these centers along with research projects on var. breeding and improvement of production practices (planting dates, density, pest and disease control, requirement of irrigation). The results and advances in research are also evaluated. The Centros de Investigaciones Agrícolas del Pacífico Norte (CIAPAN), del Pacífico Centro (CIAPAC), del Pacífico Sur (CIAPS), de la Península de Yucatán (CIAPY), del Golfo Central (CIAGOC), del Golfo Norte (CIAGON), del Norte (CIAN), del Norte Centro (CIANOC), del Bajío (CIAB), and de la Mesa Central (CIAMEC) are distributed among the different geographical regions of the country and carry out adaptation and yield trials of improved var. such as Jamapá, Delicias 71, Flor de Mayo, Canario 101, and Canario 107. The region of the highest yields is located in the states of Baja California Sur, Sinaloa, and Nayarit and is under the region of influence of the CIAPAN. A total of 171,888 t of beans were produced on 170,570 ha (1008 kg/ha) in this region during the fall-winter cycles of 1979-80. In Mexico the greatest surface area is planted to beans during the spring-summer cycles; likewise, the highest bean production is obtained (1,372,076 ha and 530,839 t, resp.). During this cycle yields are low (387 kg/ha) due to factors such as droughts, early frosts, and inadequate production systems. Several tables on the production and yield in the different regions and a map on the distribution of the centers throughout the country are included. *(Summary by C.P.G. Trans. by L.M.F.)* D00 G00

0417

17393 AESCHLIMANN A., J.; ALVAREZ A., M.; CAFATI K., C.; OBRADOR R., J.; QUIROZ, C.; RAMIREZ, A.; SOTOMAYOR, I.; TAPIA F., F.; TOSSO, J. 1979. **El cultivo del frejol.** *(Bean cultivation).* Santiago, Chile, Estación Experimental La Platina. Instituto de Investigaciones Agropecuarias. Boletín Divulgativo no. 52. 38p. Span., Illus.

Phaseolus vulgaris. **Production. Cultivation. Agronomic characters. Cultivars. Irrigation. Weeding. Bacterioses. Mycoses. Viroses. Disease control. Chemical control. Injurious insects. Stored grain pests. Insect control. Chile.**

Major factors determining bean yields are described for grain producers in order to assure a good production in bean-growing areas in Chile. Among these are environmental factors (temp., light., water, soil); land preparation (incorporation of OM, leveling, and weed control); var. characteristics (growth habit and planting distances); planting systems; fertili-

zation rates; irrigation methods and frequencies; methods of weed control; and harvest operations. Major fungal, bacterial, and viral diseases, nematodes, and physiological disorders are described along with methods for their control. A description is given of pests found in the soil (*Agrotis* spp., *Hylemya* spp., *Elasmopalpus lignosellus*); foliage (*Plusia* spp., *Epinotia aporema*); and stored grain (*Acanthoscelides obtectus*). *(Summary by C.P.G. Trans. by L.M.F.)* D00 E00 F00

0418

17471 OHLANDER, L.J.R. 1980. **Research on haricot bean (*Phaseolus vulgaris* L.) production in Ethiopia 1972-1976.** Uppsala, Sweden, Swedish University of Agricultural Sciences. Department of Plant Husbandry. Report no. 82. 288p. Engl., Sum. Engl., 131 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Developmental research. Cultivation. Planting. Timing. Weeding. Water requirements. Climatic requirements. Cultivars. Adaptation. Yields. Selection. Seed. Protein content.** *Ophiomyia phaseoli.* **Seed treatment. Ethiopia.**

Research on haricot (*Phaseolus vulgaris*) in Ethiopia from 1972-76 is summarized. In field trials, yields 3 times the present av. agronomic yield of 0.7 t/ha were obtained using suitable cv. and cultural practices. The doubling of agronomic yield by modifying traditional technology was envisaged. Variation in disease resistance and disease attack were responsible for the differences in yield shown by the cv. tested. Variation in rainfall affected yield in arid areas. The reduction of runoff by soil management to improve soil infiltration is suggested. A suitable environment for growing *P. vulgaris* was 1400-2000 m alt.; av. max. temp. 30-32°C; av. min. temp. 10-12°C; and 350-500 mm rainfall in the 1st 70-100 days of growth, followed by dry weather. Hand weeding 25-35 days after sowing was usually sufficient. The application of 40-70 kg P_2O_5 and 20 kg N/ha in the humid areas was adequate. *Rhizobium* inoculation gave no positive effects unless *Phaseolus* beans had not been grown in the soil previously. The optimum crop density was 300,000 plants/ha. Harvesting was successful after 70% of the pods had yellowed until 10 days after all the seeds had hardened. The no. of hard-shelled beans which did not readily imbibe water was increased by early harvesting. Early sowing of *P. vulgaris* in the main rainy season gave the highest yield. *(Summary by Field Crop Abstracts)* D00 I01

0419

15248 ANDRADE A., F. RODRIGUEZ G., H.; AREVALO V., A.; MARTINEZ A., J.; DIAZ C., G. 1979. **El cultivo del fríjol de temporal en el centro y sur del Estado de Guanajuato.** *(Rainfed bean cultivation in the central and southern regions of the state of Guanajuato).* México, Instituto Nacional de Investigaciones Agropecuarias. Centro de Investigaciones Agrícolas de El Bajío. Serie CIAB no. 121. 2p. Span., Illus.

Phaseolus vulgaris. **Cultivation. Technological package. Mexico.**

Recommendations are included to improve bean yields under rainfed conditions in the central and southern regions of the state of Guanajuato, Mexico: land preparation; var. (Canario 101, Canario 107, Bayomex, Flor de Mayo, Rosita, Apaseo, and Negro Queretaro 78); planting time, method, and density; fertilization; and weed, pest, and disease control. *(Summary by F.G. Trans. by L.M.F.)* D00

See also 0547

D01 Soil, Water, Climate and Fertilization

0420

17349 SILVEIRA, P.M. DA; FONSECA, J.R.; GUIMARAES, C.M. 1981. **Consumo de água pelo feijão de 3a. época irrigado por aspersão.** *(Water absorption by beans under sprinkler irrigation planted during winter).* Goiânia-GO, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa Arroz, Feijão. Comunicado Técnico no. 9. 5p. Port., 4 Refs.

Phaseolus vulgaris. **Irrigation. Water requirements. Climatic requirements. Soil water. Timing. Brazil.**

Water requirements for bean var. Rio Tibagi planted during the winter were studied on a clay loam dark red Latosol at the Centro Nacional de Pesquisa de Arroz, Feijão, GO, Brazil. Precipitation (P), irrigation water (I), runoff (R),drainage (D), and the variation in soil water storage (ΔA) were determined in order to estimate real evapotranspiration (ETa) using the equation $ETa = P + I - R \pm D \pm \Delta A$. Data were grouped in 7-day periods, except for the latter which had 6 days from planting to harvest. Total consumptive use by evapotranspiration was 337.96 mm, runoff 4.6 mm, and drainage 10.1 mm. Av. consumptive use by evapotranspiration for bean winter cultivation was 3.5 mm/day. It is recommended to apply every 7 days a water depth of 27 mm to satisfy crop requirements. Results are summarized in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0421

17470 MILLAR, A.A.; CHOUDHURY, E.N. 1980. **A model to define operational irrigation frequency for maximum yield of crops.** Turrialba 30(4):391-398. Engl., Sum. Port., Span., Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Irrigation. Water requirements. Soil water. Evapotranspiration.**

A model defining operational frequency for max. yield of crops is described. Plant response to soil moisture conditions, soil water retention and transmission characteristics, evapotranspiration and atmospheric demand were the basic information used in the model. Results of the application of the model for tomato and *Phaseolus vulgaris* on sandy loam soil are presented. The utilization of world data of the yield-water relationship of various crop species is discussed. *(Author's summary)* D01

0422

16447 GODOY, O.P. 1968. **Adubação mineral do feijoeiro (*Phaseolus vulgaris* L.).** *(Mineral fertilization of bean crops).* Tese Livre Docencia. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. 64p. Port., Sum. Port., 38 Refs., Illus.

Phaseolus vulgaris. **N. P. K. Agricultural lime. Nutritional requirements. Climatic requirements. Productivity. Experiment design. Statistical analysis. Economics. Brazil.**

An expt. with bean var. Rosinha was conducted at the Escola Superior de Agricultura Luiz de Queiroz, SP, Brazil, on N, P, and K fertilization during 4 planting times in 3 crop yr. Twelve factorial trials were set up at 3 different sites, one with a basic application of 5 t

dolomitic limestone/ha, another with 2.5 t/ha, and one without the application of lime. N, P, and K fertilizers were applied each at rates of 0, 30, and 60 kg/ha. P and K were applied to the furrow at planting and N was applied half to the furrow at planting and the other half top dressed 17-25 days after plant emergence. Data on plant wt., pod wt. and no., and grain wt. were registered. Highest production was obtained with the rate of 2.5 t limestone/ha. Although N fertilization was not as economically productive as P, a response to N and P application was observed. *(Summary by C.P.G. Trans. by L.M.F.)* D01 K00

0423

16084 SMITTLE, D.A.; STANSELL, J.R.; WILLIAMSON, R.E. 1978. **Cultural studies with snap beans.** Athens, University of Georgia. College of Agriculture. Experiment Stations. Research Bulletin no. 226. 22p. Engl., Sum. Engl., 30 Refs.

Phaseolus vulgaris. **Snap bean. Cultivation. Spacing. Fertilizers. Irrigation. Water requirements. Harvesung. Agricultural equipment. Cultivars. Agronomic characters. Pods. Yields. Field experiments. USA.**

Results of studies on snap beans conducted during 1973-76 in SE Coastal Plain, Georgia, USA to adapt cultural practices established in other areas and develop new cultural methods according to regional requirements are summarized. Recommendations are given on aspects of production and management such as seed quality, soil preparation, var. selection, plant population and arrangement, irrigation, fertilization, and harvesting. Desirable characteristics of these var. include: (1) high pod production; (2) erect plant growth; (3) low resistance to pod detachment; and (4) disease resistance. The efficiency of mechanical harvest is determined by the type of plant growth along with the frequent check and adjustment of mechanical harvesters. Tables are included on the results of the expt. *(Summary by C.P.G. Trans. by L.M.F.)* D01 D02

0424

17484 MACK, H.J.; VARSEVELD, G.W. 1982 **Response of bush snap beans (*Phaseolus vulgaris* L.) to irrigation and plant density.** Journal of the American Society for Horticultural Science 107(2):286-290. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Irrigation. Soil water. Water requirements. Spacing. Fibre content. Pods. Seeds. Yields. Cultivars. Bush bean. USA.**

Yields of snap bean pods were increased by irrigation and plant density in 4 field expt. at the Oregon State U. Vegetable Research Farm (USA). Highest yields were obtained with the -0.6 bar soil water potential regime which represented removal of 40-45% of the available soil water at 30 cm depth. Yields were lowest with the -2.5 bars soil water potential which represented 65-70% water removal. An av. of 60% more water applied to the -0.6 bar than the -2.5 bars treatment increased yields approx. 54%. Yields were usually intermediate with the -1.0 bar soil water potential representing 50-55% available soil water removal. Two cv. were used in 2 of the expt. and responded differently to irrigation. Yield of Oregon 1604 was higher than that of Galamor with -0.6 bar soil water potential but was lower than Galamor with -2.5 bars. Yield of Oregon 1604 averaged 27% higher in square arrangement than in 91 cm rows and the increase was greater for the high than for the low population density when compared in 1 expt. Yield was 20% higher for high density of 43 plants/m^2 than for low density of 21.5 plants/m^2. Yields of 2 cv. in 2 expt. averaged 67% higher in high density (40-57 plants/m^2) than in low density (20-33 plants/m^2) plantings. There were no consistent irrigation x density interactions. Usually there was a more rapid depletion of soil water for high density than for low density. Fiber in canned sieve size 5 pods was higher in Oregon 1604 at -2.5 bars soil water potential than for Galamor, but at the -0.6 bar soil water potential regime, the amount of fiber was similar in the 2 cv. Percent of pod wt. attributed to seed and % fiber were usually highest at -2.5 soil water potential. *(Author's summary)* D01 D02

0425

17404 CARELLI, M.L.C.; FAHL, J.I.; TEIXEIRA, J.P.F. 1981. **Efeito do nitrogênio no teor de proteína e composição em aminoácidos de sementes de feijão.** *(Effect of nitrogen on protein content and amino acid composition of bean seeds).* Pesquisa Agropecuária Brasileira 16(6):795-799. Port., Sum. Port., Engl., 18 Refs.

Phaseolus vulgaris. **N. Fertilizers. Plant nutrition. Amino acids. Seed. Analysis. Brazil.**

Greenhouse and field expt. at the Centro Exptl. de Campinas, SP, Brazil, were conducted with bean cv. Aroana in order to study the effect of N on protein content of seeds. In the greenhouse, the plants were cultivated in pots, with vermiculite and irrigated with nutrient solution containing 70, 210, and 630 ppm N. In the field, N was top dressed in the form of NH_4NO_3, at rates of 0, 50, and 100 kg/ha, at the flowering stage. Protein content in the seeds at harvest was 24.7, 27.6, and 33.7%, resp. for levels of 70, 210, and 630 ppm. In the field, 100 kg N/ha resulted in increases of 27.8, 20.7, and 28.1%, resp. in total N, protein-N, and nonprotein-N contents when compared with check. N application increased lysine, cystine, and leucine contents and reduced that of valine, threonine, and met., while phenylalanine and isoleucine contents were not affected. *(Author's summary)* D01 H01

0426

17483 THUNG, M. 1979. **Metodología simultánea de screening por la eficiencia en el uso de bajos niveles de fósforo y por la tolerancia a toxicidad de aluminio y manganeso en suelos adversos para fríjol (*Phaseolus vulgaris* L.).** *(Simultaneous screening methodology for efficiency in using low phosphorus levels and for tolerance to aluminum and manganese toxicity in soils unfavorable for bean cultivation).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 41p. Span., 37 Refs., Illus.

Phaseolus vulgaris. **P. Mineral deficiencies. Al. Mn. Toxicity. Host-plant resistance. Agronomic characters. Cultivars. Selection. Agricultural lime. Soil reactions. pH. Yields. Statistical analysis. Field experiments. Colombia.**

A description is given of a simultaneous screening methodology developed to (1) evaluate the efficiency of beans in using low soil P and the response to additional P, (2) evaluate the tolerance to Al and Mn toxicity and bean response to liming, (3) identify efficient/responsive plants, and (4) recommend outstanding materials for breeding. Some introductory notions on the nature of P, Al, and Mn and their interrelationships with the plant-soil system are given along with some aspects on soils in bean-growing regions in L.A. Materials are classified as efficient and inefficient on the basis of yield. The Bean Agronomy Program at the Centro Internacional de Agricultura Tropical carries out screening under field conditions since the plant demands a greater amount of P during the pod filling stage. The application of different levels of lime allows Mn and Al toxicity to be determined; tolerant and susceptible bean materials are planted and compared. Stress level for P are determined by a graphic relating the yields of the different materials used with the different soil P levels; the stress level being the point where the differences among the materials are most marked. An expt. design for simultaneous screening is given including aspects on soil preparation, density, and growth habits. For the phenological evaluation data required include days to germination, germination rate, days to flowering, and days to physiological maturity; for yield analysis the no. of plants harvested, no. of filled pods/plant, no. of pods/plant, and yield in g/m² are required. In addition to the statistical analysis of data, yield stability of each material is analyzed. Plants can be divided into 4 groups on the basis of 2 parameters, α and β, obtained with screening data: efficient with or without a good response; inefficient with or without a good response. Tables and graphics illustrating the results are included. *(Summary by C.P.G. Trans. by I.M.F.)* D01 G01

0427

17762 BADJI, M.; FLYEN, J.; BASSTANIF, L. 1982. **Effet du déficit en eau du sol sur l'évapotranspiration et la production de féveroles: une évaluation de modèles.** *(Effect of soil water deficit on evapotranspiration and on dry matter production in field beans: evaluation of models).* Agronomie 2(3):213-218. Fr., Sum. Fr., Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Soil moisture. Evapotranspiration. Dry matter. Irrigation. Water requirements (plant). Shoots. Growth.**

A simultaneous determination was made of the effect of limiting soil water on evapotranspiration and on DM production in field beans. The crop was grown in cylinders of humic sandy soil at 4 levels of irrigation and under controlled climatological conditions. The pattern of evapotranspiration was measured by weighing the columns and by periodic γ-ray scanning of the moisture profile. Shoot growth rate was determined by frequent plant sampling during the growing season. The observed evapotranspiration and growth rates under the 4 irrigation treatments were used to test some fairly simple prediction models into which different growth parameters can easily be incorporated. *(Author's summary)* D01 C02

0428

17489 HAMMOND, L.L. 1977. **Effectiveness of phosphate rocks in Colombian soils as measured by crop response and soil phosphorus levels.** Ph.D. Thesis. East Lansing, Michigan State University. 193p. Engl., Sum. Engl., 57 Refs., Illus.

Phaseolus vulgaris. **P. Fertilizers. Manures. Analysis. Soil requirements. Soil analysis. Soils. pH. Nutrient absorption. Timing. Yields. Experiment design. Statistical analysis. Colombia.**

Seven phosphate rocks from the USA, Colombia, Peru, and Tunisia were compared with triple superphosphate and/or basic slag as sources of P. A greenhouse expt. with *Panicum maximum*, a field expt. with cassava using an acid Oxisol deficient in P, and a field expt. with bean var. Huasano P 588 on an acid Andosol deficient in P and with an initial pH of 4.9 were conducted. In all 3 expt. the correlation between citrate soluble P in the phosphate rocks and yield and P uptake was highly significant and increased with increasing application rates. In the expt. with beans, 4.7 t agricultural limestone was applied per ha, 42 days before planting to raise soil pH to 5.5. At planting, all sources of P were broadcast at rates of 50, 100, 200, and 400 kg P/ha and incorporated into the soil to a depth of approx. 12 cm with a rototiller. A basic fertilizer of 80 kg N, 40 kg K, 5 kg Mg, and 1 kg B was also applied per ha. Beans were planted in 3.15 x 5.5 m plots, with 45 cm between rows, in a split plot design with 4 replications and levels of application as the main plots and sources of P as the subplots. The same bean var. was replanted and triple superphosphate was reapplied to the same plots at the same rate used before; the treatments involving phosphate rock and remaining triple superphosphate plots did not receive additional P and were used to evaluate residual P. Ten randomly selected plants were collected 30 days after planting and 5 randomly selected plants were collected 65 days after planting to analyze P content. In the 1st crop of beans av. yields of all sources were increased 64, 76, 115, and 138% by applications of 50, 100, 200, and 400 kg P/ha, resp. The set of plots which received 2 applications of triple superphosphate produced higher yields than those with residual triple superphosphate. Reapplication yielded significantly higher only at the 100 and 200 kg P/ha rates. For all sources except phosphate rock from Huila (Colombia), the yields obtained in the 2nd crop were higher than those obtained in the 1st crop. *(Summary by C.P.G. Trans. by L.M.F.)* D01 C01

0429

17495 LAUER, D.A. 1982. **Foliar fertilization of dry beans with Zn and NPKS.** Agronomy Journal 74(2):339-344. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. Leaves. N. P. K. S. Zn. Plant assimilation. Plant tissues. Seed. Mineral content. Timing. Developmental stages. Yields.**

In response to increasing grower use of foliar fertilization, field expt. were conducted from 1977-79 to evaluate the effects of Zn and NPKS foliar fertilization of dry bean cv. Rufus on nutrient concn. in the tissue and on yield. Commercial Zn formulations of $ZnSO_4$, ZnEDTA, NZn, and ZnPK were sprayed at growth stages ranging from early vegetative (V4) to early bloom (R1). Foliar NPKS was applied at growth stages ranging from full bloom

(R2) to fully expanded seed (R7). Foliar Zn and NPKS were applied either separately or together in combination treatments. Throughout the study there was no yield increase from foliar-applied Zn when soil Zn was adequate. There was a yield increase over the untreated check in 1978 but not in 1979. No consistent differences in bean yields were observed among $ZnSO_4$, ZnEDTA, NZn, or ZnKP. Stage of growth at which the foliar fertilization was applied did not affect yield response. All foliar Zn treatments increased plant tissue Zn except at growth stage V4 which had insufficient foliage to intercept the spray. Similar tissue Zn concn. resulted from foliar $ZnSO_4$, ZnEDTA, and ZnKP. The NZn material, containing Zn dissolved in a solution of urea, ammonium, and nitrate N, consistently resulted in about 2-fold greater tissue Zn than the other Zn materials. Concn. of N, P, K, and Zn in the bean seed were not consistently affected by foliar applications of Zn or NPKS. Even 2-fold to 4-fold differences in whole plant Zn concn. did not affect seed Zn concn. *(Author's summary)* D01 C01

0430

17727 PESSANHA, G.G.; PENTEADO, A. DE F. 1982. **Efeito de N, P e calagem sobre a cultura de feijão.** *(Effect of N, P, and liming on bean cultivation).* Pesquisa Agropecuária Brasileira. Serie Agronomía 17(3):375-379. Port., Sum. Port., Engl., 16 Refs.

Phaseolus vulgaris. **Fertilizers. N. P. Agricultural lime. Soils. Income. Brazil.**

A field expt. with beans was conducted on a red yellow podzolic soil, Itaguaí series, at the U. Federal Rural do Rio de Janeiro, SP, Brazil. A 5^3 factorial design was used with 5 different rates each of N, P, and lime for a total of 125 treatments. Statistical analysis of the results showed significant linear and quadratic effects for P and linear effects for liming and grain production. Max. bean production (1357.22 kg/ha) was obtained with 259.5 kg P/ha. These increases, due to the significant effects of P and lime, proved to economically important for farmers. The optimum economic rate was estimated at 156.8 kg P/ha, presenting profits of Cr$ 8337.57 and Cr$ 2458.53/ha, resp., in the presence (4 t/ha) and in the absence of dolomitic limestone. *(Author's summary)* D01

0431

17488 DRAKE, S.R.; SILBERNAGEL, M.J. 1982. **The influence of irrigation and row spacing on the quality of processed snap beans.** Journal of the American Society for Horticultural Science 107(2):239-242. Engl., Sum. Engl., 17 Refs.

Phaseolus vulgaris. **Snap bean. Canned beans. Irrigation. Spacing. Nutritive value. Nutrient loss. Water stress. Water content. Vitamin content. Pods.**

Irrigation method and row spacing had a significant influence on the quality of fresh, canned, and frozen snap beans. Sprinkle irrigated fresh and canned snap beans contained more ascorbic acid than rill irrigated snap beans. Rill irrigated snap beans had more intense color, lower shear values, less turbid brine, and less drained wt. loss. Canned snap beans grown in narrow rows had less drained wt. loss than snap beans from wide rows. Frozen snap beans from narrow rows had more drip loss, less moisture, increased soluble solids and ascorbic acid content than those from wide rows. Under the conditions of this study, rill irrigated snap beans and snap beans grown in narrow rows did have quality advantages over sprinkle irrigated snap beans and snap beans grown in wide rows. *(Author's summary)* D01 C03

0432

17759 VIEIRA, C.; SILVA, C.C. DA; CHAGAS, J.M. 1981. **'Negrito 897', outro cultivar de feijão preto para a Zona da Mata de Minas Gerais.** *(Negrito 897, another black bean cultivar for the Zona da Mata area of Minas Gerais).* Revista Ceres 28 (158):373-382. Port., Sum. Port., Engl., 12 Refs.

Phaseolus vulgaris. **Cultivars. Seed characters. Plant habit. Yields. Adaptation.** *Uromyces phaseoli. Colletotrichum lindemuthianum.* **Bean common mosaic virus.** *Empoasca kraemeri.* **Host-plant resistance. Brazil.**

Bean cv. S-182-N is recommended as another alternative to the small black-seeded type for the Zona da Mata area in Brazil. It has been renamed Negrito 897. It is productive and presents a tall and erect plant type, with good resistance to lodging, which makes it especially adapted to rainy season plantings and mechanical harvesting. It is susceptible to angular leaf spot (*Isariopsis griseola*) and shows intermediate resistance to rust (*Uromyces phaseoli* var. *typica*). It is resistant to BCMV and anthracnose (*Colletotrichum lindemuthianum*) and presents intermediate resistance to leafhoppers (*Empoasca kraemeri*). *(Summary by Abstracts on Tropical Agriculture)* D01

0433

17413 SARKAR, A.N.; WYN JONES, R.G. 1982. **Influence of rhizosphere on the nutrient status of dwarf French beans.** Plant and Soil 64:369-380. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Snap beans. Seedlings. Rhizosphere. Growth-chamber experiments. pH. Nutrient absorption. N. P. Shoots.**

French bean seedlings grown on choline, ammoniacal, and nitrate forms of N together with equivalent basal application of P as KH_2PO_4 were tested for nutrient uptake from the rhizosphere under standard growth chamber conditions. Statistical tests on soil (rhizosphere and non-rhizosphere) and plant (root and shoot) revealed that with the exception of P, levels of all other estimated macro-(Na^+, K^+, Ca^{2+}, Mg^{2+}) and micronutrients (Fe^{2+}, Mn^{2+}, Zn^{2+}) were significantly changed after 42 days growth as compared with 21 day growth period. The higher uptake into shoots of Na^+, K^+, Fe^{2+}, Mn^{2+}, Zn^{2+}, and H_2PO_4 and higher biomass accumulation in the rhizosphere were associated with lower rhizosphere pH. The uptake of Ca^{2+} and Mg^{2+} increased with higher rhizosphere pH. While ammoniacal and choline forms decreased rhizosphere pH and increased the P uptake, nitrate form reversed the trend showing significant inverse relationship between shoot phosphate and rhizosphere pH. Ca and Fe were associated with an inhibition of the translocation of P from root to shoot. However no causal relationships could be established. Both shoot wt. and shoot P content were closely associated with a no. of rhizosphere soil parameters. *(Author's summary)* D01 C01

0434

17499 MACHADO, J. DOS S.; JUNQUEIRA NETTO, A.; GUEDES, G.A. DE A.; REZENDE, P.M. DE 1979. **Efeitos de fósforo, molibdênio e cobalto sobre o feijoeiro-comum** (*Phaseolus vulgaris* L.), **cultivado em oxissolos.** *(Effect of phosphorus, molybdenum, and cobalt on common bean grown in Oxisols).* Ciência e Prática 3(2):101-106. Port., Sum. Port., Engl., 25 Refs.

Phaseolus vulgaris. **Fertilizers. P. Co. Mo. Micronutrients. Yields. Brazil.**

Av. common bean yield in Brazil is only 600-700 kg/ha. In order to study ways of increasing yield, effects of P, Mo, and Co dressings on beans grown in 2 Latosols were evaluated. Fertilizers were applied at the following rates: 0 and 200 kg P/ha, 0 and 13 g Mo/ha, and 0 and 0.25 g Co/ha. P applications increased yields by 110.72% (1115 kg/ha) and 46.85% (626 kg/ha), resp., at Lavras and Três Pontas (MG). Yields were not affected by Mo and Co dressings. *(Summary by Abstracts on Tropical Agriculture)* D01

0435

17500 RATHERT, G.; DOERING, H.W.; WITT, J. 1981. **Influence of extreme K:Na ratios and high substrate salinity on plant metabolism of crops differing in salt tolerance. 1. K/Na effects on growth, mineral uptake and distribution of extreme salt tolerance crop species.** Journal of Plant Nutrition 3(6):967-986. Engl., Sum. Engl., 65 Refs., Illus.

Phaseolus vulgaris. **Dwarf beans. Nutrient solution. Salinity. K. Na. Growth. Nutrient absorption. Mineral content. German Federal Republic.**

Growth and mineral distribution in bush beans and sugar beets in response to salt tolerance were studied in water culture expt. carried out under controlled conditions. Ion-specific effects of extreme K:Na ratios, supplying Cl and sulfate counter ions, at a high level of salinization (80 meq/*l*) were investigated. No specific effects on the rate of either plant species were observed. Ratios in uptake and translocation were more affected than the total mineral content. As a result of Na exclusion from leaves of salt-sensitive bush beans, the internal K:Na ratio was extremely high whereas the K:Na ratio in salt-tolerant sugar beet plants was similar to the K:Na ratios supplied. Divalent cations in the leaves of both plant species were suppressed by ion antagonism. The level of Cl accumulated was closely related to the K uptake of both crops. Comparing both plant species, beans already react to disorder of ion regulation during the time of treatment, whereas sugar beets balanced their ionic uptake and translocation. This ionic imbalance of sensitive beans might affect various metabolic pathways which together result in the tolerance to salinity of the species. *(Summary by Fertilizers Abstracts)* D01 C01

0436

17790 ESCALANTE F., J.A.S.; KOHASHI-SHIBATA, J.; GOMEZ R., O.B. 1980. **Efecto del sombreado artificial en tres épocas a partir de la floración sobre el rendimiento en semillas y sus componentes del fríjol (*Phaseolus vulgaris* L.).** *(Effect of artificial shading during three periods after the initiation of flowering on seed yield and yield components of beans).* Agrociencia (Mexico) 42:5-16. Span., Sum. Span., Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Field experiments. Flowering. Solar radiation. Seed production. Yields. Yield components. Mexico.**

The effect of 76, 55, 50, and 42% artificial shading during the beginning, middle, and end of the flowering period on yield and yield components in bean var. Michoacán 12-A-3 was studied in 1975, 1977, and 1978 under field conditions in Xalostoc and Chapingo, Mexico. The control, 0%, consisted of plants without shade. In 1975, a period of shade of 7-28 days was used. In 77 and 1978 each period was equivalent to 90 h of bright sunlight. The seed yield/plant a. yield components, no. of seeds/plant, and seed size were not affected by shading. Components like the no. of pods that contain seeds (at maturity)/plant and the no. of seeds/pod were affected by shading only in 1977 and 1978. An increase in the value of one component was accompanied by a decrease in the value of the other, so the yield remained unchanged, demonstrating the operation of a compensation mechanism among yield components. The no. of empty pods and the no. of aborted seeds at harvest showed significant differences due to shading (1977 and 1978), while the no. of abscised reproductive organs did not (1978). *(Author's summary)* D01

0437

15883 DIEUDONNE, C. 1981. **Bean production in Burundi.** *In* Regional Workshop on Potential for Field Beans in Eastern Africa, Lilongwe, Malawi, 1980. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. Series 031:B-1. pp.30-34. Engl., Illus.

Phaseolus vulgaris. **Climatic requirements. Research. Pests. Burundi.**

The importance of beans in Burundi (Africa) is briefly analyzed; 120,000 t dry beans are produced per yr on approx. 240,000 ha during 3 seasons: Oct.-Dec., Feb.-May, and June-Sept. Major factors limiting production are described: climatic (soils, rainfall), phytopathological [anthracnose (*Colletotrichum lindemuthianum*) and aphids (*Aphis fabae*)], and phenotypical factors; aspects of research and extension carried out by the Department of Agronomy of the Ministry of Agriculture and Animal Production are also included. Aspects

of the research program of the Agronomic Science Institute are listed: var. selection, preliminary and final trials of selected var., and distribution of new var. *(Summary by F.C. Trans. by L.M.F.)* D01

0438

17794 LIGERO, F.; LLUCH, C. 1982. Macronutrient content in leaves of bean plants (*Phaseolus vulgaris* L.) grown with different rates of N/S as fertilizers. Plant and Soil 65:421-424. Engl., Sum. Engl., 21 Refs.

Phaseolus vulgaris. Fertilizers. N. S. Yields. Leaf area. Leaves. Mineral content. Dry matter.

The effect of increasing rates of N and S as fertilizers on the yield, leaf area, and N, P, S, Ca, Mg, NO_3^-, and $SO_4^=$ content in leaves of beans were studied in a hydroponic culture expt. under greenhouse conditions. Bean plants responded significantly to all treatments with different N/S ratios. When plants grew with high N/S ratios, the leaf content of N, Ca, and NO_3^- increased while the content of K, P, and $SO_4^=$ decreased. However, optimal yield and leaf area were not obtained. Optimal leaf and fruit DM was obtained at N/S ratio value of 1.41. When lower N/S rates were used, optimal leaf and fruit DM was only observed when the leaf N/S ratio was between 15-16. At high sulfate levels in the nutrient solution there is no interaction with nitrate which is easily observed, resulting in an increase in yield. An interaction between nitrate and sulfate in the nutrient solution was found at a N/S ratio of 0.81 which produced in leaves a synergic effect between P-K, an antagonistic effect between N-P and N-K, and a lower yield. *(Author's summary)* D01 C01

0439

17747 WALLACE, D.H. 1978. Adaptation of *Phaseolus* to different environments. *In* Summerfield, R.J. Bunting, A.H., eds. International Legume Conference, Kew, England, 1978. Advances in legume science. Proceedings. Kew, England, Royal Botanical Gardens. v.1, pp.349-357. Engl., Sum. Engl., 87 Refs., Illus.

Phaseolus vulgaris. Adaptation. Plant geography. Radiation. Photoperiod. Temperature. Soil moisture. Yields.

A comprehensive review of literature on *Phaseolus vulgaris* is given. Growth of *P. vulgaris* is favored by moderate air temp., warm soils, and adequate soil water but is restricted by cold or hot temp., deficient or excessive water (especially the latter), and is not strongly modulated by irradiation. Mean temp. and day/night temp. differences interact with daylength to regulate continued development of initiated floral buds, time from sowing to the appearance of flowers, axillary branch production, no. and area of leaves, stem thickness and length, HI, endogenous hormone concn., and crop duration. Warm temp., long days, and especially the interaction between these factors, cause supposedly photoperiod-insensitive lines to flower and mature earlier, whereas they delay flowering and maturity of sensitive lines. Sensitivity to photoperiod is under genetic control; about 40% of bean lines are insensitive and the remaining are sensitive. *(Author's summary)* D01

See also 0387 0393 0394 0472 0475 0483 0486 0487 0510 0535 0563 0568 0571

D02 Cultivation Practices: Planting, Weed Control and Harvesting

0440

17406 REIS, M.S.; VIEIRA, C.; BOLSANELLO, J. 1979. **Efeitos de populações de plantas sobre cultivares de feijão (*Phaseolus vulgaris* L.) de crescimento determinado.** *(Effect of plant populations on determinate bean cultivars).* Revista Ceres 26 (147):474-480. Port., Sum. Port., Engl., 11 Refs.

Phaseolus vulgaris. **Cultivars. Dwarf beans. Spacing. Climatic requirements. Yield components. Yields. Brazil.**

In 2 trials in Viçosa, MG, Brazil, during 1976-78, bean cv. Manteigao Fosco 11, Sacavém 650, and Preto 53 (the 1st taking 80-85 days to maturity and the others 65-70 days) were sown in rows 50 cm apart at densities of 12, 17, or 22 seeds/m of row on 2 dates in the wet season and 2 in the dry season. The highest seed yield in the wet season was obtained from Sacavém 650 and in the dry season from Manteigão Fosco 11 and Sacavém 650. There were no significant differences in yield between sowing densities in the wet season, but the density of 12 seeds/m gave the lowest yield in the dry season. *(Summary by Field Crop Abstracts)* D02 D05

0441

17407 TOMPKINS, F.D.; MULLINS, C.A.; MERRYMAN, D.M.; JEFFERY, L.S. 1979. **Effects of seedbed preparation and herbicides on weed control in snap beans.** Tennessee Farm and Home Science 111:21-23. Engl., 4 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Soil requirements. Soil conservation practices. Herbicides. Weeds. Weeding. Yields. USA.**

In 1978, trials were conducted at the Plateau Expt. Station of the U. of Tennessee, Crossville (USA) to evaluate the effectiveness of selected herbicides and herbicide combinations for controlling weeds in snap bean var. Early Gallatin, planted with 4 different methods of seedbed preparation. Plantings were made on June 21 and 29, and July 7 on a Hartsells sandy loam soil. A split plot expt. design replicated 3 times at each planting date was used. Conventional preparation consisted of moldboard plowing to a depth of 15.25 cm in the spring and 2 trips with a powered harrow before planting. Treatment 2 used a powered harrow to stir the top 12.7 cm of soil twice. The other treatments were seeded in sod using a non-till unit equiped with fluted coulters. These were clipped 10 days before planting with a rotary mower and 0.678 kg paraquat/ha was applied to one group and 3.24 kg glyphosate/ha to the other. Seven herbicide treatments were also broadcast applied after planting including paraquat, glyphosate, dinoseb, metolachlor, pendimethalin, and bentazon, alone or combined at different rates. Predominant weeds among 4 grass species and 16 broadleaf species were *Digitaria sanguinalis, Setaria viriois, Panicum dicholomiflorum, Ambrosia artemisifolia,* and *Amaranthus retroflexus.* The method of seedbed preparation did not affect the chemical control of the 5 predominant weed species; however, it was a significant factor in controlling some other species as compared with no-till plots. Chemical control for the predominant species varied from 77-98%. Combining dinoseb with either metolachlor or pendimethalin increased weed control to 96 and 92%, resp. Yield was significantly less in no-till plots. However, herbicide treatment did not significantly affect yields. Tables are given on the treatments and different results obtained. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0442

17408 GROOT, W. DE; KITIVO, D.K.; LIMO, J.K.; NYANGIRI, E.N.; TIAMBATI, H.M. 1981. **Effect of time of weeding on yields of foodbeans in Kenya.** Thika, Kenya, National Horticultural Research Station. Technical Bulletin no. 1. 7p. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Weeding. Timing. Yields. Field experiments. Kenya.**

Weeding trials were carried out during 3 consecutive seasons at 4 agricultural stations in Kenya to determine the min. no. and optimum timing of hand weedings required for good bean yields. Bean var. Mwezi moja was used at Katumani and Rose coco K74 at Embu, Kisii, and Kakamega. The no. of plants/plot was recorded 2 wk. after emergence and at harvest. The 1st expt. consisted of 12 treatments replicated 4 times in a randomized block design. Treatments varied from 0-4 weedings at intervals of 10, 15, or 20 days. Treatments in the following 2 planting seasons were reduced to 8 and the no. of replications increased to 6. A first weeding at 20 days after crop emergence was found to be required in all areas. In areas with medium to high rainfall and a crop growth period > 100 days, a 2nd weeding approx. 20 days after the 1st one proved to be necessary. Recommendations to farmers are based on these results, bearing in mind that as a 1st step of good weed control, planting should be done in a weed-free environment. *(Author's summary)* D02

0443

17432 DEUBER, R.; FORSTER, R. 1978. **Influência do EPTC na nodulação natural de feijão (*Phaseolus vulgaris* L.).** *(Effect of EPTC on natural nodulation of beans).* Planta Daninha 1(2):38-43. Port., Sum. Port., Engl., 7 Refs.

Phaseolus vulgaris. Rhizobium phaseoli. **Nodulation. Nodules. Herbicides. Timing.**

Three field expt. were performed on different soils, with application of EPTC at 0, 1, 2, 4, 8, and 16 kg/ha. to study its effect on natural nodulation of common bean. The nodules were sampled at flowering, counted and their DM wt. was obtained. Seed production was obtained at harvest. None of the expt. showed significant differences among no. or wt. of nodules due to any of the EPTC applied rates. In only one expt. was there a significant yield reduction with the application of 8 and 16 kg EPTC/ha. *(Author's summary)* D02 C01

0444

17443 CARVALHO, D.A. DE 1980. **Estudo sobre a competição específica de malerbas na cultura do feijoeiro. 1. Efeito competitivo do capim-marmelada (*Brachiaria plantaginea* (Link) Hitch.) e picão-preto (*Bidens pilosa* L.), em diferentes densidades, sobre o crescimento e nutrição mineral do feijoeiro (*Phaseolus vulgaris* L.).** *(Study on specific weed competition in bean crops. 1. Competitive effects of Brachiaria plantaginea and Bidens pilosa at different densities on the growth and mineral nutrition of common beans).* Ciência e Prática 4(2):171-179. Port., Sum. Port., Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Weeds. Weeding. Timing. Spacing. Field experiments. Brazil.**

The influence of 2 weeds, *Brachiaria plantaginea* and *Bidens pilosa*, at different densities on growth and mineral nutrition of common bean cv. Carioca 1030 was studied at the Escola Superior de Agricultura de Lavras, MG, Brazil. Dry wt. of above ground parts as well as N, P, K, Ca, and Mg contents of the bean plant were determined 30, 55, and 87 days after planting. The shade cast by weeds was the most important competition factor affecting the dry wt. of above ground parts of beans. *B. pilosa* at a density of 82 plants/m^2 did not affect bean growth. Higher densities of this weed and all the densities of *B. plantaginea* behaved in a similar way, reducing bean growth. *(Author's summary)* D02

0445

15864 MALUF, E. 1980. **Utilização do paraquat em cultura de feijão.** *(Use of paraquat in bean crops).* Revista de Agricultura (São Paulo) 54(4):231-237. Port., Sum. Port., 1 Ref., Illus.

Phaseolus vulgaris. **Weeding. Herbicides. Plant injuries. Brazil.**

The effect of paraquat on 30-70 day old bean plants was studied to determine the most adequate rate for weed control without damaging the crop. A commercial product containing 20% paraquat was used. The rate that least affected the crop and presented a good weed control was 300-400 cc commercial product/ha. Furthermore, with a reapplication there was reduced growth, marked defoliation, and beans were able to gain height and suppress weeds. In the direct planting system, the herbicide could be applied without protectors by placing the spray nozzle as to directly apply between the rows. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0446

17473 GALVAO, J.D.; RODRIGUES, J.J.V.; PURISSIMO, C. 1981. **Sistemas de plantio, direto e convencional, na cultura do feijão da seca, em Viçosa, Minas Gerais.** *(Planting systems, direct and traditional, for beans during the dry season in Viçosa, Minas Gerais).* Revista Ceres 28(158):412-416. Port., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Soil conservation practices. Soil requirements. Planting. Climatic requirements. Herbicides. Weeding. Yields. Brazil.**

A field test was carried out at the U. Federal de Viçosa, MG, Brazil, to compare no-till and conventional planted dry beans during the dry season. Herbicide treatments were glyphosate + chloramben + alachlor; glyphosate + chloramben + metolachlor; and glyphosate + chloramben, applied as preemergence treatments. There were no differences in weed control among herbicide treatments. The no-till yield was better than that of the conventional planted dry beans. *(Author's summary)* D02

0447

17465 MARINIS, G. DE; FERREIRA, A.A.A.; SANTOS, R.F. DOS; DELITTI, W. B.C. 1980. **Alguns efeitos do fluometuron sobre o crescimento inicial da raiz do feijoeiro (*Phaseolus vulgaris* L.).** *(Some effects of fluometuron on early growth of bean roots).* Revista de Agricultura 55(4):305-309. Port., Sum. Engl., Port., 6 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Roots. Rooting. Growth.**

The herbicide fluometuron applied at concn. varying between 5-625 ppm affected considerably the length of the main root and piliferous layer of bean cv. Carioca as well as the length of its secondary roots. The need of a more detailed study of the effects of fluometuron concn. between 0-5 ppm and 25-125 ppm was highlighted. None of the effects observed can be attributed to biochemical lesions of the photosynthetic process. *(Author's summary)* D02

0448

17771 SCHNEITER, A.A.; NAGLE, B.J. 1980. **Effects of seeding rate and row spacing on dry bean production.** North Dakota Farm Research 38(1):8-11, 21. Engl., 5 Refs.

Phaseolus vulgaris. **Field experiments. Cultivars. Planting. Spacing. Yields. USA.**

In field trials under dryland and irrigated conditions in North Dakota (USA) in 1976-78 navy bean cv. Seafarer and pinto bean cv. UI 114 were sown in rows 10, 20, 30, and 40 in.

apart and different plant populations were established by thinning. The seed yields of both cv. were equal to or significantly increased when grown in rows 10 in. apart as compared with rows 30 or 40 in. apart. Cv. UI 114 was not significantly affected in its yield by plant population whereas cv. Seafarer gave higher yields at plant populations above 90,000 plants/ac. In both cv., stem Ø increased as plant population decreased. *(Summary by Field Crop Abstracts)* D02

0449

17758 RIVEROS, G. 1982. **Herbicide screening for four grain legumes in Puerto Rico.** Journal of Agriculture of the University of Puerto Rico 66(1):18-26. Engl., Sum. Engl., Span., 7 Refs.

Phaseolus vulgaris. **Cultivars. Herbicides. Puerto Rico.**

In Puerto Rico, 19 herbicides were tested on soybeans, pigeon peas, cowpeas, and field beans, cultivated in 3 localities at exptl. substations in Isabela, Lajas, and Fortuna. Main weed species in the 3 localities were: *Euphorbia heterophylla, Bidens pilosa, Rhynchosia minima, Ipomoea tiliacea, Leonotis nepetifolia, Eleusine indica, Digitaria sanguinalis,* and *Brachiaria platiphylla.* Although the majority of the products tested were selective to the 4 crops at the 3 sites, some were more toxic to certain crops or in given localities. Fluchloralin was more toxic to soybeans and field beans at Lajas. Cowpeas and field beans were very sensitive to metribuzin, while soybeans and pigeon peas were more tolerant. Results strongly support the importance of simultaneously considering the crop, weed population, and soil characteristics before recommending herbicides. *(Extracted from author's summary)* D02

0450

17713 FISCHER C., A.; TASISTRO, S.A. 1981. **Efecto de diversos herbicidas sobre la simbiosis** *Rhizobium phaseoli - Phaseolus vulgaris. (Effect of several herbicides on Rhizobium phaseoli - Phaseolus vulgaris symbiosis).* Chapingo 31/32: 53-60. Span., Sum. Span., Engl., 11 Refs.

Phaseolus vulgaris, Rhizobium phaseoli. **Strains. Nodulation. Herbicides. N. Mineral requirements. Roots. Nodules. Dry matter. Plant development.**

In a greenhouse trial the effect of several herbicides (dinoseb, alachlor, prometryn, linuron, trifluralin, EPTC, bentazon, acifluorfen, and dalapon) on the symbiosis of *Phaseolus vulgaris* with *Rhizobium phaseoli* was studied. Three strains of *R. phaseoli* (CP12, CP27, and CP30) and one treatment of 40 kg N/ha were used as main plot treatments in a split plot design with 3 replications. Herbicides and one control treatment were placed in the subplots. Three parameters were evaluated: dry wt. of the aerial part of bean plants, roots, and nodules. Herbicides mainly affected the nodules. Considering all 3 parameters, bentazon and trifluralin were relatively innocuous; EPTC and acifluorfen caused moderate damage; dinoseb, moderate to severe suppression; alachlor, linuron, and prometryn, severe suppression; and dalapon, very severe suppression. There were no significant differences among N treatments regarding the 3 parameters. Inhibitory effects of herbicide treatments were observed on aerial and root dry wt. in uninoculated, N-treated plots. It is concluded that the inhibitory effect of symbiosis is accompanied by inhibitory effects on plant aerial parts and roots. *(Author's summary)* D02

0451

15203 FRANCIS, C.A.; HERNANDEZ B., G. 1971. **The Latin American Program for increasing yields of dry beans.** *In* Workshop on Grain Legume Improvement, 1st., Ibadan, 1973. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. pp.96-101. Engl.

Phaseolus vulgaris. **Research. Cultivation. Yields. Colombia.**

The objectives of the bean program at the Centro Internacional de Agricultura Tropical are listed: (1) support national programs and institutions concerned with bean research through training and team organization; (2) improve yield potential through collection, evaluation, and recombination of promising germplasm, especially in the tropics; (3) increase the range of adaptation of new var.; (4) improve the protein quality and nutritional value of beans for human consumption; (5) develop genetic resistance to pathogens and insects; (6) identify, reduce, or eliminate limiting physical and socioeconomic factors which influence the production, marketing, and consumption; (7) study, develop, test, and demonstrate production systems under different levels of technology. A description is given of current research in the areas of agronomy, breeding, economics, entomology, microbiology, nutrition, pathology, physiology, and international activities. *(Summary by F.G. Trans. by L.M.F.)* D02

0452

16758 GONZALEZ R., C.; TREJO S., M.; QUIÑONES F., J.A. 1980. **El cultivo del fríjol en Nayarit.** *(Bean cultivation in Nayarit).* México, Instituto Nacional de Investigaciones Agrícolas. Centro de Investigaciones Agrícolas del Pacífico Norte. Circular CIAPAN no. 100. 12p. Span., Illus.

Phaseolus vulgaris. **Cultivation. Technological package. Mexico.**

Recommendations are given for bean cultivation in Nayarit (Mexico): land preparation; var. [Negro Nayarit, Jamapa (black-seeded), Sataya 425 (black-seeded), Canario 101 (pink-seeded), and Canario 72]; planting time, method, and density; fertilization; weed and disease control; harvesting and threshing. A table is included with the pests attacking beans and the commercial product, application rate/ha, and application time for their control. *(Summary by F.G. Trans. by L.M.F.)* D02

See also 0423 0424 0457 0462 0549 0577

D03 Cultivation Systems: Intercropping, Rotation Crops

0453

17475 NADAR, H.M.; RODEWALD, G.E. 1979. **Relay cropping and intercropping: an approach to maximize maize yield in the marginal rainfall areas of Kenya.** *In* International Workshop on Intercropping, Hyderabad, India, 1979. Proceedings. Patancheru, International Crops Research Institute for the Semi-Arid Tropics. pp.86-97. Engl., Sum. Engl., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Planting. Climatic requirements. Timing. Spacing. Yields. Kenya.**

An expt. was conducted to study maize yield response to 2 planting methods (1 or 2 plants/site), 3 row spacings (60-, 75-, or 90-cm), and 2 cropping systems (relay cropping and intercropping with beans), in a marginal rainfall area of Kenya with bimodal rainfall pattern. Results from this expt. and the economic survey of the farming systems employed by the farmers in the study area indicated that the maize yields in the long rainy season can be greatly improved by minor modification of the technologies presently used by farmers. Planting date was one of the major critical factors determining maize yield during the long rainy season. Delay in planting beyond the 1st wk. of March resulted in substantial yield losses. Relay cropping was found to be a means of planting maize early in the long rainy season. In intercropping with beans, bean yield was found to be almost the same under maize row spacings of 60-, 75-, and 90-cm, while maize yield was significantly reduced in the 75-cm row spacing. An effort made to determine the effect of introducing a new technology on net farm income by using 3 linear programming models developed from the survey data is discussed. *(Author's summary)* D03

0454

17476 LIMA, A.F.; LOPES, H.O. 1981. **Plant population and spatial arrangement study on the intercropping of maize and beans (*Phaseolus vulgaris* L.) in Northeast Brazil.** *In* International Workshop on Intercropping, Hyderabad, India, 1979. Proceedings. Patancheru, International Crops Research Institute for the Semi-Arid Tropics. pp.41-45. Engl., Sum. Engl.

Phaseolus vulgaris. Zea mays. **Intercropping. Spacing. Lodging. Yields. Experiment design. Statistical analysis. Brazil.**

In order to examine plant populations and spatial arrangements of maize and beans in association, an expt. was carried out at Filadelfia, BA, Brazil, located at 10°45'S and 40° 07' W at 550 m alt. The av. annual rainfall of the area is 811 mm. The statistical design was a randomized complete block with a split-plot arrangement, with four replications. Four population levels of maize (25,000, 50,000, 75,000, and 100,000 plants/ha) and beans (150,000, 200,000, 250,000, and 300,000 plants/ha) formed the main plots. The subplots were composed of 5 spatial arrangements (sole maize; 1 row of maize (M): 2 of beans (B): 1M:3B; 1M:4B; and sole beans). The best spatial arrangement was 1:3, comprising 12,500 maize plants/ha and 150,000 bean plants/ha. *(Author's summary)* D03 K00

0455

17442 NETO, F.B.; ANDRADE, M.A. DE; JUNQUEIRA NETTO, A. 1980. **Comportamento de cultivares de feijão (*Phaseolus vulgaris* L.) em consórcio com milho (*Zea mays* L.).** *(Performance of common bean cultivars intercropped with maize).* Ciência e Prática 4(2):103-108. Port., Sum. Port., Engl., 15 Refs.

Phaseolus vulgaris. Zea mays. **Intercropping. Cultivars. Agronomic characters. Yield components. Yields. Brazil.**

In order to study the performance of bean cv. intercropped with maize, 3 trials were conducted in Lavras, Três Pontas and Caldas, MG, Brazil during the 1977/78 crop yr. Bean cv. utilized were Carioca 1030, Costa Rica 1031, ESAL-1, Moruna, Pintado, Rico 23, Ricobaio 1014, Ricopardo 896, Rio Tibagi, and Venezuela 2. Maize cv. were Piranão, Centralmex, and Erecta. A randomized complete block exptl. design was used in split plots with 4 replicates. Maize cv. were grown in the main plots; bean cv. were arranged in the subplots. Marked differences were observed in the performance between bean cv., indicating the need to select bean var. with better performance when they are grown in association with maize. There was no interaction between maize and bean cv., although interaction between bean cv. and sites was observed. Cv. Ricopardo 896 and Rio Tibagi had the highest yields; Carioca 1030 and ESAL-1 proved to be inadequate for intercropping with maize. *(Author's summary)* D03 D05

0456

17477 MAFRA, R.C.; LIRA, M. DE A.; ARCOVERDE, A.S.S.; ROBERIO, G.; FARIS, M.A. 1981. **Studies on the intercropping of sorghum and corn with *Phaseolus* beans (*Phaseolus vulgaris*) and cowpea (*Vigna unguiculata*).** *In* International Workshop on Intercropping, Hyderabad, India, 1979. Proceedings. Patancheru, International Crops Research Institute for the Semi-Arid Tropics. pp.46-51. Engl., Sum. Engl.

Phaseolus vulgaris. Vigna unguiculata. Zea mays. **Intercropping. Spacing. Yields. Ecology. Climatic requirements. Brazil.**

The intercropping of maize and sorghum with *Vigna unguiculata* and *Phaseolus vulgaris* was studied in the Agreste and Sertao, 2 ecological zones of the state of Pernambuco, Brazil. The no. of plant units was the same in both the intercropping and the sole-crop systems, since 1 row of maize or sorghum was replaced by 1 row of cowpea or 2 rows of beans. The results clearly indicate that maize can be replaced by sorghum in maize/legume intercropping systems without damage to the legume yield. This replacement should promote a yield stability because sorghum is less affected by the weather than maize. *(Author's summary)* D03

0457

17411 AIDAR, H. 1978. **Estudo sobre populações de plantas em dois sistemas de culturas associadas de milho e feijão.** *(Study on plant populations in two cropping systems of maize/bean intercropping).* Tese D. Sc. Viçosa-MG, Brazil, Universidade Federal de Viçosa. 103p. Port., Sum. Port., 65 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Spacing. Climatic requirements. Yield components. Yields. Productivity. Experiment design. Statistical analysis. Brazil.**

Three expt. with different bean var. Ricobaio 1014 and maize plant populations in 2 intercropping systems were conducted in the municipalities of Paula Cândido and Viçosa, MG, Brazil, to study the performance of the 2 crops, measure the influence of plant density on characteristics of both crops, and interpret the results obtained in economic terms. In Paula Cândido bean and maize were planted simultaneously in the same row at the beginning of

the rainy season. A factorial design consisting of 3 maize populations (20,000, 40,000, and 60,000 plants/ha) and 5 bean planting densities (0, 40,000, 80,000, 120,000, and 160,000 seeds/ha) was used with treatments in randomized blocks with 4 replications. In Viçosa 2 expt. were conducted in the dry seasons of 1975/76 and 1976/77; maize was planted at the beginning of the rainy season and beans, between the rows of maize when these began to dry. The same factorial design was used. In Paula Cândido, approx. 52% of the variation obtained in bean yield was due to maize populations and 36% to bean population. Beans did not affect maize yields. During the 1st expt. in Viçosa, 91% of the variation in bean production was due to the presence of maize. In the 2nd expt. poor rainfall was the major limiting production factor. However, in the 3 expt. the relationship of land use efficiency was greater and consequently, higher income was obtained per unit of area. *(Summary by C.P.G. Trans. by L.M.F.)* D03 D02

0458

17721 URIBE G., M.; TURRENT F., A. 1980. **Respuesta del cultivo de maíz asociado con fríjol a cinco factores controlables de la producción.** *(Response of maize/bean intercropping to five controllable production factors).* Chapingo 23/24:75-88. Span., Sum. Span., Engl., 11 Refs.

Phaseolus vulgaris. Zea mays. **Intercropping. Spacing. Manures. Fertilizers. Productivity. Experiment design. Statistical analysis. Mexico.**

Two expt. were conducted in Ocuilan, municipality of Arteaga (Mexico) on Andosols to study the response of maize/climbing bean intercropping to the application of N, P, bovine manure, bean plant density, and topological arrangement of maize plants (50,000 plants/ha). A split plot exptl. design was used with 2 replications. Main plots consisted of twenty-eight 8-m rows and subplots, of two 8-m rows. In order to optimize the 5 factors under study, a mixed matrix design was used for the treatments, a 2^2 factorial matrix and a matrix Plan Puebla 1 for 3 factors. Levels studied were: topological arrangement of maize plants (2 and 3 plants/hill); FYM (1 and 2 t/ha); 30, 60, 90, and 120 kg N/ha; 0, 30, 60, and 90 kg P/ha; and bean density (1-0-1, 1-1-1, 1-1-2, and 1-2-1 bean plants/1 maize plant). Statistical analyses of the different factors indicated that (1) maize arrangement affected maize yield, and to a lesser degree, bean yield; (2) FYM had a positive effect on the intercrop; (3) the use of a mixed matrix for optimizing 5-8 factors is a good method for studying the different factors involved in production, especially in rainfed areas. Although an economic analysis was conducted, it was not considered efficient for maize/bean intercropping. Results of analyses are presented in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D03 K00

0459

17720 FRANCIS, C.A.; PRAGER, M.; TEJADA, G. 1982. **Effects of relative planting dates in bean (*Phaseolus vulgaris* L.) and maize (*Zea mays* L.) intercropping patterns.** Field Crops Research 5:45-54. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Planting. Timing. Climatic requirements. Plant habit. Experiment design. Statistical analysis. Colombia.**

To study the impact of the planting date on competition and yield, 4 bean cv. (P788, P566, P498, P589) were intercropped with maize hybrid ICA H-207 using different relative planting dates for the 2 component crops in the pattern. These intercropping patterns were compared with monocultures of each crop in 2 successive seasons in Valle del Cauca, Colombia. Yields of beans, the lower story crop, were strongly affected by maize competition. The 1st crop planted in each pattern was less affected compared with monoculture than the crop which was planted later. Maize and bean yields were negatively correlated across cropping patterns and dates of planting. Competition from maize also reduced bean components of yield in the 4 bean cv. Yield reduction of climbing beans (compared with monoculture) due to intercropping was greater than yield reduction in the other 3 bean cv. Bean seed yield/

plant, pods/plant, and pods/m² were significantly correlated with maize yield. Maize yield was reduced by early competition from an advanced planting of each of the bean cv. Nineteen of the 20 intercrop combinations (4 bean cv. x 5 dates) had LER values greater than unity in both seasons. Highest LER values above 1.5 indicate a biological potential for intercropping to produce 50% more under these conditions than monoculture. *(Author's summary)* D03

0460

17803 HERNANDEZ R., J.C. 1982. **Efecto de la asociación maíz-fríjol sobre poblaciones de insectos plagas, con énfasis en *Empoasca kraemeri*, Ross & Moore.** *(Effect of maize bean intercropping on insect pest populations, emphasizing Empoasca kraemeri.* Tesis Mag. Sc. Chapingo, Mexico, Colegio de Postgraduados. 120p. Span., Sum. Span., 58 Refs., Illus.

Phaseolus vulgaris, Zea mays. **Intercropping. Spacing. Planting. Timing. *Empoasca kraemeri.* Field experiments. Laboratory experiments. Biological control. Yields. Colombia.**

A study was conducted at the Centro Internacional de Agricultura Tropical, Palmira, Colombia to determine the effect of different planting densities and dates of maize in 2 bean var. on populations of and damage caused by *Empoasca kraemeri*, parasitism of this leafhopper by *Anagrus* sp., egg hatch of *E. kraemeri*, populations of other phytophagous insects, and specific environmental factors. The type of stimulus (olfactory and/or visual) that attracts *E. kraemeri* towards beans in monoculture was also determined. Four field trials and 1 greenhouse trial were conducted. In the 1st 3, beans were planted in monoculture at a constant density, and in association with different maize densities; in the 4th trial 2 bean var. (BAT-41, susceptible, and EMP-81, tolerant to *E. kraemeri*) were planted in monoculture, and in association with different maize densities. Regarding beans, maize was planted on 2 different dates. Samples of insect populations as well as parasitism by *Anagrus* sp. were taken weekly along with the counting of non-hatched *E. kraemeri* eggs and the measurement of environmental factors. Traps were used to capture *E. kraemeri* and D-Vac for other phytophagous insects. Preference trials were conducted in the greenhouse trial to observe the behavior of *E. kraemeri* regarding intercropping vs. monoculture; the stimulus (olfactory and/or visual) which *E. kraemeri* responds to in its preference for beans in monoculture was also determined. Adult *E. kraemeri* populations were lower in maize/bean intercropping compared with beans in monoculture. There was evidence that the influence of maize associated with beans does not affect nymphal populations of *E. kraemeri*. Damage by *E. kraemeri* was greater in monoculture compared with beans in association. The % of parasitism of *E. kraemeri* by *Anagrus* sp. was higher in association and when beans were planted simultaneously with maize. The [illegible] of non-hatched *E. kraemeri* eggs was higher in bean var. EMP-81. When beans were planted 15 days after maize, *E. kraemeri* populations were lower. Nymphal populations and plant damage were greater in bean var. BAT-41. *Diabrotica* spp. tended to increase in population with increasing maize densities. Its highest populations were found on var. EMP-81 and when this var. was planted 15 days after maize. There was evidence that *Cerotoma* spp. and *Scaphytopius tuliginosus* populations are lower in maize bean intercropping. These 2 insects prefer to colonize var. EMP-81. *Cerotoma* spp. occurred in equal no. in maize bean intercropping on different planting dates. *S. tuliginosus* appeared in higher no. in beans planted 15 days after maize. Light intensity and temp. of beans leaves were lower in maize bean intercropping compared with that of beans in monoculture. Leaf temp. was higher in var. BAT-41 and bean yield was lower in association due perhaps to competition for light with maize plants. The visual stimulus attracting *E. kraemeri* towards beans is somehow interfered with by the presence of the intercrop, indicating that maize is responsible for this interference. *(Author's summary. Trans. by L.M. E.)* D03 I 01

0461

17702 FRANCIS, C.A., PRAGER, M., HEJADA, G. 1982. **Density interactions in tropical intercropping. I. Maize (*Zea mays* L.) and climbing beans (*Phaseolus vulgaris* L.).** Field Crops Research 5:163-176. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. **Intercropping.** *Zea mays*. **Spacing. Climbing beans. Yields. Yield components. Income. Colombia.**

Densities of maize and climbing beans were studied in monoculture and in a no. of intercrop combinations over 2 seasons in the Valle del Cauca, Colombia (4° N lat., 1000 m.a.s.l.). Maize densities from 1.5-10.5 plants/m² were combined with bean densities from 5.6-37.5 plants/m². Bean-maize density combinations included 48 treatments in the 1st season and 25 treatments in the 2nd season. Yields and yield components of both crops were measured. Maize density had a greater influence than bean density on both maize and bean yields and yield components. Maize is taller and shades the developing bean crop. A vigorous intercropped climbing bean reduced maize yield in the 2nd season, though not in the 1st. Maize yields were positively correlated with maize density and ears/plant. Bean seed yield was positively correlated with pods/m² and pods/plant, but not with bean density. Bean yields and yield components were consistently and negatively correlated with maize yields and yield components, negative correlations between maize and bean yields were r = -0.84** and r = -0.72** for the 1st and 2nd seasons, resp. Per plant yield is reduced in both intercrop components by increased density of either crop. One additional maize plant/m² reduces per plant maize grain yield approx. 5-6 times more than one additional bean plant added to the intercrop. Bean yield/plant is reduced 2-3 times as much by adding one additional maize plant/m² compared with adding one additional bean plant/m². Intraspecific competition appears to be more intense than interspecific competition. Effects of one additional plant of either species decrease at higher densities in the intercrop as both components compete for scarce growth factors. Total grain yields did not show an advantage for either monoculture or intercropping at higher maize densities. LERs consistently were > 1, and specific combinations reached 1.20. Total protein yield was higher for intercrop systems over all density combinations. Net income was higher for monoculture beans and for intercrop patterns than for monoculture maize. Results suggest that a range in maize/climbing bean density combinations can be used to obtain max. or near max. total production and net income. *(Author's summary)* D03

0462

17781 AMADOR A., M.I. 1980 **Comportamiento de tres especies (maíz, fríjol, calabaza) en policultivos en la Chontalpa, Tabasco, México.** [*Behavior of three species (maize, beans, squash) in mixed cropping in Chontalpa, Tabasco, Mexico*]. Tesis Ing. Agr. Cárdenas, Tabasco, Colegio Superior de Agricultura Tropical. **82p.** Span., Sum. Span., 53 Refs., Illus.

Phaseolus vulgaris. **Intercropping.** *Zea mays*. **Yields. Weeding. Mexico.**

The behavior of maize, beans, and squash in association and in monoculture was assessed in humid-warm areas of Mexico. Three study areas were selected with similar climatic conditions but with different agronomic backgrounds: the 1st site (C-34), cultivated with traditional cultural practices, the 2nd (CSAT field), generally prepared mechanically; and the 3rd (CSAT module), with secondary forest eliminated by land clearance, felling, and burning over. A randomized block and a modified Latin square design were used. Planting took place during the summer cycle, total harvest occurring in Nov. of the same yr. Regarding beans, yields were higher in monoculture than in mixed cropping in sites C-34 and CSAT field. Weeding affected crop performance. A higher total biomass was obtained in mixed cropping than in monoculture at only 1 site, C-34. The results obtained showed the possibility of increasing yields of the main crop as well as the area cultivated. Further studies regarding crop combinations that imply overproduction are required. *(Author's summary. Trans. by I.M.E.)* D03 D02

0463

17805 RUIZ R., O. 1981 **Influencia de las arvenses asociadas al cultivo de fríjol (*Phaseolus vulgaris* L), sobre la incidencia de insectos y enfermedades.** *(Influence of arvensis associated with beans on insect and disease incidence).* Tesis Ing. Agr. Cárdenas, Tabasco, México, Colegio Superior de Agricultura Tropical. 70p. Span., Sum. Span., 47 Refs., Illus.

Phaseolus vulgaris. Intercropping. Weeds. Plant damage. Mexico.

The role of arvensis within the bean agrosystem was studied regarding insect pests in a sole 1-ha plot of the Poblado C-26, General Lázaro Cárdenas, belonging to the Unión de Ejidos Colectivos del Plan Chontalpa, Cárdenas, Tabasco, Mexico (alt. 11 m.a.s.l., mean annual temp. 26.6°C, annual rainfall 2250 mm). A randomized block design was used with the following treatments: bean cultivation with a strip of arvensis intercropped bordering the crop; bean cultivation with a central square of intercropped arvensis; bean cultivation with a central strip of arvensis intercropped lengthwise through the plot; and a check, weeding once 30 days after plant emergence. Samples of arvensis were taken to determine their dominance, abundance, and diversity along with insect samples to determine their diversity and habit (herbivore, parasite, and predator). The damage caused by leaf-feeding insects in the bean crop surrounded by maize in monoculture was quantified and disease incidence assessed. Predator insect populations are reduced in beans when the distribution of arvensis plants was controlled 25-45 days after emergence. Leaf damage was min. and statistically and biologically insignificant. The presence of *Diabrotica* spp. decreases after the crop reaches 45 days of age. The presence of arvensis within the crop is determinant in the dissemination of rust (*Uromyces phaseoli* var. *typica*) spores. Grain production is increased since arvensis plants are also harvested. *(Author's summary. Trans. by L.M.F.)* D03

0464

17822 FRANCIS, C.A.; PRAGER, M.; TEJADA, G. 1982. Density interactions in tropical intercropping. 2. Maize *(Zea mays* L.) and bush beans *(Phaseolus vulgaris* L.). Field Crops Research 5(3): 253-264. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. Intercropping. Dwarf beans. *Zea mays.* Spacing. Yields. Income. Colombia.

Densities of maize and bush beans were evaluated in monoculture and in several intercrop combinations over 2 seasons in the Valle del Cauca, Colombia (4° N lat., 1000 m elevation). To determine whether optimum density combinations existed for intercropping, maize densities from 1-10 plants/m² were combined with bean densities from 10-40 plants/m². Yields and yield components of both crops were measured, and net income and biological efficiency of intercrop patterns compared with monoculture of each component crop. Max. maize yields in monoculture were 3640 kg/ha with a tall hybrid in the 1st season, and 7000 kg/ha with a semi-dwarf hybrid in the 2nd season. Bean yield maxima in monoculture were about 2100 kg/ha in each season. Highest intercrop yields were attained with low to moderate maize densities and a wide range of bush bean densities. Higher total grain yields were found in intercrops in each season than in the best monoculture treatment. Bush bean yield/plant was reduced by increasing bean or maize plants/m² in the intercrop, but not proportionally to the no. of additional plants. Thus, bush beans under severe competition are more efficient in use of scarce resources. One tall maize plant was equivalent in competition to 3.5-4 bush bean plants, while one semi-dwarf maize plant was equivalent to 2-3 bush bean plants. Net income generally was higher in the intercrop patterns, followed by monoculture beans and monoculture maize. Biological efficiency as measured by the LER was higher in intercrop than in monoculture, and one intercrop treatment in the 1st season showed a 65% advantage over the single crop alternatives. *(Author's summary)* D03

0465

17773 MWAKHA, F. 1980. Intercropping dry beans in high density arabica coffee. 2. Response to bean rows and nitrogen fertilizer. Kenya Coffee 45(536): 319-324. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. Intercropping. Spacing. Fertilizers. N. Yields. Kenya.

Coffee trees, cv. SL 28, after being stumped and every other row uprooted so as to leave the stand at a spacing of 2.0 x 1.0 m, were interplanted with 0, 2, 4, or 8 rows of beans, and

N was applied at 0, 80, or 160 kg/ha. During the 2nd and part of the 3rd yr, 3 consecutive dry bean crops showed significant yield increase with increasing bean rows and N fertilizer rates. Responses were more pronounced in the 1st than in the subsequent bean crops. No significant interactions between dry bean rows and N were found for both dry bean and clean coffee yields. *(Author's summary)* D03

See also 0573 0576

CIAT ABSTRACTS ON
TROPICAL PASTURES

- Tropical grasses and forage legumes
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- ONLY AVAILABLE IN SPANISH

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

D04 Seed Production

0466

17724 DICKSON, M.H.; BOETTGER, M.A. 1982. **Heritability of semi-hard seed induced by low seed moisture in beans (*Phaseolus vulgaris* L.).** Journal of the American Society for Horticultural Science 107(1):69-71. Engl., Sum. Engl., 11 Refs.

Phaseolus vulgaris. **Seed coat. Seed. Water content. Storage. Germination. Cultivars. Backcrossing. Inheritance. Seed characters. Genes.**

Semi-hard seed in beans is defined as dry seed which does not imbibe water during a 24 h soak, but which will gain moisture rapidly at high RH within 14 days and then germinate normally. The inheritance of semi-hard seed was found to involve several genes. Soft seed was incompletely dominant to semi-hard seed. Narrow sense heritability ranged from 20-50% in the populations studied. Semi-hard seed was associated with excellent seed quality resulting in unusually vigorous seedlings. *(Author's summary)* D04

See also 0469 0580

D05 Varietal Trials

0467

17479 FANJUL, L.; KOHASHI-SHIBATA, J.; HERNANDEZ-XOLOCOTZI, E. 1982. **Yield potential and stratified growth analysis of an indeterminate climbing pole bean (*Phaseolus vulgaris*) in Mexico.** Experimental Agriculture 18:167-175. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Climbing bean. Growth. Branching. Leaf area. Pods. Seeds. Dry matter. Yields. Yield components. Mexico.**

The yield potential of a highly productive non-commercial Type IV bean cv. was determined under optimum field conditions, grown in monoculture at 1 plant/m^2 on trellises 3 m high. Canopy growth was analyzed by dividing the stand into 25 cm horizontal strata. The main components of yield were no. of inflorescences and no. of pods/stratum. Daily yield for the growing period was 4.9 g dry wt./m^2. Although a high yield/plant was recorded (823 g/plant) drop of young pods and seed abortion were the major factors reducing the potential yield. *(Author's summary)* D05

0468

16721 GUAZZELLI, R.J. 1980. **Cultivares melhoradas e tradicionais de feijão nos estados.** *(Improved and traditional bean varieties in Brazil).* Goiânia-GO, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa Arroz, Feijão. Comunicado Técnico no. 7. 4p. Port.

Phaseolus vulgaris. **Cultivars. Plant introduction. Brazil.**

A list of traditional bean var. and improved ones introduced into different states in Brazil is given. A table is also included on the increases in production % in the different regions of the country, obtained with improved var. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0469

17430 GARCIA, R.M.; DIAZ C., H.; PIVOVAROV, V.F.; PAZ L., J. 1980. **Comportamiento de cultivares de fríjol (*Phaseolus vulgaris* L.) en condiciones de Cuba. 1. Fríjoles.** *(Performance of bean cultivars under the conditions of Cuba. 1. Beans).* Informe Científico-Técnico (Cuba) 108:21-22. Span., 8 Refs.

Phaseolus vulgaris. **Cultivars. Seed color. Agronomic characters. Seed production. Plant introductions.** *Uromyces appendiculatus.* **Host-plant resistance. Cuba.**

In trials of approx. 100 Cuban and introduced var. in 1974-76, var. Cuba C25-9-28 surpassed all others in seed yield. The best 7 white-, pink-, or red-seeded var. were earlier than

the best of those with black seeds, but lower yielding, Blanco de Cueto being the most productive among them. The black-seeded VER 37, which equalled Blanco de Cueto in yield, displayed complete resistance to *Uromyces appendiculatus*. *(Summary by Field Crop Abstracts)* D05 D04

0470

16720 RIVERA, R. 1980. **Variedades de fríjol para las zonas altas.** *(Bean varieties for highlands).* Recursos (Honduras) 2(6):39-41. Span., Illus.

Phaseolus vulgaris. **Plant introductions. Cultivars. Agronomic characters. Yields. Climatic requirements. Adaptation. Selection. Field experiments. Honduras.**

Results are given of a series of trials carried out in the communities of Santa Elena and Yarula, Honduras to assess bean var. regarding their adaptation, yields, agronomic characteristics, and quality of grain. Trials were planted in 6 m furrows with N, P, K applications at rates of 15, 30, and 15 kg/ha, resp., manual weed control up to 45 days, and the control of *Epitrix* sp. with 1 *l* methamidophos/ha. Of a total of 72 var., the best were 51052, 51051, EF UU 104, and Jamapa-Venezuela, yielding 1209, 1125, 1167, and 1167 kg/ha, resp. The growth cycle varied between 88-130 days compared with 240 days for traditional var. In another trial with 10 red bean and 10 black bean var., the best red bean var. were Zamorano, Retinto Copán, and EF UU 104 with av. yields of 978, 807, and 673 kg/ha, resp. Among black bean var., 51051, 51052, and PI-370-739 were outstanding with 1211, 1223, and 1073 kg/ha, resp. ICA-TUI yielded an av. of 642 kg/ha. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0471

16439 LIMA, P.R. DE A.; MENDES, M.C. 1981. **Competição de cultivares de feijão (safra das águas) na UEPAE Dourados, 1980/81.** [*Competition of bean cultivars (rainy season) at UEPAE, Dourados, 1980/81*]. Dourados-MS, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Pesquisa em Andamento no. 10. 4p. Port.

Phaseolus vulgaris. **Planting. Timing. Climatic requirements. Cultivars. Agronomic characters. Yields. Yield components. Bean golden mosaic virus.** *Xanthomonas phaseoli. Uromyces phaseoli.* **Host-plant resistance. Selection. Brazil.**

An expt. was conducted at the Unidade de Execução de Pesquisa de Ambito Estadual in Dourados, MS, Brazil, to assess the performance of bean var. during the rainy season. Characteristics evaluated were: plant height, height of the 1st pod, no. of pods/plant, no. of seeds/pod, no. of beans, wt. of 100 seeds, and disease resistance. The most productive var. were Portillo 70, Ica Coll 10103, PR-R-42-1, Porrillo Sintético, 10988, and Ica Pijao with 845, 764, 763, 727, 668, and 624 kg/ha, resp. Moreover, the pods of these var. did not touch the ground. The bean golden mosaic disease and rust (*Uromyces phaseoli*) had a relatively low incidence while common blight (*Xanthomonas phaseoli*) was widespread, favored by the high temp. and RH. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0472

17358 LIMA, P.R. DE A.; MENDES, M.C. 1981. **Comportamento de cultivares de feijão (*Phaseolus vulgaris* L.) em várzea, em Dourados, MS, em 1981.** *(Performance of bean cultivars in lowlands in Dourados, MS, in 1981).* Dourados-MS, Empresa Brasileira de Pesquisa Agropecuária. Pesquisa em Andamento no. 14. 6p. Port.

Phaseolus vulgaris. **Cultivars. Climatic requirements. Adaptation. Agronomic characters. Yields. Selection.** *Xanthomonas phaseoli. Uromyces phaseoli. Isariopsis griseola.* **Bean golden mosaic virus. Host-plant resistance. Brazil.**

Thirteen bean var. were planted at the Unidade de Execução de Pesquisa de Ambito Estadual in Dourados, Brazil, to evaluate their performance under lowland climatic conditions and to study the effect of planting dates on losses due to frost or drought. The trial was set up on March 19 and on April 20, 1981 in randomized blocks with 4 replicates in plots consisting of four 5 m rows, spaced at 0.5 m. Frosts on June 17 and 18 affected the var. planted on the 2nd date The var. planted on the 1st date were not affected and these were assessed for bean yield, height of the 1st and last pod, no. of pods/plant, no. of seeds/pod, and wt. of 100 seeds. The incidence of common bacterial blight (*Xanthomonas phaseoli*), rust (*Uromyces phaseoli*), angular leaf spot (*Isariopsis griseola*), and BGMV and BCMV was registered. Outstanding var. were ICA Pijao, ICA Coll 10103, and 10988 yielding 1886, 1803, and 1601 kg/ha, resp. These did not touch the gound, a characteristic important for mechanical harvesting. Angular leaf spot and the golden mosaic had the highest indices of infection. *(Summary by C.P.G. Trans. by L.M.F.)* D05 D01

0472

17733 THAMBURAJ, S.; SHANMUGAVELU, K.G.; CHOCKALINGAM, P.; PILLAI, O.A.A. 1980. **Varietal evaluation in bush beans (*Phaseolus vulgaris* L.).** South Indian Horticulture 28(4):113-115. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Agronomic characters. Dwarf beans. Snap beans. Pods. Yields. India.**

Of 30 French bean var. tested over 3 seasons, Premier, Masterpiece, Stringless Grey Pod, and Bountiful are recommended for growing on the plains of Tamil Nadu, India. Green-pod yields of the 4 var. ranged from 14.62-15.52 t/ha and crop duration from 81-90 days. *(Summary by Plant Breeding Abstracts)* D05

0474

17707 STOFFELLA, P.J.; BRYAN, H.H.; McMILLAN JUNIOR, R.T.; MARTIN, F.G. 1981. **Black bean production potential in south Florida.** Proceedings of the Florida State Horticultural Society 94:169-172. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Seed production. Seed color. Planting. Spacing. Climatic requirements. Lodging. Host-plant resistance. Cultivars. USA.**

The production of several black bean genotypes grown under south Florida's environmental conditions (USA) was studied. Genotypes were evaluated for seed yield and growth characteristics during several seasons at the Agricultural Research Center, Fort Pierce and Agricultural Research and Education Center, Homestead. Seed yields ranged from 433-1389 kg/ha at Fort Pierce and 976-2914 kg/ha at Homestead. No statistical differences in seed yield occurred among genotypes except for the fall 1977 planting at Homestead and the F_8 (Tui x Guali) trial during spring 1981 at Fort Pierce. In 2 trials at Homestead, 4 rows/bed had significantly higher seed yield than with 2 rows/bed. Arbolito, 70002, and 70003 were significantly more resistant to lodging than Black Turtle Soup or Strain 39 in 2 trials at Fort Pierce. Results suggest that black beans can be grown in south Florida, with optimum seed production on 4 rows/bed. Seed yields were comparable to those obtained in other trials in New York State. *(Author's summary)* D05

See also 0440 0455 0534

E00 PLANT PATHOLOGY

0475

17428 ABAWI, G.S. 1980. **Field screening procedures for identifying resistance to soil-borne diseases of beans.** *In* Nene, Y.L., ed. Consultants' Group Discussion on the Resistance to Soil-Borne Diseases of Legumes, Patancheru, India, 1979. Proceedings. Patancheru, International Crops Research Institute for the Semi-Arid Tropics. pp.151-156. Engl., Sum. Engl., 26 Refs.

Phaseolus vulgaris. **Rots. Roots. Diseases and pathogens. Inoculation. Host-plant resistance. Selection. Soil requirements.**

Several field screening procedures for identifying resistance to soil-borne diseases of beans are available, although they have not been standardized or studied in detail. Establishment of permanent root rot nurseries appears to be the most effective and practical procedure for this purpose. Many soil and environmental factors as well as cultural practices are known to influence the damage potential of soil-borne pathogens to beans. Whenever possible, these factors should be used or manipulated in order to maintain adequate root rot severity and also to reduce seasonal variation in root rot incidence. *(Author's summary)* E00 D01

0476

16441 ZAUMEYER, W.J.; MEINERS, J.P. 1975. **Disease resistance in beans.** Annual Review [illegible] topathology 13:313-334. Engl., 143 Refs.

Phaseolus vulgaris. **Bean common mosaic virus. Bean yellow mosaic virus. Bean southern mosaic virus. Curly top virus.** *Colletotrichum lindemuthianum. Uromyces phaseoli. Fusarium solani phaseoli. Rhizoctonia solani. Isariopsis griseola. Meloidogyne incognita. Pseudomonas phaseolicola. Corynebacterium flaccumfaciens. Pseudomonas syringae.* **Host-plant resistance. Germpla**

A review is given on the progress in breeding beans resistant to viral (BCMV, BYMV, curly top, BSMV, pod mottle) and fungal diseases [anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces phaseoli*), root rots caused by *Fusarium, Rhizoctonia, Thielaviopsis basicola, Pythium aphanidermatum*, and *P. ultimum*, angular leaf spot (*Isariopsis griseola*), powdery mildew (*Erysiphe polygoni*), white mold (*Sclerotinia sclerotiorum*)], diseases caused by nematodes (*Meloidogyne incognita*), and by bacteria [halo blight (*Pseudomonas phaseolicola*), common and fuscous blights (*Xanthomonas phaseoli* and *X. phaseoli* var. *fuscans*), bacterial wilt (*Corynebacterium flaccumfaciens*), and brown spot (*Pseudomonas syringae*)]. The greatest progress has probably been the development of BCMV-resistant cv. Sources of germplasm are also indicated along with potential problems regarding genetic vulnerability and areas where future research should be directed towards. *(Summary by A. J.C. Trans. by L.M.F.)* E00 G00

See also 0417

E02 Bacterioses

0477

15861 MOFFETT, M.L.; MIDDLETON, K.J. 1979. **Effect of common blight on yield of navy beans.** Australasian Plant Pathology 8(2):19. Engl., 2 Refs.

Phaseolus vulgaris, Xanthomonas phaseoli. **Plant injuries. Leaves. Pods. Seeds. Yields.**

In a field trial conducted at the J. Bjelke-Petersen Field Station, Kingaroy (Australia) to determine the effects of *Xanthomonas phaseoli* on foliage, pods, yield, seed size, and seed staining of the bean cv. Kerman, it was found impossible to maintain the control plots free from infection, but results indicated that yield loss and seed quality were clearly related to the level of disease in the crop. *(Summary by Review of Plant Pathology)* E02

0478

17450 GNANAMANICKAM, S.S.; SMITH, D.A. 1980. **Selective toxicity of isoflavonoid phytoalexins to Gram-positive bacteria.** Phytopathology 70(9):894-896. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Phaseollin. Phytoalexins. Toxicity. Bacteria. Bacteriology. Culture media.**

The isoflavonoid phytoalexins, kievitone and phaseollin, were found to be selectively toxic to Gram-positive bacteria. In a standard paper-disk bioassay, 10-50 μg kievitone or phaseollin inhibited the growth of all 7 Gram-positive, but none of the 8 Gram-negative, bacteria tested. Phaseollidin and phaseollinisoflavan also possessed such selective toxicity to Gram-positive bacteria. Further assays showed that even 2 μg kievitone (0.56 x 10^{-8} mole), which proved to be the most toxic of the compounds examined, inhibited the growth of *Corynebacterium fascians, Bacillus subtilis,* and *Micrococcus luteus. (Author's summary)* E02

0479

17436 ANDERSON, A.J. 1980. **Unique aspects of the cell surface polysaccharide of *Pseudomonas phaseolicola* as demonstrated by bacteriophage specificity.** Canadian Journal of Microbiology 26(2):1422-1427. Engl., Sum. Engl., Fr., 23 Refs.

Phaseolus vulgaris, Pseudomonas phaseolicola. **Identification. Cell walls. Proteins. Analysis. Host-plant resistance. Laboratory experiments.**

Bacteriophage 12P caused lysis of *Pseudomonas phaseolicola* but not other plant paghogenic or saprophytic pseudomonads. Specificity of the bacteriophage may depend on recognition of some unique feature of the *P. phaseolicola* cell surface polysaccharides. Exopolysaccharide (EPS) and lipopolysaccharide (LPS) from *P. phaseolicola* were more efficient at inhibiting bacteriophage attachment than were identically prepared extracts from 5 other pseudomonad species. Mutants of *P. phaseolicola* with bacteriophage resistance produced EPS and LPS different in amount and composition from those of the parental strain. Thus, in some manner the EPS and LPS structures of *P. phaseolicola* are distinct from those of

other pla. ' 'athogenic and saprophytic species. The difference may prevent recognition and initiation ot resistance events when *P. phaseolicola* challenges its susceptible host plant, bean. *(Author's summary)* E02

0480

17451 CAFATI, C R.; SAETTLER, A.W. 1980. **Transmission of *Xanthomonas phaseoli* in seed of resistant and susceptible *Phaseolus* genotypes.** Phytopathology 70(7):638-640. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. Phaseolus acutifolius. Xanthomonas phaseoli. **Cultivars. Host-plant resistance. Disease transmission. Seed transmission. Seeds.**

A study was conducted on the possible transmission of the bean common blight pathogen *Xanthomonas phaseoli* (= *X. campestris*) (*Xp*) in seed of resistant *Phaseolus acutifolius* (tepary bean), and in *P. vulgaris* genotypes Great Northern (G.N.) Nebraska no. 1 selection 27, cv. G.N. Valley, cv. G.N. Jules, and breeding line MSU-51319 (all moderately resistant) and cv. Tuscola and Seafarer (both susceptible). Field-grown plants were inoculated by scratching the dorsal suture of pods at the flat green stage of development with a syringe containing a suspension of R15-1 (an *Xp* mutant resistant to 50 ppm rifampin) at 10^7 colony-forming units/ml. At normal maturity, only susceptible Tuscola had typical bacterial blight symptoms. Internally borne blight bacteria were isolated in both solid and liquid rifampin-containing media. Mutant R15-1 was recovered from 40, 42, 46, 51, 42, and 70% of seeds with any type of visible symptoms of internal blight infection in the genotypes tepary, Nebraska no. 1 selection 27, Valley, Jules, MSU-51319, and Tuscola, resp. Mutant R15-1 also was recovered from 1.3, 2.0, 1.3, 1.9, 2.0, and 10.4% of symptomless seeds of the same genotypes, resp. Data suggest that tests to detect seed-borne bacterial blight should be included in production programs for certified, blight-free seed of all dry bean cv. *(Author's summary)* E02

0481

17715 BARZIC, M.R.; TRIGALET, A. 1982. **Détection de *Pseudomonas phaseolicola* (Burkh.) Dowson par la technique ELISA.** *(Detection of Pseudomonas phaseolicola by the ELISA technique).* Agronomie 2(4):389-397. Fr., Sum. Fr., Engl., 23 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Seeds. Leaves. Identification. Analysis. Antisera. ELISA.**

ELISA tests were performed according to the sandwich method as described by Clark & Adams (1977) and slightly modified by using *Tris*-HCl saline buffer for the enzymatic phase with alkaline phosphatase from *Escherichia coli* to detect *Pseudomonas phaseolicola* in contaminated bean seed and leaves. Purified immunoglobulins were obtained by affinity chromatography using either protein A, or whole bacterial *P. phaseolicola* as ligands. Preliminary studies revealed that the ELISA technique was effective when applied to bacterial suspensions or to corresponding filtrates through 0.22 μm membranes as well. Under these exptl. conditions, the lower limit of detection of the ELISA sandwich method was about 10^4 bacteria/ml within 4 h. The bacterial metabolites in the filtrates led to heavy, rapid positive responses; the detectable amount of soluble protein is about 10 ng/ml by reference to serum albumin. ELISA sensitivity could not be expressed in terms of bacterial concn., but rather in terms of the concn. of bacterial antigens soluble or not. The possible correlation between a bacterial concn. and its related metabolite production under natural environmental conditions should be established. A good correlation was demonstrated between the immunofluorescence indirect method and ELISA in detecting *P. phaseolicola* in contaminated seeds and leaves. The extraction and purification of some bacterial metabolites involved in pathogenicity should lead to the production of specific antisera. These should be of great help in qualitative and quantitative studies by ELISA on the production and distribution of these pathogenic metabolites in vivo. Standardization in purifying immunoglobulins and in conjugating them with more active enzymes is needed to allow valid comparisons and improve the sensitivity of ELISA. *(Author's summary)* E02

See also 0536 0542 0546 0551

E03 Mycoses

0482

17410 KINYUA, G.K. 1979. **The occurrence of race alpha of *Colletotrichum lindemuthianum* in Kisii District Kenya.** Thika, Kenya, Ministry of Agriculture. National Horticultural Research Station. 3p. Engl., Sum. Engl., 5 Refs.

Paper presented at the Symposium on Grain Legume Improvement in Eastern Africa. Kenya, University of Nairobi, 1979.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Races. Cultivars. Host-plant resistance. Laboratory experiments. Field experiments. Kenya.**

In a cv. trial conducted in Kisii, Kenya, red haricot bean GLP-3 showed typical symptoms of bean anthracnose (*Colletotrichum lindemuthianum*) on pods. Previously this var. had been tested several times in the lab. and had proved to be resistant to the λ race of *C. lindemuthianum*. A pure culture of *C. lindemuthianum* was obtained from infected GLP-3 pods. By using different bean var. (Canadian Wonder, Processor, Dark Red Kidney, Perry Marrow, Kaboon, Double White Princess, Cornell 49-242, Evolutie, Pepita) to distinguish the races of *C. lindemuthianum*, the Kisii isolate was found to be an α race. In most areas where beans are grown, GLP-3 is found to be resistant to bean anthracnose, indicating the absence of this race in these areas. *(Author's summary)* E03 G01

0483

17429 SUMNER, D.R.; SPIVEY, C.D.; GAY, J.D. 1979. **Populations of soil fungi and root diseases of vegetables in Norfolk loamy sand soil treated with sodium azide and methyl bromide.** Athens, Georgia, University of Georgia. College of Agriculture. Experiment Stations. Research Bulletin no. 244. 19p. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. Fusarium oxysporum. Fusarium solani. Pythium sp. **Soil populations. Soil treatment. Disease control. Chemical control. Timing. USA.**

In field trials over 2 yr on cucumber, polebean, and capsicums the soil was treated with methyl bromide fumigant at 504 kg/ha or sodium azide granules at 67 or 112 kg/ha under plastic. Sodium azide at both rates markedly reduced soil populations of *Pythium, Fusarium, Trichoderma, Aspergillus, Penicillium,* and *Paecilomyces* spp. Methyl bromide was less effective than sodium azide in the 1st yr but in the 2nd yr the efficacies of the chemicals were similar. When the plastic remained as a film mulch sodium azide was phytotoxic to all crops but when the film was removed before planting the higher rate caused stunting in polebeans and capsicums, the lower rate and all methyl bromide treatments having no phytotoxic effect. Methyl bromide and sodium azide at 67 kg/ha increased yields of all 3 crops (without plastic mulch) by an av. of 54 and 30%, resp., being particularly effective in increasing yields of cucumber for the fresh market. *(Summary by Horticultural Abstracts)* E03 D01 I00

0484

17492 SMITH, D.A.; HARRER, J.M.; CLEVELAND, T.E. 1981. **Simultaneous detoxification of phytoalexins by *Fusarium solani* f. sp. *phaseoli*.** Phytopathology 71(11):1212-1215. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. *Fusarium solani phaseoli*. **Culture media. Phytoalexins. Toxicity. Enzymes. Laboratory experiments.**

The isoflavonoid phytoalexins, kievitone and phaseollidin, added to liquid cultures of *Fusarium solani* f. sp. *phaseoli*, were simultaneously detoxified to kievitone hydrate and phaseollidin hydrate, resp. Both phytoalexins (each at 20 µg/ml) were transformed within 24 h after being added to fungal cultures. No increase in mycelial dry wt. occurred during detoxification. A purified preparation of kievitone hydratase, the enzyme for kievitone transformation, did not accomplish simultaneous detoxification; kievitone was detoxified but phaseollidin was not. *(Author's summary)* I-03

0485

17767 KHARE, M.N.; LATIN, K.B.; AGRAWAL, S.C. 1979. **Influence of fungicides on the incidence of foliar diseases, phylloplane mycoflora, yield, seed-borne fungi and protein contents of French bean.** Proceedings of the National Academy of Sciences 49(2):69-72. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Snap beans.** *Colletotrichum lindemuthianum*; *Alternaria alternata*; *Cercospora canescens*. **Disease control. Yields.**

Of 7 fungicide spray treatments tested (mancozeb, copper oxichloride, zineb, wettable S, ziram, wettable S + ziram, and copper oxychloride + zineb), mancozeb gave the best control of various leaf diseases of *Phaseolus vulgaris* which included anthracnose (*Colletotrichum lindemuthianum*), Alternaria leaf and pod spot (*Alternaria alternata*), and Cercospora leaf spot (*Cercospora canescens*). Max. reduction in phylloplane fungi was observed, and mancozeb had the best effect on yield. Association of fungi with harvested seed was least with mancozeb and wettable S. *(Summary by Review of Plant Pathology)* I-03

0486

17716 SIPPELL, D.W.; HALL, R. 1982. **Effects of pathogen species, inoculum concentration, temperature, and soil moisture on bean root rot and plant growth.** Canadian Journal of Plant Pathology 4(1):1-7. Engl., Sum. Engl., Fr., 25 Refs.

Phaseolus vulgaris. *Pythium ultimum*; *Fusarium solani phaseoli*. **Inoculation. Soil populations. Rots. Roots. Temperature. Soil moisture. Growth.**

The effects of 3 temp. (14, 21, and 28 C), 2 soil moistures (-50 and -170 mbars), 2 fungal species (*Pythium ultimum* and *Fusarium solani* f. sp. *phaseoli*), and 4 inoculum concn. (0, 10, 100, and 1000 spores/g of soil) on growth and root rot of white bean were determined. Root rot severity increased with inoculum concn. Effects of the fungi on root rot were additive at 10 and 100 spores/g, and less than additive at 1000 spores/g. Reductions in total plant dry wt. were greatest at 1000 spores/g of *P. ultimum* or at 10 and 100 spores/g of the combination of fungi. Effects of the fungi on plant growth were additive at all inoculum concn. Root rot was more severe in moist (-50 mbars) than in drier soil (-170 mbars). *F. solani phaseoli* genetally caused most disease at 21 C and there was a tendency for *P. ultimum* to cause more disease at 14 and 21 C than at 28 C. The combination of fungi caused most disease at 14 C. Total plant dry wt. was greatest at 28 C but was not affected differentially by the soil moisture levels tested. Plant wt. was influenced primarily by temp. whereas root rot severity was determined mainly by inoculum concn. *(Author's summary)* I-03 D01

0487

17726 MAGALHAES, A.A. DE; CHOUDHURY, M.M.; MILLAR, A.A.; ALBUQUERQUE, M.M. DE 1982. **Efeito do déficit de água no solo sobre o ataque de *Macrophomina phaseolina* em feijão.** *(Effect of soil water deficit on the attack of Macrophomina phaseolina in beans).* Pesquisa Agropecuária Brasileira. Serie Agronomía 17(3):407-411. Port., Sum. Port., Engl., 20 Refs., Illus.

Phaseolus vulgaris. Macrophomina phaseolina. **Disease control. Soil moisture. Plant development. Drought. Irrigation. Timing. Plant injuries. Yields. Field experiments. Brazil.**

The effect of water stress on the incidence of the ashy stem blight (*Macrophomina phaseolina*) in beans was evaluated under field conditions at the exptl. station of the Centro do Pesquisa Agropecuária do Trópico Semi-Arido of the Empresa Brasileira de Pesquisa Agropecuária in Petrolina, PE, Brazil. A randomized block design was used with 4 replications and 7 treatments. Treatments 1 to 7 corresponded to 0, 6, 9, 11, 13, 16, and 18 days without watering from the beginning of the flowering period, resp. Before and after the water stress treatments, the soil of the exptl. plots was maintained at optimum moisture conditions. Diseased plants were counted 49, 63, and 84 days after planting. Plant mortality caused by the fungus was significantly different among treatments at the 1% level. The no. of diseased plants increased as the period of water stress was prolonged, resulting in 8.6% dead plants under ideal soil moisture conditions vs. 63.9% dead plants in plots with 18 days of water stress. *(Author's summary)* E03 D01

0488

17431 GARCIA, R.M.; DIAZ C., H.; PIVOVAROV, V.F.; PIEDRA, S.; VELAZQUEZ, O. 1980. **Comportamiento de cultivares de fríjol (*Phaseolus vulgaris* L.) en condiciones de Cuba. 2. Habichuelas.** *(Behaviour of bean cultivars under Cuban conditions. 2. Snap beans).* Informe Científico-Técnico (Cuba) 108 23-24. Span., 4 Refs.

Phaseolus vulgaris. **Snap beans. Field experiments. Cultivars.** *Uromyces phaseoli.* **Host-plant resistance. Cuba.**

Of approx. 30 Soviet cv. tested in the field at the N.I. Vavilov Exptl. Station, La Habana (Cuba), only Fana and Asta were relatively resistant to rust (*Uromyces phaseoli*). A table comparing the behaviour of introduced and improved var. already existent in the country is included. *(Summary by Review of Plant Pathology)* E03 G01

0489

17437 ANDERSON, A.J. 1980. **Differences in the biochemical compositions and elicitor activity of extracellular components produced by three races of a fungal plant pathogen,** *Colletotrichum lindemuthianum.* Canadian Journal of Microbiology 26(12):1473-1479. Engl., Sum. Engl., Fr., 16 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Races. Toxins. Analysis. Host-plant resistance. Laboratory experiments.**

High mol. wt. products from the α, β, and γ races of *Colletotrichum lindemuthianum* differed in their carbohydrate and protein compositions and in their abilities to elicit symptoms of a hypersensitive response in dark red kidney bean. The neutral sugar composition of the products varied in their proportions of rhamnose, mannose, galactose, and glucose. Polyacrylamide gel electrophoresis showed the protein components to be more numerous in the β race products than in the α or γ race products. Each protein band co-stained for carbohydrate. Highest elicitor activity was observed in the products from the α race, a race avirulent on dark red kidney. The products from the weakly virulent γ race were about 10-fold less active as elicitors than those of the α race. With the β race, a race highly virulent on dark red kidney, elicitor activity was 100-fold less than that of the α race. *(Author's summary)* E03

0490

17719 GROTH, J.V.; URS, N.V.R.R. 1982. **Differences among bean cultivars in receptivity to *Uromyces phaseoli* var. *typica*.** Phytopathology 72(4):374-378. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Cultivars. Inoculation. Leaves. Leaf area. Plant development. Host-plant resistance. Statistical analysis.**

Receptivity (no. of uredia obtained/propagule applied) to rust (*Uromyces phaseoli* var. *typica)* was measured on unifoliolate and trifoliolate leaves of 6 bean cv. Differences in receptivity among cv. were observed after precision inoculation of leaves having a range of ages and less precise inoculation of leaves of uniform age. Both methods showed cv. differences in receptivity. Plants of cv. Royal Red Kidney, which was least receptive overall, exhibited lower receptivity for both unifoliolate and trifoliolate leaves at every age than did those of the highly receptive cv. Pinto 111. Differences in receptivity for these 2 cv. over all ages were approx. 3-fold for both leaf types. Method of measuring receptivity influenced the results obtained; those made on leaves of different ages provided sufficient information for fully describing receptivity. *(Author's summary)* F03

0491

17752 PAPAVIZAS, G.C. 1981. **Survival of *Trichoderma harzianum* in soil and in pea and bean rhizospheres.** Phytopathology 72(1):121-125. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Trichoderma harzianum. **Isolation. Rhizosphere. Inoculation. Soils.**

A semiselective medium was developed for the direct isolation of *Trichoderma harzianum* and other *Trichoderma* spp. from soil, and for the quantitative estimation of its inoculum density in soil. The selective agar medium contained per liter: V-8 juice, 200 ml; glucose, 1 g; agar, 20 g; and water, 800 ml. The agar was autoclaved separately in 0.5 *l* water and added to the V-8 juice after autoclaving. The *Trichoderma* medium I (TMI) contained the following antimicrobial agents (µg/ml): neomycin sulfate, bacitracin, penicillin G, and chloroneb, 100 each; nystatin, 20; chlortetracycline HCl, 25; sodium propionate, 500; and pentachloronitrobenzene, 100. For benomyl-tolerant biotypes, the TMI medium was supplemented with 10 µg/ml of benomyl. Conidia of *T. harzianum* that were added to soil without nutrient-supplying amendments survived for at least 130 days, but the duration and the % survival depended on the isolate used. *T. harzianum* did not survive well in the rhizosphere of bean and pea seedlings when seed was coated with conidia of the fungus. It also did not increase in the rhizosphere of pea seedlings from conidia applied directly to soil 1 day before planting. Infusion of pea seed with the fungicide metalaxyl before coating it with conidia of *T. harzianum* improved survival of conidia in the rhizosphere compared with the survival in the rhizosphere from seed that received conidia only. *(Summary by Biological Abstracts)* F03

0492

17472 RIBEIRO, S.R. 1981. **Reação de cultivares de feijão a nove raças fisiológicas de *Colletotrichum lindemuthianum* (Sacc. et Magn.) Scrib.** *(Reaction of bean cultivars to nine physiological races of Colletotrichum lindemuthianum).* Revista Ceres 28(158):342-350. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris. **Cultivars.** *Colletotrichum lindemuthianum.* **Host-plant resistance. Brazil.**

Thirty-six Brazilian commercial bean cv. and 11 European and N. American cv. were tested for resistance to 9 races of *Colletotrichum lindemuthianum.* Results revealed that most of the commercial cv. tested were susceptible to the races of the pathogen. Some European and N. American cv. that showed resistance could be used as sources of resistance in breeding programs: Kaboon, resistant to races BA-1, BA-2, BA-3 BA-5, BA-6, BA-8, and BA-9; Widusa, resistant to races BA-3, BA-8, and BA-9; Master Piece, resistant to races BA-1, BA-2, and BA-6; and Cornell 49-242, resistant to all races. *(Author's summary)* F03

0493

17452 IMHOFF, M.W.; COOVER, S.R. 1981. **Design of an acoustical particle counter and its use in phytopathological research.** Phytopathology 71(2):152-156. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Laboratory experiments.** *Uromyces phaseoli.* **Epidemiology.**

An acoustical particle counter and rotorod samplers were used to monitor spores of *Uromyces phaseoli* var. *typica* on snap bean cv. Bountiful during the course of 4 epidemics in controlled environment chambers. In the acoustical counter, air-borne particles are drawn through a capillary section of a tubular acoustical element, where particles larger than 5 μm in Ø shed vortices as they are accelerated less rapidly than the surrounding air. Pressure changes caused by these disturbances in the laminar flow cause sound waves detectable with an electret microphone. Acoustical counts and rotorod counts were highly correlated (r = 0.98), with approx. 1 acoustical count for every 26 rotorod counts. Disease increase as measured by a visual rating scale was highly correlated with both acoustical counts (r = 0.94) and rotorod counts (r = 0.96). Immediate digital readout, simplicity of design, and large sampling vol. give the acoustical counter advantages over other particle counting methods for some phytopathological investigations. *(Author's summary)* 1 03

0494

17815 KISTLER, H.C.; VAN ETTEN, H.D. 1981. **Phaseollin metabolism and tolerance in *Fusarium solani* f. sp. *phaseoli*.** Physiological Plant Pathology 19(2): 257-271. Engl., Sum. Engl., 30 Refs., Illus.

Phaseolus vulgaris. **Phaseollin. Metabolism.** *Fusarium solani phaseoli.* **Analysis. USA.**

Metabolism of bean phaseollin to 1a-hydroxyphaseollone appears to occur by way of an inducible mono-oxygenase. The metabolism of this phytoalexin may be a component (but not the complete cause) of adaptive tolerance of phaseollin. The expression of tolerance was closely correlated in time with metabolism. Also pretreatment of the fungus with compounds that stimulated metabolism also enhanced tolerance. However, inhibition of metabolism by naphtho-(2,3-d)-1,3-dioxole did not render cultures completely sensitive to the toxic effect of the phytoalexin. *(Extracted from author's summary)* 1 03

0495

17796 ZULU, J.N.; WHELLER, B.J. 1982. **The importance of host factors of beans (*Phaseolus vulgaris*) on the control of rust (*Uromyces appendiculatus*).** Tropical Agriculture 59(3): 235-238. Engl., Sum. Engl., 1 Ref., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Disease control. Host-plant resistance. Cultivars.**

The influence of different properties of the host *Phaseolus vulgaris* on the control of rust, *Uromyces appendiculatus*, was determined. Several host factors, like leaf age, leaf type, and cv. type were investigated. Disease density was highest on leaves 12 days old at inoculation for unifoliates and 22 days old for trifoliate leaves. The disease density on leaves younger or older than this was significantly lower. However, the trifoliate leaves were significantly more resistant than corresponding unifoliate leaves. A few cv. chosen at random (Prince, Canadian Wonder, Kinghorn Wax, Harvester, Masterpiece, Tendergreen, Remus, and Pinto) showed a wide variation in their susceptibility to the rust. *(Author's summary)* 1 03

0496

17798 CARDOSO, J.L.; OLIVEIRA, L.B. DE; MESQUITA, J.L. DE L. 1980. **Efeito da mela do feijoeiro na qualidade da semente.** *(Effect of web blight of beans on seed quality).* Rio Branco, Acre, Brazil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execução de Pesquisa de Ambito Estadual. Comunicado Técnico no. 18. 3p. Port.

Phaseolus vulgaris. Seeds. *Rhizoctonia solani.* Germination. Seed characters. Brazil.

Comparison of batches of *Phaseolus vulgaris* seed with or without infection by *Rhizoctonia solani* showed that the infected batch had a germination of 68% and a 100-seed wt. of 12.2 g compared with 93% and 22.2 g in the uninfected batch. The dry wt. of seedlings from infected seed was 0.13 g and the hypocotyl height was 6.54 cm compared with 0.16 g and 6.92 cm from uninfected seed. *(Summary by Field Crop Abstracts)* E03

0497

17802 FARINA, G.; BARBIERI, N.; BASSI, M.; BETTO, E. 1981. Heat sensitivity of mycelium and haustoria in bean leaves infected with bean rust. Ultrastructural observations. Mycopathologia 73:121-125. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Leaves. Inoculation. *Uromyces phaseoli.* Heat treatment. Hosts and pathogens.

Leaves of *Phaseolus vulgaris* inoculated with *Uromyces appendiculatus* were heat-treated at 50°C for 20 s at different times after inoculation. The treatment had no effect on the host but caused severe ultrastructural alterations in the pathogen. The alterations were already visible in the haustoria and hyphae at the end of the treatment, became progressively more severe with time and led to pathogen death 2 days after treatment. From this time onwards the haustoria appeared shrunken, extremely electron dense and encased in a mass of granular material, seemingly secreted by the host cell. No encasement was observed in apparently senesced dead haustoria in untreated leaves. *(Author's summary)* E03

0498

17788 CHRIST, B.J.; GROTH, J.V. 1982. Inheritance of virulence to three bean cultivars in three isolates of the bean rust pathogen. Phytopathology 72(7):767-770. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. Uromyces phaseoli. Inheritance. Isolation. Virulence. Genes. Cultivars.

The mode of inheritance of virulence of 3 selected rust (*Uromyces phaseoli* var. *typica*) isolates on 3 bean cv. was determined on plants with each isolate in isolation chambers or in the greenhouse. Two single-pustule collections of *U. phaseoli* var. *typica*, isolates S1-5 and P10-1, gave differential reactions on 2 bean cv., US#3 and Early Gallatin (EG), while both isolates were virulent on Pinto 111. The 3rd isolate, S1-1, was virulent on all 3 cv. Upon selfing, S1-5 did not segregate for virulence, whereas P10-1 and S1-1 segregated only on EG and US#3, resp. Crosses were made among the 3 isolates in all combinations. The F_1 progeny of P10-1 x S1-5 segregated in a ratio of one virulent to one avirulent on EG and US#3, indicating 2 independent genes for virulence. Combining the results of selfing and of all the crosses, 3 genes for virulence to the 3 cv. were identified. Further proof of the 3 virulence genes was obtained by selfing, crossing, and backcrossing selected F_1 isolates. The 3 virulence loci were designated as UpA_1, UpA_2, and UpV_3. For 2 of the genes avirulence was dominant, but for the 3rd, virulence was dominant. *(Author's summary)* E03

See also 0537 0548 0550

E04 Viroses

0499

17447 FATING, K.B.; KHARE, M.N. 1978. **Influence of virus infection on the phyllosphere mycoflora of frenchbean.** Indian Phytopathology 31(3):387-388. Engl., 7 Refs.

Phaseolus vulgaris. **Snap beans. Bean common mosaic virus. Leaves. Microbiology. Mycoses. Isolates.**

The mycoflora present on leaves of healthy and BCMV-infected plants of snap bean cv. Tennessee green was compared at different stages of growth (vegetative, flowering, and crop maturity). Fungi were isolated by the washing and shaking 2 trifoliate leaves in 100 ml sterile water and were incubated on plates at room temp. (22-28°C). *Alternaria alternata, Aspergillus* spp., *Cladosporium* sp., *Helminthosporium* sp., *Penicillium variabile*, and *Trichoderma aureoviride* were observed in the phylloplane of both healthy and virus-infected plants while *Fusarium* sp., *Myrothecium roridum*, and *Rhizopus* sp. were obtained from leaves of healthy plants. Premature aging of plant organs and physiological disorders of virus-infected plant tissues may be responsible for the reduction in fungal flora in the phylloplane of these plants. The differences in the phylloplane mycoflora of healthy plants at different stages may be due to the changes in the physical nature of leaf surface and chemical nature of leaf exudates. *(Summary by C.P.G. Trans. by L.M.F.)* E04 100

0500

17468 GOODMAN, R.M.; SHOCK, T.L.; HABER, S.; BROWNING, K.S.; BOWERS JUNIOR, G.R. 1980. **The composition of bean golden mosaic virus and its single-stranded DNA genome.** Virology 106(1):168-172. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Bean golden mosaic virus. DNA. Proteins. Analysis. Enzymes. Biochemistry.**

BGMV contains predominantly circular single-stranded DNA, but DNA isolation by treating virus with proteinase K results in conversion of the DNA to a linear form. The conversion is inhibited by as little as 0.025% SDS but not by phenylmethylsulfonyl fluoride and does not occur when purified DNA is incubated with proteinase K. Protein is not involved in the covalent structure of BGMV DNA; the conversion appears to be caused by an endonuclease that copurifies with the virus and is resistant to proteinase K. BGMV contains a major capsid protein with an estimated mol. wt. of 27,400. Two minor proteins are found, even in the most highly purified virus preparations, their origin and role in virus structure or function are unknown. BGMV particles contain 19% DNA; therefore, each geminate particle must contain a single DNA molecule, of which over 90% are circular. The estimated mol. wt. of the virus is 3.8 x 10^6. *(Author's summary)* E04

0501

17474 ALVAREZ A., M.; SEPULVEDA R., P. 1982. **Determinación de una raza necrótica del virus del mosaico común del poroto en Chile.** *(Determination of a necrotic strain of the bean common mosaic virus on beans in Chile).* Agricultura Técnica (Chile) 42(1):61-66. Span., Sum. Span., Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Bean common mosaic virus. Races. Host range. Disease transmission. Seed transmission. Symptomatology. Serology. Electron microscopy. Cultivars. Host-plant resistance. Chile.**

A virus isolated from *Phaseolus vulgaris* was identified as a necrotic strain of BCMV, different from the strains tipo and N.Y. 15, previously reported in Chile. The new strain produced apical necrosis and severe vascular necrosis in leaves, stems, pods, and roots in those var. which carry the dominant hypersensitive gene with Corbett Refugee type resistance against strains tipo and N.Y. 15. Plants infected at an early stage of growth died. The new strain produced mosaic symptoms on Chilean var. traditionally susceptible to both latter strains. It was determined that the necrotic strain corresponded to BCMV, on the basis of its symptomatology; restricted host range; physical properties; serology; transmission by mechanical means, by seed, and by aphids in a nonpersistent form; and size and morphology of the virus particles. *(Author's summary)* F04

0502

17714 SHIMOMURA, T. 1982. **Effects of boron on the formation of local lesions and accumulation of callose in French bean and Samsun NN tobacco leaves inoculated with tobacco mosaic virus.** Physiological Plant Pathology 20:257-261. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Tobacco mosaic virus. Inoculation. Leaves. Symptomatology. Plant nutrition. B. Host-plant resistance. Laboratory experiments.**

Bean plants grown in culture solution containing excess B and inoculated on their primary leaves with TMV yielded fewer and smaller local lesions with intense callose fluorescence around the lesions. Fluorescence lasted for 5 days after inoculation vs. 2 days for control plants. Similar phenomena occurred in leaf-halves of bean floated on a solution of excess B after inoculation with TMV. Contrary to this, when leaf-halves of Samsun NN tobacco plants were floated on B solution after inoculation with TMV, the treatment had no effect on lesion formation and callose fluorescence. There is a correlation between the amount of callose accumulation in the leaves and the ultimate size of lesions formed in the inoculated leaves. *(Author's summary)* F04

0503

17809 WEBER, K.A.; SEHGAL, O.P. 1982. **Subgenomic RNAs in virions of southern bean mosaic virus.** Phytopathology 72(7):909-913. Engl., Sum. Engl., 30 Refs., Illus.

Phaseolus vulgaris. **Bean southern mosaic virus. RNA. Virulence.**

The proportion of subgenomic RNAs in BSMV bean strain (BSMV-B), relative to the infectious genomic (25S) RNA, is approx. 2.3 times greater in late- vs. early-progeny virions. The specific infectivity of late-progeny BSMV is also lower than that of the early-progeny virions. Apparently, a proportion of late-progeny BSMV lacks 25S RNA; attempts to resolve them were unsuccessful. Subgenomic BSMV RNAs neither inhibit nor stimulate the infectivity of 25S RNA. When virions are exposed at 45 C for 2 h, subgenomic components complex with genomic RNA, but this treatment causes no marked decline in the infectivity. Exposure at a somewhat higher temp. (65 C, 10 min) is necessary for BSMV inactivation with genomic compaction. Subgenomic RNAs were detected in BSMV-B virions synthesized in necrotized tissue of bean cv. Pinto as well as in the 50S subviral nucleoprotein. Two additional BSMV strains, cowpea and Nigerian, also encapsidate the subgenomic components. *(Author's summary)* F04

0504

17789 CUPERTINO, F.P.; LIN, M.L.; KITAJIMA, E.W.; COSTA, C.L. 1982. **Occurrence of southern bean mosaic virus in Central Brazil.** Plant Disease 66(8): 742-743. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Bean southern mosaic virus. Isolation. Etiology. Host range. Electron microscopy. Serology. Brazil.**

Bean plants infected with BSMV were found for the 1st time in central Brazil. Identification of the virus was based on host range, in vitro properties, electron microscopy, and serology. PI 313310 and Preto 153 were found to be good local lesion hosts for the virus. *(Author's summary)* E04

See also 0524 0539 0540 0541

CIAT ABSTRACTS ON CASSAVA

- World literature on *Manihot esculenta* Crantz
- Issued three times a year
- Author and subject indexed
- Retrospective searches offered
- Complete documents available in photocopy
- Also in Spanish

CIAT - Documentation Services,
Apartado aéreo 6713, Cali, Colombia, S.A.

E05 Nematodes

0505

14940 SINGH, D.B.; REDDY, P.P. 1981. **Note on the chemical control of root-knot nematodes infesting French-bean.** Indian Journal of Agricultural Sciences 51 (7):534-535. Engl., 4 Refs.

Phaseolus vulgaris. Meloidogyne incognita. **Nematode control. Chemical control. Yields. Snap bean. India.**

The effect of 6 nematicides (aldicarb, carbofuran, dichlofenthion, fensulfothion, phenamiphos, and ethoprophos) in controlling the root knot nematode (*Meloidogyne incognita*) in the field was studied using French bean var. Burfee's Stringless. The expt. was established in 1979 on a red sandy loam soil with a nematode larvae population of 242/250 cc of soil. A randomized block design was used with 2 replications/treatment. Nematicides were applied to the rows before planting at rates of 0.5, 1.0, and 2.0 kg a.i./ha. Ten plants from each replicate were selected at random and the root knot index was rated on a 1-to-5 scale (1 = no galling, 5 = severe galling). All the nematicides significantly lowered the root knot index. The least root-knot index was obtained with the rate of 2 kg a.i./ha. The effect of the different nematicides on French bean yield was also significant. Phenamiphos and aldicarb were effective both in controlling root knot nematodes and in increasing French bean yield. *(Summary by C.P.G. Trans. by L.M.F.)* E05

0506

17776 NOEL, G.R.; JACOBSEN, B.J.; LEEPER, C.D. 1982. **Soybean cyst nematode in commercial snap beans.** Plant Disease 66(6):520-522. Engl., Sum. Engl., 8 Refs., Illus.

Phaseolus vulgaris. **Snap beans. Nematodes.** *Heterodera glycines.* **Plant injuries. USA.**

In July 1981, chlorotic, stunted snap beans in a 30-ha commercial production field in Mason County, Illinois were found to be infected by a cyst nematode that was subsequently identified as the soybean cyst nematode, *Heterodera glycines* race 3. This is the 1st report of the occurrence of this nematode in a commercial production area of *Phaseolus* spp. in the USA. *(Author's summary)* E05

0507

17738 McSORLEY, R. 1980. **Effect of** *Rotylenchulus reniformis* **on snap bean and methods for control by oxamyl.** Nematropica 10(2):89-95. Engl., Sum. Engl., Span., 19 Refs., Illus.

Phaseolus vulgaris. Rotylenchulus reniformis. Quinisulcius acutus. Helicotylenchus dihystera. **Nematode control. Chemical control. Soil populations. Timing. USA.**

Of several methods of applying oxamyl to snap beans, 6 weekly foliar sprays of 0.56 kg a.i. oxamyl/ha combined with a soil drench of 2.24 kg a.i. oxamyl/ha at planting was the most effective in reducing soil populations of *Rotylenchulus reniformis* and *Quinisulcius acutus* at 4 sites near Homestead, Florida (USA). Yield of snap beans was negatively correlated with soil populations of *R. reniformis* at harvest, but not with populations at planting

time or at midseason. Final populations of *R. reniformis* were not correlated with initial populations in 18 test plots, whereas highly significant (P = 0.01) correlations between final and initial populations existed for *Q. acutus* and *Helicotylenchus dihystera*. However, there was no correlation of yield with initial, midseason, or final population levels of these 2 nematodes. *(Author's summary)* E05

0508

17817 SMITTLE, D.A.; JOHNSON, A.W. 1982. **Effects of management practices on *Meloidogyne incognita* and snap bean yield.** Journal of Nematology 14(1):63-68. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. Snap beans. *Meloidogyne incognita.* **Nematode control. Irrigation. Cultivation. Mulching. USA.**

Phenamiphos applied at 6.7 kg a.i./ha through a solid set or a center pivot irrigation system with 28 mm of water effectively controlled root knot nematodes, *Meloidogyne incognita*, and resulted in greater snap bean growth and yields irrespective of growing season, tillage method, or cover crop system. The % yield increases attributed to this method of *M. incognita* control over nontreated controls were 45% in the spring crop, and 90 and 409% in the fall crops following winter rye and fallow, resp. Root galling was not affected by tillage systems or cover crop, but disk tillage resulted in > 50% reduction in bean yield compared with yields from the subsoil-bed tillage system. *(Author's summary)* E05

0509

17705 McSORLEY, R.; POHRONEZNY, K.; STALL, W.M. 1981. **Aspects of nematode control on snap bean with emphasis on the relationship between nematode density and plant damage.** Proceedings of the Florida State Horticultural Society 94:134-136. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. Snap beans. *Meloidogyne incognita. Rotylenchulus reniformis.* **Nematode control. Host-plant resistance. Cultivars. USA.**

Relationships between nematode density and yield of snap bean were examined in several field studies conducted near Homestead, Florida (USA) in 1979. Regression equations were developed describing the inverse relationship between final density of *Meloidogyne incognita* and yield of snap bean cv. Spite. An inverse relationship between nematode no. and yield was also found in 18 plots of snap bean which were naturally infested with *Rotylenchulus reniformis*. Control of *R. reniformis* in these plots was attempted with a soil drench of 2.24 kg a.i. oxamyl/ha followed by weekly foliar sprays of 0.56 kg a.i. oxamyl/ha. Control of *R. reniformis* resulted in yield increases at high nematode population levels, but no consistent yield increase was obtained by treating plots having low population levels, even though nematode populations were reduced by treatment. Such results indicate that there may be an opportunity to make future treatment decisions based on population levels. Control of the root knot nematode, *M. incognita*, was attempted using nematode-tolerant cv. In a field test, 4 *M. incognita*-tolerant snap bean cv. (G698, G699, G700, and G701) showed significantly less galling than the commercial cv. Harvester. *(Author's summary)* E05

See also 0545

E06 Physiological Disorders

0510

17493 DAVIDS, J.A.; DAVIS, D.D.; PENNYPACKER, S.P. 1981. **The influence of soil moisture on macroscopic sulfur dioxide injury to pinto bean foliage.** Phytopathology 71(11):1208-1212. Engl., Sum. Engl., 29 Refs., Illus.

Phaseolus vulgaris. **Soil moisture. Air pollution. SO_2. Drought. Plant injuries. Plant physiological disorders. Leaves.**

The influence of soil moisture stress on SO_2 injury to pinto bean foliage was investigated in relation to stomatal conductance rate, soil MC, and plant water potential. Bean plants were grown at 4 soil water potentials and exposed to 5720 $\mu g/m^3$ (2.2 ppm) SO_2 for 3 h. Macroscopic injury was severe on plants at -1/3 and -1 atm. and negligible at -3 and -5 atm. Injury was highly correlated with % of soil moisture, and both injury and soil moisture with stomatal conductance rate and water potential of the plants. The duration of soil moisture stress (1, 2, or 3 days) did not affect the amount of macroscopic injury induced by SO_2, stomatal conductance rate, or plant water potential. Stomatal conductance rates of plants grown at -1/3 and -1 atm. decreased when the plants were exposed to SO_2, while those of plants at -3 and -5 atm. were not affected. *(Author's summary)* E06 D01

0511

17464 TEH, K.H.; SWANSON, C.A. 1982. **Sulfur dioxide inhibition of translocation in bean plants.** Plant Physiology 69(1):88-92. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Air pollution. SO_2. Plant physiological disorders. Photosynthesis. Plant injuries. Plant vascular system. Translocation. Laboratory experiments.**

Exposure of the source leaf of bean cv. Black Valentine for 2 h to 2.9 $\mu l/l$ SO_2 inhibited the net photosynthetic rate an av. of 75% and, simultaneously, the translocation rate an av. of 45%. The experimentally determined translocation rates from SO_2-stressed leaves were lower than the rates expected on the basis of the observed reductions in photosynthesis. Evidently, under SO_2 stress, the phloem-loading system becomes a major limiting step in controlling the translocation rate. Following removal of SO_2, photosynthesis recovered quite rapidly (to approx. 60% of its preexposure rate within 2 h) but the translocation rate failed to increase during this time interval. This delayed response of translocation to removal of SO_2 does not appear to be due to an injury effect of SO_2, since a similar effect was obtained by exposing the source leaf to a short (2-h) interval of darkness. *(Author's summary)* E06

See also 0410

F00 PEST CONTROL AND ENTOMOLOGY

0512

17400 BARROWS, E.M.; HOOKER, M.E. 1981. **Parasitization of the Mexican bean beetle by *Pediobius foveolatus* in urban vegetable gardens.** Environmental Entomology 10(5):782-786. Engl., Sum. Engl., 5 Refs., Illus.

Phaseolus vulgaris. Epilachna varivestis. **Insect control. Biological control. *Pediobius foveolatus.* USA.**

Parasitization of the Mexican bean beetle, *Epilachna varivestis*, by *Pediobius foveolatus* was monitored in 5 urban vegetable gardens in Washington, D.C., USA, in 1979 and 1980. In all 5 gardens *P. foveolatus* was released in 1979 and 1 of these gardens in 1980. This cholcidoid parasite is an exotic, non-overwintering biocontrol agent trial that is used in Maryland soybean fields.These inoculative releases, or *P. foveolatus* that probably came from Maryland, or both, resulted in parasitism of 97-100% of *E. varivestis* larvae in each garden by late summer. Therefore, most of the *E. varivestis* damage in these urban gardens probably could be eliminated by making inoculative releases of adequate no. of *P. foveolatus* throughout gardens at appropriate times. *(Author's summary)* F00

0513

17418 BLICKENSTAFF, C.C.; JOLLEY, P.M. 1982. **Host plants of western bean cutworm.** Environmental Entomology 11(2):421-425. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. Loxagrotis albicosta. **Insect biology. Host range. Laboratory experiments. Field experiments. USA.**

The western bean cutworm, *Loxagrotis albicosta* (Lepidoptera: Noctuidae), is native to the w. USA. It was 1st recognized as a pest of beans and maize in Colorado and Idaho, and later farther northward and eastward. Early workers found larvae feeding on fruits of nightshade (*Solanum nigrum*), ground cherry (*Physalis* sp.),and tomato, and speculated that these may have been the original hosts. By feeding larvae on these plants and close relatives of beans and maize, beans and maize were found to be the most suitable hosts. Ground cherry, black nightshade, tomato, soybeans, and teosinte (*Euchaena mexicana*) were not suitable hosts. Maize and beans are probably the original hosts, since they are native to the area. *(Author's summary)* F00

0514

17487 JONES, C.G.; HOGGARD, M.P.; BLUM, M.S. 1981. **Pattern and process in insect feeding behaviour: a quantitative analysis of the Mexican bean beetle, *Epilachna varivestis.*** Entomologia Experimentalis et Applicata 30(3):254-264. Engl., Sum. Engl., Fr., 39 Refs., Illus.

Phaseolus vulgaris. Epilachna varivestis. **Insect biology. Behavior. Feeding. Timing. Laboratory experiments.**

No-choice feeding trials and automatic feeding detector studies were used in a quantitative analysis of the feeding behavior of adult Mexican bean beetles on their host plant *Phaseolus vulgaris*. Different chemical stimuli and physiological factors gave clearly distinguishable patterns in the feeding process. Compared to controls: age had no marked effect; starvation synchronized and reduced the time of initiating feeding, increased consumption rates, increased feeding duration, but did not alter the no. of meals; sucrose increased consumption rates over the same feeding duration as controls and reduced the no. of meals; phenolic compounds decreased consumption rates, feeding durations and no. of meals. The methodology produces quantitative indices of specific feeding behaviors from the measurement of cumulative consumption/time data, while being sufficiently rapid for screening plant materials and chemicals. The methods are applicable to lab. bioassays with phytophagous insects and are being used to generate a predictive model for the Mexican bean beetle. *(Author's summary)* F00

0515

16753 CRUZ, C. 1981. Effect of soil mulches on leafhopper (*Empoasca* spp.) population and on dry bean yield. Journal of Agriculture of the University of Puerto Rico 65(1):79-80. Engl., 5 Refs.

Phaseolus vulgaris. Empoasca sp. Population dynamics. Mulching. Insect control. Chemical control. Yields. Puerto Rico.

The effect of different soil mulches on populations of *Empoasca* spp. and on yields of bean var. Rayada was studied. Treatments were: T_1, paraquat applied to weeds 14 days before planting; T_2, black plastic; T_3, silver plated plastic; T_4, sugar cane straw; and T_5, clean cultivation used as check. These were arranged in a randomized complete block design with 4 replicates in carbofuran treated (2.2 kg a.i./ha) and untreated 10 m^2 plots. The highest no. of nymphs (24.6) was registered in T_2 in carbofuran untreated plots. Highest bean yield (823 g/plot) were obtained in T_3 in untreated plots. *(Summary by C.P.G. Trans. by L.M.F.)* F00

0516

17402 ANTONELLI, A.L.; O'KEEFFE, L.E. 1981. Possible resistance in bean varieties to the western bean cutworm. Journal of Economic Entomology 74(5): 499-501. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. Loxagrotis albicosta. Insect biology. Cultivars. Host-plant resistance. Plant injuries. Seeds. Pods. USA.

During a study carried out in Idaho, USA, 16 bean var. were evaluated for their resistance to attack by *Loxagrotis albicosta*. The methods used consisted of comparing plant materials for oviposition preference and larval damage of both seeds and pods. The evaluation of seed damage proved to be the best method of determining differences in *L. albicosta* damage to the plant materials screened. No significant differences in pod damage or oviposition incidence were found; however, 2 var. consistently showed extremes in damage from feeding by the pest on seeds. Var. N203 showed the least amount of damage and Michigan Improved Cranberry the greatest. The growth rates and efficiency of food utilization of larvae fed on pods of N203 and Michigan Improved Cranberry were found to be similar. *(Author's summary)* F00 G01

0517

16927 HOHMANN, C.L. 1980. Ocorrência de larvas da mosca da semente *Delia platura* (Meigen, 1826) (Diptera: Anthomyiidae) em feijoeiro, no Estado do Paraná. [*Incidence of larvae of the seed corn maggot Delia platura (Diptera: Anthomyiidae) in beans*]. Anais da Sociedade Entomológica do Brasil 9(2):293-294. Port., 2 Refs.

Phaseolus vulgaris. Delia platura. **Identification. Insect biology. Plant injuries. Seeds. Brazil.**

The incidence of the seed corn maggot, *Delia platura (Hylemya cilicrura)*, was observed in bean crops in the state of Paraná, Brazil, during the 1978/79 rainy seasons. Aspects of insect biology and the form of attacking seeds are described. Adults oviposite in soils high in OM or on plants. Larvae attack the germinating seeds, penetrating the cotyledons or partially or totally destroying the embryo. The maggot is also a vector of the bacterium *Erwinia carotovora.* It can become a limiting pest when conditions favor its development. *(Summary by C.P.G. Trans. by L.M.F.)* F00

0518

15837 PIZZAMIGLIO, M.A. 1979. **Aspectos da biologia de** *Empoasca kraemeri* **(Ross & Moore, 1957) (Homoptera:Cicadellidae) em** *Phaseolus vulgaris* **(Linnaeus, 1753) e ocorrência de parasitismo em ovos.** [*Aspects on the biology of Empoasca kraemeri (Homoptera:Cicadellidae) in Phaseolus vulgaris and the incidence of parasitism in the eggs*]. Anais d. Sociedade Entomológica do Brasil 8(2):369-372. Port., 3 Refs.

Phaseolus vulgaris. Empoasca kraemeri. **Insect biology. Insect control. Biological control. Laboratory experiments.**

An expt. was conducted under lab. conditions to determine the no. and length of instars of *Empoasca kraemeri* and to detect parasitism on eggs in the field. Recently borne nymphs were collected in the field and placed on Petri dishes with leaves of bean var. Carioca as substrate at 28 ± 1°C and 80% RH. Of a total of 319 nymphs, only 53 reached the adult stage, the nymphal stage lasting an av. of 8.97 days. The no. of instars varied from 4 to 7. Some micro hymenoptera such as *Anagrus flaveolus* and *Aphelinoidea plutella* were observed to parasite on eggs of *Empoasca*, especially in the substrate containing stems and branches. *(Summary by C.P.G. Trans. by L.M.F.)* F00

0519

17427 VILLACORTA, A.; PIZZAMIGLIO, M.A. 1979. **Comparação de uma dieta semi-sintética e uma dieta natural, no desenvolvimento de** *Trichoplusia ni* **(Hübner) (Lepidoptera, Noctuidae).** [*Comparison of a semisynthetic diet and a natural one in the development of Trichoplusia ni (Lepidoptera, Noctuidae)*]. Anais da Sociedade Entomológica do Brasil 8(1):155-162. Port., Sum. Engl., Port., 9 Refs.

Phaseolus vulgaris. Trichoplusia ni. **Insect biology. Uses. Laboratory experiments. Brazil.**

An artificial diet based on ingredients readily available on the Brazilian market was developed in Brazil for the rearing of larvae of *Trichoplusia ni.* The diet which contained dried beans, yeast, sorbic acid, ascorbic acid, vitamins, ar i-microbial agents, water and agar, was used to rear more than 6 generations. Larvae reared on the diet completed their development more quickly and produced heavier pupae than those reared on cotton leaves. *(Summary by Review of Applied Entomology)* F00

0520

17466 LINK, D.; PANICHI, J. DE A.V.; CONCATTO, L.C. 1980. **Oviposição de** *Piezodorus guildinii* **(Westwood, 1837) sobre feijoeiro.** *(Oviposition of Piezodorus guildinii on beans).* Revista do Centro de Ciências Rurais 10(3):271-276. Port., Sum. Port., Engl., 8 Refs., Illus.

Phaseolus vulgaris. Piezodorus guildinii. **Insect biology. Insect control. Biological control. Field experiments. Brazil.**

The oviposition of stink bugs, *Piezodorus guildinii*, on bean plants, was studied on an exptl. field of the U. Federal de Santa Maria, RS, Brazil during 2 crop yr, 1978 and 1979. Mean no. of eggs/lay was 11.65, ranging between 3-26. The upper side of the leaf was the main oviposition site. More than 50% of the eggs laid were parasitized by *Telenomus mormideae* (Hymenoptera, Scelionidae). Oviposition occurred on the upper third part of the bean plant. *(Author's summary)* F00

0521

17710 SANBORN, S.M.; WYMAN, J.A.; CHAPMAN, R.K. 1982. **Studies on the European corn borer in relation to its management on snap beans.** Journal of Economic Entomology 75(3):551-555. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. Ostrinia nubilalis. **Insect biology. Plant injuries. Leaves. Pods. Stems. Timing.**

Egg masses or larvae of *Ostrinia nubilalis* were placed on snap beans to determine the effect of egg hatch at various days before harvest, on crop damage at harvest, and the length of time larvae feed externally on the plants before boring into stems and pods. When egg hatch occurred between 14-30 days before harvest, damaged stems and pods were found at harvest. Egg hatch at 7 and 35 days before harvest resulted in little crop damage. In lab. and field studies of larval feeding behavior, larvae fed externally on the plants (primarily on the undersides of leaves) for 6-7 days and had completed the 1st or 2nd instar before they began to bore. Day degrees accumulations > 10°C were related to the interval between egg hatch and the onset of boring. *(Author's summary)* F00

See also 0417 0582

F01 Injurious Insects, Mites and their Control

0522

17301 JAGTAP, A.B.; AWATE, B.G.; NAIK, L.M. 1979. **Chemical control of stem fly *Ophiomyia phaseoli* Tryon (Agromyzidae-Diptera) infesting French-bean (*Phaseolus vulgaris* Linn.) in Maharashtra.** Journal of Maharashtra Agricultural Universities 4(1):83-84. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. Ophiomyia phaseoli. **Insect control. Chemical control. India.**

Three field-plot tests were carried out in Pune, Maharashtra, India, during the rabi seasons (Nov.-April) of 1975-78 to evaluate the effectiveness of foliar sprays of 9 insecticides for the control of *Ophiomyia phaseoli* (Tryon) on French bean. Percentage infestation 7 days after treatment showed that 0.03% diazinon and 0.05% quinalphos gave the best control of the agromyzid; treatment with the former compound was less expensive than that with the latter. *(Summary by Review of Applied Entomology)* F01

0523

17403 ECKENRODE, C.J. 1981. **Influence of potato leafhopper control on kidney beans in New York.** Journal of Economic Entomology 74(5):510-513. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Empoasca fabae. **Insect control. Chemical control. Timing. Yields. USA.**

Field studies carried out in New York State (USA) in 1977 and 1978 showed that naturally occurring infestations of *Empoasca fabae* were suppressed by treatments of phorate, disulfoton, and carbaryl on 2 kidney bean cv., Red Kloud and California Light Red. Greater no. of nymphs and adults were observed on Red Kloud than on California Light Red, but leafhopper control resulted in seed yield increases only in the latter cv. No differences were noted either in the wt. of dried plants and pods or in the no. of pods between the 2 cv. *(Author's summary)* F01

0524

17772 SINGH, S.J.; SASTRY, K.S.; SASTRY, K.S.M. 1981. **Field tests with insecticides and mineral oil for the protection of French beans from yellow mosaic virus disease.** Gartenbauwissenschaft 46(2):88-91. Engl., Sum. Engl., Germ., Fr., Russ., 6 Refs.

Phaseolus vulgaris. **Snap beans.** *Bemisia tabaci.* **Insect control. Chemical control. Bean yellow mosaic virus. Disease control. India.**

In a 3-yr trial conducted at the exptl. farm of the Indian Institute of Horticultural Research, Hessaraghatta, Bangalore (India), plants of French bean cv. Contender were sprayed 4 times at 10-day intervals with one of 8 insecticides (monocrotophos, dimethoate, mancozeb, carbaryl, chlorfenvinphos, endosulfan, leptophos, and tetrachlorvinphos) or 1% mineral oil to control whitefly (*Bemisia tabaci*), the vector of BYMV. In the 2 later yr 4 granular insecticides (carbofuran, fensulfothion, disulfoton, and phorate) were also used on other plots before planting. In general monocrotophos and dimethoate each at 0.05% or mineral

oil controlled whitefly and reduced BYMV incidence; the granular insecticides were also effective. Plots of plants free from BYMV produced nearly double the yield of control plots of infected plants. *(Summary by Field Crop Abstracts)* F01 E04

0525

17497 BERNHARDT, J.L. 1979. **Ecology of the Mexican bean beetle (*Epilachna varivestis* Mulsant) on soybeans (*Glycine max* (L.) Merrill) and snap beans (*Phaseolus* spp.).** Ph.D. Thesis. South Carolina, Clemson University. 85p. Engl., Sum Engl., 50 Refs., Illus.

Phaseolus vulgaris, Epilachna varivestis. **Ecology. Insect biology. Climatic requirements. Insect control. Biological control.**

The ecology of *Epilachna varivestis* in soybeans and *Phaseolus* spp. was studied to elucidate fundamental relationships among this pest, host plants, and environmental factors. These data were essential for the refinement of a computer simulation model. *E. varivestis* adults preferred pine litter for overwintering. Emergence began in March and continued until May when most emergence occurred, generally following periods of rainfall. Adults fed with *Phaseolus lunatus* and *P. vulgaris* had increased fecundity and longevity of males and females, shortened preoviposition period and less days between ovipositions in comparison with those adults fed soybeans and other diets. On a per weekly basis, adults damaged 30% more soybean surface area than on *Phaseolus lunatus*. Lab. expt. using constant and alternating temp. regimes and soybeans as a diet indicated that preoviposition period and longevity were inversely related to temp., and fecundity was directly related to longevity. Field observations showed that plant canopy of soybeans had a positive influence on % hatch, which was reduced from 62.4 to 25.7% as a result of low rainfall and humidity, and high temp. Results from field and lab. expt. were used to validate a physiological day equation used in predicting developmental periods of larvae. Correction coefficients, which allowed adjustments for variations in the daily temp. cycle due to geographical location, were added to the equation. Other studies were also conducted on larval development, leaf area damage, and predators of *E. varivestis* in soybeans. *(Summary by C.P.G. Trans. by L.M. F.)* F01

0526

17787 GALWEY, N.W.; EVANS, A.M. 1982. **Alternative methods of interpreting measurements of resistance to the leafhopper *Empoasca kraemeri* Ross and Moore in the common bean, *Phaseolus vulgaris* L.** Euphytica 31:225-236. Engl., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris, Empoasca kraemeri. **Host-plant resistance. Germplasm. Chemical control. Symptomatology. Growth. Colombia.**

Appropriate definitions of, and methods of measuring, resistance are sought using *Phaseolus vulgaris*, a major source of protein in L.A., and its most important pest, *Empoasca kraemeri*. The concepts of general vigor and narrow-sense resistance are defined: these 2 components make up broad-sense resistance. The validity of these definitions, which depend on the inclusion of tolerance as a resistance mechanism, is discussed. In order to distinguish the components, 38 genotypes of *P. vulgaris* were grown with and without insecticidal protection, in 3 replications in a split-plot design, with 3 planting dates at the Centro Internacional de Agricultura Tropical (Valle del Cauca, Colombia). Seed yield/plant, and a visual score of damage symptoms or vigor, were measured. Three methods of estimating narrow-sense resistance are considered: (1) the genotype x insecticide interaction effect in a split-plot analysis, (2) the yield of each genotype unprotected (Y_u) divided by its yield protected (Y_p), and (3) the deviation of each genotype from a regression of Y_u on Y_p. The 3rd method overcomes some objections to the 1st 2, and can be applied to damage and vigor scores as well as to yields. The 38 genotypes differed in narrow-sense resistance according to

all 3 methods, and it appears that in practice methods 2 and 3 were both valid. They also differed in general vigor. Breeders working with many pests and crops have found that low damage and high yield in the presence of the pest are effective selection criteria. The work reported here supports this view. *(Author's summary)* F01

0527

16770 TURENNE, H. 1981. Ensayo de control químico de la mosca blanca (*Bemisia tabaci*) en fríjol común (*Phaseolus vulgaris*). [*Chemical control of the whitefly (Bemisia tabaci) in beans*]. Haití, Ministerio de Agricultura. pp.L8-1-L8-9. Span., 9 Refs., Illus.

Paper presented at the Reunión Anual del PCCMCA, 27a., Santo Domingo, República Dominicana, 1981.

Phaseolus vulgaris. Field experiments. *Bemisia tabaci.* Chemical control. Yields. Haití.

At the Damien exptl. field, Port-au-Prince (Haiti) a preliminary trial was conducted on the chemical control of the whitefly (*Bemisia tabaci*) in order to select the most efficient and economical insecticides. Bean var. Pois Rouge (susceptible to BGMV) was used in a randomized block design with 4 replications and 6 treatments: 5 insecticides (pirimiphos-methyl, decamethrin, malathion 57%, trichlorfon, and carbaryl at 1, 0.5, 1 *l*/ha and 2 and 1.5 kg/ha, resp. in 1000 *l* water) and one control. Twenty days after planting 3 applications were made at 8-day intervals. All the plots were harvested and yields determined. Significant differences were only observed among blocks; however, there were highly significant differences among treatments. Best treatments were decamethrin, pirimiphos-methyl, and malathion with av. yields of 3.1, 3.07, and 2.56 lb/32 m^2 plots. *(Summary by F.G. Trans. by L.M.F.)* F01

0528

17810 YABAR L., E. 1980. Insecticidas contra el medidor del fríjol (*Pseudoplusia includens*) y su efecto sobre la población de arañas. [*Insecticides that control the bean looper (Pseudoplusia includens) and their effect on spider populations*]. Revista Peruana de Entomología 23(1):149-150. Span., Sum. Span., Engl., 6 Refs.

Phaseolus vulgaris. Pseudoplusia includens. Chemical control. Integrated control. Biological control. Peru.

Seven insecticides were tested for the control of *Pseudoplusia includens* on beans in Sahuayaco (La Convención), Peru, and the effect of the treatments on the spiders that afford a measure of biological control of this pest was also observed. The sprays comprised 0.2% carbofuran, 0.15% methamidophos, 0.15% triazophos, 0.25% trichlorphon, 0.1% deltamethrin (decamethrin), 0.25% carbaryl, or 0.1% dimethoate. Carbaryl and trichlorphon provided a moderate degree of initial control of *Pseudoplusia*, but their effect did not persist much beyond 4 days; however, they caused a low level of mortality of spiders (18.76 and 21.05%, resp.). Deltamethrin, methamidophos, dimethoate, triazophos, and carbofuran remained effective for 9 days against *Pseudoplusia*. Triazophos and dimethoate were the most injurious to the spider population, causing 36.49 and 35.51% mortality, resp. *(Summary by Review of Applied Entomology)* F01

See also 0460

G00 GENETICS AND PLANT BREEDING

0529

17750 EVANS, A.M. 1978. **Structure, variation, evolution, and classification in *Phaseolus*.** *In* Summerfield, R.J.; Bunting, A.H., eds. International Legume Conference, Kew, England, 1978. Advances in legume science. Proceedings. Kew, England, Royal Botanical Gardens. v.1. pp.337-347. Engl., Sum. Engl., 57 Refs.

Phaseolus vulgaris. P. coccineus. P. acutifolius. P. lunatus. **Centre of origin. Hybridizing. Polyploidy. Mutation. Taxonomy.**

The taxonomic limits of the genus *Phaseolus*, the 4 cultivated species within the genus, and their origin, evolution, and world-wide dispersal are reviewed, highlighting the 2 most economically important species, *P. vulgaris* and *P. lunatus*. The effects of domestication on changes in growth habit, in seed no./pod, in pod structure, and in photoperiod response are described and the classification of growth habit races within 5000 accessions of the Cambridge germplasm collection is outlined. Genetic studies in *Phaseolus* have concentrated on the cultivated species. Interspecific hybridization is most successful between *P. vulgaris* and *P. coccineus* but hybrids have also been produced between cultivated species and their wild relatives. Very few other species hybrids have been produced. Polyploidy and mutations have been induced with the aim of producing viable hybrids and to increase the variation available. Both techniques are underexploited in this genus. Prospects for the utilization of natural and induced variation in crop improvement are discussed. There is a need for both further collections of cv. and wild relatives of *Phaseolus*, and more studies on the genetic relationships of species within the genus. *(Author's summary)* G00

0530

17722 FAWOLE, I.; GABELMAN, W.H.; GERLOFF, G.C. 1982. **Genetic control of root development in beans (*Phaseolus vulgaris* L.) grown under phosphorus stress.** Journal of the American Society for Horticultural Science 107(1):98-100. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Roots. Rooting. P. Nutritional requirements. Mineral deficiencies. Nutrient absorption. Inheritance. Genes. Backcrossing. Statistical analysis.**

Genetic control of root development in beans was investigated in the parents, F_1, backcrosses, and F_2 obtained from 6 crosses made among 6 lines obtained from an earlier study of efficiency in P utilization. One line produced significantly larger and more vigorous roots and a narrower shoot/root ratio than the other 5 lines, both at stress and at adequate levels of P. Quantitative inheritance patterns and transgressive segregation for root dry wt. were observed and high broad-sense heritability estimates were obtained. Dominance variance was more important than additive variance in 4 families. *(Author's summary)* G00 B00

0531

17755 WYATT, J.E. 1981. **Inheritance of a pale-green foliage mutant in beans, *Phaseolus vulgaris* L.** Journal of Heredity 72(3):218-219. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Mutation. Inheritance. Backcrossing. Genes. Genetics. Leaves. Agronomic characters.**

Inheritance of a pale-green mutant in beans was studied in crosses with the normal green cv. Early Gallatin. Segregation of the F_2 population, 2 F_1 x parental backcross populations, and the progeny of normal F_2 and backcross segregates indicated that the pale-green character was controlled by a single recessive gene. Plants with the pale-green character were not as vigorous as normal green plants but could be used for the study of linkage or chlorophyll physiology. The symbol pa_1 is proposed to denote the recessive gene, pale. *(Author's summary)* G00

See also 0416 0476

G01 Breeding, Selection and Germplasm

0532

16457 ANGULO R., N.F.; DAVIS, J.H.C. 1981. **Informe de trabajos 1980/81; programa de fríjol.** *(Research report 1980/81; bean program).* Obonuco, Nariño, Convenio ICA/CIAT. 21p. Span., Sum. Span.

Phaseolus vulgaris. **Plant introductions. Germplasm. Cultivars. Yields. Selection. Plant habit. Intercropping.** *Colletotrichum lindemuthianum. Uromyces phaseoli. Erysiphe polygoni.* **Host-plant resistance. Field experiments. Statistical analysis. Colombia.**

The ICA-CIAT collaborative project for beans for cold climates at the regional center of the ICA at Obonuco, Nariño (Colombia) selected 7 climbing bean lines for evaluation in 1981, 4 from ICA at Tibaitatá [L 33003-M(4), L 32980-M(4), L 32980-M(8), L32983] and 3 from the Ecuadorian collection at CIAT (E 605, E 525, E 521). With large red or purple colored grain, these lines had greater resistance to major diseases and matured at an earlier age (20-60 days) than the regional var. Mortiño, grains drying at 6-7 mo. Two outstanding and early-maturing (5-6 mo.) bush bean materials were also selected: ICA L-ANT 8 and ICA L-33462. Thirty-nine promissory var. from Colombia and Peru were identified. Three outstanding anthracnose-resistant lines of commercial grain were selected: Compuesto 24, Revoltura Liborino, and Sañudo 27. Var. with growth habits IV A and IV B are generally more productive than those of habit III B; those of habit IV A mature at an earlier age and are more uniform at maturity. Crosses made in the field with an efficiency of 0.54 seeds/pollination were planted in order to multiply F_2 seed. Lines V 7917, V 7918, and V 7920, adapted to intermediate climates, were used as sources of resistance to anthracnose and common mosaic. A total of 326 individual plants were selected; 81% with red colored grain, selecting 37 in F_2, 145 in F_3, and 144 in advanced generations. In progeny tests (generation F_3), 47% of the material were segregating or resistant to anthracnose. In a trial of bean lines planted in association with maize and in monoculture, bean yield was reduced 48% (1199 kg/ha in association, 2505 kg/ha in monoculture). Best lines of commercial grains were E 605, E 166-1, E 525, and E 521. In bush bean trials 7 lines gave yields statistically higher than those of the control Diacol Andino, and showed resistance or tolerance to halo blight, red necrotic mosaic, and anthracnose. *(Extracted from author's summary. Trans. by L.M.F.)* G01

0533

17309 YAMASHITA, K.; HANAJIMA, S.; HORIUCHI, T.; NAGAOKA, K. 1976. **Informe sobre la exploración del fríjol en México, América Central y Colombia (1975).** [*Report on research in beans in Mexico, Central America, and Colombia (1975)*]. Tokyo, Japan, Fundación Japonesa del Fríjol. 107p. Span., Illus.

Phaseolus vulgaris. **Plant geography. Germplasm. Plant introductions. Seeds. Legume crops. Mexico. Colombia.**

A research project carried out by the Fundación Japonesa del Fríjol collected *Phaseolus vulgaris* species between Oct.-Dec. 1976 in the following countries: Colombia, Panama, Costa Rica, Nicaragua, El Salvador, Guatemala, and Mexico. A total of 1085 bean seeds, 49 seeds of other legumes, and 111 of other species were collected. Fifteen wild bean species were

found in Mexico (alt. 1260-2250 m) and 3 in Colombia (alt. 740-2000 m). The collections donated by the Centro Internacional de Agricultura Tropical (103 cultivated species, 15 wild) were included. The itinerary and conferences, maps and tables of the collections, and characteristics of the specimens in the visited areas are included. *(Summary by A.J.C. Trans. by L.M.F.)* G01

0534

16942 ALFARO M., R. 1981. **Adaptabilidade e estabilidade de comportamento de linhagens e cultivares de feijão preto (*Phaseolus vulgaris* L.) em 124 ensaios internacionais.** *(Adaptability and stability of the performance of black bean lines and cultivars in 124 international trials).* Tese Mag. Sc. Viçosa-MG, Universidade Federal de Viçosa. 50p. Port., Sum. Port., 27 Refs.

Phaseolus vulgaris. **Cultivars. Adaptation. Germplasm. Yields. Statistical analysis. Field experiments.**

Data from 124 bean yield trials conducted at 80 sites in 20 countries during 1976-79 are analyzed. In each trial in addition to local materials, var. Jamapa and Porrillo Sintético were included as international checks. The methods of Eberhart and Russell (1966) and Plaisted and Peterson (1960) were used to measure the stability and adaptability of the materials. With the 1st method, the environmental index was determined with the av. yields of Jamapa and Porrillo Sintético. All materials had av. yields similar to those of the international checks. There was no relationship between adaptability and yield in the tested materials. The parameters of stability of Eberhart and Russell and that of Plaisted had a positive correlation (1% level of significance) in all trials. Mean values of the coefficients of determination (r^2) were higher when the av. of all var. was used as environmental index. *(Summary by C.P.G. Trans. by L.M.F.)* G01 D05

0535

17421 KEMP, G.A. 1979. **Interaction and inheritance of suboptimal temperature interference with photonastic response of leaves of *Phaseolus vulgaris* L.** Euphytica 28:425-433. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. **Leaves. Temperature. Light. Cultivars. Inheritance. Genes. Growth.**

The interaction of suboptimal temp. with light on the normal photonastic movement of the unifoliate leaf of cv. and progeny derived from crosses of the common bean was studied. Nastic movements are normally inhibited by a temp. of 10°C, but tolerance permits the normal orientation of the leaf-blade to the light. Analysis of data from parental, F_1, and F_2 populations of 2 sensitive and 1 tolerant cv. indicated that this trait was controlled by 2 major genes. Tolerance appeared to be due to 2 pairs of recessive genes. The intolerant reaction was due to either one, or both, of the dominant alleles, one of which was epistatic to the 2nd and similar in response. It is suggested that early growth could be improved by selection for photonastic response at low. temp. *(Author's summary)* G01 D01

0536

17405 WEBSTER, D.M. 1978. **Evaluation of resistance in beans (*Phaseolus vulgaris*) to *Xanthomonas phaseoli*.** Ph.D. Thesis. Madison, University of Wisconsin. 117p. Engl., Sum. Engl., 61 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. **Host-plant resistance. Genes. Genetics. Inoculation. Leaves. Pods. Seedlings. Developmental stages. Hybridization. Inheritance. Germplasm. Selection. Field experiments. Colombia.**

Studies were conducted at the Centro Internacional de Agricultura Tropical to develop a breeding program to improve the field resistance of beans to *Xanthomonas phaseoli.* Line PI207262 and Great Northern var. Jules, among other promising materials of the temperate

zone, were used as sources of resistance. Daylength and the flowering stage of these materials were c...ted by providing artificial light and by spraying with fungicides to control fungal diseases, the development of common blight symptoms in Jules was delayed for over 3 wk. after other lines were severely affected. Line PI207262 showed intermediate resistance. Under greenhouse conditions, the response to inoculation by 2 methods (multiple needle and leaf-clipping) and to 2 inoculum densities (5×10^6 and 5×10^7 cells/ml) varied among lines, Jules being the most resistant. The resistance of 6 *Phaseolus* lines to 11 isolates of *X. phaseoli* from different regions in North and South America was also assessed. The levels of aggressiveness of isolates varied and the resistance to these isolates appears to be horizontal. The precision of greenhouse procedures to detect resistance was tested by means of the regression of F_3 family response means on response of the F_2 parent. The regression of field response on response to either greenhouse inoculation method accounted for over 90% of the variability in the field among families of the cross P566 x Jules, even though the deviations from regression were significantly greater than error. The relationship of mature plant and seedling resistance was also studied; in the crosses P566 x Jules the variance attributed to the simple differences among families was 25 times as large as the variance attributable to the interaction between families and developmental stage. With families from Pijao x PI207262 the family variance was more than 10 times as large as the interaction variance. When the response to inoculation of pods was compared with the foliar response, a correlation of 0.72 was observed indicating that the genes controlling pod and foliar resistance are closely linked or are identical. *(Summary by C.P.G. Trans. by L.M.F.)* G01 F02

0537

15848 HAGEDORN, D.J.; RAND, R.E. 1980. **Wisconsin (RRR) 46 snap bean breeding line.** HortScience 15(4):529-530. Engl., 2 Refs., Illus.

Phaseolus vulgaris. **Snap beans. Germplasm. Cultivars. Host-plant resistance. Agronomic characters.** *Pythium. Rhizoctonia solani. Fusarium solani phaseoli.* **USA.**

A new breeding line of bush snap bean designated Wisconsin (RRR) 46 has been released with high level resistance to the root rot disease complex (*Pythium* spp., *Fusarium solani* sp. *phaseoli*, and *Rhizoctonia solani*). Its origin and agronomic characteristics are described. Av. yields estimated for 1977 and 1978 were 25,473 kg/ha for the new line vs. 2450 kg/ha for the susceptible control. *(Summary by F.G. Trans. by L.M.F.)* G01 F03

0538

17795 POLIGNANO, G.B. 1982. **Breeding for protein percentage and seed weight in *Phaseolus vulgaris* L.** Journal of Agricultural Science 99:191-197. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Genotypes. Seed characters. Protein content. Seeds. Inheritance.**

Three successive generations (parents, F_1, F_2) and backcrosses of the common bean hybrid between the cv. Swedish Brown and Seafarer were used to assess the relationship between the seed wt./plant and the protein % of the seed. Protein % showed a higher estimated heritability and a greater stability over environments than seed wt. Partial dominance for low % protein and low seed wt. was noted. Negative and low regression coefficients between these 2 characters was also observed. SDS-gel electrophoresis was used to examine the variation in banding patterns of total seed polypeptides and their stability over environments. *(Author's summary)* G01 C03

0539

17743 BAGGETT, J.R.; FRAZIER, W.A.; VARSEVELD, G.W. 1981. **'Oregon 17' green bean.** HortScience 16(2):228-229. Engl., 1 Ref., Illus.

Phaseolus vulgaris. **Snap beans. Dwarf beans. Agronomic characters. Maturation. Bean common mosaic virus. Host-plant resistance. USA.**

Phaseolus vulgaris Oregon 17, derived from a cross between Oregon 1604 and 2217-29, is an early-maturing dwarf bean of Blue Lake pod type. Yields are approx. 80% of those of Oregon 1604. Oregon 17 has white seed, is of good quality, and is resistant to BCMV. It is intended for commercial processing in Oregon, USA. *(Summary by Plant Breeding Abstracts)* G01 E04

0540

17780 BAGGETT, J.R.; FRAZIER, W.A.; VARSEVELD, G.W. 1981. 'Oregon 91' green bean. HortScience 16(2):230. Engl., 1 Ref., Illus.

Phaseolus vulgaris. Snap beans. Agronomic characters. Plant habit. Maturation. Dwarf beans. Bean common mosaic virus. Host-plant resistance. USA.

Phaseolus vulgaris Oregon 91, derived from the cross Oregon 1604 x OSU 2217-6, is slightly later in maturity and slightly less productive than Oregon 1604, but has a better growth habit and straighter pods. Oregon 91 is of good quality and is resistant to BCMV. It is a dwarf var. intended for commercial processing in w. Oregon, USA. *(Summary by Plant Breeding Abstracts)* G01 E04

0541

17779 BAGGETT, J.R.; FRAZIER, W.A.; VARSEVELD, G.W. 1981. 'Oregon 83' green bean. HortScience 16(2):229. Engl., Illus.

Phaseolus vulgaris. Snap beans. Dwarf beans. Agronomic characters. Host-plant resistance. Bean common mosaic virus. USA.

Phaseolus vulgaris Oregon 83, derived from a cross between OSU 2217 x Oregon 1604 and Oregon 58 x Bush Blue Lake 290, is a dwarf green bean which is slightly later and has a shorter, straighter pod and better growth habit than Oregon 1604. It is of good quality and is resistant to BCMV. Pods of Oregon 83 mature uniformly to the processing stage in 64-68 days from May plantings in w. Oregon, USA, where it is intended for commercial processing. *(Summary by Plant Breeding Abstracts)* G01 E04

0542

15847 HAGEDORN, D.J.; WALKER, J.C.; RAND, R.E. 1974. Wis. HBR 40 and Wis. HBR 72 bean germplasm. HortScience 9(4):402. Engl., Illus.

Phaseolus vulgaris. Cultivars. Germplasm. Host-plant resistance. *Pseudomonas phaseolicola.* Agronomic characters. USA.

Two processing lines of bean, Wis. HBR 40 and Wis. HBR 72, were released in 1970. They combine, for the 1st time, resistance to both race 1 and race 2 of the bean halo blight (*Pseudomonas phaseolicola*). Their origin, outstanding characteristics, and uses are described. *(Summary by E.G. Trans. by L.M.E.)* G01 E02

0543

17819 COYNE, D.P.; KORBAN, S.S.; KNUDSEN, D.; CLARK, R.B. 1982. Inheritance of iron deficiency in crosses of dry beans (*Phaseolus vulgaris* L.). Journal of Plant Nutrition 5(4/7):575-585. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. Cultivars. Inheritance. Chlorosis. Mineral deficiencies. Fe. Crossbreeding. USA.

Inheritance of Fe-deficiency chlorosis was determined in the field from crosses between a highly susceptible (PI 165078) and 3 resistant Great Northern cv. (GN Valley, GN Emerson, and GN UI 59) of dry edible beans. Segregation of the F_2 generations indicated quantitative

inheritance, with complete dominance for resistance in 2 crosses. Based on F_3 segregations, it was hypothesized that the Fe deficiency trait was controlled primarily by 2 major gene pairs; true-breeding susceptible plants were homozygous recessive and resistant plants were homozygous dominant (*Fe*-1 *Fe*-1, *Fe*-2 *Fe*-2). No significant relationships between Fe and other elements were noted in leaves, petioles, and stems. Leaves had considerably higher Fe concn. than either the petioles or stems which were similar. *(Author's summary)* G01 C01

0544

17786 NUÑEZ G., S. 1981. Estudio de algunos factores que afectan el cruzamiento artificial en fríjol común *Phaseolus vulgaris* L. de riego. *(Study of several factors affecting artificial crossing in irrigated beans)*. Agricultura Técnica en México 7(2):83-96. Span., Sum. Span., 18 Refs.

Phaseolus vulgaris. Field experiments. Laboratory experiments. Cultivars. Pollination. Cross-pollination. Mexico.

Bean var. were artificially pollinated in the greenhouse and in the field in the region of Chapingo, Mexico, using different progenitors; remaining flowers on the female progenitor were cut or left on the plant. Pollination took place in the morning and in the afternoon in order to estimate the effect of these variants on the % of crossing. Results indicate that it was more efficient to pollinate in the greenhouse. Var. Canario-107 was a better female progenitor than Bayo-107. No differences were observed between male progenitors Negro-150 and Bayo-107. In the greenhouse the cutting of the remaining flowers increased the % of artificial crossing while under field conditions its effect was insignificant. In the greenhouse the % of artificial crossing was the same whether pollination took place in the morning or in the afternoon; however, under field conditions a higher % of crossing occurred with morning pollinations. It was verified that artificial crossing depends on the progenitors used, the treatment given to the remaining flowers of the female progenitor, and the hour and environment where pollination takes place. The no. of beans/pod was higher in greenhouse pollinations; there was no difference in the no. of beans/pod when different progenitors were used. *(Author's summary. Trans. by L.M.F.)* G01

0545

15819 WYATT, J.E.; FASSULIOTIS, G.; JOHNSON, A.W.; HOFFMAN, J.C.; DEAKIN, J.R. 1980. B4175 root-knot nematode resistant snap bean breeding line. HortScience 15(4):530. Engl., Illus.

Phaseolus vulgaris. Snap beans. Cultivars. Host-plant resistance. *Meloidogyne incognita*. Dwarf beans. USA.

B4175 is a new breeding line of bush snap bean with resistance to the root knot nematodes (*Meloidogyne incognita*). Their origin and agronomic characteristics are described. *(Summary by F.G. Trans. by L.M.F.)* G01 E05

0546

16768 ZAPATA, M.; FREYTAG, G.F.; LOPEZ R., J.H. 1981. Confirmación en el campo de resistencia al tizón bacterial (*Xanthomonas phaseoli*) del fríjol. [*Field verification of bean resistance to the common blight (Xanthomonas phaseoli)*]. *In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1982. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.3, pp.L10-1-L10-6. Span., 7 Refs.

Phaseolus vulgaris. Field experiments. Germplasm. Cultivars. *Xanthomonas phaseoli*. Host-plant resistance. Puerto Rico.

Bean line no. 235-1 and 4 lines from the U. of Cornell (79-1981, 79-1982, 79-1984, and 79-1987) were identified as resistant to 6 strains of *Xanthomonas phaseoli* in lab. and

greenhouse trials; a field trial was carried out to verify their resistance. These lines, in addition to checks La Vega and W-117, were planted at the Fortuna substation of the Estación Exptl. Agrícola, U. of Puerto Rico,in a completely randomized design (5-m rows). The inoculum was prepared from naturally-infected leaves and half of each row was inoculated 52 days after planting (flowering). Sprinkler irrigation was applied for 1 wk. to maintain a high MC. Readings regarding severity and the type of symptoms occurring on leaves and pods were taken 7, 14, and 33 days after inoculation. Cv. W-117 under natural conditions had a lower level of susceptibility than cv. La Vega. Resistant lines maintained their resistance even with artificial inoculation. *(Summary by F.G. Trans. by L.M.F.)* G01 E02

0547

15249 BUESTAN R., H.; PONCE M., A.; VALLE P., N.; BARRAGAN R., A. 1979. INIAP-BAYITO: una variedad de frejol para el litoral ecuatoriano. *(INIAP-BAYITO: a bean variety for the Ecuadorian coastal areas).* Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias. Estación Experimental Boliche. Boletín Divulgativo no. 107. 8p. Span., Illus.

Phaseolus vulgaris. Cultivars. Cultivation. Agronomic characters. Ecuador.

The Instituto Nacional de Investigaciones Agropecuarias has released a new bean var. designated INIAP-BAYITO for farmers; it is apt for the ecological conditions of the Ecuadorian coastal area and certain sectors of the Andean region. Agronomic characteristics and technical recommendations on planting distances and densities, fertilization, weed, insect, and disease control, and harvesting are included. *(Summary by F.G. Trans. by L.M.F.)* G01 D00

0548

17808 CHRIST, B.J.; GROTH, J.V. 1982. Inheritance of resistance in three cultivars of beans to the bean rust pathogen and the interaction of virulence and resistance genes. Phytopathology 72(7):771-773. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. Laboratory experiments. Inheritance. *Uromyces phaseoli.* Cultivars. Host-plant resistance. Genes. Virulence. USA.

In greenhouse trials conducted to determine the mode of inheritance of bean cv. to bean rust isolates, bean cv. US#3 was resistant to single-pustule isolate S1-5 of *Uromyces phaseoli* var. *typica*, but susceptible to isolate P10-1; Early Gallatin (EG) was susceptible to S1-5, but resistant to P10-1; and Pinto 111 (111) was susceptible to both isolates. From the cross US#3 x EG the F_1 seedlings were resistant to both isolates, while the F_2 progeny segregated for 2 independent dominant resistance genes. F_2 progenies of crosses 111 x EG and 111 x US#3 gave further evidence of these 2 genes. F_2 progeny from the cross 111 x EG also gave evidence for possible complementary resistance genes effective against isolate S1-5. In US#3, a resistance gene Up_1 was matched to 2 virulence loci, UpA_1 and UpV_3, in isolates P10-1 and S1-5. In EG, a resistance gene Up_2 was matched to virulence locus UpA_2 in the 2 isolates. This interaction of virulence and resistance genes indicates that the expression of resistance in beans and virulence in bean rust is dependent upon the genotype of the other organism, and the results provide evidence for a gene-for-gene relationship. *(Author's summary)* G01 F03

0549

15892 PEREZ G., P. 1981. Negro Puebla, nueva variedad de fríjol para los Valles Altos de México. *(Negro Puebla, a new bean variety for the Valles Altos of Mexico).* Chapingo, México, Instituto Nacional de Investigaciones Agrícolas. Centro de Investigaciones Agrícolas de la Mesa Central. Folleto Técnico no.7. 6p. Span., Illus.

Phaseolus vulgaris. Cultivars. Agronomic characters. Yields. Adaptation. Mexico.

From the yearly evaluations of beans collected by the Genetic Resources Unit of the Instituto Nacional de Investigaciones Agrícolas (INIA), Mexico, var. Negro Puebla arose with the main characteristic of producing high yields in monoculture (1986 kg/ha) and in association (1029 kg/ha). Its genealogy, agronomic characteristics, and areas of adaptation (Valle de Mexico, Valle de Huamantla, and San Martín Texmelucan) are described. *(Summary by F.G. Trans. by L.M.F.)* G01 D02

0550

15860 COSTA, J.G.C.; ANTUNES, I.F.; OLIVEIRA, E.A. 1974. **Feijão; cultivar IAS-4, Tayhú.** *(Beans: cultivar IAS-4, Tayhú).* Pelotas-RS, Brasil, Instituto de Pesquisas e Experimentação Agropecuárias do Sul. Boletim Técnico no. 96. 4p. Port., 4 Refs.

Phaseolus vulgaris. **Cultivars. Agronomic characters. Yields. Host-plant resistance.** *Uromyces phaseoli. Colletotrichum lindemuthianum.* **Brazil.**

The origin, major agronomic characteristics, disease resistance in the greenhouse (races B_6 and B_{10} of *Uromyces phaseoli* and races of group β of *Colletotrichum lindemuthianum*), av. production obtained during the trials conducted during the crop years 1969-72, adequate planting time and density, and availability of seed of cv. IAS-4, Tayhú. *(Summary by F.G. Trans. by L.M.F.)* G01 F03

0551

15850 HAGEDORN, D.J.; RAND, R.J. 1977. **Wisconsin (BBSR) 130 bean breeding line.** HortScience 12(4):356. Engl., Illus.

Phaseolus vulgaris. **Snap beans. Cultivars. Dwarf beans. Germplasm. Host-plant resistance.** *Pseudomonas syringae.* **Agronomic characters. USA.**

The 1st bush green bean with excellent resistance to the bacterial brown spot disease (*Pseudomonas syringae*), designated Wis. (BBSR) 130, is reported. It is recommended for use in breeding programs. Its origin and outstanding agronomic characteristics are described. *(Summary by F.G. Trans. by L.M.F.)* G01 F02

See also 0414 0426 0482 0488 0516

H00 NUTRITION

0552

17438 LABANEIAH, M.E.O.; LUH, B.S. 1981. **Changes of starch, crude fiber, and oligosaccharides in germinating dry beans.** Cereal Chemistry 58(2):135-138. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. **Cultivars. Seeds. Germination. Carbohydrate content. Analysis. Biochemistry.**

The effect of germination at 22°C on changes in carbohydrate components of red kidney, Gloria pink (*Phaseolus vulgaris* cv. Gloria), and black eye (*Vigna sinensis*) dry beans was investigated. Starch, amylose, and amylopectin decreased gradually during the 6-day sprouting period. The ratio of amylose to amylopectin also decreased during germination. Acid detergent fiber, cellulose, and lignin in the sprouts did not change appreciably during germination. The red kidney and Gloria pink var. were higher in acid detergent fiber and cellulose contents than were the black eye beans. High pressure liquid chromatography was used to determine quantitative changes of oligosaccharides in the germinating beans. During the preliminary soaking period of 14 h, an appreciable loss of sucrose, raffinose, and stachyose took place as a result of diffusion. The levels of raffinose and stachyose continued to decrease during germination. They disappeared after 6 days of germination in the Gloria pink and black eye beans. Sucrose increased in the 4-day sprouts. *(Author's summary)* H00 C03

0553

17731 WILSON, A.B.; KING, T.P.; CLARKE, E.M.W.; PUSZTAI, A. 1980. **Kidney bean (*Phaseolus vulgaris*) lectin-induced lesions in rat small intestine: 2. Microbiological studies.** Journal of Comparative Pathology 90(4):597-602. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Animal nutrition. Proteins. Diets. Toxicity. Cultivars. Laboratory animals.**

The differences in coliform populations in rats fed on diets containing either a high-lectin, highly toxic kidney bean var. Processor or a low-lectin, relatively non-toxic var. Pinto III were studied. When var. Processor was included in the rat diets, there was a dramatic overgrowth of *Escherichia coli* in the small intestine. No overgrowth occurred when the bean var. Pinto III was fed to the rats. Kidney bean lectins appear to indirectly or directly enhance the virulence of coliform strains either through aggregation and elimination of competitive strains or by agglutination of certain strains of *E. coli* to one another and to the mucosal surfaces of the gut. Severe disruption of microvilli precedes and accompanies the proliferation of *E. coli* and it is possible that malabsorption provides a suitable growth substrate for intestinal bacteria, augmented by cell fragments in the form of microvilli, and possibly also by cellular exudates due to loss of polarization in membrane transport systems. *(Author's summary)* H00

H01 Foods and Nutritive Value

0554

17461 KON, S. 1979. **Effect of soaking temperature on cooking and nutritional quality of beans.** Journal of Food Science 44(5):1329-1334, 1340. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Seed. Water absorption. Temperature. Cooking. Timing. Composition. Analysis. Nutritive value.**

California small white beans were soaked at different temp. in 10°C increments, from 20 to 90°C, until max. imbibition was achieved. Losses of total solids, N compounds, total sugars, oligosaccharides, Ca, Mg, and 3 water-soluble vitamins (thiamin, riboflavin, and niacin) were measured and found to be very small at soaking temp. up to 50°C. An increase in those losses of from three- to fourfold was found when the soaking temp. was raised to 60°C or above. Cooking rates followed a bell-shaped pattern with the peak, longest cooking time, being for beans soaked at 70°C and shortest cooking time for beans soaked at 90°C. Cooking rates corresponded closely to the amount of organic phosphate left in the beans after soaking at the different temp. *(Author's summary)* H01

0555

16474 READI, G.B.; McPHERSON, L.; BENDER, A.E. 1981. **Toxicity of red kidney beans (*Phaseolus vulgaris*).** Journal of the Science of Food and Agriculture 32(8):846-847. Engl., 6 Refs.

Phaseolus vulgaris. **Cultivars. Plant toxins. Phytohaemagglutinins. Cooking. Timing. Analysis. Human nutrition.**

Twelve samples of legumes, including red kidney, white kidney, and rose coco beans, were analyzed for lectin content (LC) and their degree of destruction after soaking in water for 18 h or after cooking at 100°C for 2, 5, 10, and 20 min. LC was estimated by an agglutination test on rabbit red blood cells performed according to Leiner's method. Only red and white kidney beans and, to a lesser extent, red lentils contained considerable amounts of lectins. Soaking removed 25-50% of the lectins. Most hemagglutinins were destroyed after 10 min of cooking; however, one bean cv. contained considerable amounts even after 20 min of cooking. It has been suggested that the toxic effects in vivo are due to a combination of lectins with carbohydrate moities on the mucosal cells lining the small intestine. *(Summary by C.P.G. Trans. by L.M.F.)* H01 C03

0556

17439 SATHE, S.K.; PONTE JUNIOR, J.G.; RANGNEKAR, P.D.; SALUNKHE, D.K. 1981. **Effects of addition of Great Northern bean flour and protein concentrates on rheological properties of dough and baking quality of bread.** Cereal Chemistry 58(2):97-100. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Proteins. Bean flour. Uses. Bread-making. Diets. Human nutrition.**

Proteins from Great Northern beans were concentrated. The rheological and baking properties of a blend of wheat flour and protein concentrates were compared with those of a blend of wheat flour and bean flour. Addition of the bean flour or protein concentrates to wheat flours caused an increase in water absorption and a decrease in mixing time, dough stability, and mixograph peak height. Load-extension curves for wheat flour/bean flour blends indicated a decreased resistance to extension with increased concn. of the bean flour. For a fixed bean flour level in the blend, however, resistance to extension increased with an increase in resting time. Addition of the bean flour at levels above 10% was detrimental to the dough and bread quality. However, breads prepared with added protein concentrates (≤ 10%) were more acceptable than those prepared with added bean flour (≤ 10%). *(Author's summary)* H01

0557

17462 MANCINI FILHO, J.; LAJOLO, F.M.; VIZEU, D.M. 1979. **Lectins from red kidney beans: radiation effect on agglutinating and mitogenic activity.** Journal of Food Science 44(4):1194-1196, 1200. Engl., Sum. Engl., 31 Refs., Illus.

Phaseolus vulgaris. **Seed. Phytohaemagglutinins. Toxicity. Analysis. Biochemistry.**

The effect of ionizing radiations on hemagglutinating and mitogenic activity of purified phytohemagglutinin in solution was studied. Beans irradiated were var. Rico 23 and Pintado from Brazil. A dose of 10 krad is needed for 50% destruction of the agglutinating capacity; the mitogenic effect is more resistant, 70 krad for 50% inactivation. Results indicate that the agglutinating and mitogenic effects are due to different structures. The radiation effect on agglutinating activity is an exponential function of the lectin concn. Macromolecular changes, followed by polyacrylamide gel electrophoresis, were evident for doses higher than 40 krad. A dose up to 3 Mrad was ineffective to inactivate the hemagglutinin in kidney beans even with 30 or 60% water content. *(Author's summary)* H01

0558

17746 MONTE, W.C.; MAGA, J.A. 1980. **Extraction and isolation of soluble and insoluble fiber fractions from the pinto bean (*Phaseolus vulgaris*).** Journal of Agricultural and Food Chemistry 28(6):1169-1174. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Cooking. Fibre content. Protein content. Carbohydrate content. Cellulose. Fat content. Analysis. USA.**

A method was tested to separate the fiber portion of the pinto bean into 13 fractions. The method overcame many problems which make extraction of fiber from high-starch and/or high-protein products difficult. The lipid, fatty acid, and protein content associated with each fraction was investigated in both raw and cooked beans. Cooked beans contained more than twice the amount of soluble fiber than the raw pinto beans, while the cooking process reduced by ⅓ the extractable hemicellulose A and completely depleted the hemicellulose B. Extraction by this technique revealed a 50% decrease in the levels of lignocellulose and crude cellulose after the cooking process. Some protein contamination was found in all fiber fractions except the bound pectin. Lipids, as phospholipids, monoglycerides, diglycerides, triglycerides, and free fatty acids were found in all fiber fractions tested except at the lignocellulose level of the cooked beans *(Author's summary)* H01

0559

17485 ANGELIS, R.C. DE; ELIAS, L.G.; BRESSANI, R. 1982. **Mezclas de arroz y fríjol (55:45 y 77:23). I. Valor nutricional de las proteínas de las mezclas.** [*Rice/bean mixtures (55:45 and 77:23). I. Nutritive value of proteins in mixtures*]. Archivos Latinoamericanos de Nutrición 32(1):47-63. Span., Sum. Span., 18 Refs.

Phaseolus vulgaris. **Uses. Diets. Nutritive value. Composition. Proteins. Laboratory experiments.**

The nutritive value of rice/bean mixtures in proportions of 55:45 (B_1) and 77:23 (B_2) parts, resp. was studied using conventional methods (NPR, PER, NPU, utilization of protein calories, and protein utilization). Rats were fed diets containing 10% protein with or without supplements of powdered milk/cassava (75:25), starch (75%), sugar (25%), and oil (26%). Studies on the value of the cassava/milk supplement indicated that it improved the quality of both mixtures (B_1 and B_2) and a greater efficiency was observed at 28 days with the B_2 mixture. However, the other supplements of B_1 and B_2 diets were not significantly different. There were no differences among the groups regarding biochemical parameters (plasmatic protein and albumin, and the ratio nonessential/essential amino acids). *(Author's summary. Trans. by L.M.F.)* H01

0560

17756 PAK, N.; ARAYA, H. 1981. **Fríjol extruido: potencialidad de su utilización en la alimentación infantil.** *(Extruded beans: potential use in feeding children).* Archivos Latinoamericanos de Nutrición 31(2):371-383. Span., Sum. Span., Engl., 19 Refs.

Phaseolus vulgaris. **Cooking. Nutritive value. Bean flour. Analysis. Protein content. Methionine. Human nutrition. Chile.**

The nutritional value of extruded bean flour (*Phaseolus vulgaris* var. Tórtola) obtained from the food industry was assessed in terms of chemical composition, biological value of protein, amino acid supplementation, and hemagglutinin content. The assessment also included several mixtures with extruded bean that could be applicable for infant and preschool feeding. The NPU of the samples ranged from 37.3-43.9 and hemagglutinin activity, from 0-2. Protein quality was increased considerably by adding DL-met. but not tryptophan. Six mixtures using extruded bean in concn. ranging from 30-80% , plus rice, wheat flour, skimmed milk and DL-met. were formulated. Protein contents varied from 16.4-26.8%, with a NPU of 58.5-69.7%. The usefulness of these mixtures to meet the energy and protein allowances, according to the WHO/FAO report of 1973, is discussed. It is concluded that extruded bean flour is a promising food for infant and preschool feeding, especially when added to mixtures that will improve their efficiency in meeting nutritional allowances. *(Author's summary)* H01

0561

17486 ANGELIS, R.C. DE; ELIAS, L.G.; BRESSANI, R. 1982. **Mezclas de arroz y fríjol (55:45 y 77:23). 2. Limitación de vitaminas liposolubles y minerales.** [*Rice/bean mixtures (55:45 and 77:23). 2. Limitation of minerals and liposoluble vitamins*]. Archivos Latinoamericanos de Nutrición 32(1):64-78. Span., Sum. Span., 6 Refs.

Phaseolus vulgaris. **Uses. Diets. Vitamin content. Mineral content. Amino acids. Nutritive value.**

The nutritive value of rice/bean mixtures in proportions of 55:45 parts was studied using the methods of NRP, PER, NPU, protein utilization, and calorie intake. Supplementation with cassava and milk (CM) as well as with vitamins and minerals improved all indexes but the addition of only minerals or cod-liver oil gave better results but not to the same extent as with CM. No effect was observed with casein, met., or hydrosoluble vitamin supplementation. Ca and P were efficient in partially improving the indexes, especially by inducing an increase in appetite. It is suggested that the rice/bean mixture is limiting regarding its mineral (Ca and P) and liposoluble vitamin content. *(Author's summary. Trans. by L.M.F.)* H01

See also 0425

I00 MICROBIOLOGY

See also 0483 0499

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation

0562

17463 BEYNON, J.L.; BERINGER, J.E.; JOHNSTON, A.W.B. 1980. **Plasmids and host-range in *Rhizobium leguminosarum* and *Rhizobium phaseoli*.** Journal of General Microbiology 120(2):421-429. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. Rhizobium leguminosarum. Rhizobium phaseoli. **Strains. Cell structure. Chromosomes. Genetics. Nodulation. Nitrogen-fixing bacteria.**

Rhizobium phaseoli strain 1233 forms N-fixing nodules on *Phaseolus vulgaris* and produces a brown pigment (probably melanin) in plate culture. This strain contains 2 plasmids of mol. wt. approx. 200 x 10^6. Spontaneous deletions in the smaller plasmid abolished pigment production and the ability to nodulate *Phaseolus* beans, suggesting that genes involved in the determination of both these phenotypes are on this plasmid. The conjugative *R. leguminosarum* plasmid pJB5JI, which carries genes that determine the ability to nodulate peas, was transferred from *R. leguminosarum* strain T3 into *R. phaseoli* strain 1233. The majority (approx. 97%) of transconjugants produced pigment and nodulated both peas and *Phaseolus* beans poorly. The others (approx. 3%) had received not only pJB5JI but also an extra plasmid present in strain T3 and they had lost the smaller of the 2 plasmids of *R. phaseoli* strain 1233, suggesting incompatibility between the plasmid transferred from T3 and that lost from the recipient. Most of the bacteria isolated from nodules following inoculation of peas by the pigmented transconjugants failed to produce pigment. These strains contained the larger plasmid from strain 1233, and pJB5JI, but not the smaller plasmid of strain 1233. The few pigment-producing bacteria isolated from pea nodules had suffered a deletion in the smaller plasmid of strain 1233. *(Author's summary)* I01

0563

17763 SUNDSTROM, F.J.; MOUSE, R.D.; NEAL, J.L. 1982. **Nodulation and nitrogen fixation of *Phaseolus vulgaris* L. grown in minesoil as affected by soil compaction and N fertilization.** Communications in Soil Science and Plant Analysis 13(3):231-242. Engl., Sum. Engl., 25 Refs.

Phaseolus vulgaris. Rhizobium phaseoli. **Nitrogen-fixing bacteria. Nodulation. Nodules. Stems. Roots. Dry matter. N. Fertilizers. Soil requirements. Soils. Growth-chamber experiments.**

The influence of 3 soil compaction levels, as determined by bulk density, and 4 N fertilizer treatments on growth, nodulation and N_2 fixation of *Phaseolus vulgaris* in minesoils, was assessed in a growth chamber study. Shoot and root growth was severely retarded and nodulation essentially absent in N unfertilized, uninoculated (control) plants. With inoculated plants, root and shoot mass increased and nodule mass decreased as bulk density was decreased from 1.55 g/cm^3 (unamended) to 1.40 g/cm^3 (amended with 50% by vol. sand). Root and shoot mass increased as N fertilizer rates increased from 0 to 100 kg N/ha. Nodule mass increased at 25 kg N/ha, but higher N rates decreased nodule mass compared to unfertilized plants. There was no significant correlation between bulk density and N_2 fixation, as measured by the acetylene reduction assay. In general, N_2 (C_2H_2) fixation was the greatest at 35 days from seeding; however, at 21 days, unfertilized plants showed high

N_2 (C_2H_2) fixation rates. Fertilizer N at 25 kg/ha increased acetylene reduction as compared with unfertilized plants, while at 50 and 100 kg/ha the rate of N_2 (C_2H_2) fixation decreased. *(Author's summary)* 101 D01

0564

17757 MONTANGE, D.; WAREMBOURG, F.R.; BARDIN, R. 1981. **Utilisation du $^{15}N_2$ pour estimer la fixation d'azote et sa repartition chez les legumineuses.** *(Use of $^{15}N_2$ to estimate nitrogen fixation and distribution in legumes).* Plant and Soil 63(2):131-139. Fr., Sum. Fr., Engl., 13 Refs., Illus.

Phaseolus vulgaris. Rhizobium. **Nitrogen fixation. Nitrogen-fixing bacteria. Soil air. Tracers. N. Mineral content. Analysis.**

A method for the use of $^{15}N_2$ in the study of N fixation by complex legume-*Rhizobium* associations grown in soil is proposed. The procedure consists of labelling the soil atmosphere with $^{15}N_2$ for short periods of time, measuring ^{15}N enrichment in the plants, and calculating the total N fixed during this period. The 1st results obtained with beans and clover plants demonstrate that after only 7 h of incubation, significant amounts of ^{15}N can be measured in the plants allowing the precise determination of the C_2H_4/N_2 ratio, which ranged between 2.6-3.1 in this expt. Over longer periods of time, such amounts enable the pattern of N distribution from the nodules to the reproductive organs of bean plants to be followed. *(Author's summary)* 101

0565

17703 GRAHAM, P.H.; VITERI, S.E.; MACKIE, F.; VARGAS, A.T.; PALACIOS, A. 1982. **Variation in acid soil tolerance among strains of *Rhizobium phaseoli*.** Field Crops Research 5:121-128. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. pH. Al. Mn. Soils. Nodulation. Inoculation. Colombia.**

The tolerance of 55 strains of *Rhizobium phaseoli* to acid pH, Al, and Mn in nutrient medium was examined and the tolerance of these stresses related to the survival and nodulating ability of strains of *R. phaseoli* in acid soils. At pH 4.5 only 6 of the 55 strains tested produced isolated colonies on modified Keyser-Munns medium. Eight strains grew well on pH 4.7 medium to which 6 ppm Al had been added, but only 6 of these grew when the Al was replaced with 50 ppm Mn. When 2 strains differing in tolerance to pH in nutrient medium were introduced into an Ultisol from Santander de Quilichao, Colombia, which had been limed to differing pH values, the tolerant strain CIAT 899 survived better from pH 4.15-4.90. In a field trial with soil limed to pH values from 3.8-4.4, the % of plants nodulated and the no. of nodules/plant were greater when CIAT 899 was used as inoculant instead of the strain CIAT 632, shown sensitive to pH in both nutrient media and soil tests. In this trial granular, soil applied inoculants gave better results than those which were seed applied. In a 2nd field trial, on a Typic Distrandept limed from pH 4.45-5.20, yields of *Phaseolus vulgaris* were enhanced by inoculation, but again CIAT 899 performed better than did CIAT 632. In this trial there was no significant difference between inoculation methods. The possible value of granular inoculation methods to the production of *P. vulgaris* under small-farm conditions is discussed. *(Author's summary)* 101

0566

17718 BAIRD, L.M.; WEBSTER, B.D. 1982. **Morphogenesis of effective and ineffective root nodules in *Phaseolus vulgaris* L.** Botanical Gazette 143(1):41-51. Engl., Sum. Engl., 39 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. Nodulation. Nodules. Inoculation. Morphogenesis. Nitrogen-fixing bacteria. Electron microscopy.**

Seedlings of *Phaseolus vulgaris*, inoculated with an effective strain of *Rhizobium phaseoli* (CIAT 73) or an ineffective strain (14c), were maintained on a N-free nutrient solution in sterilized sand. Acetylene reduction was measured periodically, and nodules were harvested for light and electron microscopy. In plant host cells infected with CIAT 73, there was an increase in cell vol., nuclear size, and mitochondrial length as bacteria multiplied and became bacteroidal. Golgi activity and rough endoplasmic reticulum (RER) were sparse at nodule maturity, but close associations of amyloplasts and elongated, energized mitochondria were observed. N fixation peaked at 5 wk. and dropped sharply coincident with flowering. Plant host cells infected with 14c typically contained numerous mitochondria; Golgi bodies and RER were conspicuous throughout nodule development. By the time the bacteria became bacteroidal, plant shoots were chlorotic, and under N stress the apex had made the transition to flowering. Data suggest that such ineffective nodulation may accelerate the process of normal nodule senescence. *(Author's summary)* I01

0567

17768 SPITKO, R.A.; MANNING, W.J. 1981. **Irradiated digested sewage sludge: effects on plant-symbiont associations in the field.** Environmental Pollution 25(1): 1-8. Engl., Sum. Engl., 27 Refs.

Phaseolus vulgaris. **Manures. Nodulation.** *Rhizobium.* **Symbiosis. N. Growth. Yields. USA.**

Phaseolus vulgaris cv. Contender was sown 2 wk. after application of liquid municipal sewage sludge to land at Waltham, Massachusetts (USA) in 1977 and 1978. Sewage sludge inhibited nodulation by *Rhizobium* spp. but this was not due to the N fertilizer level as the sludge contained only 1.5% N. There was no excessive accumulation of heavy metals in the treated plants. *(Summary by Soils and Fertilizers)* I01

0568

17739 SHRINER, D.S.; JOHNSTON, J.W. 1981. **Effects of simulated, acidified rain on nodulation of leguminous plants by** *Rhizobium* **spp.** Environmental and Experimental Botany 21(2):199-209. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. Glycine max. Rhizobium. **Rainfall. pH. Nodulation. Growth. Yields. Agricultural lime. Soils. USA.**

Simulated rain acidified with sulfuric acid to pH 3.2 inhibited *Rhizobium* nodulation of greenhouse- and field-grown Red Kidney beans in the USA and greenhouse-grown soybeans cv. Lee. Plants were inoculated with *Rhizobium* and exposed at regular intervals to simulated rain of pH 3.2 ± 0.1 or pH 6.0 ± 0.2 at a rate of 1.9-5.7 cm/wk. for 1-9 wk. Nodulation of Red Kidney beans and soybeans exposed to acid rain (pH 3.2) was inhibited by 73%. Nodulation of beans was inhibited when rain of pH 3.2 was applied only to the foliage as well as when applied only to the soil or to the soil and foliage together. Inhibition of nodulation was partially or completely reversed in 3 of 4 soil types tested by addition of dolomitic lime. Results suggest that acidic precipitation is a potentially important environmental stress factor under marginal site conditions where bacterial symbiosis may be critical to the fitness of temperate leguminous plants. *(Author's summary)* I01 D01

0569

17717 NEVES, M.C.P.; FERNANDES, M.S.; SA, M.F.M. 1982. **Assimilaçao de nitrogénio em plantas noduladas de** *Phaseolus vulgaris* **L. e** *Vigna unguiculata* **(L.) Walp.** *(Nitrogen assimilation by nodulated plants of Phaseolus vulgaris and Vigna unguiculata).* Pesquisa Agropecuária Brasileira 17(5):689-695. Port., Sum. Port., Engl., 24 Refs., Illus.

Phaseolus vulgaris. Rhizobium. **Inoculation. N. Plant assimilation. Nodulation. Brazil.**

Under field conditions, the processes of N assimilation via nitrogenase and nitrate-reductase, the transport and the accumulation of N in plants of bean cv. Rio Tibagi and cowpea cv.

Vita 34 inoculated with *Rhizobium* were compared and contrasted. Cowpea showed better nodulation than beans and consequently had higher rates of nitrogenase activity. The small nodulation of beans resulted in greater dependence on soil mineral N as indicated by the higher rates of nitrate-reductase activity compared with cowpea, especially during the reproductive stage of growth. The superiority of cowpea in terms of assimilation and remobilization of stored nitrogen resulted in a seed yield 28% greater than that of beans. There was no correlation between the seasonal changes in the ureides content of the xylem sap and the nitrogenase activity for both plant species. Beans, however, showed a negative correlation between the nitrate-reductase activity and the ureide content of the sap indicating that the metabolic pathways leading to ureide production operates alternatively to nitrate assimilation. *(Author's summary)* 101 C03

0570

17785 CUAUTLE F., F., NUÑEZ F., R.; VALDES R., M. 1981. **Efecto de la fertilización, fumigación del suelo e inoculación con *Rhizobium*, sobre la nodulación, contenido de nitrógeno y rendimiento de fríjol (*Phaseolus vulgaris* L.) en Chapingo, México.** *(Effect of fertilization, soil fumigation, and inoculation with Rhizobium on nodulation, nitrogen content, and yields of beans in Chapingo, Mexico).* Agrociencia (México) 43:19-35. Span., Sum. Span., 25 Refs.

Phaseolus vulgaris. **Field experiments. Laboratory experiments. Cultivars.** *Rhizobium phaseoli.* **Nodulation. Nitrogen fixation. Fertilizers. N. Inoculation. Yields. Mineral content. Soil treatment. Strains. Mexico.**

Several factors affecting nodulation and the capacity of symbiotic fixation by *Rhizobium* in beans were identified and assessed in the Valle area of Mexico in order to verify if the high no. of native *Rhizobium* bacteria interfere with the effective symbiosis with introduced strains, thus reducing the effectiveness of inoculation. Two field trials were established: one in Lomas de San Juan and the other in Xaltepa (under rainfed and irrigated conditions, resp.) in exptl. plots in Chapingo. Two greenhouse trials using the same soils were also set up. Three inoculants prepared from strains isolated from the soils under study and 2 commercial inoculants were tested on 2 bean var. planted in both fumigated and unfumigated soil to reduce the interference of native strains. In the expt. under rainfed conditions max. yields were obtained and the total no. of nodules decreased in both var. with both the application of 80 kg N/ha and soil fumigation. In the expt. under irrigated conditions higher yields and a higher no. of nodules in the 2 var. were obtained in both var. with soil fumigation. Under greenhouse conditions with both types of soil tested bean var. Negro-Puebla had a higher no. of nodules and a higher dry wt. than var. Negro-150. Soil fumigation was effective in increasing yields since soil fertility was increased and weeds were controlled, but this fumigation is impractical due to its high cost. Therefore, for successful inoculation it is necessary to incorporate a very high amount of bacteria (of the order of $\geq 10^8$/seed) so they can compete with the high native population of *Rhizobium* in these soils. In field trials there was no correlation between the no. of nodules and bean yield. On the other hand, in greenhouse trials there was a correlation between the no. of nodules and DM yield, due perhaps to the fact that a higher concn. of bacteria were used in the greenhouse than in the field. *(Author's summary. Trans. by I.M.F.)* 101

0571

17807 RUSCHEL, A.P.; VOSI, P.B.; MATSUI, E.; VICTORIA, R.L.; SAITO, S.M. T. 1982. **Field evaluation of N_2-fixation and N-utilization by *Phaseolus* bean varieties determined by ^{15}N isotope dilution.** Plant and Soil 65:397-407. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. **Field experiments. Cultivars. Nitrogen fixation. Fertilizers. N.** *Rhizobium.* **Yields. Nodulation. Brazil.**

Differences in N_2-fixation by bean cv. were successfully evaluated in the field using ^{15}N isotope dilution technique with a nonfixing test crop of a different species (wheat). *Phaseo-*

lus cv. could have been similarly ranked for N_2-fixation capacity from either seed yield or total N yield, but the isotope method provided a direct measure of N_2-fixation and made it possible to estimate the proportion of fixed to total N in the crop and in plant parts. Amounts of N fixed varied between 24.59 kg N/ha for the 60-day cv. Goiano precoce to 64.91 kg N/ha for the 90-day cv. Carioca. The % of plant N due to fixation was 57-68% for the 90-day cv. and 37% for Goiano precoce (60-day cv.). Fertilizer utilization was 17-30% of a 20 kg N/ha fertilizer application. An application of 100 kg N/ha decreased N_2-fixation without suppressing it totally. Differences in yield between the highest yielding 90-day cv. (Carioca) and the lowest (Moruna) were also due apparently to var. differences in efficiency of conversion of N to economic matter (seed), as well as to differences in capacity of genotypes for N_2-fixation. *(Author's summary)* 101 D01

See also 0418

J00 ECONOMICS AND DEVELOPMENT

0572

14511 PACHICO, D. 1982. **Implicaciones de la estructura de producción y consumo de fríjol en América Latina para desarrollo de nueva tecnología.** *(Implications of the system of bean production and consumption in Latin America for the development of new technologies).* Cali, Colombia, Centro Internacional de Agricultura Tropical. Seminarios Internos SE-06-82. Span.. Illus.

Phaseolus vulgaris. **Consumption. Production. Economics. Latin America. Colombia.**

Some key characteristics of the system of bean production and patterns of consumption in Latin America are given along with the implications that these can have on the development of new production technology in the region. On-farm trials are recommended for the development of improved technology for intercropping systems with the collaboration of multidisciplinary teams (economists, agronomists, etc.). The development of low-input technology for small farmers is of primary importance since subsistence farming is prevalent in the region. Efforts of on-farm trials, that should be directed by national institutions supported by an international center, should include the following elements: characterization of current management practices mainly through socioeconomic surveys and interviews; var. and agronomic trials; and agronomic and economic evaluation of the new technology. New improved var. developed in international research centers should be transferred for their use by farmers on a national level. It is indicated that the degree to which bean production technology can be developed for intercropping systems, especially for small farmers, depends on 3 factors: the technical feasibility of developing technology; evaluation of economic implications as a consequence of developing technology; and the determination of policy-makers regarding the suitability of the cited strategy. *(Summary by A.J.C. Trans. by L.M.F.)* J00

0573

17441 MUÑANTE P., D., VILLA I., M.R.; TURRENT F., A. 1979. **Evaluación financiera del Programa de Investigación del Plan Puebla-Ciclo Agrícola 76-76.** *(Financial evaluation of the Plan Puebla Research Program for the 1976 crop year).* Agrociencia (México) 35:63-79. Span., Sum. Span., Engl., 7 Refs.

Phaseolus vulgaris. Zea mays. **Intercropping. Cultivation. Cultivars. Climatic requirements. Production. Costs. Income. Economics. Mexico.**

A methodology to evaluate financially the recommendations from the Plant Puebla Research Program for the 1976 crop yr was applied. On the basis of exptl. results, this program recommends 4 new production systems, 2 for maize and 2 for maize/bean intercropping (in both cases for limited and unlimited capital). The possibility of increasing farmer's income by cultivating beans on trellises, using 3 bean var. (amarillo, mantequilla, and ayocote), was shown by the results obtained in the production systems applied which used long term investment. The evaluation criterion for annual crops was the benefit/cost ratio; for bean production systems using trellises 3 indicators were used: the internal return rate, the current net value, and the benefit-cost ratio. Production systems for annual crops, for farm who own land or those who pay rent but do not incur in commercialization costs, proved

to be profitable. Financial analysis of bean production systems showed that var. mantequilla and ayocote were profitable. Sensitivity analysis indicated that the profitability of the production systems was affected by the variations in yield and investment costs, due to the use of wire and cotton cord substitutes on the trellises. According to sensitivity analysis, bean var. amarillo production system was not viable. When yields are reduced and costs increased by 10%, all 3 alternatives to bean production systems are unprofitable. *(Author's summary)* J00 D03

0574

15893 INSTITUTO SUPERIOR DE AGRICULTURA. SANTO DOMINGO. 1980. **Programa nacional de investigación en leguminosas comestibles 1980-1982.** *(National research program on edible legumes 1980-1982).* Santo Domingo, República Dominicana. Secretaría de Estado de Agricultura. 27p. Span., 11 Refs.

Phaseolus vulgaris. **Legume crops. Developmental research. Production. Economics. Cultivation systems. Productivity. Diseases and pathogens. Injurious insects. Research. Dominican Republic.**

The National Research Program on Edible Legumes, a part of the 1980-82 Agricultural Development Plan of the Secretaria de Estado de Agricultura of the Dominican Republic,is presented. This program seeks to increase bean and pigeon pea (*Cajanus cajan*) production by 9 and 5.4%, resp. as well as reduce the % of postharvest loss through improved production management. A description is given of the characteristics of red and black bean and pigeon pea production (cultivation systems, av. yield, area planted, imports, exports) and the causes of low productivity (low quality of improved seed, inadequate use of irrigation, fertilizers, weed control, and low planting density). Research programs are directed towards the diagnosis of cropping systems with legumes and determination of their economic importance, the design and evaluation of methods associating beans with other major crops, development of breeding programs, selection and introduction of new var., use of climatic, water, and soil resources, fertilizers and inputs, reduction of yield loss caused by pests and diseases, determination of ways of harvesting and storing grain, identification of major problems in the distribution of the product, and estimation of crop profitability. Research programs are developed by collaborators in charge of specific research projects on the problems identified in each area. At this rate, 44,000 t of beans and 20,354 t of chickpeas are expected to be produced per yr. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0575

17467 CAVALCANTI, J.E.A.; AMIN, M.M.; ROCHA, D.S. 1980. **Análise harmônica: uma aplicação para estudos de variações cíclicas de produtos agrícolas.** *(Harmonic analysis: an application for studies of cyclic variations of farm products).* Revista de Economía Rural (Brasil) 18(4):673-699. Port., Sum. Engl., Port., 12 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Production. Marketing. Trade. Prices. Economics. Statistical analysis. Brazil.**

The most relevant cyclic patterns of beans, maize, and rice in the state of São Paulo (Brazil), as well as coefficient of flexibility and price response to the variations in the amount sold were determined. Results indicated well-defined cycles for maize and rice. No cyclic pattern was evident for beans, due to their irregular behavior in the market. The adoption of a policy aiming at better price levels for producers would result in a higher social cost in the case of maize, since this product showed the lowest coefficient of price flexibility. For beans, it was impossible to measure this effect since the performance of this product was not adequately described by the method of harmonic analysis. *(Author's summary)* J00

0576

17318 FEDERACION NACIONAL DE CAFETEROS DE COLOMBIA. PROGRAMA DE DESARROLLO Y DIVERSIFICACION DE ZONAS CAFETERAS. 1981. **Fríjol; requerimiento promedio de mano de obra y otros insumos por hectárea por cosecha.** *(Beans; average input of labor and other inputs per hectare per crop). In* ——. Costos, ingresos y rentabilidad para productos de diversificación. Bogotá. pp.23-25. Span.

Phaseolus vulgaris. **Cultivation systems. Costs. Labour. Income. Colombia.**

Tables are given on labor requirements/day/ha, inputs (seed, fertilizers, pesticides, tools), and costs and income/ha of bean cultivation in coffee-growing areas with yields of 1500 kg/ha. Net income was estimated at Col$6329/ha/crop. *(Summary by C.P.G. Trans. by L.M.F.)* J00 D03

0577

17394 RAAD, H.J. 1981. **The economics of growing air-freighted export vegetables on Rarotonga 1979-1980: a case study for capsicum, beans and courgettes.** Rarotonga, Cook Islands, Ministry of Agriculture and Fisheries. Farm Management Notes no. 5. 12p. Engl., 2 Refs.

Phaseolus vulgaris. **Cultivation. Costs. Income. Trade. Productivity. Cook Islands.**

Since the advent of a regular air service to New Zealand, a rapid increase in air freighted exports of fresh vegetables (mainly capsicum, beans, and courgettes) and fruits (mainly pawpaw) has taken place. Detailed knowledge about the costs and returns, the profitability and the value added for these crops will be indicative for the air freighted export vegetable sector in total. Economic aspects of the growing of these 3 vegetables over the years 1979 and 1980 are discussed. A farm record system of labor, machine costs, and inputs is included, resulting in a tentative economic analysis of growing each of these crops. *(Summary by Abstracts on Tropical Agriculture)* J00 D02

K00 FIELD PLOT TECHNIQUE

0578

17744 CHIYENDA, S.S.; EDJE, O.T. 1976. **Effect of plot size and number of replicates on the relative efficiency of the randomized complete block design in determinate bean experiments.** Research Bulletin of Bunda College of Agriculture 7:59-71. Engl., Sum. Engl., 6 Refs.

Phaseolus vulgaris. Dwarf beans. Experiment design. Statistical analysis.

The effects of no. of replicates and plot size, defined as the middle ridge only, 1 outer ridge + the middle ridge, or the whole plot (3 ridges), on the relative efficiency of the randomized complete block design were investigated in an expt. with the determinate *Phaseolus vulgaris* cv. 253/1. Greatest relative efficiency in terms of least variation and lowest values of the standard deviation expressed as a % of the mean was observed for data based on the whole plot. This was clearly demonstrated by a decrease in the range of this index from 9.0-21.3% for the middle ridge only to 8.5-15.8% for the whole plot. Relative efficiency also increased as the no. of replicates increased from 2 to 5. *(Author's summary)* K00

See also 0422 0454 0458

L00 GRAIN STORAGE

0579

16763 ELIAS, L.G. 1981. **Conocimientos actuales sobre el proceso de endurecimiento del fríjol.** *(Current information on the process of bean hardening). In* Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, 27a., Santo Domingo, República Dominicana, 1981. Memoria. Santo Domingo, Secretaría de Estado de Agricultura. v.1-A, pp.SEF7-1-SEF7-34. Span., Illus.

Phaseolus vulgaris. Storage. Seeds. Water content. Climatic requirements. Seed quality. Cooking. Analysis. Guatemala.

A literature review on factors affecting the cooking quality of beans is given emphasizing grain moisture, temp., RH, and storage time. The parameters affected by these factors are discussed, including seed water absorption capacity and hardness. Regarding the mechanisms of the process of bean hardening, the physicochemical and structural changes of beans under storage conditions are discussed; the role of polyphenols, starches, proteins, and lipids are emphasized. From a structural point of view, cell walls and intermediate laminae are also discussed. It is concluded that the process of hardening during storage depends on various physical, chemical, and structural mechanisms of varying incidence. It is recommended to standardize a methodology to assess parameters in order to avoid the differences observed in the results obtained up to date. Moreover, it is recommended to select var. presenting a low tendency for bean hardening under storage conditions. *(Summary by A.J.C. Trans. by L.M.F.)* L00

0580

17723 GONZALEZ, A.R.; EDWARDS, K.M.; MARX, D.B. 1982. **Storage and processing quality of beans (*Phaseolus vulgaris* L.) harvested at the semi-dry stage.** Journal of the American Society for Horticultural Science 107(1):82-86. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Storage. Canned beans. Seed. Water content. Maturation. Harvesting. Product quality. Climatic requirements. Cultivars.

The processing quality of kidney, pinto, and small white beans (*Phaseolus vulgaris* cv. Redkloud, UI-111, and Aurora) was compared when harvested at the dry (11-14% MC) and semi-dry (50-60% MC) stage in the spring and fall growing seasons. Semi-dry harvested beans were canned immediately after harvest and after being stored at 27°C for 24 h. Dry harvested beans were canned after harvest. The respiratory rate of semi-dry harvested beans stored at 27°C decreased with time in storage. Significant differences in objective and subjective evaluations were found between cv., harvest stage, storage treatments, and spring and fall growing seasons. Semi-dry harvested beans stored for 24 h at 27°C had fewer split beans than the non-stored counterpart and the dry harvested beans. Semi-dry beans with and without storage treatment were firmer than those harvested dry. An increase in color was observed in semi-dry beans of UI-111 and Redkloud after being stored for 24 h at 27°C. Sensory panel evaluations indicated that beans harvested at the semi-dry stage and stored for 24 h at 27°C before canning had similar or higher acceptability than beans harvested dry. *(Author's summary)* L00 D04

0581

16762 MORA, M.A. 1981. **Estudios realizados por el CIGRAS sobre el endurecimiento de fríjol** *(Phaseolus vulgaris). (Studies carried out by CIGRAS on bean hardening).* Costa Rica, Centro para Investigaciones en Granos y Semillas. pp. SEF10-1-SEF10-17. Span., 3 Refs., Illus.

Paper presented at the Reunión Anual del PCCMCA, 27a., Santo Domingo, República Dominicana, 1981.

Phaseolus vulgaris. **Seed. Cooking. Temperature. Relative humidity. Storage. Deterioration. Water content. Timing. Costa Rica.**

The 4 trials conducted by the Centro para Investigaciones en Granos y Semillas (Costa Rica) on bean performance under different storage conditions are described in detail. In the 1st trial the effect of 3 MC (9.3, 13, and 15.4%) and 3 temp. (15, 20, and 25°C) on the hardness of beans stored for 6 mo. was determined. Monthly samples were taken for each storage condition and MC and cooking time, with or without previous soaking, were determined for each one. Beans did not harden under the conditions and time periods tested, except for a slight increase in cooking time when beans stored for 6 mo. at 25°C with 15.4% MC were assessed. In the 2nd trial storage conditions similar to the 1st were used except that storage time was prolonged to 18 mo.; monthly evaluations regarding cooking and MC were made as of the 7th mo. Initially an increase in the cooking time of beans stored under all conditions was observed but hardness decreased after a certain time. In the 3rd trial recently harvested beans were used with MC of 13 and 16% ; these were placed in a forced-air oven at 125°C during 0, 2, 4, and 6 min. Beans of each combination were then stored at 25°C with 13 and 16% MC during 12 mo., assessing MC and cooking quality at 0, 3, 6, 9, and 12 mo. There was no considerable change in hardness. Only a slight hardening was noticed in beans whose MC had been lowered to 13% to be subjected to a heat treatment and then were remoistened to 16% MC for storage. In the 4th trial beans were stored under 3 environmental conditions: (a) in a cooling chamber (av. temp. 22°C and 50% RH); (b) at a site located at 2300 m.a.s.l. (temp. 8-20°C); and (c) another site located at 1000 m.a.s.l. (temp. 15-29°C). At each site beans were stored under 2 initial MC (9.4-13 and 13.8-15.4%). Grain MC was considerably affected. Storing beans at a low-temp. site was as effective as storage in a controlled environmental chamber. *(Summary by F.G. Trans. by L.M.F.)* L00

L01 Stored Grain Pests

0582

17496 SCHOONHOVEN, A. VAN; CARDONA, C.; VALOR, J.F. 1981. **Niveles de resistencia al gorgojo pintado,** *Zabrotes subfasciatus* **(Boheman) en fríjoles cultivados y silvestres.** *(Levels of resistance to the bruchid Zabrotes subfasciatus in cultivated and wild dry beans).* Revista Colombiana de Entomología 7(1/2):41-45. Span., Sum. Engl., Span., 7 Refs., Illus.

Phaseolus vulgaris. Zabrotes subfasciatus. **Stored grain pests. Insect biology. Cultivars. Host-plant resistance. Experiment design. Statistical analysis. Colombia.**

Low levels of resistance were detected among 5661 accessions of cultivated dry beans exposed to *Zabrotes subfasciatus.* Although significant differences were found among the accessions for all of the parameters of resistance measured, the most consistent separation among accessions was obtained by using developmental time and wt. of adult progeny. Expression of resistance was maintained when the no. of bean seeds exposed/adult was varied; however, the standard method used (7 pairs of adults infesting 50 seeds) was the best infestation level to detect differences in resistance. Successive rearing for 5 generations on resistant or susceptible classified entries did not change expression or reduce reproduction of *Z. subfasciatus* on resistant lines. Resistance levels were too low to be of economic value. Instead, excellent sources of resistance were found among 170 wild bean accessions. Resistant wild accessions had a significant effect on the biology of the insect; thus, the progeny/female was significantly reduced and the developmental time was prolonged. The importance that this finding could have on bean breeding for resistance to *Z. subfasciatus* is discussed. *(Author's summary)* L01 F00

When requesting photocopies, do not forget to cite the five-digit number appearing at the upper left-hand corner of each reference.

LIST OF ABBREVIATIONS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
CAMD	Cassava African mosaic disease
CAMV	Cassava African mosaic virus
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxygen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter
COD	Chemical oxygen demand
concd.	Concentrated
concn.	Concentration
CP	Crude protein
in.	Inches
i.e.	That is
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilogram-calorie(s)
kg	Kilogram(s)
Kj	Kilojoule
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
expt.	Experiment
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
govt.	Government
govtl.	Governmental
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
IAA	Indoleacetic acid
IBA	Indolebutyric acid
Illus.	Illustrated
oz	Ounce(s)
P	Probability
Pa	Pascal(s)
PAN	Pexoxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pphm	Parts per hundred million
PPI	Pre-planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar

km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s) (only in combination with no.)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio
LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	α-Naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced from
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
pv.	Pathovar.
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGRs	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
Russ.	Russian
S	Svedberg unit of sedimentation coeff. (10^{-13} s)
s	Second
$S_{20,w}$	Sedimentation coefficient corrected to water at 20°C
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Specie
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with *N*-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
W	West
wk.	Week
WP	Wettable powder
wt.	Weight
YFEL	Youngest fully expanded leaves
yr	Year(s)
α	*alpha*
β	*beta*
γ	*gamma*
δ	*delta*
ε	*epsilon*
λ	*lambda*
π	*pi*
ψ	*psi*
/	Per
μ	Micro
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus
ϕ	Diameter
≪	Much less than
≫	Much greater than

CUMULATIVE AUTHOR INDEX
1982

ABAWI, G.S.
0308 0475

ABBOUD, S.
0210

ABRAHAO, I.O.
0382

ABRAHAO, J.T.M.
0274

ABREU F., S.
0159

ACEVEDO S., F.J.
0066

ADAMS, M.W.
0147 0383

ADRIANO, D.C.
0015 0198

AESCHLIMANN A., J.
0278 0417

AFANADOR, L.
0288

AGRAWAL, S.C.
0485

AGUDELO, D.
0287

AGUILERA A., M.R.
0263

AHMED, A.M.
0047

AIDAR, H.
0457

AJIMURA, G.M.
0254

AL-MUKHTAR, F.A.
0344

ALADRO, R.
0348

ALBUQUERQUE, M.M. DE
0487

ALCALDE S., S.
0070

ALDANA DE LEON, L.F.
0138

ALEXANDER, S.V.
0220

ALEXANDER, M.
0166

ALFARO A., G.
0368

ALFARO M., R.
0349 0534

ALLI, I.
0169 0172

ALMEIDA, L. D'A. DE
0243

ALVARADO J., M.
0368

ALVAREZ A., M.
0082 0417 0501

ALVAREZ C., E.
0284

ALVES, A.
0061

AMADOR A., M.F.
0462

AMARAL, F. DE A.L. DO
0014 0219 0395

AMIN, M.M.
0575

ANDERSHAN, T.
0097

ANDERSON, A.J.
0479 0469

ANDERSON, F.N.
0155

ANDO, A.
0112 0298

ANDRADE A., E.
0419

ANDRADE, A.G. DE
0215

ANDRADE, M.A. DE
0455

ANDREWS, D.J.
0236

ANGELIS, R.C. DE
0559 0561

ANGULO R., N.F.
0532

ANTONELLI, A.L.
0516

ANTUNES, I.F.
0247 0552

ANTUNES, P.L.
0184 0354

APPLEBAUM, S.W.
0129

ARAYA F., C.M.
0111

ARAYA V., R.
0245

ARAYA, H.
0560

ARCOVERDE, A.S.S.
0456

ARÉVALO V., A.
0412

ARMSTRONG, D.J.
0033 0128

ARNEKE, W.-W.
0387

ARNISON, P.G.
0026

ARNY, A.C.
0064

ARROYO, M.
0327

ARRUDA, F.B.
0046 0050

ARRUDA, H.V.
0081

ASHES, C.J.
0017

ATMOWIDJOJO, S.
0392

AWAIE, S.G.
0028

AYONAIKE, K.O.
0190 0191

BADILLO-FELICIANO, J.
0196 0259

BADJI, M.
0427

BAGGETT, J.R.
0539 0540 0541

BAIRD, L.M.
0566

BAKER, B.E.
0169 0172

BAKER, E.A.
0093

BALLANTYNE, D.J.
0035

BARBIERI, N.
0497

BARDIN, R.
0564

BARKER, A.W.
0150

BARNETT, G.
0316

BARUDDY, C.
0093

BARRAGAN R., A.
0547

BARRETO, A.C.
0271

BARRETO, B.A.
0243

BARRETO, P.O.
0264

BARROWS, E.M.
0512

BARTZ, H.
0345

BARZIC, M.R.
0481

BASCUR B., G.
0147

BASSETT, M.J.
0158 0343

BASSI, M.
0497

BASSO, L.C.
0119 0339

BASSTANIE, L.
0427

BASTIDAS, G.
0287

BASU, R.N.
0407

BATEN, M.A.
0198

BATISTA, C.M.
0187

BATISTA, G.C. DE
0157

BECQUER H., A.
0133

BEGZNOB, L.
0319

BEGRE, S.
0239 0339

BEN, J.R.
0245

BENDER, A.E.
0571

BERGAMASCHI, H.
0314

BERGAMIN, H.
0195

BERGER, R.D.
0306

BERINGER, J.E.
0562

BERNARDI, J.B.
0061

BERNHARDT, J.L.
0525

BETTO, E.
0497

BEVERSDORF, W.D.
0393

BEYNON, J.L.
0562

BEZDICEK, D.F.
0185 0362

BIANCHINI, A.
0075

BIENFAIT, H.F.
0401

BINGHAM, G.E.
0321

BINNIE, R.C.
0027

BIRD, R.
0004

BLACK, M.W.
0035

BLICKENSTAFF, C.C.
0513

BLISS, F.A.
0152

BLUM, M.S.
0514

BOETTGER, M.A.
0347 0466

BOLLINI, R.
0235

BOLSANELLO, J.
0440

BORCHERS ZAMPINI, C.
0012

BOS, L.
0316

BOSE, S.K.
0107

BOWERS JUNIOR, G.R.
0500

BRAIN, K.R.
0415

BRANCALION, M.J.
0019

BRASIL SOBRINHO, M.O.C.
0014 0395

BRASIL. MINISTERIO DA AGRICULTURA. COMISSAO DE FINANCIAMENTO DA PRODUCAO
0194

BRASIL. SECRETARIA DE AGRICULTURA E ABASTECIMENTO
0077

BRECKE, B.J.
0059

BRESSANI, R.
0160 0163 0181 0198 0559 0561

BREUKELEN, E.M. VAN
0291

BRIARTY, L.G.
0224

BRIDLE, K.
0004

BROWN, J.C.
0399

BROWNE, T.
0237

BROWNING, K.J.
0500

BRUNE, W.
0248

BRYAN, H.H.
0474

BUESTAN R., H.
0547

BULISANI, E.A.
0043

BURKE, D.
0185

BURKE, D.W.
0108 0110 0126 0171

BURNS, R.
0340 0351

BURUCHARA, R.A.
0292

BUSADA, C.J.
0407

CABRERA J., A.J.
0127

CAFATI K., C.
0087 0086 0290 0417

CAFATI, C.R.
0090 0091 0480

CAMPBELL, C.L.
0096 0103

CAMPOS A., J.
0110

CAMPOS S., L.
0130

CANO, R.J.
0135

CARDONA, C.
0131 0582

CARDOSO, A.A.
0245 0248 0283

CARDOSO, F.J.B.N.
0093

CARDOSO, J.E.
0496

CARELLI, M.L.C.
0425

CARMI, A.
0023

CARRIJO, I.V.
0312

CARVALHO, O.A. DE
0444

CARVALHO, M.T.V.
0233

CASTANERA, P.
0327

CASTILLO L., J.J.
0253

CASTRO, P.R.C.
0229

CATALDO, O.A.
0200

CATTINI, M.A.
0212

CAVALCANTE, R.D.
0326

CAVALCANTI, J.E.A.
0575

CERVELLINI, A.
0195

CEULEMANS, R.
0066

CHAGAS, J.M.
0432

CHAPMAN, R.K.
0521

CHAUDHURY, K.G.
0407

CHAVES, G.M.
0312

CHENG, S.J.
0158

CHIYENDA, S.S.
0578

CHOCKALINGAM, P.
0473

CHOUDHURY, F.N.
0421

CHOUDHURY, A.M.
0487

CHRIST, D.J.
0498 0548

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL
0341

CENTRO DE INVESTIGACIONES FITOTECNICAS DE PAIRUMARU, BOLIVIA.
0154

CIGNA, J.A.
0347

CILLARD, J.
0175

CILLARD, P.
0175

CLARK, R.B.
0543

CLARKE, E.M.W.
0164 0553

CLELAND, R.
0386

CLEVELAND, [illegible]
0484

CLIFFORD, P.E.
0127

CLIJSTERS, H.
0096

CONCATTO, L.C.
0520

CONDE, A.R.
0268

COOK, G.T.
0410

COOVER, S.R.
0493

CORREA V., F.
0099

CORREA, F.J.
0289

CORREA, M.U.
0375

COSTA, C.L.
0504

COSTA, [illegible]
0067 0125 0132

COSTA, J.A.
0213

COSTA, J.G.C. DA
0257 [illegible]

COSTA, J.G.L. DA
0373

COYNE, D.P.
0146 0155 0276 0296 0335 0344 05

COYNE, P.I.
0321

CRAKER, L.E.
0272

CRITCHLEY, C.
0632

CROCOMO, D.J.
0039 0209 0215 0226 0233 0352

CROSIER, D.C.
0306

CROWLEY, J.
0261

CRUZ, B.P.B.
0081

CRUZ, C.
0515

CUAUILE F., E.
0570

CUNHA, J.M. DA
0078

CUPERTINO, F.P.
0504

CURPY, T.M.
0381

CURTIS, R.W.
0037

DAMIAO FILHO, C.F.
0394

DANIELS, R.W.
0073

DAVET, P.
0093

DAVIDS, J.A.
0510

DAVIES, H.M.
0239

DAVIS, D.D.
0323 0513

DAVIS, J.H.C.
0145 0281 0346 0532

DAVIS, R.F.
0318

DAY, J.M.
0190

DE MARINIS, G.
0062

DEAKIN, J.R.
0545

DELAGE, E.
0175

DELAZARI, P.C.
0252

DELITTI, W.B.C.
0062 0447

DELL'ORTO T., H.
0123

DELMER, D.P.
0239

DERBYSHIRE, E.
0233

DEUBER, R.
0258 0443

DEVAY, J.E.
0241

DEY, P.M.
0300

DHINGRA, O.D.
0094

DIAZ C., G.
0419

DIAZ C., H.
0469 0488

DIAZ D., A.
0253

DIAZ M., F.
0409

DICKSON, M.H.
0347 0466

DIEHL, J.A.
0101

DIEUDONNE, C.
0437

DIXON, R.A.
0237 0300

DOERING, H.W.
0435

DOS SANTOS, R.F.
0062

DRAKE, S.R.
0431

DRION, A.
0327

DUIVENVOORDEN, J.
0461

DUKE, W.B.
0039

DUMROFF, E.B.
0018

DUNCAN, H.J.
0410

DURBIN, M.L.
0031

DURON A., E.
0324

ECKENRODE, C.J.
0523

EDJE, O.T.
0578

EDWARDS, C.A.
0033 0038

EDWARDS, D.G.
0017

EDWARDS, K.M.
0580

EIMORI, I.
0013

EL-GAZZAR, A.M.
0402

ELIAS, L.G.
0160 0181 0559 0561 0579

ELLIOTT, J.R.
0011

ELLIS JUNIOR, R.
0015

EMPRESA BRASILEIRA DE ASISTENCIA TECNICA E EXTENSAO RURAL DO ESTADO DE ALAGOAS
0192 0266

EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA.CENTRO NACIONAL DE PESQUISA-ARROZ, FEIJAO.
0244

EMPRESA BRASILEIRA DE ASISTENCIA TECNICA E EXTENSAO RURAL.
0072

EMPRESA PERNAMBUCANA AGROPECUARIA
0140

ENOK, H.
0229

ENRIQUEZ, G.A.
0031

ESCALANTE E., J.A.S.
0436

ESCALANTE E., L.E.
0242

ESKAFI, F.M.
0134

ESPANA, M.E. DE
0191

EVANS, A.M.
0526 0529

EVANS, L.G.
0381

EVANS, N.J.
0136

EWALD, L.F.
0001

EZE, J.M.O.
0018

FAGERIA, N.K.
0251 0373

FAHL, J.I.
0425

FAIGUENBAUM M., H.
0063

FANJUL, L.
0467

FARINA, G.
0497

FARIS, M.A.
0456

FASSULIOTIS, G.
0119 0545

FATING, K.B.
0485 0499

FAWOLE, I.
0530

FEDERACION NACIONAL DE CAFETEROS DE COLOMBIA.PROGRAMA DE DESARROLLO Y DIVERSIFICACION DE ZONAS CAFETERAS.
0576

FELIX, J.F.
0357

FELLER, U.
0238

FENSTER, W.E.
0048

FERNANDES, D.C.
0078

FERNANDES, M.B.D.
0325

FERNANDES, M.S.
0569

FERNANDEZ, R.
0160

FERRANDIZ P., R.
0133

FERRAZ, H. DE M.
0313

FERREIRA, A.A.A.
0062 0447

FERRERA\CERRATO, R.
0189

FERREYRA, H.F.F.
0195

FONSECA, J.R.
0197 0420

FISHER, N.M.
0044

FISCHER C., A.
0450

FIGUEROA, G.
0085

FEYEN, J.
0427

FONTES, L.A.N.
0245 0268

FORNASIERI FILHO, D.
0313

FORSTER, R.
0443

FOUAD, H.A.
0079

FOUGEROUX, A.
0320

FOZDAR, B.S.
0139

FRAILE, A.
0307

FRANCIS, C.A.
0451 0459 0461 0464

FRAZIER, W.A.
0539 0540 0541

FREIRE, A. DE B.
0197

FREIRE, M.S.
0197 0373

FREYTAG, G.F.
0413 0546

FUCIKOVSKY Z., L.
0100 0310

FUNDACAO INSTITUTO AGRONOMICO DO PARANA.
0342

GABELMAN, W.H.
0530

GALOMO R., T.
0187

GALVAO, J.D.
0268 0446

GALWEY, N.W.
0526

GAMEZ, R.
0315

GANIOTTI, B.V.
0293

GARCIA-ARENAL, F.
0307

GARCIA, J.
0131

GARCIA, R.M.
0469 0488

GARCIA, S.
0281

GARDINER, T.R.
0272

GARLAND, T.R.
0200

GARRUTI, R.S.
0184

GARZON, F.
0131

GAY, J.D.
0483

GEPSTEIN, S.
0025 0406

GEPTS, P.
0336

GERLOFF, G.C.
0530

GERSANI, M.
0009

GHADERI, A.
0147

GIACOMELLI, W.J.
0298

GILES, L.J.
0388

GINOUX, J.P.
0326

GIRALDO, G.
0076

GIUDICE, M. DE L.P. DEL
0182

GLAMM, A.B.
0012

GNANAMANICKAM, S.S.
0478

GODOY JUNIOR, C.
0062

GODOY, O.P.
0078 0422

GOMEZ R., O.B.
0436

GOMEZ, M.
0360

GONZALEZ A., M.
0348

GONZALEZ R., C.
0452

GONZALEZ W., M.E.
0207

GONZALEZ, A.L.
0065

GONZALEZ, A.R.
0580

GOODMAN, R.M.
0500

GOVINDARAJAN, V.S.
0068

GRAHAM, P.H.
0281 0565

GRANT, G.
0164

GREEF, J.A. DE
0214 0223

GREIG, J.K.
0236

GROOT, W. DE
0442

GROTH, J.V.
0490 0498 0546

GUAMAN J., R.W.
0270

GUAZZELLI, R.J.
0193 0247 0468

GUEDES, G.A. DE A.
0434

GUGLIELMETTI M., H.
0080

GUIMARAES, C.M.
0423

GUTIERREZ, L.E.
0019 0039

HABER, S.
0500

HAGEDORN, D.J.
0304 0316 0537 0542 0551

HAGEL, G.T.
0126

HALL, R.
0486

HAMMOND, L.L.
0428

HAMPTON, R.D.
0316 0318

HANAJIMA, S.
0533

HANCHEY, P.
0299

HANNA, M.A.
0335

HARASHIMA, K.
0174

HARDWICK, R.C.
0206

HARGREAVES, J.A.
0005

HARKER, J.M.
0484

HASSELBACH, O.E.
0267

HATZIOS, K.K.
0390

HAYWARD, A.C.
0087 0089

HEATH, M.C.
0104 0106 0311

HEDGE, D.M.
0265

HEGDE, R.K.
0109 0297

HELL, K.G.
0405

HEMBERG, I.
0034 0036

HERNANDEZ B., G.
0451

HERNANDEZ R., J.C.
0460

HERNANDEZ V., C.
0280

HERNANDEZ-XOLOCOTZI, E.
0467

HEUER, B.
0023

HILL, J.
0129

HILLMAN, J.R.
0021 0404 0408

HIREMATH, R.V.
0109 0297

HO, G.K.H.
0293

HOBBS, H.A.
0114

HODDINOTT, J.
0012

HOFFMAN, J.C.
0545

HOGGARD, M.P.
0514

HOHMANN, C.L.
0517

HOOKER, M.E.
0512

HORIUCHI, T.
0533

HOSFIELD, G.L.
0042

HUGHES, P.R.
0331

HUNT, G.M.
0003

HUNTER, J.E.
0308 0347

HYMES, W.L.
0255

IBARRA P., F.J.
0069 0151

IGARASHI, T.
0397

IGUE, T.
0372

ILAN, I.
0025 0406

IMHOFF, M.W.
0095 0309 0493

INOUYE, T.
0316

INSTITUTO CENTROAMERICANO DE INVES
TIGACIONES Y TECNOLOGIA INDUSTRIAL.
GUATEMALA.
0166 0179 0180

INSTITUTO SUPERIOR DE AGRICULTURA.
SANTO DOMINGO.
0574

ISASI, E.M.
0159

ISLAM, A.K.M.S.
0017

ISSA, E.
0081

IYER, V.
0161 0168

IZQUIERDO, J.A.
0042

JACOBSEN, B.J.
0506

JACQUA, G.
0320

JAFFE, M.J.
0004

JAGTAP, A.B.
0522

JARRY, M.
0378

JAYACHANDRA
0121

JEFFERY, L.S.
0441

JENKINS, G.I.
0216

JOHN, W.W.
0037

JOHNSON, A.W.
0119 0508 0545

JOHNSTON, A.W.B.
0562

JOHNSTON, J.W.
0568

JOLLEY, P.M.
0513

JONES JUNIOR, J.B.
0400

JONES, C.G.
0514

JONES, R.G.W.
0221

JUNQUEIRA NETTO, A.
0434 0455

JURSINIC, P.A.
0008

KAHN, B.A.
0255

KAPLAN, L.
0201 0202

KATHERMAN, M.J.
0099 0302

KATUNDU, J.M.
0330

KAWASE, M.
0029

KEIKAL, M.M.
0047

KEMP, G.A.
0359 0535

KENIS, J.O.
0020

KENNING, L.A.
0299

KEYA, S.O.
0152

KHADR, A.H.
0402

KHAN, A.
0396

KHARE, M.N.
0485

KHARE, M.N.
0499

KIGEL, J.
0022

KIMATI, H.
0385

KIMMINS, W.C.
0309

KING, T.P.
0164 0553

KINYUA, G.K.
0291 0482

KISTLER, H.C.
0494

KITAJIMA, E.W.
0113 0315 0504

KITIVO, D.K.
0442

KLEINKOPF, G.P.
0361

KLUTHCOUSKI, J.
0247 0251

KNECHT, G.N.
0230

KNUDSEN, D.
0543

KOBAYASHI, M.
0174

KOEHLER, H.H.
0171

KOGAN A., M.
0256

KOHASHI\SHIBATA, J.
0385 0409 0436 0467

KON, S.
0554

KORBAN, S.S.
0146 0276 0335 0543

KRAFT, J.M.
0110

KRAMM M., V.
0080

KREICHMER, P.J.
0144

KRUG, F.J.
0195

KRZYZANOWSKI, F.C.
0279

KUBINSKI, A.M.
0135

LABANEIAH, M.E.O.
0552

LAING, D.R.
0144

LAJOLO, F.M.
0414 0557

LAUER, D.A.
0429

LAURENTIZ, S. DE
0394

LAZARTE S., W.H.
0269

LEA, P.J.
0190 0191

LEAL, T.L.
0182

LEAO, M.L.
0001

LEBARON, M.J.
0384

LEEPER, C.D.
0506

LEGGETT, G.E.
0361

LEIDI, E.O.
0360

LENNOX, L.B.
0186

LEON, L.A.
0048

LEONARD, K.J.
0095 0309

LEONG, K.L.H.
0135

LEPIZ I., R.
0187 0416

LEROI, B.
0124 0378

LEWIN, K.F.
0381

LEWIS, L.N.
0030

LIBAPDI, P.L.
0195

LIENER, I.E.
0173

LIGERO, F.
0438

LIMA FILHO, J.M.P.
0051 0213

LIMA, A.F.
0454

LIMA, P.R. DE A.
0471 0472

LIMO, J.K.
0442

LIN, M.T.
0113 0315 0504

LINDEN, C.T.G.
0016

LINES, D.S.
0415

LINK, D.
0007 0125 0132 0520

LIPS, S.H.
0009

LIRA, M. DE A.
0456

LITZENBERGER, S.C.
0162

LLUCH, C.
0438

LOPES, H.O.
0454

LOPEZ G., R.
0329

LOPEZ R., J.H.
0546

LOPEZ S., E.
0151

LOPEZ, R.
0120 0324

LOYA R., J.G.
0122

LUZANO, E.
0167

LUDFORD, P.M.
0392

LUGO-LOPEZ, M.A.
0057 0196 0259

LUH, B.S.
0552

LYNAM, J.
0345

MACHADO JUNIOR, G.R.
0394

MACHADO, J. DOS S.
0434

MACK, H.J.
0424

MACKIE, F.
0565

MACLEOD, R.D.
0222

MADDEN, L.V.
0096

MAFRA, R.C.
0456

MAGA, J.A.
0558

MAGALHAES, A.A. DE
0487

MAHATANYA, E.T.
0058

MAIN, C.E.
0095 0309

MALAVOLTA, E.
0013 0014 0056 0391 0394 0395

MALUF, E.
0445

MANCINI FILHO, J.
0414 0557

MANGUAL C., G.
0260

MANGUAL\CRESPO, G.
0065

MANNING, W.J.
0567

MARCOS FILHO, J.
0275

MARINIS, G. DE
0447

MARID, J.L.
0132

MARRERO, H.
0348

MARTIN, F.G.
0474

MARTINEZ A., J.
0419

MARTINOTTO, V.
0243

MARX, D.B.
0580

MASAYA S., P.
0138

MATSUI, E.
0195 0571

MATSUI, H.
0029

MAZIER, C.
0324

MCDOUGALL, J.
0408

MCGINNIS, J.
0353

MCLAUGHLIN, S.B.
0010

MCMILLAN JUNIOR, R.T.
0474

MCNAUGHTON, M.E.
0305

MCPHERSON, L.
0555

MCSORLEY, R.
0507 0509

MEINERS, J.P.
0316 0339 0476

MEIRELLES, N.M.F.
0195

MENDES, M.C.
0471 0472

MENEZES, J.R.
0075

MENGEL, K.
0387

MENTEN, J.O.M.
0056 0112 0298

MERRYMAN, O.M.
0441

MESQUITA, J.E. DE L.
0496

MESSIAEN, C.M.
0320 0357

METZLER, J.T.
0322

MIDDLETON, K.J.
0477

MIFLIN, B.J.
0190 0191

MILLAR, A.A.
0421 0487

MILLER, C.A.
0323

MILLER, D.E.
0108 0110

MILLS, D.
0294 0295

MILLS, H.A.
0400

MIRANDA C., S.
0141

MIYACHI, S.
0397

MOFFETT, M.L.
0477

MOHAN, S.K.
0075

MOHAN, S.T.
0148

MOK, D.W.S.
0143

MOK, M.C.
0143

MOLINA, M.R.
0198

MOLLEL, S.L.
0064 0067

MONTANGE, D.
0564

MONTE, W.C.
0558

MONTEIRO, A.A.T.
0248

MORA C., M.
0377

MORA, M.A.
0581

MORRIS, A.J.
0301

MORRIS, T.J.
0115

MORSE, R.D.
0563

MOSCOSO, W.
0183

MOSHA, C.J.
0064 0067

MUCHOVEJ, J.J.
0094

MUHALET, C.S.
0147

MUIGAI, S.G.S.
0267

MUJEEB, K.A.
0205 0236

MUKUNYA, D.M.
0152 0291

MULLER, H.P.
0233

MULLER, L.
0001

MULLINS, C.A.
0441

MUNANTE P., C.
0573

MUNSON, R.D.
0232

MURPHY, D.L.
0300

MURPHY, L.S.
0015

MUSIL, M.
0316

MUZILLI, O.
0250

MWAKHA, E.
0465

NADAR, H.M.
0453

NAGAOKA, K.
0533

NAGARAJA, K.V.
0240

NAGLE, B.J.
0448

NAIK, L.M.
0522

NAITO, K.
0227 0411

NAKAMURA, K.
0285

NAKAYAMA, L.
0013

NASCIMENTO, F.J.L. 00
0046 0050

NASCIMENTO, V.F.
0195

NAYLOR, A.W.
0388

NEAL, J.L.
0563

NELSON, W.L.
0232

NEPTUNE, A.M.L.
0217

NETO, F.B.
0455

NEVES, M.C.P.
0569

NODA, H.
0113

NOEL, G.R.
0500

NOGUEIRA, F.D.
0013

NOLAN, W.G.
0211

NOOR SALEH, A.
0034 0036

NUNEZ C., G.
0374

NULAND, D.S.
0155

NUNES, J.C.
0314

NUNEZ E., R.
0570

NUNEZ G., S.
0544

NYANGIRI, E.N.
0442

O'KEEFFE, L.E.
0516

O'LEARY, J.W.
0230

OBATON, M.
0357

OBRADOR R., J.
0417

OGUCHI, T.
0293

OHLANDER, L.J.R.
0418

OLIVEIRA, E.A.
0550

OLIVEIRA, E.B. DE
0496

OLIVEIRA, E.T. DE
0254

OLIVEIRA, I.P. DE
0013 0373 0391

OLIVEIRA, J.V. DE
0137 0325

OLOFAJO, O.G.
0073

ORTEGA D., M.L.
0176 0177 0178

OTOYA, M.M.
0399

OZBUN, J.L.
0392

PACHICO, D.
0572

PADDOCK, E.F.
0352

PAHLEN, A. VAN DER
0113

PAK, N.
0566

PALACIOS, A.
0565

PANICHI, J. DE A.V.
0007 0520

PAPAVIZAS, G.C.
0491

PAREDES C., M.
0053

PASTOR C., M.A.
0289 0292

PATIL, S.
0293

PATRICK, J.W.
0218

PATWARDHAN, M.V.
0240

PAZ L., J.
0469

PENA G., M.A.
0262

PEAIRS, F.
0324

PEIRSON, D.R.
0011

PELL, E.J.
0322

PENNER, D.
0390

PENNYPACKER, S.P.
0096 0103 0510

PENTEADO, A. DE F.
0430

PEPPER, I.L.
0362

PERALTA J., F.
0122

PEREIRA, A.A.
0312

PEREZ G., P.
0549

PESSANHA, G.G.
0283 0430

PETERS, J.E.
0209 0226 0352

PFENDER, W.F.
0304

PIEDRA, S.
0488

PIERRE, D.
0328

PILLAI, O.A.A.
0473

PINEDA D., P.A.
0099

PIPOLY III, J.J.
0383

PIVOVAROV, V.F.
0469 0488

PIZZAMIGLIO, M.A.
0518 0519

PLAUT, J.L.
0336

PLOPER, L.D.
0105

PODOLER, H.
0128

POHRONEZNY, K.
0509

POLIGNANO, G.B.
0538

POLYA, G.M.
0041 0231

POMPEO, A.S.
0232

PONCE M., A.
0547

PONS, A.L.
0243

PONTE JUNIOR, J.G.
0556

PORTER, L.K.
0361

POSPIESZNY, H.
0318

POTTER, J.E.
0331

POWLES, S.B.
0032

POZSAR, B.I.
0225

PRADO, E. DE C.
0053

PRAGER, M.
0459 0461 0464

PRAKASH, K.S.
0024

PRENDEVILLE, G.N.
0261

PRIETO B., V.
0385

PROFI, M. DE
0214 0223

PROVVIDENTI, R.
0308

PURISSIMO, C.
0446

PUSZTAI, A.
0164 0553

QUESENBERRY, K.H.
0158

QUINONES F., J.A.
0452

QUINTERO C., P.
0317

QUINTERO Q., J.
0052

QUIROZ, C.
0417

QUAKENBUSH, L.S.
0049

QUANT, R.
0295

RAAD, H.J.
0577

RAM, H.H.
0024

RAMALHO, M.A.P.
0078

RAMASWAMY, H.S.
0068

RAMIREZ, A.
0417

RAMOS S., A.
0187

RANA, R.S.
0157

RAND, R.[illegible]
0537 0542 0551

RANGANNA, S.
0068

RANGNEKAR, P.G.
0556

RASCHE, [illegible]
0086

RATHERT, G.
0435

RAUSER, W.E.
0040

RAVISE, A.
0095

REAIDI, G.B.
0555

REDDY, P.P.
0319 0505

REICHARDT, K.
0195

REIS, M.S.
0440

RENNIE, R.J.
0359

REZENDE, H.E.C. DE
0014 0395

REZENDE, P.M. DE
0434

RHEENEN, H.A. VAN
0267

RIBEIRO, S.R.
0492

RIEDEL, R.M.
0118

RIGAUD, J.
0363

RIOS M., E.E.
0153

RIVERA, R.
0470

RIVEROS, G.
0449

RIZZO, M.E.
0198

ROBERIO, G.
0456

ROCHA, D.S.
0575

ROCHA, J.A.M.
0247

ROCKLAND, L.B.
0161 0168 0170

RODEWALD, G.E.
0453

RODRIGUES G., H.
0419

RODRIGUEZ C., C.
0177 0178

RODRIGUEZ F., M.T.
0339

RODRIGUEZ G., A.G.
0366

RODRIGUEZ, J.J.V.
0446

ROJAS M., M.
0268

ROMAN V., A.
0281 0346

ROMNEY, E.M.
0224

ROSA, P.R.F.
0394

ROUGHLEY, R.J.
0190

ROY, R.M.
0210

RUDOLPH, K.
0286

RUIZ G., J.L.
0176

RUIZ R., O.
0463

RUIZ, A.
0167

RUIZ, M.E.
0167

RUSCHEL, A.P.
0195 0358 0571

SA, M.F.M.
0569

SABINO, J.C.
0056

SACHS, I.
0009

SAETTLER, A.W.
0084 0086 0090 0091 0092 0147 0480

SAGASTA, E.M.
0307

SAHAI, S.
0157

SAITO, S.M.T.
0195 0358 0571

SALATI, E.
0195

SALAZAR M., O.
0368

SALGUERO, V.
0338

SALIH, F.A.
0074

SALSAC, L.
0357

SALUNKHE, D.K.
0161 0168 0412 0556

SANBAI, L.M.
0064 0067

SANBORN, S.M.
0521

SANCHEZ C., G.E.
0052

SANCHEZ, A.L.
0313

SANDSTED, R.F.
0255

SANTA CECILIA, F.C.
0053

SANTANA, B.F.
0182

SANTOS, R.F. DOS
0447

SÃO PAULO.SECRETARIA DE AGRICULTURA E ABASTECIMENTO.
0365 0366 0367

SARKAR, A.N.
0221 0433

SARTORATO, A.
0247 0277

SASTRY, K.S.
0524

SASTRY, K.S.M.
0524

SATHE, S.K.
0161 0168 0412 0556

SATISCHANDRA, K.M.
0297

SATISHCHANDRA, K.M.
0109

SAWADA, S.
0397

SCARISBRICK, D.H.
0073

SCHERER, E.
0045

SCHNEITER, A.A.
0448

SCHOONHOVEN, A. VAN
0129 0131 0134 0582

SCHUSTER, M.L.
0155 0296

SCHWARTZ, H.F.
0099 0150 0302

SCOTT, T.W.
0057 0259

SECCHI, V.A.
0243

SEDIYAMA, C.S.
0283

SEHGAL, O.P.
0116 0503

SEIJAS, C.A.R.
0373

SEMINARIO DE PRODUCCION DE FRIJOL EN LA REGION CENTRO ORIENTAL,DANLI, HONDURAS.
0371

SEMINARIO DE PRODUCCION DE FRIJOL EN LA REGION NORORIENTAL,CATACAMAS, HONDURAS.
0369

SEPULVEDA R., P.
0501

SERPA, J.E.S.
0265 0271

SEXTON, R.
0035

SGARBIERI, V.C.
0184 0354

SHANMUGAVELU, K.G.
0473

SHARMA, S.R.
0319

SHARP, W.R.
0209 0226 0352

SHEPARD, M.
0334

SHIH, C.T.
0143

SHIMUMURA, T.
0502

SHOCK, T.L.
0500

SHRINER, D.S.
0568

SILBERNAGEL, M.
0318

SILBERNAGEL, M.J.
0126 0431

SILVA, C.C. DA
0071 0283 0432

SILVA, H.T. DA
0208

SILVA, I.P. DA
0325

SILVA, J.C.
0283

SILVA, J.F.G. DA
0370

SILVEIRA, M.A.V.
0405

SILVEIRA, P.M. DA
0247 0254 0420

SINDHAN, G.S.
0107

SINGH, D.D.
0319 0505

SINGH, S.J.
0524

SIPPELL, D.W.
0486

SLUSARENKO, A.J.
0088

SMARTT, J.
0149

SMITH, D.A.
0301 0478 0484

SMITTLE, D.A.
0054 0423 0538

SOBRAL, L.F.
0246

SOLORZANO V., R.
0203

SOLTANPOUR, P.N.
0396

SOTOMAYOR, I.
0417

SOUZA, G.L.
0075

SPITKO, R.A.
0567

SPIVEY, C.D.
0483

SRIVASTAVA, H.K.
0156

SSALI, H.
0055

[illegible] S.J.

[illegible] M.

[illegible] L., J.R.
[illegible] 0423

[illegible] AN, J.R.

[illegible] ET[illegible], F.H.
[illegible]

[illegible] N, N.H.
[illegible]

STERLING R., F.
0273

STOFFELLA, P.J.
0255 0474

STONE, L.F.
0254

SUBHADRABANDHU, S.
0028

SUGE, H.
0249

SUHET, A.R.
0217

SUKHADA, K.
0121

SUMNER, D.R.
0483

SUNDARESAN, R.V.S.
0389

SUNDSTROM, F.J.
0563

SUNDSTROM, F.J.
0356

SUZUKI, H.
0227

SWANSON, C.A.
0512 0511

SZABO, L.J.
0294

SZENTESI, A.
0199

TADMOR, U.
0128

TANAKA, M.A.S.
0375

TAPIA F., [illegible]
0417

TASISTRO, S.A.
0452

TAY U., J.
0080

TAYLOR, G.F.
0012

TAYLOR, R.W.D.
0136

TEAKLE, D.S.
0115

TEGENKAMP, T.
0352

TEGENKAMP, T.
0352

TEH, K.H.
0511

TEIXEIRA, J.P.F.
0425

TEIXEIRA, M.G.
0247

TEJADA, G.
0459 0461 0464

TELEK, L.
0413

TELES, F.F.F.
0182

TEMPLE, S.R.
0143 0281

THAMBURAJ, S.
0473

THIEBAUT, J.T.L.
0245

THOMAS, J.M.
0200

THOMPSON, A.
0222

THOMPSON, J.E.
0018

THOMPSON, R.M.
0173

THUNG, M.D.T.
0302 0393 0426

TIAMBATI, H.M.
0442

TJEPKEMA, J.D.
0188

TOMPKINS, F.D.
0441

TOSSO, J.
0417

TREJO S., M.
0452

TRIGALET, A.
0481

TRINCHANT, J.C.
0363

TRIPPI, V.S.
0020

TSUJI, H.
0411

TU, J.C.
0102 0117 0303 0305

TUBELIS, A.
0046 0050

TULMANN NETO, A.
0056 0112 0298

TURENNE, H.
0527

TURRENT F., A.
0070 0458 0573

TURVEY, P.M.
0218

UEDA, K.
0411

URBEN FILHO, G.
0245

URIBE C., M.
0458

URS, N.V.R.R.
0490

VALDES R., M.
0570

VALLE B., R. DEL
0070

VALLE DE MEJIA, E. DEL
0376

VALLE JUNIOR, R. DEL
0057

VALLE P., N.
0547

VALOR, J.F.
0582

VALVERDE S., C.
0374

VAN ASSCHE, F.
0006

VAN ETTEN, H.D.
0494

VAN VOLKENBURGH, E.
0386

VANDERMOLEN, G.E.
0241

VANEGAS G., G.
0284

VARELA T., C.A.
0127

VARGAS, A.T.
0565

VARSEVELD, G.H.
0424 0539 0540 0541

VEERISETTY, V.
0116

VEIGA, A.A.
0056

VELANDIA C., F.H.
0052

VELAZQUEZ, O.
0488

VELHO, L.M.S.
0394

VERDUGO G., F.
0310

VERKERKE, W.
0401

VERDUSTRAETE, F.
0223

VICTORIA FILHO, R.
0060

VICTORIA K., J.I.
0284 0287

VICTORIA, R.L.
0195 0355 0571

VIEIRA, C.
0071 0245 0248 0283 0432 0440

VIEIRA, R.F.
0277

VIEIRA, S.A.
0045

VIGUE, G.T.
0185 0362

VILHORJO, B.W.
0001

VILLA I., M.R.
0573

VILLACORTA, A.
0519

VILLALOBOS M., C.L.
0368

VITALE, A.
0235

VITERI, S.E.
0565

VITTI, G.C.
0014

VIZEU, D.M.
0557

VOLKE H., V.
0070

VOLPE, L.A.
0394

VOLPE, J.
0294

VOSE, P.B.
0571

VOYSEST, O.
0350

WADDILL, V.
0334

WALDER, J.M.M.
0380

WALKER, J.C.
0542

WALLACE, A.
0220 0402 0403

WALLACE, D.H.
0031 0144 0439

WANDERLEY, M. DE N.B.
0370

WARO, M.
0237

WARDROP, A.J.
0041 0231

WAREMBOURG, F.R.
0564

WATERSTON, J.M.
0087 0089

WATTANABE, K.
0081

WEBER, K.A.
0503

WEBER, Z.
0318

WEBSTER, B.D.
0566

WEBSTER, D.M.
0536

WEIHING, J.L.
0146 0276 0335

WEINSTEIN, L.H.
0331

WEISETH, G.
0002

WELLER, D.M.
0084

WESTERMANN, D.T.
0361

WESTPHALEN, S.L.
0314

WETALA, M.P.E.
0064 0067

WHATLEY, J.M.
0228

WHEELER, B.E.J.
0495

WHITEHEAD, I.M.
0300

WIENDL, F.M.
0379

WILDUNG, R.E.
0705

WILHELM, J.
0234

WILHELMOVA, N.
0234

WILLIAMSON, K.E.
0423

WILLOX, G.E.
0373

WILSON, A.B.
0553

WILSON, K.A.
0165

WILSON, R.G.
0049

WINSHIP, L.J.
0188

WITT, J.
0435

WOOD, R.K.S.
0088 0097

WOODWARD, M.D.
0083

WOOLHOUSE, H.W.
0216

WRENSCH, D.L.
0332

WRONA, A.F.
0241

WYATT, J.E.
0119 0531 0[illegible]

WYMAN, J.A.
0521

WYN JONES, R.G.
0436

YABAR L., E.
0528

YAMASHITA, K.
0533

YANKULOV, M.T.
0150

YEANG, H.Y.
0221 0424

YOKOYAMA, M.
0227 0247

YOSHII, K.
0138

YOUNG, S.S.Y.
0[illegible]

ZAGATTI, [illegible]
0195

ZAPATA, M.
0546

ZARAGOSA, E.M.
0170

ZAUMEYER, W.J.
0475

ZEDAN, M.A.
0047

ZIMMERMANN, F.J.P.
0197 0373

ZIMMERMANN, M.J. DE O.
0373

ZULU, J.N.
0495

CUMULATIVE SUBJECT INDEX
1982

ABSCISSION
0073
FLOWERS
0027 0028 0042 0121 0385
LEAVES
0007 0018 0020 0022 0030 0242

ACANTHOSCELIDES OBTECTUS
0123 0124 0127 0130 0199 0275
HOST\PLANT RESISTANCE
0378
INSECT CONTROL
0136 0137

ADAPTATION
0146 0439
CULTIVARS
0031 0142 0151 0153 0249 0280 0283
0341 0342 0345 0349 0350 0416 0418
0432 0470 0472 0534 0549

AFRICA
0064 0067 0152 0267 0291 0330 0418
0437 0442 0453 0465 0482

AGRICULTURAL EQUIPMENT
0254
HARVESTING
0065 0068 0244 0423
PLANTING
0079 0244

AGRICULTURAL LIME
0243 0342
FERTILIZERS
0055 0196 0250 0358 0393 0403 0422
0430
PH
0055 0196 0250 0426 0568

AGRICULTURAL PROJECTS
0367

AGRONOMIC CHARACTERS
0024 0058 0063 0076 0080 0126 0141
0142 0144 0145 0148 0153 0154 0156
0203 0204 0207 0208 0242 0257 0263
0270 0281 0337 0340 0341 0343 0344
0346 0351 0359 0384 0409 0416 0417
0423 0426 0432 0440 0455 0459 0467
0469 0470 0471 0472 0473 0531 0532
0537 0539 0540 0541 0542 0547 0549
0550 0551 0578

AGROTIS IPSILON
0130

AIR POLLUTION
0010
PLANT INJURIES
0331 0381 0510 0511
OZONE
0321

ALUMINIUM
0056
PH
0013 0055 0250 0251 0426 0565
PHOSPHORUS
0013 0250 0393 0394 0426
TOXICITY
0391 0426

AMINO ACIDS
0353 0561
ANALYSIS
0184 0212 0236 0238 0354 0414 0425
0560
LEAVES
0212 0236 0238
SEED
0160 0181 0236 0238 0248 0354 0425

AMMONIUM SULPHATE
FERTILIZERS
0195

ANIMAL NUTRITION
0164 0167 0173 0198 0353 0553

APHIS GRACCIVORA
0133

APHIS FABAE
0130 0267

APHIS GOSSYPII
0133

APION GODMANI
HOST\PLANT RESISTANCE
0338

APION SP
0338

ARGENTINA
0002

ASH CONTENT
0171

ASIA
0265 0397 0473 0505 0522 0524

ASPERGILLUS SP
0375

ATP
0035 0059

AUXINS
0036 0041 0407 0408
GROWTH
0022 0209 0226 0231
PLANT DEVELOPMENT
0029 0034 0209 0226

BACTERIA
0478

BACTERIOLOGY
0478

BACTERIOSIS
0043 0084 0284 0288 0294 0295 0367
0477 0478 0481
DISEASE CONTROL
0087 0089 0244 0267 0277 0417
HOST\PLANT RESISTANCE
0085 0088 0091 0092 0141 0152 0155
0285 0287 0289 0290 0291 0293 0296
0342 0471 0472 0476 0479 0480 0536
0542 0546 0551
INOCULATION
0090 0091 0092 0289 0290 0292 0293
0536
ISOLATION
0286

BEAN COMMON MOSAIC VIRUS
0082 0317 0499
ELECTRON MICROSCOPY
0501
HOST\PLANT RESISTANCE
0080 0287 0339 0432 0475 0501 0539
0540 0541
PLANT BREEDING
0080 0287 0339 0475
DISEASE TRANSMISSION
0277 0501

BEAN GOLDEN MOSAIC VIRUS
0112 0317 0500
HOST\PLANT RESISTANCE
0138 0314 0342 0471 0472

BEAN ROOT ROTS
0396

BEAN RUGOSE MOSAIC VIRUS
0315 0317

BEAN SOUTHERN MOSAIC VIRUS
0317 0475 0503
DISEASE CONTROL
0116
ELECTRON MICROSCOPY
0504
DISEASE TRANSMISSION
0115

BEAN YELLOW MOSAIC VIRUS
0082 0524
HOST\PLANT RESISTANCE
0080 0475

BEMISIA TABACI
0313 0527
HOST\PLANT RESISTANCE
0138
CHEMICAL CONTROL
0122 0138 0524

BIOCHEMISTRY
0005 0026 0030 0033 0034 0038 0039
0041 0083 0088 0128 0157 0164 0177
0178 0216 0231 0233 0235 0237 0238
0239 0240 0286 0288 0294 0295 0318
0408 0410 0500 0552 0557

BOLIVIA
0154 0263

BORON
0502
MINERAL DEFICIENCIES
0394

BRAZIL
0001 0007 0043 0051 0053 0071 0072
0075 0077 0078 0113 0125 0140 0182
0192 0193 0194 0197 0208 0212 0217
0219 0243 0244 0245 0246 0247 0248
0250 0252 0254 0258 0259 0264 0266
0268 0271 0274 0275 0277 0279 0282
0283 0285 0290 0298 0313 0314 0315
0325 0326 0342 0358 0365 0366 0367
0370 0372 0373 0379 0380 0395 0405
0414 0420 0422 0425 0430 0432 0434
0440 0444 0445 0446 0454 0455 0456
0457 0468 0471 0472 0487 0492 0496
0504 0517 0519 0520 0550 0569 0571
0575

BUDS
0021 0037 0404

CADMIUM
0403

CALCIUM
0210 0250
LEAVES
0258 0394
MINERAL DEFICIENCIES
0393 0394

CALLOSOBRUCHUS MACULATUS
INSECT BIOLOGY
0380
INSECT CONTROL
0137 0380

CANNED BEAN
0431 0580

CANOPY
0272

CARBOHYDRATE CONTENT
0552 0558
LEAVES
0012 0023 0406
PODS
0028
SEED
0128 0177 0178 0182 0406 0412
STEMS
0012 0023

CARBON DIOXIDE
0010 0028 0188 0230
LIGHT
0006 0032 0215
PHOTOSYNTHESIS
0006 0032 0215

CARBON FIXATION
0006 0215 0225

CELL STRUCTURE
0003 0035 0224 0228 0240 0241 0261
0299 0386 0389 0562

CELLULOSE
0558

CHILE
0063 0080 0092 0142 0207 0256 0278
0417 0501 0560

CHLOROPLASTS
0008 0032 0211 0216 0228 0234 0411

CHLOROSIS
0143 0291 0396 0399 0401 0543

CHROMOSOMES
0139 0156 0157 [illegible]
0562

CLIMATIC REQUIREMENTS
0043 0105 0192 0200 0201 0208 0215
0243 0244 0245 0263 0272 0277 0345
0357 0367 0388 0416 0418 0420 0422
0437 0440 0446 0453 0456 0457 0459
0470 0471 0472 0474 0525 0573 0579
0580
PHOTOPERIOD
0028 0031 0439
TEMPERATURE
0031 0044 0046 0102 0108 0134 0183
0197 0203 0206 0211 0247 0359 0439
0486

CLIMBING BEANS
0001 0070 0144 0145 0346 0461 0467

COBALT
0403 0434

COLEOPTERA
0123 0124 0127 0129 0130 0136 0137
0199 0267 0326 0334 0338 0378 0379
0380 0512 0514 0525 0582
LEAVES
0329 0331
PODS
0328
SEED
0128 0275

COLLETOTRICHUM LINDEMUTHIANUM
0102 0111 0300
DISEASE CONTROL
0092 0399 0267 0277 0305 0485
HOST\PLANT RESISTANCE
0097 0099 0141 0147 0152 0154 0237
0281 0282 0305 0339 0342 0346 0432
0475 0482 0489 0492 0532 0550
PLANT BREEDING
0141 0147 0154 0261 0282 0339 0342
0346 0475 0532
RACES
0097 0147 0305 0482 0489

COLOMBIA
0052 0076 0085 0118 0127 0129 0143
0145 0190 0203 0253 0281 0284 0287
0288 0289 0292 0294 0302 0336 0340
0341 0345 0346 0350 0351 0393 0426
0428 0451 0459 0460 0461 0464 0526
0532 0533 0536 0565 0572 0576 0582

COMPOSITION
0003 0013 0068 0175 0190 0217 0233
0242 0256 0257 0327 0389 0391 0409
0427 0554 0559
ASH CONTENT
0171
CARBOHIDRATE CONTENT
0023 0028 0128 0177 0178 0182 0406
0412 0552 0558
FAT CONTENT
0171 0559
FIBRE CONTENT
0424 0558

MINERAL CONTENT
0023 0040 0047 0171 0212 0219 0220
0221 0258 0360 0361 0362 0374 0394
0395 0429 0435 0438 0561 0564 0570
PHENOLIC CONTENT
0376 0413
PROTEIN CONTENT
0018 0026 0160 0169 0171 0178 0181
0212 0225 0235 0236 0238 0248 0258
0353 0354 0411 0418 0425 0538 0558
0560
VITAMIN CONTENT
0171 0431 0561
WATER CONTENT
0023 0073 0183 0213 0376 0377 0431
0466 0579 0580 0581

CONSUMPTION
0572

COOKING
0161 0163 0166 0168 0170 0171 0176
0181 0183 0198 0353 0376 0377 0554
0555 0558 0560 0579 0581

COPPER
0403

CORYNEBACTERIUM FLACCUMFACIENS
HOST\PLANT RESISTANCE
0296 0475

COSTA RICA
0120 0167 0273 0349 0368 0377 0581

COSTS
0045 0167 0194 0247 0271 0368 0371
0573 0576 0577

COTYLEDONS
0035 0026 0036 0088 0096 0223 0224
0239
GERMINATION
0019 0025 0238 0405 0406

CROP LOSSES
0065 0118 0302 0303 0373
PLANT INJURIES
0112 0132 0150 0241 0249 0261 0274
0299 0313 0327 0329 0330 0331 0333
0445 0477 0506 0510 0521

CROSS\POLLINATION
0544

CUBA
0133 0349 [illegible] 0488

CULTIVAR
0014 [illegible] 0042 [illegible] 44 0047 0053
0058 0061 0074 0076 0081 0088 0094
0097 0104 0111 0119 0120 0126 0138
0146 0148 0160 0170 0171 0178 0181
0182 0187 0201 0202 0207 0215 0219
0233 0242 0244 0247 0251 0252 0255
0256 0257 0259 0262 0263 0270 0274
0276 0278 0284 0289 0291 0293 0305
0308 0310 0312 0313 0325 0335 0348
0353 0357 0359 0361 0392 0395 0398
0409 0414 0417 0423 0424 0426 0440
0448 0449 0452 0455 0466 0467 0471
0473 0474 0480 0482 0488 0490 0492
0495 0498 0501 0509 0516 0535 0543
0544 0545 0547 0548 0550 0552 0553
0555 0570 0571 0573 0580 0582
ADAPTATION
0031 0142 0151 0153 0249 0280 0283
0341 0342 0345 0349 0350 0416 0418
0432 0470 0472 0534 0549
GERMPLASM
0085 0091 0092 0150 0152 0155 0208
0281 0282 0287 0290 0303 0338 0345
0346 0349 0351 0532 0534 0537 0542
0546 0551
IDENTIFICATION
0001 0203 0204 0285 0304 0314
PLANT INTRODUCTIONS
0080 0290 0338 0341 0350 0468 0469
0470 0532

CULTIVATION SYSTEMS
0057 0069 0070 0071 0072 0073 0140
0145 0266 0267 0268 0269 0270 0271
0272 0273 0281 0346 0416 0453 0454
0455 0456 0457 0458 0459 0460 0461
0462 0463 0464 0465 0532 0573 0574
0576

CULTURE MEDIA
0016 0100 0209 0222 0226 0237 0240
0300 0305 0352 0363 0478 0484

CYTOGENETICS
0156 0158 0352 0529

CYTOKININS
0025 0033 0038 0225 0227 0231 0411

CYTOLOGY
0003 0005 0021 0059 0088 0104 0106
0139 0156 0157 0218 0224 0227 0228
0240 0241 0261 0299 0322 0352 0562

DEFICIENCIES
MINERAL DEFICIENCIES
0212 0251 0394 0396 0398 0401 0402
0543

DELIA PLATURA
INSECT BIOLOGY
0517

DETERIORATION
0163 0179 0180 0197 0198 0275 0376
0581

DEVELOPMENTAL STAGES
0012 0024 0040 0054 0056 0062 0063
0073 0084 0097 0111 0112 0143 0205
0208 0230 0242 0253 0255 0270 0325

0361 0384 0407 0409 0429 0433 0510
0536
BRANCHING
0206 0385 0467
FLOWERING
0027 0031 0042 0050 0076 0436
GERMINATION
0019 0025 0034 0046 0050 0076 0078
0094 0197 0274 0275 0313 0405 0406
MATURATION
0068 0076 0344
PODDING
0027 0042 0046 0050

DIABROTICA BALTEATA
0114

DIETARY VALUE
0173

DIGESTIBILITY
0160 0168 0173 0181

DIPTERA
0126 0313 0330 0418 0517
INSECT CONTROL
0522

DISEASE CONTROL
0243 0262 0324
BACTERIOSES
0087 0089 0244 0267 0277 0417
MYCOSES
0081 0082 0093 0099 0101 0105 0110
0185 0244 0247 0267 0277 0297 0302
0303 0305 0310 0375 0417 0483 0485
0487 0495
VIROSES
0082 0116 0244 0277 0417 0524

DISEASE TRANSMISSION
0087 0089 0090 0091 0092 0102 0111
SEED TRANSMISSION
0107 0115 0277 0284 0310 0318 0480
0501
VECTORS
0313
VIROSES
0113 0114 0115 0277 0313 0318 0501

DNA
0500

DOMINICAN REPUBLIC
0183 0574

DROUGHT
0018 0044 0249 0487 0510

DRY MATTER
0013 0047 0055 0190 0207 0219 0242
0257 0327 0362 0391 0394 0409 0427
0438 0450 0467 0563

DWARF BEANS
0023 0144 0346 0397 0403 0435 0473
0539 0540 0541 0545 0551 0578
SPACING
0440 0464

ECOLOGY
0077 0227 0153 0160 0200 0201 0203
0204 0281 0356 0357 0358 0359 0363
0443 0450 0456 0525 0565 0567 0568

ECONOMICS
0045 0167 0192 0193 0194 0247 0252
0262 0269 0270 0271 0365 0366 0367
0368 0370 0422 0430 0458 0461 0464
0572 0573 0574 0575 0576 0577

ECUADOR
0547

EMPOASCA FABAE
CHEMICAL CONTROL
0524

EMPOASCA KRAEMERI
0125 0460
HOST\PLANT RESISTANCE
0134 0342 0432 0526
INSECT BIOLOGY
0325 0518
BIOLOGICAL CONTROL
0131 0518
CHEMICAL CONTROL
0134

ENZYMES
0011 0019 0020 0025 0026 0030 0035
0037 0039 0041 0116 0128 0161 0165
0173 0188 0191 0215 0235 0237 0238
0239 0240 0300 0354 0356 0357 0363
0376 0406 0410 0484 0500

EPILACHNA VARIVESTIS
INSECT BIOLOGY
0331 0514 0525
BIOLOGICAL CONTROL
0334 0512 0525

EPIPHYTOLOGY
0082 0090 0296

ERYSIPHE POLYGONI
DISEASE CONTROL
0082 0267
CHEMICAL CONTROL
0390
HOST\PLANT RESISTANCE
0532

EUROPE
0337 0347 0401 0435

EXPERIMENT DESIGN
0067 0068 0081 0111 0119 0150 0167
0221 0242 0246 0253 0255 0262 0263

0264 0292 0329 0350 0372 0374 0422
0428 0454 0457 0458 0459 0578 0582

FAT CONTENT
0171 0558

FERTILIZER
0015 0043 0045 0048 0053 0055 0057
0058 0072 0140 0187 0190 0195 0196
0221 0245 0246 0248 0250 0252 0260
0266 0356 0357 0358 0361 0363 0374
0393 0403 0422 0423 0425 0428 0429
0430 0434 0438 0458 0465 0563 0570
0571

FIBER CONTENT
0558
P005
0424

FLOWERING
0027 0041 0050 0076 0148 0416
GENETICS
0031 0144
PHOTOPERIOD
0031 0144
TEMPERATURE
0031

FOOD ENERGY
0557

FUSARIUM OXYSPORUM
0098 [illegible]
DISEASE CONTROL
0093
CHEMICAL
0483

FUSARIUM SOLANI
0096 0099 [illegible] 0294
DISEASE CONTROL
0087 0101 [illegible] 0185
HOST\PLANT RESISTANCE
0101 0475 0537
PLANT BREEDING
0475

GENES
0002 0031 0085 0092 0143 0144 0146
0147 0149 0291 0308 0335 0339 0343
0344 0466 0498 0530 0531 0535 0536
0548

GERMPLASM
0005 0091 0092 0150 0152 0154 0155
0208 0281 0282 0287 0290 0296 0303
0318 0320 0336 0338 0340 0345 0346
0349 0351 0475 0526 0531 0533 0534
0536 0537 0542 0546 0551

GIBBERELLINS
0229 0475

GLYCINE MAX
0568

GROWTH
0004 0012 0014 0017 0021 0022 0023
0026 0062 0121 0143 0279 0213 0224
0226 0230 0231 0366 0394 0397 0402
0404 0405 0427 0447 0457 0526 0567
0568
LIGHT
0006 0272 0386 0388 [illegible]
MINERALS AND NUTRIENTS
0012 0217 0219 0232 [illegible] 0362 0387
0391 0394 0395 0397 0398 0399 0400
0401 0402 [illegible]
SALINITY
0016 0047 0455
SPACING
0003
TEMPERATURE
0203 0206 0359 0486 0535

GUATEMALA
0070 0138 0155 0156 0179 0180 0181
0198 0219 0338 0579

HARVESTING
0243 0265 0268 0272 0273 0244 0263
0266 0277 0280 0339 0413 0580

HEAT TREATMENT
0173 0176 0494 0497

HELIOTHIS ZEA
0132

HEMIPTERA
0130 0132
INSECT CONTROL
0520

HERBICIDES
0069 0061 0064 0066 0067 0118 0256
0[illegible] 0441 0443 0446 0447
0449 [illegible]
DISEASE AND PATHOGENS
0049
PLANT TOXICITY
0059 0062 0261 0445

HETEROSIS
0145 0156 0335

HISTORY
0252 0371

HOMOPTERA
0125 0130 0133 0325 0342 0466 0526
0527
INSECT CONTROL
0131 0134 0138 0515 0516 0523 0524

HONDURAS
0324 0339 0369 0371 0470

HUMAN NUTRITION
0160 0161 0166 0169 0170 0181 0182
0183 0184 0198 0243 0554 0555 0556
0560

HUMAN PHYSIOLOGY
0161

HYBRIDIZING
0141 0143 0149 0156 0158 0320 0336
0337 0343 0345 0347 0529 0536

HYBRIDS
0336 0337

INCOME
0045 0054 0070 0071 0134 0247 0252
0269 0270 0368 0432 0461 0464 0473
0576 0577

INDOLEACETIC ACID
0034 0036 0039 0226 0231 0424 0497
0498 0541

INHIBITORS
0134 0161 0165 0173 0216 0354 0389
0390 0414 0415
GROWTH
0231 0424

INJURIOUS INSECTS
0114 0243 0244 0324 0417 0523 0574
COLEOPTERA
0123 0124 0127 0128 0129 0135 0136
0137 0199 0207 0275 0326 0328 0329
0331 0334 0339 0378 0379 0380 0381
0514 0515 0518
DIPTERA
0126 0313 0330 0418 0517 0527
HEMIPTERA
0130 0132 0570
HOMOPTERA
0125 0130 0131 0133 0134 0138 0375
0342 0461 0515 0518 0523 0524 0526
0527
LEPIDOPTERA
0130 0131 0207 0513 0516 0519 0521

INJURIOUS MITE
0125 0131 0367
TETRANYCHUS TELARIUS
0332

INOCULATION
0086 0090 0091 0092 0134 0139 0141
0187 0189 0289 0290 0292 0293 0299
0301 0306 0310 0312 0316 0319 0347
0355 0356 0375 0475 0476 0490 0491
0497 0502 0536 0565 0566 0567 0575

INTEGRATED CONTROL
0528

INTERCROPPING
0140 0265 0452 0463 0532
CASSAVA
0269
ZEA MAYS
0070 0071 0072 0145 0266 0267 0268
0270 0271 0272 0281 0324 0416 0453
0454 0455 0456 0457 0458 0459 0460
0461 0462 0464 0573

IRON
0217
LEAVES
0052 0394
MINERAL DEFICIENCIES
0394 0397 0401 0402 0543

IRRADIATION
0159 0205 0210 0236 0275 0353 0379
0380 0475

IRRIGATION
0054 0247 0253 0254 0319 0367 0417
0420 0421 0424 0426 0427 0431 0487
0528

ISARIOPSIS GRISEOLA
0133 0137
DISEASE CONTROL
0099 0367 0377
CHEMICAL CONTROL
0133
HOST/PLANT RESISTANCE
0099 0346 0472 0475
PLANT BREEDING
0346 0475

LATIN AMERICA
0126 0130 0150 0572

LEAF AREA
0003 0063 0207 0213 0242 0257 0272
0329 0388 0438 0467 0490

LEAVES
0003 0006 0007 0010 0011 0012 0016
0018 0020 0021 0022 0023 0025 0026
0029 0031 0032 0040 0043 0041 0047
0051 0059 0063 0086 0095 0143 0200
0205 0211 0213 0215 0216 0220 0223
0224 0225 0226 0227 0228 0230 0231
0234 0236 0238 0239 0242 0249 0261
0272 0322 0323 0367 0382 0383 0385
0381 0386 0388 0389 0390 0406 0411
0497 0510 0531 0535
DISEASES AND PATHOGENS
0084 0104 0106 0116 0241 0291 0292
0293 0477 0481 0490 0499 0502 0536
INJURIOUS INSECTS
0329 0331 0524
MINERALS AND NUTRIENTS
0052 0212 0219 0258 0337 0374 0429
0438

LEGUME CROPS
0456 0533 0568 0574

LEPIDOPTERA
0130 0132 0513 0516 0519 0521
INSECT CONTROL
0135

LIGHT
0006 0008 0020 0032 0134 0215 0234
0256 0321
GROWTH
0272 0386 0388 0535
PHOTOPERIOD
0144

LODGING
0454 0474

MACROPHOMINA PHASEOLI
0098 0109
DISEASE CONTROL
0082 0297 0487

MAGNESIUM
0394
PLANT ASSIMILATION
0250 0258 0393

MANGANESE
0055 0056 0391 0393 0394 0403 0426
0565

MANURES
0045 0049 0072 0372 0428 0458 0567

MATURATION
0058 0066 0076 0234 0263 0344 0539
0540 0580

MECHANICAL DAMAGE
0064 0274 0335

MELOIDOGYNE INCOGNITA
0319 0508
CHEMICAL CONTROL
0525
HOST\PLANT RESISTANCE
0118 0119 0120 0320 0475 0509 0545

METABOLISM
0059 0239 0410 0415 0494

METHIONINE
0184 0248 0560

MEXICO
0069 0100 0141 0151 0176 0177 0178
0189 0203 0242 0257 0262 0270 0280
0310 0409 0416 0419 0436 0452 0458
0462 0463 0467 0533 0544 0549 0570
0573

MICRONUTRIENTS
0006 0015 0040 0052 0217 0220 0246
0358 0394 0434 0552

MINERAL CONTENT
0017 0023 0040 0047 0052 0056 0171
0212 0219 0220 0221 0258 0358 0361
0362 0374 0394 0395 0429 0435 0438
0561 0564 0570

MINERAL DEFICIENCIES
0048 0056 0212 0251 0387 0392 0393
0394 0396 0397 0398 0399 0401 0402
0426 0530 0543

MINERALS AND NUTRIENTS
0232
ALUMINIUM
0013 0055 0056 0250 0391 0393 0394
0426 0565
BORON
0394
CALCIUM
0210 0250 0258 0393 0394
COPPER
0433
IRON
0052 0217 0394 0399 0401 0402
MAGNESIUM
0250 0258 0393 0394
MANGANESE
0055 0056 0391 0393 0394 0403 0426
0565
MOLYBDENUM
0434
NITROGEN
0053 0190 0191 0195 0219 0221 0248
0250 0252 0258 0358 0361 0362 0363
0372 0374 0393 0394 0395 0400 0402
0422 0425 0429 0430 0433 0438 0450
0465 0563 0564 0570 0571
OXIGEN
0110 0363
PHOSPHORUS
0013 0057 0219 0221 0250 0252 0258
0358 0372 0374 0393 0394 0395 0396
0397 0398 0422 0426 0428 0429 0430
0433 0434
POTASIUM
0212 0219 0250 0258 0358 0372 0367
0392 0393 0394 0395 0422 0429 0435
SULFUR
0393 0394 0429 0438
ZINC
0217 0396 0398 0399 0429

MITOCHONDRIA
0035 0240

MOLYBDENUM
0434

MORPHOGENESIS
0024 0139 0209 0226 0566

MULCHING
0058 0515

MUTATION
0159 0265 0343 0529 0531

MYCOSES
0063 0075 0081 0082 0083 0093 0096
0099 0103 0105 0107 0141 0147 0150

0152 0154 0237 0244 0267 0277 0282
0287 0297 0298 0302 0303 0305 0307
0311 0339 0342 0346 0367 0417 0471
0472 0475 0482 0483 0484 0485 0487
0488 0489 0492 0494 0495 0496 0532
0537 0548 0550
EPIDEMIOLOGY
0306 0493
INOCULATION
0104 0106 0109 0111 0241 0299 0301
0306 0310 0312 0347 0375 0496 0490
0499
ISOLATION
0498 0499
LEAVES
0104 0106 0241 0490 0499
SEED
0094 0375
SEEDLINGS
0097 0110 0241 0300 0301
ROOTS
0049 0098 0101 0108 0110 0185 0304
0486
TEMPERATURE
0100 0102 0108 0247 0486

MYZUS PERSICAE
0130

NEMATODES
0118 0119 0120 0319 0320 0475 0505
0506 0507 0508 0509 0545

NICARAGUA
0317

NITROGEN
0360 0362 0372 0395 0450 0564 0567
FERTILIZERS
0043 0053 0070 0190 0195 0221 0245
0248 0252 0256 0262 0357 0359 0361
0363 0374 0393 0422 0425 0429 0430
0438 0465 0563 0570 0571
MINERAL DEFICIENCIES
0393 0394 0402
NUTRIENT ABSORPTION
0011 0014 0219 0221 0250 0258 0361
0393 0400 0402 0431
PLANT ASSIMILATION
0011 0014 0191 0219 0221 0250 0258
0361 0393 0430 0429 0433 0569
PROTEIN CONTENT
0248 0258 0425

NITROGEN FIXATION
0185 0186 0188 0189 0190 0191 0217
0281 0355 0356 0357 0359 0360 0361
0362 0564 0570 0571

NITROGEN-FIXING BACTERIA
0154 0190 0191 0356 0357 0362 0563
0564 0566

NODULATION
0185 0186 0188 0355 0356 0357 0362
0566 0567 0568 0569

HERBICIDES
0443 0450
MINERALS AND NUTRIENTS
0055 0217 0565
NITROGEN
0053 0191 0358 0361 0362 0363
0450 0563 0570 0571
PHOSPHORUS
0358

NORTH AMERICA
0049 0096 0119 0126 0135 0171 0185
0201 0204 0242 0257 0303 0304 0335
0353 0359 0384 0388 0396 0398 0399
0409 0419 0423 0436 0441 0448 0452
0458 0462 0463 0474 0494 0506 0507
0508 0509 0512 0513 0516 0523 0539
0540 0542 0543 0544 0545 0548 0549
0551 0558 0567 0568 0570 0573

NOXIOUS ANIMALS
0118 0119 0120 0123 0124 0125 0126
0127 0128 0129 0130 0131 0132 0133
0134 0135 0136 0137 0138 0199 0243
0244 0267 0275 0313 0319 0320 0324
0325 0326 0327 0328 0329 0330 0331
0332 0333 0334 0338 0342 0378 0379
0385 0417 0418 0465 0505 0507 0512
0513 0514 0515 0516 0517 0518 0519
0520 0521 0522 0523 0524 0525 0526
0527 0529 0545 0574 0582

NUCLEIC ACID
0020 0227 0294 0295 0500
RNA
0038 0115 0390

NUTRIENT ABSORPTION
0011 0013 0014 0017 0052 0059 0210
0219 0221 0250 0251 0258 0361 0393
0396 0398 0399 0400 0402 0403 0428
0433 0435 0530

NUTRIENT LOSSES
0381 0431

NUTRIENT SOLUTION
0006 0012 0014 0017 0212 0213 0217
0219 0220 0230 0360 0362 0387 0391
0394 0395 0397 0398 0399 0400 0401
0402 0435

NUTRIENT TRANSPORT
0009 0012 0218 0398

NUTRITIONAL REQUIREMENTS
0014 0015 0043 0045 0049 0053 0055
0057 0058 0187 0195 0196 0221 0232
0243 0244 0245 0246 0248 0250 0251
0252 0266 0356 0358 0361 0363 0372
0374 0393 0395 0422 0423 0425 0428
0429 0430 0434 0438 0458 0465 0530
0563 0567 0570 0571

NUTRITIVE VALUE
0161 0163 0167 0168 0169 0171 0176
0184 0243 0353 0431 0554 0559 0560
0561

OSMOTIC POTENTIAL
0016 0054 0387

OSMOTIC PRESSURE
0387

OZONE
AIR POLLUTION
0321
PLANT INJURIES
0323

PENICILLIUM SP
0375

PERU
0269 0374 0528

PH
0013 0017 0100 0169 0176 0251 0381
0428 0433 0565
AGRICULTURAL LIME
0055 0196 0250 0426 0568

PHASEOLLINS
0478
ANALYSIS
0235 0239 0413 0494

PHASEOLUS ACUTIFOLIUS
0086 0091 0201 0285 0336 0383 0480
0529

PHASEOLUS COCCINEUS
0143 0158 0178 0189 0201 0308 0310
0336 0347 0378 0383 0529

PHASEOLUS LUNATUS
0139 0169 0201 0310 0336 0337 0339
0345 0383 0529

PHENOLIC CONTENT
0168 0376 0413

PHENOLOGY
0203 0208

PHOSPHORUS
0015 0043 0057 0058 0070 0246 0252
0262 0358 0372 0374 0395 0422 0430
0434
MINERAL DEFICIENCIES
0048 0393 0394 0396 0397 0398 0426
0530
NUTRIENT ABSORPTION
0013 0014 0219 0221 0250 0258 0393
0396 0398 0428 0433 0530
PLANT ASSIMILATION
0013 0014 0219 0221 0250 0258 0393
0396 0398 0428 0429 0433 0530

TRANSLOCATION
0398

PHOTOPERIOD
0028 0031 0144 0439

PHOTOSYNTHESIS
0006 0008 0032 0047 0211 0215 0216
0218 0256 0321 0390 0392 0397 0511

PHYTOALEXINS
0005 0083 0097 0104 0239 0300 0301
0307 0307 0413 0478 0484 0494

PHYTOHEMAGGLUTININS
0164 0354 0414 0555 0557

PLANT ANATOMY
0002 0003 0006 0007 0009 0012 0016
0018 0025 0027 0028 0029 0040 0042
0051 0062 0063 0073 0075 0084 0101
0104 0106 0115 0120 0139 0141 0143
0188 0190 0203 0204 0205 0206 0208
0209 0218 0219 0221 0222 0226 0228
0229 0230 0242 0249 0257 0258 0261
0299 0300 0304 0323 0335 0337 0343
0344 0352 0362 0381 0384 0385 0404
0409 0429 0447 0450 0467 0511 0530

PLANT ASSIMILATION
0010 0011 0012 0013 0014 0032 0052
0059 0191 0200 0219 0220 0221 0232
0250 0251 0258 0276 0331 0361 0393
0396 0398 0399 0400 0428 0429 0433
0435 0530 0569

PLANT BREEDING
0002 0077 0080 0140 0146 0147 0148
0159 0268 0282 0283 0287 0290 0291
0296 0303 0339 0342 0344 0353 0365
0416 0475 0534
BACKCROSSING
0139 0141 0143 0144 0308 0336 0466
0530 0531
HYBRIDIZING
0141 0143 0156 0158 0320 0336 0337
0343 0345 0347 0529 0536
SELECTION
0141 0144 0154 0158 0193 0281 0318
0320 0335 0337 0340 0345 0346 0349
0350 0351 0532 0536

PLANT DEVELOPMENT
0003 0004 0016 0017 0021 0023 0025
0026 0028 0029 0031 0034 0046 0047
0059 0061 0063 0068 0073 0120 0121
0196 0203 0205 0209 0212 0213 0222
0223 0224 0225 0226 0228 0229 0232
0236 0248 0250 0256 0258 0269 0276
0276 0319 0327 0359 0360 0362 0385
0386 0388 0392 0394 0397 0402 0404
0405 0406 0427 0435 0447 0450 0486
0487 0490 0526 0535 0567

PLANT GEOGRAPHY
0201 0202 0204 0383 0439 0529 0533

PLANT\GROWTH SUBSTANCES
0009 0018 0023 0028 0029 0034 0036
0038 0041 0051 0159 0206 0209 0213
0223 0225 0226 0227 0229 0231 0240
0241 0249 0352 0404 0405 0407 0408
0410 0411

PLANT HABIT
0001 0023 0063 0144 0145 0153 0203
0204 0208 0242 0257 0281 0359 0384
0397 0409 0424 0432 0435 0440 0459
0461 0467 0473 0532 0540 0545 0578

PLANT INJURIES
0005 0009 0017 0099 0101 0103 0112
0132 0150 0241 0274 0275 0296 0299
0313 0322 0327 0329 0330 0333 0378
0379 0477 0487 0506 0516 0517 0521
AIR POLLUTION
0331 0381 0510 0511
HERBICIDES
0059 0062 0261 0445
TEMPERATURE
0134 0323
WATER REQUIREMENTS
0249 0381

PLANT NUTRITION
0006 0012 0015 0016 0220 0221 0250
0373 0387 0392 0394 0395 0396 0425
0502

PLANT PHYSIOLOGICAL DISORDERS
0017 0040 0056 0121 0237 0276 0321
0322 0335 0410 0510 0511

PLANT PHYSIOLOGICAL PROCESSES
0015 0019 0041 0231 0234 0237 0238
0239 0240 0300 0387 0410 0415
ABSCISSION
0007 0018 0020 0027 0030 0385
NUTRIENT TRANSPORT
0009 0012 0218 0398
PHOTOSYNTHESIS
0006 0008 0032 0047 0211 0215 0216
0218 0321 0390 0392 0397 0511
PLANT ASSIMILATION
0010 0011 0012 0013 0014 0032 0052
0059 0191 0200 0219 0220 0221 0250
0258 0276 0393 0398 0399 0400 0435
0569
PLANT RESPIRATION
0059 0210

PLANT PIGMENTS
0008 0018 0047 0205 0215 0234 0348
0388 0411

PLANT REPRODUCTION
0343 0544

0014 0219 0250 0258 0393 0435
PLANT ASSIMILATION
0014 0219 0250 0258 0393 0429 0435

PRICES
0252 0271 0370 0575

PRODUCTION
0193 0194 0262 0365 0366 0367 0368
0370 0416 0417 0572 0573 0574 0575

PLANT RESPIRATION
0037 0059 0210 0224

PLANT TISSUES
0005 0006 0051 0059 0084 0104 0106
0115 0209 0210 0222 0226 0227 0261
0293 0299 0322 0352 0429
ENZYMES
0026 0037 0237 0240 0300

PLANT TOXINS
0165 0555

PLANT VASCULAR SYSTEM
0009 0012 0040 0218 0511

PLANTING
0043 0044 0046 0050 0078 0195 0196
0262 0263 0266 0280 0325 0366 0418
0446 0459 0471
AGRICULTURAL EQUIPMENT
0079 0244
SPACING
0069 0071 0072 0259 0260 0264 0342
0448 0453 0460 0474
PRODUCTIVITY
0071 0247 0269

PODDING
0027 0042 0046 0050 0272

PODS
0027 0028 0042 0054 0065 0068 0073
0139 0204 0207 0242 0327 0344 0385
0423 0424 0431 0467 0473
DISEASES AND PATHOGENS
0292 0477 0536
INJURIOUS INSECTS
0328 0516 0521

POLLEN
0139 0157 0158 0352

POLLINATION
0544

POLYPLOIDY
0352 0529

POTASSIUM
0043 0358 0372 0395 0422
MINERAL DEFICIENCIES
0212 0387 0392 0393 0394
NUTRIENT ABSORPTION

PRODUCTIVITY
0045 0070 0071 0140 0145 0192 0194
0247 0252 0268 0269 0270 0271 0275
0282 0368 0422 0457 0458 0574 0577

PROTEIN CONTENT
0018 0026 0055 0167 0171 0184 0212
0225 0258 0353 0411 0414 0538 0558
0560
SEED
0160 0169 0172 0178 0181 0235 0236
0238 0248 0354 0418 0425

PROTEINS
0025 0116 0164 0176 0227 0390 0553
0559
AMINO ACIDS
0238 0354
ANALYSIS
0026 0041 0157 0173 0231 0233 0235
0238 0239 0354 0479 0500
DIGESTIBILITY
0173

PSEUDOMONAS PHASEOLICOLA
0286 0481
DISEASE CONTROL
0267 0277
HOST\PLANT RESISTANCE
0085 0086 0088 0092 0141 0152 0291
0296 0475 0479 0542

PSEUDOMONAS SYRINGAE
0292 0294 0295
HOST\PLANT RESISTANCE
0293 0475 0551

PYTHIUM APHANIDERMATUM
0098

PYTHIUM ULTIMUM
0486

RADIATION
0097 0439

RAINFALL DATA
0050 0134

RESEARCH
0006 0007 0051 0102 0115 0136 0140
0145 0150 0151 0154 0185 0193 0209
0219 0232 0255 0257 0289 0324 0329
0332 0335 0341 0342 0346 0356 0365
0373 0377 0379 0380 0394 0395 0396
0398 0414 0416 0418 0426 0436 0437
0448 0451 0460 0479 0488 0493 0527
0536 0544 0546 0548 0552 0570 0571
0574

RHIZOBIUM
0185 0186 0188 0190 0191 0217 0281
0359 0360 0563 0564 0567 0568 0571
INOCULATION
0187 0189 0355 0356 0565 0566 0569
0570
STRAINS
0357 0358 0363 0450 0562 0565 0566
0570

RHIZOBIUM LEGUMINOSARUM
NODULATION
0562

RHIZOBIUM PHASEOLI
0185 0186 0187 0189 0191 0217 0281
0355 0356 0357 0359 0363 0443 0450
0562 0563 0565 0566 0570

RHIZOCTONIA SOLANI
0096 0103 0241 0299 0319 0496
DISEASE CONTROL
0082
CHEMICAL CONTROL
0483
HOST\PLANT RESISTANCE
0150 0301 0475 0537

RHIZOSPHERE
0221 0433 0491

RNA
0033 0038 0116 0390 0503

ROOTING
0062 0222 0407 0447 0530

ROOTS
0016 0023 0026 0029 0047 0049 0062
0098 0101 0108 0110 0115 0185 0188
0190 0191 0209 0219 0221 0222 0304
0360 0362 0363 0391 0409 0415 0447
0450 0475 0486 0530 0563

ROTS
0096 0101 0103 0108 0110 0297 0304
0475 0486

SALINITY
0251
GROWTH
0016 0047 0435
PLANT DEVELOPMENT
0016 0047 0435

SCLEROTIUM ROLFSII
HOST\PLANT RESISTANCE
0150

SEED
0157 0175 0177 0182 0233 0239 0348
0355 0554 0557
AMINO ACIDS
0160 0181 0236 0238 0248 0354 0425
DISEASES AND PATHOGENS
0094 0273 0313 0318 0375
GENETICS
0146 0466
GERMINATION
0094 0214 0238 0273 0274 0275 0276

0313 0406 0466
INJURIOUS INSECTS
0128 0275 0313 0418
PROTEIN CONTENT
0160 0169 0172 0178 0181 0235 0236
0238 0248 0354 0418 0425
STORAGE
0163 0183 0198 0273 0275 0375 0376
0466 0580 0581
YIELDS
0073 0074 0153 0248 0273 0281 0349
0418 0429

SEED CHARACTERS
0074 0078 0079 0112 0153 0178 0183
0201 0202 0204 0263 0273 0276 0279
0281 0412 0432 0466 0496 0538
SEED COLOR
0126 0146 0160 0181 0208 0349 0376
0413 0469 0474

SEED COAT
0094 0181 0214 0378
ANALYSIS
0115 0413
INHERITANCE
0146 0335 0466

SEED COLOR
0094 0126 0146 0160 0181 0208 0348
0349 0376 0413 0469 0474

SEED PRODUCTION
0015 0024 0042 0058 0073 0076 0077
0112 0192 0193 0246 0257 0273 0277
0278 0279 0340 0343 0360 0361 0365
0366 0373 0436 0469 0474

SEED TRANSMISSION
0107 0109 0115 0277 0284 0305 0310
0318 0480 0501

SEED TREATMENT
0094 0159 0184 0186 0199 0305 0405
0418

SEEDS
0019 0025 0026 0027 0034 0036 0075
0078 0094 0109 0115 0124 0165 0179
0180 0184 0190 0197 0199 0204 0205
0207 0208 0242 0258 0274 0275 0276
0278 0279 0284 0296 0298 0313 0328
0335 0340 0341 0344 0353 0376 0378
0379 0382 0409 0413 0424 0467 0477
0480 0481 0496 0516 0517 0531 0538
0552 0579

SELECTION
0014 0085 0142 0152 0251 0280 0338
0341 0418 0426 0470 0471 0472 0475
PLANT BREEDING
0141 0144 0154 0158 0193 0281 0318
0320 0335 0337 0340 0345 0346 0349
0350 0351 0522 0536

SELFING
0393 0394 0429 0438

SHOOTS
0427 0433

SOIL ANALYSIS
0048 0049 0052 0057 0071 0243 0248
0250 0393 0428

SOIL CONSERVATION PRACTICES
0441 0446

SOIL FERTILITY
0048 0049 0052 0060 0101 0185 0243
0246 0250 0251 0373 0373 0373

SOIL IMPOVERISHMENT
0057 0246 0251

SOIL POPULATION
0093 0107 0110 0186 0296 0297 0483
0486 0507

SOIL REACTIONS
0393 0426

SOIL REQUIREMENTS
0015 0052 0108 0244 0246 0250 0251
0361 0393 0426 0428 0441 0446 0475
0563

SOIL TEMPERATURE
0108 0118

SOIL WATER
0195 0232 0249 0254 0420 0421 0424

SOILS
0048 0052 0055 0057 0077 0078 0115
0196 0243 0246 0248 0250 0259 0356
0358 0372 0428 0430 0491 0563 0565
0568

SOLAR RADIATION
0436

SPACING
0058 0072 0409 0431 0444 0474
PRODUCTIVITY
0070 0071 0192 0268 0271 0457 0458
YIELDS
0063 0069 0071 0099 0242 0255 0257
0259 0260 0264 0268 0342 0423 0424
0440 0448 0453 0454 0456 0457 0460
0461 0464 0465

STARCH CONTENT
0028 0178 0412

STATISTICAL ANALYSIS
0014 0022 0024 0031 0046 0050 0051
0078 0095 0096 0099 0103 0122 0146
0151 0197 0207 0221 0248 0262 0263
0264 0274 0275 0280 0283 0284 0290

0292 0306 0329 0332 0335 0344 0349
0350 0362 0368 0378 0391 0422 0426
0428 0454 0457 0458 0459 0490 0530
0532 0534 0575 0578 0582

STEMS
0207 0218 0242 0389 0409 0521
GROWTH
0004 0016 0021 0022 0023 0047 0206
0360 0404
MINERALS AND NUTRIENTS
0190 0219 0362 0563
TRANSLOCATION
0012

STOMATA
0006 0047 0230 0321 0322 0323

STORAGE
0077 0163 0179 0180 0192 0198 0266
0279 0366 0377 0466 0579 0580
DISEASES AND PATHOGENS
0043 0244 0273 0277 0365 0375
INJURIOUS INSECTS
0129 0244 0275
TEMPERATURE
0183 0197 0376 0581

STORED GRAIN PESTS
0124 0128 0129 0136 0199 0243 0378
0379 0417 0582

SUGARS
0009 0020 0040 0177 0218 0389

SULFUR
0393 0394 0429 0438

SYMBIOSIS
0281 0359 0360 0564
NODULATION
0186 0356 0357 0443 0562 0566 0567
0568 0569
MINERALS AND NUTRIENTS
0053 0055 0191 0217 0358 0363
0450 0563 0565 0570
PHOSPHORUS
0358

SYMPTOMATOLOGY
0043 0056 0082 0084 0085 0086 0087
0089 0100 0105 0117 0143 0150 0212
0261 0291 0292 0293 0298 0314 0316
0317 0322 0327 0501 0502 0526

TAXONOMY
0002 0157 0201 0204 0326 0336 0529

TECHNOLOGY
0365 0369 0370 0371 0419 0452

TECHNOLOGICAL PACKAGE
0419 0452

TEMPERATURE
0031 0095 0100 0102 0108 0169 0183
0197 0289 0376 0554 0581
GROWTH
0203 0206 0359 0486 0535
PHOTOSYNTHESIS
0211
PLANT INJURIES
0134 0323
PRODUCTIVITY
0247
YIELDS
0044 0046 0134 0206 0439

TETRANYCHUS TELARIUS
0332

THIELAVIOPSIS BASICOLA
0098

TIMING
0004 0031 0042 0044 0046 0050 0060
0071 0074 0076 0096 0102 0107 0124
0131 0133 0136 0143 0148 0166 0183
0185 0195 0196 0205 0208 0214 0245
0247 0248 0255 0263 0268 0269 0289
0325 0342 0366 0367 0376 0377 0418
0420 0428 0429 0442 0443 0444 0453
0459 0460 0471 0483 0487 0507 0514
0521 0523 0554 0555 0581

TISSUE CULTURE
0026 0415

TOBACCO MOSAIC VIRUS
0502

TOXICITY
0040 0160 0164 0176 0181 0220 0354
0414 0478 0484 0553 0557
HERBICIDES
0060 0410
MINERALS AND NUTRIENTS
0362 0391 0426

TRACERS
0040 0059 0200 0217 0218 0239 0374
0564

TRADE
0278 0371 0575 0577

TRANSLOCATION
0012 0040 0200 0398 0511

TRANSPIRATION
0051

UROMYCES PHASEOLI
0306 0493 0498
DISEASE CONTROL
0082 0267 0495
CHEMICAL CONTROL
0081

ELECTRON MICROSCOPY
0106
ETIOLOGY
0082 0095
HOST\PLANT RESISTANCE
0104 0106 0141 0152 0311 0312 0432
0469 0471 0472 0475 0488 0490 0495
0532 0548 0550

HOSTS AND PATHOGENS
0104 0497

USA
0049 0096 0119 0126 0135 0170 0171
0174 0185 0201 0204 0272 0304 0335
0353 0384 0388 0396 0398 0399 0423
0424 0441 0448 0474 0483 0494 0506
0507 0508 0509 0512 0513 0516 0523
0537 0539 0540 0542 0543 0545 0548
0551 0558 0567 0568

VECTORS
0313

VICIA FABA
0383

VIROSES
0043 0080 0082 0112 0113 0114 0115
0116 0117 0138 0141 0244 0277 0287
0313 0314 0315 0316 0317 0318 0339
0342 0367 0417 0432 0471 0475 0499
0500 0501 0502 0504 0524 0539 0540
0541

VITAMIN CONTENT
0171 0431 0561

WATER ABSORPTION
0554

WATER CONTENT
0023 0073 0183 0213 0276 0376 0377
0387 0431 0466 0579 0580 0581

WATER REQUIREMENTS
0050 0051 0054 0102 0195 0247 0249
0253 0254 0276 0381 0416 0418 0420
0421 0423 0424 0427 0431 0568

WATER STRESS
0018 0023 0051 0386 0431

WEEDING
0049 0060 0061 0064 0066 0067 0256
0258 0261 0280 0342 0417 0418 0441
0442 0444 0445 0446 0449 0462

WEEDS
0121 0131 0444 0463
HERBICIDES
0061 0064 0066 0067 0256 0441

WHETZELINIA SCLEROTIORUM
0308 0347
DISEASE CONTROL
0267
CHEMICAL CONTROL
0303 0310
SEED TRANSMISSION
0310

XANTHOMONAS PHASEOLI
0084 0090 0288 0477
DISEASE CONTROL
0082 0087 0267 0277
HOST\PLANT RESISTANCE
0086 0091 0148 0155 0287 0289 0290
0296 0471 0472 0480 0536 0546
PLANT BREEDING
0148 0287 0290 0296 0536
SEED TRANSMISSION
0277 0284 0480

XANTHOMONAS PHASEOLI VAR FUSCANS
0084 0090 0285 0290
DISEASE CONTROL
0089

YIELD COMPONENTS
0024 0027 0058 0063 0073 0074 0153
0196 0204 0206 0207 0242 0257 0273
0280 0436 0440 0455 0457 0461 0467
0471

ZABROTES SUBFASCIATUS
0127 0129 0137 0328 0379 0582

ZEA MAYS
0036 0057 0069 0181 0346 0371 0575
INTERCROPPING
0070 0071 0072 0145 0266 0267 0268
0270 0271 0272 0281 0324 0416 0453
0454 0455 0456 0457 0458 0459 0460
0461 0462 0464 0573

ZINC
0006 0217 0396 0398 0399 0429

DOCUMENTATION SERVICES

[redacted]

Susan C. Harris, *MLS, Information Specialist, Library and Documentation Services Unit, Head*
Fabiola Amariles, *BA, Documentalist, Production Supervisor*
Marlene Cárdenas, *Bibliographer*
Manuelita de Chacón, *Typesetting*
Rommel Durán, *Layout*
Carlos P. González, *Ing. Agr., Documentalist-Beans*
Francy González, *Ing. Agr., Documentalist-Cassava*
Jorge López, *Bibliographic Services (Supervisor)*
Mariano Mejía, *BA, Documentalist-Tropical Pastures*
Lynn Menéndez, *Editing and Translation*
Keyttel de Prieto, *Information input*
Gladys de Ramos, *Proofreader*
Guillermo Solís, *Layout*

BEAN PROGRAM

[redacted]

Aart van Schoonhoven, *PhD, Coordinator*
Stephen Beebe, *PhD, Central America Bean Project*
* César Cardona, *PhD, Entomology (Visiting Scientist)*
Marcial Pastor Corrales, *PhD, Plant Pathology*
Jeremy H. C. Davis, *PhD, Agronomy*
* Ramiro de la Cruz, *PhD, Physiology (Visiting Scientist)*
Michael Dessert, *PhD, Plant Breeding (Postdoctoral Fellow)*
Guillermo E. Gálvez, *PhD, Coordinator, Central America Bean Project*
Peter H. Graham, *PhD, Microbiology*
Francisco Morales, *PhD, Virology*
James Nienhuis, *PhD, Plant Breeding (Postdoctoral Fellow)*
Silvio H. Orozco, *MS, Central America Bean Project*
Douglas Pachico, *PhD, Economics*
Federico Scheuch, *MS, Peru CIAT Bean Project*
Shree P. Singh, *PhD, Plant Breeding*
Steven R. Temple, *PhD, Plant Breeding (on sabbatical leave)*
Michael D. Thung, *PhD, Agronomy — stationed at CNPAF, Goiania, Brazil*
Oswaldo Voysest, *PhD, Agronomy*
Jonathan Woolley, *PhD, Cropping Systems Agronomy*

---

* Left during this period.