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Vol. VI

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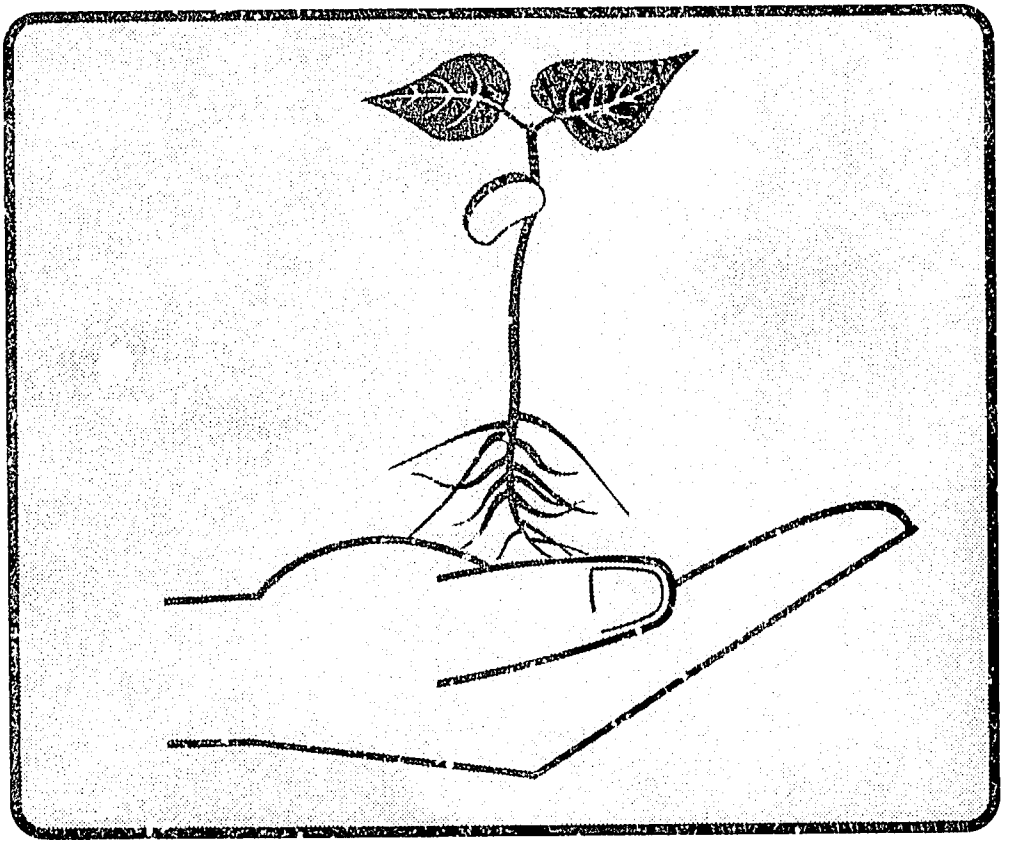
Abstracts on Field Beans

(*Phaseolus vulgaris* L.)

Volume VI



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Abstracts on Field Beans

(*Phaseolus vulgaris* L.)

VOLUME VI

CIAT CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

FOREWORD

CIAT's Documentation Center covers the following areas: **cassava** (*Manihot esculenta*), **beans** (*Phaseolus vulgaris*) grown under tropical conditions, **tropical pastures**, and **agricultural economics** within the Latin American context.

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It is our hope that services provided by CIAT's Documentation Center will be a major supporting pillar for research aimed at ameliorating the problem of food production for the world.

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CONTENTS

	A GUIDE FOR USERS	ix
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY	3
C00	PLANT PHYSIOLOGY	10
C01	Plant Nutrition	21
C02	Plant Development	35
C03	Chemical Composition, Methodology and Analyses	48
D00	AGRONOMY	55
D01	Soil Water, Climate and Fertilization	60
D02	Cultivation Practices: Planting, Weed Control and Harvesting	80
D03	Cultivation Systems: Intercropping, Rotational Crops	93
D04	Seed Production	101
D05	Varietal Trials	105
E00	PLANT PATHOLOGY	115
E01	General Descriptive Studies	117
E02	Bacterioses	119
E03	Mycoses	127
E04	Viroses	150
E05	Nematodes	159
E06	Physiological Disorders	162
E07	Mycoplasmoses	163

F00 PEST CONTROL AND ENTOMOLOGY 164

F01 Injurious Insects, Mites and their Control 172

G00 GENETICS AND PLANT BREEDING 177

G01 Breeding, Selection and Germplasm 188
G02 Cytogenetics 198
G03 Polyploidy 200

H00 NUTRITION 201

H01 Foods and Nutritive Value 208

I00 MICROBIOLOGY 224

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation 225

J00 ECONOMICS AND DEVELOPMENT 231

K00 FIELD PLOT TECHNIQUE 244

L00 GRAIN STORAGE 246

L01 Stored Grain Pests 248

Z00 GENERAL 250

AUTHOR INDEX 254

SUBJECT INDEX

LIST OF ABBREVIATIONS

A GUIDE FOR USERS

Components of a reference

Sequential number in this volume

0001

1 — 12669 BAUDET, J.C. Recherches sur la classification generique des Papilionaceae- 3

2 — Phaseoleae. *(Research on the generic classification of Papilionaceae-Phaseoleae).* 4

5 — These. Ph.D. Paris, France, Université Pierre et Marie Curie, 1977. 213p. Fr., Sum.
Fr., 168 Refs., Illus.
6 7

8 — *Phaseolus vulgaris.* Taxonomy. Plant anatomy. Zaire.

9 — The pantropical tribe Phaseoleae (91 genus and approx 1500 spp) was subdivided into 6 subtribes on an organographic basis. A critical study of the non-organographic postulates at a generic level including new observations on certain areas (chorology, palynology, dermology, blastography and flavone chemistry) has permitted a "choro-ecological" hypothesis to be formed that divides Phaseoleae into Glycininae, a forestal-type subtribe and Phaseolinae and Cajaninae, 2 more advanced savanna-type subtribes. The taxonomic importance of the different non-organographic characteristics is established and a group sub-division of the 3 existing subtribes is proposed. *(Author's summary. Trans. by L.M.F.)*
10

A00
11

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

Use of indexes

The author and subject indexes at the end of this volume 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.

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* Special acknowledgments to Ing. María del Rosario Henao, Systems Analyst.

Author index

Here you will find the complete list in alphabetical order of the authors of the documents summarized in this volume. 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 volume.

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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:

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A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0001

3839 GENTRY, H.S. **The ancestor of the common bean and its potential as a breeding resource.** *In* Dry Bean Research Conference, 9th., Fort Collins, Colorado, 1968. Report. Washington, D.C., U.S. Department of Agriculture. Agriculture Research Service, 1969. pp.73-78. Engl., 6 Refs.

Phaseolus vulgaris. **Plant geography. Plant anatomy. Plant breeding. Cultivars. Genetics. Mycoses. Host-plant resistance.**

The antecedents and genetic possibilities of wild beans are examined for their use as breeding resource for bean crops. Morphological and climatic characteristics are described as well as genetic evidence (no. of chromosomes) linking wild forms with cultivated var., and their agricultural and historical evolution. *(Summary by I.B. Trans. by L.M.F.)* A00

0002

14720 DAVILA H., R.F. Catálogo de variedades de fríjol común *(Phaseolus vulgaris* L.). *(Catalogue of common bean varieties).* Managua, Instituto Nicaraguense de Tecnología Agropecuaria, 1977. 8p. Span.

Phaseolus vulgaris. **.Cultivars. Identification. Agronomic characters. Climatic requirements. Nicaragua.**

Some agronomic characteristics of 20 common bean var. in Nicaragua are described: plant growth habit, duration of growth cycle, flower color, seed characteristics, and climatic zones of adaptation. *(Summary by C.P.G. Trans. by L.M.F.)* A00 D00

0003

15402 FREYTAG, G.F. **Variation of the common bean (*Phaseolus vulgaris* L.) in Central America.** Ph.D. Thesis. Saint Louis, Missouri, Washington University, 1955. 131p. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Taxonomy. Plant geography. Climatic requirements. Ecology.** *Phaseolus coccineus. Phaseolus lunatus.* **Plant antomy. Central America.**

Studies were conducted during 2 yr at the Escuela Agrícola Panamericana in El Zamorano, Honduras, regarding bean cultivation practices. Specimens of approx. 125 bean collections of Mexico, Central and South America, were collected and perserved in a herbarium to later be subjected to a series of measurements and graphic presentations according to the Anderson method. Important aspects are given on: the history and the evolution of the taxonomic classification of *Phaseolus vulgaris* and its relation with *P. lunatus* and *P. coccineus;* climatic factors and crop distribution in the geographical area under study; and cultural practices with pure stands and crops in association. A method of selection was used, based on the principal components of each var., cultivated in the rainy and dry seasons. Morphological differences among the species *P. vulgaris, P. lunatus,* and *P. coccineus* are described and the methods of measurement and association of seed, pod, leaf, and flower characteristics are given. A description is also included on the types of extreme character complexes (*P.*

vulgaris and Tropical Black Bean), according to the analysis by scatter diagrams. Intermediate complexes (Honduras Red Bean and Black seeded bean) are obtained from the recombinations of the characteristics. In addition to the 2 sources of variation due to the extreme complexes, there is a 3rd source, the Mongrel-*Coccineus* complex. The determination of these extreme types and the centers of complexes, and their recombination pattern are of great value in the identification and description of bean material used in research. *(Summary by C.P.G. Trans. by L.M.F.)* A00 B00

0004

11188 COERTZE, A.F. **Introductory aspects on the production of green beans.** Farming in South Africa. Series: The cultivation of vegetables in South Africa. Green Beans and Green Peas no. A.1/1977. 3p. Engl., Illus.

Phaseolus vulgaris. **Taxonomy. Production. Yields. Consumption. South Africa.**

Brief information is given on the taxonomic position, plant characteristics regarding consumption, economic importance, and production areas of green beans in S. Africa. Between 1970-73 production was estimated at 27,300 t and for 1975, 9000 t were processed from a total production of 37,000 t. Transvaal and Cape Province, that have green bean processing industries, are the highest producing states; other states of minor importance are Orange Free State and Natal, whose production is for the domestic market. *(Summary by C.P.G. Trans. by L.M.F.)* A00 J00

0005

14338 BLACK, V.J. and UNSWORTH, M.H. **Stomatal responses to sulphur dioxide and vapour pressure deficit.** Journal of Experimental Botany 31(121): 667-677. 1980. Engl., Sum. Engl., 35 Refs., Illus.

Phaseolus vulgaris. **Stomata. Leaves. Air pollution. Vapour pressure deficit. Growth-chamber experiments. Plant physiological disorders. Light.**

Stomatal conductances (g_s) of plants of *Vicia faba, Raphanus sativus, Phaseolus vulgaris, Helianthus annuus,* and *Nicotiana tabacum* were measured in chambers containing either clean air or air containing between 18 and 1000 parts 10^9 SO_2 at water vapour pressure deficits (vpd) ranging from 1.0 to 1.8 kPa. When vpd was low (< 1.3 kPa at 22°C) and stomata were open, exposure to SO_2 induced rapid and irreversible increases in g_s in *V. faba.* This response persisted throughout the exposure (3 days). The increase in g_s, 20-30% compared with clean air, was independent of SO_2 concn. up to 350 parts 10^9. Stomatal conductances of polluted plants at night were greater than controls. When stomata were closed before exposure to SO_2, there was no effect on g_s. When vpd was varied, g_s of unpolluted plants of *P. vulgaris* showed no response, but that of *R. sativus* increased slightly with increasing vpd. In both species exposure to SO_2 caused an increase in g_s at all vpd values. g_s of unpolluted plants of *V. faba, H. annuus,* and *N. tabacum* decreased with increasing vpd. At low vpd values exposure to SO_2 in these species caused an increase in g_s, but, above a certain value of vpd, depending on species, g_s decreased with exposure to SO_2. It is postulated that SO_2, once in the substomatal cavity, enters the stomatal complex via adjacent epidermal cells and at low concn. leads to a reduction in turgor in these cells and consequently to stomatal opening. In vpd-sensitive species, increased transpiration from guard cells or epidermal cells adjacent to the stomata induced by SO_2 may lead to stomatal closure at large-vpd levels. Stomatal sensitivity to vpd in such cases may be enhanced because adjacent epidermal cell turgor is lowered by SO_2. At high SO_2 concn. direct disruption of guard cell structure may lead to a loss of turgor and stomatal closure. *(Author's summary)* A00 C00

See also 0464 0466

B00 PLANT ANATOMY, MORPHOLOGY AND CYTOLOGY

0006

15832 HAYES, A.B. **The interaction of auxin and ethylene in the maintenance of leaf blade form in *Phaseolus vulgaris* L. var. pinto.** American Journal of Botany 68 (6): 733-740. 1981. Engl., Sum. Engl., 29 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Leaves. Plant anatomy. Auxins. Ethylene. Laboratory experiments.**

Auxin treatment results in hyponastic curvature of the primary leaves of *Phaseolus vulgaris* var. pinto. Ethylene production by hyponastic leaves is detected within 1 h after treatment with IAA in concn. at or above 1 μM. The amount of ethylene detected is proportional to the concn. of auxin applied. Untreated control leaves and leaves treated with 2,3,5-tri-iodobenzoic acid or GA did not produce ethylene detectable by the equipment used. The hyponastic curvature induced by auxin treatment can be inhibited by exogenous application of ethylene or ethylene-generating compounds, and these treatments produce epinasty in auxin-treated leaves. Treatment with inhibitors of ethylene synthesis or action, such as aminoethoxyvinylglycine, CO_2, or heat treatment, prolong hyponasty. The planar form, therefore, appears to be affected by both hyponastic auxin effect and an epinastic ethylene effect. *(Author's summary)* B00 C00

0007

15816 CROCOMO, O.J., PETERS, J.E. and SHARP, W.R. **The induction of root and shoot morphogenesis in *Phaseolus vulgaris* tissue cultures.** Anais da Escola Superior de Agricultura Luiz de Queiroz 32:327-334. 1975. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Plant tissues. Seeds. Morphogenesis. Roots. Stems. Plant development. Laboratory experiments.**

Bean seed extract prepared from seeds pre-treated in aerated water, homogenized in Veliky and Martin's 67-V salt solution, filtered, and added to the culture medium promoted callus proliferation and root and shoot morphogenesis in leaf explants of the cv. Bico de Ouro. The activity of the seed extract was dependent on the period of pre-treatment in aerated water (1-7 days). *(Summary by Crop Physiology Abstracts)* B00 C00

0008

14738 MESA C., J.H. and MESA C., O.J. **Caracterización morfo-agronómica de la colección colombiana de fríjol (*Phaseolus vulgaris* L.).** *(Morphoagronomic characterization of the Colombian Bean collection).* Tesis Ing. Agr. Palmira, Universidad Nacional de Colombia, 1977. 105p. Span., Sum. Span., Engl., 16 Refs.

Phaseolus vulgaris. **Taxonomy. Identification. Cultivars. Agronomic characters. Plant anatomy. Leaves. Flowers. Seeds. Stems. Pods. Hypocotyls. Flowering. Yield components. Yields. Colombia.**

The present study consisted in the morphoagronomic characterization of the Colombian collection of common beans with 362 var., conducted in Popayán (Cauca, Colombia). Predominate ecological conditions were: mean temp., 20°C; mean annual rainfall, 1600 mm; alt., 1700 m.a.s.l.; lat., 2°42' N; black light soils of volcanic origin, slightly acid and low in available P. Thirty-one characteristics were evaluated; the var. studied showed a high degree of variability of great importance for improvement programs: color of flowers and seeds, seed form, growth habit, plant height (10 cm - 2 m), yields (0.2-145 g/plant), duration of flowering (6-70 days), pods/plant (2-54), seeds/pod (3-7), and HI (0.09-0.84). Due to a long summer that prevailed during the semester of this study (1976 semester B-1977 semester A) the results obtained can be considered of limited value. *(Author's summary)* B00

0009

16056 BRIARTY, L.G. **Stereological analysis of cotyledon cell development in *Phaseolus*. I. Analysis of a cell model.** Journal of Experimental Botany 31(124): 1379-1386. 1980. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Seed. Cotyledons. Cell structure. Cell division. Plant tissues. Growth. Analysis. Electron microscopy.**

A scheme for the stereological analysis of maturing cotyledon cells is described and assessed, and examples of subcellular structural parameters from seeds at an early stage of development are presented. *(Author's summary)* B00 C02

0010

11678 PERLA A., T.A. **Biología del fríjol y maíz.** *(Biology of beans and maize). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.45-52. Span., 5 Refs.

Phaseolus vulgaris. Zea mays. **Plant anatomy. Taxonomy.**

Some fundamental botanical aspects of bean and maize plants are described. The origin, vegetative (roots, stems, leaves) and reproductive structures (flowers, fruits, seeds), and taxonomic classifications of beans and maize are briefly reviewed. *(Summary by W.M.S. Trans. by L.M.F.)* B00

0011

15876 BAUMGARTNER, B., TOKUYASU, K.T. and CHRISPEELS, M.J. **Immunocytochemical localization of reserve protein in the endoplasmic reticulum of developing bean (*Phaseolus vulgaris*) cotyledons.** Planta 150:419-425. 1980. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Seeds. Cell structure. Proteins. Staining methods. Phytoalexins. Seed. Cotyledons. Analysis. Laboratory experiments.**

The ultrastructure of the storage parenchyma cells of the cotyledons of developing bean seeds was examined in ultrathin frozen sections of specimens fixed in a mixture of glutaraldehyde, formaldehyde, and acrolein, infused with 1 *M* sucrose, and sectioned at -80°C. Ultrastructural preservation was excellent and the various subcellular organelles could readily be identified in sections which had been stained with uranyl acetate and embedded in Carbowax (polyethyleneglycol) and methylcellulose. The cells contained large protein bodies, numerous long endoplasmic reticulum cisternae, mitochondria, dictyosomes, and electron-dense vesicles ranging in size from 0.2-1.0 μm. Indirect immunolabelling using rabbit immunoglobulin G against purified phaseolin (7 S reserve protein), and ferritin-conjugated goat immunoglobulin G against rabbit immunoglobulin G was used to localize phaseolin. With a conen. of 0.1 mg/ml of anti-phaseolin immunoglobulin G, heavy labeling

with ferritin particles was observed over the protein bodies, the cisternae of the endoplasmic reticulum, and the vesicles. The same structures were lightly labeled when the concn. of the primary antigen was 0.02 mg/ml. Ferritin particles were also found over the Golgi bodies. The absence of ferritin particles from other organelles such as mitochondria and from areas of cytoplasm devoid of organelles indicated the specificity of the staining, especially at the lower concn. of anti-phaseolin immunoglobulin G. *(Author's summary)* B00

0012

14251 ERNER, Y., BIRO, R. and JAFFE, M.J. **Thigmomorphogenesis: evidence for a translocatable thigmomorphogenetic factor induced by mechanical perturbation of beans *(Phaseolus vulgaris)*.** Physiologia Plantarum 50:21-25. 1980. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Plant anatomy. Plant injuries. Mechanical damage. Morphogenesis. Stems.**

Mechanical perturbation of bean internodes results in reduced elongation and increased ϕ of the internodes (thigmomorphogenesis). Perturbation of a single lower internode results in thigmomorphogenesis in that internode and all of those internodes above it, the degree of which depends on the age (size) of the internodes and the frequency of perturbation. Application of ethephon to the internodes mimics mechanical perturbation. Early removal of the shoot tip or the cotyledons does not effect thigmomorphogenesis, indicating that those organs do not exert control over the response. Mechanical perturbation of 1 plant of a pair grafted together at the 1st internodes results in thigmomorphogenesis in both plants. This indicates the transport of some factor from the mechanically perturbed donor to the non-treated receiver. Evidence is presented to support the contention that ethylene is not this transportable factor. *(Author's summary)* B00 G00

0013

14335 TSUJI, H., NAITO, K. and HATAKEYAMA, I. **Benzyladenine-induced increase in DNA content per cell, chloroplast size, and chloroplast number per cell in intact bean leaves.** Journal of Experimental Botany 30(119):1145-1151. 1979. Engl.. Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **DNA. Chloroplasts. Leaves. Cell division. Plant-growth substances. Cytokinins.**

Primary leaves of intact bean plants were treated with benzyladenine (BA) at different stages of their growth. BA induced a marked increase in DNA content/cell in growing leaves where no cell division occurred. BA stimulated the chloroplast replication compared with untreated leaves. After the replication period, chloroplast size continued to increase in BA-treated leaves, but not in untreated controls. *(Author's summary)* B00 C03

0014

14742 PANIAGUA G., C.V. **Identification and stability analysis of traits important to yield of beans in associated culture.** Ph.D. Thesis. East Lansing, Michigan State University, 1977. 76p. Engl., Sum. Engl., 63 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant breeding. Agronomic characters. Yields. Intercropping. Cultivation systems. Yield components. Flowering. Maturation. Leaves. Pods. Hypocotyls. Identification. Climatic requirements. Statistical analysis. Colombia.**

The identification of the traits in beans, which when grown in association with maize promote to the greatest practicable extent the potential for yield, was studied in 18 bean cv. grown in monoculture and associated culture. The qualitative effects of 17 traits upon certain parameters of adaptation were determined in each cv. grown in 6 different cultural environments at 2 locations in Colombia. The cultural environments were deter-

mined by location, crop system, and maize type. These parameters were slightly different from those proposed by Finlay and Wilkinson (1963) because the purpose was to remove the geographic location effect and consider only the environmental effect produced by the different cultural systems. The 2 statistics used, the var. mean and the environment mean, were adjusted by division by the location mean. It was considered that var. are best adapted when the regressions of var. scores upon the resp. environmental indexes approach unity, and had high mean values for the character under consideration. A var with a regression coefficient of zero or approaching zero was considered to be stable. A multiple regression analysis was carried out for each cultural system with yield as the response variable and the yield components as independent variable in the 1st case and the individual yield components as response variables and plant morphological traits as independent variables in the 2nd case. In terms of the 2 adaptation measures, variation appeared to be higher in the least complex traits in a developmental and a genetic sense and lower in the more complex traits suggesting adaptation stability increased with an increase in the complexity of the trait. Growth habit was the major var. characteristic that determined var. performance in almost all cultural environments. Var of Type I were stable ($b \rightarrow 0$) for cultural environmental changes. Type II var. appear to be adapted to cultural environmental changes ($b \rightarrow 1$) and var. of Type III and IV have differential responses to cultural environment changes ($b \lessgtr 1$). Some var. that were high yielding in monoculture were also high yielding in associations, but in general, var. high yielding in monoculture tended to be low yielding in associations and var. low yielding in monoculture, tended to be high yielding in associations. This suggests that a var. cannot be selected for yield in the monoculture system to be grown in the association system. It should be noted, however, that only in one case (var. Guatemala #594) was the regression value significantly different from unity. From results of the multiple regression analysis, it was concluded that no. of racemes, plant height hypocotyl ϕ and leaf dry wt. were important to the determination of yield through the determination of yield components for the association of bean and short maize but no. of branches and days to maturity had contrasting values for yield components. Stem dry wt. and leaf area had negative effects upon yield. The traits hypocotyl ϕ, days to maturity, and plant height were important in the determination of yield components in the association of bean and tall maize, but leaf dry wt., no. of racemes, and leaf area had contrasting values for yield components. Days to first flower and number of branches had negative effects upon yield. This suggests that plant breeders will have to make compromises in their decisions concerning the best set of traits in any given cultural environment. Var. 5 (Guatemala #109-1-1), with good general adaptability for yield, capable of producing high yields in all the cultural environments considered in the present study, also showed regression values near unity for most of the morphological traits measured. In extrapolation from this example, it may be postulated that for a var. to be widely adapted to mixed cultural environments it should show good adaptation for most of the morphological traits important in yield determination. Var. 1 (Rabia de Gato, also from Guatemala) was the least well-adapted var. with respect to yield. Interestingly, none of the morphological traits showed regression slopes close to unity, all being below one and most near zero. This case was the converse of the situation with var. 5 but was consistent with the postulate arrived at on the evidence of var. 5 and tends to reinforce that postulate. *(Author's summary)* B00 D05

0015

14358 HUNT JUNIOR, E.R. and JAFFE, M.J. **Thigmomorphogenesis: the interaction of wind and temperature in the field on the growth of *Phaseolus vulgaris* L.** Annals of Botany 45(6):665-672, 1980, Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Plant anatomy. Morphogenesis. Mechanical damage. Growth. Stems. Temperature. Climatic requirements. Field experiments. Laboratory experiments. USA.**

Field and lab. expt. were performed to determine the interaction of wind and temp. on thigmomorphogenesis (defined here as decreased elongation and increased internodal radial enlargement due to mechanical perturbation). Kidney bean plants cv. Red Cherokee Wax were sheltered or exposed to wind for 10 days. Wind velocity, wind gusting, temp.

light, and rainfall were measured for the duration of each of 10 expt. Stem elongation and ϕ were measured and it was found that thigmomorphogenesis due to wind occurs naturally. There was more internodal secondary xylem produced in the wind-exposed plants than in the sheltered plants. The exptl. data were analyzed by multiple linear regression and the wind was found to be a significant factor in the prediction of bean stem elongation and thickening. Lab. expt. show that as wind velocity increases, thigmomorphogenesis increases in an approx. linear fashion. Furthermore, it was found that low temp. interact with mechanical perturbation to reduce the amount of thigmomorphogenesis, both in the field due to wind and in the lab. due to rubbing. Other environmental factors do not seem to interact with the wind to modulate thigmomorphogenesis even though these factors affect plant growth. *(Author's summary)* B00 K00 G00

0016

14239 CUNHA, J.M. DA *et al.* **Influência da densidade da semente do feijoeiro na germinação e no vigor da planta.** *(Influence of bean seed density on germination and plant vigor).* Pesquisa Agropecuária Brasileira 15(1):37-45. 1980. Port., Sum. Port., Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Seed. Germination. Developmental stages. Plant fertility. Seed characters. Brazil.**

Bean 'Rico 23' seeds were separated into 4 classes according to their density using sucrose solutions of 1225, 1250, 1275, 1300 and 1325 densities. Seeds of the 4 density classes and those unselected (control treatment) were planted in sandy soil. The objective was to determine the vigor through no. and speed of emerged plants, wt. of aerial parts of dry plants and plant productivity. The results of the analyses carried out under the prevailing conditions led to the following conclusion that seeds with densities above 1275 are more vigorous since they presented higher germination capacity, more rapid emergence, and originated more vigorous plants and of higher productivity. *(Author's summary)* B00 D04

0017

14268 OWENS, T. and POOLE, R.J. **Regulation of cytoplasmic and vacuolar volumes by plant cells in suspension culture.** Plant Physiology 64:900-904. 1979. Engl., Sum. Engl., 30 Refs., Illus.

Phaseolus vulgaris. **Cytology. Cell structure. Cell division. Culture media. Laboratory experiments. Electron microscopy. Plant tissues.**

Quantitative microscopical measurements have been made of the proportion of cell vol. occupied by cytoplasm in a cell suspension culture derived from cotyledons of bush beans (cv. Contender). On a 7-day culture cycle, the content of cytoplasm varies from 25% at the time of transfer to 45% at the start of the phase of rapid cell division. If the culture is continued beyond 7 days, the vacuole vol. reaches 90% of cell vol. by day 12. Attempts to measure relative cytoplasmic vol. by compartmental analysis of nonelectrolyte efflux were unsuccessful. The proportion of cell vol. occupied by cytoplasm is roughly correlated with protein content, but shows no correlation with cell size or with intracellular concn. of K or Na. The most striking observation is that the growth of cytoplasmic vol. for the culture as a whole appears to be constant throughout the culture cycle, despite changes in the rate of cell division, cell size, rate of increase in fresh or dry wt.; amount of cytoplasm/cell, the cellular concn. or fluxes of Na or K, and the rate of vacuolation. It is suggested that cytoplasmic vol. is under the control of its own regulatory mechanism, which operates to give a constant exponential increase in cytoplasmic vol. independently of most other observed cellular properties. *(Author's summary)* B00 C00

0018

14387 GUADAMUZ M., E. **Relación entre morfología radical y componentes de producción en fríjol común** *Phaseolus vulgaris* **(L.).** *(Relation between root morphology and production components in common beans).* Tesis Ing. Agr. Costa Rica, Universidad de Costa Rica, Facultad de Agronomía. Escuela de Fitotecnia. 1980. 69p. Span., Sum. Span., 49 Refs.

Phaseolus vulgaris. **Plant anatomy. Roots. Yield components. Lodging. Inheritance. Planting. Seed. Pods. Yields. Soil analysis. Climatic requirements. Ecology. Cultivars. Statistical analysis. Field experiments. Costa Rica.**

The relation between root morphology and primary production factors in common beans was investigated through field work which covered 2 localities and 2 planting seasons in Costa Rica. The trial included 15 cv. selected for tap-root and fibrous root morphology. The 1st planting (2nd selection) was conducted from Nov. 1977-Feb. 1978 and the 2nd planting (3rd selection) from May-Sept. 1978; cv. 15-R-148 was eliminated from the last planting. In each planting, bean production was evaluated in terms of g/plant, no. of pods/plant, no. of seeds/plant, no. of seeds/pod, % of unfertile pods, % of lodging, and the degree of hereditability of root morphology. In the 1st selection highly significant differences were found with regard to the effect of root form on wt./plant, fertile pods/plant, no. of seeds/plant, and % of lodging. All cv. showed highly significant differences for variables and performance (growth habits). Root type x cv. interaction was only highly significant for the no. of pods/plant, significant for the % unfertile pods and the no. of seeds/plant and was not significant production wise. However, when Student's *t* distribution test was applied to production, plants with tap-roots had a higher yield in cv. Mexico-309, Venezuela-36, Jamapa, 15-R-42, and Porrillo than fibrous ones. In the 2nd planting (3rd selection) highly significant differences were found, favoring tap-root architecture for all the variables evaluated. Highly significant differences were also found favoring loamy soil and for all the variables under consideration in this investigation. Cv. had the same performance as that of root and soil factors. Root x soil interaction was only highly significant for production/plant, fertile pods/plant, and seeds/plant. Cv. x soil interaction was not significant for any of the variables under study. Cv. x root interaction was significant at 10% with regard to production/plant and significant for the no. of seeds/pod, and the 3rd order of interaction cv. x root x soil was significant only for the no. of seeds/plant and no. of seeds/pod. *(Author's summary. Trans. by L.M.F.)* B00

0019

14357 BIRO, R.L. *et al.* **Thigmomorphogenesis: changes in cell division and elongation in the internodes of mechanically-perturbed or Ethrel-treated bean plants.** Annals of Botany 45(6):655-664. 1980. Engl., Sum. Engl., 43 Refs., Illus.

Phaseolus vulgaris. **Morphogenesis. Mechanical damage. Plant-growth substances. Stems. Cell structure. Growth. Cell division. Plant vascular system.**

Examination of 1st internodes of young *Phaseolus vulgaris* plants which have been subjected to mechanical perturbation shows decreased elongation and increased radial growth. The decreased elongation can be attributed to both reduced cell elongation of epidermal and cortical cells and a reduced no. of cells in the vascular and pith tissues. The increased radial enlargement is due to increased cortical cell expansion and increased secondary xylem production resulting from increased cambial activity. All of these responses are observable within a few hours of a single mechanical perturbation. Treatment of plants with ethephon mimics all of these effects of mechanical perturbation. *(Author's summary)* B00 C02

0020

14259 STOFFELLA, P.J. *et al.* **Root characteristics of black beans. II. Morphological differences among genotypes.** Crop Science 19:826-830. 1979. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Plant anatomy. Roots. Biomass. Field experiments. Cultivars. Rooting. USA.**

Total root biomass of 2 black bean cv., Black Turtle Soup (BTS) and Strain 39, and 4 black-seeded lines (70001, 70002, 70003, and 70004) was partitioned into adventitious, basal, and taproot components at several growth stages under both greenhouse and field conditions. Basal root wt. were significantly higher for the 4 lines in the field and for 70001 and 70002 in the greenhouse than for BTS and Strain 39. Genotypes did not differ for adventitious root wt. in both environments. Taproot wt. were higher for all the lines compared with BTS; and for 70001, 70003, and 70004 compared with Strain 39 in the field. Genotypes did not differ for taproot wt. in the greenhouse. Stem, hypocotyl, and taproot ϕ were significantly higher for all the lines than for the 2 cv. in the field. Hypocotyl and stem ϕ of all lines were higher than for the 2 cv., except for stem ϕ of 70002 when compared with BTS in the greenhouse. Taproot ϕ of 70001, 70002, and 70004 were significantly higher than for Strain 39 under greenhouse conditions. Basal root ϕ (sum of individual basal root ϕ) of the 4 lines were significantly higher than for BTS or Strain 39 in both expt. Genotypes did not differ in the no. of basal roots under field conditions. In the field, most root parameters increased up to the seed initiation stage, followed by a significant decrease or no further increase at the pod fill stage. Significant stage x genotype interactions occurred for basal root ϕ and hypocotyl ϕ in the field and for taproot wt., stem, hypocotyl, and basal root ϕ in the greenhouse. The erect plant type of the lines may be attributable to larger basal roots. *(Author's summary)* B00

See also 0003 0029 0030 0044 0048 0062 0063 0088 0099 0123 0431 0478

C00 PLANT PHYSIOLOGY

0021

11986 RESTREPO M., J. and LAING, D.R. **Conceptos básicos en la fisiología del fríjol.** *(Basic concepts on bean physiology).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 24p. Span.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. **Plant physiology. Plant physiological processes. Photoperiod. Photosynthesis. Plant habit. Yield components. Colombia.**

Some basic concepts of physiology are presented in relation to bean cultivation, and the external and internal factors affecting crop development and production are described: the environment (edaphic and climatic factors), photosynthesis and factors that affect it (light, CO_2, O, temp., wind and water) photorespiration and photoperiod. In beans a great variation exists between the different lines and var. with regard to their response to the photoperiod. Adaptation is determined by: (a) insensitivity to the photoperiod, (b) a stable growth habit, (c) insensitivity to temp. during flowering, (d) drought tolerance, and (e) tolerance to excess moisture. Growth habits in beans are determinate, indeterminate, semi-climbing indeterminate and climbing indeterminate. Other factors are described such as the period of growth and development (emergence, appearance of the 1st trifoliated leaf, flowering, complete flowering, beginning of pod formation, development of the bean and maturity). Yield components (morphological, physiological, leaf area and LAD) and simplified yield, including biological and economic yield and growth, are analyzed. Abscission is studied by plant maps and 3 ideotypes are proposed to improve yields by the selection of desirable morphological and physiological characters. *(Summary by C.P.G. Trans. by L.M. F.)* C00

0022

14236 BENGOCHEA, T. *et al.* **Studies on ethylene binding by cell-free preparations from cotyledons of *Phaseolus vulgaris* L. I. Separation and characterisation.** Planta 148(4):397-406. 1980. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Plant physiology. Cotyledons. Proteins. Enzymes. Plant-growth substances. Cytology. Plant development.**

The preparation of a cell-free system from developing cotyledons of *Phaseolus vulgaris* cv. Canadian Wonder which is capable of binding ethylene is described. The binding is saturable and the apparent dissociation constant for ethylene is 6.4×10^{-10} *M* in solution. The binding site is associated with subcellular particles and treatment with Triton X-100 results in substantial solubilization of the activity. The kinetics of association and dissociation of the ligand and the binding site are described. The system is heat labile and binding activity is diminished by treatment with some proteolytic enzymes. *(Author's summary)* C00 C02

0023

14229 BENGOCHEA, T. *et al.* **Studies on ethylene binding by cell free preparations from cotyledons of *Phaseolus vulgaris* L. II. Effects of structural analogues of ethylene and of inhibitors.** Planta 148:407-411. 1980. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Plant physiology. Plant-growth substances. Cotyledons. Plant development. Biochemistry. Cytology.**

Various protein reactive agents such as dithioerythritol, dithiothreitol, mercaptoethanol and p-chloromercuribenzoate inhibit binding of ethylene to cell free preparations of *Phaseolus vulgaris.* The effect of the thiols is partially reversed by treatment with diamide; occupation of the binding site by ligand diminishes the inhibition caused by p-chloromercuribenzoate but not that caused by thiols. Growth regulators other than ethylene do not affect binding. Physiologically active structural analogues of ethylene competitively inhibit binding of the growth regulator and their relative effectiveness in the cell free system closely resembles that in developmental processes controlled by ethylene. *(Author's summary)* C00 C02

0024

14201 BECKERSON, D.W. and HOFSTRA, G. **Effect of sulphur dioxide and ozone singly or in combination on leaf chlorophyll, RNA, and protein in white bean.** Canadian Journal of Botany 57(18):1940-1945. 1979. Engl., Sum. Engl., Fr., 25 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Ozone. Plant physiology. Protein content. RNA. Chlorophyll. Plant injuries. Canada.**

The effect of 0.15 ppm ozone and/or 0.15 ppm SO_2 on leaf chlorophyll, RNA and protein levels was investigated. Leaves of *Phaseolus vulgaris* cv. Sanilac treated with ozone exhibited reddish-brown lesions and an immediate and continuous decrease in chlorophyll a and b levels over a 5-day period, whereas protein levels increased and there was no effect on RNA levels compared with the control group of plants. SO_2-treated leaves (0.15 ppm) exhibited an immediate increase in chlorophyll a and b, but protein and RNA were not affected. The SO_2-ozone mixture caused interveinal chlorosis by about day 3 and produced a decrease in chlorophyll which was delayed by 2 days compared with leaves exposed to ozone alone. By the end of the 5-day period, chlorophyll levels were less than in leaves treated with ozone alone, but the interveinal chlorosis that occurred was not due to phaeophytinization of the chlorophyll molecules. Protein and RNA levels were not affected. Although both ozone and the pollutant mixture caused chlorophyll destruction and premature leaf drop, the changes that occurred were not typical of normal leaf senescence. *(Author's summary)* C00 C03

0025

14363 JOHN, W.W. and CURTIS, R.W. **Stimulation and inhibition of respiration by malformin: relationship to enhanced ethane production.** Plant and Cell Physiology 21(1):1-8. 1980. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Plant respiration. Plant physiological processes. Inhibitors. O. Ca. Seedlings. Leaves. Ethane. Plant-growth substances. Bacterioses. Laboratory experiments.**

When apical bud sections of *Phaseolus vulgaris* were vacuum-infiltrated with malformin, their rate of respiration increased significantly without a lag and without altering the respiratory quotient. When tissues were soaked in solutions, the effect of malformin was concn. dependent. At high malformin concn. (200 μM), a marked inhibition of respiration for 8-10 h was followed by a rapid increase of O uptake which reached a level nearly 3-fold greater than that of controls. At lower concn. (20 μM) malformin had no effect on respiration for 8-10 h, but then stimulated respiration markedly. Ca^{2+} completely blocked the early inhibition of respiration by malformin (200 μM), but had little or no effect on the subsequent stimulation of respiration. O deficiency may be a contributing factor to the enhancement of ethane production by malformin. *(Author's summary)* C00

0026

14749 DAVIS, S.D. **Effect of leaf age on stomatal resistance and its significance for carbon dioxide assimilation in bush bean** *(Phaseolus vulgaris* L.) Ph.D. Thesis. College Station, Texas A & M University, 1974. 119p. Engl., Sum. Engl., 98 Refs., Illus.

Phaseolus vulgaris. **Plant development. Leaves. Stomata. CO_2. Plant assimilation. Light. Cytology. Analysis. Water content. Growth-chamber experiments.**

The objectives of this research were: (1) to determine if leaf age significantly affects leaf resistance to gaseous diffusion in *Phaseolus vulgaris* at constant light and external CO_2 level, leaf temp., ambient humidity and leaf water potential; (2) to test the possibility that 3 parameters inherently related to leaf age, shading of lower leaves, stage of plant development, and stomatal density, also affect leaf resistance; (3) to determine the extent to which the leaf age effect on leaf resistance alters the rate of CO_2 assimilation in the light; (4) to test the hypothesis that the controlling mechanism of the leaf age effect on leaf resistance (if any) is an increase in the CO_2 concn. in the substomatal cavity. Bean plants were grown and tested in environmental chambers under constant conditions of high light (900-1150 microeinsteins/s/m^2, 400-700 nm), 12 h photoperiod, 30°C air temp., 25°C dew point, 320 ppm CO_2 and 1 m/s air speed. Measurements of leaf resistance, leaf water potential, stomatal density and light level at the leaf were made throughout all stages of plant growth (60 days from emergence). In one expt. leaf resistances were simultaneously measured with a diffusion porometer cup and a CO_2 assimilation cup. The values obtained by both methods were in close agreement. This work was divided into 3 expt. In expt. 1, the effect of long-term shading on leaf resistance was separated from the leaf age effect proper. It was discovered that once a leaf which is held under constant high light levels becomes fully expanded, the aging process causes the diffusive resistance of the whole leaf to increase continuously (from 0.07 s/mm to 0.86 s/mm) until leaf abscission. This same pattern, at a higher level of resistance, was found to occur for leaves that were continuously shaded to 15% of the full light level. The rate of change in leaf resistance with age varied among leaves within a plant, but the differences were eliminated when the life span of each leaf was taken into account. The same held true among leaves measured during different expt. In expt. 2, the effects of different stages of plant development, and of stomatal densities, on leaf resistance, were found to be negligible, although the stomatal densities did decrease from 70 stomates/mm^2 to 15 stomates/mm^2 on the adaxial surface of certain leaves. Leaf water potentials increased slightly with age, due to an increase in internal plant resistance to water flow, but this also had a negligible effect on the resistance. In expt. 3, CO_2 assimilation rates in full light and normal ambient CO_2 level were found to decline from 2.4 g/h/m^2 at leaf maturity to approximately 0.2 g/h/m^2 at senescence. This decline was attributed both to the increase in leaf resistance and to a decline in the internal capacity of the leaf to assimilate CO_2. The CO_2 concn. in the substomatal cavity remained nearly constant with age. This suggests that changes in internal CO_2 level of the leaf do not cause the observed increases in resistance with leaf age. It was concluded that: (1) there was a significant effect of leaf age on leaf resistance; (2) the effects of accompanying factors such as shading, stage of plant development, and stomatal densities were negligible; (3) the leaf age effect occurred not only during the latter stages of senescence when the leaf was already chlorotic or necrotic, but was a continuous process, beginning near leaf maturity and continuing until leaf abscission; (4) the leaf age effect, relative to the life span of each leaf, is the same among different leaves within a plant; (5) net photosynthetic rates (measured as CO_2 influx in the light) of individual leaves, appreciably declined with time, due to the effects of age on both resistance and the internal capacity of the leaf to assimilate CO_2; (6) the internal CO_2 concn. remained constant with age, and therefore could not have caused the increase in resistance. *(Author's summary)* C00 C02

0027

14740 WILSON, K.A. **Studies on the trypsin inhibitors of the garden bean,** ***Phaseolus vulgaris.*** Ph.D. Thesis. Amherst., N.Y., State University of New York at Buffalo, 1973. 199p. Engl., Sum. Engl., 145 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Trypsin. Inhibitors. Proteins. Amino acids. Composition. Analysis. pH. Plant physiological processes. Plant physiology. Germination. Plant development. Laboratory experiments.**

Three isoinhibitors of trypsin have been isolated from the garden bean in a highly purified state as indicated by disc gel electrophoresis, equilibrium chromatography, and amino acid analysis. The amino acid composition is characterized by the absence of free sulfhydryl groups, high half-cystine (14), and absence of met. in isoinhibitors II and IIIb. Isoinhibitor I contains 74, II - 79, and IIIb - 81 amino acid residues. Isoinhibitor I has lysine in the reactive site, while isoinhibitor II has arginine. Isoinhibitor II is significantly displaced from the trypsin complex by 1 m*M* substrate; isoinhibitors I and IIIb are not. I and II inhibit α-chymotrypsin weakly (0.2 units/mg). Isoinhibitor IIIb inhibits strongly (2.87 units/mg) and has an independent site for each enzyme: trypsin and chymotrypsin. The partial sequence of isoinhibitor II is reported. A high degree of homology is noted with lima bean trypsin inhibitor IV and Bowman-Birk soybean trypsin inhibitor. *(Author's summary)* C00 H00

0028

14337 HARTMANN, E. **Attempts to demonstrate incorporation of labelled precursors into acetylcholine by *Phaseolus vulgaris* seedlings.** Phytochemistry 18(10):1643-1646. 1979. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Metabolism. Tracers. Plant assimilation. Seedlings. Hypocotyls. Nutrient solution. Tissue culture. Irradiation. Nutrient transport. Enzymes.**

The labelling of acetylcholine was investigated in bean seedlings and hypocotyl hooks. Labelling could only be found after red light irradiation but not in the dark. Acetate was a much better precursor than choline. Glucose gave no detectable amounts of acetylcholine labelling during 24 h of incubation. The rate of acetylcholine labelling was higher in whole seedlings than in hypocotyl hook preparations. *(Author's summary)* C00 C03

0029

14726 BAKER, C.J., AIST, J.R. and BATEMAN, D.F. **Ultrastructural and biochemical effects of endopectate lyase on cell walls from cell suspension cultures of bean and rice.** Canadian Journal of Botany 58(8):867-880. 1980. Engl., Sum. Engl., Fr., 27 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Plant tissues. Roots. Cell walls. Cell structure. Biochemistry.**

Cell walls prepared from suspension cell cultures of beans and rice in log-phase growth were used to examine the effects of endopectate lyase (PL) on the solubilization of cell wall carbohydrates and concomitant ultrastructural alterations. Cell wall preparations from both plant sources were heterogeneous and contained a range of wall types from primary walls to xylem elements with spiral, secondary wall thickenings. Marked differences in wall thickness and no. of wall laminations typified both preparations. Bean cell walls were more susceptible to degradation by PL than were those of rice. Upon treatment of the former with 2.3 x 10^{-3} units/ml of PL (1 unit released 1 μmol of unsaturated uronide/min at 30°C from polygalacturonic acid at pH 8.5), 27% of the noncellulosic wall carbohydrate was solubilized in 1 h. This represented 50% of the PL susceptible carbohydrate in the preparation. Only 3% of the noncellulosic carbohydrate was released from rice cell walls in 1 h when treated with 115 x 10^{-3} units of PL/ml. This accounted for 60% of the PL susceptible wall fractions. Only uronic acid, rhamnose, galactose, and arabinose were solubilized from both preparations by PL. Cell walls in the bean and rice preparations were affected differentially by the PL. Those walls with secondary thickenings did not appear to be degraded, while the distinct fibrillar appearance of both bean and rice walls tended to fade or disappear. The middle lamella tended to dissolve to varying degrees in the presence of PL. Bean walls were more severely degraded than were the rice walls and many exhibited swelling, separation of wall layers, markedly reduced staining intensity, and (or) a granular ultrastructure. This study has demonstrated that as PL acts on susceptible cell

walls there are major changes evoked in cell wall structure which suggest that the rhamnogalacturonan fraction of the higher plant cell wall contributes significantly to cell wall integrity. The need for cell wall material of proven uniformity for investigations of both cell wall composition and effects of specific polysaccharide degrading enzymes on cell wall integrity is also emphasized. Preliminary studies indicate that tobacco pith may provide more uniform cell walls than do cell suspension cultures. *(Author's summary)* C00 B00

0030

14204 ARIAS, O. and CROCOMO, O. **Influencia de la arginina en la diferenciación de raíces en tejidos de fríjol (*Phaseolus vulgaris* L.) cultivados in vitro.** *(Effect of arginine on the root differentiation in tissue cultures of beans cultivated in vitro).* Agronomía Costarricense 3(2):193-195. 1979. Span., Sum. Span., Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Developmental stages. Amino acids. Arginine. Tissue culture. Roots. Brazil.**

A preliminary study was undertaken to evaluate the effect of increasing levels of arginine, 0, 30, 60, 120 and 240 mg/*l*, on the differentiation of roots in tissue cultures of beans. A treatment with hydrolized casein (at a concn. of 2 g/*l*) was also included. The culture medium proposed by Veliky and Martin was used in this study. Arginine concn. of 120 and 240, mg/*l* induced the development of roots, but the treatment with hydrolyzed casein proved to be superior. For further study the use of higher concn. of arginine as well as the inclusion of other amino acids present in the hydrolyzed casein are suggested. *(Author's summary)* C00 B00

0031

14309 CANVIN, D.T. *et al.* **Oxygen exchange in leaves in the light.** Plant Physiology 66(2):302-307. 1980. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Light. Plant respiration. Leaves. O. Nutrient absorption. CO_2. Carbon fixation. Metabolism. Enzymes. Temperature.**

Photosynthetic O_2 production and photorespiratory O_2 uptake were measured using isotopic techniques, in the C_3 species *Hirschfeldia incana, Helianthus annuus,* and *Phaseolus vulgaris.* At high CO_2 and normal O_2, O_2 production increased linearly with light intensity. At low O_2 or low CO_2, O_2 production was suppressed, indicating that increased concn. of both O_2 and CO_2 can stimulate O_2 production. At the CO_2 compensation point, O_2 uptake equaled O_2 production over a wide range of O_2 concn. O_2 uptake increased with light intensity and O_2 concn. At low light intensities, O_2 uptake was suppressed by increased CO_2 concn. so that O_2 uptake at 1000 *ul/l* CO_2 was 28-35% of the uptake at the CO_2 compensation point. At high light intensities, O_2 uptake was stimulated by low concn. of CO_2 and suppressed by higher concn. of CO_2. O_2 uptake at high light intensity and 1000 *ul/l* CO_2 was 75% or more of the rate of O_2 uptake at the compensation point. The response of O_2 uptake to light intensity extrapolated to zero in darkness, suggesting that O_2 uptake via dark respiration may be suppressed in the light. The response of O_2 uptake to O_2 concn. saturated at about 30% O_2 in high light and at a lower O_2 concn. in low light. O_2 uptake was also observed with the C_4 plant *Amaranthus edulis;* the rate of uptake at the CO_2 compensation point was 20% of that observed at the same light intensity with the C_3 species, and this rate was not influenced by the CO_2 concn. The results are discussed and interpreted in terms of the ribulose-1,5-bisphosphate oxygenase reaction, the associated metabolism of the photorespiration pathway, and direct photosynthetic reduction of O_2. *(Author's summary)* C00

0032

13179 VILLIERS, O.T. DE, MERWE, M.J. VAN DER and KOCH, H.M. **Comparative effects of methabenzthiazuron and metribuzin on photosystem II and ATPase activity of chloroplasts of *Phaseolus vulgaris*.** South African Journal of Science 75: 315-316. 1979. Engl., 9 Refs., Illus.

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

The effect of 2 herbicides (methabenzthiazuron and metribuzin) on electron transport and O evolution in photosystem II (PSII) and on the activity of light-induced ATPase in isolated chloroplasts of *Phaseolus vulgaris* var. Top Crop plants grown in moist Perlite was investigated. Chloroplasts were isolated from 10-day-old leaves by the method of Avron. Chlorophyll content was determined according to Vernon. Photoreduction of ferricyanide was determined spectrophotometrically at 420 nm following illumination (4300 lx) of the reaction mixture for 3 min. The reaction mixture (8 ml) consisted of 0.037 *M* tris-HCl (pH 7.2), 0.02 *M* KCl and 0.0005 *M* ferricyanide, 1 ml chloroplasts in suspension and 0.2 ml herbicide solution at different concn. (10^{-8}, 10^{-7}, 10^{-6}, 10^{-5} or 10^{-4} *M*). One ml of TCA was added and precipitated protein removed by centrifugation. O evolution was determined by a Gilson respirometer according to the method of Vishniac and readings were made every 5 min. ATPase activity was determined according to the method of Alsop and Moreland; at the end of the process, the precipitated protein was removed by centrifugation and inorganic phosphate, determined colorimetrically. It was deduced that both herbicides inhibit photosynthesis in the light-dependent part of the photosynthetic process by inhibiting PSII-mediated O evolution. Results also show that the transport of electrons was more strongly inhibited than O evolution and that both herbicides had no effect on light-induced ATPase activity of the chloroplasts. *(Summary by A.J. Trans. by L.M.F.)* C00

0033

14352 VOLKENBURGH, E. VAN and CLELAND, R.E. **Protein excretion and cell expansion in bean leaves.** Planta 148(3):273-278. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Growth. Leaves. Light. pH. Seedlings. Plant tissues. Cell wall. Fungal toxins.**

Light-induced expansion of *Phaseolus vulgaris* L. leaf cells is accompanied by increased cell-wall plasticity. The possibility that leaf-cell walls are loosened by excreted protons has been investigated: (1) light causes acidification, detected at the leaf surface, within 5-15 min. Growth starts 10-20 min after exposure to light; exogenous acid induces loosening of isolated leaf cell walls; (3) infiltration of the tissue with a neutral buffer inhibits light-induced growth, and (4) fusicoccin stimulates growth of as well as H^+ excretion by bean leaf cells, without light. These findings show that the acid-growth theory is applicable to light-induced growth of leaf cells, and indicate that light-induced proton excretion initiates cell enlargement in leaves. *(Author's summary)* C00

0034

14701 VILLIERS, O.T. DE, and MERWE, M.J. VAN DER. **A study of the mode of action of methabenzthiazuron and metribuzin in isolated cells of *Phaseolus vulgaris*.** South African Journal of Science 74(11):440-442. 1978. Engl., 10 Refs. Illus.

Phaseolus vulgaris. **Herbicides. Laboratory experiments. Leaves. Cytology. Photosynthesis. Inhibition. Plant physiological processes. Nucleic acids. Proteins.**

Histograms are presented on the effects of methabenzthiazuron and metribuzin from 10^{-8}*M* to 10^{-4}*M* on photosynthesis, respiration, RNA synthesis, protein synthesis and lipid synthesis in isolated mesophyll cells of 9-day-old leaves of *Phaseolus vulgaris*, assessed at

intervals up to 120 min. Photosynthesis ($^{14}CO_2$ fixation) after 120 min was stimulated by 33 and 14% of each herbicide, resp., at the lowest concn., but almost complete inhibition was induced by the highest concn. RNA synthesis was also stimulated by 25-40% by methabenzthiazuron at all concn. except the lowest. *(Summary by Weed Abstracts)* C00 D02

0035

14261 SHANER, D.L. and LYON, J.L. **Stomatal cycling in *Phaseolus vulgaris* L. in response to glyphosate.** Plant Science Letters 15:83-87. 1979. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Stomata. Photosynthesis. Temperature. Herbicides. Plant physiological disorders.**

Leaf conductance and net photosynthesis decreased simultaneously in response to treatment of bean leaves with glyphosate. In a constant environment of 300 $\mu E/m^2/s$ light, 50% RH, and either 21 or 27°C, spontaneous stomatal cycling occurred in response to glyphosate treatment. At a higher temp. (37°C) or a higher RH (80%) no stomatal cycling was observed. *(Author's summary)* C00

0036

14287 WALLACE, A., MUELLER, R.T. and WOOD, R.A. **Arsenic phytotoxicity and interactions in bush bean plants grown in solution culture.** Journal of Plant Nutrition 2(1/2):111-113. 1980. Engl., Sum. Engl., 6 Refs.

Phaseolus vulgaris. **Micronutrients. Toxicity. Nutrient transport. Plant anatomy. Mineral deficiencies. Laboratory experiments. Plant nutrition.**

Bush bean plants (cv. Improved Tendergreen) were grown in solution culture with varied levels of As to ascertain levels and plant concn. associated with phytotoxicity and to determine if there were any interactions between As and other minerals in plants. The level of 10^{-4} *M* arsenate in solution resulted in considerable plant damage. Plant concn. of As at this application rate were 3.6, 18.8 and 41.7 $\mu g/g$ resp. for leaves, stems, and roots. This level of arsenate resulted in increased Fe, Cu, Mg, Al, Si, Ti and Ba in all plant parts except Mg in roots. All of the increases may be due to concn. Simultaneously there was depressed Mn, P and Ca in all plant parts. K also was depressed in roots. These depressions were not due to dilution. *(Author's summary)* C00 C01

0037

14260 TAMAS, I.A. *et al.* **Effect of older fruits on abortion and abscisic acid concentration of younger fruits in *Phaseolus vulgaris* L.** Plant Physiology 64:620-622. 1979. Engl., Sum. Engl., 18 Refs.

Phaseolus vulgaris. **Plant-growth substances. Pods. Age. Harvesting. Productivity. USA.**

In 2 bean cv. Redkloud and Redkote the older fruits growing at the base of racemes aborted less frequently than the younger ones above them. When older fruits at the base of racemes were removed, the abortion rate of the younger ones was reduced and their ABA concn. was lowered. Thirteen days after fruit removal, 36-45% of the younger fruits remained viable on treated plants while less than 12% of the younger fruits were viable on control plants. On these intact controls the ABA concn. of young fruits was at least twice that of defruited plants. A similar difference was found when the ABA content was expressed on a per fruit basis, suggesting a direct regulatory influence of older fruits over the ABA content of younger fruits. *(Author's summary)* C00

0038

13192 LEE, T.E.G. and CROCOMO, O.J. **Protein pattern changes in the germinating bean seed.** Turrialba 30(1):87-91. 1980. Engl., Sum. Span., Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Seed. Germination. Plant physiological processes. Cotyledons. Protein content.**

The changes of total soluble proteins, glycoproteins and their subunit patterns in the cotyledons of germinating *Phaseolus vulgaris* L. beans were investigated. Polyacrylamide gel electrophoresis techniques were used to detect these proteins and subunits. The disappearence of these protein bands was found to be in sequence with the legumin-like protein as the first one to be hydrolyzed followed by the vicilin-I and finally the vicilin-II. The synthesis of new protein in the cotyledons of germinating bean seed was also detected. *(Author's summary)* C00 C03

0039

14389 PANDEY, D.P and KANNAN, S. **Effects of sodium chloride pretreatment on cation absorption by bean plants.** Zeitschrift fur Pflanzenphysiologie 92(1): 91-94. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Salinity. Nutrient absorption. Plant assimilation. Micronutrients. Fe. Mn. Seedlings. Growth. Plant-growth substances. Tracers. Cell structure. Laboratory experiments.**

The absorption of Rb^{+}, Fe^{++} and Mn^{++} by bean seedlings pretreated with low concn. of NaCl was found to be enhanced. The effect was temporary in the case of Fe^{++}, and was concn.-dependent for Mn^{++} absorption. Pretreatment with 50 m*M* NaCl enhanced Rb^{+} uptake from 0.5 m*M* RbCl significantly. The presence of 2-chloroethyltrimethylammonium chloride (CCC), or N,N-dimethylaminosuccinamic acid (Alar) at 1 μg/ml of the pretreatment medium did not alter the effect of NaCl on Fe^{++} absorption and transport. *(Author's summary)* C00

0040

14219 KENIS, J.D. and TRIPPI, V.S. **Regulación de la abscisión en *Phaseolus vulgaris* L. III. Efecto del peróxido de hidrógeno sobre la abscisión y la actividad de amilasas.** *(Regulation of abscission in Phaseolus vulgaris. III. Effect of hydrogen peroxide on abscission and amylase activity).* Phyton 38(2):147-154. 1980. Span., Sum. Engl., Span., 34 Refs., Illus.

Phaseolus vulgaris. **Abscission. Leaves. Enzymes. Light. Plant physiological disorders.**

Hydrogen peroxide was found to be a powerful abscission agent in *Phaseolus vulgaris* L. explants. It stimulated abscission in explants obtained from young, mature or yellowing leaves, when they were incubated in the dark or under red (r) or far-red (RL) light. Amylase activity increased, especially in the proximal zone of the H_2O_2-induced abscission. Explants obtained from young leaves responded to R and RL light like those obtained from old leaves, when they were incubated in the dark or under red (R) or far-red (RL) light. Amylase induces abscission by initiating oxidative senescence changes in cellular membranes. *(Author's summary)* C00

0041

15488 BARRATT, D.H.P. and WOOLHOUSE, H.W. **Protein turnover in the primary leaves of *Phaseolus vulgaris.*** Journal of Experimental Botany 32(127): 443-452. 1981. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Leaves. Proteins. Plant physiological processes. Nutrient solution. Tracers. Chloroplasts. Analysis. Laboratory experiments.**

A technique which measures the change in 2-^{3}H content of protein with time by racemization of the protein hydrolysate with acetic anhydride was employed to measure protein turnover in the primary leaves of *Phaseolus vulgaris* var. The Prince. Plants were grown in liquid culture and the radioactivity was introduced through the roots in the form of tritiated water. Substantial quantities of ^3H_2O (1 mCi/ml), a 48 h exposure ^3H_2O, together with detopping of the plant (which stimulates resumption of protein synthesis as shown by a 3-fold increase, over normal plants, in ^{3}H incorporated into different protein fractions in the 24 h immediately following detopping) were required to obtain manageable amounts of label incorporated into mature leaves. Under these particular conditions the half-life, the time required for half the protein molecules initially present to be degraded of: (1) chloroplast coupling factor (CF_1) was estimated as 1.53 days, (2) a total soluble protein fraction (TSP) as 1.9 days, and (3) a chloroplast lamellae fraction as 7.65 days. *(Author's summary)* C00

0042

14375 ASHENDEN, T.W. **Effects of SO_2 and NO_2 pollution on transpiration in *Phaseolus vulgaris* L.** Environmental Pollution 18(1):45-50. 1979. Engl., Sum. Engl., 24 Refs.

Phaseolus vulgaris. **Air pollution. Transpiration. Growth-chamber experiments. Laboratory experiments. Growth. Leaves. Stomata.**

An investigation was conducted to determine the effects of 10 pphm SO_2 and 10 pphm NO_2, applied both singly and in combination, on whole plant transpiration rates of *Phaseolus vulgaris.* The individually applied pollutants caused short-term increases and the pollutant combination caused a decrease in transpiration rate. These results are discussed in relation to previous studies. *(Author's summary)* C00

0043

15417 BROWN, K.W. and THOMAS, J.C. **The influence of water stress preconditioning on dark respiration.** Physiologia Plantarum 49(2):205-209. 1980. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Water requirements. Drought. Plant respiration. Plant physiological processes. Leaves. Photosynthesis.**

The respiration rate of individual leaves of cotton, bean cv. Bush Blue Lake, and sorghum which had been fully expanded prior to a series of severe water stresses was compared with those of unstressed leaves of similar age. Measurements were made over a range of leaf temp. Respiration rate/unit leaf area of all rewatered plants were significantly lower than those of the plants which had not undergone water stress. During the stress periods, the leaves of all species suffered DM loss. Respiration rates/unit DM for cotton and beans were the same for the plants that had and had not undergone stress. Thus for these 2 C_3 plants the decrease in dark respiration due to water stress could be explained entirely by loss of DM. The lower respiration rates of the stressed leaves when expressed on both an area basis and a wt. basis for the C_4 species indicate that water stress adaptation of C_4 plants may include alterations in the respiratory mechanism or in the amount of residual respirable substrate. The light compensation points of all species were not altered by the water stress preconditioning. This indicates that the mechanisms controlling the net photosynthetic exchange/unit leaf area underwent adaptations as a result of repeated water stress which decreased its efficiency. *(Author's summary)* C00

0044

15491 SCHUMACHER, T.E. and SMUCKER, A.J.M. **Mechanical impedance effects on oxygen uptake and porosity of dry bean roots.** Agronomy Journal 73(1): 51-55. 1981. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **O. Plant assimilation. Roots. Mechanical damage. Plant respiration. Plant development. Laboratory experiments.**

Low oxigen concn. and mechanical impedance are 2 components of soil compaction often implicated in the reduction of crop yields. The relative importance of these 2 stresses to the root system has not been thoroughly assessed. A system was developed to study the effect of mechanical impedance on root respiration and morphology. O uptake, by intact plant root systems subjected to 3 levels of mechanical impedance, was determined polarographically by measuring the O concn. of nutrient solutions before and after flowing through a root media of 1 mm, 3 mm, or no glass beads. O uptake rates by dry bean roots were independent of solution flow rates > 6.0 ml/min^{-1} when inlet pO_2 was 0.21 atm. Mechanical impedance reduced dry wt., fresh wt., vol., and length of roots after 8 days of treatment. DM % of mechanically impeded roots was greater than the control. Roots subjected to mechanical impedance were deformed, branched more frequently, less porous, and consumed more %/unit fresh wt. It is suggested that a greater O supply may be required at the root surface to prevent anoxia in mechanically impeded roots. *(Author's summary)* C00 B00

0045

14395 COOK, G.T. and DUNCAN, H.J. **Uptake of aminotriazole from humectant-surfactant combinations and the influence of humidity.** Pesticide Science 9(6):535-544. 1978. Engl., Sum. Engl., 22 Refs.

Phaseolus vulgaris. **Plant-growth substances. Herbicides. Growth-chamber experiments. Temperature. Photoperiod. Relative humidity. Plant assimilation.**

Uptake of aminotriazole (3-amino-1,2,4-triazole) by bean leaves of var. Canadian Wonder was not greatly influenced by the addition to the spray solution of dimethylformamide (DMF), ethylene glycol and polypropylene glycol 400 (PPG 400) over the concn. range 1.0-50.0 ml/*l*. However, the addition of polyoxyethylene 20 sorbitan monolaurate (polysorbate 20) (0.2-1.0 g/*l*) to spray solutions of the above additives and glycerol (5.0 ml/*l*; except for DMF, 50.0 ml/*l*) substantially increased uptake to 80-100% in all cases at 50 ± 10% RH. Similar penetration figures were recorded when a range of polysorbate surfactants (polysorbate 20, 40, 60, 80, and 85; 0.2 g/*l*) were applied to spray solutions containing either dimethyl sulphoxide (DMSO) or glycerol (5.0 ml/*l*). Humidity was found to have a critical effect upon the humectant-surfactant combinations tested; DMSO + polysorbate 20, ethylene glycol + polysorbate 20 and PPG 400 + polysorbate 20 (5.0 ml/*l* + 0.2 g/*l*). With DMSO + polysorbate 20 the following uptake figures were recorded: < 30% RH, 3.1%; 45 ± 10% RH, 86.8%; 55-65% RH, 48.2% and 100% RH, 0.3%. Similar trends were recorded with all 3 humectant-surfactant combinations. Further studies revealed that the adverse effect of humidity on DMSO-polysorbate mixtures could be at least overcome partially by regulating the DMSO concn. *(Author's summary)* C00 D02

0046

15812 MANGAT, B.S. **The effect of diuron on the soluble nucleotide pool and growth of bean and corn seedlings.** Pesticide Biochemistry and Physiology 10(3): 251-258. 1979. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Herbicides. ATP. Seedlings. Metabolism. Chlorophyll. Plant physiological processes. Laboratory experiments.**

The effect of diuron on the acid-soluble nucleotides and growth of bean and maize seedlings was examined. Seeds were germinated in sterile vermiculite and the seedlings fed with different concn. of diuron through the roots. In the control plants there was a predominance

of adenine and uridine nucleotides over guanine and cytosine nucleotides with ATP and UDP-glucose (UDPG) being the most abundant. Seedlings fed with 50 μM diuron showed a significant increase in ATP level and then a subsequent decrease with increasing diuron concn. There was a considerable decrease in the total nucleotide content of both types of seedlings fed with 125 and 250 μM diuron, the effect being much more pronounced in the ones treated with 250 μM. The decrease in the total nucleotide content resulted in reduced metabolic activity of the seedlings as was shown by the decrease in chlorophyll and in reduced fresh and dry wt. *(Author's summary)* C00 D00

0047

16077 SAMMLER, P. and SCHMIDT, A. **Comparative studies in the petiolus abscission test of *Phaseolus vulgaris* L.** Biochemie und Physiologie der Pflanzen 174 (4):322-325. 1979. Germ., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris. **Abscission. Leaves. Host-plant resistance. Plant-growth substances.**

The petiolus abscission of *Phaseolus vulgaris* was analyzed by 2 different methods in parallel expt. The decrease in abscission break strength and the simultaneous increase in the % of petiole abscission after excision of the leaf lamina as well as the influence of ethephon, IAA, or $AgNO_3$, on abscission indicated that both the estimate of 50% abscission time and the measurement of break strength gave reproducible results for intact bean plants. The advantages and disadvantages of both methods are discussed with regard to their use for screening substances which delay abscission, and a combination of the 2 methods is suggested. *(Extracted from author's summary)* C00

0048

16092 PRIESTLEY, D.A. and WOOLHOUSE, H.W. **The chloroplast envelope of *Phaseolus vulgaris* L. II. Enzymic characteristics.** Plant and Cell Physiology 21(4): 709-717. 1980. Engl., Sum. Engl., 34 Refs., Illus.

Phaseolus vulgaris. **Leaves. Chloroplasts. Enzymes. Analysis. Cytology.**

The isolated chloroplast envelope of *Phaseolus vulgaris* was found to synthesize galactolipids when supplied with exogenous UDP galactose. The rate of total galactose incorporation varied within the range 0.4-50 nmole g/protein/s with age of the tissues. The activities of NADH dehydrogenase, malate dehydrogenase, and Mg^{2+}-ATPase in the envelope fraction were also investigated. The use of a positive "marker" activity for the isolated chloroplast envelope is considered. *(Author's summary)* C00 B00

See also 0005 0006 0007 0017 0062 0068 0073 0087 0089 0090 0091 0097 0113 0114 0117 0139 0158 0171 0219 0293 0330 0371 0591

C01 Plant Nutrition

0049

14205 KOONTZ, H.V. and BERLE, K.L. **Silver uptake, distribution, and effect on calcium, phosphorus, and sulfur uptake.** Plant Physiology 65:336-339. 1980. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. Plant physiological disorders. Mineral deficiencies. Tracers. Plant anatomy. Ca. P. S. Nutrient absorption. USA.**

Bean, maize, and tomato plants were grown in a nutrient solution labeled with ^{32}P, ^{45}Ca, or ^{35}S and varying concn. of $AgNO_3$. Following a 6-h treatment period, plants were harvested and analyzed. A low Ag^+ concn. (50 n*M*) inhibited the shoot uptake of the ions investigated. In the roots, Ca uptake increased whereas P and S uptake decreased. Autoradiograms of bean and maize plants, using ^{110m}Ag, showed that Ag^+ was uniformly deposited in the bean shoot, but maize shoots had regions of high activity along the leaf margins and at the tips where guttation had occurred. Roots were heavily labeled and shoots (especially the new growth) continued to accumulate Ag^+ even after the intact plant was returned to Ag-free solution. Ag was believed to be phloem-mobile since it was exported from a treated leaf. Bean plants removed ½ the Ag^+ from 4 *l* of nutrient solution containing 50 n*M* $AgNO_3$ within 1.5 h, but took 16 h for 20 *l* of solution. *(Author's summary)* C01

0050

14226 GERBER, J.M. **The relationship between boron soil test results and boron uptake by bean plants.** Communications in Soil Science and Plant Analysis 11(5): 525-532. 1980. Engl., Sum. Engl., 10 Refs.

Phaseolus vulgaris. **Plant physiological disorders. B. Soil requirements. Plant injuries. Toxicity. USA.**

B-sensitive crops, kidney beans and soybeans, were grown in pots containing soil collected from a beet field and a nearby pasture. Two soil extraction procedures were used to measure B concn. in the soils. Dilute acid was used to extract what is believed to be readily available B. A modified-Soxhlet apparatus, which employed continuous leaching with hot water, measured what is believed to be slowly available B. Plant B status was determined by analyzing the above ground portion of the plants grown in 2 soils. The amount of B in the plant tops provides an indication of biologically available B. Although kidney beans and soybeans extracted more B from the beet soil, both soil extraction procedures indicated that the concn. of B was higher in the pasture soil. Neither extraction procedure proved reliable in predicting plant response. *(Author's summary)* C01

0051

14217 WALLACE, A. **Excess trace metal effects on calcium distribution in plants.** Communications in Soil Science and Plant Analysis 10(1/2):473-479. 1979. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Plant nutrition. Plant physiological disorders. Micronutrients. Mineral deficiencies. Ca.**

One of the most important roles of Ca in plants is that of protecting against toxicities of trace metals. Even though this is a function of Ca, at least some of the trace metals in excess do inhibit uptake and/or translocation of Ca. Mn, when supplied at a very high level to bush bean cv. Improved Tendergreen in solution culture, decreased the Ca concn. in leaves, stems, and roots. The inhibition was pronounced for 10^{-3} and 10^{-2} *M* Mn. The decrease for the latter was 76% for leaves, 61% for stems, and 49% for roots. Mo at 10^{-3} *M* decreased bush bean leaf, stem, and root concn. of Ca by 38%, 24%, and 16%, resp. Vanadate at 10^{-5} *M* decreased bush bean concn. of Ca in leaves, stems, and roots by 37%, 50%, and 11%, resp. Ag at 10^{-5} *M* decreased Ca in leaves by 67%. Cd at 10^{-4} *M* decreased leaf, stem, and root Ca by 76%, 28%, and 61%, resp. Li at 50 ppm in soil decreased yields of bush beans by 75%, but had no effect on Ca in the shoots. In soil, 500 ppm Li decreased shoot yield of barley cv. Atlas 57 by 66% and Ca concn. by 72%. Ni (2×10^{-5} *M*) decreased Ca concn. in bush bean leaves by 45% at 10^{-4} *M* Ca, 42% at 10^{-3} *M* Ca, and 33% at 10^{-2} *M* Ca. In roots the reductions were 35, 43 and 44%, resp. Decreased uptake of Ca caused by excess trace metals could increase their phytotoxicity. *(Author's summary)* C01

0052

14288 WALLACE, A., MUELLER, R.T. and WOOD, R.A. **Selenate toxicity effects on bush beans grown in solution culture.** Journal of Plant Nutrition 2(1/2): 107-109. 1980. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Micronutrients. Toxicity. Etiology. Leaves. Nutrient transport. Nutrient absorption. P. Ca. Laboratory experiments. Plant nutrition.**

Bush beans (cv. Improved Tendergreen) were grown in solution culture with 0, 10^{-5}, 10^{-4}, and 10^{-3} *M* levels of Na_2SeO_3. Mild toxicity was obtained for 10^{-4} *M* and severe toxicity at 10^{-3} *M*. At severe toxicity, leaves were stunted and had brown spots. Se was fairly evenly distributed in plant parts. At severe toxicity, concn. in μg/g were leaves 901, stems 1058, and roots 1842. The high level of Se also decreased P, Ca, Mg, Mn and K concn. in leaves, and P and Ca in roots. Si and Ti tended to be higher with the highest Se level. *(Author's summary)* C01

0053

14284 PATEL, P.M., WALLACE, A. and ALEXANDER, G.V. **Transfer values to fruits of Li in tomato and Cd in bush beans.** Journal of Plant Nutrition 2(1/2):87-91. 1980. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Mineral content. Translocation. Cd. Leaves. Roots. Pods. Nutrient transport. Micronutrients.**

Different levels of Li (10^{-5}, 10^{-4}, 5×10^{-4}*M*) and Cd (2×10^{-6}, 10^{-5}, 10^{-4}*M*) were studied in solution culture in a glasshouse to evaluate the effects on growth and fruit transfer values in tomato cv. Marglobe and bush beans, cv. Improved Tendergreen. No effect on yield was observed for up to 10^{-4}*M* Li levels; after that yields were significantly decreased. The yield of bush beans was significantly reduced by the Cd levels added. The Li in solution culture significantly increased the Li concn. in tomato roots, leaves, and fruits. The Cd had an increasing effect on Cd concn. only in bush bean roots and a nonsignificant effect was observed in leaves and pods. Considerable amounts of Li were translocated to leaves and fruits while very little Cd was found in fruit pods. The exact amount was unknown due to limits of the method. *(Author's summary)* C01 C02

0054

14285 WALLACE, A. *et al.* **Influence of environmental stresses on response of bush bean plants to excess copper.** Journal of Plant Nutrition 2(1/2):39-49. 1980. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Micronutrients. Cu. Toxicity. Nutrient solution. Roots. Temperature. Mineral deficiencies. P. Laboratory experiments. Plant nutrition.**

Bush bean cv. Improved Tendergreen was grown in nutrient solutions in a glasshouse at low and at potentially toxic levels of Cu. These Cu treatments were interacted with other treatments to create various types of environmental stress. In an exploratory expt.,salinity (0.05*M* NaCl) and P deficiency stresses were observed to result in proportionately more plant toxicity with a high Cu level than with a low. These 2 factors were then further studied in additional expt. and the observations were verified. Levels of P and NaCl which resulted in no or little yield reduction with normal amounts of Cu resulted in proportionately large yield decreases at high levels of Cu. Stress resulting from no aeration of the nutrient solution was less harmful relatively at a high Cu level than at a low. Slightly increased root temp. was slightly more injurious at the high Cu level than at the low while severe shading was equally harmful of both Cu treatments. Synergistic effects were noted for salinity and P levels as they interacted with the Cu levels on growth of the plants. Mineral analyses do not explain these synergistic effects. *(Author's summary)* C01

0055

14286 WALLACE, A., ROMNEY, E.M. and ALEXANDER, G.V. **Zinc-cadmium interactions on the availability of each to bush bean plants grown in solution culture.** Journal of Plant Nutrition 2(1/2):51-54. 1980. Engl., Sum. Engl., 11 Refs.

Phaseolus vulgaris. **Nutrient solution. Zn. Cd. Leaves. Roots. Stems. pH. Toxicity.**

Bush bean plants (cv. Improved Tendergreen) were grown for 12 days in nutrient solutions in a factorial expt. involving 0 and $10^{-5}M$ $CdSO_4$, 0 and $10^{-4}M$ $ZnSO_4$, 2 solution pH values (4.5 and 7) and 0, $10^{-4}M$ EDTA and 10^{-4} *M* DTPA. There were then 24 treatments each with 4 replicates. Plants were separated to primary leaves, trifoliate leaves, stems and roots, washed in 0.1*M* HCl and deionized water, and assayed by emission spectrography. The low Zn level resulted in some Zn deficiencies particularly with chelating agents and at high solution pH. Although Cd tended to depress Zn uptake, Zn did not modify Cd toxicity without chelating agents. Cd was not strongly toxic in the presence of chelating agents at high solution pH even though there was some Cd accumulation in leaves with those treatments. High Zn tended to favor large root accumulation of Cd but only at the low solution pH. *(Author's summary)* C01

0056

14743 NAIDOO, G. **Aluminum toxicity in two snapbean varieties.** Ph.D. Thesis. Knoxville, The University of Tennessee, 1976. 110p. Engl., Sum. Engl., 81 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Al. Toxicity. Host-plant resistance. Plant development. Plant nutrition. Growth. Roots. Leaves. Plant tissues. Composition. P. K. Yields. Analysis. Electron microscopy.**

The mechanism of Al tolerance in plants was investigated in a series of greenhouse expt. which compared 2 var. of snap beans that were differentially tolerant to Al. The more tolerant Dade var. was compared to Romano with respect to growth, mineral nutrition, pH, total acidity, Al fixation by root macerates, organic acid content, morphological effects of Al, and to location of Al and P in roots. To compare the 2 var. with respect to growth and mineral nutrition, seedlings were grown in 1/5 strength Hoagland's nutrient solution (pH 4.8) at 0, 4, 8, and 12 ppm added Al for 10 days. The Al treatments reduced yields and the concn. of P and Mg in roots and tops of both var. In both var.,the Al treatments generally increased the K concn. in roots and tops. In the Romano var. Al decreased the Ca concn. in roots and tops. The Al-tolerant Dade var. had a significantly higher root wt. than Romano at 12 ppm added Al. Comparison of the pH, titratable acidity, Al-fixing capacity of root

macerates and citric and malic acid concn. revealed no major differences between var. Plants of both var. treated for 12 days at 20 ppm Al at pH 4.6 exhibited typical symptoms of Al toxicity. These included upward curling of roots; root discoloration; significant reductions in root and top growth; inhibition of lateral root growth; abnormally dark green leaves and gelatinous root tips. The Romano var. also showed purple coloration of stems and petioles. Anatomical changes induced by Al included swelling of root tips; curling backward and detachment of root caps; disorganization of cells in the root cap and meristem and loss of cell contents of root cap cells. The relative degree of Al injury was greater in the susceptible Romano var. Elemental distribution in Dade and Romano snap bean roots, treated for 12 days with 20 ppm added Al, was determined by staining with Mo and by energy dispersive analysis for X-rays generated in the scanning electron microscope. The results of both techniques revealed that young meristematic tissues of the root tip are the sites of Al action. The location of Al was identical to that for P, suggesting the precipitation of P by Al. High concn. of Al and P were found on the root surface and within the root cap. There was no relationship between the distribution of Al and that of Ca, Mg and K. Al was located in cell walls, cell contents and in nuclei of root cap and meristematic cells. It is suggested that Al disrupts the cell division process in the nucleus. The ability to maintain adequate levels of P in tops, and the capacity to exclude a major part of the Al from sensitive root tissues by regeneration of root cap cells probably account for the greater tolerance of the Dade var. to Al. *(Author's summary)* C01 C02

0057

14746 LINDEN, C.T.G. The mist culture system in the study of growth in lettuce and beans at low salt concentrations. Ph.D. Thesis. Ithaca, N Y. Cornell University, 1977. 109p. Engl., Sum. Engl., 84 Refs., Illus.

Phaseolus vulgaris. Cultivation systems. Nutrient solution. Osmotic potential. Plant development. Growth. Roots. Laboratory experiments. CO_2. O. Nutrient absorption.

Mist culture is defined and development of the method is reviewed. A mist culture system used at Cornell University (USA) is described in detail. The system was used to study growth of lettuce and dry beans at 4 different osmotic potentials of the nutrient solution. In hydroponic cultivation relatively low osmotic potentials, -0.75 atm. and often lower, are used. Through infrequent application of the nutrient solution, the osmotic potentials of the solution in direct contact with the root surfaces may decrease below these values. The purpose of this study was to examine whether relatively high osmotic potentials of a nutrient solution would promote better plant growth, particularly of roots. The mist culture system permits the isolation of the influence of osmotic potential from other factors associated with growth in conventional hydroponic media, and a constant osmotic potential at the root surface can be maintained by frequent misting of the roots, the use of a large solution vol./plant and frequent changes of the nutrient solution. Plants were grown under mist culture for about 30 days at 4 different osmotic potentials of the nutrient solution, -0.25, -0.50, -0.75, and -1.00 atm., with 2 expt. on lettuce and 2 on dry beans. Growth in all mist treatments was superior to that of controls in peat mix. It was found that neither max. growth nor water uptake necessarily followed simple osmotic gradients. Thus max. fresh and dry wt. of roots occurred at -0.50 atm. in both species. Max. top growth in beans also occurred at -0.50 atm., while that in lettuce occurred at a lower osmotic potential than for roots, -0.75 atm. However, max. root length in beans occurred at a higher osmotic potential than max. root fresh or dry wt., -0.25 atm. In all treatments lowest fresh and dry wt. of both tops and roots occurred at the lowest osmotic potential, -1.00 atm. While water uptake/g dry wt. in beans showed little variation with osmotic potential of the nutrient solution, min. water uptake/g dry wt. in lettuce corresponded with max. plant dry or fresh wt. (top and root). Max. water uptake corresponded with the highest and lowest osmotic potentials, -0.25 and -1.00 atm. resp., where growth was reduced. The results confirmed that improved plant growth, particularly of roots, could be obtained with nutrient solutions of higher osmotic potentials. Actual values in practice would depend on irrigation frequency and other factors. The results also indicate that more direct attention to the root system as an important factor contributing to survival and yield should become part of future

agricultural research in general and in plant breeding in particular. The mist system offers good possibilities for investigating root development through a more exactly controlled root environment. Of particular interest was its flexibility, and the possibility of isolating specific problems, such as nutrient absorption, water uptake, gas exchange for example, from the influences of other factors. Properly applied, it could open the way to a new understanding of plant growth and root-shoot interactions. *(Summary by Dissertation Abstracts International)* C01 C02 D03

0058

14732 CHANG, G.T. **The effect of zinc nutrition on mitotic frequency and DNA metabolism in the root tips of the Sanilac navy bean plants** *(Phaseolus vulgaris* **L.).** Ph.D. Thesis, Toledo, Ohio, The University of Toledo, 1976. 110p. Engl., Sum. Engl., 115 Refs., Illus.

Phaseolus vulgaris. **Nutrient absorption. Plant nutrition. Zn. Cell division. Genes. DNA. Roots. Statistical analysis.**

The effect of Zn nutrition on mitotic frequency and DNA metabolism was examined in the root tips of navy bean plants cv. Sanilac. These plants were grown in a modified Hoagland solution in growth chambers. The chamber was set for a 16 h light period at 2,000 ft-ca. (28°C) and and 8 h dark period (20°C). On the 7th day the seedlings were transferred to aerated nutrient solution. After 4 days in the nutrient solution containing various amounts of Zn as $ZnSO_4$, the root tips (approx. 2-4 mm) were excised for the expt. The various parameters examined in this research were (a) mitotic frequency, (b) DNA content/mg fresh wt., (c) ^{3}H-thymidine uptake, (d) DNA synthesis, and (e) deoxyribonuclease (DNase) activity. The root tips were fixed in a mixture of formalin, glacial acetic acid and 70% ethanol (1:1:18). After paraffin-embedding, sectioning and staining, the whole area of each longitudinal median section which was within 2100 μm of root cap was scanned for a total mitotic frequency. The mitotic frequency was 1.8, 16, 28, and 1.3 within 2100 μm of the root tip for 0.03, 0.3, 3 and 30μM Zn, resp. (an av. of 8-14 roots). Based on growth rate, a concn. of 3 μM Zn represents an optimal concn. for normal growth and development. When the Zn deficient plants (grown at 0.03 μM Zn) were allowed to recover in the solution containing 3 μM Zn, the mitotic frequency rose to a normal level of 25. As Zn concn. increased from 0.03 to 3 μM, the zone of cell division appeared to extend. Also, the effect of Zn nutrition on mitotic frequency in roots paralleled that of the shoot and root growth as measured by fresh and dry wt. The DNA content was measured by a modified diphenylamine reaction. The ^{3}H-thymidine uptake was determined by counting the radioactivity retained in the root tips after washing with a nonradioactive thymidine solution. The DNA synthesis was determined by measuring the incorporation of ^{3}H-thymidine into the DNA fraction. The DNA synthesis thus measured was sensitive to hydroxyurea, mitomycin C and fluorodeoxyuridine. The acidic DNase was assayed by the spectrophotometric determination of nucleotides which were released from denatured salmon DNA (type III) The total DNA/mg fresh wt. uptake of ^{3}H-thymidine and its subsequent incorporation into DNA fraction all had peak values at a Zn concn. of 3 μM at which mitotic frequency was highest. Thus, the results suggest that the Zn-mediated stimulation of mitosis may result from increased DNA synthesis. ^{3}H-thymidine uptake was much less affected by Zn deficiency than the incorporation of ^{3}H-thymidine into DNA fraction was. At the same time, the activity of DNase was low during Zn deficiency. It is therefore proposed that Zn regulates mitosis primarily through DNA synthesis. An autoradiographic study is also presented which shows the localization of absorbed ^{3}H-thymidine in the nuclei and reveals higher counts of silver grains in the nuclei at 3 than at 0.03 μM Zn. *(Author's summary)* C01

0059

14707 CHRISTIANSON, M.L. **Zinc sensitivity in** *Phaseolus:* **expression in cell culture.** Environmental and Experimental Botany 19(3):217-221. 1979. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. **Plant nutrition. Micronutrients. Zn. Mineral deficiencies. Host-plant resistance. Cultivars. Tissue culture. Epicotyl. Culture media. Growth. Photosynthesis. Metabolism. Plant physiological processes.**

A significant intercultivar difference exists for growth over levels of Zn in whole plants of *Phaseolus vulgaris* cv. Sanilac and Saginaw, but not for epicotyl-derived dark-grown callus cultures. The partially differentiated states obtained under various callus cultural regimes are seen to dissect metabolism, resulting in the assignment of genetic lesions to a certain part of metabolism. In this case, Zn sensitivity is assigned to a step in photosynthesis, some related metabolism, or a shoot-specific isozyme. Variance in growth of callus cultures was partitioned. Analysis of variance shows the importance of exptl. design for the detection of significant differences and identifies parameters governing growth of cells in culture heretofore not quantitatively investigated. *(Author's summary)* C01 C02

0060

14308 PECK, N.H. *et al.* **Nutritional quality of vegetable crops as affected by phosphorus and zinc fertilizers.** Agronomy Journal 72(3):528-534. 1980. Engl., Sum. Engl., 40 Refs., Illus.

Phaseolus vulgaris. **Nutritive value. Composition. Fertilizers. P. Zn. pH. Yields. Harvesting. Analysis. Micronutrients. Plant toxins.**

The nutritional quality as well as the yield of the portions of vegetable plants used for human consumption should be considered in fertilization programs. The effects of rates of concd. superphosphate and Zn sources on some nutritionally important factors were studied including the concn. of P, Zn, phytic acid, and oxalic acid in the edible portions of 4 vegetables. The plants, pea, snap bean, cabbage, and table beet were grown on a Honeoye fine sandy loam derived from calcareous glacial till. These crops were fertilized with concd. superphosphate (CSP) at rates of 0, 30, 60, and 120 kg P/ha, and $ZnSO_4$ or $ZnCl_2$ at rates of 0, 5, 20, and 80 kg Zn/ha applied in a band at planting time in a factorially designed expt. The plants were sampled at processing stage except that pea and snap bean seeds were also sampled at full maturity. Increasing fertilizer CSP rates increased yields and P concn. in all crops. Fertilizer CSP increased phytic acid concn. in immature and mature pea seeds and in mature snap bean seeds. Oxalic acid concn. in table beet plants decreased with increasing rates of CSP fertilizer. Fertilizer CSP without Zn fertilizer decreased Zn concn. in the plants, but CSP with Zn fertilizer generally increased Zn concn. Fertilizer Zn did not affect yields nor cause visible plant toxicities. However, Zn fertilizer increased Zn concn. in the plants, especially when applied with high rates of CSP fertilizer. Thus, CSP fertilization without Zn fertilization of vegetable crops can reduce their nutritional quality by lowering their Zn concn. However, the concomitant use of Zn fertilizer, with high rates of CSP fertilization, can improve the nutritional quality of vegetable crops with respect to Zn. *(Author's summary)* C01 D01 H01

0061

14216 MULLETT, J.H. and CONSIDINE, J.A. **Potassium release and uptake in germinating legume seeds in relation to seed condition and germination environment.** Journal of Experimental Botany 31 (120):151-162. 1980. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Nutrient absorption. K. Seed. Seed characters. Composition. Cytology. Plant-physiological processes. Laboratory experiments. Germination. Temperature. Plant injuries.**

The levels of K^+ and total electrolyte leakage into leaching solution from imbibed seeds of *Pisum sativum* and *Phaseolus vulgaris* have been followed to determine the relationship of K^+ loss to the level of total electrolyte loss, and its relation to the physiological condition of the seed. The extent and rate of loss of both K^+ and total electrolytes varied with both seed

condition and the conditions imposed by the expt. K^+ accounted for between 25 and 50% of the total electrolyte leakage. The relationship was at all times significantly correlated, but changed with time and with exptl. conditions. The effect of immersion, which increased electrolyte leakage due to soaking injury, masked differences in seeds of varying field performance. Imbibition at either 5°C or 40°C before leaching was shown to increase both K^+ and total electrolyte loss in comparison to seeds imbibed at 25°C. These results suggest that the conductivity test, which is used as a measure of seed deterioration, may need to be re-examined in terms of exptl. procedure and interpretation. *(Author's summary)* C01 C03

0062

14253 JOOSTE, J.H. and BRUYN, J.A. DE **Desorption of absorbed iron in bean root and leaf tissues.** Journal of South African Botany 45(3):249-256. 1979. Engl., Sum. Engl., Afr., 9 Refs.

Phaseolus vulgaris. **Nutrient absorption. Plant physiological processes. Plant tissues. Leaves. Roots. Cell walls. Ca. Fe.**

The effect of different desorption media on the amount of absorbed Fe (from a solution of $FeCl_3$ in 0.5 m*M* $CaCl_2$) retained by leaf discs and excised root tips of bean plants was investigated. Attempts were also made to determine the effect of desorption on the intracellular distribution of Fe. Desorption in water or an $FeCl_3$ solution had no pronounced effect on the amount of absorbed Fe retained by either the leaf or root tissues. However, Na_2-EDTA was able to desorb a considerable portion of the absorbed Fe, especially in root tissue. This applies to Fe absorbed from solutions of $FeCl_3$ and Fe-EDDHA. Desorption by the chelate removed Fe from practically all the different particulate fractions of both root and leaf tissues, but desorption following the longer absorption periods resulted in an increase in the Fe content of the "soluble" fraction. The possibility that Na_2-EDTA causes an increased permeability of cell membranes seems likely. The view that removal of Ca by the chelate causes this increase in permeability could not be confirmed. *(Author's summary)* C01 C00 B00

0063

14355 ROBB, J., BUSCH, L. and RAUSER, W.E. **Zinc toxicity and xylem vessel wall alterations in white beans.** Annals of Botany 46(1):43-50. 1980. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Zn. Toxicity. Plant vascular system. Cell walls. Electron microscopy. Cell structure.**

When white beans are exposed to excess Zn, reddish brown patches appear along the leaf veins. Ultrastructural observations of the xylem vessels in the discoloured zones show several modifications of the vessel walls including gelation of the pit membranes, coating of the lumen surface with an abnormal layer and deposition of electron-dense material in the secondary vessel walls. Histochemical studies indicate that the altered pit membranes and the coating layer stain positively for lipid, while the secondary wall deposits stain positively for phenolic compounds. *(Author's summary)* C01 B00

0064

14297 WALLACE, A. and MUELLER, R.T. **Effect of steam sterilization of soil on trace metal toxicity in bush beans.** Journal of Plant Nutrition 2(1/2):123-126. 1980. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris. **Plant nutrition. Micronutrients. Soil temperature. Nutrient absorption.**

Bush beans (cv. Improved Tendergreen) were grown in steam sterilized soils and in control soils with and without added Ni, Cd, and Cu. The objective was to determine if steam steri-

lization had interaction with the availability of trace metals to plants. The increased availability of Mn and possibly Cu to plants following sterilization depressed uptake of at least Ni and resulted in yield improvement. Steam sterilization increased Mo uptake by plants. *(Author's summary)* C01

0065

14291 WALLACE, A. and MUELLER, R.T. **Effect of iron level on trace metal stress in bush bean plants grown in solution culture.** Journal of Plant Nutrition 2 (1/2):99-102. 1980. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Nutrient absorption. Fe. Micronutrients. Dwarf beans. Nutrient solution. Mineral deficiencies. Leaves.**

Bush bean cv. Improved Tendergreen was grown in nutrient solutions with levels of Cu, Zn, Ni, Cd, Co, and Mn at or near the stress point and with a high and a low level of Fe supplied as the chelate Fe EDDHA. No Fe deficiency was present on the control plants at the low Fe level. Cu resulted in severe stress at low Fe and none at high Fe. Zn resulted in severe stress at the low Fe level and in considerable stress at the high Fe level. Ni resulted in a slight stress at the low Fe level and in no stress at the high Fe level. Cd resulted in severe stress at both Fe levels. Co resulted in severe stress at low Fe and in moderate stress at the high Fe level. Mn resulted in considerable stress at the low Fe level and in no stress at the high Fe level. Thus no 2 metals behaved similarly at the levels used. Cu, Zn, Cd, and Co resulted in low Fe concn. in trifoliate leaves on plants supplied low Fe but only Cd resulted in low Fe concn. in plants grown with high Fe. These results with Fe were also quite similar for primary leaves. The high Fe level suppressed Ni, Cd, Cu, and Mn concn. in leaves but not those of Co and Zn. Mn was the only element in excess which accumulated in primary leaves to a large extent. Trace metals often decreased Ca levels in leaves which resulted in some increase in K. *(Author's summary)* C01

0066

14214 LEA, P.J., HUGHES, J.S. and MIFLIN, B.J. **Glutamine- and asparagine-dependent protein synthesis in maturing legume cotyledons cultured in vitro.** Journal of Experimental Botany 30(116):529-537. 1979. Engl., Sum. Engl., 30 Refs., Illus.

Phaseolus vulgaris. **Amino acids. Protein content. Cotyledons. Tissue culture. Plant nutrition. N.**

Legume cotyledons have been grown in sterile culture and shown to synthesize up to 16 mg protein in 5 days when supplied with either asparagine or glutamine as sole N sources. Glutamate, nitrate,and ureides also served as N sources for protein synthesis but to a lesser extent. Met. sulphoximine and azaserine inhibited asparagine-dependent protein synthesis suggesting that ammonia is liberated from asparagine which is reassimilated via glutamine synthetase and glutamate synthase. *(Author's summary)* C01

0067

14258 JOOSTE, J.H. **Comparison of iron uptake by bean root and leaf tissues.** Journal of South African Botany 45(3):257-261. 1979. Engl., Sum. Engl., Afr., 9 Refs.

Phaseolus vulgaris. **Nutrient transport. Leaves. Roots. Fe. Plant physiological processes. Cytology. Plant tissues.**

An explanation was sought for the observed difference in uptake between root and leaf tissues of the bean plant (higher uptake by root tips than by leaf disks in spite of a similar pattern of uptake by the 2 tissues). Although leaf slices absorbed more Fe than leaf

disks, the absorption was still considerably lower than by root tips. Fe absorption by enzymically isolated root and leaf cells also reflected the observed difference in uptake between root and leaf tissues. It appeared unlikely that the lower Fe uptake by leaf disks compared with that by root tips was related to structural aspects of the tissues. *(Summary by Field Crop Abstracts)* C01 B00

0068

14290 WALLACE, A. and ROMNEY, E.M. **Interactions of nitrogen sources and excess nickel on bush beans.** Journal of Plant Nutrition 2(1/2):75-78. 1980. Engl., Sum. Engl., 3 Refs.

Phaseolus vulgaris. **Micronutrients. Toxicity. Nutrient solution. N. Leaves. Roots. Plant development. Plant nutrition.**

Bush bean cv. Improved Tendergreen plants were grown in a glasshouse in 3700 ml of nutrient solution for 15 days with 3 N sources and different levels of $NiSO_4$. All NH_4^+ and urea treatments received $CaCO_3$ (10 g/3700 ml) in the nutrient solution to protect against excess acidity. In general, plants receiving the NH_4^+ source of N had less growth than those receiving urea or NO_3^- and 5 x 10^{-4} *M* Ni treatments greatly inhibited growth. There was, however, no indication of interactions of N source and Ni on yield. Plant receiving NH_4^+ and urea had higher Ni concn. than NO_3^- plants. Ni resulted in decreased Fe in trifoliate leaves but not in primary leaves and the reverse occurred in roots. There was no interaction of Ni and Fe in roots but there was a Mn-Ni-N-source interaction in roots. *(Author's summary)* C01 C00

0069

14295 WALLACE, A. **Effect of excess chelating agent on micronutrient concentrations in bush beans grown in solution culture.** Journal of Plant Nutrition 2(1/2): 163-170. 1980. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Micronutrients. Nutrient solution. Fe. Plant anatomy. Leaves. Roots. Stems. Ca. pH. Laboratory experiments.**

Bush bean plants (cv. Improved Tendergreen) were grown for 18 days in 3700 ml nutrient solutions in a glasshouse in the presence of 2 x 10^{-5}*M* $NiSO_4$, at 2 different pH levels (4.3 and 7.5) and at 0, 10^{-4}, 5 x 10^{-4} and 10^{-3}*M* NaDTPA (diethylene triamine penta-acetic acid). The objective was to determine which micronutrients were changed in uptake by DTPA. Fe in leaves was increased slightly by 10^{-4}*M* DTPA (2 x 10^{-5}*M* FeEDDHA was applied in all treatments) but decreased slightly by the highest levels of DTPA. Ni accumulation was absent in all plant parts as result of DTPA contrary to the effect observed in soil. The 2 highest levels of DTPA decreased plant yields which was probably the result of Cu deficiency at the low pH and Zn, Cu, and Mn deficiencies at the high pH (no Zn and Cu added to the solutions except as contaminants). Mo in plant parts was decreased by DTPA at the low pH. In a similar expt. with EDTA and EDDHA (10^{-4} and 5 x 10^{-4}*M* each) but with no Ni added and with plants grown for 17 days, yields were decreased by the high level of EDTA with leaf decreases in Fe and Cu and also in Zn to a slight extent. The highest level of EDDHA had relatively little effect. *(Author's summary)* C01

0070

14245 JOOSTE, J.H. and BRUYN, J.A. DE **The dual mechanism of iron absorption in bean root and leaf tissues.** Journal of South African Botany 45(3):243-248. 1979. Engl., Sum. Engl., Afr., 8 Refs., Illus.

Phaseolus vulgaris. **Nutrient absorption. Fe. Leaves. Roots. Plant tissues. Nutrient solution. Plant physiology.**

The possible existence of a dual pattern of Fe uptake in root and leaf tissues of bean plants was investigated employing a modification of the tea-bag technique. Experimental solutions, consisting of $FeCl_3$ in 0.5 m*M* $CaCl_2$ solution, varied from 0.01-0.5 m*M* in the low range and from 1.0-30.0 m*M* in the high range. Absorbed Fe was determined by means of atomic absorption spectroscopy and radiometric analysis. The Fe uptake curves for both root and leaf tissues displayed a hyperbolic rise followed by a plateau in the low conen. range, and an exponential increase in the high conen. range. The possibility exists that Fe in the high conen. range is precipitated in the tissues. *(Author's summary)* C01

0071

14241 AKIL, B.A. Metabolic factors associated with cotyledonal cracking in *Phaseolus* seed. Tecnologia de Sementes 2(2):45-53. 1979. Engl., Sum. Engl., Port., 10 Refs., Illus.

Phaseolus vulgaris. Cotyledon cracking. Plant physiological disorders. Auxins. Plant-growth substances. Nutritional requirements. Seed production. Germination. USA.

Comparison of 8 snap bean cv. indicated that cv. Earliwax and Kinghorn wax were highly resistant to cotyledonal cracking. Cv. showing a larger no. of cracks/cotyledon were more permeable to water and gave a higher rate of ethylene production during the 1st 24 h of germination. Resistant cv. emerged better in the greenhouse and their respiration was rather high during early germination. Hard seeds were encountered in a larger no. in the resistant cv., although a field environment could modify this incidence drastically. When growth regulators and nutrients were applied to the bean crop, cotyledonal cracking of the resulting seed was modified. It could be concluded, therefore, that cotyledonal cracking could be minimized in already resistant cv. by appropriate growth regulator or nutrient treatment. *(Author's summary)* C01 C02

0072

14293 WALLACE, A. and ROMNEY, E.M. Effect of chelating agents on movement of trace metals into cut stems of bush bean plants. Journal of Plant Nutrition 2(1/2):187-188. 1980. Engl., Sum. Engl., 3 Refs.

Phaseolus vulgaris. Plant nutrition. Nutrient transport. Leaves. Stems. Micronutrients.

The ability of the chelating agents EDTA and DTPA (diethylene triamine pentaacetic acid) to facilitate transport from nutrient solutions at pH 5 of trace metals to leaves of bush bean plants cv. Improved Tendergreen through cut stems was measured. Both chelating agents resulted in increased transfer of Cu, Co,and Ni to primary leaves and in Cu, Co, Ni to a lesser extent, to trifoliate leaves. K in leaves decreased as result of the cutting. *(Author's summary)* C01 C03

0073

14289 WALLACE, A. and MUELLER, R.T. Recovery from acute silver toxicity by bush beans grown in solution culture. Journal of Plant Nutrition 2(1/2):93-95. 1980. Engl., Sum. Engl., 1 Ref.

Phaseolus vulgaris. Plant nutrition. Mieronutrients. Toxicity. Nutrient solution. Plant development. Roots.

Bush bean plants (cv. Improved Tendergreen) that had been severely damaged by the application of Ag nitrate to nutrient solution, recovered at least partially after the Ag had been removed from the nutrient solution. A transition period of ca. 2 wk was necessary before plants grew normally. Ag, which usually accumulates in roots rather than in shoots, was detectable in slight amounts in stems of recovered plants and remained in or on roots even when no longer toxic. *(Author's summary)* C01 C00

0074

14794 KATHIRGAMARAJAH, S. **Relationship between transpiration and the uptake of sodium and chloride in *Zea mays* L. and *Helianthus annuus* L.** Ph.D. Thesis. Davis, University of California, 1978. 194p. Engl., Sum. Engl., 136 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Growth-chamber experiments. Transpiration. Nutrient absorption. Na. Cl. Nutrient transport. Plant tissues. Analysis. Statistical analysis.**

The equation for describing coupled solute and water flow across roots, was tested with intact plants (*Zea mays, Helianthus annuus, Hordeum vulgare,* and *Phaseolus vulgaris*). Using relevant equations of the model, an expression relating the internal concn. (Ci) of an ion in the xylem solution to the external concn. was derived. A study was conducted in growth chambers to test the model with the view of ascertaining the relationship between transpiration and the uptake of Na and Cl ions. The range of external Na and Cl concn. (C_O) employed was between 2-80 x 10^{-6} (moles/cm^3) Expt. were all conducted in solution culture, utilizing a half-strength Hoagland solution no. 2. During all expt. plants were maintained in continuous light except in one expt. The results showed that in all 4 species, a linear relationship is evident between the Ci and external Na concn. In the case of maize and red kidney beans the presence of negative intercepts indicates that Na transport across roots of these plants is fully passive. The relationship between chloride C_i and C_O is of parabolic nature. This type of relationship is curvilinear in the low range of C_O and becomes linear at high C_O. By extrapolating the linear region to the ordinate an intercept is always present in the 4 species. The intercepts for maize and barley are greater than those for sunflower and beans. *(Extracted from author's summary)* C01

0075

15424 THOMAS, R.J., FELLER, U. and ERISMANN, K.H. **Ureide metabolism in non-nodulated *Phaseolus vulgaris* L.** Journal of Experimental Botany 31(121):409-417. 1980. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **N. Metabolism. Nutrient solution. Nutritional requirements. Flowering. Podding. Enzymes. Inhibitors. Plant anatomy.**

The distribution of ureide-N was studied throughout vegetative and reproductive growth of non-nodulated bush bean grown in nitrate nutrient solution. Largest increases in ureide-N/plant were correlated with flowering and early pod formation and with seed filling. Highest amounts of ureides/organ were measured in stems and axillary trifoliates. Highest concn. (μmol ureide-N/g fresh wt.) were measured in young developing organs and stems. Seeds did not accumulate ureides until the ureide content of pods had reached a max. Results obtained using the inhibitor of xanthine oxidase, allopurinol, are consistent with the origin of ureides via purine degradation but alternative pathways cannot be discounted. Leaves and stems were shown to have the ability to degrade allantoate via an enzymic process. *(Author's summary)* C01

0076

14792 SAAD, R. **Effect of atmospheric carbon-dioxide levels on nitrogen uptake and metabolism in red kidney beans (*Phaseolus vulgaris* L.) under salt stress.** Ph.D. Thesis. Tucson, University of Arizona, 1979. 119p. Engl., Sum. Engl., 136 Refs., Illus.

Phaseolus vulgaris. **Salinity. Nutrient solution. Tracers. N. Plant nutrition. Nutrient absorption. Metabolism. Protein content. Amino acids. Growth-chamber experiments. CO_2. Dry matter.**

The absorption patterns of NH_4 and NO_3 by salt sensitive red kidney bean plants from normal and NaCl salinized Hoagland solutions were investigated at 350 (ambient), 600, 900, and 1200 ppm aerial CO_2 concn. by use of inverse isotopic dilution techniques with

$(^{15}NH_4)_2SO_4$ and $K^{15}NO_3$. Salt stress inhibited NH_4 and NO_3 absorption by bean plants. Increased absorption of both N sources occurred with CO_2 enrichment, but NH_4 absorption was more beneficially influenced than was NO_3. Max. uptake of NH_4 and NO_3 by control plants occurred at 900 ppm CO_2. In the salt-stressed plants the 900 ppm level was the most beneficial to NO_3 uptake, while NH_4 uptake benefited equally from 600, 900, and 1200 ppm. For the NH_4N source, the plants absorbed as much N under salinity and CO_2 enrichment in 84 h as control plants under ambient CO_2. However, with NO_3N as the source, the plants only absorbed about one-third as much N as control plants. Dry matter production, under salinity, was enhanced by CO_2 enrichment with both N sources. Atmospheric CO_2 enrichment (900 and 1200 ppm) increased dry wt.production in salt-stressed plants to equal dry wt.production in control plants at 350 ppm. Excess of salt in the nutrient solution inhibited protein synthesis. *(Summary by Fertilizer Abstracts)* C01

0077

15806 ROBB, J. Early cytological effects of zinc toxicity in white bean leaves. Annals of Botany 47:829-834. 1981. Engl., 16 Refs., Illus.

Phaseolus vulgaris. Zn. Nutrient absorption. Nutrient solution. Toxicity. Leaves. Cell structure. Electron microscopy.

White beans were grown in hydroponic culture. Ten-day-old seedlings were exposed to excess Zn by replacing the nutrient solution with a fresh solution containing 200 *M* zinc sulfate during 24 and 48 h. Samples of leaf tissues were taken from different discolored regions and these were treated and processed for electron microscopy. Changes observed included, among others, a decrease in plastid starch, an increase in the no. and size of plastoglobuli, alterations in chloroplast shape, disruption of chloroplast grana and the thylakoid system, disruption of mitochondrial membranes, and deposition of electron-opaque material in association with various membrane systems. In plants treated for 24 h, there was a marked increase in the extent of the rough endoplasmic reticulum within the leaf mesophyll cells as well as an increase in the size and no. of starch grains/plastid. The 1st changes appear in the phloem parenchyma of the major lateral leaf veins adjacent to the pulvinus. By 48 h the tissue can be described as necrotic. Data presented indicate that Zn phytotoxicity does not interfere with carbohydrate metabolism. However, excess Zn induced a wound response within the vascular parenchyma cells of the leaf. *(Summary by C.P.G. Trans. by L.M.F.)* C01 C02

0078

6245 KHAI, F.S. and PLESHKOV, B.P. Change in the composition of protein of bean seeds as a function of the conditions of nutrition. Doklady Botanical Science 160/162:82-85. 1965. Engl., 15 Refs.

Phaseolus vulgaris. Seeds. Protein content. Amino acids. P. K. Nutritional requirements. Nutrient solution. Seed production. Yields. Laboratory experiments.

Expt. were conducted to determine the influence of the conditions of P and K nutrition on amino acid composition of total seed proteins and the composition of individual protein fractions. Var. Saksa beans were grown in water cultures of Knop's complete nutrient mixture (NPK variation) and on mixtures with a 0.1 dose of P during the vegetation period (NK variation) or a 0.1 dose of K (NP variation) in comparison with the contents of those elements in Knop's mixture. Proteins were extracted by repeated treatments of the flour obtained with a 0.2 *M* borate buffer (pH 10.0) with an addition of 0.2% sodium bisulfite. Individual protein fractions were isolated by successive extractions on the flour with water, with 1 *M* KCl, with 75% ethanol, and with a buffer; successive precipitations and purifications were conducted. Amino acid composition of protein hydrolyzates was determined by paper chromatography; amides, according to the Conway method; proline, according to the Chinard method; and trytophan, according to Spies and Chambers. P and specially K

deficiencies produced a substantial reduction of the content of proteins extractable by water, and a corresponding increase in the content of proteins soluble in NaCl, which causes a deterioration of the assimilability of seed proteins. Protein composition is practically independent of nutrition conditions of the plant. *(Summary by I.B. Trans. by L.M.F.)* C01 C03 H01

0079

16078 LUCAS, E.O. and MILBOURN, G.M. The role of pre-anthesis assimilate in the seed development of *Phaseolus vulgaris*. Journal of Nuclear Agriculture and Biology 8(3):81-84. 1979. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Plant assimilation. Flowering. Seed production. Seed. Growth. Yields. Sugars. Tracers. Leaves. Stems. Pods.

In a field trial with bean cv. Purley King, either the topmost or the lowest trifoliate leaves were supplied with $^{14}CO_2$ for 1 h just before flowering and the plants were harvested after 2, 26, or 56 days. At the 1st harvest ^{14}C activity was much the highest in the fed leaf. By the last harvest (seed maturity) however, ^{14}C activity in the fed leaf had declined and was marked in the seeds of the pod subtended by the fed leaf. Assimilates translocated from the leaf to the stem comprised mainly sucrose, with lesser amounts of fructose and glucose, but of these little remained by the last harvest. It is suggested that the stem internode immediately below the fed leaf served as a storage site for some of the assimilates produced before and just after flowering, which were then re-mobilized for seed development. *(Summary by Crop Physiology Abstracts)* C01 C02

0080

15493 RAVEN, J.A. and FARQUHAR, G.D. Methylammonium transport in *Phaseolus vulgaris* leaf slices. Plant Physiology 67:859-863. 1981. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. N. Metabolism. Plant physiological processes. Tracers. Leaves. Cell structure. Laboratory experiments.

Methylammonium (as a nonmetabolized analog of ammonium) transport was studied in leaf slices of *Phaseolus vulgaris* var. Hawkesbury Wonder. The relationship of influx to external pH (6.0-10.5) shows that the influx at low external pH is a larger fraction of that at high external pH than would be expected from the pK_a of methylammonium and the assumption that only CH_3NH_2 is entering the cells. The relationship between methylammonium influx and external methylammonium concn. shows some evidence of saturation; this is a function of the transport system rather than of the (limited) methylammonium metabolism in the cells. The "equilibrium" concn. ratio for methylammonium between leaf slices and bathing medium is far higher than can be explained by the transport of CH_3NH_2 alone and the pH of the compartments involved. These 3 lines of evidence strongly suggest that there is an influx of $CH_3NH_3^+$, possibly by a uniporter driven by the electrical potential of the cytoplasm with respect to the medium, as has been shown for other plant cells. Competitive inhibition of methylammonium influx by ammonium suggests that there is also an ammonium transport system. The significance of this for the recycling of N within the plant and for exchange of gaseous NH_3 between leaves and the atmosphere is discussed. *(Author's summary)* C01

0081

16076 PANDEY, D.P. and KANNAN, S. Modification of retranslocation patterns of Fe^{++} and Rb^+ in bean plants during new growth. Zeitschrift für Pflanzenphysiologie 93(4):365-369. 1979. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Nutrient transport. Nutrient absorption. Micronutrients. Fe. Roots. Leaves. Plant tissues.**

Fe^{++} and Rb^{+} retranslocation from the primary leaves and stem, towards the trifoliate leaves and new roots, was examined in bean plants in which the roots were excised after absorption and new roots allowed to grow at the cut end of the stem. The patterns for the partially mobile element Fe^{++} were compared with those of the freely mobile element Rb^{+}. Retranslocation to the shoot was essentially from the primary leaves for Fe^{++}, and from the stem in the case of Rb^{+}. Fe^{++} was also retranslocated from the primary leaves to the new roots, both in the presence and absence of trifoliate leaves. Larger amounts of Rb^{+} were however retained in the stem and primary leaves when the trifoliate leaves were not present. *(Author's summary)* C01

See also 0036 0096 0122 0157 0249 0536 0539 0549

C02 Plant Development

0082

11674 BENTLEY, B. *et al.* **Plant growth substances and effects of photoperiod on flower bud development in *Phaseolus vulgaris.*** Nature 256:121-122. 1975. Engl., Illus.

Phaseolus vulgaris. Photoperiod. Abscission. Plant-growth substances. Flowering. Leaves. Cytokinins.

The effects of photoperiod on flower bud development after the initiation of floral primordia were studied. Long photoperiods (> 13-14 h) produced abscission in flower buds of *Phaseolus vulgaris.* The initial effects were produced in the leaves where ABA is produced, affecting bud abscission. ABA concn. in leaves was greater when the photoperiod was long. This difference was marked in young leaves. In flower buds, high levels of ABA were found along with promotory growth substances such as kinetin and 6-benzyl-aminopurine. *(Summary by C.P.G. Trans. by L.M.F.)* C02 D01

0083

11698 VILLA A., R. Ciclo vegetativo del fríjol. *(Vegetative cycle in beans). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.62-64. Span., 3 Refs., Illus.

Phaseolus vulgaris. Plant development. Germination. Flowering. Podding. Harvesting. Cultivars. El Salvador.

The different stages of the vegetative cycle of beans are described: germination, development, flowering and pod formation, maturity and harvesting. Some recommendations are also given on planting and harvesting dates and appropriate var. for each season. The 1st season is from May-July with var. Selección 184, Porrillo 70, Rojo de Seda and Centa 105; the 2nd from Aug.-Oct. with var. Rojo 70, Selección 184, Porrillo 70, Centa 105 and Rojo de Seda; and the 3rd from Dic.-March with var. Rojo de Seda, Centa 105, 27-R and Selección 184. *(Summary by C.P.G. Trans. by L.M.F.)* C02

0084

14747 CAMPBELL, R.E. Some effects of selected growth regulators on pod set, yield and nutrient uptake of snap beans *(Phaseolus vulgaris* L.). Ph.D. Thesis. Manhattan, Kansas State University, 1972. 81p. Engl., Sum. Engl., 61 Refs., Illus.

Phaseolus vulgaris. Plant-growth substances. Nutrient absorption. Plant assimilation. Yields. Mineral content. Analysis. Toxicity. Green-house experiments. Field experiments. USA.

Information of the effects of growth regulating compounds on vegetable crops is limited. Their effects will differ due to chemical, crop species, cv., and environmental conditions. These factorial studies were conducted in 1971 and 1972 with bush snap beans. Three greenhouse studies and 5 field studies were conducted. The objectives of these studies were: (1) to determine the effect of the materials on yield; (2) to determine if yield differ-

ence was due to differences in pod set or pod size; (3) to evaluate the accumulation of different nutrient elements in the plant leaves; (4) to determine optimum rates of application of the growth regulators CHE 8728, CHE 9064, CHE 8570 or TIBA at various rates of application depending upon the chemical increased snap bean yields. The proper time of application for these materials appeared to be in the early to mid-bloom stage or approx. 2 wk. prior to harvest. Outdoor variations in environmental conditions and seasonal changes had an influence on the action of the materials. Yield differences due to treatment were greater when crops grew under av. to below av. conditions rather than under very favorable or very adverse environmental conditions. Cv. response needs to be studied further. Yield increases were due to increased pod set rather than increased pod size. Only one material, CHE 9064, seemed to have an effect on increasing pod size. TIBA delayed pod size development. The trifoliolate leaves were analyzed for P, K, Ca, Mg, Fe, and Zn in the nutrient content study. There was no significant difference in nutrient content from any of the treatments except Ca in field study I. The reason for differences with this element in only this study is not fully understood. Nutrient analysis possibly should be done on lower leaf tissue, leaf and stem tissue, or leaf and pod tissue rather than on trifoliolate leaves alone. Fe concn. was highest in plants treated with TIBA in 2 studies, but significant differences did not occur. Some phytotoxic effects were observed with CHE 8728, CHE 9064, and TIBA at higher rates of application. CHE 8728 caused marginal chlorosis shortly after application while CHE 9064 or TIBA treatments resulted in twisting of the stem and pod. *(Author's summary)* C02

0085

14202 MAKUS, D.J. and SHANNON, C. **Temperature and photoperiod effects on abscisic acid content in "Earliwax" snapbean seed.** HortScience 14(6):732-733. 1979. Engl., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris. **Plant physiology. Temperature. Photoperiod. Plant-growth substances. Seed. USA.**

Seeds from plants of "Earliwax" snap bean stressed at 46°C during the reproductive cycle had higher ABA levels (285 ng/g) than those of plants stressed at lower temp. (257 ng/g at 41°C, 249 ng/g at 35°). Higher levels of ABA in seeds also resulted when more mature plants were stressed. A trend towards higher levels of ABA/g seed was observed in plants grown under 16 h days (219 ng/g) as opposed to 10 h days (139 ng/g). *(Author's summary)* C02

0086

4581 ALLINGTON, W.B. and LEDERER, L.F. **Growth of pinto beans in ISCO environmental chambers with two different lighting systems.** Lincoln, Nebraska. Instrumentation Specialities Company. ISCO Applications Research Bulletin no. 1. 1970. 9p. Engl., Illus.

Phaseolus vulgaris. **Plant development. Growth. Climatic requirements. Light. Photoperiod. Temperature. Laboratory experiments. USA.**

A comparison of the effects of cool white fluorescent and metal halide lighting systems on pinto bean plant growth was made in 2 ISCO model E-3 growth chambers. All other conditions were the same: temp. at 70°F, RH at 60%, and day length 16 h. The expt. lasted 6 wk. It was concluded that metal halide lamps are superior for growing beans, resembling field grown plants, even though they were more rapid in their development. They also showed early blooming and heavy pod set, larger root systems, and a more robust appearance of the plants, compared to those using cool white fluorescent lamps. *(Summary by I.B. Trans. by L.M.F.)* C02

0087

14230 VAN VOLKENBURGH, E. and CLELAND, R.E. **Proton excretion and cell expansion in bean leaves.** Planta 148(3):273-278. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Plant physiological processes. Light. Leaves. Cell walls. Growth. Plant-growth substances. Cytology.**

Light-induced expansion of *Phaseolus vulgaris* L. leaf cells is acompanied by increased cell-wall plasticity. The possibility that leaf-cell walls are loosened by excreted protons has been investigated: (1) Light causes acidification, detected at the leaf surface, within 5-15 min. Growth starts 10-20 min after exposure to light. (2) Exogenous acid induces loosening of isolated leaf cell walls. (3) Infiltration of the tissue with a neutral buffer inhibits light-induced growth, and (4) fusicoccin stimulates growth of as well as H^+ excretion by bean leaf cells, without light. These findings show that the acid-growth theory is applicable to light-induced growth of leaf cells, and indicate that light-induced proton excretion initiates cell enlargement in leaves. *(Author's summary)* C02 C00

0088

14360 SARMA, C.M. and DEKA, G. **Interactions between indole-3-acetic acid and coumarin on the extension growth of bean hypocotyl segments.** Indian Journal of Plant Physiology 20(2):119-122. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Auxins. Indoleacetic acid. Hypocotyls. Growth. Cotyledons. Seedlings.**

The response of hypocotyl sections of bean cv. Bountiful to IAA (0.1-50 ppm) and coumarin (1-100 ppm) and their combinations was examined. Both the compounds exhibited marked stimulation of extension growth of hypocotyl sections of bean. A higher stimulation by IAA + coumarin than that of IAA or coumarin demonstrated a synergistic effect (more than additive). *(Author's summary)* C02 B00

0089

14341 HOLDER, C.B. and BROWN, K.W. **The relationship between oxygen and water uptake by roots of intac bean plants.** Soil Science Society of America Journal 44(1):21-25. 1980. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Plant respiration. Water requirements. O. Nutrient absorption. Growth-chamber experiments. Roots. Climatic requirement. Water absorption. Plant physiological processes. Defoliation. Leaves.**

To facilitate simultaneous measurements of root O and H_2O uptake, bean plants var. Blue Lake were grown in washed sand in a root chamber which could be isolated from a chamber used to enclose the aerial portion of the plant. A continuous flow system was used in the root chamber and shoot chamber to measure O consumption and transpiration, resp. A good relationship between root O uptake and transpiration was found during periods where the plants were subjected to gradual decreases in O conen. in the air in the root zone and during periods after some recovery had occurred as a result of reintroduction of 21% O_2. The relationship failed, however, when plants were subjected to prolonged low O conen., probably as a result of root injury, and when plants were abruptly given an ample supply of O following a period of O_2 deficiency, probably as a result of the need for O to grow new roots before water uptake could begin again. For conditions other than those excluded, the

correlation between root O uptake and transpiration was 0.89. Transpiration decreased slightly as the O concn. in the root zone decreased from 21 to 3%. Below 3% the transpiration varied widely and depended on the length of time that the plant had been exposed to the decreased concn. Recovery from damage resulting from low O concn. depended on the length of time the roots were subjected to the low concn. In some cases, full recovery was not achieved in 5 days. The ratio of the uptake of O to water averaged 1:250 for the plants tested. *(Author's summary)* C02 C00

0090

14334 HILLMAN, J.R. and YEANG, H.Y. **Correlative inhibition of lateral bud growth in *Phaseolus vulgaris* L. Ethylene and the physical restriction of apical growth.** Journal of Experimental Botany 30(119):1075-1083. 1979. Engl., Sum. Engl., 26 Refs., Illus.

Phaseolus vulgaris. **Growth. Inhibition. Stems. Leaves. Ethylene. Plant-growth substances. Plant vascular system.**

Restriction of apical growth in *Phaseolus* by enclosing the upper part of the shoot in sealed or ventilated tubes induced development of axillary buds beneath the enclosure. Enclosed parts of shoots showed a reduction of leaf growth and, in expt. where the tubes were sealed, of internode extension. Enclosure of the shoots in large vessels that did not restrict leaf expansion, but which contained 0.5 vol.10^{-6} ethylene, similarly induced axillary bud growth. Analysis of the gaseous extract of physically restricted shoots showed a 2.5-fold increase in ethylene concn. The results suggest involvement of ethylene in the release of correlative inhibition brought about by physical restriction of apical growth. *(Author's summary)* C02 C00

0091

14283 VAN ONCKELEN, H. *et al.* **Metabolism of abscisic acid in developing seeds of *Phaseolus vulgaris* L. and its correlation to germination and α-amylase activity.** Journal of Experimental Botany 31(123):913-920. 1980. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Germination. Plant physiological processes. Enzymes. Seed. Dormancy.**

Bean seeds were unable to germinate during their development which was characterized either by an increasing ABA content (expressed as ng ABA/seed) or by a fairly high and constant ABA concn. (expressed as ng ABA/g fresh wt.). During seed maturation the mother plant induces a dormant state by depressing the ABA catabolism and keeping the endogenous ABA at a high level to prevent both the premature hydrolysis of starch (α-amylase activity) and the germination of the morphogenetically adult yet immature seeds. The depth of this induced dormancy is positively correlated with endogenous ABA concn. Application of exogenous ABA to fully mature seeds, which contain no endogenous ABA and show a very active ABA catabolism, only prolonged the lag phase but had no influence on the further development of the α-amylase activity. *(Author's summary)* C02 C00

0092

14356 WEST, D.W. and TAYLOR, J.A. **The response of *Phaseolus vulgaris* L. to root-zone anaerobiosis, waterlogging and high sodium chloride.** Annals of Botany 46(1):51-60. 1980. Engl., Sum. Engl., 29 Refs.

Phaseolus vulgaris. **Plant respiration. Salinity. Waterlogging. O. Soil water. Roots. Nutrient solution. Growth. Plant tissues. Stems. Leaves. Hypocotyls. Plant assimilation.**

Phaseolus vulgaris grown at a range of external concn. of NaCl (0-80 m*M*) responded differ-

ently to gaseous anaerobiosis (N_2 gas) in nutrient solution or stagnant waterlogging of the root-zone. With similar patterns of distribution of Na^+ and Cl^- occurring in the plants with comparable NaCl treatments, and similar final concn. of Na^+ and Cl^- in plants grown under both root-zone conditions, rates of uptake of Na^+ and Cl^- were much higher in plants with the stagnant waterlogged root-zones. After 72 h stagnant waterlogging, plant tops from plants grown at 40 m*M* NaCl contained 1.42% Na^+ and 3.44% Cl^- (dry wt. basis) while after 9 days exposure to NaCl with gaseous anaerobiosis, leaf tissue contained 1.49% Na^+ and 4.28% Cl^- (dry wt. basis). Plants exposed to 40 m*M* external NaCl were severely damaged within 72 h when grown with stagnant waterlogged root-zones; those grown with N_2 anaerobiosis continued growth and development over the 9 day period. Plants grown in nutrient solution showed changes in distribution and concn. of Na^+ and Cl^- when O concn. was reduced below 21% O_2 (full aeration). *(Author's summary)* C02 D01

0093

14280 SILVEIRA, P.M. DA *et al.* **Idade de floraçaõ e vingamento de flores em duas cultivares de feijão.** *(Effects of plant age on the percent of flower set in two bean cultivars).* Pesquisa Agropecuária Brasileira 15(2):229-232. 1980. Port., Sum. Port., Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Developmental stages. Flowering. Age. Podding. Cultivars. Yield components. Brazil.**

An expt. was carried out to study the flowering standards of the cv. Tambó and Rio Tibaji, comparing the age of plants with % of flower set. Age of plants in days was counted starting from the 1st flower opening. Twenty-three plants of each cv. were selected in the middle of an exptl. area. The open flowers of each plant were noted and labeled daily. The pods set on the same day were grouped during harvest for study of % of flower set. The no. of grains/pod was also noted. Cv. Tambó showed shorter flowering periods (19 days), and higher % of flower set (29%) than cv. Rio Tibaji, 24 days and 24%, resp. In both cv., the % of flower set and the no. of grains/pod decreased as the age of plants increased. *(Author's summary)* C02

0094

14322 WYSS, H-R. and BRUNOLD, C. **Regulation of adenosine 5'-phosphosulfate sulfotransferase activity by H_2S and cyst(e)ine in primary leaves of** *Phaseolus vulgaris* **L.** Planta 147(1):37-42. Engl., Sum., Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Plant development. Plant physiological processes. Leaves. Chloroplasts. Amino acids. Biochemistry. Enzymes. Chlorophyll. Methionine. Cysteine. S.**

During chloroplast development in the primary leaves of *Phaseolus vulgaris,* the extractable activity of adenosine 5-phosphosulfate sulfotransferase increased 10-fold. When chloroplast development took place in air enriched with 3.5 μl H_2S/l there was a decrease in adenosine 5-phosphosulfate sulfotransferase activity. Cyst(e)ine in concn. up to 1 m*M* (in the external medium) did not affect the increase in adenosine 5-phosphosulfate sulfotransferase activity in intact plants. In plants with excised roots, 0.75 m*M* cyst(e)ine inhibited this increase. In green primary leaves, H_2S or cyst(e)ine treatment resulted in a decrease of extractable adenosine 5-phosphosulfate sulfotransferase activity. In intact plants, this effect of cyst(e)ine was observed at a concn. of 1 m*M*, and in plants with excised roots, 0.25 m*M* had a comparable effect. In developing plants, the extractable activities of O-acetyl-L-serine sulfhydrylase (EC 4.2.99.9) and ribulosebisphosphate carboxylase (EC 4.1.1.39) were not affected by H_2S or cyst(e)ine. *(Author's summary)* C02 C03

0095

14343 STERRETT, J.P. **Injection methodology for evaluating plant growth retardants.** Weed Science 27(6):688-690. 1979. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. **Plant-growth substances. Growth. Inhibition. Seedlings. Stems. Leaves. Hypocotyls. Plant vascular systems.**

Separate methods for injecting growth retardants into herbaceous and woody plants are described. Bean plants cv. Black Valentine were treated by injecting growth retardant solutions into the hypocotyl cavity with a syringe. The chemical was subsequently absorbed into the vascular system. Woody California privet *(Ligustrum ovalifolium)* was injected by forcing chemical solution into the vascular system via a predrilled hole. Results with NAA and MH (1,2-dihydro-3,6-pyridazinedione) validated the methods by inhibiting growth, resp. New growth regulators, mefluidide{ *N*[2,4-dimethyl-5-[[(trifluoromethyl) sulfonyl]amino]phenyl]acetamide } and dikegulac (sodium salt of 2,3·4,6-bis-*O*-(1-methylethylidene-α-L-xylo-2-hexulofuranosonic acid], inhibited the growth of bean with concn. of 60 mg/*l* and 480 mg/*l*, resp. Sprout growth of privet was inhibited by 30 mg/*l* of mefluidide and by 188 mg/*l* dikegulac. *(Author's summary)* C02

0096

14741 RICE, R.M. **Physiology and inheritance of differential growth response under high phosphorus levels among different lines of beans, *Phaseolus vulgaris* L.** Ph.D. Thesis. Madison, University of Wisconsin, 1974. 97p. Engl., Sum. Engl., 58 Refs.

Phaseolus vulgaris. **Growth. Plant development. Plant physiology. Plant fertility. P. Plant assimilation. Cultivars. Hybridizing. Selection. Inheritance. Genes. Micronutrients. Nutrient absorption. pH. Analysis.**

Differential growth may be detected among bean lines if plants are grown in solution culture at very high levels of P (186 mg/plant). These differences are measured on the basis of dry wt. production/plant. Sixteen lines were screened on this basis. Two of the most efficient lines and 2 of the most inefficient lines were selected for use in further physiological and inheritance studies. The mechanism of efficiency of dry wt. production does not appear to be associated with P-induced deficiencies of a minor element, any single major element, or with the pH of the culture solution. Growth of bean plants in an air-conditioned greenhouse was much less than growth of plants from these same lines in the University of Wisconsin Biotron (USA). Some environmental difference(s) between these facilities was responsible for the differential plant growth. Additionally, in the greenhouse seed wt. became a major factor correlated with growth, whereas seed size was not a consistently important variable in the Biotron. Progeny data, adjusted for seed wt. effects, suggested partial dominance or multigenic inheritance of efficiency in crosses with 1 efficient parent line, and heterosis or dominance of efficiency in crosses with the other efficient parent line. Maternal effects, other than those associated with seed size, probably are not a factor in efficiency of dry wt. production at high levels of P. In spite of the constraints on genetic interpretation of the progeny data adjusted for the effects of seed wt., it is felt that the efficiency of dry wt. production by beans grown at high levels of P was heritable. *(Author's summary)* C02 C01

0097

14264 TAMAS, I.A., OZBUN, J.L. and WALLACE, D.H. **Effect of fruits on dormancy and abscisic acid concentration in the axillary buds of *Phaseolus vulgaris* L.** Plant Physiology 64:615-619. 1979. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Growth. Plant-growth substances. Buds. Dormancy. Stems. Maturation. Plant development. USA.**

The mechanism regulating the growth of adult plants in 2 determinate bean cv. was investigated. Redkloud plants flowered, formed fruits, and ceased shoot growth earlier than Redkote plants. Redkloud attained a smaller plant size, compared to Redkote, by imposing dormancy on axillary buds at an earlier age. In both cv. cessation of bud growth coincided

with max. combined fruit length/plant. Removal of fruits caused resumption of axillary bud growth within 4-5 days. The amount of new growth induced by fruit removal depended on the cv. and plant age. In fully developed Redkloud plants, where shoot growth had already ceased, total leaf and shoot no./plant nearly doubled within 2 wk. following fruit removal. A much smaller response was observed in the still growing Redkote plants. Fruits, therefore, are assumed to play a major role in the regulation of shoot growth and total plant size through the control of axillary bud dormancy. It seems that smaller plant size, earlier maturity and senescence of Redkloud, compared to Redkote, were the result of earlier flowering, and accomplished in part through the growth-inhibiting action of fruits. The endogenous ABA concn. of axillary buds was higher in Redkloud than in Redkote. It increased with plant age in both cv. Five days after fruit removal the ABA level in bud tissue dropped to approx. 10-30% of the control level. When buds were treated with a solution of ABA containing 5 nanomoles of ABA/bud, growth was substantially inhibited. Fifteen days after ABA application the mean length of growing buds on intact and defruited plants was reduced by 40 and 62%, resp., compared to the untreated controls. A role for ABA in axillary bud growth regulation was not firmly established, but these data suggest correlation between the growth potential of axillary buds and their ABA concn. *(Author's summary)* C02 C00

0098

14380 HEWITT, S. and HILLMAN, J.R. **Steroidal oestrogens and adventitious root formation in *Phaseolus* cuttings.** Annals of Botany 46:153-164. 1980. Engl., Sum. Engl., 37 Refs., Illus.

Phaseolus vulgaris. **Developmental stages. Rooting. Plant-growth substances. Inhibition. Growth. Plant tissues. Hypocotyls. Epicotyls. Leaves. Photoperiod. Cotyledons. Plant vascular system. Plant development. Carbon fixation. Tracers.**

Solutions of oestrone, oestrone-phosphate, oestrone-sulphate, oestradiol and oestradiol-sulphate in the concn. range 10^{-3} mol m^{-3} to 10^{-7} mol m^{-3} had no observable morphological or anatomical effects on adventitious root formation in *Phaseolus vulgaris* hypocotyl, epicotyl and primary leaf cuttings. Oestradiol-sulphate and oestrone-sulphate treatments at 0.1 mol m^{-3} significantly inhibited rooting in hypocotyls, and the inhibition was almost complete in epicotyls and primary leaves. In the latter, anomalous development of vascular tissues was noted. However, neither oestrone-phosphate at 0.1 mol m^{-3} nor direct application of up to 100 μg of the oestrogens to apices or primary leaves of explants modified the pattern of root formation. The results are discussed with reference to the distributive and metabolic fates of the applied substances. *(Author's summary)* C02

0099

14775 TONIN, G.S. **Cultura de tecido de folhas de feijoeiro *(Phaseolus vulgaris* L.): influências de aminoácidos.** *(Bean leaf tissue culture: influence of amino acids).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultura Luiz de Queiroz, 1978. 108p. Port., Sum. Port., Engl., 110 Refs., Illus.

Phaseolus vulgaris. **Tissue culture. Leaves. Plant-growth substances. Amino acids. Sucrose. Plant tissues. Roots. Growth. Morphogenesis. Nutrient solution.**

A series of expt. were developed at the Centro de Energia Nuclear na Agricultura (Brazil) to obtain a chemically defined medium for bean tissue culture. Bean cv. Carioca seeds were germinated in river sand and maintained in Hoagland and Arnon's nutrient solution no. 2. Explants from the 1st pair of bean plants were aseptically removed and inoculated onto a modified Murashige and Skoog agar culture medium. The medium contained mineral salts, vitamins, and sucrose (energy source). Growth factors used in the medium included kinetin plus IAA or kinetin, IAA, NAA, and 2,4-D. The pH's of all media were adjusted to 5.6 after adding all the nutrients. Individual or several amino acids were added to the basal medium in order to observe their efficiency to promote callus growth and root morphogenesis. Two

kinds of cultures were maintained as standards; one containing hydrolyzed casein as a reduced N source (medium E) and the other containing basal medium without amino acids. and casein hydrolysate. A period scoring of callus growth (fresh and dry wt. measurements) and morphogenetic development of the cultures was made at the end of each trial. IM (morphogenesis index) and IG (growth index) were calculated from the compiled data and tabulated in a statistical table. According to the results of the analysis, culture medium A containing basal medium with kinetin (1 mg/*l*), IAA (5 mg/*l*) and 3 amino acids (arginine-60 mg/*l*, aspartic acid-50 mg/*l*, and cysteine-10 mg/*l*) provided optimal morphogenesis. Whereas, medium B, containing basal medium with kinetin (1 mg/*l*), IAA (5 mg/*l*) and 3 amino acids (glutamic acid-65 mg/*l*, glycine-25 mg/*l*, and histidine-10 mg/*l*), strongly inhibited both growth and morphogenesis. When 16 glutamic acid concentrates were tested, keeping glycine and histidine constant, it was observed that glutamic acid, per se, in medium B did not inhibit growth but rather the concn. used (65 mg/*l*). Therefore, a low glutamic acid concn. (0.5 mg/*l*) produced substantial growth, however, at high concn. growth was inhibited. Optimal callus growth was obtained in medium B_4, adding 4 hormones (kinetin-0.2 mg/*l*, IAA 2 mg/*l*, NAA 1 mg/*l*, and 2,4-D 1 mg/*l*) to the basal medium with 3 amino acids (glutamic acid-0.5 mg/*l*, glycine-25 mg/*l*, and histidine-10 mg/*l*). *(Author's summary)* C02 B00

0100

15802 KIGEL, J. GA and IAA interactions controlling internode growth in decapitated plants of *Phaseolus vulgaris* L. Botanical Gazette 142(1):7-12. 1981. Engl., Sum. Engl., 26 Refs., Illus.

Phaseolus vulgaris. Plant development. Plant-growth substances. Cell division. Cytology. Indoleacetic acid. Gibberellins.

Decapitation of dwarf bean Bulgarian reduced the longitudinal and radial growth of the subjacent internode and inhibited the differentiation of the vascular bundles and cambial layer. IAA in lanolin restored radial growth but did not enhance the elongation of the decapitated internode. GA in lanolin did not affect radial growth or cell expansion but strongly enhanced transverse cell divisions and, consequently, promoted internode elongation. Cell elongation was enhanced when both IAA and GA were applied simultaneously, but IAA inhibited the GA-promoted cell divisions. The effects of IAA were duplicated by Ethrel (2-chloroethyl phosphonic acid), an ethylene-releasing agent. It is suggested that (1) internode elongation is modulated by a balance between the promotive effects of GA and inhibitory effects of IAA on cell division and their synergistic effects on cell elongation, and (2) the action of IAA and its interaction with GA are ethylene-mediated. *(Author's summary)* C02

0101

14791 HOJAT, H. Growth correlations and competitive relationships between yield components of selected varieties of the dry bean. Ph.D. Thesis. East Lansing. Michigan State University, 1977. 96p. Engl., Sum. Engl., 39 Refs., Illus.

Phaseolus vulgaris. Leaves. Pods. Growth. Growth analysis. Seeds. Ecology. Yield components. Yields. Statistical analysis. USA.

The Gompertz growth equation was used to analyze incremental data on leaflet and pod growth in 2 groups of var. of *Phaseolus vulgaris* differing in leaf size. It is assumed that the values of the parameter *b*, the rate of change in RGR, for leaflet and pod growth curves of var. grown under constant environmental conditions fit a normal distribution. There were significant differences in *b* for leaflet and pod growth curves among 8 var. This parameter could be used to distinguish any var. with a distinct growth pattern for leaflets and pods. *(Summary by Crop Physiology Abstracts)* C02

0102

4514 WIECKOWSKI, S. **The relation between the growth of the leaf and the synthesis of chlorophylls in *Phaseolus vulgaris*.** Photochemistry and Photobiology 2(2):199-205. 1963. Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Growth. Leaves. Chlorophyll. Plant pigments. Photoperiod.**

Studies were carried out in the lab. on the primary leaves of bean var. Bronowicka to determine the relationships between leaf growth and the formation of assimilatory pigments. Plants were grown on a nutrient solution (Knop) under controlled conditions of temp., light intensity, and duration of illumination. Constant conditions were provided by cultivating plants in light and dark thermostats. The trends in daily changes of the concn. of chlorophylls a and b and the value *Q* a/b were established. Among the noted observations, the following are included: leaf growth is represented by a sigmoidal line; the rate of chlorophyll formation is proportional to time, except for the initial and final stages of growth. In the initial stage, leaf growth was slower than that of chlorophyll formation. A gradual decrease was observed in the concn. of pigments due to dilution. Darkness affects both the growth of the leaf and the concn. of chlorophyll. In alternating periods of light and darkness (12 h), the curve of leaf growth adopts a sigmoidal shape. In spite of 24 h fluctuations there occurs an increase of pigment concn./unit area in the 1st stage of growth and a decrease in the later stage. The ratio of chlorophyll a to chlorophyll b (*Q* a/b) also shows characteristic 24 h changes. *Q* a/b decreases in the 1st hours of exposure to light but after several hours it starts to increase. The rate of formation of chlorophyll a during the 12 h period is more uniform than that of chlorophyll b. Darkness affects the 2 chlorophylls in a completely different way and a hypothesis is presented to explain this phenomenon. *(Summary by I.B. Trans. by L.M.F.)* C02

0103

15490 YEANG, H.Y. and HILLMAN, J.R. **Control of lateral bud growth in *Phaseolus vulgaris* L. by ethylene in the apical shoot.** Journal of Experimental Botany 32(127):395-404. 1981. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Buds. Growth. Plant-growth substances. Ethylene. Plant development.**

Elongation growth of the 1st trifoliate leaf axillary bud was induced by physical restriction of the apical growth or by treating the apical shoot with ethylene or ethephon. There is evidence to suggest that the promotion of axillary bud development by ethylene action on the apical shoot was associated with the availability of freely diffusible ethylene in the tissues of the treated shoot. Loss of apical dominance was not, apparently, directly dependent on either the internal ethylene concn. (concn. in the vacuum-extracted gases) or on the rate of ethylene emanation. The effects of aminoethoxyvinyl glycine (AVG) and silver nitrate on ethylene production were examined. Although treatment of the shoot with tri-iodobenzoic acid (TIBA) induced various morphological responses in the plant, including axillary bud outgrowth, which appeared similar to the responses to ethylene, the initial effect of TIBA is not thought to be ethylene-mediated. *(Author's summary)* C02 C03

0104

14795 WHITE, J.W. **A quantitative analysis of the growth and development of bean plants (*Phaseolus vulgaris* L.).** Berkeley, University of California. Department of Botany, 1981. 286p. Engl., Sum. Engl., 140 Refs., Illus.

Phaseolus vulgaris. **Plant development. Growth. Agronomic characters. Climatic requirements. Yield components. Germplasm. Cultivars. Leaves. Pods. Maturation. Yield. Statistical analysis. Colombia.**

A series of qualitative and quantitative models were developed to explain genetically determined differences in the growth and development of bean plants. Data for the models was collected in a series of var. growth analysis trials performed at the Centro Internacional de

Agricultura Tropical (CIAT), Cali, Colombia. From the various lines of evidence presented by the models, it was observed that seed yield was closely related to overall plant growth, particularly as measured by crop dry wt. at maturity and LAD, and that growth depended largely on the length of the growth period as measured by time to physiological maturity Variables that might affect maturity date include leaf initiation rate, node of 1st flower, duration of floral primordium development, and duration of individual pod development. Variation in growth rates among bean lines was also sufficient to account for some of the observed differences in overall growth, but further analyses failed to identify variables that consistently explained the differences in growth rates. All models predicting behavior of yield components indicated that compensatory changes in components would probably occur if components are manipulated without altering more basic characteristics of plant growth at the same time. Of the different modeling approaches used, the qualitative models proved most useful. *(Author's summary)* C02

0105

15406 JENKINS, G.I. and WOOLHOUSE, H.W. **Photosynthetic electron transport during senescence of the primary leaves of *Phaseolus vulgaris* L. I. Non-cyclic electron transport.** Journal of Experimental Botany 32(128):467-478. 1981. Engl., Sum. Engl., 50 Refs., Illus.

Phaseolus vulgaris. **Leaves. Chloroplasts. Photosynthesis. Plant age. Growth. Laboratory experiments.**

Coupled, non-cyclic electron transport was measured for chloroplasts isolated from the primary leaves of *Phaseolus vulgaris.* Preparations from young, fully expanded leaves gave good rates of electron transport, but the rates obtained decreased by approx. 80% during leaf senescence. Higher rates of electron transport were recorded for chloroplasts isolated from primary leaves which had regreened following removal of the remainder of the shoot. With preparations from leaves of all ages, photophosphorylation was coupled to electron transport with a mean P/2e ratio of approx. 1:3. No evidence was obtained for inactivation of chloroplasts from older leaves during isolation or assay, and it is suggested that the decrease in rate of electron transport over the period of senescence, and its increase during regreening, were consequences of changes in the composition and physical properties of the thylakoid membrane which occur in vivo. The decrease in rate of non-cyclic electron transport may be important in limiting the rate of photosynthesis in the senescing leaves. *(Author's summary)* C02

0106

4577 ALLINGTON, W.B. and LEDERER, L.F. **Growth of pinto beans in ISCO environmental chambers under controlled levels of CO2.** Lincoln, Nebraska. Instrumentation Specialties Company. ISCO Application Research Bulletin no. 5. 1971. 6p. Engl., Illus.

Phaseolus vulgaris. **Growth-chamber experiments. Growth. CO_2. Plant development.**

A control system of a gaseous component of the atmosphere, in this case CO_2, in ISCO (Instrumentation Specialties Company) chambers is described. Although the results are specifically related to plant growth at different levels of CO_2, they can be extensively used in research on physiological and pathological responses of plants. Two Model E-3A environmental chambers with different CO_2 levels were used. The CO_2 level in only 1 plant growth chamber was controlled; pumps no. 1 and 2 were omitted and no. 3 was programmed to stop at certain intervals. The chamber was sealed and equipped with a Lucite door with rubber gloves. A pump inside the chamber provided daily watering, condensing water from the water tank of the humidity control system. CO_2 was analyzed by a MSA infrared analyzer with a range of 0-1000 ppm CO_2 and by the use of CO_2-sensitized detector; the instrument responds only to energy in the wavelength regions which are absorbed by CO_2. Energy passes through a cell containing the sample gas and the amount

of energy absorbance is measured. Information is presented as an electrical signal which is proportional to the amount of CO_2 in the sample gas. CO_2 level signals are registered by a multi-channel recorder and a CO_2 level controller of a proportional design, which feeds 0-10 pulses in each cycle, depending on the degree of error. The vol./pulse of the 2 gases (CO_2 and CO_2-free gas) were determined and the values corrected for barometric pressure and alt. and then converted to gravimetric values. The performance of the system was excellent and plants developed normally; those exposed to a higher level of CO_2 grew more vigorous, and had a darker green color. *(Summary by I.B. Trans. by L.M.F.)* C02

0107

15844 PATRICK, J.W. and McDONALD, R. **Pathway of carbon transport within developing ovules of *Phaseolus vulgaris* L.** Australian Journal of Plant Physiology 7:671-684. 1980. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Plant development. Flowering. Carbon fixation. Photosynthesis. Ovules. Cotyledons. Seed.**

^{14}C-labelled photosynthates, on reaching developing ovules of *Phaseolus vulgaris* plants, were transported rapidly and evenly throughout the highly vascularized seed coats. Apoplastic transfer of ^{14}C-labelled photosynthates from the seed coats to the developing embryos occurred over the entire inner surface of the seed coats. Further lateral transfer of the photosynthate through the cotyledons exhibited characteristics consistent with a diffusional process. The ^{14}C-labelled photosynthates transported from the seed coat to cotyledon symplasts were principally composed of sucrose. The free space of the cotyledons was fully permeated by photosynthates at concn. in the range of 100-200 m*M* sucrose equivalents. This pool of photosynthates was continuously maintained by transfer from the seed coats. Furthermore, initial rates of depletion of the free-space pool of photosynthates, following removal of the seed coats, accounted for cotyledon growth rates. These observations are consistent with photosynthate movement being largely restricted to the apoplast of the cotyledons. *(Author's summary)* C02

0108

15834 PALMER, M.V., SCOTT, I.M. and HORGAN, R. **Cytokinin metabolism in *Phaseolus vulgaris* L. II. Comparative metabolism of exogenous cytokinins by detached leaves.** Plant Science Letters 22:187-195. 1981. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Metabolism. Cytokinins. Plant-growth substances. Leaves. Biochemistry. Analysis.**

The stability of 8-^{14}C-analogues of zeatin, zeatin-O-β-D-glucoside, dihydrozeatin, and dihydrozeatin-O-β-D-glucoside has been studied in detached bean leaves. The metabolites of these cytokinins were characterized by ion exchange, paper chromatography, and Sephadex LH-20 and high performance liquid chromatography (HPLC). Over 3 days the glucosides were more stable in leaves than were their free bases and dihydrozeatin derivatives were more stable than zeatin derivatives. In each case urea and ureides appeared to be major metabolites; minor metabolites included adenine, adenosine, and a range of glucoside-like conjugates. A major metabolite of dihydrozeatin appeared to be dihydrozeatin-O-glucoside. Very little or no radioactivity cochromatographed with cytokinin ribosides and ribotides in any extract. These results are discussed in relation to the metabolism and distribution of endogenous cytokinins in the whole plant. *(Author's summary)* C02

0109

16057 METIVIER, J. and PAULILO, M.T. **The utilization of cotyledonary reserves in *Phaseolus vulgaris* L. cv. Carioca. II. The effects of 6-benzyladenine and gibberellic acid upon embryonated and detached cotyledons.** Journal of Experimental Botany 31(124):1271-1282. 1980. Engl., Sum. Engl., 46 Refs., Illus.

***Phaseolus vulgaris*. Plant development. Seedlings. Cotyledons. Embryo. Enzymes. Inhibitors. Plant-growth substances.**

The presence of the embryo axis promotes starch hydrolysis in cotyledons of *Phaseolus vulgaris* and, although reduced rates of enzyme activity proceed in its absence, wt. loss from the cotyledon is only significant in its presence. Application of GA at various concn. had no effect upon amylase or protease activity in either detached or embryonated cotyledons; this was not the case for 6-benzyladenine which promoted both. In detached cotyledons amylolytic activity was directly proportional to the concn. of applied 6-BA; concn. below 10^{-6} *M* were unable to completely substitute for the presence of the axis, while, above 10^{-6} *M*, hydrolytic activity higher than that of treated embryonated cotyledons was observed. Increasing the concn. of 6-BA had no effect, however, upon the amylolytic activity of embryonated cotyledons. Detached cotyledons showed an increased chlorophyll content and 6-BA treatment further increased this; the proportions of chlorophyll a and chlorophyll b remained unaltered. An inhibitor of amylase activity, destroyed by heating, is present in embryonated cotyledons and can depress amylolysis in detached cotyledons which appear to be inhibitor-free. Results in total suggest that the developing axis may regulate reserve hydrolysis in 3 distinct manners; (1) by stimulating the synthesis of amylase via hormonal control, most probably a cytokinin; (2) by checking the rate of amylolysis by means of an amylase inhibitor; and (3) by being a sink for the products of reserve degradation. *(Author's summary)* C02

0110

16055 WARDLE, K. and SIMPKINS, I. **Response of cultured embryos of *Phaseolus vulgaris* and *Hordeum vulgare* to farnesol.** Annals of Botany 46:505-510. 1980. Engl., Sum. Engl., 17 Refs., Illus.

***Phaseolus vulgaris*. Cotyledons. Embryo. Nutrient solution. Plant development. Roots. Leaves. Growth.**

Excised embryos of *Phaseolus vulgaris* incubated in a medium containing 10 mg/dm^3 farnesol showed enhanced root growth whereas the leaves remained rudimentary. At lower concn. of exogenous farnesol normal leaf development occurred and root growth was comparable to untreated cultures. Enhanced root growth also occurred when excised embryos of *Hordeum vulgare* were treated with farnesol but only at 10 mg/dm^3 and this treatment did not prevent leaf growth. X-ray microprobe analysis of leaves revealed an increased P content in *P. vulgaris* and a decreased S content in *H. vulgare* in comparison to untreated plants. *(Author's summary)* C02

0111

16058 METIVIER, J. and PAULILO, M.T. **The utilization of cotyledonary reserves in *Phaseolus vulgaris* L. cv. Carioca. I. Changes in total amylolytic and proteolytic activity and the effects of 6-benzyladenine and gibberellic acid upon whole seedlings.** Journal of Experimental Botany 31(124):1257-1270. 1980. Engl., Sum. Engl., 42 Refs., Illus.

***Phaseolus vulgaris*. Plant development. Seedlings. Cotyledons. Enzymes. Dry matter. Protein content. Amino acids. Plant-growth substances. Plant tissues.**

Axis growth commenced only 20 h from imbibition in *Phaseolus vulgaris* when both uptake of water and O were levelling off. Cotyledonary dry material was exhausted by day 9, the greatest rates of transfer occurring from day 2. Utilization of reserve protein proceeded

relatively faster than DM and proportionately more was translocated to the shoot, particularly the leaf blades. Lamina protein and chlorophyll content showed a biphasic increase with rapid synthesis prior to day 7 being followed by slower rates up to max. leaf area on day 17. The level of free amino acids in the cotyledons fell continuously from day 3 and rose to peak levels in the axis between days 5-7. Soluble sugars increased throughout the period examined in the axis and accumulated in the cotyledons prior to day 7. Exogenous application of GA_3 had marked morphological effects upon the seedling though did not significantly alter the distribution of DM or protein reserves; 6-BA, in addition to distinct morphological effects, delayed the mobilization of reserves to the axis. Total amylolytic activity in the cotyledon, optimal at pH 5.5, increased continually from day 3-9 whereupon activity abruptly declined. This increase was due to the appearance of α-amylase; β-amylase, while present, remained at a constant and comparatively low level. Peak proteolytic activity occurred prior to that for amylases between days 5-7. 6-BA significantly increased both amylolytic and proteolytic activities in vitro though did not alter the changes in levels of free amino acids or sugars in the reserve tissue and axis. The discrepancy between in vivo and in vitro effects of 6-BA may be attributed to concomitant effects upon seedling development whereby sink capacity is reduced. *(Author's summary)* C02 C03

0112

16091 KENIS, J.D. and TRIPPI, V.S. **Regulación de la abscisión en *Phaseolus vulgaris*. IV. Participación del fitocromo y su interacción con la edad de los tejidos.** *(Regulation of abscission in Phaseolus vulgaris. IV. Participation of the phytochrome and its interaction with tissue age).* Phyton 39:153-159. 1980. Span., Sum. Span., Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Abscission. Leaves. Plant tissues. Light. Plant age.**

The high irradiation response (HIR) is involved in the regulation of abscission in type I explants of *Phaseolus vulgaris* (obtained from young leaves), while the classical induction-reversion reaction controls abscission in type II explants (taken from mature leaves). The participation of either the HIR or the induction-reversion response seems to be regulated by the age of the tissue, probably by means of changes in the rates of phytochrome destruction accompanying aging. *(Author's summary)* C02

See also 0009 0019 0022 0023 0026 0053 0056 0057 0059 0071 0077 0079 0120 0158 0187 0192 0220 0449 0461 0462

C03 Chemical Composition, Methodology and Analyses

0113

10665 VAN HOLST, C.J. *et al.* **Changing cell-wall compositions in hypocotyls of dark-grown bean seedlings.** Planta 149:209-212. 1980. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Cytology. Cell structure. Cell walls. Hypocotyls. Plant tissues. Growth. Composition. Carbohydrate content. Plant physiology.**

Hypocotyls of dark-grown 6-day-old seedlings of *Phaseolus vulgaris* L. proved to be sufficiently homogeneous to permit studies relating the rate of cell elongation to the composition of the primary cell walls. Whereas the levels of cellulose and uronic acids remained practically constant during and after cell extension, all other components showed major or minor changes. Cell-wall protein, as such, decreased by more than 50%, but indications are that hydroxyproline-rich glycoprotein increased with a decreasing rate of cell elongation, concomitant with a rise in the degree of arabinosylation of wall-bound hydroxyproline. As cell elongation slowed down, non-cellulosic glucose accumulated, presumably in the form of a β(1-4) glucan closely associated with cellulose. These findings confirm the notion that the primary cell wall is a highly dynamic structure. *(Author's summary)* C03 C00

0114

14271 POWLES, S.B. and OSMOND, C.B. **Photoinhibition of intact attached leaves of C_3 plants illuminated in the absence of both carbon dioxide and of photorespiration.** Plant Physiology 64(6):982-988. 1979. Engl., Sum. Engl., 22 Refs., Illus.

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

When *Phaseolus vulgaris* leaflets were illuminated in the absence of CO_2 and at low O_2 partial pressure, the capacity for CO_2 assimilation at saturating light intensity and its efficiency at low light intensities were reduced. In young leaflets, following short exposure to these photoinhibitory conditions, some recovery of CO_2 assimilation capacity occurred immediately, but following substantial photoinhibition of CO_2 assimilation recovery in fully expanded leaflets occurred only after 48 h in normal air. Photoinhibition was largely prevented by providing CO_2 at partial pressures equivalent to the CO_2 compensation point, or by providing > 210 millibars O_2 which permitted internal CO_2 production by photorespiration. The studies supported the hypothesis that the recycling of CO_2 through photorespiration was an effective means of dissipating excess photochemical energy when the CO_2 supply to illuminated leaves was limited. *(Summary by Horticultural Abstracts)* C03 C00

0115

14705 MUJEEB, K.A. and GREIG, J.K. **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. 1978. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Leaves. Amino acids. Composition. Irradiation. Plant development. Metabolism.**

Phaseolus vulgaris cv. Blue Lake 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 planted in the greenhouse. Primary leaf samples collected at two stages (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. Biochemical processes mediated by enzymatic activities and irradiation are thought to relate to amino acid variations. *(Author's summary)* C03

0116

14318 HAWKER, J.S. **Invertases from leaves of *Phaseolus vulgaris* plants grown on nutrient solutions containing NaCl.** Australian Journal of Plant Physiology 7(1): 67-72. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Leaves. Nutrient solution. Salinity. Analysis. Biochemistry. Cell division. Growth.**

Two invertases occur in leaves of *Phaseolus vulgaris* with pH optima near 5.0 and 7.5. They have been separated and partially purified by chromatography on DEAE-cellulose. Tris-HCl buffer at 10 m*M* inhibited the former enzyme by only 7% but the latter enzyme by 90%. A comparison of the enzymes from leaves of plants grown on 0, 20 and 50 m*M* NaCl in nutrient solution showed that the amount of the pH 5.0 enzyme was significantly lower in the NaCl treatments, whereas the amount of the pH 7.5 enzyme was not shown to be significantly affected by the salt treatment. The K_m values for sucrose were about 7.5 and 27 m*M* for the partially purified pH 5.0 and pH 7.5 enzymes resp. and they were not altered by NaCl treatment of the plants. A previous report of NaCl causing increasing K_m values for sucrose at pH 5.0 in less pure extracts was presumably an artefact, possibly caused by interference by the pH 7.5 enzyme or by other unknown reactions. *(Author's summary)* C03

0117

14266 PATRICK, J.W., JOHNSTONE, G.F.S. and WAREING, P.F. **Mobilizing ability of gibberellic acid and kinetin applied to mature, decapitated stems of *Phaseolus vulgaris* L.** Annals of Botany 44(4):517-519. 1979. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Gibberellins. Plant-growth substances. Plant development. Growth. Stems. USA.**

Twenty-one to 24-day-old seedlings of *P. vulgaris* in which internode 2 had ceased elongation growth were decapitated in internode 2 and aqueous lanoline paste dispersions of 0.1% GA or kinetin applied to the top 1.5 cm of the stumps; 6 h later the same region was fed ^{14}C-sucrose for 6 h. Metabolite transport and accumulation tended to be increased by kinetin and especially GA. In a 2nd trial in which GA and kinetin were applied as aqueous solutions at various concn., metabolite transport was increased by both growth substances at concn. $> 10^{-7}$ *M*, with an optimum concn. of 10^{-6} *M*. *(Summary by Field Crop Abstracts)* C03 C00

0118

13149 GUEVARA G., M. and PFOST, H.B. **Equilibrium moisture content of beans.** Manhattan, Kansas. Food & Feed Grain Institute. Grain Storage, Processing and Marketing. Research Report no. 5. 1973. 54p. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Seed. Water content. Storage. Temperature. Physiology. Laboratory experiments. USA.**

The objectives of this investigation were to: (1) find adsorption and desorption isotherms of various types of beans at different temp. and over a range of RH (10-90%); (2) study the rate of desorption in beans; (3) evaluate the results in Chung and Pfost equation, and (4) determine the heats of desorption and adsorption of water by various types of beans. A literature review is included on isotherm theories and hysteresis. The types of beans used were *Phaseolus vulgaris* (small red and pinto) and *P. lunatus*, obtained commercially and wetted to 25% MC and oven dried at 120°F to obtain 5-10% initial MC, on a dry basis. RH of the samples was controlled by sulfuric acid and the RH at different solution concn. was determined (range 10-90%). The sample was suspended inside a sealed flask, placed in a temp. control chamber for 3 wk. The equilibrium MC were determined by an oven method (72 h at 103°C). Results indicate that the equilibrium MC of the types of beans investigated decreases with an increase in temp. and increases with an increase in RH. Type II or sigmoid isotherms for beans are consistent with those for other grains. It was concluded that hysteresis, for beans, decreases with an increase in temp.; the rate of desorption is a function of the RH and temp.; and that these rates were higher in the 1st 2 days of storage. The equation by Chung and Pfost predicts the equilibrium moisture of beans for a wide range of RH at a given temp. Isoteric heats of desorption and adsorption continually decreases with increasing MC and values of Δ Hst for desorption are greater than those of adsorption. The heat of desorption for beans was greater than that of the latent heat of vaporization of pure water. *(Summary by I.B. Trans. by L.M.F.)* C03

0119

14323 SARMA, R. *et al.* **The effect of 3,5-diiodo-4-hydroxyphenylmethylsulphone (ioxysone) on *Phaseolus vulgaris*: absorption and translocation studies.** Annals of Applied Biology 93(3):305-310. 1979. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Plant assimilation. Roots. Tracers. Translocation. Uradiation. Metabolism. Hypocotyls. Epicotyls. Cotyledons. Toxicity.**

The herbicide 3,5-diiodo-4-hydroxyphenylmethylsulphone (ioxysone) is shown to be absorbed by the roots of dwarf bean and readily translocated. No evidence was obtained that iodide becomes released from the herbicide within the plant. This behaviour is discussed and contrasted with that of the corresponding nitrile (ioxynil), a widely used contact herbicide which is not readily translocated in the plant and whose mode of action is different from that of ioxysone. *(Author's summary)* C03 D02

0120

14370 KENIS, J.D. and TRIPPI, V.S. **Regulación de la abscisión en *Phaseolus vulgaris*. II. Actividad de amilasas.** *(Regulation of abscission in beans. II. Amylase activity).* Phyton 37(2):127-134. Span., Sum. Span., Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Abscission. Plant physiological processes. Enzymes. Plant-growth substances. Chlorosis. Starch content.**

The activity of amylases during aging and abscission was studied in the proximal and distal zone of *P. vulgaris* explants obtained from young or yellowing leaves. Explants were incubated in water or sucrose 0.05 *M* or pretreated with Triton X-100 2% during 1 h, and then exposed to R or FR radiation. An increase in amylases activity was always found accompanying natural or Triton- and saccharose-induced abscission. Triton- and sucrose-induced mechanisms of enzymatic activation are discussed as well as the possible meaning of amylases variation in proximal and distal zones of explants, in relation to abscission. *(Author's summary)* C03 C02

0121

14729 VERIN-VERGEAU, C. *et al.* **Les phosphoglycolate phosphatases des feuilles de haricot: propriétés catalytiques des deux isoenzymes.** *(Phosphoglycollate phosphatases in bean leaves: catalytic properties of two isoenzymes).* Phytochemistry 19(5):763-767. 1980. Fr., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Metabolism. Biochemistry. Analysis. pH. Leaves.**

2-Phosphoglycollate phosphatase isoenzymes I and II from bean leaves had pH optima at 6.7-6.9 and 6.7-7.0, resp., showing specificity for 2-phosphoglycollate; K_m values were 2.0 x 10^{-3} *M* (E_I) and 0.18-0.85 x 10^{-3} *M* at low and high substrate concn. (E_{II}). Both isoenzymes required divalent metal ions for activity; K_m values for Co^{2+} and Mg^{2+} were 1.7 x 10^{-4} and 1.0 x 10^{-4} *M* with E_I and 5.0 x 10^{-4} and 0.9 x 10^{-4} *M* with E_{II}. They exhibited regulatory responses to a no. of metabolites including sugar phosphates, amino acids and some organic acids. Serine (K_i 0.87 m*M*), glycollate (K_i 6.50 m*M*), 6-P-gluconate (K_i 0.55 m*M*), fructose-6-phosphate (K_i 2.40 m*M*) and formate (K_i 32.0 m*M*) were the most potent inhibitors of isoenzyme E_I. Two kinds of inhibitors interacted with E_{II} which was inhibited by glycine, glycollate and glyoxylate at substrate concn. > 0.40 x 10^{-3} *M*, and by α-alanine, glutamate and fructose-6-phosphate at any substrate concn. The activity of the 2 isoenzymes was stimulated by adenosine 5′-diphosphate. On the other hand, glycollate biosynthesis was inhibited by treating excised leaves with glutamate or serine. *(Author's summary)* C03

0122

14296 WALLACE, A., WALLACE, G.A. and CHA, J.W. **Effect of calcium deficiency on stem thickening and mineral composition of stem of bush beans.** Journal of Plant Nutrition 2(1/2):245-246. 1980. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris. **Plant nutrition. Mineral deficiencies. Ca. Stems. Composition. Mineral content. Minerals and nutrients.**

Bush bean cv. Improved Tendergreen when grown in a nutrient solution with no added Ca had dead terminal growing points and a greatly enlarged stem ∅. Mineral composition of the stems relative to that of control plants showed increases of 9.6, 3.2, 2.0, 24.0, 3.2, 14.8, 1.6, 3.6, 3.5, 32.0, 2.9, 12.8, and 12.0 times,resp. for Na, K, Zn, Cu, Fe, Mn, B, Al, Si, Mo, Sr, Ba and Pb. Simultaneously the Ca concn. of the stems was decreased 30.5 times. *(Author's summary)* C03 C01

0123

14333 BERTOLA, M.A. and KLIS, F.M. **Continuous cultivation of glucose-limited bean cells** *(Phaseolus vulgaris* L.) **in a modified bacterial fermentor.** Journal of Experimental Botany 30(119):1223-1231. 1979. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Tissue culture. Culture media. Growth. Temperature. pH. Biomass. N. Carbon fixation. Seedlings. Cell structure. Laboratory experiments.**

A commercially available bacterial fermentor was modified to allow the continuous cultivation of glucose-limited bean cells at a defined pH. A steady state was reached using a dilution rate of 0.004/h and was maintained for 4 mo.; during this period the dry wt. and packed cell vol. of the culture remained constant; the yield for glucose was 0.34 (dry wt./dry wt.) and for carbon 0.27 (g atom/g atom). Glucose-limited cells had lower C/N ratios both for cytoplasm and cell walls than cells in the exponential phase of growth in batch cultures. *(Author's summary)* C03 B00

0124

6246 KKHAE, F.S. and PLESHKOV, B.P. **The effect of phosphorus regime on fractional distribution and amino acid composition of proteins in bean.** Doklady Botanical Science 157/159:126-129. 1964. Engl., 9 Refs.

Phaseolus vulgaris. **P. Protein content. Amino acids. Composition. Maturation. Leaves. Pods. Laboratory experiments.**

The effect of a P regime on fractional distribution and amino acid composition of protein from leaves and maturing pods of beans was studied. Amino acid composition was determined by paper partition chromatography in 4 solvent solutions, from precipitated protein of aqueous extract obtained by homogenization, dialysis, and centrifugation. These methods of extraction are described and the results of amino acid composition of leaf and pods are presented in 2 tables. It was concluded that the amino acid composition of proteins from leaves and maturing pods of bean plants is fairly stable and is only slightly affected by reducing the amount of P supplied; only in the borate soluble fraction was there a certain reduction in amide content with P deficiency. There was also an increase in cystine content of various fractions. *(Summary by I.B. Trans. by L.M.F.)* C03 1100

0125

15489 YEANG, H.Y. and HILLMAN, J.R. **Extraction of endogenous ethylene and ethane from leaves of *Phaseolus vulgaris* L.** Journal of Experimental Botany 32 (127):381-394. 1981. Engl., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Composition. Leaves. Ethylene. Ethane. Analysis.**

A procedure to recover small vol. of gases from plant tissues by vacuum extraction is described. Changes in the vol. of the gases and the concn. of ethylene and ethane recovered from *Phaseolus* leaves were observed when the evacuation conditions during extraction were altered. These changes were different in the primary leaves and in the 2nd trifoliate leaves. Thus, estimates of internal ethylene and ethane concn. appear to be influenced both by the morphology of the tissue and the evacuation conditions employed. There was a positive correlation between the concn. of ethylene and ethane in the gaseous extracts. The internal ethylene concn. in the primary 1st trifoliate, and 2nd trifoliate leaves, considered together, were correlated with their resp. rates of ethylene emanation. *(Author's summary)* C03

0126

15842 FIELD, R.J. **The effect of low temperature on ethylene production by leaf tissue of *Phaseolus vulgaris* L.** Annals of Botany 47:215-223. 1981. Engl., Sum. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Temperature. Ethylene. Plant injuries. Enzymes. Leaves. Plant tissues. Statistical analysis.**

When leaf discs cut from primary leaves of *Phaseolus vulgaris* cv. Masterpiece plants grown at 25°C were incubated at temp. below 25°C, basal and wound ethylene production continued at reduced rates. In both cases detectable levels of ethylene were produced at 2.5°C. When the rates of ethylene production were plotted according to the Arrhenius equation a market discontinuity was found at 11.4°C, which is consistent with a membrane phase-transition at the critical chilling temp of the plant. Activation energies for the rate-limiting enzyme reaction in ethylene production above and below the critical temp. have been calculated and the data interpreted as indicating the involvement of membrane-bound enzyme systems in the biosynthesis of basal and wound ethylene. *(Author's summary)* C03

0127

15431 IZQUIERDO, J.A. and HOSFIELD, G.L. **Ethylene production from bean flowers and pods.** Bean Improvement Cooperative Annual Report 23:96-99. 1980. Engl., 2 Refs.

Phaseolus vulgaris. **Ethylene. Abscission. Flowers. Pods. Cultivars.**

Ethylene production rates and their relationship with C-assimilate and bean abscission are reported. Three var., Black Turtle Soup (BTS), Tuscola, and NEP-II, were grown at a commercial population density in a complete block design with restricted randomization and 4 replications on the Michigan State U. Botany Farm (USA) in 1979. Flowers and pods were sampled at 5 day intervals during the bloom period beginning 8 days after the appearance of the 1st flower. The reproductive structures of each cv. sampled were classified in 4 categories: (1) fresh flowers; (2) old flowers; (3) small pods; and (4) large pods. These were placed in gas-tight 20 cc tubes and incubated for 30 min. The ethylene released was immediately withdrawn and analyzed by gas chromatography. Significant differences were found among cv., reproductive structures, and sampling periods for the rate of ethylene production. BTS was a strong producer of endogenous ethylene. Data are given on ethylene production from bean flowers and pods at different times after flowering. *(Summary by C.P.G. Trans. by L.M.F.)* C03

0128

14709 MONTANHEIRO, M.N.S. **Espectrometria gama monocanal para detecção conjunta de ^{54}Mn, ^{65}Zn e ^{59}Fe em soluções e tecido vegetal.** *(Single channel gamma spectrometer to detect ^{54}Mn, ^{65}Zn, and ^{59}Fe in plant tissue solutions).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultura "Luiz de Queiroz", 1975. 74p. Port., Sum. Port., Engl., 57 Refs., Illus.

Phaseolus vulgaris. **Irradiation. Roots. Nutrient solution. Mineral content. Micronutrients. Mn. Zn. Fe.**

A methodology has been developed to detect the activities of ^{54}Mn, ^{65}Zn and ^{59}Fe in the same sample, with a single channel spectrometer coupled to a 3" x 3" well-type scintillator detector of NaI(Tl). Initially a selection of the energy channel was made based on the criteria of maximizing the signal/background ratio and consequently, the minimization of the variation coefficient. In the channels, a study of min. detectable actitivies is conducted for each radioisotope. Samples containing different combinations of these radioisotopes were prepared and their activities were calculated using simultaneous equations. In order to demonstrate the pratical utility of this methodology, an expt. was developed in which roots, isolated from bean plants were examined to determine levels of ionic absorption interference among micronutrients (Mn, Zn, and Fe). *(Author's summary)* C03

0129

14776 ZAGATTO, E.A.G. **Utilização da análise por ativação neutrônica não destrutiva para determinação de alguns elementos em folhas de feijoeiros (*Phaseolus vulgaris* L.) tratados com herbicidas.** *(Utilization of non-destructive neutron activation analysis to determine some elements of herbicide-treated bean leaves).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultura "Luiz de Queiroz", 1974. 79p. Port., Sum. Port., Engl., 51 Refs., Illus.

Phaseolus vulgaris. **Irradiation. Minerals and nutrients. Composition. Plant tissues. Leaves. Herbicides.**

The use of the non-destructive neutron activation analysis in plant tissues is indicated under Brazilian conditions. Al, Mn, Cl, Na, and K contents in bean leaves were determined. The methodology of sampling and standard preparation, the irradiation and detection conditions, and the possibilities of the occurrence of nuclear interferences are discussed. For comparison purposes, the same content determinations were made using different analytical

conditions. The use of this technique to determine other elements of agricultural interest is also discussed. Considering the accuracy and sensitivity obtained, the feasibility of non-destructive neutron activation analysis of Al, Mn, Cl, and K was verified under field conditions where herbicides have not produced any modification in the contents of those elements in bean leaves. *(Author's summary)* C03

0130

16041 HOCK, K. and HARTMANN, E. **Localization of phosphatidylcholine synthesizing enzymes in etiolated bean seedlings (*Phaseolus vulgaris* L.).** Plant Science Letters 21:389-396. 1981. Engl., Sum. Engl., 32 Refs., Illus.

Phaseolus vulgaris. **Hypocotyls. Seedlings. Enzymes. Plant physiological processes. Biochemistry. Plant tissues.**

The enzymes of the CDP-choline pathway of lecithin biosynthesis are present in etiolated hypocotyl hooks of bean seedlings. Subcellular distribution of the enzymes was determined by sucrose density gradient centrifugation. The enzyme choline kinase (EC 2.7.1.32) proved to be soluble protein while phosphorylcholine-cytidyl transferase (EC 2.7.7.15) and phosphorylcholine-diglyceride transferase (EC 2.7.8.2) were associated with particulate fractions. Phosphorylcholine-cytidyl transferase activity was found in microsomal fractional (density 1.10 g/cm^3) whereas phosphorylcholine-diglyceride transferase activity was exclusively localized in the microsomal fraction. *(Author's summary)* C03

See also 0013 0024 0028 0038 0061 0072 0078 0094 0103 0111 0245 0302 0329 0370 0499 0504 0505 0542

D00 AGRONOMY

0131

13504 OLIVEIRA, A.C.S. DE, FELICIO FILHO, A. and MOURA, P.A.M. DE **Diagnóstico da cultura do feijão em Minas Gerais.** *(Diagnosis of bean cultivation in Minas Gerais).* Belo Horizonte, Brasil, Empresa de Pesquisa Agropecuária de Minas Gerais. Série Programação no. 6. 1980. 19p. Port.

Phaseolus vulgaris. **Cultivation systems. Land preparation. Planting. Harvesting. Marketing. Technology evaluation. Diseas.' and pathogens. Brazil.**

A joint survey by CFP/AGMIG (Comissão de Financiamento de Produção - Agência de M. Gerais), EMATER-MG (Empresa de Assistência Técnica e Extensão Rural de M. Gerais), and EPAMIG (Empresa de Pesquisa Agropecuária de M. Gerais) was conducted in the main bean-producing regions of the state of Minas Gerais (Brazil) (Metalúrgica e Campo das Vertentes, Mata, Sul, Alto S. Francisco, Noroeste, Jequitinhonha, and Rio Doce) to determine practices related to: planting systems and main types of beans used in each region; soil preparation; production inputs used; pests and diseases; harvesting, and commercialization. A low level of technology is still used in bean cultivation, preventing increases in yields. Only through a continuous and integrated effort of federal and state agencies will it be possible to detect deficiencies and outline joint actions for an improved utilization of human and economic resources. *(Summary by I.B. Trans. by L.M.F.)* D00 J00

0132

14222 FRIJOL DE guia. *(Climbing beans).* Agroindustria 9(3):29-30. 1980. Span.

Phaseolus vulgaris. **Climbing bean. Cultivation systems. Intercropping.** *Zea mays.* **Cultivation. Costa Rica.**

Brief information is given on climbing bean cultivation in association with maize in Costa Rica, referring to cultural practices such as planting time and method,recommended var., land preparation, seed treatment, fertilization, weeding, pest and disease control. The practice of doubling maize on the internodes immediately after planting beans avoids damage to the seedling, allows maize grains to mature and dry, and increases total yields/ha. Var. Alajuela 1 (red) and Mexico 29 (black) are recommended. *(Summary by C.P.G. Trans. by L.M.F.)* D00

0133

14276 WRIGHT, R.M. **Seed size studies in dwarf french beans.** Australian Seed Science Newsletter 5:120-125. 1979. Engl.

Phaseolus vulgaris. **Fertilizers. Seed characters. Climatic requirements. Spacing. Cultivation. Australia.**

The effect of N fertilization (0-200 kg/N/ha applied 10 days after emergence and a side-dressing of 0-90 kg N/ha), plant density, and environment on seed size of dwarf french

beans in Bowen, Queensland (Australia). Only the environment affected seed size. Early plantings, as soon as possible after the rainy season (Dic.-March), are recommended. *(Summary by I.B. Trans. by L.M.F.)* D00 D04

0134

14252 DENNY, S. **Homestead snap beans—top management beats weather and disease.** Florida Grower and Rancher 71(1):4-6. 1978. Engl., Illus.

Phaseolus vulgaris. **Productivity. Yields. USA.**

The good results obtained in a 600-ac snap bean cultivation in Dade County, Florida (USA) are reported, where a total of 3000 ac of snap beans are produced in 7 mo. A yield of 132 bushels/ac was obtained by a complicated spray program applied by airplane in close collaboration with commercial firms and during tough weather and disease conditions. *(Summary by I.B. Trans. by L.M.F.)* D00

0135

14713 ALVARADO C., A.M., PADILLA, L.F. and MONTERROSO, A. **Evaluación de los factores que influyen en la producción del fríjol.** *(Evaluation of factors affecting bean production).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 13p. Span., 3 Refs., Illus.

Paper presented at Reunión Anual del PCCMCA, 26a. Guatemala, 1980.

Phaseolus vulgaris. **Productivity. Yields. Cultivation. Planting. Spacing. Fertilizers. Seeds. Water content. Pest control. Statistical analysis. Costs. Economics. Guatemala.**

In order to evaluate the factors that significantly affect bean yields, expt. with 2nd plantings (August) were set up in 3 localities of the state of Jutiapa, Guatemala. Individual variance analyses showed 1% level of significance for treatments. Combined variance analyses showed 1% level of significance for treatments and treatments/locality. Evaluated treatments were farmers'seed (Fs), Suchitán seed from ICTA (S), Culma seed from ICTA (C), ICTA fertilization (IF), farmer fertilization (FF), ICTA pest control (IPC), farmers' pest control (FPC), and possible combinations of these factors. An economic analysis of the alternatives was conducted to be able to determine the best alternatives,and studentized curves for small samples were conducted to determine factors of stability. Results show that higher yields were obtained with the 3 var. (Fs, S, C) and ICTA technology (IF + IPC). Fs + IF + IPC, S + IF + IPC, C + IF + IPC exceeded the check (Fs + FF + FPC) in 83, 80, and 79% of the yields, resp. Economic analysis shows that with S + IF + IPC as compared to the complete farmer technology, capital returns of 2.73 quetzals/each quetzal invested by the farmer was obtained to reach costs of ICTA technology and showed higher stability and consistency throughout the localities; this was the most recommended technology for beans in the Jutiapa region. *(Author's summary. Trans. by L.M.F.)* D00

0136

15818 IDSO, S.B. *et al.* **A generalization of the stress-degree-day concept of yield prediction to accommodate a diversity of crops.** Agricultural Meteorology 21(3): 205-211. 1978. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. **Solar radiation. Temperature. Photoperiod. Climatic requirements. Adaptation. Yields. Statistical analysis.**

Data from 7 different crops (2 cv. of wheat, barley, *Phaseolus vulgaris*, lucerne, soybeans, and sorghum), some of which were grown in 3 different locations and in 3 different yr, with a variety of sowing dates and rates and irrigation regimes were combined to develop a single broad relationship between yield, as normalized for solar radiation reception over the

crop's vegetative growth stage, and the summation of stress-degree-days accumulated over the crop's reproductive growth stage. Some reasons for expecting a common relationship of this type were presented along with suggestions for future modifications that might be required as data from other crops and climates are acquired. *(Summary by Field Crop Abstracts)* D00

0137

15422 PESSANHA, G.G., VIEIRA, C. and CARDOSO, A.A. Efeitos de populações de plantas e da adubação mineral sobre misturas de cultivares de feijão (*Phaseolus vulgaris* L.). *(Effects of plant populations and mineral fertilization on bean cultivar associations).* Revista Ceres 27(152):413-430. 1980. Port., Sum. Port., Engl., 24 Refs.

Phaseolus vulgaris. Spacing. Nutritional requirements. Intercropping. Cultivars. Agronomic characters. Climatic requirements. Timing. Fertilizers. N. P. K. Brazil.

Exptl. studies have shown that mixtures of bean cv. have transitory duration, since weak competitors are quickly eliminated due to intergenotypic competition. However, in the Zona da Mata area, state of Minas Gerais, Brazil, mixtures of bean cv. are quite common, showing that some factors contribute to preserve them. In order to know the effect of plant populations and fertilization levels on cv. blends of beans, expt. were carried out during both planting seasons (rainy and dry). Cv. Ricopardo 896, Ricobaio 1014, Costa Rica 1031, Manteigão Fosco 11, Manteigão 977, Jalo, and the mixtures 896 + 1014 + 1031 and 11 + 977 + Jalo were included in the expt. The blends were made up of equal no. of seeds of each component. Cv. and their mixtures were planted as 4 different populations and with 4 levels of fertilization at Viçosa, Minas Gerais. It was found that the performance of cv. mixtures can be affected by plant population, planting time, and fertilization. Therefore, after a mixture is released, its performance will depend on how and when it is planted. Additionally, small farmers in the Zona da Mata area generally intercrop beans with maize, planting small populations of beans during the rainy season and large populations during the dry season. This practice should markedly affect the performance of the mixtures; the performance of mixtures in these intercropping systems has not been studied. *(Author's summary)* D00

0138

13126 MENEGARIO, A. Feijão na ordem do dia. *(Current situation of bean cultivation in the state of São Paulo).* Fir 10(3):28-36. 1967. Port.

Phaseolus vulgaris. Cultivation. Fertilizers. Pest control. Inoculation. *Rhizobium.* Brazil.

Some recommendations on the obtainment of higher yields are given for bean cultivators. These include the following aspects: land selection and topography, crop rotation, soil analysis and fertilization, selection of var., good quality seed, pH amendment, inoculation, planting dates, spacing, land preparation, earthing up, cultural practices, pests and diseases, harvesting, and preparation of the product. *(Summary by I.B. Trans. by L.M.E.)* D00

0139

13200 ESCALANTE E., J.A.S. Reporte de investigaciones sobre fríjol 1979-1980. *(Bean research report, 1979-1980).* Iguala, Guerrero, México, Instituto Superior Agropecuario Autónomo del Estado de Guerrero, 1981. 31p. Span., Illus.

Phaseolus vulgaris. Research. Planting. Spacing. Fertilizers. Leaves. Weeding. Yields. Yield components. Mexico.

A report is given of the results of theses conducted at the Instituto Superior Agropecuario Autónomo del Estado de Guerrero, Mexico, in 1979-80 on the institute's own exptl. field.

The effect of different fertilizer treatments and plant densities on yields and yield components of bean Michoacán 12-A-3 were investigated and higher seed yields (129.5 g/m²) were found with a plant density of 28 plants/m² with 80-40-00 fertilization at planting. In an expt. on the effect of plant density on maize/bean yields, it was demonstrated that the greater competition between plants did not determine maize grain yield but did determine bean yields. Methods of weed control were compared and the application of preemergent herbicide prometryn (2.5 kg/ha) gave a better control. Yields of 23 bean genotypes were examined in Iguala, Guerrero and significant differences were found among them. The effect of complementary leaf fertilization on bean seed yield and yield components was assessed and an increase up to 15% was found when leaf fertilization was used due to a larger no. of normal grains and of pods with grains. The effect of different treatments of leaf removal on seed yield and yield components of bean Michoacán 12-A-3 was studied and it was concluded that the photosynthates produced after flowering by upper leaves had more influence on yields; photosynthates produced by the stem, branches, and pods had little influence on Michoacán 12-A-3 yields. *(Summary by I.B. Trans. by L.M.F.)* D00 C00

0140

15233 STOFFELLA, P.J. *et al.* **Lodging resistance in black beans.** Bean Improvement Cooperative Annual Report 23:42-43. 1980. Engl., 2 Refs.

Phaseolus vulgaris. **Cultivars. Lodging. Host-plant resistance. Harvesting. Yields.**

Six black bean lines were grown in Manhattan, Kansas, USA, to determine the degree of lodging resistance. Lodging, yields, and HI were determined prior to harvest on the basis of 6 replications. Four of the lines assessed, 70001, 70002, 70003, and 70004, showed less lodging and higher seed yields (1531, 1514, 1574, and 1585 kg/ha, resp.) than cv. Black Turtle Soup and Strain 39 (962 and 1210 kg/ha, resp.). *(Summary by C.P.G. Trans. by L.M.F.)* D00

0141

14778 AGUIRRE, C.H. **Efecto del distanciamiento y número de surcos por parcela en la competencia entre variedades de fríjol (*Phaseolus vulgaris* L.) de distinto hábito de crecimiento.** *(Effect of spacing and number of rows per plot on competition between bean varieties of different growth habits).* Tesis Ing. Agr. Guatemala, Universidad Autónoma de San Carlos de Guatemala, 1968. 20p. Span., 17 Refs.

Phaseolus vulgaris. **Planting. Spacing. Cultivars. Plant habit. Yields. Field experiments.**

This investigation seeks to determine, between 2 alternatives, the distance between rows that produces the highest yield as well as the effect of marginal competition between var. of different or similar growth habits and the influence of the no. of rows/plot considered from a point of view of exptl. accuracy. The expt. was established at the Estación Exptl. Agrícola in Chimaltenango, Guatemala in June 1966. Exptl. treatments included: A, no. of rows/plot; B, growth habit; C, distance between rows; D, competition. Furthermore, fertilization was done at planting and weeds and pests controlled. Higher yields were obtained in rows spaced at 1 m; however, yield/unit of area was not higher at this distance than at 0.60 m. Differences in yield among the 2 var. of different growth habits were not significant; however, marginal competition of these distinct var. negatively affected yields. Spacing x marginal competition and rows x marginal competition interactions were highly significant. It is suggested that the effect of different margins is only shown when rows are close (0.60 m). The no. of rows/plot did not have significant effects. *(Summary by I.B. Trans. by L.M.F.)* D00

0142

13571 OROZCO, S.H. **Fríjol de suelo en monocultivo para Chimaltenango.** *(Bush beans in monoculture for Chimaltenango).* Guatemala, C.A., Instituto de Ciencia y Tecnología Agrícolas. Folleto Técnico no. 11. 1979. 17p. Span., Illus.

Phaseolus vulgaris. **Cultivation. Seed. Cultivars. Spacing. Weeding. Pest control. Composition. Agronomic characters. Dwarf bean. Guatemala.**

The recommendations necessary to increase bean productivity and improve bean production in the Altiplano Central in Guatemala are given, result of research conducted by the Instituto de Ciencia y Tecnología Agrícolas (ICTA). These include the selection and preparation of soil (use of amendments), selection of seed, var., planting distances, fertilization, weed, pest, and disease control. Agronomic characteristics of the var. San Martin, which is a good alternative regarding vigor and yields, are given and the culinary and nutritional characteristics of 8 var. are listed in table form. *(Summary by I.B. Trans. by L.M.F.)* D00

0143

4620 COYNE, D.P. *et al.* **Growing dry edible beans in Nebraska.** Lincoln, University of Nebraska. Lincoln College of Agriculture. Agricultural Experiment Station. SR 527. 1973. 39p. Engl., Illus.

Phaseolus vulgaris. **Cultivars. Planting. Fertilizers. Weeding. Irrigation. Harvesting. Costs. Seed production.** *Epilachna varivestis. Xanthomonas phaseoli. Uromyces phaseoli. Whetzelinia sclerotiorum.* **Insect control. Disease control.**

The cultivation of Great Northern and Pinto bean types in Nebraska, USA, was investigated. The following aspects are emphasized: recent trends of cultivation; production in the USA; utilization; and nutritional value. A description is given on the agronomic characteristics and production of the var. Great Northern (UI-59, 1140, UI-31, 1, Tara, Jules, and Emerson), Pinto (UI 111, UI 114, Ouray, Luna), Sutter California Pink bean, pea beans (Sanilac, Seaway, Gratiot), Light Red Kidney Redkote, Red Mexican (UI-36, UI-34, and Big Bend), Small White (Bailif, Bonus, and Atlas), and California Small White 53 and 59 along with land selection and preparation, planting, fertilization, weed control, irrigation, harvesting, cleaning, grading, marketing, costs of production, production of certified bean seed, bean insects (Mexican bean beetle, cutworms) and diseases (common bacterial blight, bacterial wilt, halo blight, bacterial brown spot, rust, root rot, and white mold disease). *(Summary by W.M.S. Trans. by L.M.F.)* D00 E00 F00

See also 0002 0046 0197 0396 0440 0444 0558 0563

D01 Soil Water, Climate and Fertilization

0144

11185 COERTZE, A.F. **Irrigation of green beans.** Farming in South Africa. Vegetable Series II. Green Beans and Green Peas F.1/1978. 2p. Engl., Illus.

Phaseolus vulgaris. Water requirements. Irrigation. Cultivation. South Africa.

Some considerations are given on the importance, the amount and method of irrigation that should be used in green bean cultivation. An adequate irrigation increases yields and the no. of pods and produces more vigorous plants; however, it can also contribute favorably to the development of weeds. The effective root depth of green beans is 450 mm. The amount of water needed for germination depends on the type of soil and can vary from 25 mm on a sandy soil to 60 mm on a clayey soil. After emergence, an irrigation of 35 mm is sufficient for a period of 10 days; after flowering, 35 mm/wk. should be provided until the moment of harvest. The total amount of water required for the crop is 355 mm; if the efficiency of the irrigation is taken into account, 450 mm should be provided, this without taking into consideration rainfall. The advantages and disadvantages of sprinkler and flood irrigation are presented. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0145

11641 COERTZE, A.F. **Climate and soil requirements for green beans.** Farming in South Africa. Series: Vegetable Cultivation in South Africa. Green Beans and Green Peas no. B.1/1977. 2p. Engl., Illus.

Phaseolus vulgaris. Climatic requirements. Soil requirements. Diseases and pathogens. South Africa.

Edaphoclimatic requirements for snap bean cultivation are described. Optimum daily temp. for growth, quality and yield varies between 16-21°C. Temp. > 35°C cause flowers to abort and yield decreases. Night temp. < 5°C cause damage to the seed production in pods. Halo blight, pod rotting caused by *Botrytis* and anthracnose can occur in wet conditions, which also cause difficulties during harvesting. Dry winds adversely affect pollination. Snap beans require deep, well-drained but water-retaining soils. Optimum pH of the soil varies between 6.0-6.5. The crop presents toxicity in soils with high Bo content. The best results have been found in medium loamy soils and adequate fertilization is important for an excellent production. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0146

11189 COERTZE, A.F. and JACKSON, D.C. **Fertilization of green beans.** Farming in South Africa. Vegetable Series II. Green Beans and Green Peas E.1/1977. 3p. Engl., Illus.

Phaseolus vulgaris. Planting. Fertilizers. N. P. K. Zn. Mn. B. Mineral deficiencies. South Africa.

Recommendations are given on the date and rates of NPK application in green bean crops and Zn, Mn and B deficiencies are described including the rates and ways of applying trace

elements for correction. Foliar nutrition and the inoculation of seed with N-fixing bacteria have not given positive results. The crop should not be planted more than once in 3 yr and green peas (*Pisum sativum*) should not precede or follow green beans to avoid the incidence of pathogens in the soil. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0147

11655 ARAUJO, G.A. DE A. Influência do molibdênio e do nitrogênio sobre duas variedades de feijão (*Phaseolus vulgaris* L.). *(Influence of molybdenum and nitrogen on two bean varieties).* Tese Mag. Sc. Viçosa-MG, Brasil, Universidade Federal de Viçosa, 1977. 30p. Port., Sum. Port., 39 Refs., Illus.

Phaseolus vulgaris. Fertilizers. N. Mo. Soil analysis. Nodulation. Seed treatment. Productivity. Yield components. Agronomic characters. Cultivars. Brazil.

The effect of Mo and N on 2 bean var. was studied under field conditions in Viçosa, Minas Gerais (Brazil). Three levels of N, a control treatment without N and Mo and a special residual treatment were used, the latter characterized by the use of planting seed resulting from plants that had received Mo leaf aspersion and which combined 2 var., Rico 23 and I-162 Guatemala. The var. presented an uniform behavior in relation to the treatments; however, there was a difference in plant development, the no. of pods/plant, N content in the leaves and due to the better efficiency of one of the var., Rico 23, in seed production. Only the nodulation of var. I-162 Guatemala continued during the flowering period. N reduced and Mo increased nodulation; however, neither of the 2 elements caused a significant variation in seed production. Both Mo and N presented contrasting quadratic effects on seed size. The av. of Mo and N treatments only differed from the control av. in straw production. *(Author's summary. Trans. by L.M.F.)* D01 101

0148

13168 GUAZZELLI, R.J. Exigencias climáticas do feijoeiro. *(Climatic requirements for bean cultivation).* Informe Agropecuário 4(46):9-11. 1978. Port. 22 Refs.

Phaseolus vulgaris. Climatic requirements. Plant development. Yields. Brazil.

The climatic requirements for bean cultivation are presented. For a 90 day vegetative period, 200-300 mm of precipitation are sufficient; the highest requirement is between germination and complete flowering with a demand of 110-180 mm. Dry periods 15 days before flowering can be critical for the crop since they cause flower abortions, a reduction in the no. of pods and dry wt. of the bean. Yields are favored by a min. daily temp. > 17°C, day and night differences in temp. < 10.5°C, daily evaporation < 4.7 mm, wind velocity < 11.5 mm, RH > 85.5% and solar radiation < 412.8 cal/m²/day. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0149

11689 SALAZAR, J.R. Muestreo, análisis de suelo y su interpretación, enfatizando en la fertilización de maíz y fríjol. *(Sampling, soil analysis and its interpretation emphasizing maize and bean fertilization). In* Miranda M., H., comp. Curso de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.143-170. Span., 15 Refs., Illus.

Phaseolus vulgaris. Soil fertility. Soil analysis. Fertilizers. N. P. K. El Salvador.

El Salvador is situated in an area of relatively high rainfall and temp., conditions that affect the fertility of the soil. The factors that determine a good soil fertilization and amendment of nonfavorable conditions such as acidity and high Al content are given. The techniques for taking samples are described along with the principles of soil analysis and the interpretation

of the results of research, which emphasize maize and bean production during several yr of study. The levels of N are low due to the high rainfall and the low OM content. The reddish clay latosol soils (in the regions of Moncagua and Suchitoto) are deficient in P. None of the soils presented K deficiency. Liming may lead to: (1) the alteration of the Ca-Mg relation; (2) Mo deficiency (important for beans); (3) Al and Mn toxicity, and (4) P fixation. The former aspects are analyzed and the recommendations on the handling and the amounts of nutrients are presented. A literature review on the research conducted and the results of analyses conducted in different regions of the states of Usulutan and San Miguel are given. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0150

11662 CANCIAN, A.J. **Estudo dos componentes prevenção e tolerância à seca em *Vigna unguiculata* (L.) Walp. cv. "Seridó" e *Phaseolus vulgaris* L. cv. "Rico 23".** *(Study on the elements of drought prevention and tolerance in Vigna unguiculata var. Seridó and Phaseolus vulgaris var. Rico 23).* Teses Mag. Sc. Viçosa-MG, Brasil, Universidade Federal de Viçosa, 1978. 35p. Port., Sum. Port., 55 Refs., Illus.

Phaseolus vulgaris. Vigna unguiculata. **Drought. Stomata. Leaves. Host-plant resistance. Amino acids. Water requirements. Water content. Transpiration. Brazil.**

The relative participation of the elements of drought prevention and tolerance and total resistance was evaluated for *Vigna unguiculata* and *Phaseolus vulgcris* plants. Stomatic performance and the relative rate of cuticular transpiration were considered as parameters to drought prevention. The rate of reduction of the relative amount of water and the critical deficit in saturation were taken as measures of plant tolerance to drought. The length of survival of excised leaves is an estimator of the total resistance of the plant to drought. An intent was made to correlate the accumulation of free proline to the parameters of drought tolerance. Stomatic performance defined by diffusive leaf resistance, was evaluated by the use of a measuring device of diffusive resistance; the rate of relative cuticular transpiration, the relative amount of water and the critical deficit in saturation were evaluated by gravimetric methods. The accumulation of free proline was studied in leaf discs subjected to osmotic dehydration. Even though the values of diffusive resistance of the abaxial surface and the total diffusive resistance were the same for both species, the stomatic apparatus of *V. unguiculata* showed more sensitivity to the variation of the water condition of the leaves, since higher values were shown for stomatic resistance of the abaxial surface and water potential, critical for stomatal closure. Gradually the rate of total transpiration was more accented for *V. unguiculata* and the relative rate of cuticular transpiration was approx. half of that observed for *P. vulgaris. V. unguiculata* plants maintained their water content for a longer period of time than *P. vulgaris* since wilting was less. The critical deficit in saturation did not present significant differences between the 2 species studied. The length of survival, determined for excised leaves was greater in *V. unguiculata.* Osmotic dehydration produced an accumulation of total amino acids and free proline in the 2 species. The amount of amino acids was always inferior in *V. unguiculata* than that observed in *P. vulgaris.* The accumulation of free proline was greater in *V. unguiculata* leaf discs subjected to osmotic dehydration. *(Author's summary. Trans. by L.M.F.)* D01

0151

13136 FORSYTHE, W.M. and HUERTAS, A. **Effect of soil penetration resistance on the growth and yield of beans (*Phaseolus vulgaris* L.) 27-R variety.** Turrialba 29 (4):293-298. 1979. Engl., Sum. Span. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Soil requirements. Roots. Growth. Yields. Seed production. Research. Costa Rica.**

Seed, aerial DM production,and root production of bean var. 27-R increased when penetration resistance at field capacity in the 0-25 cm layers or the 12.5-25 cm layers was increased to 6-10 bars. This was attributed to better contact between the roots and the soil. Further

increase in penetration resistance up to 21 bars reduced yields (approx. 50%) and aerial and root growth. Increased resistance in the 0-12.5 cm layer only slightly reduced yield and aerial DM production, whereas root production followed the trends of the other treatments except that root density was similar throughout the 0-25 cm soil depth. The expt. was carried out in 26-*l* pots containing a fumigated Typic Dystropept fine mixed isohyperthermic soil in a greenhouse at Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica. Soil layers were compacted to the desired penetration resistance by a hydraulic press. Resistance to a 5-mm ϕ circular stainless steel piston pushed 5 mm into the soil was measured with a portable penetrometer suitable for field use. The plants were grown within the soil moistue suction range of 0.1-0.8 bars. Oxygen diffusion rates measured at a 15 cm depth after irrigation indicated that none of the treatments experienced limiting O supply although air space measurements indicated temporary limiting conditions in some treatments. *(Author's summary)* D01

0152

13169 GUEDES, G.A.A. and JUNQUEIRA NETTO, A. Calagem e adubação. *(Liming and fertilization).* Informe Agropecuário 4(46):21-23. 1978. Port., 7 Refs.

Phaseolus vulgaris. **Nutritional requirements. Fertilizers. Agricultural lime. N. P. K. Micronutrients. Ca. pH. Al. Brazil.**

Beans have high N and K requirements and develop better in soils with pH 5.5.-6.5. Liming is used to increase soil pH, eliminate toxic Al, and supply Ca and Mg. The importance of liming, recommendations on rates and application are discussed as well as other necessary fertilizing elements. The consequences of NPK deficiencies, their correction, applications, and recommendations are given. Cerrado soil responded to K application. Mo and Co applications originated response in bean crops. *(Summary by I.B. Trans. by L.M.F.)* D01

0153

14281 OLIVEIRA, I.P. DE *et al.* Influência de diferentes níveis de fósforo na presença de calagem na cultura do feijoeiro *(Phaseolus vulgaris* L.). *(Influence of different levels of P and liming on bean cultivation).* Agros 12:55-65. 1977. Port., Sum. Port., Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. P. Ca. Yields. Experiment design. Statistical analysis. Brazil.**

An expt. was conducted on a dark-red Latosol at the Fazenda Capivara, Goiânia-state of Goiás (Brasil), previously planted in corn, with the objective of observing the behavior of 4 cv. (Tibagi River, Rico 23, Tayhú, and Tambó) with the application of 0, 40, 80, 120 and 160 kg P_2O_5/ha. in the presence of 0, 2, 4, 6, and 8 t/ha of calcitic limestone with 80% of PRNT. Under these conditions Tibagi River was most productive; followed by Rico 23. Cv. Tibagi River and Rico 23 responded linearly to P_2O_5 level. Cv. Tambó did not respond to P. Cv. yielded better with 2 t of lime/ha, equivalent to a pH of 5.7. There was no influence of treatment on the no. of nodules. The wt./100 seeds was significantly affected by liming. With regard to P only its interaction with lime significantly affected the wt. of 100 seeds; Ca and P alone and the interaction of the 2 significantly affected the no. of the pods/plant. *(Author's summary)* D01

0154

14399 ROWELL, B. *et al.* Maintenance of soil fertility for vegetable crops. Tennessee Farm and Home Science Report 108:28-31. 1978 Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. N. P. K. Soil impoverishment. Soil fertility. Yields.**

Annual applications of 60 lb/ac of both P_2O_5 and K_2O were sufficient for maintaining max. yields of tomatoes, cabbage, lima beans, and snap beans for 3 yr at 3 locations in Tennessee (USA). Lima bean yields were not reduced when P and K were withheld for 2 yr at the Main Expt. Station, Knoxville (KNOX) and at the West Tennessee Expt. Station (WTES). Snap bean yields at Plateau Expt. Station (PES) showed no response to N application for 2 yr and no response to P and K applications for 3 yr. Soil tests indicated that annual applications of 60 lb/ac of both P_2O_5 and K_2O maintained high P and K for 3 yr under these cropping conditions. When P and K were withheld, soil K levels appeared to decline faster than soil P levels. Soil P levels remained high with no P applications, but levels were declining somewhat after 3 cropping seasons. There was a net accumulation of available soil P with the 120 lb/ac P_2O_5 treatment at KNOX. Results of these tests indicate that high yields of vegetables can be maintained for several yr with relatively small annual applications of P and K on soils which have high levels of these nutrients. Omitting P and K applications may not affect yields for several yr on some soils. Depletion and accumulation rates of P and K will vary with soil characteristics, climate, and cropping intensity. Since soils may gradually accumulate residual available P and K, continued additions of large amounts of these nutrients may make it possible at some period to reduce annual application rates of P and K without lowering crop yields. Environmental and management factors often cause greater yield responses than fertility levels. *(Author's summary)* D01

0155

14388 OTERO, C.A. **Efecto de la fertilización al suelo más foliar sobre el rendimiento y componentes del fríjol *(Phaseolus vulgaris* L.) var. Michoacán 12-A-3.** *(Effect of soil fertilization plus leaf fertilization on the yield and components of bean var. Michoacán 12-A-3).* Tesis Ing. Agr. Iguala, México, Instituto Superior Agropecuario Autónomo del Estado de Guerrero, 1981. 64p. Span., Sum. Span., 30 Refs., Illus.

***Phaseolus vulgaris*. Cultivation. Growth analysis. Fertilizers. Planting. Flowering. Plant development. Growth. Yields. Yield components. Flowers. Stems. Pods. Harvesting. Experiment design. Statistical analysis. Mexico.**

A study was conducted from Nov. 1979-Feb. 1980 at the exptl. fields of the Instituto Superior Agropecuario Autónomo of the state of Guerrero (Mexico) to determine the effect of soil + leaf fertilization on grain yield and its components, in addition to other physiological parameters in bean var. Michoacán 12-A-3. The treatments used were: soil fertilization at planting (SF), soil fertilization at planting + leaf fertilization (SF + LF), applied during the growth cycle (20 days after planting, E_1) and 2 times during the reproductive cycle (at the initiation and end of flowering, 40 and 60 days after planting, E_2 and E_3, resp.) and the control (without fertilization). Results showed that grain yield (dry wt. of grain at 10% humidity) of soil- and leaf-fertilized plants during the growth cycle increased up to 15% compared to the yield of plants with only soil fertilization. This increase is due to a higher no. of normal grains/plant and a higher no. of filled pods/plant. The no. of normal grains/pod and the size of the grain (av. dry wt./grain) were not significantly affected by treatments. The LAI did not show significant differences among treatments. On the other hand, LAD was affected; it was found that plants with SF + LF showed higher values of LAD. Total dry wt./plant was increased with SF + LFE_1 and SF treatments, decreasing in the rest of the treatments, which in turn, showed higher HI values. To make correlations between the grain yield and its most immediate components, it was found that the no. of normal grains and the no. of filled pods/plant showed the highest coefficient of correlation in var. Michoacán 12-A-3. *(Author's summary. Trans. by L.M.F.)* D01

0156

13598 FERNANDES, B., RESENDE, M. and REZENDE, S. B. DE **Caracterização de alguns solos sob cerrado e disponibilidade d'água para culturas.** *(Characterization of some soils under cerrado and water availability for crops).* Experientiae 24(9): 209-260. 1978. Port., Sum. Engl., Port., 21 Refs., Illus.

Phaseolus vulgaris. **Soils.** *Zea mays.* **Rotational crops. Water requirements. Irrigation. Drought. Soil requirements. Field experiments. Brazil.**

This study was conducted on soils under cerrado vegetation in the Triângulo Mineiro and w. part of the Alto Paranaiba region of Minas Gerais (Brazil). There is a recent trend towards growing cotton and soybeans on red latosols, and rice and soybeans on medium textured latosols. Maize has been traditionally grown on the better soils but its yield has been adversely affected by drought and uneven precipitation. Permanent wilting point was estimated by physiological methods using maize, beans, and soybeans. Estimation of available water for crops showed similar values for the various types of soils in spite of a great difference in clay content, the av. being 6.2% ± 1.0. *(Summary by Field Crop Abstracts)* D01

0157

14739 ESCAMILLA E. E. **Greenhouse studies on the effects of foliar spray of nutrient solutions during the grain filling period on spring wheat** *(Triticum aestivum* **L.) and black field bean** *(Phaseolus vulgaris* **L.) varieties.** Ph.D. Thesis. Ames, Iowa State University, 1977. 160p. Engl., Sum Engl., 123 Refs.

Phaseolus vulgaris. **Fertilizers. Leaves. Plant development. Growth. Soil fertility. Cultivars. Yields. Spacing. Plant nutrition. Nutritional requirements. Green-house experiments.**

The major objectives of this dissertation research were to investigate the effectiveness of foliar fertilization (FF) applied during the grain filling period, and also to study grain yields and plant responses under greenhouse conditions. This study was conducted on spring wheat and grain black beans. The beans were grown under 2 different watering systems. One of those systems consisted of a constant supply of water by subirrigation, and the other involved manually supplying water to the soil surface. Wheat was grown under the constant subirrigation system. Plants were grown in big boxes and with soil fertilized to optimal conditions for each species. A complete formulation of N, P, K and S was sprayed in each of 4 applications. The nutrient ratio used was 12:2:3:1 for wheat and 15:2:6:1 for beans of N, P, K, and S, resp. Up to 60N:10P:15K:5S kg/ha and up to 120N:16P:48K:8S kg/ha were applied on wheat and beans, resp. In both expt. an equivalent of 255 *l*/ha were sprayed in each application. From the 5 wheat var. grown, var. Xocomil-75 was the only one that increased yields with foliar treatment. An increase of 43% was observed in this var. when grown at a density of 520 seeds/m^2. However, a decrease in yields in var. Zunil-75 was observed at the same density. Foliar fertilizer applied on wheat sowed at 1040 seeds/m^2 decreased the no. of heads/plot. FF lowered concn. of N in the grain of all var. grown at the low plant density, but the N concn. increased at the high plant density. No clear pattern was found for the concn. of leaf-N with foliar application at the low density, whereas at the high density there was a marked increase of leaf-N and of head-N. Grain yields in beans were higher when grown under the constant water supply than when grown under the manual watering system. Var. Jalpatagua and Turrialba I did not show a clear response to FF when grown under the manual watering system, however, when grown under the constant subirrigation system those var. had an increase of more than 50% and more than 80%, resp. when 80N:10.8P:32.4K:5.4S kg/ha were applied in foliar spray. Protein content of grain beans was constantly increased from 22.6 to 28.7% by the application of nutrients in foliar form. S content of grain was increased by foliar fertilizer, but at a lower rate than the total protein indicating a decrease in the amount of S amino acids in relation to the total grain protein. *(Author's summary)* D01 C01

0158

14377 PARRA, M.A. and CRUZ R., G. **On the dependence of salt tolerance of beans *(Phaseolus vulgaris* L.) on soil water matric potentials.** Plant and Soil 56: 3-16. 1980. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Water requirements. Salinity. Host-plant resistance. Irrigation. Leaves. Growth. Transpiration. Water stress. Soil requirements. Pods. Yields.**

Bean plants (Kora cv.) were grown in potted soil artificially salinized by adding NaCl and $CaCl_2$ to the irrigation water to obtain an electrical conductivity of the soil saturation extract (EC_e) 30 days after emergence of 0.1, 0.3, 0.5, and 0.7 S/m at 25°C and a sodium adsorption ratio (SAR) of 4 $(mmol/l)^{1/2}$ Thereafter, plants were irrigated when soil water matric potential (Ψ_M) was in the range of -20 to -30kPa (wet treatment) and when Ψ_M was in the range of -40 to -60kPa (dry treatment). Transpiration rates (Tr) and leaf extension rates (LER)/plant or per unit of leaf area were decreased by increasing soil salinity and by decreasing soil moisture. However, a given decrease of Ψ_M produced a considerable larger decrement in Tr of LER than an equivalent reduction of soil water osmotic potential (Ψ_O). Absolute yields of green pods under wet treatments were from twice to 1½times as large under the wet than under the dry treatment at equivalent values of Ψ_O. Relative yields were reduced by 25% when EC_e were about 0.5 S/m and 0.7 S/m in the dry and wet treatment,resp. Salt tolerance data of crops may not have a quantitative interest when soil irrigation regimes under which they were obtained are not specified. *(Author's summary)* D01 C00

0159

14240 CUNHA, J.M. DA *et al.* **Niveis de nitrogênio, na cultura do feijão.** *(Nitrogen levels in bean crop production).* Pesquisa Agropecuária Brasileira 15(1):47-52. 1980. Port., Sum. Port., Engl., 23 Refs.

Phaseolus vulgaris. **Yields. Fertilizers. N. Field experiments. Productivity. Brazil.**

Bean yields related to 6 levels of N application have been determined in soils of a particular producing area of Minas Gerais (Brazil) which responds to this element. A linear response was obtained in 2 tests and both linear and quadratic effects in one of them. The economic interpretation by cost-return method using both market price and support price have shown that N at 20 kg/ha afforded the best return rate while N at 80 kg/ha gave the best net return. *(Author's summary)* D01

0160

14361 MULLINS, C.A., TOMPKINS, F.D. and PARKS, W.L. **Effects of tillage methods on soil nutrient distribution, plant nutrient absorption, stand, and yields of snap beans and lima beans.** Journal of the American Society for Horticultural Science 105(4):591-593. 1980. Engl., Sum. Engl., 24 Refs.

Phaseolus vulgaris. **Land preparation. Soil requirements. Nutritional requirements. Spacing Nutrient absorption. N. P. K. Mg. Ca. Leaves. Pods. Cultivation. Herbicides. USA.**

A 3 yr (1976-78) tillage study was conducted with snap beans and lima beans. Treatments included 2 no-till systems where furrows were opened with a fluted coulter or a vibratory unit, 2 reduced tillage methods with seedbeds prepared with a disk or a powered harrow, and conventional tillage. Tillage method did not affect soil pH at sampled depths. Soil P levels were higher at the 10-15 cm depth with conventional compared to tillage with vibratory unit. Soil K levels were higher at the 5-10 and 10-15 cm depths with conventional tillage. Tillage method did not affect petiole N, K, and Ca concn. Petiole P concn. were lowest with conventional tillage. Petiole Mg concn. were lowest with the no-till treatments using fluted coulter for snap beans and the vibratory unit for lima beans. Snap bean stand was highest with no-till the vibratory unit. Tillage method did not affect mean snap

bean yield or lima bean stand. Mean lima bean yield was highest with conventional tillage. *(Author's summary)* D01 D02

0161

14345 VOTH, R.D. and CHRISTENSON, D.R. **Effect of fertilizer reaction and placement on availability of manganese.** Agronomy Journal 72(5):769-773. 1980. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Fertilizers. Nutritional requirements. N. Mn. pH. Nutrient absorption. Laboratory experiments. Field experiments. Plant tissues. Composition.**

Mn deficiencies are a serious problem in crop production on some high pH soils of the lake-bed regions of Michigan and Ohio (USA). It has been observed that some fertilizers banded near the seed increase Mn availability. Several factors have been suggested to be responsible for this increased availability. A series of lab. incubation, greenhouse and field studies were conducted to evaluate fertilizer reaction and Mn sources on availability of Mn to sugar beets, soybeans, and navy beans. The incubation study showed that fertilizer sources which produce an acidic reaction initially increase the level of DTPA (diethylenetriaminepenta-acetic acid) and 0.1 *N* H_3PO_4 extractable Mn in the soil contiguous to the fertilizer band. After 7 wk. of incubation, H_3PO_4 extractable Mn levels were not significantly different for the various fertilizer treatment. The level of Mn extracted with DTPA after 7 wk. for the fertilizer sources was: DAP-urea-KCl > control = MAP-urea-KCl > NH_4NO_3-MCP-KCl = $(NH_4)_2SO_4$-MCP-KCl, where DAP = diammonium phosphate, MAP = monoammonium phosphate and MCP = monocalcium phosphate. The greenhouse study was conducted on a Tappan loam (Typic Haplaquepts) and consisted of a 2^4 factorial set of treatments with N sources of urea and $(NH_4)_2SO_4$; N and P (MCP) placements of mixed and banded; and Mn levels of banded Mn and no Mn. Banded MCP proved to be as effective as banded Mn in increasing Mn availability (extractable and plant uptake). Banded Mn along with banded MCP proved to be much superior to either factor alone. N source and placement had small and variable effects on Mn availability and were largely masked by the Mn and P placement treatments. Field studies were conducted on 7 soil types to test the effect of fertilizer and Mn sources and showed the following order of tissue Mn: $MnSO_4$ = MnO (100 mesh) > oxysulfate (partially acidulated MnO) = Mn-EDTA = control. Tissue samples taken within 5 wk. of planting had higher Mn conen. for a NH_4NO_3-MCP-KCl (acidic) fertilizer than for the urea-DAP-KCl (basic) fertilizer. However, when oxidation of the NH_4-N in the basic fertilizer was more complete, the difference diminished. The results suggest that when Mn deficiencies occur early in the growing season, use of an acidic fertilizer in combination with $MnSO_4$ or finely divided MnO would be helpful in elimination of the problem. *(Author's summary)* D01

0162

14339 BURNS, I.G. **A simple model for predicting the effects of leaching of fertilizer nitrate during the growing season on the nitrogen fertilizer need of crops.** Journal of Soil Science 31(2):175-185. 1980. Engl., Sum. Engl., 29 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. Cultivation. N. Nutrient absorption. Soil impoverishment. Soil requirements. Roots. Soil water. Evapotranspiration. Statistical analysis.**

This model for predicting the effects of leaching of fertilizer nitrate is based on the concept that there is an effective rooting depth above which all the inorganic N in the soil is equally available and below which all N is totally unavailable. The extent to which nitrate is leached below this depth is calculated from the excess rainfall over evapotranspiration and the water holding capacity of the soil. The model was tested against the results of N fertilizer expt. with lettuce, french beans and overwintered onions which had been carried out in at least 2 yr (and often more) on adjacent sites of the same field. The yields from all of the expt. with each crop were plotted against the level of fertilizer applied and against the difference

between that applied and that lost by leaching. Comparison of these graphs showed that correcting for leaching in this way greatly reduced the variability between the response curves. The model was also tested against the results of similar expt. with Brussels sprouts grown on different sites with different combinations of base and top dressing. The results showed that the poor response to top dressing could be explained by the relatively small amounts of N in the base dressing which were leached from the rooting zone of this crop. It appears that the model will enable worthwhile adjustments in N fertilizer dressings to be made for differences in rainfall, provided that leaching occurs during the early stages of crop growth when uptake is small. *(Author's summary)* D01 K00

0163

10670 LEGARDA-BURBANO, L. **Determinación de la evapotranspiración en el cultivo del fríjol** *(Phaseolus vulgaris* **L.) en clima muy húmedo tropical, Turrialba, Costa Rica.** *(Determination of evapotranspiration in bean crops in very humid tropical climates, Turrialba, Costa Rica).* Revista de Ciencias Agrícolas 7(1/2): 1-10. 1977. Span., Sum. Span., Engl., 20 Refs.

Phaseolus vulgaris. **Plant development. Climatic requirements. Evapotranspiration. Soil water. Growth. Yields. Experiment design. Timing. Plant age. Water requirements. Costa Rica.**

Evapotranspiration effect on the production of bean var. 27 R was studied under greenhouse conditions at the Instituto Interamericano de Ciencias Agrícolas-Centro Agronómico Tropical de Investigación y Enseñanza (IICA-CATIE), Turrialba, Costa Rica (a very humid tropical climate). The Margoth soil series (Typic Distropet) was used along with a randomized block design with 13 treatments and 4 replications. Factor F was estimated on the basis of the ratio potential evapotranspiration (ETP)/evaporation, and factor R by the ratio actual evapotranspiration (ETA)/ETP. This last ratio decreased with the increase of max. suction, showing that water is not equally available within the range of disposible soil water for bean plant 27 R. Factor F decreased with aging of the plant, reaching its max. value at anthesis. Max. bean production was obtained at a suction of 0.80 bars. Actual and potential evapotranspiration carries a great relation with the growing stage of bean crops. *(Author's summary)* D01 K00

0164

14724 SOTOMAYOR R., I. **Compost de basura como fuente de fertilización orgánica comparado con fertilizante químico. Primer ciclo.** *(Garbage compost as an organic fertilizer source, compared to chemical fertilizers. First cycle).* Agricultura Técnica (Chile) 39(4):152-157. 1979. Span., Sum. Span., Engl., 2 Refs.

Phaseolus vulgaris. **Manures. Fertilizers. Soil fertility. Soil analysis. Yields. N. Timing. Chile.**

A permanent field expt. was established at La Platina Exptl. Station, close to the city of Santiago, Chile, to evaluate the efficiency of mineral vs. organic nutrition. Several vegetables were tested. Urea and triple superphosphate were used as mineral fertilizers and garbage compost as organic fertilizer. Two N levels were tested: 200 and 400 kg/ha/yr. The results reported are those for the 1st 4 yr cycle, from Oct.1971-Dec. 1975. The soil of the Exptl. Station belongs to the Santiago series. On all occasions the mineral fertilizers proved to be more efficient than the organic. Also, the high dosis treatment yielded better than the low one. In those plots fertilized with compost, accumulation of OM, P and K was detected in the soil. In those plots supplied with mineral fertilizers, P accumulation was detected with the high rate treatment. A slight increase in OM levels were observed in those plots fertilized with urea at the high rate. This effect was attributed to a larger development of roots due to N. *(Author's summary)* D01

0165

14718 GUZMAN L., P. **Efecto de la fertilización nitrogenada fosfórica y tratamientos satélites de carbonato de calcio en la producción de fríjol común** *(Phaseolus vulgaris* L.). *(Effect of NP fertilization and additional treatments with calcium carbonate on common bean production).* San José, Costa Rica, Ministerio de Agricultura y Ganadería, 1980?. 18p. Span., Sum. Span., 21 Refs.

Phaseolus vulgaris. **Fertilizers. N. P. K. Ca. pH. Soil requirements. Productivity. Yields. Field experiments. Costa Rica.**

The study was conducted in the zone of San Pablo de Turrubares (Costa Rica) in a low fertility soil with pH 5.1, a P level of 4 ppm, and an Al amount of 0.5 meq/100 ml soil. This soil requires a high level of technology to obtain acceptable production. In both field evaluations and at harvesting, differences between treatments were observed. Results of statistical analysis indicate that as P fertilization was increased, production increased; the same effect was obtained with N fertilization, except with higher levels which tend to reduce production. The sole check produced only 318 kg/ha. The treatment that included the application of 2 MT of calcium carbonate/ha was the best with 1302 kg/ha. Regarding P fertilization, max. production was obtained with 120 kg P_2O_5/ha, and regarding N fertilization with 90 kg/ha. The influence of diverse factors on common bean production is also discussed. *(Author's summary. Trans. by L.M.F.)* D01

0166

14262 VRIES, M.P.C. DE **Analysis of short portions of curves relating yield and uptake of phosphorus in glasshouse experiments.** Tropenlandwirt 80:38-46. 1979. Engl., Sum. Engl., Germ., 5 Refs., Illus.

Phaseolus vulgaris. **Plant fertility. Yields. Fertilizers. P. Nutrient absorption.**

It was shown that pot expt. with considerable variation between yields of replicate phosphate treatments can still give valuable information when the dry wt. of the plant tops are plotted against their P uptake. This applies only to young plants that are genetically stable. The position of the lines relating yield and P uptake is subject to many factors which include the superimposing of a fertilizer on the applied phosphates, structure of the soil, placement of the phosphate in the soil and attack of an insect. The graphs show that there are 2 kinds of yield variation between replicate phosphate treatments. The 1st provides points along the yield-P uptake line, the 2nd points away from it. Yield variation between replicate treatments can be tolerated if yield-P uptake points are near to the line. Short portions of yield-P uptake lines can be considered to be regression lines. The position of yield-P uptake regression lines in the coordinate system and the residual variances about these regression lines can be used to explain the effect of soil treatments. *(Author's summary)* D01

0167

2974 KINBACHER, E.J. **Bean stress physiology studies.** *In* Bean Improvement Cooperative. Annual Report no. 13. Lincoln, University of Nebraska, 1970. pp. 57-59. Engl.

Phaseolus vulgaris. **Drought. Host-plant resistance. Protein content. Proteins. Enzymes. Analysis. Laboratory experiments.**

The heat tolerance tests using malic dehydrogenase extracted from leaves of 2 *Phaseolus vulgaris* var. (Harvester and G.N. Nebraska # 1) and *P. acutifolius* (Tepary Buff) are described in detail. The soluble enzyme fraction (intracellular) contained 20 times more protein than the mitochondrial fraction but this exhibited more specific activity and thermal stability than the soluble intracellular enzyme. Drought, heat, and cold hardening increases the stability of existing proteins; RNA and DNA studies were made. Research conducted on the influence of high temp. and drought on photosynthesis are described. *(Summary by W.M.S. Trans. by L.M.F.)* D01

0168

15866 MURAOKA, T. and NEPTUNE, A.M.L. **Effect of day time on foliar spraying of several levels of nitrogen fertilizer, NPKS solutions and its components, on common bean leaves.** Anais da Escola Superior de Agricultura Luiz de Queiroz 34:493-495. 1977. Engl., Sum. Engl., Port., 2 Refs.

Phaseolus vulgaris. **Fertilizers. Leaves. N. P. K. S. Timing.**

An expt. was carried out in order to determine the effect of time of the day of foliar spraying of several levels of N fertilizers, N-P-K-S solution, and its components on common bean leaves. Results, based on the visual observations, indicated that max. levels of each fertilizer did not cause injuries and showed that the foliar spraying early in the morning is the best time of the day. *(Author's summary)* D01

0169

14265 PRINGLE, J.C. JUNIOR, ANDERSON, L.W.J. and RAINES, R.W. **Residues in crops irrigated with water containing simazine.** Journal of Agricultural and Food Chemistry 26(5):1143-1147. 1978. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Irrigation. Herbicides. Plant injuries.**

Annual ditchbank vegetation growing on the inside slopes of irrigation canals can be managed with low-rate applications of simazine. When a herbicide is applied to the bank of either a flowing or a dry canal, some residue might be expected in the irrigation water applied to crops. Six crops representing 9 commodity groupings were irrigated with water containing simazine [2-chloro-4,6-bis(ethyl-amino)-*s*-triazine] at 0.01 and 0.10 mg/*l*. The treatment levels were selected to simulate the max. amount and 10 times the max. that might be expected to enter irrigation water after bank application for weed control. Herbicide was applied to randomized test plots through sprinkler and furrow irrigation, and crops were harvested 7 and 30 days after treatment. Samples were analyzed for residues with a gas chromatograph equipped with a N and P detector. No simazine residue was found in maize grain and pinto bean pods while trace amounts were found in pinto bean foliage and cucumbers. Amounts ranging from 0.6-2.9 µg/kg were found in sugar beets, corn foliage, and tomatoes. Sugarbeet foliage collected 7 days after application of simazine at 0.01 and 0.10 mg/*l* by sprinkler irrigation contained 5 µg/kg. Alfalfa contained the most residue of the crops tested; samples collected from plots that were sprinkler-irrigated with water containing simazine at 0.10 mg/*l* contained 6.4 µg/kg. *(Author's summary)* D01

0170

14780 ZAFFARONI, E. *et al.* **Influencia del no laboreo en la producción de maíz y fríjol, en Turrialba, Costa Rica.** *(Influence of zero tillage on maize and bean production in Turrialba, Costa Rica).* Turrialba, Centro Agronómico Tropical de Investigación y Enseñanza. Programa de Cultivos Anuales, 1979. 21p. Span., Sum. Span., Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Cultivation. Land preparation. Cultivation systems. Intercropping. Weeding.** *Zea mays.*

Different systems of vegetation management prior to planting were studied in maize in monoculture and in a maize/bean association. Vegetation managements included 2 mechanized treatments; one without any subsequent weed control, and one "sterile seedbed", plus three treatments with zero tillage, two of these based on herbicides and the third on a mulch. The 2 treatments of zero tillage with chemical control resulted in statistically superior yields to those obtained with the mulch and the 2 mechanized treatments. Yields of maize in monoculture were superior to maize yields in association with beans. However, total production of edible grain was not different for maize in monoculture and the maize/bean association. The economic analysis demonstrates a clear advantage for the zero tillage systems with chemical control, compared to the mechanized and mulch treatments. *(Author's summary)* D01

0171

3834 HALEVY, A.H. and KESSLER, B. **Increase tolerance of bean plants to soil drought by means of growth-retarding substances.** Nature 197(4864):310-311. 1963. Engl., 4 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Drought. Host-plant resistance. Soil water. Leaves. Transpiration.**

Two expt. were carried out to determine the influence of CCC (2-chloroethyl) trimethyl ammonium chloride and Phosfon (2,4-dichlorobenzyltributyl phosphonium chloride) on the tolerance of *Phaseolus vulgaris* cv. Brittle Wax plants to soil drought. In the 1st, 3 treatments (CCC, Phosfon, and the control) were applied to bean seedlings in cans (10 seedlings/can) when the 1st pair of leaves were fully expanded; 4 replications were made. Treated plants remained turgid during the 30 critical days of drought and it was determined that moisture % in the treated soil was below the wilting point (3.98 and 4.36 for Phosfon and CCC-treated soil, resp.). In the 2nd expt. of random block design, 3 different water regimes and 4 replications/treatment were used. Soil moisture was determined daily. Both fresh and dry wt. of Phosfon-treated plants were considerably higher in dry treatments than the control plants. It was concluded that both CCC and Phosfon increased the drought tolerance of plants. *(Summary by I.B. Trans. by L.M.E.)* D01 C00

0172

15865 NEPTUNE, A.M.L. and MURAOKA, T. **Effects of foliar fertilization of common bean (*Phaseolus vulgaris*, L.) during the seed-filling stage.** Anais da Escola Superior de Agricultura Luiz de Queiroz 34:551-563. 1977. Engl., Sum. Engl., Port., 18 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. Leaves. Podding. Maturation. Nodulation. N. P. K. Mineral content.**

An expt. was carried out with common bean in a red yellow latosol, sandy phase, in order to study the influence of foliar spraying of Hanway nutrient solution (NPKS) at grain filling stage on: (1) grain yield; (2) the uptake of fertilizer and soil N by this crop through the root system; and (3) the efficiency of utilization of the N in the foliar spray solution by the grain. Results of this expt. showed that the foliar application of the Hanway solution with ammonium nitrate at the pod filling period caused severe leaf burn and grain yield was inferior to that of the plants which received a soil application of this fertilizer at the same stage. These facts can be attributed to the presence of ammonium nitrate in the concn. used. The composition of final spray was: 114.28 kg NH_4NO_3 + 43.11 kg potassium poliphosphate + 12.44 kg potassium sulphate/500 *l*. The uptake of N fertilizer through the root system and the efficiency of its utilization was greater than that through the leaves. *(Author's summary)* D01

0173

15416 FOSTER, H.L. **Yields and responses to lime and potassium fertilizer in different cropping years in Uganda.** Experimental Agriculture 15(2):193-201. 1979. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. **Fertilizers. K. Agricultural lime. Yields. Organic matter. pH. Nutritional requirements.**

Trials on ferrallitic soils in Uganda showed that cotton, millet, maize, and bean crops responded to lime after the 1st yr of cropping on soils which had a pH up to 6.0, and to K on soils which had an extractable K level up to 18 mg/100 g. Soil and leaf analyses indicated that responses to lime on soils of pH above 5.2 were due to an increase in phosphate availability. Low yields at several sites in the 1st yr were apparently due to immobilization of nutrients during rapid mineralization of soil OM. In later yr soil OM did not decline appreciably, and yields dropped only at sites where K or minor element deficiencies apparently developed. *(Author's summary)* D01

0174

14784 PALMA Z., T. **Respuesta del fríjol (*Phaseolus vulgaris* L.) a dosis crecientes de nitrógeno en suelos de Buenos Aires de Puntarenas.** *(Response of beans to increasing doses of nitrogen in soils of Buenos Aires de Puntarenas).* Tesis Ing. Agr., San José, Universidad de Costa Rica, 1978. 76p. Span., Sum. Span., 46 Refs., Illus.

Phaseolus vulgaris. **Soils. Fertilizers. N. P. K. Ca. Mg. Plant nutrition. Nutrient absorption. Analysis. Leaves. Flowering. Plant development. Costa Rica.**

The response of bean var. Turrialba 4 to increasing doses of N with sulfate-based fertilizers was studied on an Ultisol located in the Cantón de Buenos Aires, Puntarenas Province (Costa Rica) in order to determine the optimal level of N in these soils and the seasonal variation of N, P, K, Ca, and Mg. Eight doses of N (0, 50, 100, 150, 200, 250, 300, and 350 kg/ha) and a general base were applied, using a random complete block design. The evaluation of the treatments was done by periodic chemical analyses (every 10 days, 4 in total) of the N soluble in water (NTSA), organic N soluble in water (NOSA), N-NO_3, P-PO_4, K, Ca, and Mg elements in the leaves (leaf blade and petioles individually). For these analysis 2nd leaf petioles (from the top downwards) were used; for totals, leaf blades. The dose 300 kg N/ha produced the highest yields. During the flowering stage, a critical level of total N soluble in water was obtained, tentatively placed at 3500 ppm. It was determined that bean plants show sudden changes in the velocity of absorbing nutritive elements associated with the most important physiological stages (flowering and maturing). A larger accumulation of N fractions (NTSA, NOSA, N-NO_3) was observed at 36-46 days, as well as for P-PO_4 and Mg. It was found that both K and Ca accumulated in greater amounts during the last wk. of crop growth. *(Author's summary. Trans. by L.M.F.)* D01

0175

14772 BASCUR B., G.A. **Estudo da resistência à seca em doze cultivares de feijão (*Phaseolus vulgaris* L.), mediante termometria a infra-vermelho.** *(Study on drought resistance of twelve bean cultivars using infrared thermometry).* Mag. Sc. Thesis. Viçosa-MG, Universidade Federal de Viçosa, 1981. 63p. Port., Sum. Port., 53 Refs., Illus.

Phaseolus vulgaris. **Drought. Host-plant resistance. Cultivars. Leaves. Stems. Temperature. Growth. Dry matter. Composition. Soil water. Yield components. Yields. Brazil.**

The effect of drought on 12 bean var. was evaluated by studying the relation of water potential in the soil and in leaves, stomatic resistance and temp. of the canopy, and parameters for growth and productivity. The drought index was verified by measuring the temp. of the canopy (leaves) with an infrared thermometer, representing the internal water condition of the plant. A difference in performance was observed between the different cv., mainly in the response to stomatic resistance and therefore, to leaf temp. when soil water potential began to diminish. Some cv. such as Negro Argel, C.C.G.B.-44, and BAT-44 showed low values of stomatic resistance and temp. in leaves; on the contrary, Bayos Titan, BAT-240, and Bico de Ouro had high stomatic resistance and high leaf temp. during the whole period of drought. This difference was also observed in the performance related to growth parameters. In the case of cv. with high stomatic resistance and high leaf temp., the LAI, duration of leaf area, and crop growth rate were the parameters most affected by drought. A strong effect on the no. of pods/m^2 and pods/plant, the no. of seeds/pod, and the wt. of 100 seeds in addition to a final reduction in productivity was confirmed. An alternation in the distribution of assimilates tending to a higher accumulation of DM in stems, branches, and pods was also observed in detriment to seed wt. in cv. affected by drought. The infrared thermometer method can be used to estimate the internal water condition of the plant, and therefore to select under field conditions, drought-resistant bean cv. *(Author's summary. Trans. by L.M.F.)* D01 D05

0176

14768 MARTINEZ G., C.L. **Influencia de la lámina de agua aplicada y frecuencia de riego; sobre el rendimiento del cultivo del fríjol en la Unidad de Riego San Jerónimo.** *(Influence of irrigation water applied and irrigation frequency on bean yields at the Unidad de Riego San Jerónimo).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1977. 66p. Span., 14 Refs., Illus.

Phaseolus vulgaris. **Irrigation. Soil water. Soil analysis. Plant development. Transpiration. Yields. Statistical analysis. Guatemala.**

Research was conducted at the exptl. station of the Unidad de Riego San Jerónimo of the Instituto de Ciencia y Tecnología Agrícolas (ICTA) in the state of Verapaz, Guatemala, to determine the consultative use of bean var. Jamapa, min. moisture level in the soil, and the effect of the water application rate on yield (yield curves). Data are given on climate, physical and chemical characteristics of the soil (at 3 depths, 0-30, 30-60, and 60-90 cm). Moisture content of the soil profile was determined, varying from 33.95-37.96% field capacity (FC) up to 17.45-22.40% at the permanent wilting point (PWP). Irrigation water was analyzed and a random block design was used with 4 treatments, 4 replications, plots with 7 furrows (6 x 4.5 m, A = 27 m^2), furrows with 0 slope, 50 cm between furrows, and 60 plants/furrow. Treatments (T) were: (I) gross irrigation water (GIW) of 27 mm every 4 days; (II) GIW of 54 mm every 8 days; (III) GIW of 81 mm every 12 days; and (IV) GIW of 108 mm every 16 days. Aspects of field research and cultural practices are described. Two classes of furrow irrigation were applied on the same dates: uniform irrigation without measuring the vol. until the soil is completely saturated and differential irrigation depending on the treatment. Total water vol. applied was constant in all treatments; it was estimated according to the area to be irrigated and irrigation water/treatment. MC of the soil profile was determined by the gravimetric method. *Empoasca* and *Tetranychus* attacks were observed during cropping. Plant growth was measured to compare the effects between treatments. In T III and T IV plants reached a higher height and flowering was quicker by 5 days; in T I and T II, there was a higher incidence of anthracnose on the leaves. The highest grain wt. was obtained in treatments II and III, tending to decrease in the greatest interval (T IV) and the lowest in T I. Highest yields (1689.25 kg/ha) were obtained with T III, and the lowest (888.25 kg/ha) in T I. According to the results, the min. level of available moisture varies between 39.8-50.3% for the soil under study. A net demand of irrigation water of 432 mm was obtained during the cropping cycle. An irrigation frequency of 81 mm every 12 days is recommended. Tables and diagrams illustrating the information are given. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0177

9468 GOMES, J. DE C. **Relação entre a capacidade tampão de fósforo de três latossolos de Minas Gerais e a absorção diferencial de fósforo em três cultivares de feijão (*Phaseolus vulgaris* L.).** *(Relationship between phosphorus buffer capacity in three latosols and differential phosphorus uptake in three bean cultivars).* Tese Mag. Sc. Viçosa, Minas Gerais, Universidade Federal de Viçosa, 1976. 59p. Port., Sum. Port., 51 Refs., Illus.

Phaseolus vulgaris. **Soils. P. Plant assimilation. Soil water. Soil analysis. Dry matter. Al. Ca. Brazil.**

P intensity, amount, and buffer capacity in dark red Latosol soils was studied under greenhouse conditions, using 4 levels of P (0.00b, 0.25b, 0.50b, and 1.00b; b = max. uptake capacity of phosphates) and 3 bean cv. in order to improve knowledge on the soil-P-plant system. Available P contents varied depending on the extractors used and on the soil; the forms of inorganic P are unevenly distributed and Fe and Al phosphates predominate. The buffer capacity of the soil increases as the max. uptake capacity of the soil increases. Cv. showed a differential uptake capacity. Responses of absorbed P, in function of the doses of P and the buffer capacity of the soil, increased in every case. *(Extracted from author's summary. Trans. by L.M.F.)* D01

0178

14242 VILLALOBOS M., I. *et al.* **Respuesta de la caraota (*Phaseolus vulgaris*) a la fertilización con N, P y K, en suelos de la planicie aluvial del Río Motatán.** *(Response of black turtle bean to NPK fertilization in alluvial plain soils of Río Motatán).* Maracaibo, Universidad del Zulia. Facultad de Agronomía. Instituto de Investigaciones Agronómicas, 1976. 23p. Span., Sum. Span., 18 Refs.

Paper presented at Congreso Nacional de la Sociedad Venezolana de la Ciencia del Suelo, 4o., Maturín, 1976.

Phaseolus vulgaris. **Soils. Fertilizers. N. P. K. Soil analysis. Seed production. Yields. Statistical analysis. Venezuela.**

The response of bean var. Tacarigua to the application of different rates of N, P, K was evaluated on alluvial plain soils of Río Motatán in the sector of "El Tigre", Baralt District, state of Zulia, Venezuela, presenting textures from silt loam to silt clay up to 70 cm, with high silt and clay contents that favor the formation of a superficial crust that difficults seedling emergence and reduces water entrance. These soils have low C, N, and P contents and medium to high K values. Five levels of N (0, 20, 50, 80, and 100 kg/ha), 5 of P (0, 40, 100, 160, and 200 kg/ha), and 5 of K (0, 20, 50, 80, and 100 kg/ha) were applied. The response to fertilization was measured on the basis of crop grain yield. According to the results obtained, it was noted that there were significant statistic differences related to the effect of P; there was no response to N or K, the latter could be due to the high K contents in the soil. When the control treatment (0-0-0) was compared with the intermediate treatment (50-100-50), there was no significant difference observed, but when these 2 treatments were compared with the rates of 100-200 and 50 kg/ha of N, P, and K, resp., there was a significant difference possibly due to the high rate of P. *(Author's summary. Trans. by L.M.F.)* D01

0179

15803 RESENDE, M., HENDERSON, D.W. and FERRERES, F. **Freqüência de irrigação, desenvolvimento e produção do feijão kidney.** *(Irrigation frequency, crop development, and yield of Kidney bean).* Pesquisa Agropecuária Brasileira 16 (3):363-370. 1981. Port., Sum. Port., Engl., 13 Refs., Illus.

Phaseolus vulgaris. **Irrigation. Plant development. CO_2. Leaves. Yields.**

The effects of high frequency irrigation on plant water status, leaf growth, DM accumulation, leaf resistance, photosynthesis rate, and yield of Dark-Red Kidney bean were studied by using line-source sprinkler irrigation on a Yolo soil at Davis, California, USA in 1977-78. Aiming at different degrees of plant water stress at each frequency, the amount of water applied in the different treatments as a % of evapotranspiration varied. Leaf resistance and photosynthetic rate were not affected by irrigation regimes nor by the degree of stress. On the other hand, source size, total DM, and yield were reduced about the same proportion as the reduction on evapotranspiration, independently of the irrigation frequency. No advantage was found by using high frequency irrigation as compared with normal. *(Author's summary)* D01

0180

14244 JUNQUEIRA NETTO, A. **Resposta diferencial de variedades de feijão (*Phaseolus vulgaris* L.) à adubação nitrogenada e fosfatada.** *(Differential response of bean varieties to nitrogen and phosphorus fertilization).* Tese Mag. Sc. Viçosa-MG, Universidade Federal de Viçosa, 1977. 99p. Port., Sum. Port., 72 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Fertilizers. N. P. Costs. Income. Yield components. Yields. Economics. Brazil.**

Under greenhouse conditions, 130 var. of the Bean Germplasm Bank of the U. Federal de

Viçosa in Minas Gerais (Brazil) were assessed in order to verify their response to the applications of levels of N and P (0-60 and 0-300 kg/ha, resp.). A random block 2 x 2 factorial design/var. was used with 3 replicates. A marked response to P was observed while there was no response to N. With the outstanding var. of the previous trial, 3 field expt. were conducted in Paula Candido and another in Lavras, Minas Gerais, using a random block, 5 x 5 factorial design in combinations of 5 bean var. and 5 levels of P_2O_5 (0, 75, 150, 225, and 300 kg/ha) as triple superphoshate (TSP). An economic analysis based on bean and fertilizer prices was conducted to establish economic levels of TSP. P fertilization increased in all var., grain production, no. of pods/plant and seeds/pod, wt. of 100 seeds, and III. Under field conditions, max. dose of P application for max. production varied between 144-260 kg P_2O_5/ha, depending on the var. and on the test site. The av. max. dose was estimated at 195 kg P_2O_5/ha. Results of the economic analysis are given; var. 491, fertilized with 184 kg P_2O_5/ha and yielding 2162 kg/ha, was the most profitable. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0181

14781 HOLLE, M. *et al.* **Efecto del manejo del lomillo, aporque y fertilización en el rendimiento de sistema maíz asociado con fríjol en el año agrícola de Perez Zeledón, Costa Rica (1978). Informe preliminar.** [*Effect of the management of ridges, hilling, and fertilization on yields of maize/beans in association in the crop year in the area of Pérez Zeledón, Costa Rica (1978). Preliminary Report*]. Turrialba, Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza, 1979. pp.M33/1-M33/13. Span., 2 Refs.

Paper presented at Reunión Anual del PCCMCA,25a., Tegucigalpa, Honduras, 1979.

Phaseolus vulgaris. Zea mays. **Intercropping. Cultivation. Fertilizers. Productivity. Income. Costa Rica.**

The results of a trial on increasing productivity were assessed by the higher no. of harvests in an area during the crop yr; in this case, 2 maize/bean crops under different forms of management. Four trials were established with 3 treatments (shovelling with a change in ridge, min. tillage, and hilling on the original ridge) and 2 subtreatments (normal fertilization and a high level of NPK fertilization) in 2 seasons, the 1st and the last. A split-plot exptl. design was used. Bean yields were low due to competence with maize, that reduces the productive ability of beans, and to the incidence of *Rhizoctonia* and *Isariopsis* in the foliage; however, they were sufficient to satisfy family needs. In only one case, the effects of the var., management, and costs of fertilizers produced higher yields (cv. Tico yielded more than the local cv.) due to lodging. The advantage of the treatment that consisted of shovelling and normal hilling was shown in both planting seasons. Net income analysis slightly favors the treatments with normal fertilizer rates and normal shovelling, with or without min. tillage. *(Summary by I.B. Trans. by L.M.F.)* D01 D03

0182

14777 SUHET, A.R. **Efeito do ^{59}Fe e do ^{65}Zn na produção de matéria seca e na composição química do feijoeiro (*Phaseolus vulgaris* L.) cv. Carioca e na fixação de nitrogênio atmosférico, em três solos.** *(Effect of ^{59}Fe and ^{65}Zn on dry matter production and chemical composition of bean cv. Carioca and on N_2 fixation on three soils).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultura "Luiz de Queiroz", 1976. 73p. Port., Sum. Port., Engl., 50 Refs., Illus.

Phaseolus vulgaris. **Plant nutrition. Fe. Zn. Tracers. Nitrogen fixation. Composition.**

Fe and Zn effects on yield, chemical composition, and N_2-fixation of common bean were studied on 3 soils: Terra Roxa Estruturada (TRE), Latossol Vermelho Escuro (LVE), and Podzólico Vermelho Amarelo (PVA). The coefficient of utilization of these micronutrients

by this crop and their distribution in the canopy and roots were also assessed. The expt. was carried out in a greenhouse using an exptl. 3 x 7 factorial random block design, with 3 replications (7 treatments/soil). Treatments were: Fe_1, Fe_2, Zn_1, Zn_2, Fe_1Zn_1, Fe_2Zn_2, and the control. Rates for Fe were 1.5 and 3.0 ppm, and for Zn, 2.5 and 5.0 ppm. An application of 7.5 μCi of ^{59}Fe/kg of soil with the lower rate of the stable Fe, and 5.0 and 10.0 μCi of ^{65}Zn/kg of soil was made in the pots corresponding to the lower and higher rate of the stable Zn, resp. All seeds were inoculated with *Rhizobium phaseoli.* Plants were harvested at the age of 60 days and N, P, K, Ca, Mg, Fe, and Zn contents were determined. After harvesting, symbiotic N-fixation was assessed, using the acetylene reduction method. The detection of ^{59}Fe and ^{65}Zn radioactivity was carried out on nitric-percloric extract, by γ ray spectrometry. The behavior of the common bean presented high variation among the 3 soils, for all variables. There was no influence of Fe and Zn treatments on the yield of the canopy and roots, wt. and no. of nodules. Fe at the rate of 3.0 ppm decreased the capacity of nodules to fix N_2 as compared to the rate of 1.5 ppm, while the rate of 5.0 ppm of Zn increased this capacity, compared to the rate of 2.5 ppm. There was a significative effect of treatments on N, K, Ca, Mg, and Zn contents in the canopy and on N, Ca, and Zn contents in roots. *(Author's summary)* D01 101

0183

15234 ARAYA V., R. and VIEIRA, C. **Time of application of nitrogen fertilizer as side dressing on beans.** Bean Improvement Cooperative Annual Report 23:45. 1980. Engl.

Phaseolus vulgaris. **Nutritional requirements. Fertilizers. N. P. Timing. Yields.**

An expt. was carried out in Viçosa, Brazil to study the effect of the time of N fertilizer (urea) application as side dressing to bean crops. Treatments were: no fertilizer; superphosphate (SP); SP + 80 kg N/ha applied entirely in the row at planting time; and SP + 80 kg N/ha applied half in the row at planting and half as side dressing 15, 22, 29, 36, 43, and 50 days after emergence. P (60 kg/ha) was applied in all treatments. The best method was the application of half of the N fertilizer at planting and the rest 15, 22, or 29 days after emergence. Bean yields decreased considerably with treatments 36, 43, and 50 days after emergence. Compared to the method of side dressing, the application of the total amount of N at planting time showed yield reduction. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0184

13583 PONS, A.L. **Adubação do feijoeiro.** *(Fertilization of bean crops).* IPAGRO Informa 14:10-14. 1976. Port., 3 Refs., Illus.

Phaseolus vulgaris. **Fertilizers. Agricultural lime. N. P. K. Plant nutrition.**

The different factors that should be considered when fertilizing bean crops are analyzed; beans require that the layer of soil near the surface (20 cm) presents an adequate equilibrium between air and water during the entire growth cycle of the plant and be rich in nutritive elements such as Ca, P, and K. In soils with high pH, high Ca, P, and K contents, and a moderate OM content, without toxic levels of Al and Mn, a good nodulation occurs resulting from symbiotic fixation (*Rhizobium*). Under other circumstances, soil should be amended which consists of liming to increase the acidity and the use of P and K fertilizers to improve fertility. Some considerations are given on the application of Ca, fertilizers (of both corrective and maintenance type), P, K, sources and methods of application, and N fertilizers. *(Summary by I.B. Trans. by L.M.F.)* D01

0185

15878 FEITOSA, C.T. *et al.* **Adubação NP para o feijoeiro (*Phaseolus vulgaris* L.) na presença e na ausência de calcário.** *(NP fertilization in beans with or without liming).* Revista Brasileira de Ciência do Solo 4:156-159. 1980. Port., Sum. Port., Engl., 14 Refs.

Phaseolus vulgaris. **Fertilizers. Agricultural lime. Ammonium sulphate. Yields. Mineral content. Leaves.**

The effects of N, P, and liming on bean yield, DM production, and plant height at flowering were studied on a red yellow podzolic soil at Tietê, São Paulo, Brazil. The expt. was carried out from Feb.-May, 1978 and received 3 irrigations. Applications of 25 and 50 kg N/ha as ammonium sulphate and 30, 60, and 90 kg P_2O_5/ha as normal superphosphate were made on plots receiving or not 1 t of dolomitic limestone/ha. Limestone significantly increased yield and decreased plant height; however, it reduced Mn, Cu, and Fe contents in the leaves, and Mn and B contents in the seeds. The best grain yields were observed at higher N and P_2O_5 applications. There is decreasing P and Cu contents in the seed with increasing N levels. A significant positive correlation between DM production at flowering and grain yield was also found. *(Author's summary)* D01

0186

12690 MARTINI, J.A. **Guía para la investigación en el abonamiento del fríjol para el PCCMCA, 1968.** *(Guide for research on bean fertilizing for the PCCMCA, 1968).* Turrialba, Costa Rica, 1968. 28p. Span., 35 Refs.

Phaseolus vulgaris. **Nutritional requirements. Fertilizers. N. P. K. Yields. Yield components. Greenhouse experiments. Field experiments. Costa Rica.**

A guide for research on fertilizing beans and other annual crops is given along with recommendations that try to differentiate the problems regarding soils and bean nutrition with min. cost, time, and effort. The concept of fertility is discussed and a work plan consisting of the following fundamental steps is given: literature review, preparation of a coordinated work plan, study of exptl. soils, field and greenhouse trials. A series of trials is recommended as part of an integral program designed to solve different problems associated with bean fertilization and adaptable to the level of development of research in each country. General recommendations are also included to assure the efficiency of research in the field. *(Summary by I.B. Trans. by L.M.F.)* D01

0187

15498 BITTENCOURT, V.C., GOMES, V.B. and ZAMBELLO JUNIOR, E. **Efeito da aplicação de calcário em Terra Roxa Estruturada e sua influência na produção do feijoeiro.** *(Effect of limestone on Terra Roxa Estruturada and its influence on bean production). In* Congresso Brasileiro de Ciência do Solo, 15a., Campinas, 1976. Anais. Campinas. Sociedade Brasileira de Ciência do Solo, 1976. pp.265-271. Port., Sum. Port., Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Soils. Soil requirements. Soil fertility. Agricultural lime. Nutrient absorption. Soil impoverishment. Laboratory experiments.**

Leaching of exchangeable bases from Terra Roxa Estruturada (TE) soils caused a decrease in CEC of the samples. Subsequent lime application did not restore the original CEC, suggesting that in acid conditions the negative charges on the soil colloids were blocked by the formation of aluminum polymers. On the other hand, Ca and Mg additions to the same soil, revealed a very low effective CEC, confirming the existence of blocked charges which do not participate in the normal ionic exchange reactions. Finally, better bean development was observed in the samples, with a mixture of 40% HCl treated soil, 60% original soil, and having received 4 t of dolomitic limestone/ha. *(Author's summary)* D01 C02

0188

15427 MEIRELLES, N.M.F., LIBARDI, P.L. and REICHARDT, K. **Absorção e lixiviação de nitrogênio em cultura de feijão (*Phaseolus vulgaris* L.).** *(Nitrogen absorption and leaching in bean crops).* Revista Brasileira de Ciencia do Solo 4(2): 83-88. 1980. Port., Sum. Port., Engl., 15 Refs., Illus.

Phaseolus vulgaris. **Nutritional requirements. Fertilizers. N. Tracers. Developmental stages. Planting. Timing.**

Studies on the destination of N fertilizer applied to bean crops were carried out on an Oxic Paleudalf soil plot in Piracicaba, state of São Paulo (Brazil). N leaching losses by drainage at 120 cm depth and plant absorption were specially considered. Neutron probe, tensiometers, soil solution extractors, and ^{15}N-labelled N fertilizer applied at a rate of 100 kg of N/ha were used in the expt. Determination of total N, ^{15}N % atom excess in soil solution and plant samples, as well as DM made it possible to determine the N fertilizer utilization efficiency by the crop at different growing stages. The data obtained permitted to quantify N leaching losses (approx. 15 kg of N/ha/yr, 9% from fertilizer) as well as the best timing for N fertilizer application (1/3 at planting and the balance 30-45 days after germination). *(Author's summary)* D01

0189

13171 MIAYASAKA, S. **Verde dobra produção de feijão.** *(Green manure doubles bean production).* Coopercotia 13(196):26-27. 1966. Port., Illus.

Phaseolus vulgaris. **Green manures. Soil fertility. Mulching. Organic matter. Fertilizers. Yields.**

The Legume Section of the Instituto Agronómico de Campinas, São Paulo, Brazil, conducted 3 expt. at 3 exptl. stations to study the effect of incorporating green manure immediately before planting on bean crop yields. During the summer 4 legume species (*Cajanus cajan, Crotalaria juncea, Dolichos lab-lab, Tephrosia candida*) and one grass (*Sorghum vulgare*). In all expt. N, P, and K were applied at 40, 100, and 45 kg/ha, resp. All legume green manures increased yields regarding the control in which green manure was not incorporated. The effect of incorporating 58 t of *Crotalaria juncea*/ha on crop yields (an av. of 800 kg/ha) was emphasized regarding control yields (an av. of 418 kg/ha). Sorghum did not increase yields. The incorporation of vegetal cover reduces the nocive effect of high temp. on the soil and improves crop yield. Exptl. results are summarized in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D01

0190

16083 NAZRALA, M.L. and MARTINEZ, H. **Abonos verdes y cobertura vegetal en vid.** *(Green manures and mulching in grapevines).* Idia 343/348:7-42. 1976. Span., 25 Refs., Illus.

Phaseolus vulgaris. **Green manures. Mulching. Soil fertility. Rotational crops.**

Seven-yr trials were carried out with the grapevine cv. Tempranilla trained on the Cuyano system at the Junin and La Consulta Exptl. Substations, Mendoza (Argentina). The soil treatments were (1) clean cultivation (control), (2) barley as green manure, (3) beans as green manure, (4) *Vicia benghalensis* as green manure, or (5) permanent cover with alfalfa cut 3-4 times annually before flowering and used as mulch. The effects of treatments on shoot and grape production, grape sugar content, and soil properties were determined. The data are tabulated and graphically presented. Av. yields were highest (318 q/ha) in (4) followed by (3) with 294 q/ha and lowest in (2) with 235 q/ha. *(Summary by Horticultural Abstracts)* D01

0191

15821 SCARISBRICK, D.H. and GOMEZ-BARONA, J.A. **Conclusiones finales de los efectos de época de siembra sobre la producción de grano Navy beans (*Phaseolus vulgaris* L.) durante los años 1972-1976.** *(Final conclusions on the effects of planting time on Navy bean grain production during the years 1972-1976).* Anales del Instituto Nacional de Investigaciones Agrarias: Producción Vegetal 10:79-91. 1979. Span., Sum. Span., Engl., 7 Refs., Illus.

Phaseolus vulgaris. **Planting. Timing. Germination. Soil temperature. Seed. Maturation.**

Results of expt. in which navy beans cv. Purley King were precision drilled on different sowing dates suggest a threshold soil temp. of 13°C for a good emergence. The % of establishment is asymptotic correlated with soil temp. Although the accumulating temp. system developed by Brown offered a reliable method for estimating the date of physiological seed maturity, it is concluded that the system is a poor indicator of the crop maturity. Similar cv. to Purley King can not be regarded as on intercrop due to the variable climatic summer conditions experienced in S. England. Var. must be selected which are more tolerant to cold conditions in spring. *(Author's summary)* D01

0192

15971 FARLOW, P.J. **Effect of low temperature on number and location of developed seed in two cultivars of French beans (*Phaseolus vulgaris* L.)** Australian Journal of Agricultural Research 32:325-330. 1981. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Plant development. Seeds. Pods. Temperature. Maturation. Ovules. Pollen.**

Seed and pod development for the French bean cv. Redlands Pioneer were both reduced at temp. treatments below 21°C. At temp. greater than 13.9°C undeveloped seeds were distributed uniformly within pods, and this was attributed to failure of the female gamete. At 13.9°C restriction of developed seed to the stigmatic end of the pod was apparent, and below this temp. the no. of undeveloped seeds increased significantly, with no seeds developing at 10°C. This cessation appeared to be due to both random failure of the female gamete and inadequate pollen tube growth. Seed development within pods of the cv. Redlands Pioneer and Tweed Wonder was compared at 12°C. Tweed Wonder performed significantly better, and this was attributed to greater cold tolerance of both male and female gametes. *(Author's summary)* D01 C02

See also 0060 0082 0092 0265 0272 0285 0312 0461 0462 0471 0536 0540 0541 0581

D02 Cultivation Practices: Planting, Weed Control and Harvesting

0193

11186 COERTZE, A.F. **Cultivation practices in green bean production.** Farming in South Africa. Vegetable Series II. Green Beans and Green Peas G.1/1978. 2p. Engl., Illus.

Phaseolus vulgaris. Cultivation. Land preparation. Planting. Spacing. Weeds. Herbicides. South Africa.

Some cultural practices of snap bean cultivation are briefly described and recommendations are given to improve cultural operations and increase yields. Among the recommendations given, the following were emphasized: avoid an excessive pulverised condition of the soil that weakens its structure; apply a pesticide against nematodes to the soil; plant at a depth < 50 mm; avoid seed damage and cultivating under wet conditions or with dew to prevent disease incidence, and preferably use chemical weed control instead of mechanical. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0194

11192 PROCESSORS & GROWERS RESEARCH ORGANISATION. (ENGLAND). **The use of Treflan in dwarf green and dried beans.** Thornhaugh, England. The Research Station. Information Sheet no. 40. 2p. Engl.

Phaseolus vulgaris. Weeding. Herbicides.

PGRO (Processors and Growers Research Organization) has evaluated various materials for weed control in beans; trifluralin was found to be one of the most promising. It is effective in controlling a large no. of weeds, but it should be used combined with other herbicides such as bentazone or with combinations such as dinoseb-acetate + monolinuron for a good control program. Data are presented on suitable dosis for crop safety, taints, and application and incorporation techniques. A table is presented on weed species susceptible and resistant to trifluralin. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0195

13586 LUNA, J.E., ANCHORENA, A.C. and SENTANA, A.A. **Porotó: Precauciones a tener en cuenta para la obtención de su propia semilla. Hábitos de crecimiento. ¿Qué se siembra en la zona?.** *(Beans: precautions to be taken into account for the obtainment of seed. Growth habits and varieties recommended for the area).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 5. 1980. 2p. Span.

Phaseolus vulgaris. Planting. Plant habit. Argentina.

To obtain high-quality bean seeds, it is recommended to isolate the plot under cultivation from those of other var. that could cause natural crosses and conduct a control of vector pests to avoid disease transmission. Growth habits of beans and some var. cultivated in the area are described. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0196

11187 COERTZE, A.F. **The picking stage, harvesting, yield and post-harvest handling of green beans.** Farming in South Africa. Vegetable Series II. Green Beans and Green Peas I.1/1978. 4p. Engl., Illus.

Phaseolus vulgaris. Maturation. Harvesting. Yields. Cultivation. South Africa.

Recommendations are given on the collection, handling and storage of green beans, requirements for mechanically reaped cv. and the ideal stage for harvesting. The process of pod formation can be divided into 3 stages: (1) pod development and the initiation of seed development; (2) enlargement of the pods and a rapid enlargement of the seed and (3) thickening of the cell wall, maturing and drying of the pod; drying and hardening of the seed. The 2nd stage is the most acceptable for harvesting since green beans reach their max. yield. Crop yields vary between 6000-10,000 kg/ha under commercial conditions, depending on the technology and control given to the crop. Optimum temp. for storage varies between 7-10°C. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0197

11995 PIEDRAHITA C., W. **Metodología para la investigación en el control de las malezas en el cultivo del fríjol.** *(Methodology for research on weed control in bean crops).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 14p. Span.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Weeds. Research. Cultivation. Weeding. Colombia.

Six fundamental aspects of applied methodology are presented for the study on weeds in bean crops: competition, cultural, mechanical, biological, chemical and integrated control. Plant density and agronomic characteristics, the types of weeds and the environment are factors that interact in competition. The use of cultural practices such as irrigation, crop rotation, associated crops, fertilization, drainage and weed control constitute cultural control. Mechanical control, when programmed with zero tillage, should be aided with the application of herbicides. Studies on allelopathy, pathogenic organisms and insect pests contribute to biological weed control. The production of herbicides and chemical control is attained by studies on selectivity, efficiency and adaptation of the product, conducted on different types of plots: screening, micro, demonstrative and commercial. Each product is evaluated qualitative and quantitatively, and is accompanied by a data register of forms of application, environmental conditions and types of weeds. Integrated control is presented as the joint application, in a rational manner, of all the former. *(Summary by C.P.G. Trans. by L.M.F.)* D02 D00

0198

13593 LUNA, J.E. **Resiembra de poroto con sembradora de Labranza Cero.** *(Reseeding beans with a zero tillage seeder).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 10. 1980. 2p. Span., Sum. Span.

Phaseolus vulgaris. Planting. Agricultural equipment. Argentina.

A seeding may be lost by heavy rainfall when seedlings are emerging. Normally, the conventional technique of reseeding, when bean seeding lost occurs, is to harrow again and sow. Since the optimum planting time in this case is delayed, it is recommended to use a seeder of zero tillage. It is an ordinary seeder to which a device consisting of a smooth cutting blade, a coulter for opening furrows connected to the seed outlet, and lids are adapted. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0199

13569 GONZALEZ A., J. **Control químico de malezas en el cultivo de la habichuela (*Phaseolus vulgaris* L.) en la zona de Santágueda.** *(Chemical weed control of snap bean crops in the Santágueda area).* Tesis Ing. Agr. Manizales, Colombia, Universidad de Caldas. Facultad de Agronomía, 1975. 64p. Span., Sum. Span., 25 Refs., Illus.

Phaseolus vulgaris. Weeding. Herbicides. Plant injuries. Experiment design. Colombia.

With the objective of finding a herbicide that helps solve the problem of weed control in snap beans, a trial was conducted with 7 herbicides on the "Montelindo" farm, located in the Santágueda zone, state of Caldas (Colombia). Bean var. used was "Raleo" with a direct planting system without thinning. The exptl. design used was random block with 23 treatments and 4 replications. The herbicides tested were: linuron, alachlor, methabenzthiazuron and dinitro as preemergents; trifluralin as P.P.I.; and AC 553-dinoseb acetate as postemergent. Each one of the herbicides was used at 3 different rates. The effects of the herbicides were evaluated according to the following parameters: (a) germination expressed as a %; (b) crop phytotoxicity using the conventional scale utilized by the ICA; (c) wt. of the weeds present in two 0.25 x 0.50 m areas in each plot; (d) determination of the species with the common and scientific names of the weeds tested, and (e) the yields, by weighing the production of each plot. The predominant weeds in the snap bean crop were broadleaf weeds among which *Eleusine indica, Digitaria sanguinalis* and *Cynodon dactylon* were found. The broadleaf weeds found in the lot where the trial was conducted were, mainly, *Borreira* sp., *Commelina difusa* and *Emilia sonchifolia.* The herbicide that showed the highest effectiveness in weed control was dinitro at a rate of 16.01 *l*/ha. A very high phytotoxicity occurred with herbicides methabenzthiazuron (10 kg/ha) and dinuron (4 kg/ha). These products caused the total death of the plants. Methabenzthiazuron (2.5 kg/ha) and alachlor (4 kg/ha) were considered as promissory treatments. No significant differences were found among treatments for broadleaf weed control. *(Author's summary. Trans. by L.M.F.)* D02 K00

0200

13584 LUNA, J.E., ANCHORENA, A.C. and SENTANA, A.A. **Poroto: Sistemas de siembra.** *(Bean planting systems).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 2. 1980. 2p. Span., Sum. Span.

Phaseolus vulgaris. Cultivars. Spacing. Planting. Argentina.

According to studies by INTA-Metán, traditional bean plantings in Argentina varied between 140,000-170,000 plants/ha in 1971-1972. Different bean cv. are currently planted and experience indicates that each cv. requires an ideal plant population/ha to obtain the best yields. Due to the great variability in temp. rainfall and soil conditions, plant densities and growth habits, a study on black and white bean var. and their behavior in different plant densities was necessary. The results of the trial were presented showing that the highest yields were obtained with 249,000 and 232,400 plants/ha at 60 cm between rows for white and black beans, resp. It is recommended to test new distances, which should adjust to specific conditions. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0201

13594 LUNA, J.E. **Labranza Cero de poroto sobre rastrojo de maíz sin pastorear y alta presencia de malezas.** *(Zero tillage in beans on maize stubble without grazing and with a high incidence of weeds).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 11. 1980. 2p. Span., Sum. Span.

Phaseolus vulgaris. Soil conservation practices. Planting. Argentina.

It is recommended to utilize zero tillage in bean cultivation since it permits farmers to plant opportunely, conserve the soil, retain more moisture, control weeds, reduce lodging and

production costs. Two causes of edaphic erosion are explained: fallow land and the inversion of surface soil. An exptl. trial is presented to demonstrate the advantages of this technique. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0202

13585 INSTITUTO NACIONAL DE TECNOLOGIA AGROPECUARIA. ARGENTINA. Poroto: Desinfección de semilla. Profundidad de siembra. *(Beans: seed disinfection. Planting depth).* Metán, Argentina, Secretaría de Estado de Asuntos Agrarios de la Provincia de Salta. Hoja Informativa no. 4. 1980. 2p. Span., Sum. Span.

Phaseolus vulgaris. **Planting. Seed treatment. Argentina.**

Some cultural practices are considered for improving bean production such as the orientation of planting in areas with wind problems and on level land with gentle slopes, seed disinfection and planting depth. It is recommended to plant the crop so as to cut off the direction of the predominant winds (88% from the north and south), the use of fungicides such as thiram to prevent diseases during germination at rates of 200 g of thiram 50%/100 kg of seed. Planting depth is related to seed size, soil texture and available moisture. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0203

11195 PROCESSORS & GROWERS RESEARCH ORGANISATION. (ENGLAND). Notes on growing dwarf beans. Thornhaugh, England. The Research Station. Information Sheet no. 58. 1977. Engl., 6 Refs.

Phaseolus vulgaris. **Cultivation. Weeding. Seed treatment. Manures. Spacing. Water requirements. Diseases and pathogens. Chemical control. Injurious insects. England.**

The PGRO (Processors and Growers Research Organisation) began investigating bean cultivation in 1963 and has established an advisory service for farmers, which annually publishes the reports on investigated problems. The most important cultural practices used in cultivation are briefly described: selection of var. to plant, seed handling and treatment, soil preparation, planting depth, irrigation, fertilization, density, weed, disease (*Pseudomonas, Botrytis, Colletotrichum* and *Thielaviopsis*), and aphid control. The chemicals most frequently used in seed treatment and weed, pest, and disease control are listed. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0204

14227 CECILIA, F.C.S., RAMALHO, M.A.P. and SOUZA, A.F. DE Efeitos do espaçamento de plantio na cultura do feijão. *(Effect of spacing on bean cultivation).* Agros 4(1):11-21. 1974. Port., Sum. Port., Engl., 3 Refs.

Phaseolus vulgaris. **Spacing. Cultivars. Cultivation. Yield components. Yields. Seed characters. Brazil.**

This expt. on bean spacings was conducted at 2 locations in s. Minas Gerais. Some agronomical characteristics of Rico-23 cv. under between-line spacings (20, 40, 60, and 80 cm) and between-plant spacings (2.5, 5.0, 7.5, and 10.0 cm) were compared. Those characteristics studied were: no. of pods/plant, no. of seeds/pod, av. wt. of 100 seeds, grain yields, stand, and quantity of seeds required. It was observed that greater no. of pods/plant was obtained under smaller between-line spacings. Smaller spacings gave fewer stands. The spacings between plants did not influence av. seed wt. The smaller spacings were likely to yield more grains. However, such spacings are not encouraged for practice because the higher cost of seeds was not compensated. *(Author's summary)* D02

0205

14378 WILSON JUNIOR, R.G., WICKS, G.A. and FENSTER, C.R. **Weed control in field beans *(Phaseolus vulgaris)* in Western Nebraska.** Weed Science 28(3): 295-299. 1980. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. **Weeds. Weeding. Agricultural equipment. Cultivation. Herbicides. Planting. Rainfall data. Timing. USA.**

In field studies conducted in 1971 through 1977 weed yields were higher in EPTC (*S*-ethyl dipropylthiocarbamate) and alachlor [2-chloro-2′,6′-diethyl-*N*-(methoxymethyl)acetanilide] -treated areas as compared to handweeded plots. Weeds present in EPTC- and alachlor-treated areas did not result in a significant field bean Great Northern 59 yield reduction as compared to handweeded plots. For every 1000 kg of dry weeds present in field beans there was a corresponding decrease in field bean yields of 208 kg/ha. Weed yields produced in plots treated with alachlor, dinitramine (N^4, N^4 -diethyl- α, α, α-trifluoro -3,5-dinitrotoluene - 2,4 - diamine), EPTC, metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide], trifluralin (α, α, α-trifluoro-2,6-dinitro-*N*, *N*-dipropyl-*p*-toluidine), and profluralin [*N*-(cyclopropylmethyl)-α, α, α-trifluoro-2,6-dinitro-*N*-propyl-*p*-toluidine] were significantly less when herbicides were incorporated with the rotary tiller as compared to incorporation with the spike-tooth harrow. Incorporation method was not as critical with butralin [4-(1,1-dimethylethyl)-*N*-(1-methylpropyl)-2,6-dinitrobenzenamine], with spike-tooth harrow incorporation of herbicides providing similar weed control to that obtained with the rotary tiller. Weed densities and yields were higher in plots seeded with field bean determinate var. Great Northern 1140 than in plots seeded with indeterminate var. Tara, when either EPTC or alachlor were applied preplant and incorporated. Neither field bean var. competed well with weeds when no herbicide was used. *(Author's summary)* D02

0206

14347 KISH, A.J. and OGLE, W.L. **Improving the heat unit system in predicting maturity date of snap beans.** HortScience 15(2):140-141. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Water requirements. Water content. Agricultural equipment. Maturation. Harvesting. Cultivars.**

Field expt. were conducted at Clemson U. (USA) every yr from 1975-78 to study the accuracy of the heat unit system in predicting maturity date of snap beans. The growing-degree day method was found to be unreliable. Indications were that other environmental factors, in addition to temp., affected the maturity of this crop. The available soil moisture for each of 10 plantings grown under natural rainfall varied greatly. Because of the unreliability of the heat unit method, it was decided to integrate the available soil moisture parameter into the degree day method. The formula that gave the smallest C.V. was one using the daily heat unit multiplied by a ratio of the available soil moisture to a constant soil moisture value. Predicting the maturity of snap beans was improved by integrating available soil moisture into the heat unit system. *(Author's summary)* D02

0207

14730 HOHMANN, C.L., SCHOONHOVEN, A. VAN and CARDONA, C. **Manejo de las plagas de fríjol *(Phaseolus vulgaris* Linnaeus, 1753) a través de la utilización de sistemas de diversificación del cultivo con malezas asociado a resistencia varietal. *(Bean pest management using live weed mulches associated with varietal resistance).*** Anais da Sociedade Entomológica do Brasil 9(1):143-153. 1980. Span., Sum. Engl., Port., 4 Refs., Illus.

Phaseolus vulgaris. Empoasca kraemeri. **Injurious insects. Integrated control. Host-plant resistance. Cultivars. Weeds. Herbicides. Pest control. Colombia.**

During the 1st dry season of 1978 (Jan.-March) a study on the effects of live weed mulches associated with var. resistance in beans on pest populations, virus incidence, and yield was carried out at the Centro Internacional de Agricultura Tropical - CIAT - Colombia. It was observed that the live weed mulch, *Leptochloa filiformis*, and those weeds killed by herbicides had some effect on adult and nymph populations of *Empoasca kraemeri;* the presence of weeds killed by herbicide decreased virus incidence. It was also found that the greatest damage caused by larvae and the highest population of Chrysomelidae adults took place in the plots where weed seeds had been previously sowed. Var. Calima, susceptible to insects and diseases, yielded less than var. P 14. Among the treatments where weed seeds had been previously sowed, var. Calima yielded more when insecticides were applied, followed by a treatment where seeds were killed by herbicide; yields were significant regarding the control, P14 responded to the treatments and yielded more than Calima. The treatment in which weeds were killed by herbicides was effective, yielding 21% less than the complete protection treatment. Yield analysis showed that competition occurred between weeds and beans, and that the effect of weeds decreased bean yields by 25%. *(Author's summary. Trans. by L.M.F.)* D02

0208

14273 TOMPKINS, F.D., GUINN, R.S. and MULLINS, C.A. **Optimizing plant spacing for commercial snap bean production.** Tennessee Farm and Home Science Progress Report 110:41-44. 1979. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Cultivation. Spacing. Yields. Yield components. USA.**

In trials with the bean cv. Early Gallatin between row spacings were 12, 24, and 36 in. and within-row spacings 6, 9, or 12 plants/ft. Av. pod yield/ac from 12-in. rows was 29% greater than from 36-in. rows. Pods were higher off the ground on plants in narrow rows. Increasing plant density from 6 to 9 plants/ft augmented pod yield by about 15% and a further increase to 12 plants/ft augmented the yield by a further 2.5%. The highest av. pod yield (6.2 t/ac) was obtained from plots with 12 in. rows and 12 plants/ft of row. *(Summary by Horticultural Abstracts)* D02

0209

11690 VIDES, J.E. **Control de malas hierbas en maíz y fríjol.** *(Weed control in maize and beans). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.126-142. Span., 10 Refs.

Phaseolus vulgaris. **Cultivation. Weeding. Herbicides. Agricultural equipment. El Salvador.**

Some methods of weed control used in El Salvador are described, emphasizing chemical control. A list of the herbicides most frequently used on maize and bean crops is given, including application time and rates, the type of weeds and other aspects on the handling of herbicides. Cultural control is carried out through cultural practices and the utilization of improved seed; mechanical control requires the use of any implement such as a cultivator. With regard to chemical control, herbicides can be classified as pre- and postemergence and those incorporated into the soil. A methodology to calibrate different types of sprinklers is given according to the method of application: hand (with 1 or more nozzles) or mechanical (with a tractor). Two lists are given of the most important weeds found in both crops. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0210

14735 POLLAK, T. **The response of beans to fluorodifen as affected by light and other factors.** Ph.D. Thesis. Corvallis, Oregon State University, 1974. 84p. Engl., Sum. Engl., 51 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Plant injuries. Climatic requirements. Light. Temperature. Cultivation. Soil requirements. Plant assimilation. Seedlings.**

Studies with fluorodifen were conducted to gain more information about its field performance and the influence of light quantity, quality and timing of exposure on its phytotoxic properties. Uptake and translocation in 3 plant species were also investigated. These studies were aimed at evaluating the usefulness of this chemical as a selective herbicide for controlling weeds in beans in Oregon (USA). Field data compiled for a period of 3 consecutive yr. indicated that the highest yields of green beans were obtained when fluorodifen was applied at a rate of 6 lb/ac preemergence. At higher rates, crop injury was noticeable in the form of shortening of midrib and necrotic lesions on hypocotyls and other plant tissues such as cotyledons that came into contact with the herbicide. Occasionally these symptoms were observed at rates as low as 1 lb/ac under an unspecified set of conditions occurring in the field. A combination of fluorodifen applied preemergence and cultivation 2 wk. after emergence of the crop provided the best weed control. Shading the crop at different stages of development did not provide an explanation for the cause of stem lesion development, but when shade was provided from application until the 1st true leaf, phytotoxicity was noticeable. Three soil types and 2 watering regimes did not provide significant, consistent phytotoxicity or stem burning. By the use of neutral density filters, different intensities of light with the same spectral emission were obtained in growth chambers. Bean and soybean plants were more sensitive to fluorodifen at low levels of light. The % dry wt. reduction decreased as the light intensity increased from 1000 to 2000 ft-ca. In determining the critical period in which light enhances fluorodifen injury to beans and soybeans, it was found that plants exposed to light on the 2nd-3rd day after planting were most severely injured. When filters were used to evaluate the influence of light quality on fluorodifen toxicity to beans and soybeans, these plants were more sensitive to fluorodifen when exposed to yellow and red light than when exposed to blue or white light. Phytotoxic symptoms were observed especially under yellow light. Exposure to light at the time of crop emergence resulted in the greatest phytotoxicity. Autoradiography and radioassay results indicated that ^{14}C-fluorodifen was absorbed mostly within 6 h after application. The distribution pattern remained fairly constant in beans and soybeans with the largest % of activity remaining in the treated portion at all times. Greater mobility of the label was observed in cucumber plants with some acropetal and basipetal movement recorded from the treated leaves 12 h after applications. Covering the treated leaf did not alter the uptake of fluorodifen in any of the 3 plant species. Following applications to stem and roots, a similar pattern was observed, rapid uptake but little or no mobility. In a separate study, the persistence of fluorodifen in soil subjected to different environmental conditions was evaluated by gas chromatography. Fluorodifen was degraded more readily under high temp. provided that the soil was dry. *(Author's summary)* D02

0211

13173 VIEIRA, C. **Estudos sobre métodos culturais para o feijoeiro.** *(Studies on cultural methods in beans).* Informe Agropecuário 4(46):31-34. 1978. Port., 9 Refs., Illus.

Phaseolus vulgaris. **Cultivation. Planting. Spacing. Productivity. Herbicides. Brazil.**

The results are presented of several expt. conducted in Brazil to determine the effect of various cultural practices (planting distance, seed distribution within the row, and weed control) on bean productivity. The distances between rows were 30, 40, 50, and 60 cm and the distances between seeds, 2.5, 5, 7.5, and 10 cm. All the expt. indicated that production was higher with less spacing between the rows (30 cm) but difficulties occurred in mechanical planting and other cultural practices. The amount of seed used varied between 300,000-375,000 seeds/ha for a final population of 240,000-300,000 plants/ha. Weed control up to 30 days after germination allows a max. yield to be reached. Recommended herbicides are DCPA, EPTC, nitralin, fluorodifen, and trifluralin. Results are presented in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D02 K00

0212

14212 PUTNAM, A.R. and RICE JUNIOR, R.P. **Environmental and edaphic influences on the selectivity of alachlor on snap beans** *(Phaseolus vulgaris)*. Weed Science 27(5):570-574. 1979. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Soil requirements. Climatic requirements. Planting. Cultivation. Soil water. Temperature. Organic matter. Ecology.**

The influence of several environmental and edaphic factors on alachlor selectivity in snap bean was examined. Crop safety was consistently improved when alachlor was applied preplant incorporated as compared to surface preemergence treatment. Under field conditions, max. injury occurred either when temp. during germination were cool and rainfall was min., or when temp. approached or exceeded 27°C and the soil was saturated. In the growth chamber, more damage occurred under low temp. regimes, although volatilization of alachlor from moist soil also produced injury under higher temp. Injury was less severe in soils high in OM content. Alachlor injury decreased after 5 cm of simulated rainfall were applied on a loamy sand. *(Author's summary)* D02

0213

14243 ROCHA, J.A.M. and SARTORATO, A. **Efeito da época de plantio na incidência do mosaico dourado do feijoeiro.** *(Effect of planting time on the incidence of bean golden mosaic)*. Goiana-GO, Brasil, Empresa Goiana de Pesquisa Agropecuária. Comunicado Técnico-Científico v. 1, no. 1. 1980. 11p. Port., Sum. Port., 5 Refs., Illus.

Phaseolus vulgaris. **Planting. Timing. Cultivars. Bean golden mosaic virus. Pest control. Field experiments. Brazil.**

An expt. was conducted at the Santa Helena Exptl. Station in Goiás, Brazil (17° 47' 53" S.) to identify the best planting times with regard to BGMV attack. The performance of 20 bean cv. was studied in the field, 10 of which were considered tolerant to golden mosaic. Results indicated the 1st (Nov.) and the 2nd season (Dic.) as the most favorable for bean planting; the advantage of the 2nd season is greater due to the fact that harvesting coincides with the season of less rainfall, facilitating harvesting and yielding a product of better quality. *(Author's summary. Trans. by L.M.F.)* D02 E04

0214

14213 KANCHAN, S.D. and JAYACHANDRA. **Allelopathic effects of** *Parthenium hysterophorus* **L. III. Inhibitory effects of the weed residue.** Plant and Soil 53: 37-47. 1979. Engl., Sum. Engl. 22 Refs.

Phaseolus vulgaris. **Weeds. Allelopathy. Soil fertility. Plant development. Developmental stages. Nodulation.**

Growth toxins are released to the soil through leaching and during decay from the air-dried parts of *Parthenium hysterophorus*. The dry leaves mixed to the soil inhibit nodulation and growth in legumes, branching in tomato (cv. Pusa Ruby), plant height and tillering in ragi *(Eleusine coracana)* cv. Poorna, and yield in bean cv. Burpees Stringless, cowpea, tomato and ragi, but have stimulatory effect on bajra *(Pennisetum typhoideum)* cv. H.B.1. The inhibitors released to the substratum remain active for about 30 days. *(Author's summary)* D02

0215

14321 KUENEMAN, E.A., SANDSTED, R.F. and WALLACE, D.H. **Comments on plant arrangement, plant density and genotype x spacing interaction effects on yields of beans grown in monoculture. I. Rowspacing studies.** *In* Bean Improvement Cooperative. Annual Report no. 21:26-27. 1978. Engl.

Phaseolus vulgaris. **Cultivation. Spacing. Cultivars. Genetics. Yields.**

Results of 11 expt. on planting density in bean crops and the effect on yield increase are summarized. Narrow rows gave significantly higher yields in 7 of 9 expt. on row spacing. Cv. used had a different growth habit. Spacing x genotype interaction was frequent, some genotypes giving larger yield increases in narrow rows than others. The adoption of these spacings to commercial production systems implies certain difficulties in harvesting due to the lack of specialized machinery. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0216

14736 WYSE, D.L. **Interaction of herbicides, disease, and cultural practices on growth and development of navy bean** *(Phaseolus vulgaris* L.). Ph.D. Thesis. East Lansing, Michigan State University, 1974. 148p. Engl., Sum. Engl., 155 Refs., Illus.

Phaseolus vulgaris **Cultivation. Herbicides. Diseases and pathogens. Growth. Plant development. Plant injuries. Chlorosis. Leaves. Soil water. Transpiration. Temperature.** *Fusarium solani.* **Inoculation. Roots. Hypocotyls.**

Injury to navy beans from EPTC (*S*-ethyl dipropylthiocarbamate) was investigated as a function of soil moisture, planting depth, soil compaction, temp. available N and seed quality. Greenhouse and growth chamber expt. showed that both high and low moisture stress increased navy bean injury from EPTC. Deep planting increased the injury from high rates of EPTC. Soil compaction in combination with EPTC greatly reduced navy bean growth. Ambient temp. of 20-30°C did not alter the susceptibility of navy bean to EPTC. Stimulation of navy bean growth by N as measured by fresh wt. was inhibited by EPTC. Field and greenhouse studies showed that EPTC injury was greater to mechanically damaged seed that to non-damaged seed. The interaction of EPTC and atrazine on navy bean was studied in field and lab. expt. Navy beans grown in soil treated with the combination of EPTC and atrazine developed extensive leaf chlorosis, greater than the atrazine treatment alone. Navy bean yields in field studies in 1972 were reduced 39% when grown in the presence of 0.55 kg atrazine/ha and 3.36 kg EPTC/ha, whereas, the single application of each herbicide reduced yields 0 and 14% , resp. In 1973, atrazine at 0.28 kg/ha did not significantly reduce yields, but in combination with 2.24, 3.36,and 4.48 kg EPTC/ha yields of navy bean were reduced 40, 30, and 62% , resp. The combination of atrazine and EPTC also reduced plant wt. and delayed flower and pod development. EPTC was found to increase wind blast injury under conditions of low relative humidity, high winds, and limited soil moisture. EPTC at 2.24, 3.36,and 4.48 kg/ha reduced the chloroform-soluble leaf extract from the surface of navy bean leaves. Scanning electron micrographs confirmed that EPTC at 10^{-6} *M* altered leaf surface waxes. EPTC at 10^{-5} and 10^{-6} *M* increased the transpiration rate. Increased uptake of ^{14}C-atrazine from solution was associated with the increased transpiration rate. Applications of EPTC at 3.36 and 4.48 kg/ha increased root rot severity and reduced yields in artificially infested soil. EPTC at 3.36 kg/ha and chloramben at 3.36 kg/ha in field expt. caused the greatest increase in root rot severity and yield reductions. Dinoseb and fluorodifin at 5.04 kg/ha caused the least root rot development of any herbicide treatment. In growth chamber expt. at 24°C, EPTC at 3.36 kg/ha and alachlor at 2.80 kg/ha applied to soil infested with *Fusarium solani* reduced navy bean root and shoot growth. Root rot severity was greatest in plants grown on EPTC treated soil at the 20°C ambient temp. The growth of navy bean was reduced more as the level of *Fusarium solani* chlamydospore inoculum level increased in the presence of EPTC, than without EPTC. Growth of a moderately root rot resistant navy bean line RRR041 was not reduced when grown in soil infested with *Fusarium solani* and treated with EPTC. None of the herbicides tested increased virulence of *Fusarium solani* when grown on potato dextrose agar supplemented with herbicide. EPTC-treated navy bean seedlings were more susceptible to *Fusarium solani* than untreated seedlings. Scanning electron micrographs indicated that navy bean plants grown in EPTC had altered hypocotyl surfaces. EPTC and dinoseb increased the exudation of electrolytes, amino acids,and sugars from root and hypocotyl tissue. None of the herbicides tested increased *Fusarium solani* hyphal develop-

ment in soil or liquid culture. Dinoseb reduced hyphal development by the greatest amount of any herbicide tested in soil and liquid culture. *(Author's summary)* D02 E03

0217

14716 RONZELLI JUNIOR, P. **Comparação de herbicidas na cultura consorciada de milho *(Zea mays* L.) com feijão *(Phaseolus vulgaris* L.)** *(Comparison of herbicides in bean intercropping with maize).* Tese Mag. Sc. Viçosa, Minas Gerais, Universidade Federal de Viçosa, 1980. 45p. Port., Sum. Port., 65 Refs., Illus.

Phaseolus vulgaris. **Weeding. Herbicides. Intercropping.** *Zea mays.* **Weeds. Plant injuries. Statistical analysis. Brazil.**

Combinations of herbicides chloramben and sodium salt of acifluorfen were evaluated at rates of 0.0, 1.5, 3.0, and 4.5 kg/ha and *l*/ha, resp. in beans intercropped with maize. The former was efficient in controlling narrow-leaf weeds, while the 2nd controlled broadleaf weeds. Predominant species were *Brachiaria plantaginea, Ipomoea* sp., and *Bidens pilosa.* No signs of toxicity were observed in the crops as the result of herbicide application. The best treatments for intercropping were: 3.0 kg chloramben/ha and 3.0 *l* sodium salt of acifluorfen/ha; 4.5 kg chloramben/ha and 3.0 *l* sodium salt of acifluorfen/ha; and 4.5 kg chloramben/ha and 4.5 *l* sodium salt of acifluorfen/ha. *(Author's summary. Trans. by L. M.F.)* D02

0218

14303 WALKER, S.R. **Tolerance of navy beans to the post-emergence herbicides bentazone and dinoseb.** *In* Conference of the Council of Australian Weed Science Societies, 1st., Kingaroy, Queensland, 1978. Proceedings. Australia, Queensland Department of Primary Industries, 1978. pp.197-202. Engl., Sum. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Herbicides. Host-plant resistance. Plant injuries. Yields. Australia.**

Post-emergence applications of bentazone at 1 and 2 kg/ha and dinoseb at 1.12 and 2.25 kg were generally well tolerated by navy beans in 3 trials on red clay loam soil during 1975-77, though under conditions of high temp., dinoseb caused leaf scorch, stunting and reduction in the crop yield. No differential var. susceptibility to either herbicide was evident. *(Summary by Weed Abstracts)* D02

0219

14397 COOK, G.T. and DUNCAN, H.J. **Mode of action of thiocyanates and iodides in aminotriazole formulations.** Pesticide Science 10(4):281-290. 1979. Engl., Sum. Engl., 26 Refs.

Phaseolus vulgaris. **Inhibitors. Metabolism. Leaves. Amino acids. Plant-growth substances. Herbicides. Plant injuries.**

Ammonium thiocyanate (I) was shown to inhibit the oxidation of aminotriazole (3-amino-1,2,4-triazole) in 2 free-radical generating systems: (a) riboflavin photosensitised oxidation; and (b) oxidation by hydroxyl radicals. Evidence from in vitro studies is presented to show that I could enhance aminotriazole performance by being preferentially oxidized within the leaf, thereby preventing aminotriazole free-radical formation and subsequent conjugation with amino acids and other compounds. This opens up the possibility of a whole new range of additives which could enhance translocation by inhibiting free-radical reactions. A comparison of possible inhibitors revealed that cyanides, iodides and perhaps bromides may be of use in this respect. In addition to inhibiting free-radical reactions, I and potassium iodide (II) were shown to have a considerable effect on the uptake of aminotriazole by bean leaves (var. Canadian Wonder). In the absence of additives, uptake of aminotriazole was negligible (1.8%); in the presence of a 1:1 *M* ratio of I or II, uptake of aminotriazole was increased to

36.6% and 54.2%, resp. At a 3:1 *M* ratio of additive:aminotriazole, the resp. figures were 63.5% and 81.0%. It appeared to be the more efficient of the 2 additives at higher humidity. However, the results and observations indicated that the situation may be reversed under low-humidity conditions. *(Author's summary)* D02 C00

0220

14790 McLAUGHLIN, M.F. **Crop growth and weed competition.** Ph.D. Thesis. Ithaca, N.Y., Cornell University, 1978. 187p. Engl., Sum. Engl., 188 Refs., Illus.

Phaseolus vulgaris. **Weeds. Weeding. Herbicides. Spacing. Germination. Seedlings. Leaves. Growth. Soil requirements. Soil water. Soil temperature. Seed characters. Snap bean. USA.**

The effect of *Amaranthus retroflexus* on *Phaseolus vulgaris* was investigated in field, greenhouse and controlled environment trials. Of the following cultivation treatments: herbicides + cultivation, herbicides alone, cultivation alone or crop spacing, seed yields were increased with close row spacing. In controlled environment and field conditions a reduction in light intensity reduced emergence and growth in both *P. vulgaris* and weeds. LAI throughout the growing season was greater but RGR was lower in *P. vulgaris* than *A. retroflexus*. *(Summary by Field Crop Abstracts)* D02 C02

0221

14225 DUTRA, L.G. *et al.* **Espaçamento e densidade de plantio de feijão da seca em área de Campo-Cerrado.** *(Spacing and density of bean planting during the dry season in a Campo-Cerrado area).* Revista Seiva 39(88):1-9. 1979. Port., Sum. Port., Engl., 7 Refs.

Phaseolus vulgaris. **Cultivation. Spacing. Yields. Fertilizers. Green manures. Soil analysis.**

An expt. to study the spacing and densities of separate plantings was carried out in the Central Plateau in Brazil (16° 19' 48'' S. and 48° 58' 23'' W.) for 4 consecutive yr in the same area. Basic chemical fertilizer was used during all the pases of the expt.; green fertilizer containing *Crotalaria juncea* was applied only during the last 3 yr. The results showed a linear effect on the component spacing, certified by the Tukey test at a 5% level of significance. A distance of 30 cm between the rows was better, and the quadratic effect for the component density of the planting, was more favorable when the spacing between the holes was 10 and 15 cm. *(Author's summary)* D02

0222

14359 LABRADA, R. **Las malas hierbas y su combate en algunas hortalizas y frijol.** *(Weeds and their control in some vegetables and in beans).* Boletín de Reseñas. Serie Agricultura 4(8):5-45. 1977. Span., 146 Refs.

Phaseolus vulgaris. **Weeds. Herbicides. Weeding. Research. Cuba.**

A bibliographic review on different aspects related to weed incidence in some vegetables and in beans and their chemical control is given including: composition of weed species, particular bioecologic aspects of weeds, role of former crops, critical period of competition with crops, use of herbicides and their effects, herbicide residues and economic efficiency, and techniques for their use. *(Summary by I.B. Trans. by L.M.F.)* D02

0223

14349 BARTHA, L. and NANCARROW, R.J. **Field determination of bean quality.** Journal of the Australian Institute of Agricultural Science 45(4):257-260. 1979. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Pods. Cultivars. Selection. Harvesting. Timing. Climatic requirements. Yields. Australia.**

Sampling of pod density from commercial and exptl. bean plots has shown changes in pod density to be a satisfactory measure of pod quality. It is suggested that by sampling the more advanced pods from a crop the timing of the harvest operation, to maximize yield and quality, can be predicted. *(Author's summary)* D02

0224

14770 HERNANDEZ C., C.J. **Asociación de maíz, fríjol y papa con diferentes poblaciones de papa y tres niveles de fertilización nitrogenada al maíz-fríjol, en el Valle de Quetzaltenango.** *(Association of maize, beans, and potatoes with different potato populations and three levels of nitrogen fertilizer to maize-beans in the Valle de Quetzaltenango).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1977?. 32p. Span., 30 Refs.

Phaseolus vulgaris. **Cultivation systems. Intercropping.** *Zea mays. Solanum tuberosum.* **Spacing. Yields. Costs. Income. Guatemala.**

In 1974 an expt. was conducted to study different plant densities of potato and N fertilization of maize-beans in maize-potatoes-beans in association at the Centro de Investigación Agrícola de Occidente "Labor Ovalle" of the Instituto de Ciencia y Tecnología Agrícolas (ICTA), located in Olintepeque, state of Quetzaltenango, Guatemala. Characteristics of the area are: 2400 m.a.s.l., area of low-montane, humid forest, fine sandy loam soil with volcanic ash. Potato var. Alpha, bean var. Bolonillo, and maize var. San Marceño were used in 18 cropping systems, maize and bean populations were constant (33,333 and 16,666 plants/ha, resp.), 6 potato densities (6944, 7575, 8333, 10,416, 13,888, 20,833 plants/ha) were used with 3 levels of N fertilization (75, 100, and 125 kg/ha). An analysis on profitability was conducted for each system, based on the cost/benefit ratio. Results indicate that potato densities do not affect maize yield. A highly significant difference was observed in the profitability of the systems used; the treatment of highest returns for maize-potatoes-beans in association consisted of 75 kg N/ha and 6944 potato plants/ha. Tables are included on the statistical analysis of profitability and on maize yields. *(Summary by C.P.G. Trans. by L.M.F.)* D02

0225

11688 REIS, M.S., VIEIRA, C. and BOLSANELLO, J. **Efeito do plantio de fileiras duplas de feijoeiros (*Phaseolus vulgaris* L.) sobre o rendimento e seus componentes.** *(Effect of planting beans in double rows on yield and its components).* Revista Ceres 26(145):310-315. 1979. Span., 3 Refs.

Phaseolus vulgaris. **Spacing. Planting. Yields. Yield components. Brazil.**

Three expt. were carried out in order to study the effect of single and double rows of bean plants on yield and its components. The single rows were placed 50 and 60 cm apart. The double rows were placed at the same intervals, with spacings of 20 and 30 cm between the pairs. It was concluded that the double rows were not advantageous to bean yield. *(Author's summary)* D02

0226

14783 SHENK, M. *et al.* Respuesta de fríjol (*Phaseolus vulgaris* L.) a diferentes manejos de la vegetación. *(Bean response to different plant managements).* Turrialba, Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza, 1979. pp.L19/1-L19/8. Span., Sum. Span., 23 Refs.

Paper presented at Reunión Anual del PCCMCA, 25a., Tegucigalpa, Honduras, 1979.

Phaseolus vulgaris. **Land preparation. Weeds. Weeding. Herbicides. Cultivation systems. Yields. Costa Rica.**

Several plant management systems, based on zero tillage, were compared with traditional mechanization systems. It was demonstrated that the zero tillage systems, that provide adequate weed control during the growth cycle, give yields that are agronomically and economically superior to those obtained with conventional mechanization. The application of 1.5 kg glyphosate on the sprouts 24 days after the vegetation has been cut, resulted in yields of 1 384 kg/ha. With traditional mechanization, yields were 1169 kg/ha and the traditional system yielded 77 kg/ha. The traditional system consisted in simply scattering the seeds on weedy land and immediately covering them by cutting the weeds present at that moment. It was also shown that it is possible to significantly improve yields in the traditional system with the simple modification of planting in hill-plots or with cuttings, instead of scattering seeds on weedy land. This modification gave yields of 495 kg/ha. *(Author's summary. Trans. by I.M.F.)* D02 D03

0227

16071 STOLK, J.H. Stamslabonen onder glas. *(Dwarf French beans under glass).* Groenten en Fruit 35(38):55. 1980. Dutch.

Phaseolus vulgaris. **Dwarf bean. Snap bean. Pods. Agronomic characters. Yields.**

Data are presented on the yields/m² and pod characteristics of 11 dwarf *Phaseolus vulgaris* cv. with once-over or multiple harvesting, assessed from trials in several places. For either harvesting method Preresco, Kap-Prevabel, and Rubio were the most suitable; Lotus was also satisfactory for once-over harvesting and Centrum-Resulta, Prelude, and Piter for multiple harvesting. *(Summary by Horticultural Abstracts)* D02

See also 0034 0045 0119 0160 0486

D03 Cultivation Systems: Intercropping, Rotational Crops

0228

14319 HOLLE, M. *et al.* **Prueba de 6 arreglos cronológicos de maíz (cv. Tuxpeño y Local), fríjol (*Phaseolus vulgaris* cv. Turrialba 4 y CATIE 1) y caupí (*Vigna unguiculata* - cv. Centa 105) en el cantón de Pérez Zeledon, Región Pacífico Sur, Costa Rica.** [*Trial on 6 chronological arrangements of maize (cv. Tuxpeño and Local), beans (cv. Turrialba 4 and CATIE 1) and cowpea (cv. Centa 105) in the Perez Zeledon canton, South Pacific region, Costa Rica*]. Turrialba, Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza. Programa de Cultivos Anuales, 1978. 25p. Span., Sum. Span. Illus.

Paper presented at Reunión Anual del PCCMA, 24a., San Salvador, 1978.

Phaseolus vulgaris. **Cultivation systems. Intercropping. Rotational crops. Planting. Spacing. Timing. Climatic requirements. Stastistical analysis. Experiment design. Yield components. Yields. Costa Rica.**

In order to measure the effect of crop intensification on a plot, the following 6 combinations were tested in the 1977 crop yr: maize + beans; maize + bean intercropping + beans; maize/bean intercropping + maize/bean intercropping; maize + cowpeas; maize/cowpea intercropping + cowpeas; maize/cowpea intercropping + maize/cowpea intercropping for the 1st and 2nd planting seasons; resp. Trials were set up in 4 farmers' fields that had different rainfall regimes and soil characteristics. Maize cv. Tuxpeño and Local and bean cv. Turrialba-4 were planted during the 1st season and cv. Catie in the 2nd; cowpea cv. Centa-105, in the season during which the regional farmers usually plant. Beans and cowpeas were intercropped 8 days after maize in the 1st season and simultaneously with maize in the 2nd. Spacings among rows varied; among plants, maize was planted in hill-plots at 0.5 m (2 seeds/plant); and beans or cowpeas at 0.2 m (2 seeds/plant) and 2 rows/each row of maize. Fertilization was determined by soil analysis, using an intermediate level to define rates and elements to apply. Insect control was preventive for *Phyllophaga* spp. in maize and *Diabrotica* spp. in legumes. One to three fungicide applications were made during flowering and fructification to prevent diseases, mainly *Rhizoctonia* and *Isariopsis*, depending on predominant climatic conditions at the site. Plots consisted of 5-7 rows, 8-10 m long, 2-4 replications/site. Plants were counted at the beginning of the cultivation and at harvest. Yield was measured by harvesting 3-5 central rows and registering for maize, the no. and wt. of corn cobs, wt of grains, and moisture %. In the case of beans and cowpeas, the grains were weighed and seed size evaluated. Data on yields and their relation to prevalent rainfall regime and soil conditions were discussed. *(Author's summary. Trans. by L.M.F.)* D03

0229

14238 VIEIRA, S.A., BEN, J.R. and GASTAL, F.L. DA C. **Avaliação do cultivo de milho e feijão nos sistemas exclusivo e consorciado.** *(Evaluation of maize and beans in pure stand and mixed cropping in alternated strips).* Pesquisa Agropecuária Brasileira 15(1):19-26. 1980. Port., Sum. Port., Engl., 19 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Production. Productivity. Yields. Income. Economics. Brazil.**

The behavior of maize and beans in pure stand and intercropped in alternated strips and peasant farming situation were studied in relation to grain production, land use efficiency, gross income and gross profit. The best grain production in maize was achieved with pure stand and alternated strips. The potential production of grain beans as a monoculture was reduced in 32-50% when planted in association with maize. Economic studies of grain yield performance over all systems, with relative values for 1978, showed that the treatments in alternated strips were the most profitable and they also gave a better effective land use with the index of 157% *(Author's summary)* D03

0230

14354 AIDAR, H. and VIEIRA, C. **Cultura associada de feijão e milho. III. Efeitos de populações de plantas sobre o feijão da seca.** *(Bean/maize intercropping. III. Effects of plant population on dry beans).* Revista Ceres 26(147):465-473. 1979. Port., Sum. Port., Engl., 16 Refs.

Phaseolus vulgaris. Zea mays. **Intercropping. Planting. Timing. Spacing. Maturation. Harvesting. Yields. Productivity. Income.**

Two expt. were carried out at Viçosa, state of Minas Gerais, Brazil, in which maize was planted at the beginning of the rainy season and field beans were sown between the maize rows, when the maize had begun to dry. A factorial design was used with 3 maize plant populations (20, 40, and 60 thousand/ha in 1 expt., and 20, 30, and 40 thousand/ha in the other) x 5 bean densities (0, 100, 200, 300, and 400 thousand seeds/ha). As would be expected, maize yields were not affected by the bean crop. Bean yields were low and no differences in yields were obtained among the 5 bean planting densities. In 1 expt. the bean yield was higher with the lowest maize plant population, while in the other expt. the bean yield was not affected by the maize populations. Beans increased the protein production/area by 10-19% . The LER was higher at the lowest maize plant population, reaching approx. 1.5, while with the other populations the ratio reached approx. 1.3. As the bean crop does not affect the maize yield, any bean production is an extra gain for the farmer. Depending on the ratio of the bean price to the maize price, it may be economically justifiable to decrease the maize plant population (which decreases the maize yield) in order to benefit the bean yield. *(Author's summary)* D03

0231

14315 LOPEZ P., F.M. **Ensayo preliminar de asociación de caña de azúcar con fríjol.** *(Preliminary trial of sugar cane in association with beans).* Tesis Ing. Agr. Lima, Perú, Universidad Nacional Agraria La Molina. 1972. 88p. Span., Sum. Span., 21 Refs., Illus.

Phaseolus vulgaris. **Intercropping. Cultivation systems. Cultivation. Planting. Spacing. Experiment design. Yields. Yield components. Climatic requirements. Weeding. Costs. Perú.**

The agricultural potential of the sugar cane-producing area of Peru can be increased. It is possible to associate sugar cane during its 1st stage of growth and development, with other crops with short growth cycles, among them beans, especially in rainy seasons when sugar cane grows very slowly. This 1st exptl. trial was conducted to obtain the association of sugar cane with bean var. "Panamito mejorado" so that there were no interferences with routine cultural labors of sugar cane cultivation, so has to study the effect of bean intercropping on the height of the sugar cane stems and tillering. The expt. was conducted at the Lampay 2A field, belonging to the Cooperativa Agraria de Producción Paramonga Ltda. no. 37 in the Valle de Pativilca, Lima. The association was carried out with the 3rd ratoon of the sugar cane var. H32-8560 between May 25-26th, 2 mo. after the 2nd cutting. A completely randomized block design was used with 3 treatments and 5 replications. Treatments studied were: (a) double rows of beans between sugar cane rows; (b) a single row of beans between sugar cane rows; and (c) sugar cane without beans (check). Results

obtained show that the % of depopulation in sugar cane was not significant and a great variability of depopulation existed in the exptl. field. Likewise, it was concluded that the 2 treatments of bean intercropping did not exert a significant effect on the no. of tillers and on the sugar cane stem height. It was also found that the treatment (a) significantly outyielded treatment (b). On the other hand, no significant differences have been obtained for the following characteristics evaluated in beans: no. of pods/plant, wt. of 100 seeds, and no. of healthy pods. The no. of empty peds was significant. Comparisons between the av. of var. in monoculture, and the av. obtained for the no. of beans/pod have shown that they were not affected by bean cultivation and other factors. However, the no. of pods/plant decreased approx. 50%. Correlations between the no. of tillers and no. of pods/linear m of row in each treatment, reveal that a slight reduction existed in the no. of pods when the no. of tillers was increased. Through field observations, it has been confirmed that the companion crop did not interfere with the cultural practices of sugar cane cultivation, except in weed control since preemergent herbicides could not be used on sugar cane. Bean crop yields were 435.3 kg/ha in treatment (a) and 284.5 kg/ha in treatment (b). Costs/ha were S/. 8531.13 and S/. 6260.82, resp. However, bean yields in each treatment have not counterbalanced their resp. production cost. Therefore, sugar cane/bean association was considered uneconomical, but a reduction in costs may be possible. *(Author's summary. Trans. by L.M.F.)* D03

0232

12650 EMPRESA CAPIXABA DE PESQUISA AGROPECUARIA. **Sistemas de produção para milho e feijão.** *(Maize and bean production systems).* Viana-ES, Brasil. Circular no. 121. 1976. 39p. Port.

Phaseolus vulgaris. **Technology. Cultivation systems. Planting. Spacing. Harvesting. Yields. Brazil.**

Five bean and maize production systems are given, based on the conclusions of a meeting among researchers, extension workers, and producers, conducted in Viana, Espírito Santo, Brazil (May 1976). Systems adapt to the regional conditions and to the characteristics of the group of farmers for whom they are designed: (1) beans, farmers with a high level of technological knowledge and who accept the transfer of technology; (2) beans, farmers with primary education that successfully practice some techniques; (3) beans, farmers with a low level of technological knowledge, elemental practices, and simple equipment; (4) beans/maize, a superior level of technology and receptivity; and (5) beans/maize, a low level of education and technology. Characteristics of the product and of producing areas are described. Soil preparation, soil amendment and fertilization, planting, cultural practices, harvesting, post-harvest treatments, storage, and commercialization are included. Economic data on each system are given. *(Summary by I.B. Trans. by L.M.F.)* D03

0233

13182 VIEIRA, C. **Cultivo consorciado de milho com feijão.** *(Maize/bean intercropping).* Informe Agropecuário 4(46):42-45. 1978. Port., 8 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Spacing. Cultivars. Yields. Brazil.**

Aspects on maize/bean intercropping in Minas Gerais (Brazil) are given and the advantages of this system, that uses to a greater extent agricultural techniques to obtain higher yields, are highlighted. The results of some studies on maize/bean intercropping are included. More efficient land usage as well as the extra profit that bean cultivation represents for the farmer when maize productivity does not vary as the result of its association with beans, are among the advantages mentioned of this system. Planting approx. 160,000 bean seeds/ha is recommended for the rainy season; for the dry season, a higher density. Climbing bean var. give better results during the dry season since maize supplies an adequate support; on the other hand, lodging is reduced in this sytem compared to maize in monoculture, apparently due to the better rooting caused by the presence of the legume. *(Summary by I.B. Trans. by L.M.F.)* D03

0234

14702 BURGOS, C.F. and MENESES, R. **Prueba de seis arreglos cronológicos de maíz, fríjol, arroz y yuca en Cariari. Pococí, Limón, Costa Rica.** *(Trials on six chronological arrangements of maize, beans, rice, and cassava in Cariari, Pococí, Limón, Costa Rica).* Turrialba, Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza, 1979. pp.L33/1-L33/15. Span., Sum. Span., 2 Refs., Illus.

Paper presented at Reunión Anual del PCCMCA, 25a., Tegucigalpa, Honduras, 1979.

Phaseolus vulgaris. **Cultivation systems. Intercropping. Rotational crops. Energy productivity. Income. Costs. Economics. Costa Rica.**

The performance of 6 chronological arrangements of maize, beans, rice, and cassava were evaluated on a farm of the District of Cariari, Cantón Pococí, Limón Province, Costa Rica. The systems under evaluation consisted of monoculture crop rotation, crop rotation of a monoculture followed by association, rotation of associations and association followed by relay cropping. Three arrangements were performed as designed before planting. Data of one, rice followed by rice, were not included in this report since production was lost in 2 replications due to damage by birds. The other 2, maize followed by maize and beans in relay cropping, and rotation of maize associated with rice, suffered modifications due to the climatic conditions and the lack of adaptation of bean var. Turrialba 4 to the environment of the area. The LER was estimated for the 5 systems showing acceptable performance. The highest LER (2.27) was given by the system maize associated with cassava followed by beans intercropped with cassava stems (M + C + B°). The LER that followed in descending order was that estimated for the system cassava followed by beans C + B (1.98). The system maize followed by maize gave a LER of 0.99 in comparison. Yields for each one of the 5 systems are expressed in terms of Mcal./ha. The system M + C + B° yielded 61,115 Mcal./ha while the system C + B yielded 55,016 Mcal./ha. However, the system with maize is recommended due to its importance in family consumption. In terms of net income, the system C + B yielded more (CA $4123/ha) than system M + C + B (CA $3742). Traditional systems in the area are maize followed by maize, maize and cassava in association, and cassava in monoculture. Results of this expt. and those obtained in studies on land preparation, static surveys, dynamic surveys and records, socieconomic studies and fertilization studies were used to develop an alternative cropping system for farmers of the area. The alternative has been prepared in form of a document consisting of 3 parts: a description of the area in which this system can be applied; a detailed description of the system, comparing it to the traditional one in agronomic and economic terms; and the exptl. evidence that verifies the changes included in the alternative. *(Author's summary. Trans. by L.M.F.)* D03 J00

0235

15433 DAVIS, J. **Relaciones de competencia entre fríjol y maíz en sistemas de asociación y sus inferencias para el mejoramiento genético.** *(Competitive relations between beans and maize in associated systems and their inferences on genetic improvement).* Cali, Colombia, Centro Internacional de Agricultura Tropical. Seminarios Internos. Serie SE-6-81. 1981. 35p. Span., Sum. Span., 12 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Cultivation systems. Intercropping. Agronomic characters. Selection. Cultivars. Yields. Income. Colombia.**

The process of selection in climbing bean improvement should be conducted with maize in association due to the high cost of sole cropping with stakes or with a trellis system. The relation between yields of beans and maize is negative and the regression coefficient is normally between -1 and -2. In other words, for each additional kg of beans, between 1-2 kg of maize is lost due to competition. The line of regression may be used to forecast yields of maize in monoculture and the reduction of maize yields serves as an index of the competitive ability of beans. Therefore it is not necessary to plant the resp. monocultures. The most competitive bean genotypes have higher yields in association with maize. However,

in monoculture the var. of less competitive ability tend to be more productive. More competitive var. are taller and of later maturity and are of growth habit IVB. The most competitive maize var. are also tall. Early-maturing and shorter var. show interesting possibilities for association, but they have to be selected for resistance to stem lodging. Economic analysis shows that the most competitive bean var. (habit IVB) produce the highest income. Habit IVB attributes a high capacity to survive regardless the competence by maize, weeds, diseases, and pests. To study the change in the type of plant to an earlier-maturing plant (habit IVA) that, together with an earlier-maturing maize, allows the relay or rotational system to be extended to other crops, improved cultural practices and resistance to major diseases and pests should be included. These are the objectives of the program and the results obtained up to date, indicate that beans can be selected for a reduced competitive ability and higher productivity in association with maize in early generations. *(Author's summary. Trans. by L.M.F.)* D03 G00

0236

13161 EMPRESA BRASILEIRA DE ASSISTÊNCIA TECNICA E EXTENSÃO RURAL. **Sistema de produção para o feijão: Santa Catarina.** *(Bean production system: Santa Catarina).* Santa Catarina-FL Brasil. Sistema de Produção. Circular no. 61. 1977. 31p. Port.

Phaseolus vulgaris. **Technology. Cultivation systems. Intercropping. Cultivation. Pest control. Brazil.**

Two bean production systems are given for farmers of the areas of Litoral, Vale do Itajai, Vale do Rio do Peixe, Planalto, and the northern and eastern part of the state of Santa Catarina (Brazil); this is the 1st attempt to combine technology and the experience of local extension workers and producers to promote an improved utilization of available resources. The 1st system is for farmers who plant monocultures and basically use mechanization and animal traction as well as family labor; the 2nd system is for bean/maize growers who use family labor, basic equipment, and animal traction. Soil conservation, conservation of soil acidity and fertility, land preparation, fertilization and planting, cultural practices, disease and pest control, harvesting, and storage are included in the technical recommendations. Technical coefficients of the 2 systems are included. *(Summary by I.B. Trans. by L.M.F.)* D03

0237

13502 GONZALEZ M., C. **Análisis agroeconómico del fríjol asociado con caña de azúcar.** *(Agroeconomic analysis of beans in association with sugar cane).* Tesis Ing. Agr. San José, Universidad de Costa Rica. Escuela de Economía Agrícola, 1975. 64p. Span., Sum. Span., 21 Refs., Illus.

Phaseolus vulgaris. **Cultivation systems. Economics.** *Saccharum officinarum.* **Intercropping. Costs. Income. Productivity. Costa Rica.**

An agroeconomic study was conducted on bean cultivation in association with sugar cane on the farm La Argentina, province of Alajuela, Costa Rica, located at 10°02' N lat. and at 84°21' W longitude at an alt. of 825 m.a.s.l. There are 2 well-defined climatologic seasons: a rainy season from May-Dec. and a dry season from Dec.-April. An av. min. temp. of 17.8°C and an av. max. temp. of 29.7°C occurs. Specific objectives were: (a) to determine production costs of vineless bean cultivation in association with sugar cane; (b) determine the cost-benefit relation in this system; (c) determine the net return/invested colón; (d) establish the agricultural potential of this planting system; and (e) analyze the possibilities of reducing the items of highest expenditures. Results indicate that production cost was Colón $ 1776.25/ha; highest expenditures being planting (57.97%) and harvesting (bean recollection, beating, and cleaning, 24%). Net income was Colón $ 2879.75/ha, based on a production of 704.61 kg/ha. Net return/invested colón was 1.62, which expressed in % gives a net return of 162% . Cost-benefit relation of this system was 2.62. Agricultural potential in the

districts of Grecia, Atenas, Poás, Valverde, Vega, Naranjo, and Central of the province of Alajuela, and Santa Bárbara and Central of the province of Heredia, showed that there are 2380.22 ha and a production of 1,677,121.85 kg with an av. yield of 704.61 kg/ha. *(Author's summary. Trans. by L.M.E.)* D03

0238

12649 EMPRESA BRASILEIRA DE ASSISTÊNCIA TECNICA E EXTENSÃO RURAL. **Sistemas de produção para feijão: Território Federal de Rondônia.** *(Bean production systems: Territorio Federal de Rondônia).* Vila de Rondônia-RO, Brasil. Série Sistemas de Produção. Boletim no. 66. 1976. 23p. Port., Illus.

Phaseolus vulgaris. **Cultivation. Cultivation systems. Planting. Spacing. Harvesting. Yields. Brazil.**

Two bean production systems are given, result of the meeting conducted at Vila de Rondônia, Territorio Federal de Rondônia, Brazil in Dec. 1976. The analysis of actual cultivation in the region is included as well as the diagnosis of characteristics and pertinent recommendations. The 1st system is for farmers with a high level of education, sufficient experience in bean cultivation and good receptivity; the 2nd, for farmers with a low level of education who practice a traditional cultivation system. A description of the product and of the bean-producing regions (climatic and edaphic aspects), the distribution of properties by size as well as a map of the included areas are given. Farm planning and the choice of area, soil preparation, planting, cultural practices, harvesting and post-harvest treatment, storage, and commercialization are included. For each system, tables on pest control and the technical coefficients/ha are given. *(Summary by I.B. Trans. by L.M.E.)* D03

0239

15017 CASTELLANOS D., V.H. **Comportamiento de la yuca (*Manihot esculenta* Crantz) sometida a una poda parcial y cultivada en asociación con frijol arbustivo y voluble (*Phaseolus vulgaris* L.).** *(Performance of cassava subjected to partial pruning and grown in association with climbing and bush beans).* Tesis Mag. Sc. Turrialba, Costa Rica, Universidad de Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza, 1981. 102p. Span., Sum. Span., Engl., 74 Refs., Illus.

Phaseolus vulgaris. Manihot esculenta. **Intercropping. Planting. Timing. Plant habit. Energy productivity.**

Two expt. were conducted at the Centro Internacional de Agricultura Tropical (CIAT), Palmira, Colombia from Dec. 1979-Jan. 1981 in order to: (1) evaluate the performance of cassava (cv. M Mex-11) and bean (bush type II cv. P-556 and climbing bean type IV b cv. G-2258) crops in monoculture and in association during the 2nd half of the cassava growth cycle; (2) determine the most adequate planting time for both bean cv. in relation to the cassava crop, at least 6 mo. old, pruned or unpruned; and (3) assess the N-P-K-Ca and Mg extraction by the components of the cassava/bean association and their resp. monocultures. A random block design was used with 14 treatments and 4 replications; expt. 1 was cassava + bush beans and expt. 2, cassava + climbing beans. Treatments were established when cassava was 7, 8, and 9 mo. old, with or without pruning. Maize cv. La Posta (intermediate height: 2.5 m) was used as support in plots of climbing beans in monoculture. Highest bush bean yields were in monocultures (1.8 mt/ha) and bush bean + cassava pruned at 8 mo. yielded (1.3 mt/ha). Highest monoculture yield of climbing beans were 1.0 mt/ha and there was no clear response from the cassava association with and without pruning. Nutrient extraction by both types of beans was greater in monoculture as compared to those associated with cassava. Pruned cassava + bush beans had a higher LER, surpassing the corresponding monocultures by 56%. The system unpruned cassava + climbing beans was 33% more efficient regarding land efficiency than their resp. monocultures. Energy efficiency of the system pruned cassava + bush beans was 1.96% and with unpruned cassava, 1.86%. Energy efficiency of the system pruned cassava + climbing beans was 0.86% and with unpruned

cassava, 0.96%. Regarding energy production, the 2 best systems were: pruned cassava + bush beans at 8 mo., producing 32,278 Mcal/ha/yr and unpruned cassava + climbing beans at 7 mo., 35,553 Mcal/ha/yr. *(Extracted from author's summary. Trans. by L.M.F.)* D03

0240

12643 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. **Pacotes tecnológicos para milho, feijão e algodão.** *(Technological packages for maize, beans, and cotton).* Aracajú-SE, Brasil. Circular no. 88. 1975. 27p. Port.

Phaseolus vulgaris. **Technology. Cultivation systems. Technological package. Storage. Trade. Brazil.**

Three technological packages, result of the meeting at Aracajú, Sergipe, Brazil (Sept. 15-20, 1975) are given for maize, bean, and cotton crops in various municipalities in the state of Sergipe. Packages include technical recommendations on area selection, soil samplings, land preparation, planting and fertilization, cultural practices, phytosanitary measures, harvesting, post-harvest preparation, storage, and commercialization. The 1st package is designed for the system maize/beans in association as the main agricultural activity; the 2nd, for beans/maize in association using certain technology; and the 3rd, for beans/maize/cotton in association, practiced by farmers that resist technical innovations. Technical coefficients of each package are given in table form, including information on the factors and costs of the cultural practices of each system. *(Summary by I.B. Trans. by L.M.F.)* D03

0241

14789 DIAZ C., J.M. **Influencia de dos sistemas de cultivo y cuatro variedades de fríjol (*Phaseolus vulgaris* L.) sobre la incidencia de roya y antracnosis.** *(Influence of two cropping systems and four bean varieties on rust and anthracnose incidence).* Tesis Mag. Sc. Bogotá, Colombia, Universidad Nacional. Instituto Colombiano Agropecuario, 1981. 101p. Span., Sum. Span., Engl., 51 Refs., Illus.

Phaseolus vulgaris. **Cultivation systems.** *Uromyces phaseoli. Colletotrichum lindemuthianum.* **Symptomatology. Leaves. Pods. Planting. Timing. Climatic requirements. Etiology. Experiment design. Colombia.**

Between March 1980-Feb. 1981 studies were conducted at 2 exptl. stations of the Centro Internacional de Agricultura Tropical (CIAT-Palmira and Popayán-Cauca, Colombia). The objectives of the studies were to determine the influence of 2 cropping systems in beans in monoculture and in association with maize, on the incidence of rust and anthracnose, using 4 bean var. (2 bush bean and 2 climbing bean) having different reactions to both diseases. Two trials were conducted at CIAT-Palmira to evaluate rust incidence and 2 at Popayán-Cauca to evaluate anthracnose incidence. Scales used to evaluate disease incidence consisted of measurements of the % of leaf area infection in the case of rust and the % of leaf and pod area infected in the case of anthracnose. Sixty-four observation spots (0.48 m^2) were evaluated for each bush bean var. and 32 for each climbing bean var. in each of the 4 replicates in both monoculture and in association. A min. of 3 evaluations were made during the growth cycle in the 4 trials from the time of disease onset, at 8-12 day intervals, up to the time disease incidence stabilized. Results obtained at CIAT-Palmira during the 1st semester showed that when there is a source of inoculum near either cropping system, var. with intermediate or susceptible types of reactions to the fungus have a higher disease incidence, regardless of the cropping system. In the 2nd semester, it was observed that in the absence of a close inoculum source, the monoculture cropping system had a higher incidence of rust. In both semesters, the rust-resistant var. in monoculture were also resistant in association with maize; apparently the resistance to a pathogen is not modified by the cropping system. Results obtained at Popayán-Cauca showed that for var. with intermediate resistance reactions, a higher disease incidence on leaves was observed when beans were grown in association with maize, but there was no difference between the 2 cropping systems regarding

disease incidence on pods. There was no difference between the 2 systems regarding leaf reaction. However, there was a higher disease incidence on pods in the associated system. When the disease appeared in the early seedling stage, there was a 100% loss in both cropping systems. During the 2 semesters at both localities, the monoculture system and resistant var. gave higher yields. At CIAT-Palmira, low yields in the association system, were partly due to the association and competition with maize. At Popayán-Cauca, apart from the competition with maize, the higher anthracnose incidence in association contributed to reducing bean yields. *(Author's summary)* D03

0242

15207 EDJE, O.T. and RAO, Y.P. **Response of climbing beans to staking height.** Bean Improvement Cooperative Annual Report 23:61-62. 1980. Engl., 1 Ref.

Phaseolus vulgaris. **Climbing bean. Plant height. Cultivation systems. Yields. Yield components. Leaves.**

Two climbing bean cv. (336 and 1039) and 4 trellis heights (0, 1, 2, and 3 m) were used to evaluate the effect of trellis height on crop yields at the Bunda College of Agriculture, Malawi, during the 1978/79 crop season. Plants were planted on 91 cm ridges and 15 cm between plants. All treatments received compound NPK fertilizer 20-8.7-0 at a rate of 300 kg/ha at planting. Yield increased significantly (P=0.01) with the increase in trellis height. Treatments with 1, 2, and 3 m heights yielded 108, 140, and 154% , resp., more than the check without trellis. There were no significant differences between av. yields of cv. 336 and 1039 (2444 and 2280 kg/ha, resp.). Trellis height improved seed quality and pod frequency was 2, 4, 5, and 6 seeded pods for treatments 0, 1, 2, and 3 m, resp. Other characteristics such as DM, LAI, leaf senescence, and physiological maturity of the crop were also affected by the treatments. Results are given in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D03

0243

12644 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. **Sistemas de produção para milho e feijão.** *(Maize and bean production systems).* Lavras-MG, Brasil. Circular no. 150. 1976. Port.

Phaseolus vulgaris. Zea mays. **Intercropping. Cultivation systems. Technology. Weeding. Planting. Harvesting. Pest control. Chemical control. Brazil.**

Four maize and bean production systems are given for farmers with different technological levels in order to obtain foreseen yields; the most appropriate measures were taken in each case. Techniques were developed with the participation of research technicians, producers, extension workers, and cover the following operations: liming; land preparation and conservation; planting and fertilization; weed and pest control; harvesting; storage; and commercialization. The 1st production system is exclusively for maize growers [expected yield (e.y.) = 4.5 t/ha] with the necessary infrastructure for mechanized operations; the 2nd, exclusively for bean growers (e.y. = 1.5 t/ha), capable of using recommended technology and of high receptivity; the 3rd, for farmers that grow maize and beans in association (e.y. = 3000 and 750 kg/ha for maize and beans, resp.), with a low technological level; the 4th, for maize and bean growers (e.y. = 5000 and 700 kg/ha for maize and beans, resp.) with the highest level of technology. Technical coefficients are given for each system. *(Summary by I.B. Trans. by L.M.F.)* D03

See also 0057 0181 0226 0554 0583

D04 Seed Production

0244

11693 ECHANDI Z., R. **Objetivos de un programa de semillas.** *(Objectives of a seed program). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.103-110. Span.

Phaseolus vulgaris. **Seed production. Production.**

The 4 elements necessary for a seed program are: (a) a legal basis for the organization and regulation of production; (b) a laboratory for quality control with trained personnel and equipment for trials (inert material, seeds of weeds and other var.); (c) a certified seed production program that guarantees the quality and genetic purity of the seed, and (d) a seed processing plant where seed is conditioned for storage. The above elements are explained in detail and the benefits of an organized seed program given. *(Summary by C.P.G. Trans. by L.M.F.)* D04

0245

14302 VENDRAMIN, J.D. and ANDO, A. **Influencia do teor de umidade na radiosensitividade em sementes de feijão (*Phaseolus vulgaris* L.).** *(Influence of humidity on the radiosensitivity of bean seeds).* Piracicaba, SP, Brasil, Centro de Energia Nuclear na Agricultura. Boletim Científico no. 037. 1975. 19p. Port., Sum. Port., Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Seed. Water content. Irradiation. Germination. Laboratory experiments. Brazil.**

The purpose of this expt. was to investigate if the radiosensitivity in beans is influenced by seed water content during the irradiation as it happens in barley, peas, and other cultivated plants. Radiosensitivity was measured on the basis of plant emergence, height, and survival. The analysis of the results showed that the radiosensitivity in beans was influenced by the water content during the irradiation. It was also demonstrated that this influence was more pronounced at very high or very low water content in the seed. *(Author's summary)* D04 C03

0246

14277 GAGE, J.F. and BAIN, J.M. **Seasonal variation in french bean seed weight.** Australian Seed Science Newsletter 5:72-75. 1979. Engl., Illus.

Phaseolus vulgaris. **Climatic requirements. Seed characters. Temperature. Photoperiod. Flowering. Plant development. Australia.**

A no. of french bean cv. was planted at Redland Bay, in SE Queensland (Australia) every mo. during a 12-mo. period (1977-78) with uniform cultural conditions, to determine the influence of environmental factors on bean seed size. Seed was harvested when mature and mean seed dry wt. was determined. An inverse relationship between temp. and seed wt. was found. The apparent relationship between seed wt. and photoperiod probably results

from the correlation between photoperiod and temp. The possibility of using early or late plantings as a means of reducing seed size is indicated. *(Summary by I.B. Trans. by L.M. F.)* D04

0247

14314 LIMA, P.R. DE A. Efeitos da catação eletrônica pela cor e do tratamento fungicida sobre a qualidade de sementes de feijão *(Phaseolus vulgaris* L.). *(Effects of electronic selection and fungicide treatment on bean seed quality).* Tese Mag. Sc. Piracicaba-SP. Brasil, Universidade de São Paulo. Escola Superior de Agricultura Luiz de Queiroz, 1980. 60p. Port., Sum. Port., Engl., 26 Refs., Illus.

Phaseolus vulgaris. Seed. Seed production. Seed treatment. Seed color. Seed coat. Seed characters. Germination. Laboratory experiments. Brazil.

Researchers working with beans agree that the bad quality of seeds used by farmers is one the main factors responsable for the low productivity of bean crops in Brazil. The effect of color electronic selection and chemical treatment on seed quality was studied. Seeds of bean cv. Rosinha G-2 of the Agricultural Institute of Campinas, state of São Paulo, were utilized. Seeds were processed using an air ventilator and screens and submitted to 5 electronic separations using an electronic separator SELECTRON - SM-500, belonging to the Agriculture and Horticulture Department of the Escola Superior de Agricultura "Luiz de Queiroz", U. of São Paulo. Furthermore, both the seeds separated electronically and the unseparated ones were treated with fungicide in order to verify its effects. The effect of electronic selection as well as that of chemical treatment of seeds were evaluated by germination tests, first germination count, accelerated aging, % of seedling emergence and survival. A visual and pathologic analysis of materials was conducted of both groups of seeds; unbleached, seeds with yeast bleaches, wrinkled seeds, maggoty seeds, and seeds with microorganisms were selected. It was concluded that there was no effect of the no. of separations on seed quality; the seeds thrown away by the machine were always of inferior quality; there was a benefic effect of chemical treatment on the first count of plant germination and survival. *(Author's summary)* D04

0248

14320 MIYASAKA, S. *et al.* Esquema de produção de sementes sadias de feijão no Estado de São Paulo. *(Production system of healthy bean seeds in the state of São Paulo). In* Seminário Brasileiro de Sementes, 3o., Recife, Brasil, 1970. Anais. Recife, 1970. pp.263-266. Port.

Phaseolus vulgaris. Seed production. Diseases and pathogens. Disease transmission. Disease control. Planting. Cultivation. Ecology. Brazil.

A system is presented for multiplying bean seeds free from the most important bacterial and fungal pathogens that limit bean production in the state of São Paulo (Brazil). Production began in greenhouses (A = 200 m^2), under the observation of technicians to prevent diseases. Seeds were then multiplied in fields of exptl. stations during the dry season, with artificial irrigation and complementary cultural practices to prevent ecological conditions favorable to disease incidence. Certified seed was released for commercial production. Tables are included on the amount of seed produced during 1959-68 and on the differences related to disease incidence in plants from traditional and certified seed. *(Summary by C.P. G. Trans. by L.M.F.)* D04

0249

14278 MULLETT, J.H. The relationship between seed size, total seed electrolytes, electrolyte leakage and embryo growth of *Phaseolus vulgaris* (L.). Australian Seed Science Newsletter 5:60-64. 1979. Engl., 6 Refs.

Phaseolus vulgaris. **Seeds. Seed characters. Composition. Nutrient loss. Cotyledons. Embryo. Laboratory experiments.**

A method of determining total seed electrolytes in *Phaseolus vulgaris* seeds was developed at Knoxfield, Victoria (Australia). The method involves the use of twin cotyledons of individual seeds. One cotyledon is detached from the imbibed seed and weighed, the other cotyledon with the embryonic axis is left for 72 h in 10 ml of water, so that it is not submerged. Conductivity of the leachate was determined at intervals over the 48-h period and the fresh wt. of the embryonic axis was recorded. The detached cotyledon is frozen for 24 h, leached as described above, and conductivity is measured up to 24 h to determine the diffusion rate without membranes. By directly comparing the original seed wt., membrane efficiency, total electrolytes, and seedling growth it is concluded that the total electrolyte content in the seed is not related to seed wt. and that none of these factors affected embryo fresh wt. 48 h after imbibition. Electrolyte loss did not correlate with seed size or total electrolytes but presented a significant negative correlation with seedling wt. at 48 h. *(Summary by I.B. Trans. by L.M.F.)* D04 C01

0250

14270 PARK, J.K. **A machine that separates rough from smooth seed.** Transactions of the American Society of Agricultural Engineers 22(5):989-991, 996. 1979. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Seed production. Agricultural equipment. USA.**

A new machine has been developed to separate contaminants from seed by sensing differences in surface textures. A moving friction belt carries the seed mixture to intercepting pairs of bars that separate rough from smooth particles. The machine has effectively removed contaminants from 38 seed mixtures including dirt clods from beans, dodder from alfalfa, and inert material from many seeds. *(Author's summary)* D04

0251

13562 ARAYA, C.M. and GONZALEZ, L.C. **Efecto de la época de producción y del tratamiento de semilla en el vigor y sanidad de plantas de fríjol.** *(Effect of time of production and seed treatment on vigour and health of bean plants).* Agronomía Costarricense 3(2):201-204. 1979. Span., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Seed. Seed production. Seed treatment. Timing. Climatic requirements.** *Rhizoctonia solani. Isariopsis griseola. Colletotrichum lindemuthianum.* **Disease transmission. Disease control. Costa Rica.**

Bean seed produced during the dry season gave higher-yielding plants than seed produced at the end of the rainy season. Vigour of seed produced at the end of the rainy season was not affected by seed treatment with fungicides, but treatment with chloroneb + thiram decreased seedling stem canker due to *Rhizoctonia solani* and benomyl decreased angular leaf spot caused by *Isariopsis griseola. (Summary by Field Crop Abstracts)* D04

0252

13181 SILVA, C.M. DA **Feijão: produção de sementes.** *(Bean seed production).* Informe Agropecuário 4(46):65-68. 1978. Port.

Phaseolus vulgaris. **Seed production. Climatic requirements. Planting. Seed. Harvesting. Storage. Credit. Brazil.**

Before 1974, bean seed production in Minas Gerais (Brazil) was conducted without any legal control. From then on, the Ministry of Agriculture created the State System of Seed Production to establish directrixes in this field to satisfy farmer's needs. Seed production

begins with a genetic selection obtained in research institutions dedicated to plant breeding. Important aspects that should be taken into account in the obtainment of qualified seed are described: climatic conditions, preferrably in dry regions (low humidity and rainfall) with available irrigation; land selection (pathogen-free and without var. crossing); planting time, depending on the region; seeds of high genetic purity; opportune cultural practices; manual-mechanical harvesting; seed drying (11% humidity) and treatments with fungicides and protectants for future storage ≤ 10 mo. A credit system also exists for seed producers. In 1978, 1277 ha were cultivated in Minas Gerais for a production of 1000 t and a local demand of 492 t. Some selected var. that are currently cultivated are: Rico 23, Ricobaio 1014, Jalo EEP 558, Roxo, Carioca and Americano Precoce. *(Summary by C.P.G. Trans. by L.M.F.)* D04

0253

16070 SCARISBRICK, D.H., CLEWER, A. and WILKES, J.M. **A summary of the effect of drilling date on the seed yield of the navy bean (*Phaseolus vulgaris*) during 1972-1976.** Experimental Husbandry 34:103-117. 1978. Engl., Sum. Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Planting. Timing. Seed production. Yields. Climatic requirements. Temperature. Maturation.**

Phaseolus vulgaris cv. Purley King was sown on May 3-4, 14-17, and 28-31 in 1972-75 and also on June 11-12 in 1974-75. A temp. of 12.5°C 10 cm below a bare soil surface was necessary for good establishment (≥ 80%). Establishment was reduced by early drilling except in 1974 when soil temp. reached 12°C in early May. Seed yields ranged from 120 g/m² from the 1st sowing in 1972 to 454 g/m² from the 2nd sowing in 1973 and were highest from the 2nd sowing in 1972 and in 1973, the 1st in 1974 and the 4th in 1975. The effects of sowing date on yield components varied from yr to yr. Data for 1975-76 confirmed a previous estimate that approx. 2000 Ontario heat units were needed from emergence to physiological seed maturity. It is concluded that cv. Purley King cannot be regarded as a reliable break crop in SE England as its yield may be seriously affected by cold spring or wet autumn conditions. *(Summary by Field Crop Abstracts)* D04

See also 0016 0133 0258 0259 0299 0458

D05 Varietal Trials

0254

13578 JUAREZ O., M.G. **Prueba comparativa de adaptación y rendimiento de 36 variedades y líneas experimentales de frijol (*Phaseolus vulgaris* L.) en Linares, N.L. Ciclo tardío 1976.** *(Comparative trial of adaptability and yield of 36 experimental bean varieties and lines in Linares, N.L.)* Tesis Ing. Agr. Monterrey, México, Universidad Autónoma de Nuevo León. Facultad de Agronomía, 1977. Span., Sum. Span., 39 Refs.

Phaseolus vulgaris. **Cultivars. Adaptation. Yields. Agronomic characters. Diseases and pathogens. Injurious insects. Mexico.**

The present study was conducted on lands of the Escuela Técnica Agropecuaria no. 43 in Linares, Mexico during the late cycle of 1976 with the objective of observing the behavior and degree of adaptation of 36 exptl. bean var. and lines. The var. and lines were: Pinto Guadalupano, Pinto Fresnillo, Pinto Español, Pinto Americano, Pinamerpa, LEF-1-RB, LEF-2-RB, LEF-3-RB, LEF-11-RB, Toche 440-2, Toche 440-3, Toche 400-3, Agramejo, Agrarista, LEF-6-RB, LEF-9-RB, LEF-10-RB, LEF-17-RB, LEF-22-RB, LEF-16-RB, Negro Huasteco, Jamapa, Cacahuate 72, CIAS 72, Flor de Mayo, Negro Criollo, Negro 66, Bayo Pastilla, Bayo Baranda, Delicias 71, Río Grande, Bayo Calera, Canario 107, Bayomex and Chicomostoc. The exptl. line LEF-11-RB presented the highest yield, both in beans in g/plot excluding the borders (Y_1) as in estimated yield in g/plot excluding the borders (Y_2) which converted to kg/ha were 1872.5 and 3730.4, resp. Among the var. that resulted statistically equal in Y_2 yields, Canario 107, Pinto Americano, Bayo Baranda and Pinamerpa are recommended for the NE area of Mexico. The exptl. var. and lines that presented susceptibility to diseases were Delicias 71, Agrarista, Bayo Baranda and Toche 440-3. The most important correlations were those that presented an estimated yield with an av. of pods/plant, which were positive and highly significant. The days to flowering correlated in a negative and highly significant manner with the no. of plants/plot excluding the borders. The most important regressions were those of the av. of pods/plant for both bean yields in g (Y_1) and estimated yield (Y_2). *(Author's summary. Trans. by L.M.F.)* D05 K00

0255

11198 VIEIRA, S.A. and MONDARDO, E. **Avaliação de cultivares de feijão em Santa Catarina, nos anos agrícolas: 71/72, 72/73 e 73/74.** *(Evaluation of bean cultivars in Santa Catarina in the crop years 71/72, 72/73 and 73/74).* Florianópolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Indicação de Pesquisa no. 6. 1976. 4p. Port.

Phaseolus vulgaris. **Cultivars. Yields. Brazil.**

The yields of several bean cv. in the state of Santa Catarina (Brazil) were evaluated to recommend those that were most adapted and of greater acceptance to consumers. A 4 x 4 balanced lattice design was used with 16 treatments, 5 replications, 7.5 m^2 plots and a planting density of 0.5 m between rows and 15 plants/m. Practices on fertilization and weed control were conducted and disease incidence observed. The analysis of results presents cv. Carioca, Costa Rica and Rico 23 as the best adapted to the area. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0256

11934 ESPINDOLA, E.A., PACHECO, A.C. and MONDARDO, E. **Indicação de cultivares de feijão, no Estado de Santa Catarina para o ano agrícola 1979-80.** *(Indication of bean cultivars in the state of Santa Catarina for the crop year 1979-80).* Florianópolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Indicação de Pesquisa no. 41. 1979. 11p. Port., 8 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Climatic requirements. Adaptation. Yield components. Productivity. Brazil.**

The bean cv. evaluated in the 5 different agroclimatic regions of the state of Santa Catarina (Brazil) for the crop yr 1976/77, 1977/78 and 1978/79 are indicated. During the 1st yr, a 4 x 4 balanced lattice design with 16 treatments, 5 replications and 7.5 m^2 plots (1.5 x 5 m) was used. The following 2 yr a random block design was used with 14 treatments, 4 replications and 15 m^2 plots (1.5 x 10 m). Plants were hand sown in rows 50 cm apart with 20 plants/m; thinning afterwards up to 10 plants/m for a density of 200,000 plants/ha. Pest and disease (anthracnose, bacterioses, rust, mosaic and powdery mildew) control practices were carried out. The state of Santa Catarina has 4 agroclimatic regions that favor bean cultivation. Cv. are evaluated for adaptation, performance, stable production and on the basis of yield components (no. of pods/plant, no. of beans/pod and bean wt.). Cv. Rio Tibagi, Turrialba 4, Costa Rica, Rico 23, Iguaçu and Carioca were tested and the agronomic characters, pest- and disease-resistance, yield potential and productivity are described for each one. Tables are also included on yields in several locations, agronomic characters and yield components along with a map of the 5 regions considered. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0257

14710 SOTO D., J.J., OROZCO, S.H. and FIGUEROA, G. **Evaluación de variedades de fríjol semiarbustivas y estabilidad de sus rendimientos en ensayos de finca, Chimaltenango, Guatemala, 1979.** *(Evaluation of semi-bush bean varieties and yield stability on farm trials, Chimaltenango, Guatemala, 1979).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 8p. Span., 8 Refs.

Paper presented at Reunión Anual del PCCMCA, 26a, Guatemala, 1980.

Phaseolus vulgaris. **Cultivars. Adaptation. Ecology. Yields. Selection. Experiment design Statistical analysis. Field experiments. Seed production. Guatemala.**

In order to evaluate adaptation, yield potential and stability of semi-bush var. and selections proposed by the bean program of the Instituto de Ciencia y Tecnología Agrícolas (ICTA, Guatemala) for on-farm trials in monoculture, 10 trials were established in an equal no. of sites of the state of Chimaltenango with agricultural cooperators. Trials were under the direction of the Regional Team of Technology Testing and the Bean Program, being conducted during 1979. Three improved old var. and 5 selections from local populations were studied; one of them, San Martín, had been oustanding in trials of previous yr. A random block design was used with replications and yield variances, min. significant difference, 0.5% over the check, and data from 9 localities were used for the study on stability. Six var. outyielded the local var. used by farmers, which was utilized as the control, but were similar among themselves, with av. yields ca. 1000 kg/ha for the 10 localities. According to the interpretation of stability parameters, mixtures Chimalteco 2 and 3, and IAN 5091 responded better in favorable environments; Negro Patzicía showed a good but inconsistent response in all environments; while San Martín and Negro Pacoc, responded better in unfavorable environments; Guate 1340, the only one considered stable, had yields inferior to those of the check. Current results guarantee the recommendation of var. San Martín as a good alternative in the region and basic seed for multiplication has already been released. *(Author's summary. Trans. by L.M.F.)* D05

0258

14312 ANGULO, N., DAVIS, J. and SINGH, S.P. **Informe de trabajos 1979/80; programa de fríjol.** *(1979/80 Research report; bean program).* Obonuco, Nariño, Convenio ICA/CIAT, 1980. 29p. Span., Sum. Span., Illus.

Phaseolus vulgaris. **Research. Field experiments. Plant breeding. Cultivars. Yields. Selection. Agronomic characters. Plant habit. Dwarf bean. Climbing bean.** *Zea mays.* **Intercropping.** *Colletotrichum lindemuthianum. Uromyces phaseoli.* **Host-plant resistance. Colombia.**

Field work for the yr 1979/80 are divided into 2 groups according to the type of material used: (a) bush beans in monoculture, and (b) climbing beans in association with maize. A total of 11,349 materials from different parts of the world and from ICA's national collection were evaluated for bush beans. From this large quantity of materials, 16 promissory lines were selected for good adaptability, resistance to principal diseases, and high yields of commercially acceptable grain. Lines ICA L-33.762 M(6), Ant. 8 L-40-1-1M and ICA L-30.411-M-1-M-M-MA-M were outstanding. These lines may be a good alternative for farmers due to their early maturity (6 mo.) in cold climates. For climbing beans, 204 collections mainly from Peru and Ecuador were evaluated and intercropped with maize (ICA V-507). Eighteen of them (8.8%) were selected for their productivity and resistance in the field to anthracnose and rust. The selected materials will be tested for yields in Obonuco in 1980/81, including 3 Peruvian bean var. (ñuña) of special interest due to their cooking characteristics. In the same manner, 280 var. had been selected the previous yr from an evaluation of 1946 collections from Colombia and other countries. These yields were tested for yield in 1979, and 38 var. produced higher yields than Mortiño, a regional var. The following var. were oustanding with regard to type of commercial grain, good performance with maize (less reduction in growth), early maturity and disease-resistance: G8160 (Antioquia 123), G8216 (Cajamarca 126), G8172 (CAL. -5), G12226 (Ecuador 176-2), G12488 (Ecuador 1056), G12289 (Ecuador 572), and G8189 (BOY.-116A). Var. G12488 (Ecuador 1056) is one of the few examples found up to now of highly adaptable climbing beans since it was also selected as an outstanding var. in ICA-La Selva in 1979. For less aggressive and more early-maturing var. similar to the latter, it is advisable to look for earlier maturing maize. Seeds from promising var. are being multiplied, and will be available for all types of trials. Four advanced lines from ICA were tested with Mortiño (regional), and a Mortiño selection in association with maize and in monoculture. The lines have the following general characteristics compared to Mortiño: less aggressive climbing ability (habit IVa), early-maturing, and more resistant to anthracnose. Line ICA L-33.003-M (4) was outstanding yieldwise compared to Mortiño in monoculture and consistent with Mortiño in association. Its yield of 1500 kg/ha + 3000 kg maize/ha in association is more profitable than its production of 2450 kg/ha in monoculture with poles. To improve climbing beans, 5180 plants of F_2 population were planted; 291 (5.6%) were selected for progeny trials in 1980/81. Parents included var. selected internationally for the most effective and stable resistance to anthracnose and rust. *(Author's summary. Trans. by L.M.F.)* D05 D04 G00

0259

14362 STANG, J.R., MACK, H.J. and ROWE, K.E. **Quantitative relation of bush snap bean** *(Phaseolus vulgaris* **L.) yields to plant population density.** Journal of the American Society for Horticultural Science 104(6):873-875. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Yields. Spacing. Statistical analysis. Experiment design. Cultivars. Fertilizers. N. Pods. Harvesting. Field experiments.**

The yield-plant density relationships of 5 bush snap bean cv. and the effect of rate of N application on the yield-density relationship of a single cv. were studied in 2 separate expt. Responses were described by the equation $W^{-\theta} = \alpha + \beta p$ where W is the pod wt/plant, p is the plant population density, and θ, α and β are constants. The θ, α and β values were tested for significant differences among the cv. and levels of N. In expt. 1, θ = 0.836 was acceptable for all 5 cv. and in expt. 2, θ = 0.897 was acceptable for the 3 rates of N. Values of θ were similar to those found for bush snap beans by other researchers. Significant differences

existed among both α and β values of the cv. In the N expt., α was constant but values of β differed significantly and were inversely related to the level of N. Optimum plant density was dependent on the cv. and increased with the level of N. *(Author's summary)* D05 D04

0260

14306 GREGORY, E.J. **Dry bean variety trials, San Juan Branch Station, 1968 to 1976.** Las Cruces, New Mexico State University. Agricultural Experiment Station. Research Report 370. 1978. 12p. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. **Cultivars. Yields. Fertilizers. Irrigation. Spacing. Planting. Harvesting. Selection. USA.**

Several cv. and selections of *Phaseolus vulgaris* were tested at the San Juan Branch Station (USA) from 1968-76. Pinto, Red Mexican, and Great Northern types were grown every yr; the Small White types were included from 1971 onwards and the California Pink types were grown from 1971-73. The Red Mexican cv. generally produced the highest yields with the Red Mexican cv. UI-34 giving the top-yield over a 3-yr period. The top-yielding Pinto selection over a 7-yr period was NM 65-1314. The earliest maturing Pinto cv. was Ourayard, the latest was Luna. Tara and UI-61 were the top-yielding Great Northern cv. over a 4-yr period. The top-yielding Small White cv. over a 3-yr period was Atlas. Of the California Pink cv., Rosa was the highest producer over a 2-yr period. Sutter performed favourably in a year when irrigation water was short and yields of all entries were low. Irrigated production appeared promising for NW New Mexico. Production levels were comparable to those in other irrigated areas. *(Author's summary)* D05

0261

14324 HONMA, S. and CASH, J.N. **Golden Ruler - a flat wax snap bean.** East Lansing, Michigan Agricultural Experiment Station, Michigan State University. Research Report no. 382. 1979. 2p. Engl., Illus.

Phaseolus vulgaris. **Cultivars. Plant breeding. Pods. Harvesting. Agronomic characters. Yields.**

This snap bean cv. matures a few days later than Green Ruler or Spartan Arrow. The pods are 10-14 cm long and stringless, with low fibre content, at the normal stage of harvest. The cv. yields as high as Green Ruler and is suitable for mechanical harvesting. *(Summary by Horticultural Abstracts)* D05

0262

14711 OROZCO, S.H., HERNANDEZ O., F. and ORDOÑEZ, L.F. **Comparación de cuatro variedades de fríjol en milpa, sembradas en hilera o por sitio (con chuzo), en el oriente de Guatemala.** *(Comparison of four bean varieties in maize land planted in rows or in hill plots in east Guatemala).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 8p. Span., 6 Refs.

Paper presented at Reunión Anual del PCCMCA, 26a, Guatemala, 1980.

Phascolus vulgaris. **Plant breeding. Cultivars. Planting. Yields. Selection. Timing. Experiment design. Cultivation. Guatemala.**

In 1976, the Instituto de Ciencia y Tecnología Agrícolas' (ICTA) Bean Program identified 2 bean lines, which were released with the names of Suchitán and Culma, adapted in the SW region of Guatemala. Lines were obtained through CIAT's international yield and adaptation trials (IBYAN). During the stages of verification, on-farm trials were conducted on different production systems in the region, one of them for this study on 2nd plantings intercropped with maize, using commercial var. Negro Jalpatagua (which is still recommended) and as

check, Rabia de Gato (the local var. most diffused among farmers). For comparison, 2 planting methods were also included in rows (1 seed x 10 cm) and in hill plots (3 seeds x 30 cm) with 40 cm spaces between rows in a subdivided plot design in 7 localities in 1977. Combined analysis of yields showed highly significant differences among localities (320-1400 kg/ha), var. (Negro Jalpatagua, Culma and Suchitán, all outyielding the control by 27, 29, and 34%, resp.) and also the planting method with an av. of almost 12% with the hill plot method as compared to rows. Furthermore, this method facilitates planting in mixed systems and in those where a previous preparation of the soil is difficult. *(Author's summary. Trans. by L.M.F.)* D05

0263

13172 VIEIRA, C. **Estudos sobre variedades de feijão em Minas Gerais.** *(Study on bean varieties in Minas Gerais).* Informe Agropecuário 4(46):25-30. 1978. Port., 22 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant breeding. Selection. Productivity. Yields. Brazil.**

A synthesis is presented of several studies on bean var. improvement, conducted by diverse institutes in Brazil. The 1st breeding method used was var. crossing. Results indicated that the var. crosses in commercial crops should be renewed after 3 or 4 generations. The genetic improvement program began in 1955 and currently has a germplasm bank with approx. 1600 introductions; these have been studied in the field to evaluate productivity, disease resistance, growth cycle, and the response to photoperiod. Var. such as Rico 23, Manteigão Fosco 11, Ricopardo 896, and Ricobaio 1014 have been produced on the basis of the selection and crossing of these materials. The Ministry of Agriculture has promoted bean var. testing throughout the national territory. Tables are included on the av. productivity/ha for the tested var. *(Summary by C.P.G. Trans. by L.M.F.)* D05 G00

0264

14218 STOFFELLA, P.J. *et al.* **Root characteristics of black beans. I. Relationship on root size to lodging and seed yield.** Crop Science 19:823-826. 1979. Engl., Sum. Engl., 22 Refs.

Phaseolus vulgaris. **Plant anatomy. Roots. Lodging. Cultivars. Seeds. Productivity. USA.**

The relationship of root size to seed yield and lodging of 2 black bean cv. Black Turtle Soup (BTS) and Strain 39, was compared with that of 4 black-seeded lines (70001, 70002, 70003, and 70004) under both field and greenhouse conditions at different growth stages. Root wt. was significantly higher for the 4 lines than for the 2 cv. in the field, but not in the greenhouse. Shoot:root ratios were significantly lower for all the lines than for BTS in both environments and for Strain 39 under field conditions. Combined field data for 2 yr showed all 4 lines had significantly higher seed and biological yields than the 2 cv., although no differences were measured for HI. In both yr the 4 lines lodged less than the 2 cv. Uprooting resistance of all lines was significantly higher than for BTS and Strain 39. None of the parameters measured showed a stage x genotype interaction, except for shoot:root ratio in the greenhouse. Results suggest that a larger root biomass may be an important component of lodging resistance in black beans. Erect plant types would result in decreased yield losses by direct harvesters. *(Author's summary)* D05

0265

14714 AJQUEJAY A., S. and MASAYA S., P. **Influencia de la densidad y la fertilización en seis genotipos de fríjol** *(Phaseolus vulgaris* **L.) en dos zonas frijoleras de Guatemala.** *(Influence of density and fertilization on six bean genotypes in two bean producing areas of Guatemala).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 21p. Span., 2 Refs., Illus.

Paper presented at Reunión Anual del PCCMCA, 26a, Guatemala, 1980.

Phaseolus vulgaris. **Cultivars. Spacing. Fertilizers. Cultivation. Yield components. Soil fertility. Maturation. Agronomic characters. Guatemala.**

An intent was made to determine the effect of planting density and fertilization on the primary yield components as well as on the plant morphology of 6 genotypes. Five early-maturing, dwarf type genotypes (Línea 78-47, Línea 78-86, Línea 78-64, Rabia de Gato, Goiana Precoce) and a late-maturing, tall type (Culma) were evaluated at Monjas and Ipala (Guatemala); they were cultivated under 2 levels of fertilization (20-25 and 50-55 kg N and P_2O_5/ha, resp.) and 4 planting densities (180,000; 250,000; 416,000; and 1,250,000 plants/ha). In general yields (kg/ha), yield components, pods on the main stem and on the branches were affected statistically by density. Pod yield/plant and bean grain wt. increased with the level of fertilizer. Línea 78-64 and 78-86 showed response to increasing density by increasing yields. Var. Rabia de Gato can respond up to a density of 350,000 plants/ha; the relatively high yield of this var. in these expt. may be due to its higher seed wt. (0.20 g) compared to the rest. Var. Culma and Línea 78-47 did not support a density > 250,000 plants/ha, reducing yields from this point on as a consequence of the decrease in pods on the branches. The early-maturing var. were found to compensate their lack of yield potential by increasing planting density, provided these have an accumulation of pods around the main stem (Línea 78-64). This can be explained since the pods that originated on the branches were rapidly suppressed when density was increased and competence for light and nutrients occurred. *(Author's summary. Trad. by L.M.F.)* D05 D01

0266

14712 PADILLA M., L.F. *et al.* **Evaluación de rendimiento de materiales avanzados de fríjol.** *(Evaluation of yields of advanced breeding lines of beans).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 10p. Span., 7 Refs.

Paper presented at Reunión Anual del PCCMCA, 26a, Guatemala, 1980.

Phaseolus vulgaris. **Plant breeding. Cultivars. Yields. Selection. Ecology. Adaptation. Statistical analysis. Guatemala.**

Eighteen advanced bean materials were evaluated in 6 localities of the state of Jutiapa, Guatemala to identify yield potential and stability parameters for the materials under evaluation. Significant differences were found among treatments in 4 of the localities. Combined variance analysis for estimating stability parameters showed a 5% level of significance for materials x locality. Advanced material D-30 and D-83 showed a positive response in unfavorable environments and yield consistency. They also presented good agronomic characteristics, tolerance to BGMV (important disease in the area), outyielding the control in 42 and 56%, resp. They are recommended for the area of Jutiapa. *(Author's summary. Trans. by L.M.F.)* D05 G00

0267

14715 MASAYA S., P.N. *et al.* **Relación entre la asociación maíz-fríjol y la distribución del rendimiento de la planta de fríjol común.** *(Relation between maize/bean association and yield distribution of the common bean plant).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1979?. 17p. Span., 2 Refs.

Paper presented at Reunión Anual del PCCMCA, 26a, Guatemala, 1980.

Phaseolus vulgaris. **Intercropping. Cultivation systems.** *Zea mays.* **Planting. Spacing. Yields. Yield components. Cultivars. Statistical analysis. Guatemala.**

A comparative study was conducted on 9 bean genotypes in monoculture and in association with maize ICTA HB-17; of these, 2 bean genotypes are determinate, one early-maturing, 3 present few branches and one, early ramification. The companion crop has 3 rows of beans at 0.4 m between every 2 rows of maize at 1.2 m, and 2

localities of SE Guatemala were used: Ipala at 830 masl and Jutiapa at 900 masl. The no. of nodes on the principal stem and on the branches before the initiation of flowering and at physiologic maturity and the no. of mature pods on the main stem and on the branches were counted. The association with maize reduced the no. of nodes/plant mainly by a decrease in the no. of nodes on the branches. In the same way, the no. of pods/plant was reduced, mainly due to the reduction in the no. of pods on the branches. Genotypes ICA-Guali and Línea ICA-17 showed a higher proportion of pods and nodes on the branches. In general, the effect of the association was to enhance the proportion of pods developed on the main stem, due to a greater effect of maize competence on the development of nodes and pods on branches than those developed on the main stem. A coefficient of correlation of 0.6079 was estimated between the proportion of pods on the main stem and the yield, considering all var. in monoculture and a coefficient of 0.76 statistically significant under conditions of association. *(Author's summary. Trans. by L.M.F.)* D05

0268

14207 MULLINS, C.A. and SWINGLE, H.D. **Evaluation of new snap beans cultivars in Tennessee.** Tennessee Farm and Home Science 110:30-32. 1979. Engl., 5 Refs.

Phaseolus vulgaris. **Plant anatomy. Pods. Cultivars. Marketing. Canned beans. USA.**

Five Bush Blue Lake type and 11 non-Bush Blue Lake type snap beans cv. were evaluated and compared for pod color, curvature, roughness and length. The use of the 16 var., according to their color and pod description, for freezing, canning or the fresh market is discussed. *(Summary by Food Science and Technology Abstracts)* D05

0269

14787 TORRES FILHO, J. **Estudo da relação entre hábito de crescimento, produção de grãos e componentes da produtividade do feijoeiro-comum (*Phaseolus vulgaris* L.).** *(Study on the relation between growth habit, grain production, and productivity components of the common bean).* Tese Mag. Sc. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras, 1978. 45p. Port., Sum. Port., Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Agronomic characters. Plant habit. Plant height. Timing. Harvesting. Yields. Brazil.**

Possible yield differences among plant var. and growth habits of types I, II, and III were determined, and the environment's influence on the stability of growth habit for the common bean plant was verified. The study was conducted in Lavras and Três Pontas, Minas Gerais (Brazil) during the rainy and dry seasons of 1977/78. One trial was carried out in the dry season and 2, in the rainy season. Var. used were Línea 17, Brasil 2 (determinate, type I); Jamapa, Porrillo Sintético (indeterminate small vine, type II); Puebla 152 Marrom, Puebla 152 Preta (indeterminate large vine, type III) in a randomized complete block design with 6 replications for Três Pontas and 5 for Lavras. Yield, no. of pods/plot, no. of seeds/pod, wt. of 100 seeds, HI, plant height, no. of internode and length of internode were recorded. During the rainy season, Línea 17, Puebla 152 Preta, and Puebla 152 Marrom had the highest yields, due to the high seed wt. for Linea 17 and for greater no. of seeds/pod for the other 2 var. Var. of growth habit III were tallest, followed by plants of habit II and I. Growth habit I showed the highest no. of correlations. Growth habit was not the best indicator of productivity. During the dry season in Três Pontas there was no significant difference in production regarding var. and growth habit; however, type II showed the highest yields. During this season the HI for all var. was greater than the rainy season III, but the height of all plants tended to decrease by shortening the internode length. *(Author's summary)* D05

0270

13579 COSTA, M.S.S.DA, WESTPHALEN, S.L. and BRUSAMOLIN, E.P. **Variedades recomendadas para o Rio Grande do Sul.** *(Varieties recommended for Rio Grande do Sul).* IPAGRO Informa 14:24-25. 1976. Port.

Phaseolus vulgaris. **Cultivars. Adaptation. Selection. Yields. Brazil.**

Information is given for farmers of the state of Rio Grande do Sul, Brazil, on bean var. recommended for cultivation during the yr 1970-75. Var. recommended are: Maquiné, Tambó, Cubano, Cuva-168-N, Rico 23, and Rio Tibagi (black-seeded), Tayhú (pink-seeded), and Carioca (mulatinho group). Yields of the var. assessed varied between 1257-1381 and 1245-1454 kg/ha for the periods 1970-72 and 1970-75, resp. Var. Rico 23 showed the highest performance productionwise during the 5 yr (1362 kg/ha) with a relative yield of 109%; var. Carioca and Rio Tibagi were superior (1839 and 1742 kg/ha, resp.) but these were only evaluated during 2 yr, their relative yields being 150 and 143%, resp. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0271

13187 CANDAL NETO, J.F. and PACOVA, B.E.V. **"Rio Tibagi" nova cultivar de feijão para o Espírito Santo.** *(Rio Tibagi, a new bean cultivar for Espirito Santo).* Cariacica-ES, Brasil, Empresa Capixaba de Pesquisa Agropecuária. Serie Indicação EMCAPA v.2, no. 1, 1980. 4p. Port., 1 Ref.

Phaseolus vulgaris. **Cultivars. Agronomic characters. Seed characters. Yields. Selection.**

Twenty-eight expt. were conducted to evaluate 34 cv. during 2 yr in different municipalities of Brazil. After 2 yr of trials, 25 cv. were selected (including 3 regional cv.) and adaptability was analyzed on the basis of yields. The coefficient of determination (r^2i) was established for each cv.; Rio Tibagi (1249 kg/ha, r^2i = 0.88) and Ricopardo 896 (1339 kg/ha, r^2i = 0.80) were outstanding. The botanical and agronomic characteristics of Rio Tibagi are described and it is suggested that trials should be conducted to improve the culinary quality of Ricopardo 896. Data on the var. evaluated, no. of expt., yields, regression coefficient and coefficient of determination, reaction to major diseases, color of the seed, and commercial acceptance are given in table form. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0272

14223 LIMA, M.G. DE Estudo da resistência a seca em cultivares de feijão (*Phaseolus vulgaris* L.). *(Studies on drought resistance in bean cultivars).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultura "Luiz de Queiroz", 1978. 58p. Port., Sum. Port., Engl., 35 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Drought. Host-plant resistance. Soil water. Seed. Germination. Growth. Brazil.**

The response to drought of bean cv. Carioca, P 748-A, P 749-A, and P 750-A was studied in a greenhouse at the Exptl. Field of the Departamento de Física e Meteorologia and Laboratorios de Sementes e Bioquímica of the Escola Superior de Agricultura "Luis de Queiroz", São Paulo, Brazil. Three methods were used to measure drought resistance: 1) matric potential variation of soil water; 2) germination of seeds and growth of seedlings in mannitol solutions of different osmotic pressures; 3) chlorophyll stability index test. Three different soil moisture tensions (1, 3, and 5 atm) were used in the 1st method. Solutions of 0, 1, 3, and 5 atm of osmotic pressure were used in the mannitol study. In order to obtain the chlorophyll stability index 2 tests were conducted using heated and unheated treatments. Results showed that as the soil moisture increased, the growth response for the bean var. studied decreased. Mannitol gave the best results for drought resistance studies; no satisfactory results were obtained using the chlorophyll stability index test. Decreases in the germination % of var. Carioca, P 748-A and P 750-A were observed when submitted to 3 atm tensions, but var. P 749-A was not influenced by soil moisture stress, even at 5 atm, on both methods. *(Author's summary)* D05 D01

0273

13503 MELHORANCA, A.L. and SONEGO, O.R. **Competição de cultivares de feijão (*Phaseolus vulgaris* L.) para Mato Grosso do Sul.** *(Competition of bean cultivars in Mato Grosso do Sul).* Dourados-MS, Brasil, Unidade de Execução de Pesquisa de Ambito Estadual. Serie Pesquisa em Andamento no. 1. 1980. 3p. Port.

Phaseolus vulgaris. **Cultivars. Adaptation. Selection. Agronomic characters. Yields. Soils. Brazil.**

Two bean var. trials were conducted on a dark red Dystrophic Latosol and on a reddish-yellow, eutropic podzolic soil. In the 1st expt. cv. Cuva-168-N (1546 kg/ha), IPA-7419 (1503 kg/ha), and Rico Baio 1014 (1350 kg/ha) were outstanding since they gave higher bean yields and showed less disease incidence. In the 2nd, Cuva-168-N (2090 kg/ha) and Rico Baio (2098 kg/ha) were outstanding. Results of the expt. are given including information on evaluated var., yields, color of the seed, wt. of 100 seeds, and % of rust, powdery mildew, and virosis incidence. *(Summary by C.P.G. Trans. by L.M.F.)* D05

0274

14796 SOTO M., J. **Rendimiento comparativo de variedades de frejol (*Phaseolus vulgaris* L) grano negro y de color.** *(Comparative yields of black and colored beans).* Tesis Ing. Agr. Santa Cruz de la Sierra, Bolivia, Universidad Boliviana Gabriel René Moreno. Facultad de Ciencias Agrícolas, 1981. 50p. Span., Sum. Span., 32 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Plant development. Developmental stages. Flowering. Maturation. Yields. Bolivia.**

An expt. on comparative yield of black and colored beans compared to 10 local var. was conducted at the Instituto de Investigaciones Agrícolas y Recursos Naturales Renovables, located at 17°42'11" S lat. and 63°08'52" W long., av. temp. 24.6°C and annual rainfall of 1141 mm. The trial was divided into 2 equal groups of black and colored beans and planted in the 78/79 crop yr with a 5 x 5 lattice design with 3 replications. Phenologic and agronomic characteristics of the different var. and major diseases and pests were assessed. Results indicate that the time from planting to flowering, physiological maturity, and the entire growth cycle varies from 36-59 and 40-47, 56-85 and 70-86, and 63-107 and 90-105 days, resp., for colored and black beans. Yields varied between 0-1981 kg/ha in the group of colored beans (av. of 1239 kg/ha); local checks were outstanding. Yields of the group of black beans varied from 1181-2400 kg/ha (av. of 1772 kg/ha). The most promissory colored-grain var. were HARNR-8, BAT-24, HARNR-10, Ex-Rico 23, and Aurora and black-grain var., BAT-10, HARNR-4, ICA-COL 10103, Jamapa, BAT-14, BAT-7, Porrillo Sintético, and ICA-Pijao. Among the most important pests are *Empoasca* sp. and *Diabrotica* sp.; while thrips, whiteflies, *Heliothis* sp., webworms, pod weevils, *Epitrix*, and cutworms were observed in smaller no. Diseases that occurred were bacteriosis, web blight (*Thanatephorus cucumeris*), and virosis. Black-grain var. were more resistant. *(Author's summary. Trans. by L.M.F.)* D05

0275

12363 MIRANDA M., H. **Prueba de variedades de fríjol en América Central PCCMCA. 1969-1970.** *(Bean varietal trials in Central America PCCMCA. 1969-1970).* Ciudad de Guatemala, Instituto Interamericano de Ciencias Agrícolas de la OEA - Zona Norte. 1971. 30p. Span., 3 Refs.

Phaseolus vulgaris. **Cultivars. Adaptation. Germplasm. Yields. Central America.**

Results are given of research conducted by technicians of 9 Central American institutions, that as part of the Programa Cooperativo Centroamericano para el Mejoramiento del Fríjol sponsored the establishment of 2 trials on bean (black- and red-seeded) yields and a nursery. A total of 83 var. were tested and in 1970 all controls were surpassed due to improved

materials. In the nursery, Costa Rica 2 was outstanding yieldwise. Among black-seeded var., Preto G-1 and var. 50600 corroborated their good yields; among red-seeded ones, Mexico 235 and Mexico 193. Approx. 50% of the trials, which should have been carried out at exptl. stations or fields were conducted on farms, not always in conditions suitable for this type of trial. Tables are included on yields, names of the participating technicians and institutions, country of origin of the different var., and the localities where the trials were conducted. *(Summary by I.B. Trans. by L.M.F.)* D05

0276

15423 PESSANHA, G.G. and VIEIRA, C. **Mecanismo da competição intergenotípica em misturas de cultivares de feijão (*Phaseolus vulgaris* L.).** *(Mechanism of intergenotypic competition in bean cultivar combinations).* Revista Ceres 27(152):431-455. 1980. Port., Sum. Port., Engl., 31 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Genes. Yields. Selection. Agronomic characters. Yield components. Brazil.**

An investigation was carried out in Viçosa, Minas Gerais (Brazil) to study the mechanisms which regulate the intergenotypic competition in mixtures of bean cv. Plants from the mixtures Preto 40 + 37-R and Manteigão Fosco 11 + Rico 23 + Small White 59, as well as from their components in monoculture, were collected 10 days after emergence, to measure plant height, plant dry wt.,and foliar characteristics. At harvest, yield and its components and plant dry wt. were determined. Intergenotypic competition in mixtures started 20 days after bean emergence. The most competitive cv. had taller plants, greater dry wt., and larger foliar areas. Determinate growth habit and precocity seemed to contribute negatively to competitive ability. The no. of seeds/area and total dry wt. at harvest presented higher means in the most competitive cv. of the mixtures. Seed size is more important than the vegetative characteristics for the competitive ability of small-seeded cv., when mixed with large-seeded cv. Survival of a mixture component depends on the no. of seeds/area that it produces and not on its seed yield (kg/ha). Survival depends on the no. of descendents a cv. produces for the next generation. Large-seeded cv. yield a smaller no. of seeds/area. *(Author's summary)* D05 G00

See also 0014 0175 0307 0454 0455 0458 0463 0465

E00 PLANT PATHOLOGY

0277

13591 ANCHORENA, A.C. and SENTANA, A. · **Poroto: enfermedades.** *(Beans: diseases).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 8. 1980. 2p. Span., Sum. Span.

Phaseolus vulgaris. **Diseases and pathogens. Disease control. Argentina.**

The symptomatology and the names of the causal agents of some diseases that attack bean crops are presented along with some measures and recommendations for their control. The described diseases are: anthracnose, angular leaf spot, rust, CBB, fusarium root rot, Rhizoctonia root rot, white mold and leaf curling. *(Summary by C.P.G. Trans. by L.M.F.)* E00

0278

2908 SCHROTH, M.N. and TEAKLE, D.S. **Influence of virus and fungus lesions on plant exudation and chlamydospore germination of** *Fusarium solani* f. *phaseoli* Phytopathology 53:610-612. 1963. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Viroses. Mycoses. Hypocotyls. Etiology.**

The exudations from lesions on bean and cowpea hypocotyls caused by *Fusarium solani* f. *phaseoli* or by the tabacco necrosis virus (TNV) and its effect on *Fusarium* chlamydospore germination in soil were studied. The ninhydrin and silver nitrate tests revealed that exudation of diseased hypocotyls was abundant on cowpeas and beans with lesions caused by TNV and on beans with lesions caused by *Fusarium;* exudation was slight from healthy hypocotyls and in healthy portions of diseased ones. Plants infected with a fungus or virus may be susceptible to infection by other pathogens due to the increased exudation that provides a more favorable habitat for growth. Increased exudation from hypocotyls lesions resulted in greater chlamydospore germination of *F. solani* f. *phaseoli.* *(Summary by I.B. Trans. by L.M.F.)* E00

0279

15895 ARAUJO, E. **Incidência e severidade das doenças do feijoeiro (*Phaseolus vulgaris* L.) nas condições do Estado da Paraíba, durante o ano de 1979.** *(Incidence and severity of bean diseases in the state of Paraiba during the year of 1979).* Agropecuária Técnica (Paraíba) 1(2):149-155. 1980. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. Uromyces phaseoli var. *typica. Isariopsis griseola. Colletotrichum lindemuthianum.* **Timing. Developmental stages. Brazil.**

The incidence and severity of bean diseases were observed at different growth stages in several localities of the state of Paraiba (Brazil) during 1979. Common bacterial blight (*Xanthomonas phaseoli*) was the 1st disease observed on bean plants from the preflowering stage on, being the most severe. Rust (*Uromyces phaseoli* var. *typica*) was more frequent from the beginning of fructification on and the incidence was equal to 100% in all the stands. In the majority of the fields, angular leaf spot (*Isariopsis griseola*) and anthracnose (*Colletotrichum*

lindemuthianum) appeared during the fructification stage; the severity of the 1st disease was low whereas the 2nd one mainly attacked the pods. *(Author's summary)* E00

0280

3722 SANTOS FILHO, H.P. and WAITE, B.H. **Algumas doenças importantes do feijão na Bahia.** *(Some major diseases of beans in Bahia).* Cruz das Almas-BA, Brasil. Instituto de Pesquisa e Experimentação Agropecuárias do Leste. Circular no. 15. 1969. 35p. Port., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. Colletotrichum lindemuthianum. Uromyces phaseoli. Whetzelinia sclerotiorum. Macrophomina phaseoli. Erysiphe polygoni. **Viroses. Disease control. Brazil.**

The symptomatology and control measures of the following diseases are given: anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces phaseoli*), bacterial blights (*Xanthomonas phaseoli*), powdery mildew (*Erysiphe polygoni*), ashy stem blight (*Macrophomina phaseoli*), white mold (*Sclerotinia sclerotiorum*), bean mosaic caused by different viruses, and southern blight (*Sclerotium rolfsii*). These diseases, along with other factors such as soil impoverishment and the lack of adequate cultural practices, constitute limitations for bean cultivation in Brazil, especially in the NE region. The need to use as many preventive measures as possible is indicated considering the high costs of chemical products. *(Summary by I.B. Trans. by L.M.F.)* E00

See also 0143 0408

E01 General Descriptive Studies

0281

4380 BALLANTYNE, B. **Diseases of dry beans.** Agricultural Gazette of New South Wales 82(5):270-279. 1971. Engl., Illus.

Phaseolus vulgaris. Whetzelinia sclerotiorum. Uromyces appendiculatus. Xanthomonas phaseoli. Pseudomonas phaseolicola. Macrophomina phaseoli. **Disease control. Cultivation. Australia.**

Some diseases and physiological disorders of beans in Australia are described: sclerotinia rot (*Sclerotinia sclerotiorum*), rust (*Uromyces appendiculatus*), common blight (*Xanthomonas phaseoli*), halo blight (*Pseudomonas phaseolicola*) summer death, clover stunt, Rhizoctonia root rot, ashy stem blight (*Macrophomina phaseoli*), Zn deficiency, sunscald, bald head and pre-emergence seed rotting. Each description includes the causes or causal agent, symptoms, sources of infection, mechanisms of dissemination and factors that favor it, control methods, var. reaction and disinfection. Recommendations are given on disease prevention by the use of cultural practices such as the selection and treatment of land, irrigation and drainage, planting dates and the use of resistant var. and pesticides. *(Summary by C.P.G. Trans. by L.M.F.)* E01

0282

4528 ZAUMEYER, W.J. and THOMAS, H.R. **Bean diseases - how to control them.** U.S. Department of Agriculture. Agricultural Research Service. Agriculture Handbook no. 225. 1962. 39p. Engl., Illus.

Phaseolus vulgaris. **Diseases and pathogens. Disease control. Cultivation.**

The symptoms, causal agent and control methods (chemical and var.) of the principal diseases affecting bean crops are described: bacterial blights, mosaics, curly top, anthracnose, rust, watery soft rot, powdery mildew, root rots, root knot, ashy stem blight, angular leaf spot, web blight, baldhead and sunscald. The use of resistant var. and pathogen-free seed is recommended along with crop rotation, field sanitation and seed treatment. *(Summary by C.P.G. Trans. by L.M.F.)* E01

0283

14267 STASKAWICZ, B.J. and PANOPOULOS, N.J. A rapid and sensitive microbiological assay for phaseolotoxin. Phytopathology 69(6):663-666. 1979. Engl., Sum. Engl., 31 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. Escherichia coli. **Races. Laboratory experiments. Inhibitors. Arginine. Ornithine. Amino acids. Chlorosis. Toxicity. USA.**

Phaseolotoxin, a phytotoxic compound produced by *Pseudomonas phaseolicola*, inhibits the growth of *Escherichia coli* strain K-12 in minimal-glucose medium by inhibiting L-ornithine carbamyltransferase, thereby creating a phenotypic requirement for arginine. Inhibition is reversed by citruline and arginine but not by ornithine. A dose-response curve was established with purified preparations and as little as 10-12 pg of phaseolotoxin was detected.

Growth inhibition was also observed with cell-free culture filtrates and around colonies of *P. phaseolicola*. Zones of inhibition were max. when *P. phaseolicola* was grown at 18°C, the optimum temp. for toxin production and induction of chlorosis in plants. There was a 100% correlation between the ability of *P. phaseolicola* strains to induce chlorosis in beans and to inhibit *E. coli*. This assay technique greatly facilitates screening for nontoxigenic mutants of *P. phaseolicola*. *(Summary by Review of Plant Pathology)* E01

0284

14348 DHINGRA, O.D. and MUCHOVEJ, J.J. **Dichloromethane, trichloromethane and carbontetrachloride as solvents for bean seed treatment with systemic fungicides.** Seed Science and Technology 8(1):77-83. 1980. Engl., Sum. Engl., Fr., Al., 11 Refs.

Phaseolus vulgaris. Mycoses. **Seed transmission. Seeds. Seed coat. Seed treatment. Chemical control. Germination. Cultivars.**

Seeds of white or brown-seeded snap bean and brown or black seeded dry bean cv. were soaked in dichloromethane (DCM), trichloromethane (TCM) or carbontetrachloride (CTC) for 0.5, 1, 1.5 or 6 h. The viability of snap bean seeds dropped significantly if soaked for more than 1 h, whereas that of dry bean seed was not affected if soaked for up to 6 h. Seeds of snap bean cv. were treated for up to 1 h and those of dry bean for up to 6 h in DCM, TCM or CTC mixture with benomyl, thiophanate methyl, thiabendazole, RH 2161, PCNB or chlorothalonil. Treated seeds were washed with acetone to remove fungicide from the seed surface. Activity of benomyl and thiabendazole was found only in the seed coat of seeds from all cv. The concentration of fungicide in the seed coat did not increase with increased time in the solvent + fungicide mixture. Activity of RH 2161 and thiophanate methyl was found in the seed coat of only the white-seeded snap bean cv. Carbontetrachloride did not carry thiophanate methyl. Fungicide activity was not found in seeds treated with PCNB or chlorothalonil. Dichloromethane was significantly superior to TCM or CTC in facilitating fungicide movement into the seed coat. There was significant interaction between seed type and solvent, seed type, solvent and fungicide in the infusion of fungicides into the seed coats. *(Author's summary)* E01

0285

14767 RUEGG K., K. **Zonificación ecológica de las principales enfermedades del frijol (*Phaseolus vulgaris* L.) en las áreas productivas de Guatemala.** *(Ecological zoning of the main bean diseases in bean-producing areas of Guatemala)*. Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1975?. 59p. Span., Sum. Span., 33 Refs., Illus.

Phaseolus vulgaris. Diseases and pathogens. Ecology. *Chaetoseptoria wellmanii. Xanthomonas phaseoli. Uromyces phaseoli. Colletotrichum lindemuthianum. Fusarium* sp. Disease control. Seed production. Guatemala.

Four production areas were determined that showed the best ecological and agricultural conditions for bean production in Guatemala. Five ecological zones were defined for all the most important regions of the country. In each region, diseases were assessed, using a conventional 1-4 scale to determine the incidence and severity of each one. The distribution, incidence, and order of importance that bean diseases have related to the prevalent conditions in each region were obtained. Due to the variation in conditions, the most important diseases in the regions under study are: Chaetoseptoria leaf spot (*Chaetoseptoria wellmanii*), bean yellow stipple virus, common blight (*Xanthomonas phaseoli*), rust (*Uromyces phaseoli*), and anthracnose (*Colletotrichum lindemuthianum*). Other diseases of regional importance are smut (*Entyloma petuniae*) in the region of Asunción Mita; Fusarium root rot (*Fusarium* spp.) in the regions of Salamá and San Jerónimo; and in the region of Jalpatagua the main diseases are viral. The possibility is included of selecting regions for planting and producing disease-free seed, depending on var. adaptation. *(Author's summary. Trans. by I.M.E.)* E01 D01

E02 Bacterioses

0286

11686 ACUÑA, H. and WAITE, B. **Principales enfermedades bacterianas.** *(Principal bacterial diseases). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.179-191. Span., 14 Refs., Illus.

Phaseolus vulgaris. **Bacterioses.** *Pseudomonas phaseolicola. Xanthomonas phaseoli.* **Disease control.**

Some historical, taxonomic, morphological and biological aspects are presented on bacteria along with other aspects such as the general form of penetration of phytopathogenic bacteria and their most important genus (*Pseudomonas, Xanthomonas, Erwinia, Corynebacterium, Agrobacterium* and *Streptomyces*). Bacterial diseases attacking maize crops [basal stem rot (*Erwinia carotovora*) and bacterial streaking (*Pseudomonas andropogoni*)] and bean crops [halo blight (*Pseudomonas phaseolicola*) and common bacterial blight (*Xanthomonas phaseoli*)] are also described, including data on the causal agent, symptoms, life cycle, epidemiology and control. *(Summary by C.P.G. Trans. by L.M.F.)* E02

0287

11935 WALLEN, V.R., SUTTON, M.D. and GRAINGER, P.N. **A high incidence of fuscous blight in Sanilac beans from Southwestern Ontario.** Plant Disease Reporter 47(7):652-653. 1963. Engl., 6 Refs.

Phaseolus vulgaris. Xanthomonas phaseoli. Pseudomonas phaseolicola. **Races. Bacterioses. Disease control.**

In 1961-62, there was a high incidence of bacterial blight in bean crops in SW Ontario (Canada). Seed samples were examined by the rapid phage count method in order to identify the causal pathogen of halo blight which was attributed to *Xanthomonas phaseoli* and *Pseudomonas phaseolicola.* Only 4 samples of common blight and 2 of halo blight from a total of 151 were found by this method; therefore, the presence of a new strain of bacteria yet unidentified and insensitive to bacteriophages was suspected. Pathogenic cultures of a *Xanthomonas* strain isolated in nutrient agar produced a brown pigment characteristic of the fuscous blight organism *Xanthomonas phaseoli* var. *fuscans.* In samples of soil and mud, bacteriophages were isolated to determine the sensitivity of isolated bacterial cultures of those seeds. There were found to be sensitive to the isolated bacteriophage, designated as 62 BBPS no. 1. It was concluded that the organism that caused blight in var. Sanilac was bacteria *Xanthomonas phaseoli* var. *fuscans.* *(Summary by C.P.G. Trans. by L.M.F.)* E02

0288

11193 PROCESSORS & GROWERS RESEARCH ORGANISATION. (ENGLAND). **Halo blight (*Pseudomonas phaseolicola*).** Thornhaugh, England. The Research Station. Information Sheet no. 67. 1977. 1p. Engl.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Etiology. Bacterioses. Chemical control. England.**

The symptoms of halo blight caused by *Pseudomonas phaseolicola* are described and recommendations are given for its prevention and control. Processors & Growers Research Organisation (PGRO) offers a seed test to detect infected seed lots. The use of Cu-based fungicides such as colloidal-Cu or Cu-oxychloride is recommended for control. *(Summary by C.P.G. Trans. by L.M.F.)* E02

0289

13157 VAKILI, N.G. Pathogenicity of *Xanthomonas* strains causing bacterial blight and pustule of edible legumes in Puerto Rico. Tropical Grain Legume Bulletin no. 8:33-38. 1977. Engl.

Phaseolus vulgaris. Vigna unguiculata. Bacterioses. *Xanthomonas.* Races. Host-plant resistance. Cultivars. Puerto Rico.

Two types of pathogenicity were observed in *Xanthomonas* isolates collected from fields of diseased cowpeas (*Vigna unguiculata*) and beans (*Phaseolus vulgaris*) in tropical America. All isolates collected from cowpeas were pathogenic to both cowpeas and beans (*Xv* type). The majority of isolates from beans were pathogenic to both species (*Xv* type), while a small no. of isolates were pathogenic to beans alone (*Xp* type). Fourteen out of 503 *V. unguiculata* PI accessions were susceptible to both *Xv* and *Xp* type strains. Further isolation and inoculation provided *Xv* strains that were not pathogenic to *P. vulgaris.* Host passage of isolates indicated that the pathogenic strains were unstable. Also, isolates lost their ability to produce pigment. *Xanthomonas* bacteria have been isolated from bacterial pustules of *P. vulgaris, P. coccineus, P. lunatus* and *Glycine max.* These isolates showed a variable range of pathogenicity. No bacterial pustule has been observed on cowpea. However, *Xanthomonas* isolates from bacterial pustules on beans were pathogenic to cowpeas. Field inoculation of 651 *P. vulgaris* lines with *Xanthomonas* isolate from soybean bacterial pustule resulted in selecting 13 resistant lines. This was the 1st instance that *P. vulgaris* had shown resistance against field inoculation with a *Xanthomonas* strain. *Vigna unguiculata, P. acutifolius, P. lunatus,* and *P. coccineus* have high levels of resistance against strains of this pathogen. Some exptl. results to date are briefly summarized in 7 tables. *(Author's summary)* E02

0290

14234 DAUB, M.E. and HAGEDORN, D.J. Growth kinetics and interactions of *Pseudomonas syringae* with susceptible and resistant bean tissues. Phytopathology 70(5):429-436. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Bacterioses. *Pseudomonas syringae.* Cultivars. Host-plant resistance. Cytology. Electron microscopy. Etiology.

Differences were found in symptom expression and in multiplication rates of *Pseudomonas syringae* isolate Y-30 in leaves and pods of bean plants susceptible (cv. Tenderwhite) and resistant (WBR 133) to bacterial brown spot of bean. Symptom expression in the 2 hosts was different at all inoculum concn. tested, but there were almost no differences in bacterial growth rates and final bacterial populations in the 2 hosts at high inoculum levels. In pods that received low inoculum levels, *P. syringae* multiplied more slowly in WBR 133 than in Tenderwhite. In leaves, rates of *P. syringae* multiplication were the same during the exponential growth phase (0-12 h after inoculation), but were much slower in WBR 133 than in Tenderwhite during the transition stage between exponential growth and the stationary phase. Doubling times of *P. syringae* in Tenderwhite were not affected by inoculum concn. Infiltration of Tenderwhite leaves and pods with the incompatible pathogen *Pseudomonas coronafaciens* resulted in rapid necrosis of the inoculated area, a symptom characteristic of a hypersensitive response. However, cessation of growth of *P. coronafaciens* was not correlated with the development of visible necrosis. In leaves, *P. coronafaciens* showed an 8-12 h lag phase before starting to multiply. Doubling times of *P. coronafaciens* in both leaves and pods were longer than those of *P. syringae* in leaves and pods of either host, unless high inoculum concn. were used. Doubling times of *P. coronafaciens* decreased with increasing

inoculum concn. Electron microscopy of pod tissue in the 3 host-pathogen combinations showed changes associated with an apparent defense reaction by the host in the incompatible interactions. A fibrillar material, which appeared to arise from the host cell wall, enveloped bacteria in the intercellular spaces. However, this defense reaction did not appear effective, and, within 8 h after inoculation, bacteria were multiplying and filling the intercellular spaces. In leaves, envelopment of bacteria by fibrillar material was seen only rarely and could be found in all 3 host-pathogen combinations. *(Author's summary)* E02

0291

14744 EKPO, E.J.A. Pathogenic variation in common *(Xanthomonas phaseoli)* and fuscous *Xanthomonas phaseoli* var. *fuscans)* bacterial blights of bean *(Phaseolus vulgaris* L.). Ph.D. Thesis. East Lansing, Michigan State University, 1975. 127p. Engl., Sum. Engl., 70 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. Xanthomonas phaseoli var. *fuscans.* **Culture media. Growth-chamber experiments. Symptomatology. Cultivars. Host-plant resistance. Inoculation. Leaves. Seeds. Plant age. Laboratory experiments.**

Pathogenic variation was examined in isolates of *Xanthomonas phaseoli* (Xp) and *Xanthomonas phaseoli* var. *fuscans* (Xpf) the causal agents of common and fuscous blights of beans, resp. A total of 8 isolates of Xp and 7 isolates of Xpf were selected from different geographical regions represented by Michigan and Nebraska (USA), Uganda, Guatemala, and Colombia. Virulence of isolates was compared on 13 commercial bean var. and 2 cowpea var. at different stages of plant growth. The methods of seed infiltration, multiple needle inoculation, leaf incision, water soaking of leaves, and excised pod inoculation procedures were examined in comparative pathogenicity tests using a standard inoculum concn. of 2.8 x 10^7 cells/ml. Results were reproducible with leaf incision, water-soaking and excised pod techniques. Isolates were separated into different virulence groups or strains based on qualitative and quantitative differences in disease reactions. Plant age was important in disease development; the more virulent isolates of both bacteria incited necrosis on both old and young leaves while the less virulent isolates incited symptoms which were restricted primarily to young succulent tissues. Some isolates that were slightly virulent on plants in the vegetative stage of growth became more virulent when plants entered the reproductive phase of growth. Active multiplication within the tissue was not always accompanied by symptom development. For example, isolates Xp21 and Xp23 actively multiplied in leaves of tolerant Great Northern (G.N.) Tara without the production of visible disease symptoms. Mixed isolates of Xp and Xpf were inoculated into Manitou and G.N. Jules leaves and re-isolated from diseased tissue in varying proportions. Symptom development with such composite inocula were sometimes more severe than infection with individual isolates thus indicating compatible coexistence of both bacteria in the same plant tissue. A new cell phenotype was isolated from tissues inoculated with either several isolates of the same bacterium or a mixture of Xp and Xpf isolates. G.N. Tara and P.I. 207262 which are reported as tolerant to Xp by previous workers were shown to be susceptible to some isolates of Xp and Xpf included in the study. Isolates exhibited serological variability but such variability was not easily correlated to the observed pathogenic variation among the isolates. The implications of the findings are discussed in relation to bean breeding programs. *(Author's summary)* E02

0292

14299 TRUJILLO, G.E. The use of serology and semi-selective media as aids in the detection of *Xanthomonas* bean blight bacteria. Ph.D. Thesis. East Lansing, Michigan State University, 1979. 133p. Engl., Sum. Engl., 120 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. Xanthomonas phaseoli var. *fuscans.* **Seed transmission. Seed treatment. Laboratory experiments. Culture media. Microbiology. Disease transmission.** *Pseudomonas phaseolicola.* **Diseases and pathogens. USA.**

Seed-borne common *(Xanthomonas phaseoli, Xp)* and fuscous *(X. phaseoli* var. *fuscans,*

Xpf) bacterial blights continue to affect dry bean production in many areas of the USA, Canada and L.A. While planting of pathogen-free seed remains effective for control of the *Xanthomonas* diseases, techniques for detection of internal seed contamination by blight bacteria are often time-consuming (seedling injection) or require large bacterial populations (serology). A combined serological and semi-selective media technique for the detection of internally-borne *Xp* and *Xpf* in dry bean seed was developed. Antisera of *Xp* and *Xpf* at titres of 1:2000-1:5000 were produced in rabbits by intravenous injection of formalin-killed cells suspended in buffered saline (10^8 cells/ml). Injections were made at 0 (0.1 ml), 4 (0.3 ml), 8 (0.5 ml), 11 (1.0 ml), and 14 (2.0 ml) days; sera were collected 7, 14, and 21 days after the last injection. Agar gel double diffusion tests were found more reliable than micro- and tube-agglutinin tests in serological studies of *Xp* and *Xpf*. Live cells of *Agrobacterium*, *Bacillus*, and *Corynebacterium* sp. did not react in agar gel double diffusion tests; when steamed cells (60 min at 100°C) of other bacterial isolates *(Erwinia* or *Pseudomonas)* were tested, the reaction was *Xanthomonas* specific. In agar double diffusion tests, *Xp* and *Xpf* antisera reacted positively to steamed cells of 20/20 *Xp* and 29/29 *Xpf* isolates, but did not react to steamed cells of 19 internal bacterial contaminants obtained from surface-sterilized bean seeds. In absorption tests it was shown that *Xp* and *Xpf* possess species-specific heat stable antigens. *Xp* and *Xpf* concn. near 10^7 cells/ml were sufficient to be detected in agar gel double difussion tests. A semi-selective media (SSM), highly selective for *Xanthomonas*, was developed and contained: 1.0 g yeast extract, 25 mg cycloheximide, 2 mg nitrofurantoin, 1 mg nalixidic acid, and 0.05 mg de gentamicin in 1000 ml 0.01 *M* phosphate buffer pH 7.2. Utilizing *Xpf* R10, resistant to 50 ppm rifampin, and selective planting on media with and without rifampin, max. *Xp* R10 and min. bacterial contaminant populations were obtained by incubating R10-infected seed (1 infected seed: 4 non-infected seeds) in the SSM. SSM was inhibitory to all of the Gram + bacterial isolates tested, including different isolates of *Corynebacterium* and *Bacillus* sp., and inhibited the growth of most of the Gram-bacteria tested. The Michigan Department of Agriculture (MDA) test for internal blight contamination of bean seed currently involves: (1) surface sterilization of 1.9 kg seed for 10 min in 2.6% NaOCl; (2) rinsing in sterile H_2O; (3) incubation of seed for 18-24 h in sterile H_2O containing 10 g/*l* yeast extract; and (4) injection of a sample of liquid surrounding seed into primary leaf node of young kidney bean seedlings. Samples of 1 ml of the surrounding liquid obtained from the MDA were individually incubated in 25 ml SSM for 24-36 h in a rotary shaker. Bacteria were then sedimented by 15 min centrifugation at 5000 x g, resuspended in 1 ml buffer saline, steamed 60 min at 100°C, and tested serologically (SSMS). Sixty-one of 65 bean seed samples found to carry internal blight contamination in the MDA test reacted positively in the serological test. Thirty-seven of the 99 navy bean samples obtained from the MDA showed positive results for internal blight contamination with the SSM procedure. Of these 37 the MDA seedling injection detected blight in only 25. The SSMS also consistently detected *Xanthomonas* blight in other plant tissues infected with blight (stems and leaves). *Pseudomonas phaseolicola* and *P. syringae* were found to be internally seed-borne in navy beans. *(Author's summary)* E02

0293

14394 KWOK, O.C.H., AKO, H. and PATIL, S.S. **Inactivation of bean ornithine carbamoyltransferase by phaseotoxin: effect of phosphate.** Biochemical and Biophysical Research Communications 89(4):1361-1368. 1979. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Host-plant resistance. Amino acids. Ornithine. Enzymes. Inhibition. Analysis. Biochemistry. P. Plant physiological processes.**

The results of kinetic studies of the inactivation of bean ornithine carbamoyltransferase by phaseotoxin, the extracellular toxin of *Pseudomonas phaseolicola*, are consistent with the notion that the toxin is an active site directed irreversible inhibitor of the enzyme. Phosphate, an end product of the enzymatic reaction, protects the enzyme from inactivation by the toxin. It is proposed that phaseotoxin is one of a few naturally occurring affinity labels. *(Author's summary)* E02 C00

0294

14250 KATHERMAN, M.J., WILKINSON, R.E. and BEER, S.V. **Resistance and seed infection in three dry bean cultivars exposed to a halo blight epidemic.** Plant Disease 64(9):857-859. 1980. Engl., Sum. Engl., 17 Refs.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Host-plant resistance. Cultivars. Seed transmission. Disease transmission. Seed production. USA.**

Seeds from plants of the dry bean cv. California Light Red Kidney, Redkloud and Redkote, which had been exposed to a natural epidemic of halo blight, were harvested and assayed for the presence of *Pseudomonas phaseolicola.* Seed of the more susceptible cv. California Light Red Kidney was infected and infested with the pathogen. Redkloud seed was only infested, and no *P. phaseolicola* was recovered from Redkote seed. These data suggest that a direct relationship exists between the susceptibility of a cv. to halo blight and the likelihood of seed contamination by *P. phaseolicola. (Author's summary)* E02

0295

14350 FERGUSON, A.R. and JOHNSTON, J.S. **Phaseolotoxin: chlorosis, ornithine accumulation and inhibition of ornithine carbamoyltransferase in different plants.** Physiological Plant Pathology 16(2):269-275. 1980. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. Pseudomonas syringae. **Ornithine. Amino acids. Chlorosis. Leaves. Plant physiological processes.**

Phaseolotoxin, (δ-*N*-phosphosulphamyl) ornithylalanylhomoarginine, is the halo blight toxin produced by *Pseudomonas syringae* sp. *phaseolicola.* Application of phaseolotoxin to the leaves of 10 different plant species resulted, in every case, in the accumulation of ornithine and, with 1 exception, this was accompanied by leaf chlorosis. Ornithine carbamoyltransferase activity from all the different plants was strongly inhibited by phaseolotoxin. In contrast, of the plants tested, sp. *phaseolicola* was pathogenic only on beans. Phaseolotoxin is thus a non-specific toxin. *(Author's summary)* E02

0296

3785 OSHIMA, N. and DICKENS, L.E. **Effects of copper sprays on secondary spread of common bacterial blight of beans.** Plant Disease Reporter 55(7):609-612. 1971. Engl., 3 Refs.

Phaseolus vulgaris. **Snap bean.** *Xanthomonas phaseoli.* **Disease control. Chemical control. Cu.**

The effects of foliage sprays as a control of secondary spread of blight in snap bean cv. Gallatin 50 were determined; 53% basic copper sulfate (Ortho Copper 53) (O-Cu 53), 0.65 kg/200 *l* of water, and 8% metallic Cu from Cu ammonium carbonate (Oxy-Cop 8L) (O-C 8L), 3 *l*/200 *l* water were applied as full coverage sprays. Both O-C 8L and O-Cu 53 gave good blight control even after the beginning of secondary spread. O-Cu 8L was recommended since it can be used as a low vol. or full coverage spray. *(Summary by I.B. Trans. by L.M. E.)* E02

0297

15418 HAGEDORN, D.J., RAND, R.E. and SAAD, S.M. **Tolerance of *Phaseolus lunatus* to bacterial brown spot.** Phytopathology 61(11):1406-1407. 1971. Engl., Sum. Engl., 1 Ref.

Phaseolus lunatus. Pseudomonas syringae. **Host-plant resistance. Cultivars. Field experiments.**

Three hundred eighty-three lima bean (*Phaseolus lunatus*) lines were tested for reaction to

Pseudomonas syringae in the field. Twenty lines showed some tolerance in the field, the most tolerant being P.I. 183412. However, all were equally susceptible under greenhouse conditions. *(Author's summary)* E02

0298

4713 NATTI, J.J. **Control of bacterial diseases of bean.** *In* Bean Improvement Cooperative. Annual Report no. 13:20-26. 1969. Engl., 25 Refs.

Phaseolus vulgaris. **Bacterioses. Disease transmission. Seed transmission. Chemical control. Disease control. Inoculation. Serology.**

Information on 4 areas of control of bacterial diseases in beans are summarized: (1) Detection of bacterial pathogens in bean seed. The following methods are discussed: indexing (1 seed/pot) for quantitative determinations in the greenhouse; inoculation, serological, and fluorescence to U.V. tests. (2) Regarding the eradication of these pathogens, the treatment of contaminated seed with clorox, Cu compounds, ethylene oxide, heat, and streptomycin is discussed. (3) Chemical control of the spread of bacterial diseases in beans in the fields is discussed regarding the application of Cu compounds and streptomycin to avoid the spread of halo blight. Some Cu compounds give an effective control. (4) Survival of bacterial pathogens in crop debris and in the soil discussing viability of some pathogenic bacteria in the dust of infected bean tissues, straw, and infected plants in the field. Dry conditions favored the survival of bacteria in the soil. *(Summary by I.B. Trans. by L.M.F.)* E02

0299

15412 WIMALAJEEWA, D.L.S. and YOUNG, K.J. **Studies on the levels of common and halo blight seed infection occurring in the field.** Australasian Plant Pathology 8(3):29-30. 1979. Engl., 4 Refs.

Phaseolus vulgaris. Pseudomonas phaseolicola. Xanthomonas phaseoli. **Seeds. Leaves. Pods. Seed production. Disease control.**

Pseudomonas phaseolicola and *Xanthomonas phaseoli* do not overwinter in the soil under the conditions prevalent in East Gippsland, Victoria, Australia and it is probable that infected seed is the only source of primary infection. Bean seed was collected from plots of a spray trial, using copper hydroxide in 3 different schedules, and planted in pots in the glasshouse to assess halo and common blight infection levels. No seed infection occurred in plants receiving sprays every 7 days, and 0.28% infection by *P. phaseolicola* and none by *X. phaseoli* was recorded from plants sprayed at 14-day intervals. However, 0.28% of both pathogens occurred in seed from plants sprayed following wet weather but at intervals of not < 5 days between applications. It was concluded that disease free seed must be the aim for bean crops in seed production programs. *(Summary by Review of Plant Pathology)* E02 D04

0300

4826 BOELEMA, B.H. **Fuscous blight of beans in South Africa.** South African Journal of Agricultural Science 10(4):1059-1063. 1967. Engl., 8 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli var. *fuscans.* **Symptomatology. Identification. Seedlings. Inoculation. Pods.**

Six isolates of *Xanthomonas phaseoli* var. *fuscans* were studied; the occurrence in S. Africa was 1st established in 1962 on pods of bean cv. Contender and Seminole, in the form of slightly sunken, reddish-brown spots with a darker edge and a lighter center. Small differences found among isolates are given. Inoculation expt. were also conducted with the isolates, but even though they differed slightly in virulence, the symptoms induced were virtually the same. There are differences in their virulence towards different bean cv. The

importance of fuscous blight in breeding work with beans is emphasized. *(Summary by I.B. Trans. by L.M.F.)* E02

0301

15499 KAISER, W.J. and RAMOS, A.H. **Occurrence of *Pseudomonas syringae* on bean and soybean in Kenya.** Plant Disease 64(6):593-595. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Phaseolus lunatus. Phaseolus acutifolius. Pseudomonas syringae. **Strains. Symptomatology. Inoculation. Greenhouse experiments. Kenya.**

A bacterial disease of unknown etiology affected the foliage of bean and soybean plants in the highlands of Kenya. The bean and soybean bacterial strains were indistinguishable in cultural, morphologic, and physiologic properties and in their pathogenicity to various legume species. In greenhouse inoculation tests, bean and soybean bacterial strains produced brown, angular lesions on the foliage of bean, cowpea, lima bean, soybean, and tepary bean (*P. acutifolius*) in 3-4 days. Symptoms on bean leaves were identical to those incited by *Pseudomonas syringae*, the causal organism of bacterial brown spot of bean. Both bacterial strains were seedborne in bean. Based on bacteriological tests, pathogenicity studies, and symptomatology, Kenyan bean and soybean bacterial strains are considered to be strains of *P. syringae. (Author's summary)* E02

0302

15495 EL-BANOBY, F.E. and RUDOLPH, K. **The fate of extracellular polysaccharide from *Pseudomonas phaseolicola* in leaves and leaf extracts from halo-blight susceptible and resistant bean plants (*Phaseolus vulgaris* L.).** Physiological Plant Pathology 18:91-98. 1981. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Cultivars. Host-plant resistance. Leaves. Symptomatology. Biochemistry. Analysis. Plant tissues.**

Purified extracellular polysaccharide (EPS) from *Pseudomonas phaseolicola* was infiltrated into the mesophyll of bush bean leaves. The EPS disappeared from the intercellular spaces of the halo-blight resistant breeding line 02, 12 h after infiltration. Simultaneously, the visible water-soaked spots had vanished. By contrast, the intercellular spaces of the halo-blight susceptible cv. Red Kidney were still completely filled with EPS 3 days after infiltration, and the water-soaked leaf-areas persisted. The EPS formed a stable network in the intercellular spaces of Red Kidney, whereas small floccules were observed in the incompatible system. In vitro studies showed that the intercellular fluid (IF) from the trifoliates of breeding line 02 partially degraded the EPS, whereas IF from cv. Red Kidney did not. EPS which had been incubated with IF from resistant leaves completely lost its capacity to induce persistent water-soaked spots. It is concluded, therefore, that the resistance of bean leaves towards persistent water-soaking caused by bacterial EPS was due to enzymatic degradation and inactivation of the introduced EPS. *(Author's summary)* E02 C03

0303

15405 DAUB, M.E. and HAGEDORN, D.J. **Epiphytic populations of *Pseudomonas syringae* on susceptible and resistant bean lines.** Phytopathology 71(5):547-550. 1981. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. Pseudomonas syringae. **Host-plant resistance. Leaves. Pods. Symptomatology.**

Large differences were found in populations of virulent *Pseudomonas syringae* (cause of bacterial brown spot of bean) on resistant and susceptible bean lines in the field. About 10^6 cells/g fresh wt. were isolated from leaves of the susceptible cv. Eagle compared to

about 10^3 cells/g fresh wt. from leaves of the resistant plant introduction, WBR 133. Epiphytic populations on resistant breeding lines were intermediate to those on cv. Eagle and WBR 133. These lines were also intermediate in reaction to the brown spot pathogen. There was, however, no direct correlation between populations of *P. syringae* and brown spot disease severity on the breeding lines. *P. syringae* was identified by morphology on Crosse's medium and by production of typical brown spot symptoms on bean pods in 2 kinds of pod inoculation tests. Lower populations on the resistant lines did not appear to be due to the presence of antagonistic epiphytic microorganisms. *(Author's summary)* E02

0304

16064 PASSMOOR, M. and EPTON, H.A.S. **The relationship between toxin release and the formation of vesicles and blebs by *Pseudomonas phaseolicola*.** Phytopathologische Zeitschrift 98(4):289-295. 1980. Engl., Sum. Engl., Germ., 8 Refs., Illus.

Phaseolus vulgaris. Pseudomonas phaseolicola. **Culture media. Chlorosis. Plant injuries. Symptomatology. Leaves. Plant tissues. Electron microscopy. Analysis. Laboratory experiments.**

Blebs and vesicles produced by *Pseudomonas phaseolicola* in susceptible dwarf French bean leaves were also found to be formed when the bacterium was growing in liquid media. A comparison of the no. of vesicles and bleb-forming cells in liquid media with the presence of chlorosis-inducing toxin indicated that toxin release was not associated with the production of these structures. Toxin production did not coincide with a particular phase of growth in different media. *(Author's summary)* E02

0305

16052 WATSON, D.R.W. **Identification of bacterial brown spot of bean in New Zealand.** New Zealand Journal of Agricultural Research 23:267-272. 1980. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. Pseudomonas syringae. **Symptomatology. Leaves. Identification.**

The pathogen of a bacterial leaf spot disease of bean was identified as *Pseudomonas syringae* pv. *syringae*. This is the 1st record of the disease, brown spot, for New Zealand. The pathogen can be differentiated from other pseudomonads isolated from diseased bean leaves by a serological test and peach seedling inoculation. *(Author's summary)* E02

See also 0459

E03 Mycoses

0306

2776 BAKER, R. and NASH, S.M. **Ecology of plant pathogens in soil. VI. Inoculum density of *Fusarium solani* f. sp. *phaseoli* in bean rhizosphere as affected by cellulose and supplemental nitrogen.** Phytopathology 55(12):1381-1382. 1965. Engl., 8 Refs.

Phaseolus vulgaris. Fusarium solani phaseoli. **Soil populations. Soil fertility. C. N. Rhizosphere.**

Fusarium solani sp. *phaseoli* may be suppressed by amendments of the C:N ratio in the soil. An increase in microbial antagonism was observed in this pathogen when oat straw was added and the C:N ratio was increased. On the other hand, high levels of available N in the soil reduced this antagonism. To investigate the former, 2 expt. were conducted in a sandy loam soil from California, pH 8.1, 1.2 mmhos/cm, 0.4% OM and naturally infested with *F. solani* sp. *phaseoli.* However, conidia was added to the soil and incubated for 5 wk. to obtain a high population of chlamydospores. Cellulose was also incorporated into the soil at 5000 ppm and N, in some trials, at 20 ppm in the form of NH_4NO_3. Bean var. Pinto was planted and after 3 wk., the inoculum density was determined. These expt. show that lysis of germinating propagules does not play a significant role in the suppression of the pathogen. Control through competition for limiting N still remains the most probable explanation for suppression. Data referring to the results are given in table form. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0307

4240 COSTA, J.G.C., ANTUNOS, I.F. and AUGUSTIN, E. **Estudo de material genético de feijoeiro introduzido da Costa Rica.** *(Study on genetic material of beans from Costa Rica).* Campinas-SP, Brasil, Instituto de Pesquisa Agropecuária do Sul, 1971. 13p. Port., Sum. Port., 8 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. Uromyces phaseoli. **Races. Host-plant resistance. Cultivars. Bacterioses. Mycoses. Adaptation. Brazil.**

Cv. from the Instituto Interamericano de Ciencias Agrícolas of the OEA (IICA), Centro de Enseñanza de la Investigación, Turrialba, Costa Rica were observed with regard to their reaction to immunologic trials with the physiological races B_1 and B_{11} of the fungus *Uromyces phaseoli* var. *typica* and races α and β of *Colletotrichum lindemuthianum.* All the var., as seedlings, were subjected to infection by pathogens under greenhouse conditions. Likewise their performance was observed under field conditions for bacterioses and rust. Var. 51053. S-182-N and Guateian 6662 showed resistance to rust race B_1. Var. 51051, 51052, 51053, 50589, S-182-N, Guateian 6662 and Compuesto Negro de Chimaltenango showed resistance to rust race B_{11}. The only cv. resistant to the α race of anthracnose were Compuesto Negro de Chimaltenango and S-315-N. Cv. Jamapa, S-182-N, 50600, Compuesto Negro de Chimaltenango, S-315-N, 51051, 51052, Turrialba-1, and 50589 showed resistance to race β of anthracnose. In field conditions, cv. 51053, 51051, 51052, Turrialba-2, Compuesto Negro de Chimaltenango, Compuesto Cotaxtia and Guateian 6662 presented resistance to rust. Var. 51053, H-182-N and Flórida Copan were susceptible to

wildfire. In preliminary yield trials conducted in the locality of Monte Bonito, municipality of Pelotas, var. 51053, 51051, Turrialba-2, C-166-N, Guateian 6662, Col-126-N, and H-182-N were outstanding productionwise. Compuesto Negro de Chimaltenango was the only cv. of those observed that presented resistance to both races of rust and anthracnose. Var. 51053, Guateian 6662, and S-182-N were resistant to 2 races of rust. The majority of the var. studied presented resistant genes to race β of anthracnose. *(Author's summary. Trans. by L.M.F.)* E03 D05

0308

4569 ECHANDI, E. Basidiospore infection by *Pellicularia filamentosa* (= *Corticium microsclerotia*), the incitant of web blight of common bean. Phytopathology 55:698-699. 1965. Engl., 6 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. Mycoses. Disease transmission. Leaves.

Web blight is one of the most serious diseases attacking bean crops in Costa Rica. The fungus *Pellicularia filamentosa (Rhizoctonia solani)* attacks any part of the plant, producing preemergence and postemergence damping-off. Its method of dissemination by spores and the significance of the perfect stage of the fungus, reached on the lower side of disease mature leaves, are studied. The basidiospores are ellipsoid and hyaline, the av. size being 8.4 μ x 5.3 μ. The fungus is also grown in pure culture on a soil-rice agar medium and produces spores. An expt. was conducted on 32 bean plants, 11 days old, inoculated with the fungus by placing a drop of spore suspension containing 2700 basidiospores/ml. On observing the plants 13 days after the inoculation, the av. no. of lesions in the secondary leaves, secondary leaf axils and primary leaves was 1.5, 2.4 and 0.04/plant, resp. The rapid spread of web blight in warm and humid climates can be explained on the basis of the efficient production and dissemination of basidiospores. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0309

12667 INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS DE LA OEA. La chasparria del fríjol provocada por *Pellicularia filamentosa. (Web blight in beans caused by Pellicularia filamentosa).* San José, Costa Rica. Informe Técnico 1961:30-31. 1962. Span.

Phaseolus vulgaris. Rhizoctonia solani. Mycoses. Races.

The disease has caused great losses in bean plantations in several tropical countries. The pathogen *Pellicularia filamentosa* has been found in 40 host plant species, the majority weeds. The fungus has 16 strains with different morphological characters and pathogenicity, which indicates the existence of physiological races. The greatest damage has been observed in lowlands where MC and temp. are high. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0310

13184 LISKER, N., KATAN, J. and HENIS, Y. Lesion formation on bean seedling hypocotyls by *Rhizoctonia solani* as affected by size and nutrition of propagules. Annals of Botany 45:365-368. 1980. Engl., 8 Refs.

Phaseolus vulgaris. Rhizoctonia solani. Germination. Hypocotyls. Diseases and pathogens. Laboratory experiments.

The observations and expt. on the factors involved in lesion formation by *Rhizoctonia solani* are described. Hypocotyls were inoculated with a *R. solani* propagule, which was picked up with forceps under a stereoscopic microscope and placed in a drop (2-5 μl) of nutrient solution or distilled water on the hypocotyl surface. No evidence of damage was observed. After inoculation, the seedlings were kept in damp chambers for 2-3 days. Large propagules (400-500 μm) produced lesions at a few mm distance from the inoculation site. The increase in virulence did not affect the location of the lesions. When a drop (2.5 μl) of yeast extract

(YE) or distilled water was added 3-4 mm from each propagule, this germinated, extending hyphae in various directions, which formed lesions at distance from the propagule. By previous wounding with a sterile needle, large propagules produced non-typical lesions at the same wound site. In another expt. the infectivity of propagules increased as the distance on the hypocotyl between the propagule and the root-stem transition region grew. In other expt. the effect of detached propagules and remaining hyphae on the hypocotyls was studied; the propagules produced lesions (10%) on the new host and its infectivity was completely restored with 1 drop of YE. The extension of the nutrients exhaustion period (40 h) caused a complete loss of infectivity. In other expt. lesions were formed with small propagules after the addition of a drop of YE or chloroform. The pattern of lesion formation was consistent in all the expt; these formed at a certain distance of the propagule. The existence of a nutrient gradient from the propagule to the hyphae was assumed. It is suggested that the effect of chloroform may be due to the removal of the protective wax layer of the cuticles and/or to the modification of nutrients. It is also shown that the alterations (environmental factors) in the external supply of nutrients or in the internal reserves of the propagules caused changes in the virulence and may affect the pathogenic capacity of the fungus. *(Summary by I.B. Trans. by L.M.F.)* E03

0311

11673 GROGAN, R.G. *Sclerotinia* species: summary and comments on needed research. Phytopathology 69(8):908-910. 1979. Engl.

Phaseolus vulgaris. Whetzelinia sclerotiorum. Taxonomy. Etiology. Research.

Papers presented at a symposium at the U. of California (USA) on the biology and epidemiology of *Sclerotinia* spp. are summarized and research requirements are given for improving the techniques that control diseases caused by this fungus. Aspects related to the taxonomy of fungus, on if the name of the species indicates the ecological niche, possession of unique pathogenic capabilities as well as less virulence on some hosts, are discussed. Environmental factors favoring the development of sclerotia have been determined but information is lacking on the changes that occur during growth and maturation; factors that affect the production of potentially functional sclerotia should be determined. Pathogenesis, production and survival of sclerotia are discussed; these may survive in the soil from several wk. up to 8 yr. Disease control may be reached by fungicidal sprays of the soil at determined times, biological control, and selection of resistant germplasm. *(Summary by C.P.G. Trans. by L. M.F.)* E03

0312

11692 WEISS, A., KERR, E.D. and STEADMAN, J.R. Temperature and moisture influences on development of white mold disease *(Sclerotinia sclerotiorum)* on Great Northern beans. Plant Disease 64:757-759. 1980. Engl., Sum. Engl., 13 Refs. Illus.

Phaseolus vulgaris. Whetzelinia sclerotiorum. Etiology. Temperature. Water requirements. Irrigation. Growth-chamber experiments. Leaves. Laboratory experiments. Field experiments. USA.

Great Northern dry edible beans inoculated with a suspesion of mycelial fragments of *Sclerotinia sclerotiorum* were incubated in a constant-temp. chamber at 100% RH for periods up to 268 h at 10°-30°C. Percentage of diseased foliage was measured and expressed as a function of time and temp. Air temp. favorable for disease development ranged from 10°C to the optimum 25°C Plants incubated at 30°C did not develop white mold. White mold did develop, although more slowly, on plants incubated at 25°C until symptoms first appeared, at 30°C for 24 h, and then at 25°C. In a field expt., air temp. at 10-cm height were measured in Great Northern bean plots under normal and heavy irrigation treatments. Temp. were favorable for a white mold development 82 and 87% of the time in normal and heavy irrigation treatments, resp. Disease incidence was about 13 times greater in the

heavily irrigated plot than in the normally irrigated plot, indicating that duration of leaf moisture, rather than air temp., limits white mold disease development in western Nebraska. *(Author's summary)* E03 D01

0313

10663 LLANOS M., C. Patogenicidad del *Isariopsis griseola* Sacc. en fríjol *(Phaseolus vulgaris* L.). *(Pathogenicity of Isariopsis griseola on beans).* Acta Agronómica 7(2):165-190. 1957. Span., Sum. Span., Engl., 20 Refs., Illus.

Phaseolus vulgaris. Isariopsis griseola. **Disease transmission. Etiology. Symptomatology. Growth-chamber experiments. Infection. Colombia.**

A study is presented on the angular leaf spot of bean plants caused by the fungus *Isariopsis griseola,* a disease which in the last 2 yr has acquired a great economic importance in the Valle del Cauca, Colombia, because of the severity of attacks and the great losses that this disease has caused in the crops. A research of the available literature complemented by the personal observations and experience is given. By means of a series of expt. on the viability of the spores, it was demonstrated that light does not exercise any influence on their germination. The efficacy of the germination technique is verified concluding that the spores do not lose their viability in spite of having had several transplantations (5-6). By means of expt. designed to find an effective method to secure artificial infection with *Isariopsis griseola* spores in bean plants, it was demonstrated that it is essential to put the inoculated plants under high humidity atmospheric conditions (95-100%). It was observed that the greater the exposition period in the moist chamber (40 h as compared with 24 and 16), the greater the degree of infection. No decrease was found in the spore virulence in those which had presented several previous transplantations (5-6), as compared with the virulence of spores from cultures of recent isolation, nor differences in the effective ability of spores from natural field infections, as compared with those from pure cultures of the fungus. *(Author's summary)* E03

0314

14269 WOODWARD, M.D. New isoflavonoids related to kievitone from *Phaseolus vulgaris.* Phytochemistry 18:2007-2010. 1979. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Mycoses. Plant toxins. Phytoalexins. Host-plant resistance. Plant physiological processes. Biochemistry. Analysis. Plant tissues. Inoculation. Laboratory experiments.**

The new isoflavonoids 5,7,2′, 4′-tetrahydroxy-8-(3,3-dimethylallyl)isoflavone (2,3-dehydrokievitone) and 7, 2′, 4′-trihydroxy-8-(3,3-dimethylallyl)isoflavanone (5-deoxykievitone) have been isolated from fungus-inoculated *Phaseolus vulgaris* pod tissue and from the inoculation droplets. A third isoflavonoid was tentatively identified as 1″, 2″-dehydrocyclokievitone and appears to be a metabolite of the phytoalexin kievitone. *(Author's summary)* E03

0315

11696 OLAVE L., C.A. Resistencia de algunas variedades y líneas de fríjol *(Phaseolus vulgaris* L.) al *Isariopsis griseola* Sacc. *(Resistance of some bean var. and lines to Isariopsis griseola).* Acta Agronómica 8(4):197-219. 1958. Span., Sum. Span., Engl., 37 Refs., Illus.

Phaseolus vulgaris. Isariopsis griseola. **Host-plant resistance. Cultivars. Etiology. Inoculation. Symptomatology. Colombia.**

A summary is presented of the general characteristics of bean angular leaf spot caused by *Isariopsis griseola.* The results of the inoculation expt on bean var. Algarrobo is included in the part on pathogenicity, designed to determine the vegetative period of the plant most

susceptible to the pathogen. It was found that disease symptoms appeared 8 days after inoculation, being more characteristic at 12 days; no special difference was observed with regard to the degree of infection in plants inoculated when 20 and 30 days old. According to these results some commercial bean var. and lines were inoculated to determine their resistance to angular leaf spot. According to the degree of resistance obtained, the inoculated var. and lines were divided into the following groups: highly resistant (Mexico 11, Mexico 12, Cauca 27a); resistant (Sánchez); moderately resistant (Sangretoro, Liborino, Lines 133 and 138); susceptible (Uribe Redondo, Pico de Oro); and highly susceptible (Panameño, Estrada Rosado). *(Author's summary)* E03

0316

13156 AQUINO, M. DE L.N. DE and ARRUDA, G.P. DE **Similaridade sintomatológica da ação de fungo e de inseto em feijoeiro** *(Phaseolus vulgaris* **L.).** *(Symptomatologic similarity of the action of a fungus and an insect in beans).* Recife, Brasil. Instituto de Pesquisa Agronômica. Boletim Técnico no. 62. 1978. 23p.

Phaseolus vulgaris. Rhizoctonia solani. Hedylepta indicata. **Etiology. Plant injuries. Insect biology. Microbiology. Entomology. Disease control. Pest control. Brazil.**

In Pernambuco (Brazil) the independent action of a fungus *(Pellicularia filamentosa-Rhizoctonia solani)* and an insect *(Hedylepta indicata)* causes similar damage in certain susceptible var. of *Phaseolus vulgaris.* However, differences were observed between the 2 as the action of the agents responsable for the symptoms progressed. Symptomatology, insect and fungus behavior, and similarities and differences between them are described. A description of the insect and its taxonomy were given along with a description of the fungus and its pathogenicity. It was concluded that both agents constitute a problem for beans, either as a pest or as a disease. The insect, when it acts independently, destroys the leaf system. The fungus causes weakness and the leaves of adult plants to die and fall off. Results of inoculation trials with the fungus confirm the pathogenicity of the imperfect form and there is no doubt that *Pellicularia filamentosa* is the causal agent of bean scorching and seedling weakness. The formation of basidiospores was obtained by common artificial means. The 2 causal organisms of the injury act independently and there is no correlation between the fungus and the insect. To control the injury, an initial examination of the infested material is recommended in order to establish which agent is involved. *(Summary by I.B. Trans. by L.M.F.)* E03 F01

0317

14246 HEATH, M.C. **Effects of heat shock, actinomycin D, cycloheximide and blasticidin S on nonhost interactions with rust fungi.** Physiological Plant Pathology 15(2):211-218. 1979. Engl., Sum. Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Mycoses.** *Uromyces phaseoli.* **Biochemistry. Host-plant resistance. Microbiology. Disease control. Heat treatment. Canada.**

The effect of treating nonhost plants, before inoculation was examined in 4 angiosperm and rust combinations. In cabbage infected with cowpea rust *(Uromyces phaseoli* var. *vignae)* and in french bean with sunflower rust *(Puccinia helianthi)*, heat shock and at least one of the protein synthesis inhibitors caused increased growth of the infection hypha and an increase in the no. of infection sites at which haustoria developed. However intercellular growth still ceased at about 24 h after inoculation in spite of evidence from delayed inoculation expt. that in cabbage the effects of the blasticidin S treatment lasted for at least 48 h. In pea leaves inoculated with *U. vignae,* all treatments resulted in increased growth of the infection hypha, but they had no similar effect on this same rust in bean. All treatments, except actinomycin D in pea, also increased the frequency of haustoria formed in these 2 nonhost plants and, in contrast to their effects on the other plant-rust combinations, also allowed fungal colonies to develop which continued to grow for at least 4 days. In bean

delayed inoculation expt. with *U. vignae* suggested that such growth continued long after the plant had recovered from the pre-inoculation treatments. Such growth did not depend on the development of a haustorium from the first-formed mother cell or on the absence of necrosis of the invaded cells. None of the treatments had any observable effect on the compatible interaction of bean rust (*U. appendiculatus* var. *typica*) in french bean. The significance of these observations is discussed. *(Summary by Review of Plant Pathology)* E03

0318

12636 VAN DER WESTHUIZEN, G.C.A., JOUBERT, M.S. and GROBLER, L.J. *Sclerotinia* rot in dry beans. Farming in South Africa. (Dry Beans) F.1:1-3. 1979. Engl., Illus.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Symptomatology. Host range. Chemical control. South Africa.**

Brief information is given on the white mold disease, caused by the fungus *Sclerotinia sclerotiorum*, which has damaged crops in the state of Transvaal (South Africa). Symptoms, causal agent, form of attack, conditions favoring disease dissemination, host range, geographic distribution, and control measures are described. Cool, shady, and moist conditions promote disease development. The following practices are recommended to limit the spread and contamination of new fields: use of healthy seeds, control of host weeds, crop rotation, and spraying with 1 kg benomyl a.i./ha 3-5 days before full bloom. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0319

11687 VARGAS, E. Enfermedades fungosas. *(Fungal diseases). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.174-178. Span.

Phaseolus vulgaris. **Mycoses. Disease control.** *Rhizoctonia solani. Isariopsis griseola. Uromyces phaseoli. Colletotrichum lindemuthianum. Fusarium solani phaseoli. Erysiphe polygoni. Sclerotium rolfsii. Chaetoseptoria wellmanii.* **El Salvador.**

A brief literature review is presented on fungal diseases and the control methods (use of resistant var., seed treatment and selection, crop rotation and chemical control) of the following diseases in bean crops in El Salvador are described: web blight (*Thanatephorus cucumeris* = *Rhizoctonia solani*); angular leaf spot (*Isariopsis griseola*); rust (*Uromyces phaseoli*); anthracnose (*Colletotrichum lindemuthianum*); Chaetoseptoria leaf spot (*Chaetoseptoria wellmanii*); powdery mildew (*Erysiphe polygoni*) and root rots (*Rhizoctonia solani, Sclerotium rolfsii, Fusarium solani* sp. *phaseoli* and *Pythium* sp.). The symptomatology and environmental conditions for the development of each disease are described. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0320

11669 LUMSDEN, R.D. **Histology and physiology of pathogenesis in plant diseases caused by** *Sclerotinia* **species.** Phytopathology 69(8):890-896. 1979. Engl., 35 Refs.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Plant tissues. Physiology. Diseases and pathogens. Host-plant resistance. Phytoalexins. Phaseollin.**

This document summarizes the available information on the host-parasite interaction and the process of pathogenesis in the diseases caused by *Sclerotinia sclerotiorum* and related species, such as *S. minor* and *S. trifoliorum*. To explain this interaction, the histopathology of the disease is described, including the penetration of the host, early and advanced stages of

infection. The mechanisms of pathogenesis and resistance are listed and the biochemical factors of disease development that occur during penetration are described. The presence of different enzymes, endopolygalacturonase (endo-PG), oxalic acid, and other organic acids, has been studied regarding pathogenesis. A description is given of the physiological processes that occur during pathogenesis, allowing the colonization of the tissue, action mechanism of endo-PG, nutritional factors that determine the development of the fungus, permeability changes, and water relationships of infected tissues. Some considerations are given on factors that determine the degree of virulence of the pathogen and host resistance mechanisms. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0321

14235 FILHO, E.S. and DHINGRA, O.D. Survival of *Macrophomina phaseolina* sclerotia in nitrogen amended soils. Phytopathologische Zeitschrift 97(2):136-143. 1980. Engl., Sum. Engl., Germ., 23 Refs., Illus.

Phaseolus vulgaris. Mycoses. *Macrophomina phaseoli.* Soil fertility. Soil requirements. N. Soil population.

The effect of N at 1, 3, 5 or 7 mg/g of soil, supplied as NO_3-Na or NH_4-N, on the survival of *Macrophomina phaseolina* sclerotia was studied in 2 soils. The sandy clay loam and sandy loam soils were infested with 640 sclerotia/g of soil. The population of *M. phaseolina* declined gradually and significantly in both soils supplied with N from any source or at any concn. In sandy clay loam soil the population dropped to 2-10 propagules if supplied with 3, 5 or 7 mg N/g of soil from either source. The major drop occurred between 30-40 days after N amendment. However in sandy loam soil the population dropped to 2 or 100 propagules if amended with 7 or 5 mg NH_4-N/g of soil resp., but remainded at 250 or 450 propagules/g of soil if N source was NO_3. In both soils, NH_3-N incited more rapid and drastic decline in population than NO_3-N. *(Author's summary)* E03

0322

14344 PINZON R., C. Evaluación del fungicida Baycor en el control de *Uromyces phaseoli* var *typica* Arth. en fríjol. *(Evaluation of Baycor fungicide in controlling bean rust disease).* Fitopatología Colombiana 7(2):114-117. 1978. Span., Sum. Engl., Span., Illus.

Phaseolus vulgaris. Uromyces phaseoli var. *typica.* Disease control. Leaves. Colombia.

Three different fungicides were evaluated in their efficiency to control bean rust disease *(Uromyces phaseoli* var. *typica).* The best results were obtained with bitertanol fungicide at dosage of 0.05% a.i. *(Author's summary)* E03

0323

14256 KIMATI, H. and GALLI, F. *Glomerella cingulata* (Stonem.) Spauld. et v. Schrenk. f. sp. *phaseoli* n.f., fase ascógena do agente causal da antracnose do feijoeiro. *(Glomerella cingulata f. sp. phaseoli ascogenous phase of the causal agent of bean anthracnose).* Anais da Escola Superior de Agricultura 27:411-437. 1970. Port., Sum. Port., Engl., 38 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. Laboratory experiments. Culture media. Light. pH. Microbiology. Brazil.

The perfect stage of *Colletotrichum lindemuthianum* is described. Two isolates which formed fertile perithecia when paired were used to determine some environmental conditions favorable to sexual reproduction. Perithecia were formed in a semi-synthetic medium containing glucose, $Ca(NO_3)2.4H_2O$, $MgSO_4.7H_2O$, KH_2PO_4, agar (20 g/*l*) and water (1 *l*). The favorable quantities of glucose and $Ca(NO_3)2.4H_2O$ were 4-10 and 0.15-

0.60 g/l, resp., maintaining a C/N ratio between 29.8:1 and 89.6:1. When vitamins were added to the medium, the favorable quantity of $Ca(NO_3)2.4H_2O$ varied from 0.3-1.0 g/l, maintaining the quantity of glucose and the C/N ratio approx. the same. The most favorable quantities of KH_2PO_4 and $MgSO_4.7H_2O$ were 0.1-0.5 and 0.5-1.0 g/l, resp. Light inhibited sexual reproduction, fertile perithecia being obtained only in conditions of continuous darkness or when the light period did not exceed the 1st 3 days of incubation. The pH range favorable to fertile perithecia formation was 4.0-6.0. High humidity was important for high perithecia formation and for ascospores ejection. In paired cultures, the conidial isolates were heterothalic, fertile perithecia being formed only in determinate matings. Some matings resulted in few fertile perithecia, others gave rise to perithecia with only asci, or protoperithecia. Morphologically the ascogenous stage of *C. lindemuthianum* fell into the broad description of *Glomerella cingulata*. Since *C. lindemuthianum* is pathogenic only to *Phaseolus* spp., the name *Glomerella cingulata* f. sp. *phaseoli* is proposed for the perfect stage. *(Author's summary)* E03

0324

14367 POMPEU, A.S. Linhagens de feijoeiro *(Phaseolus vulgaris)* resistentes ao fungo da antracnose *(Colletotrichum lindemuthianum)*. [*Bean lines resistant to the anthracnose fungus (Colletotrichum lindemuthianum)*]. Summa Phytopathologica 5(3/4):148-152. 1979. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Host-plant resistance. Cultivars. Plant breeding. Seedlings. Inoculation. Selection.**

Crosses between the cv. Aroana, Moruna, and Carioca (recurrent parents) and Cornell 49-242 (donor), and backcrosses were made in the glasshouse. Seedlings from these crosses and backcrosses in the F_2 and F_1, resp., were inoculated with a spore suspension of isolates of the Brazilian 1 and α groups. The seedlings were then placed in a moist chamber for 48 h and kept in the lab. at 21°C. The pedigree method was used to identify resistant, homozygous plants. *(Summary by Review of Plant Pathology)* E03 G00

0325

14328 ALVAREZ-AYALA, G. Development of a method for testing resistance of *Phaseolus vulgaris* L. to angular leaf spot (*Isariopsis griseola* Sacc.). Mag. Sc. Thesis. Montreal, Canada, McGill University, 1979. 179p. Engl., Sum. Engl., Fr., 61 Refs., Illus.

Phaseolus vulgaris. Isariopsis griseola. **Plant breeding. Host-plant resistance. Laboratory experiments. Culture media. Inoculation. Canada.**

Techniques and materials that can be used in various steps of the method to evaluate bean resistance to *Isariopsis griseola* were tested. Isolation by picking conidia off coremia in lesions was more practical than by tissue transplants on culture media. Inoculum (conidial) yield was highest from cultures on V-8 agar grown in darkness at 14-19°C for 9-12 days. Preparation and deposition of inoculum suspension on the leaves was facilitated by the use of 0.1% Triton AE. Increasing inoculum concn. up to 2×10^5 conidia/ml (the max. used) increased disease intensity, but 2×10^4 conidia/ml was the most practical concn. Spraying was the most effective technique of inoculum application. The 1st and 2nd trifoliate leaves on 19-20 day old plants were the most responsive material. Disease intensity assessment in terms of lesions/leaf, lesions/4 cm^2, and 2 scales of % leaf area affected, gave consistent resistance and virulence ratings to different host cv. and pathogen isolates, resp. *(Author's summary)* E03

0326

14725 KURIAN, P. and STELZIG, D.A. The synergistic role of oxalic acid and endopolygalacturonase in bean leaves infected by *Cristulariella pyramidalis*. Phytopathology 69(12):1301-1304. 1979. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Cristulariella pyramidalis. **Enzymes. Plant injuries. Leaves. Cytology. Culture media. Ca. Fungal toxins.**

Amounts of oxalic acid were elevated in lesions of bean leaves that were infected for 3 days with *Cristulariella pyramidalis.* Amounts in the green tissue adjacent to these lesions were considerably higher than those in healthy leaves. Endopolygalacturonase was not detectable in extracts of healthy bean leaves but was present in leaves infected with *C. pyramidalis* and in pectin-containing medium supporting growth of this fungus. This enzyme was inhibited by $CaCl_2$ and the inhibition was reversed by oxalic acid. Oxalic acid depolarized cell potentials at a concn. as low as 10^{-4} *M* but only if the solution was approx. pH 4 or lower. This depolarization was not rapidly reversed when the bathing solution was changed to one free of oxalic acid. The data presented are consistent with synergistic roles for oxalic acid and endopolygalacturonase during invasion of bean leaves by *C. pyramidalis. (Author's summary)* E03

0327

14248 DHINGRA, O.D. and KUSHALAPPA, A.C. **No correlation between angular leaf spot intensity and seed infection in bean by *Isariopsis griseola.*** Fitopatología Brasileira 6(5):149-152. 1980. Engl., Sum. Engl., Port., 8 Refs.

Phaseolus vulgaris. Isariopsis griseola. **Disease transmission. Seed. Pods. Seed production. Brazil.**

Seeds harvested from bean cv. Ouro Preto, 51051, S-182-N, PI 201.333 or PI 313.868 with angular leaf spot prevalence on leaves ranging from 31-63.8% and disease severity on pods ranging from 8.0-17.9%, or from cv. Carioquinha with disease severity on pods ranging from 1-50% were tested for seed infection by *Isariopsis griseola.* Out of 3832 seeds tested, the fungus was isolated from only 72 seeds. There was no correlation between disease severity on pods and % of seeds infected with the pathogen. The growth of the fungus always occurred at the hilum. The seed was infected with *I. griseola* only when it was located directly under the lesion present at the pod suture. *(Author's summary)* E03

0328

14760 BOOMSTRA, A.G. **Breeding for resistance to *Fusarium* root rot in beans *(Phaseolus vulgaris* L.).** Ph.D. Thesis. Madison, University of Wisconsin, 1975. 121p. Engl., Sum. Engl., 119 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Host-plant resistance. Plant breeding. Cultivars. Selection. Inheritance. N. Nutrient solution. Seedlings. Laboratory experiments. Field experiments.**

Root rot of beans, incited by *Fusarium solani* f. sp. *phaseoli,* occurs in all bean growing areas of the world, and has increasingly become a problem in Wisconsin (USA). Since cultural practices are largely ineffective in controlling *Fusarium* root rot, the development of resistant or tolerant cv. of snap and dry beans is highly desirable. The seedling tank test, a rapid testing procedure employing a hydroponic culture technique, was developed to screen large no. of bean plants for root rot resistance. Since this procedure was too severe for the detection of low levels of resistance, a greenhouse pot test was also used. Field tests included the use of row and hill plots for evaluation of root rot resistance under natural conditions. The form in which N was provided in the seedling tank test greatly affected the results. NH_4NO_3-N increased the tolerance of susceptible plants, compared to NO_3 as the N source. Ammonium at an identical N concn. of 210 ppm was found to be toxic to young bean seedlings. Several older cv. having a low level of root rot resistance were identified using the described testing procedures. State Half Runner, Black Turtle Soup, Cherokee Wax, Bush Romano, and Resistant Asgrow Valentine were the most useful. Nearly 700 plant introductions of *Phaseolus vulgaris* originating in Mexico were screened using the seedling tank test, and 18 superior introductions also performed well in a root rot-infested

field at the Wisconsin Expt. Station at Hancock (PI 224730, 224737, 309726, 309801, 310607, 311917, 311975, 311987, 311989, 311991, 312028, 312033, 312041, 312043, 312062, 312077, 319616, and 325619). The seedling tank test was effective for single plant selection in segregating F_2 families resulting from crosses of N203 (PI 203958) with susceptible cv. However, continued selection based on family means, was necessary to obtain highly resistant homozygous breeding lines. The av. disease indices were lowered from 94 in the unselected F_2 generation to 49 in the F_4 generation after one cycle of selection with several F_4 families approaching the resistant parent. The inheritance of root rot resistance from N 203 was found to be complex, with susceptibility being dominant over resistance for plants subjected to the seedling tank test. Rather than continued use of pedigree selection and backcross breeding, it is suggested that a quantitative approach be taken. In this way, the level of resistance in bean populations can be raised gradually by recurrent selection, instead of seeking highly resistant individual plants of which the frequency in segregating populations is very low. *(Author's summary)* E03

0329

14364 WOODWARD, M.D. **Phaseollin formation and metabolism in *Phaseolus vulgaris*.** Phytochemistry 19(5):921-927. 1980. Engl., Sum. Engl., 57 Refs., Illus.

***Phaseolus vulgaris*. Mycoses. Pods. Inoculation. Phaseollin. Phytoalexins. Metabolism. Enzymes. Analysis. Biochemistry. Host-plant resistance.**

Following fungal-inoculation, *Phaseolus vulgaris* was found to produce small amounts of 7,4′-dihydroxyisoflavone (daidzein), 7,2′,4′-trihydroxyisoflavone, 7,2′,4′-trihydroxyisoflavanone, (6a*R*, 11a*R*)-3,9-dihydroxypterocarpan, and (3*R*)-7,2′,4′-trihydroxyisoflavan. The structures of the latter 4 compounds were confirmed by synthesis. The principal pterocarpans isolated were phaseollidin and phaseollin and ORD (optical rotatory dispersion) spectra indicate that these compounds have the same (6a*R*, 11a*R*)-configuration as 3,9-dihydroxypterocarpan. A pathway leading to phaseollidin and phaseollin is proposed involving 2′-hydroxylation of daidzein, reduction to the isoflavanone, further reduction, dehydration and cyclization to the pterocarpan, and prenylation to give phaseollidin and then cyclization and dehydrogenation to give phaseollin. No evidence of prenylation at the isoflavone or isoflavanone stage was obtained. The phaseollin metabolite, (6a*S*, 11a*S*)-6a-hydroxyphaseollin, was also detected. *(Author's summary)* E03 C03

0330

14738 SMITH, D.A. **Phytoalexins in *Rhizoctonia solani*-infected bean hypocotyls.** Ph.D. Thesis. Ithaca, N.Y., Cornell University, 1974. 140p. Engl., Sum. Engl., 134 Refs., Illus.

***Phaseolus vulgaris*. *Rhizoctonia solani*. Host-plant resistance. Phytoalexins. Analysis. Plant injuries. Hypocotyls. Plant tissues.**

The phytoalexins phaseollin, kievitone, phaseollidin and phaseollinisoflavan were produced soon after infection of *Phaseolus vulgaris* hypocotyls by *Rhizoctonia solani*. These compounds were extracted from diseased tissues in ethanol and subsequently purified by solvent partitioning, thin-layer chromatography, preparative-layer chromatography, column chromatography and crystallization. Kievitone was identified as 5,7,2′, 4′-tetrahydroxy-8-isopentenylisoflavanone. Its phenolic nature was indicated by positive reactions with diazotized *p*-nitroaniline, Folin's reagent and a 1% solution of $FeCl_3$. The formation of a 2,4-dinitrophenylhydrazone indicated the presence of a carbonyl group. Kievitone exhibited an ultraviolet absorption max. in ethanol at 294 nm (log ϵ = 4.17) with a shoulder at 340 nm (log ϵ = 3.46). Kievitone was optically inactive in ethanol. Methylation with diazomethane yielded, predominantly, the trimethyl derivative. The infra-red spectrum contained a hydroxyl band at 3200/cm and a carbonyl band at 1632/cm. Four phenolic hydroxyl functions, the characteristic peaks of an isopentenyl side chain, 3 additional aliphatic protons and the presence of pentasubstituted and trisubstituted benzene rings were revealed by the nuclear

magnetic resonance spectrum. The mass spectrum indicated a parent ion at m/e 356 with an elemental composition of $C_{20}H_{20}O_4$. The findings were consistent with the compound described above and with the 6-isopentenyl isomer. However, the substance isolated had the same physicochemical characteristics as an authentic sample of kievitone in which the isopentenyl side chain is located at C-8. Phaseollin was obtained as a crystalline material with the same ultra-violet absorption spectrum and melting point as authentic phaseollin. No depression of the melting point occurred upon mixing the 2 samples and both had the same Rf values in 2 chromatographic systems. The phaseollidin isolated revealed ultra-violet and mass spectral properties in agreement with the published values and, like authentic phaseollidin, gave a negative Gibb's test. The ultra-violet and mass spectral data of the phaseollinisoflavan extracted agreed with published reports. Furthermore, phaseollinisoflavan gave a positive Gibb's test, and chromatography of the isolated compound with authentic phaseollinisoflavan yielded the same Rf values. The four phytoalexins were extracted from *R. solani* lesions and the peripheral tissues at defined stages of lesion development. Ultra-violet spectrophotometry allowed determination of their concn. in the tissues, corrections being made for extraction efficiencies. Each phytoalexin was concentrated in the lesions and accumulated with time. Kievitone occurred at concn.of 183 μg/g fresh wt. in young lesions and 638 μg/g fresh wt. in mature lesions. Phaseollin concn. at the same stages of lesion development were 18 and 782 μg/fresh wt., resp. Phaseollidin and phaseollinisoflavan never exceeded 50 μg/g fresh wt. The $E.D._{50}$ values for phaseollin, kievitone, phaseollidin and phaseollinisoflavan assayed against *R. solani* in M-2 agar medium were 5.6×10^{-5} *M*, 1.0×10^{-4} *M*, 6.2×10^{-5} *M* and 8.3×10^{-5} *M*, resp. Bioassays of phaseollin and kievitone in bean-juice agar indicated similar activities. Phaseollin and kievitone exhibited additive fungistatic effects. Little expansion of *R. solani* lesions on bean hypocotyls was evident beyond that apparent at the young stage of their development. Those events responsible for the restriction of fungal spread must essentially be complete 2 days after inoculation. Incorporation of the amounts of phaseollin and kievitone occurring in young and early intermediate lesions into M-2 agar caused about 80% inhibition of the radial mycelial growth of *R. solani*. Treatment of *R. solani* shake cultures with the concn. of phaseollin and kievitone present in young lesions induced a 40% loss of fungal dry wt. within 6 h. The results suggested that the phytoalexins, primarily kievitone, might contribute a functional role in disease resistance by restricting fungal spread in the invaded host tissues. *(Author's summary)* E03 C00

0331

14392 BANDARA, J.M.R.S. **Effect of *Fusarium solani* f. sp. *phaseoli* on root nodule formation in *Phaseolus vulgaris* L.** Journal of the National Agricultural Society of Ceylon 15:1-7. 1978. Engl., Sum. Engl., 8 Refs.

Phaseolus vulgaris. Fusarium solani phaseoli. Rhizobium. **Nodulation. Roots. Inhibition Inoculation. Soil fertility. Rhizosphere. Soil population. Hypocotyls. Plant injuries.**

The presence of *Fusarium solani* sp. *phaseoli* (FSP) in french bean rhizosphere soil reduced the no. of root nodules probably following interaction between FSP and soil *Rhizobia* spp. rather than through direct effects on bean plants. *(Author's summary)* E03 101

0332

14351 CAMPBELL, C.L., MADDEN, L.V. and PENNYPACKER, S.P. **Structural characterization of bean root rot epidemics.** Phytopathology 70(2):152-155. 1980. Engl., Sum. Engl., 18 Refs.

Phaseolus vulgaris. Rhizoctonia solani. Fusarium solani phaseoli. **Symptomatology. Experiment design. Statistical analysis. Field experiments. Culture media. Roots. Rots.**

A 0.4 ha field of snapbeans cv. 'Tendercrop' was divided into 100 contiguous quadrats. Twelve plants were removed from each quadrat at 10, 20, 30, 40, and 50 days after planting to assess disease severity and incidence of bean root rot induced primarily by *Rhizoctonia*

solani, but also in part by *Fusarium solani* f.sp. *phaseoli*. A disease progress curve was developed to depict the epidemic occurring in each quadrat. The curve elements used to characterize these disease progress curves were: Weibull distribution function scale parameter; Weibull distribution function shape parameter; area under the disease progress curve; final disease severity; 1st-difference regression linear coefficient; 1st-difference regression quadratic coefficient; % plants infected; and estimated time of disease onset. The structure of the 100 disease progress curves was examined by conducting a multivariate principal axis factor analysis followed by a Varimax rotation. Four factors, accounting for 90% of the total variance, were selected to express the disease progress curve elements more simply and without confounding interactions among elements. Factor 1 was an overall description of disease progression including shape,level and rate parameters. Factor 2 showed a relationship between area under the disease progress curve and level of the epidemic. Factor 3, an indication of epidemic temporal location, identified the uniqueness of the estimated time of disease onset. Factor 4 identified a relationship between disease severity and disease incidence. *(Author's summary)* 103

0333

14754 HULUKA, M. **Population trends of three varieties of bean wilt bacterium *(Corynebacterium flaccumfaciens)* in three bean cultivars.** Ph.D. Thesis. Lincoln, The University of Nebraska, 1972. 70p. Engl., Sum. Engl., 69 Refs., Illus.

Phaseolus vulgaris. *Corynebacterium flaccumfaciens*. **Cultivars. Host-plant resistance. Inoculation. Leaves. Stomata. Temperature. Symptomatology. Chlorosis. Plant tissues. Bacteriology.**

Population trends of *Corynebacterium flaccumfaciens*, *C. flaccumfaciens* var. *aurantiacum* and *C. flaccumfaciens* var. *violaceum* in three dry bean cv. Great Northern U.I. #59, Tepary and PI 165078 were determined. Inocula containing approx. 10^8 and 10^5 bacterial cells/ml of each bacterial var. were infiltrated into the leaves through the stomata until the leaves became watersoaked. The inoculated plants were kept in a greenhouse in which the temp. was adjusted to approx. 25°C. Growth of the bacteria in the 3 hosts was assessed by periodic determination of concn. in affected tissues by dilution plating. All 3 pathogenic var. of bacteria exhibited the same characteristics insofar as the trend of multiplication and the effects on the host tissues were concerned. After the 1st logarithmic growth period, *C. flaccumfaciens* and *C. f.* var. *aurantiacum* multiplied faster than *C. f.* var. *violaceum* in all dry bean cv. The differences in the inoculum dose had little effect on the generation time of the bacteria, but the growth period was shorter at the higher concn. The final yield of bacteria/unit inoculum at the stationary phase was the highest in Great Northern followed by Tepary and the least in PI 165078. The yield decreased at the higher dosage (10^8 cell/ml). With the higher concn. of bacteria, the 3 bacterial types induced similar symptoms. All produced white pustule-like overgrowth on the leaf of the susceptible cv. Great Northern, and interveinal chlorosis in Tepary. The brownish necrotic symptom (hypersensitive reaction) was observed only in tolerant cv. PI 165078. Few leaf symptoms appeared using lower inocula level of the bacteria. Introduction of pathogenic bacteria into the intercellular spaces of immature leaves of all 3 cv. with high inoculum concn. (10^8 cells/ml) of *C. flaccumfaciens* var. *aurantiacum* checked the expansion of the leaves while lower concn. (10^5 cells/ml) had relatively little effect. The effects of temp. of 18, 25 and 30°C on multiplication of *C. flaccumfaciens* var. *aurantiacum* at a lower concn. were studied. There was no difference in the growth rate of bacteria under 18 and 25°C. Higher temp., 30°C, accelerated the rate of bacterial multiplication in Great Northern and Tepary while the effect was much less in PI 165078. *C. flaccumfaciens* var. *aurantiacum* at high concn. (10^8 cells/ml) showed similar trend of multiplication in both detached and undetached leaves of Great Northern and PI 165078. Bacteria multiply in both tolerant and susceptible tissues; however, the tolerant host may have factors which enable it to keep the population size to a min. *(Author's summary)* 103

0334

14365 EL MOHO blanco del fríjol. *(White mold on beans).* Agricultura de las Américas 29(8):18, 26, 28, 40-41. 1980. Span., Illus.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Etiology. Symptomatology. Disease control. Chemical control.**

Information is given on the white mold disease of beans (*Sclerotinia sclerotiorum*), its symptomatology, life cycle, and environmental factors that affect its propagation (humidity, temp.). Research conducted to predict white mold outbreak is reported. Methods of chemical control are discussed and it is indicated that benomyl has showed to be superior to other commercial fungicides. Regarding cultural practices, it is indicated that farmers should adopt those that encourage the drying of soil and plant surfaces. On the other hand, white mold-resistant material has been identified, mostly *Phaseolus coccineus* cv., one of whose selections produces white beans and can be crossed with *P. vulgaris. (Summary by I.B. Trans. by L.M.F.)* E03

0335

2752 CRUICKSHANK, I.A.M. **Strains of** *Colletotrichum lindemuthianum* **(Sacc and Magn.) in Eastern Australia.** Commonwealth Scientific and Industrial Research Organization ,Commonwealth of Australia. Agricultural Science 32(2):134-135. 1966. Engl., 8 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Races. Cultivars. Pods. Inoculation. Host-plant resistance.**

Twenty-eight samples of French bean pods infected with *Colletotrichum lindemuthianum* were collected for strain analysis. Pure cultures of this pathogen were isolated and for inoculation purposes, aqueous suspensions of spores were prepared from agar cultures. The pathogenicity of isolates from *C. lindemuthianum* was assessed on 5 different bean cv. Plants were spray-inoculated with a spore suspension, and incubated at a humidity > 97% at 20°C during 40 h. Disease reactions were classified into resistant, semi-resistant, and susceptible after 7 days. Results of the expt. indicate that the pathogenicity pattern was not identical to those of α, β, or γ strains. Reactions of additional cv. show clear-cut differences in pathogenicity between strains 1 and 2 in relation to 2 selections of cv. Brown Beauty. The 3 strains were grown in a culture of neopeptone agar with a semi-annual subculture during 3 yr. No reversion to non-sporulating types or pathogenicity changes were observed. *(Summary by W.M.S. Trans. by L.M.F.)* E03

0336

3993 CHORIN, M. and HALFON-MEIRI, A. **Losses caused by** *Rhizoctonia solani* **borne on bean seed.** Plant Disease Reporter 46(11):790-791. 1962. Engl., 3 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. **Seeds. Disease transmission. Symptomatology.**

Bean cv. Brittle Wax seeds, infected with the pathogen *Rhizoctonia solani,* were collected in Israel. The pathogen was isolated and cultured on potato-dextrose agar; healthy seeds were inoculated, resulting in 75% infection with typical symptoms on the seeds and young seedlings. Germination tests were conducted on 10 random samples of 300 seeds each, collected from the affected fields. The % of healthy and abnormal seedlings and of seeds failing to germinate were recorded. Seeds were graded for infection according to external symptoms. A table is given with the results of the expt. *(Summary by W.M.S. Trans by L. M.F.)* E03

0337

11670 ADAMS, P.B. and AYERS, W.A. **Ecology of** *Sclerotinia* **species.** Phytopathology 69(8):896-899. 1979. Engl., 35 Refs.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Host range. Ecology. Soil population. Disease control. Biological control.**

A literature review on *Sclerotinia* spp. is given that includes aspects on dissemination, natural inoculum densities, and survival in soil. It is indicated that various species of this important plant pathogen exist in almost all the regions of the world including Europe, Middle East, Far East, South Pacific, Africa, South and North America. Furthermore, recent discoveries in lab. of 3 mycoparasites of *Sclerotinia* spp. are reported; these may be responsible for the natural destruction of sclerotia in soil and may have potential as biological control agents. *(Summary by I.B. Trans. by L.M.E.)* E03

0338

15833 HEUVEL, J. VAN DEN **Effect of inoculum composition on infection of French bean leaves by conidia of *Botrytis cinerea*.** Netherlands Journal of Plant Pathology 87:55-64. 1981. Engl., Sum. Dutch., Engl., 21 Refs., Illus.

Phaseolus vulgaris. Snap bean. *Botrytis cinerea.* **Inoculation. Leaves. Symptomatology. Laboratory experiments.**

Inoculation of leaves of french bean with sprays or small drops of a suspension of conidia of *Botrytis cinerea* gave rise to spreading lesions, lesions remaining restricted in size or to no visible necrosis. The type of reaction depended on the composition of the inoculum. In studies with drop inoculations with buffered inocula some of the factors involved were analyzed. The formation of spreading lesions depended on pH, type and molarity of the buffer, presence of glucose, and concn. of conidia in the inoculum. If the phosphate buffer used in most of the inocula was replaced by monobasic phosphate, similar results were obtained. The reactions were not influenced by the proportion of K^+ or Na^+ ions in the phosphate buffer. Inoculations with conidia suspended in a solution of 0.067 *M* phosphate buffer (pH 5.0) or monobasic phosphate and 0.11 *M* glucose always evoked a susceptible reaction (the formation of spreading lesions). *(Author's summary)* E03

0339

14785 RIBEIRO, S.R. **Identificação de raças fisiológicas de *Colletotrichum lindemuthianum* (Sacc. et Magn.) Scrib., de Municipios do Estado do Espírito Santo, e reação de cultivares de feijão a nove raças do patógeno.** *(Identification of physiological races of Colletotrichum lindemuthianum in the municipalities of the state of Espírito Santo and the reaction of bean cultivars to new races of the pathogen).* Tese Mag. Sc. Viçosa-MG, Brasil, Universidade Federal de Viçosa, 1978. 54p. Port., Sum. Port., 27 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Cultivars. Host-plant resistance. Races. Identification. Pods. Brazil.**

Bean pods with symptoms characteristic of anthracnose were collected in order to identify physiological races of *Colletotrichum lindemuthianum*, in the municipalities of Domingos Martins, Muniz Freire, and Afonso Cláudio, state of Espirito Santo (Brazil). In each sample of a total of 107 crops, 1, 2, or 3 isolations were made from the same pod. Cv. Michelite, Dark Red Kidney, Perry Marrow, *Phaseolus aborigineus* 283, Costa Rica 1031, and Cornell 49-242 were used in the differentiation of the races. Races Ba-1 and Ba-2 of group α, Ba-4 and Ba-5 of group Brazilian I, and Ba-10 of the group δ were identified. It was noted that races Ba-1 and Ba-5 predominated over the others. The reactions of 36 of the most important commercial bean var., in the main production centers of the country, to 9 physiological races of the pathogen were determined. Seeds of bean var. Rico 23, that had shown resistance to the δ race in a previous trial, were also assessed. For the analysis, the degrees of infection were transformed according to Amaral, $I = \text{sen}^2 W$. This transformation was specific for the degrees of infection and assures the normal distribution and homogeneity in the variance. Cv. were largely susceptible or presented a mixed reaction, indicating

the need to produce resistant cv. By analyzing some European and North American cv., some sources of resistance were detected: Imuna, resistant to races Ba-1, Ba-2, Ba-3, Ba-8, and Ba-9; Emerson 51-2, resistant to races Ba-1 and Ba-2; Sanilac, to race Ba-1; Widusa, to races Ba-3, Ba-4, Ba-6, Ba-8, and Ba-9, and Master piece, to races Ba-1, Ba-2, Ba-3, Ba-5, Ba-6, Ba-8, and Ba-9. Cv. Cornell 49-242 was resistant to the 9 races under evaluation. *(Author's summary. Trans. by L.M.F.)* E03

0340

15430 FRIAS T., G.A. and GARCIA E., R. **Una indicación de interacciones de algunos fitopatógenos del suelo en fríjol (*Phaseolus vulgaris* L.) en el trópico húmedo.** *(Indication of interactions of some soil pathogens in beans in the humid tropics).* Agricultura Tropical (México) 2(2):105-108. 1980. Span., Sum. Span., Engl., 12 Refs.

Phaseolus vulgaris. **Soil populations.** *Rhizoctonia solani. Fusarium* **spp.** *Macrophomina phaseolina. Sclerotium rolfsii. Pythium* **spp. Inoculation.**

Bean production in the humid tropics faces serious phytopathological problems, among these, perhaps the most important in the reduction of production are those with origin in the soil. Some fungi that have frequently been isolated from bean roots, showing disease symptoms (*Pythium* sp., 2 strains of *Rhizoctonia solani, Fusarium* sp., *Macrophomina phaseolina,* and *Sclerotium rolfsii*) were multiplicated and inoculated to pots with natural and pasteurized soil on which beans of the var. Nacajuca were grown under greenhouse conditions. An increment of 10-45% of dead plants due to the inoculation of the pathogens was observed; most of the fungi tested caused a higher % of dead plants when they were inoculated to natural soil. When the pathogens were isolated again from the roots of these plants, it was found that *M. phaseolina, Fusarium* sp., and *S. rolfsii* were always associated with *Pythium* and/or *Fusarium,* this seems to indicate that the differences in the % of dead plants between the natural and pasteurized soil are the result of the interaction between the inoculated pathogens and those already present in the soil. *(Author's summary)* E03

0341

3994 CRISPIN, A. and GALLEGOS, C.C. **Web blight—a severe disease of beans and soybeans in Mexico.** Plant Disease Reporter 47(11):1010-1011. 1963. Engl., 3 Refs., Illus.

Phaseolus vulgaris. Rhizoctonia solani. **Cultivars. Host-plant resistance. Inoculation. Symptomatology. Mexico.**

Results of some trials conducted to isolate the causal organism of a severe bean disease observed in the fall of 1962 and spring of 1963 in Mexico are given. Inoculations were made when the bean and soybean var. Canario 101 and Lee plants were in the 2-leaf stage; the inoculum consisted of fragmented mycelium suspended in distilled water. Two checks were used, noninoculated plants and plants inoculated with *Rhizoctonia solani.* Microscopic observations identified the causal agent as *Rhizoctonia microsclerotia* and greenhouse tests indicated that all commercial var. widely distributed in bean-growing areas of Mexico are susceptible to *R. microsclerotia. (Summary by I.B. Trans. by L.M.F.)* E03

0342

2871 YARWOOD, C.E. **Predisposition to mildew by rust infection, heat, abrasion, and pressure.** Phytopathology 55:1372. 1965?. Engl., 5 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Inoculation. Symptomatology. Host-plant resistance.**

Primary leaves of Pinto beans and Blackeye cowpeas were inoculated with conidia of *Sphaerotheca fuliginea* produced on cucumber. Mildew infection was increased by heating bean

leaves (20-300 s at 45°C, 5-64 s at 50°C, and 1-8 s at 55°C). The 2 species were not susceptible to *Erysiphe graminis* from barley. Bean leaves infected with rust (*Uromyces phaseoli*) were readily infected with *S. fuliginea*. When rust was eliminated with heat without injuring the leaf, mildew developed as vigorously as on cucumber. Like pressing with fingers, abrasion by rubbing leaves with a stiff brush increased susceptibility of beans to mildew. Sporulation was also greater when the tissue was heated, abraded, and pressed; but this triple treatment was less effective than heating. *(Summary by W.M.S. Trans. by L.M.F.)* F03

0343

3944 MAURER, C.L. and BAKER, R. **Ecology of plant pathogens in soil. I. Influence of chitin and lignin amendments on development of bean root rot.** Phytopathology 54:1425-1426. 1976. Engl., 17 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Soil population. Soil treatment. Organic matter. Disease control. Ecology.**

Results using chitin and lignin to study the effects of crop residues on the development of bean root rot (*Fusarium solani* f. *phaseoli*) are reported. No significant reduction in the severity of symptoms was produced when soils infested with *F. solani* f. *phaseoli* were amended with chitin or lignin; chitin at 1000 ppm increased disease severity; the joint application of chitin and lignin significantly (5% level) reduced disease severity and this reduction was greater when 1225 ppm KNO_3 was added to these amendments. When 5000 ppm glucose was also added no reduction was observed in symptom expression. It is suggested that the control using lignin-chitin amendments may be due, at least in part, to competition for simple carbon substrates necessary for germination and penetration by the pathogen. *(Summary by I.B. Trans. by L.M.F.)* F03

0344

8149 KUHN, P.J. and SMITH, D.A. **5,7,2',4'-tetrahydroxy-8-(3"-hydroxy-3"-methyl-butyl) isoflavanone, a metabolite of kievitone produced by *Fusarium solani* f. sp. *phaseoli*.** Phytochemistry 16:296-297. 1977. Engl., 10 Refs.

Phaseolus vulgaris. Fusarium solani phaseoli. **Host-plant resistance. Phytoalexins. Analysis. Biochemistry.**

The metabolite kievitone hydrate was isolated in mg amounts from liquid cultures of *Fusarium solani* sp. *phaseoli* containing kievitone (21.6 mg of kievitone yielded 14.3 mg of kievitone hydrate). Cultures were incubated at 25°C on a reciprocal shaker for 6 h. The metabolite was isolated by slight modification of Van den Heuvel and VanEtten methods. It was later purified by TLC on Si gel and further purification was obtained through Sephadex LH-20. The structure was established as 5,7,2',4',-tetrahydroxy-8-(3"-hydroxy-3"-methyl-butyl) isoflavanone. Different aspects on conversion and molecular structure are described. Preliminary bioassays with other microorganisms (*Rhizoctonia solani, Cladosporium herbarum, Aphanomyces euteiches*) indicated that the metabolite kievitone hydrate was less fungitoxic than kievitone and the conversion of kievitone to kievitone hydrate may explain the relative insensitivity of this fungus, *F. solani*, to the phytoalexin. *(Summary by C.P.G. Trans. by L.M.F.)* F03

0345

15211 FORSTER, R.L. **Control of white mold (*Sclerotinia sclerotiorum*) of dry edible beans by irrigation management and fungicides.** Bean Improvement Cooperative Annual Report 23:70-71. 1980. Engl.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Irrigation. Timing. Disease control. Chemical control. Yields.**

Studies were conducted during 1978-79 utilizing a combination of irrigation management and fungicides for the control of white mold (*Sclerotinia sclerotiorum*). Eight-row strips of pink bean cv. Sutter Pink with 3 replications, received irrigation 64, 70, and 83 days after planting. Plants had fully developed pods with seeds that were bulging at 67 days. Foliar sprays of benomyl (2 lb/40 gal of water/ac) were applied with a compressed air sprayer at 34 psi when pods were 1.5 in. long and in full bloom at 54 days. The yields corresponding to the 3 application dates were 26, 22.7, and 23.5 cwt/ac in plots treated with benomyl and 21.4, 15.4, and 17.0 cwt/ac in check plots. These data suggest that satisfactory disease control and bean yields may be achieved by using the best date of final irrigation. *(Summary by C.P.G. Trans. by L.M.F.)* F03

0346

15840 THOMAS, C.A. and WOOD, R.K.S. **Studies on respiration in *Fusarium*-infected beans.** Canadian Journal of Botany 59:129-131. 1981. Engl., Sum. Engl., Fr., 14 Refs.

Phaseolus vulgaris. Fusarium oxysporum. **Plant respiration. Plant tissues. Leaves. Sap. Toxicity. Inoculation. Symptomatology.**

Bean plants, when inoculated with *Fusarium oxysporum* developed disease symptoms 7-9 days later and died within the next 3 wk. The most common visible symptoms of the disease were wilting, yellowing, vein clearing, and necrosis of the leaves. Just before expression of these symptoms, from 5 days onwards, the leaves of the infected plant respired at a higher rate than those of the healthy plant. With the appearance of the foliar symptoms on the 7th or 8th day, however, the respiration rate began to fall steadily until the plant wilted completely. The tracheal sap of the inoculated plant was found to be toxic and increased the rate of respiration of leaf tissues. *(Author's summary)* F03

0347

15497 COTTINGHAM, C. **Numbers and distribution of sclerotia of *Macrophomina phaseolina* in the soils of South Carolina.** Plant Disease 65(4):355-356. 1981. Engl., Sum. Engl., 10 Refs.

Phaseolus vulgaris. Macrophomina phaseolina. **Soil population. Field experiments. USA.**

Each of 692 soil samples from 46 counties of the state of South Carolina (USA) contained sclerotia of *Macrophomina phaseolina.* The no. of sclerotia varied among fields and ranged from 6-168 with an av. of 75/g of soil. Twenty-seven counties (59%) were below the av. while 10 counties (22%) were above the av. (76-100 sclerotia/g). The no. of sclerotia in 9 counties (19%) varied between 100-168/g. There appeared to be no definite pattern of sclerotial distribution in the state. Adjacent counties showed great disparity in population densities. *(Author's summary)* F03

0348

2833 GOTH, R.W. and OSTAZESKI, S.A. **Sporulation of *Macrophomina phaseoli* on propylene oxide-sterilized leaf tissues.** Phytopathology 55:1156. 1965. Engl., 5 Refs.

Phaseolus vulgaris. Macrophomina phaseoli. **Leaves. Inoculation. Light. Laboratory experiments.**

Isolates of *Macrophomina phaseoli* were obtained from diverse sources to induce sporulation using fresh and dry *Phaseolus vulgaris* leaves. These were trimmed and place in a petri dish, exposed to propylene oxide at the rate of 1 ml/*l* for 24 h, and 30 ml of 1% water agar at 45°C were added. Samples were incubated in the dark until mycelial coverage was complete (within 2-5 days at 30°C) and then exposed to white or cool white fluorescent light, or

combinations of the 2, at an intensity of approx. 300 ft-ca. Pathogenicity of the pycnidiospores was determined by the method of Luttrell. Sporulation was easily recognized by the presence of a spore mass and by the size of the pycnidia. All isolates of *M. phaseoli* sporulated quickly and profusely within 7 days under continuous light; when isolates were incubated in the dark, production was delayed, erratic, and not profuse. *(Summary by W.M. S. Trans. by L.M.F.)* E03

0349

15235 CORDOBA, J.V., STEADMAN, J.R. and LINDGREN, D.T. **Evaluation of methods for inoculating beans with rust urediospores.** Bean Improvement Cooperative Annual Report 23:46-47. 1980. Engl.

Phaseolus vulgaris. Uromyces phaseoli. **Inoculation.**

Five methods of inoculating bean cv. Pinto 114 with rust (*Uromyces phaseoli* var. *typica*) were evaluated. The inoculum consisted of: (1) a suspension of urediospores, 10 ml of tap water, and one drop of Tween-20; (2) a mixture of urediospores and 1 g of talc; (3) a suspension of urediospores and 10 ml of oil; (4) a suspension of urediospores and 10 ml of distilled water; and (5) dry urediospores, applied with spatula. Approx. 0.1 g of urediospores were used in each treatment in a randomized complete block design with 5 replicates. Seedlings were inoculated when primary leaves reached 2/3 of their normal size. Method 5, spatula method, had the greatest no. of pustules/leaf (286), followed in descending order by methods 2, 1, 4, and 3 which presented 174, 127, 95, and 65 pustules/leaf, resp. *(Summary by C.P.G. Trans. by L.M.F.)* E03

0350

5427 ANDERSEN, A.L. **Bean rust.** East Lansing. Michigan State University Cooperative Extension Service. Extension Bulletin E-893 no. 56. 2p. 1975. Engl., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Etiology. Symptomatology. Disease control. Chemical control.**

A report is given on bean rust (*Uromyces phaseoli* var. *typica*), which caused economically important damage in the state of Michigan (USA) in 1973. The morphology of the pathogen, disease symptomatology and etiology, environmental factors that favor the development of the fungus, and several control measures are described. It is recommended to allow at least 2 yr to plant beans in fields where the disease has occurred; avoid planting beans next to fields where rust-infected beans were grown the previous yr; plow under all bean refuse; monitor the crop, and apply fungicides at 7-day intervals until plants are in the early pod stage to protect the crop and guarantee good yields. *(Summary by C.P.G. Trans. by L. M.F.)* E03

0351

3975 BURKE, D.W. **Root growth obstructions and *Fusarium* root rot of beans.** Phytopathology 58:1575-1576. 1973. Engl., 6 Refs., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Rooting. Soil requirements. Disease control.**

Mechanical impedance of root growth as a determining factor in *Fusarium* root rot was considered. Plants were not significantly affected by *Fusarium* when roots grew freely out of the areas of exptl. soil into non-infected soil. The possibility of controlling root rot by breaking the hard subsoil was investigated. In non-treated plots root rot occurred; in those receiving subsoiling, it did not occur. Furthermore, marked seed yield increases were obtained in treated plots and subsoiling 51 cm deep was more effective than shallower treatments. Subsoiling before planting was more effective than subsoiling after planting. The possibility of controlling root rot by subsoiling or other means of deep tillage is indicated. The fact

that greater yields were obtained by subsoiling where all spaces between rows were irrigated suggests that improved soil moisture distribution may be an important benefit. *(Summary by I.B. Trans. by L.M.F.)* E03

0352

11671 ABAWI, G.S. and GROGAN, R.G. **Epidemiology of diseases caused by *Sclerotinia* species.** Phytopathology 69(8):899-904. 1979. Engl., 38 Refs.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Soil population. Etiology. Disease control. Biological control. Ecology. Host range.**

The epidemiological information on the white mold disease in beans, caused by *Sclerotinia sclerotiorum* and on the lettuce drop, caused by *S. minor*, is summarized. Data are given on the source of inoculum, requirements for production of ascosporic inoculum (time, soil moisture, and temp.), those for host infection and disease development (exogenous energy source, humidity, and temp.), and the role and fate of inoculum produced by primary infections. The use of epidemiological data in disease management is discussed. *(Summary by I.B. Trans. by L.M.F.)* E03

0353

3971 BURKE, D.W. and SILBERNAGEL, M.J. **Testing beans for field tolerance to Fusarium root rot.** Phytopathology 55:1045-1046. 1965. Engl., 1 Ref., Illus.

Phaseolus vulgaris. Fusarium solani phaseoli. **Host-plant resistance. Field experiments. Selection.**

A more precise method for tests for resistance to *Fusarium solani f. phaseoli* is described, consisting in mixing a small no. of test seeds with a large no. of seed of a susceptible control var. (1 test seed to 4 susceptible seeds). These were planted in the same row, at a rate of 125 lb/ac in 22-in. rows. In this way, hybrid segregants can be compared with the control. Most plants resistant to root rot are more vigorous than the susceptible plants among which they are growing. Seedlings of certain hybrids emerge more rapidly than control seedlings; others tolerate cold wet soil better than the control. Some hybrids highly susceptible to *Fusarium* in greenhouse inoculations are tolerant to root rot in the field. A comparative table of av. yields of test lines (Pinto, Red Mexican, Black Turtle, and Red Mexican no. 1) and controls is given. *(Summary by W.M.S. Trans. by L.M.F.)* E03

0354

3880 SCHEIN, R.D. **Temperature conversion of rust response of bean.** Phytopathology 51:486-488. 1961. Engl., 3 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Symptomatology. Temperature. Host-plant resistance.**

The induction and appearance of a local necrotic response to *Uromyces phaseoli* var. *typica* in Pinto 111 beans (susceptible) in 2 expt. are described. Plants were grown for 4 wk. at day-night temp. of 21-15.5°C, resp., inoculated with spores and placed in a moisture chamber 24 h. These were then removed to a controlled environment room maintaining day-night temp. optimal for disease development (27-21°C, resp.). Distinct local necroses appeared within 7-10 days on plants receiving certain temp. treatments. If colonization had proceeded beyond a certain stage, heat would not induce the reaction. In other expt. the development of the infection (older than 120 h at the time of the heat treatment) was detained but no local necrosis was observed. Actual infection follows a germination-penetration period of a least 6 h. Some possible explanations of this phenomenom are given. *(Summary by I.B. Trans. by L.M.F.)* E03

0355

15245 PEARSON, R.C., ROSENBERGER, D.A. and SMITH, C.A. **Benomyl-resistant strains of *Botrytis cinerea* on apples, beans, and grapes.** Plant Disease 64 (3):316-318. 1980. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. Botrytis cinerea. **Disease control. Host range. Strains.**

Strains of *Botrytis cinerea* resistant to benomyl were isolated from apples, beans, and grapes where the fungicide had been used primarily for control of other disease organisms. The level of resistance for each *Botrytis* isolate from the 3 hosts could not be related to the history of benomyl usage on those crops. Benomyl-resistant isolates from the 3 hosts were pathogenic on each of the other 2 hosts, and more variation in aggressiveness was observed among isolates from the same host than among isolates from different hosts. Since apples, beans, and grapes may be grown in neighboring fields, spread of benomyl-resistant pathogenic isolates from one host to another can be expected to complicate control strategies. *(Author's summary)* E03

0356

15492 SINDHAN, G.S. and BOSE, S.K. **Epidemiology of angular leaf spot of French bean caused by *Phaeoisariopsis griseola*.** Indian Phytopathology 33(1):64-68. 1980. Engl., Sum. Engl., 9 Refs.

Phaseolus vulgaris. Isariopsis griseola. **Etiology. Climatic requirements. Timing. Planting. India.**

The disease angular leaf spot (*Phaeoisariopsis griseola*) appears in french bean crops in the Kumaon hills (India) from the beginning of July with peak damage from early Aug. to the middle of Sept. Under field conditions, RH and precipitation were more important for disease development than temp. Two-wk. old plants were not susceptible to disease. Three-wk. old plants were less susceptible than 4-, 5-, and 6-wk. old plants with 15-20 day old inoculum having 400-800 spores/ml. The best time for sowing french beans was found between April 1-May 15 to maximize yields. *(Author's summary)* E03

0357

15877 GOMES, J.C. and PORTO, M.D. DE M. **Avaliação da reação de 15 cultivares de feijão (*Phaseolus vulgaris* L.) a raça alfa de *Colletotrichum lindemuthianum* (Sacc. & Magn.) Scrib., em casa de vegetação.** *(Evaluation of the reaction of 15 bean cultivars to the alpha race of Colletotrichum lindemuthianum under greenhouse conditions)* Agronomia Sulriograndense (Porto Alegre) 16(1):67-77. 1980. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Strains. Host-plant resistance. Cultivars. Selection. Symptomatology. Brazil.**

An evaluation of disease reaction on leaves of 15 bean cv. to the α race of *Colletotrichum lindemuthianum* was performed, in 1976, under greenhouse conditions, using a modified grading scale and the McKinney disease index. A non-typical reaction was shown by some cv., which produced malformation and restricted growth. Increased resistance with age of plants was detected in 8 cv. Restriction of the disease development in the bean plants, as well as the absence of infected seeds, may be due to the low levels of air humidity and the lack of disease dissemination agents in the greenhouse. *(Author's summary)* E03

0358

15801 BARTHE, J.P., CANTENYS, D. and TOUZE, A. **Purification and characterization of two polygalacturonases secreted by *Colletotrichum lindemuthianum*.** Phytopathologische Zeitschrift 100:162-171. 1981. Engl., Sum. Engl., Germ., 17 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Strains. Identification. Enzymes. Analysis. Laboratory experiments.**

Two constitutive polygalacturonases, PG I and PG II, produced in vitro by *Colletotrichum lindemuthianum* (β race) were separated and purified by Sephadex G 100 filtration, chromatography on DEAE cellulose and hydroxylapatite. These 2 enzymes are homogeneous on SDS polyacrylamide gels. Their estimated mol. wt. are 70,000 for PG I and 37,000 for PG II. Measurement of viscosity decrease of polygalacturonic acid, release of reducing group and thin layer chromatography of digest products suggest that PG I is an expolygalacturonase (EC 3.2.1.67) and PG II an endopolygalacturonase (EC 3.2.1.15). These purified enzymes are able to degrade, in vitro, bean cell walls. *(Author's summary)* E03

0359

2848 NASH, S.M. and SNYDER, W.C. **Dissemination of the root rot *Fusarium* with bean seed.** Phytopathology 54:880. 1964. Engl., 4 Refs.

Phaseolus vulgaris. Fusarium spp. **Roots. Soils. Soil populations. Seed transmission.**

A plating technique to determine the presence of soil-borne *Fusarium* by the repeated washing of bean seeds with a 0.1% agar suspension is described. One portion of this wash liquid was dried to determine the approx. wt. of the soil and the other portion was plated on peptone agar to determine the no. and kinds of *Fusarium* present. *F. oxysporum* was prevalent in a var. of clones in the soil surrounding bean seed which had not been stored for long periods of time. Evidence indicated that this pathogen may be carried with bean seed, probably as chlamydospores along with saprophytic clones of *Fusarium* commonly found in fields where bean root rot is important. *(Summary by W.M.S. Trans. by L.M.F.)* E03

0360

15896 ARAUJO, E. **Características do progresso da ferrugem (*Uromyces phaseoli* var. *typica*) do feijoeiro (*Phaseolus vulgaris* L.) em algumas áreas produtoras do Estado da Paraíba.** [*Characteristics of the evolution of bean rust (Uromyces phaseoli var. typica) in the state of Paraiba*]. Agropecuária Técnica (Paraíba) 1(2):156-161. 1980. Port., Sum. Port., Engl., 14 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Incidence. Severity. Climatic requirements. Etiology. Brazil.**

Bean rust (*Uromyces phaseoli* var. *typica*) evolution was observed in the localities of Arara, Areia (physiographic zone of Brejo), Araruna (physiographic zone of Curimataú), Esperança, Remigio, and Solânea (physiographic zone of Agreste), state of Paraíba, Brazil. Indexes for the evaluation of this disease were incidence and severity. Infection rate was determined by theVan der Plank procedure. In all localities, infection rate of incidence was higher than infection rate of severity. In those areas where the rainfall favored disease incidence and severity, with higher initial values (Esperança and Solânea), infection rates during the rest of the growing period were at a min. In the localities of Arara, Areia, Araruna and Remigio, the initial values of incidence were low, however, after 1 wk. the incidence was equal to 100%, thus determining higher infection rates in these localities. *(Author's summary)* E03

0361

16063 PRING, R.J. **A fine-structural study of the infection of leaves of *Phaseolus vulgaris* by uredospores of *Uromyces phaseoli*.** Physiological Plant Pathology 17: 269-276. 1980. Engl., Sum. Engl., 41 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Electron microscopy. Leaves. Host range. Laboratory experiments.**

The infection of leaves of *Phaseolus vulgaris* by uredospores of *Uromyces phaseoli* followed the normal sequence for rust fungi. After germination the tip of the germ tube formed an appressorium over a stoma, through which an infection peg then penetrated the leaf. The stomata were unaffected by the fungus. Cell penetration followed the formation of a haustorial mother cell and its adhesion to a plant cell. The staining characteristics of the host wall were affected, and wall apposition formed inside the infected cell at the point of penetration. A fungal haustorium formed within the plant cell, and following tannic acid treatment during fixation, the extrahaustorial complex surrounding the haustorial wall was shown to consist of 2 layers. The surface spines of uredospores were formed in pockets of wall material below the surface of the immature spore, and consisted of fibrillar material aligned towards the tip of the spine. *(Author's summary)* E03

0362

16062 BAILEY, J.A., ROWELL, P.M. and ARNOLD, G.M. **The temporal relationship between host cell death, phytoalexin accumulation and fungal inhibition during hypersensitive reactions of *Phaseolus vulgaris* to *Colletotrichum lindemuthianum*.** Physiological Plant Pathology 17:329-339. 1980. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Host-plant resistance. Phytoalexins. Temperature. Plant tissues. Cytology. Hypocotyls. Strains. Statistical analysis.**

Resistance of bean hypocotyls to a compatible strain of *Colletotrichum lindemuthianum*, race γ, was induced by incubating inoculated hypocotyls at 16°C for 72 h, which allowed the formation of short infection hyphae, and then transferring them to 25°C. Incubation at 25°C led to premature death of the infected cell and inhibition of the fungus therein. This response, being similar to the hypersensitive reaction shown by beans to incompatible races of this fungus, was termed "temp. dependent hypersensitivity". The amount of fungal growth which occurred during resistance to race γ was much greater than that during normal hypersensitivity and this enabled measurements to be made of the lengths of intracellular hyphae throughout the resistance process (from the time of transfer to 25°C until cessation of fungal growth). Comparative measurements of fungal growth, of the onset and development of host necrosis and of the amounts of phytoalexin within the infected tissue indicated that death of infected cells occurred several hours before phytoalexins formed and that inhibition of hyphal growth occurred shortly after the phytoalexins began to accumulate. These findings are consistent with the view that accumulated phytoalexins are responsible for restricting growth of intracellular hyphae during resistance of beans to *C. lindemuthianum*. *(Author's summary)* E03

0363

16061 BAILEY, J.A. and ROWELL, P.M. **Viability of *Colletotrichum lindemuthianum* in hypersensitive cells of *Phaseolus vulgaris*.** Physiological Plant Pathology 17:341-345. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Host-plant resistance. Inoculation. Plant tissues. Hypocotyls. Cytology. Phytoalexins. Laboratory experiments.**

Growth of *Colletotrichum lindemuthianum* was greatly restricted within hypersensitive cells of bean hypocotyls. Sections of infected tissue, taken 7 or 14 days after inoculation, were incubated on a nutrient agar medium and in some expt. also on water agar or on glass. Microscopical examinations of stained sections showed that regrowth of the inhibited hyphae occurred within 15-30 h. Hyphae of race γ, which elicited a hypersensitive response at 25 but not at 16°C, were large and colonized both the originally infected cell and several contiguous cells extensively before growing through the remainder of the tissue. Hyphae of race β did not extensively colonize any cells but grew directly through the tissue. Results prove that hyphae within resistant cells remain alive despite the presence of large amounts

of potentially fungicidal isoflavonoid phytoalexins. A possible explanation of this apparent contradiction is discussed. *(Author's summary)* E03

0364

15805 HUNTER, J.E., DICKSON, M.H. and CIGNA, J.A. **Limited-term inoculation: a method to screen bean plants for partial resistance to white mold.** Plant Disease 65(5):414-417. 1981. Engl., Sum. Engl., 12 Refs.

Phaseolus vulgaris. Whetzelinia sclerotiorum. **Host-plant resistance. Inoculation. Selection. Timing.**

Partial resistance to white mold (*Sclerotinia sclerotiorum*) was detected in *Phaseolus vulgaris* and *P. coccineus* with a screening technique referred to as limited-term inoculation. Pieces of autoclaved celery colonized by the fungus were attached to the stems of 2-to-5-wk. old bean plants for a limited length of time, depending on the age of the plants and the conditions under which they had been grown. When infection periods of 12, 18, and 24 h were used, 2-wk.-old plants of *P. vulgaris* Bush Blue Lake 47 and Black Valentine were ranked as susceptible and partially resistant, resp., and *P. coccineus* Tenderpod was ranked as resistant. These rankings agree with other greenhouse and field observations. An ascosporic inoculation method gave variable results, and escapes occurred. Although high levels of resistance were not found in *P. vulgaris,* the limited-term inoculation method is sensitive and rapid enough to use to select for partial resistance. The method also has the advantage of not requiring plants to be in bloom or the production of ascospores for inoculum. *(Author's summary)* E03 G00

See also 0216 0453 0469 0475 0580

E04 Viroses

0365

2855 WALTERS, H.J. **Transmission of southern bean mosaic virus by the bean leaf beetle.** Plant Disease Reporter 48(12):935. 1964. Engl., 7 Refs.

Phaseolus vulgaris. Cerotoma trifurcata. **Disease transmission. Viroses. Vectors.**

The bean leaf beetle *Cerotoma trifurcata* is a vector of the BPMV and the Arkansas cowpea mosaic virus (ACMV), both pathogens of beans. With the objective of studying the transmission of the SBMV by these insects, beetles were isolated during 48 h without food and afterwards were allowed to feed for 48 h on infected plant tissue. The beetles were then transferred to bean plants cv. Black Valentine for testing. Results showed that SBMV is transmitted by beetles and was retained by the insect for at least 5 days after being adquired through feeding. *(Summary by C.P.G. Trans. by L.M.F.)* E04 F00

0366

4571 BALLANTYNE, B. **Summer death of beans.** Agricultural Gazette of New South Wales 82(5):295-297. 1971. Engl., Illus.

Phaseolus vulgaris. Orosius argentatus. **Bean summer death. Vectors. Disease transmission. Host-plant resistance. Cultivars.**

Bean summer death is caused by a virus or mycoplasma, which is transmitted by the leafhopper *Orosius argentatus.* Symptoms appear 1-2 wk. after hot weather and may occur at any stage of growth. Seedlings collapse and die without showing other symptoms. In adult plants the 1st sign is plant yellowing; in later stages a discoloration of the vascular system occurs in the root and lower stem. Because of the differences in var. reaction, research has been carried out to find resistant var., among them: Apollo, Canyon, Idachief, Jackpot, Tendergreen and Valgod. *(Summary by C.P.G. Trans. by L.M.F.)* E04 F00

0367

4691 BALLANTYNE, B. **Bean summer death.** *In* Bean Improvement Cooperative. Annual report no. 13:32-34. 1970. Engl.

Phaseolus vulgaris. **Cultivars. Bean summer death. Host-plant resistance. Australia.**

A list is presented of 80 lines of beans and their reaction to the disease known as bean summer death, occurring in Australia. *(Summary by C.P.G. Trans. by L.M.F.)* E04

0368

4840 SMITH, P.R. **A disease of dwarf beans caused by subterranean clover stunt virus.** *In* Bean Improvement Cooperative. Annual Report no. 9. 1966. pp.37-38. Engl.

Phaseolus vulgaris. **Subterranean clover stunt virus. Disease transmission. Vectors. Host-plant resistance. Cultivars.**

A disease caused by the subterranean clover stunt virus (SCSV) was reported in dwarf beans in SE Victoria (Australia). First symptoms consisted of a severe epinasty and thickening of the trifoliate leaves, which were small and chlorotic. The virus is transmitted by insects such as *Aphis craccivora, Myzus persicae* and *Macrosiphum euphorbiae.* Cv. Tendergreen, Epicure, Brown Beauty and Windsor Long Pod were the most affected. The symptoms in all host plants were similar: stunted growth, shortened internodes and chlorosis of the foliage. *(Summary by C.P.G. Trans. by L.M.F.)* E04

0369

4709 BALLANTYNE, B. **Transmission of summer death of beans.** Australian Journal of Science 31:433-434. 1969. Engl., 14 Refs., Illus.

Phaseolus vulgaris. Orosius argentatus. **Bean summer death. Diseases and pathogens. Disease transmission. Vectors. Australia.**

Bean summer death, a disease observed in Australia, was 1st described in 1968. With the object of studying disease transmission by the leafhopper *Orosius argentatus,* 20 specimens of the insect were isolated in cages and were fed diseased plants, cv. Tendergreen. The leafhoppers were later transferred to a plant of the susceptible cv. Tendercrop; 15 days later the cv. showed the characteristic symptoms of the disease: yellowing, curling of the leaves, vascular discoloration and wilting. A subsequent trial with *O. argentatus* insects collected at different sites of Australia showed their capacity as a vector of the disease. Whether the causal agent is a virus or mycoplasma is still to be determined. *(Summary by C.P.G. Trans. by L.M.F.)* E04 F00

0370

14752 FRIES, R.E. **Influence of bean yellow mosaic and tomato ringspot viruses on elemental content of bean,** *Phaseolus vulgaris* **L.** Ph.D. Thesis. University Park. The Pennsylvania State University, 1973. 70p. Engl., Sum. Engl., 35 Refs., Illus.

Phaseolus vulgaris. **Bean yellow mosaic virus. Viroses. Composition. Nutritional requirements. Minerals and nutrients. Analysis. Seeds. Germination. Nutrient solution. pH. Experiment design. Statistical analysis.**

Greenhouse nutrient solution culture expt. were conducted to study the influence of isolates of BYMV and tomato ringspot virus on elemental content of kidney bean plant parts. A modified Hoagland solution at 1x and 2x levels was used. Primary leaves were inoculated 11-12 days after sowing; root, stem and leaf samples were harvested approx. 2 and 3 wk. after inculation. Fresh and dry wt. of samples were recorded. Concn. and total amounts of N, P, K, Ca, Mg, Mn, Fe, Cu, B, Zn, Al, and Na were determined. Measurements of changes in nutrient solution pH, conductivity, vol. and P, K, Ca, Mg, Mn, and B were made. All isolates examined reduced both fresh and dry wt. of plants. Quantitative and qualitative differences in root system growth and development were observed. Plants grown in 2x solution tended to be somewhat smaller than comparably treated 1x solution grown plants. Solution measurements showed that the overall affects of all treatments were an increase in solution pH and conductivity but a decrease in solution vol. Control solution vol. decreased more while pH's and conductivities increased more than was observed for solutions containing virus infected plants. Control plants absorbed more total P, K, Ca, Mg, Mn, and B from the solutions than inoculated ones. Data on elemental composition clearly indicated that important changes in the nutrient content of bean plants occurred as a result of virus infection. The higher concn. and total amounts of Mn in virus-infected plant parts than in tissues from control plants and the possible association between plant K levels and the amounts of water absorbed by roots were of special interest. However, findings were difficult to interpret or generalize. Observed interactions included: virus and/or isolate x plant part sampled x time of sampling x nutrient solution concn. x element. *(Author's summary)* E04 C03

0371

14282 ROSEN, C.J., BERGMAN, E.L. and SMITH, S.H. **Leaf elemental composition and bean yellow mosaic virus interrelationships in *Phaseolus vulgaris* L.** Journal of Plant Nutrition 2(3):283-303. 1980. Engl., Sum. Engl., 23 Refs.

Phaseolus vulgaris. **Bean yellow mosaic virus. Composition. Mineral deficiencies. Plant physiological disorders. Plant tissues. Leaves. Plant development. Analysis. USA.**

Two greenhouse sand culture expt. were conducted to investigate the influence of BYMV on growth and elemental composition of Dark Red Kidney beans. Virus concn. within infected beans increased rapidly between 4-8 days after inoculation. Symptom expression, growth reductions, and changes in the elemental composition of infected plants were associated with this increase. Virus distribution within the plant varied with the position of the trifoliate leaf or plant part sampled. In addition, symptom expression on the trifoliate leaves at different positions on the plant varied greatly. Changes in the plant nutrient element levels caused by virus infection were 1st detected 8 days after inoculation. Ca and Mg concn. were significantly lower in basal leaves of infected plants than in corresponding tissue from controls. In contrast, Mn and Zn tended to concentrate in infected trifoliate leaves. Total accumulation of individual elements in samples of infected 2nd and 3rd trifoliates was significantly reduced by BYMV. The lower total accumulation of elements in infected trifoliates reflected dry wt. reductions due to virus infection. Symptom expression did not appear to be correlated to an imbalance of any one specific element. *(Author's summary)* E04 C00

0372

13597 BOS, L. and BENETTI, M.P. **Direct electron microscopy and serology with plant viruses in leaf material dried and stored over calcium chloride.** Netherlands Journal of Plant Pathology 85(6):241-251. 1979. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Viroses. Disease transmission. Electron microscopy. Leaves. Storage.**

Most of 43 viruses could be readily detected in 53 out of 66 leaf samples stored over $CaCl_2$ for varying periods. Detection usually was with phosphotungstic acid, pH 6.5, but alfalfa mosaic, cucumber mosaic and tomato aspermy viruses required pH 3-4. BCMV, cowpea aphid-borne mosaic and cowpea mosaic viruses were also easily observed in newly dehydrated samples from Morocco and Tanzania. Broad bean wilt, cowpea mosaic and cucumber mosaic viruses were detected with agar gel-diffusion tests in dry leaf material ground in buffer. The serological assay demonstrated a high concn. of cucumber mosaic virus in leaf material dried over $CaCl_2$ 20 yr earlier. *(Summary by Review of Plant Pathology)* E04

0373

14755 MOGHE, P.G. **Influence of heat and systemic chemicals on the multiplication of bean common mosaic virus.** Ph.D. Thesis. University Park, The Pennsylvania State University, 1974. 74p. Engl., Sum. Engl., 84 Refs., Illus.

Phaseolus vulgaris. **Bean common mosaic virus. Physical control. Heat treatment. Chemical control. Plant-growth substances. Host range. Inoculation. Electron microscopy. Symptomatology. Serology. Leaves.**

Studies were carried out on effects of heat and systemic chemicals on multiplication of BCMV in *Phaseolus vulgaris* cv. Bountiful. Two isolates designated as Type and NY15 strains of BCMV were obtained from the Agricultural Expt. Station, Geneva, New York (USA), and used in these studies. The isolates exhibited similar properties with regard to thermal inactivation point, dilution end point and longevity in vitro. The virus particles were flexous filaments, 745-753 nm long and 15 nm wide. Both isolates were serologically related and cross protected each other in Bountiful bean. *Vigna sinensis* cv. Blackeye, *Phaseolus*

lunatus cv. Henderson's Baby Lima, *Chenopodium quinoa*, and *C. album* gave differential reaction to infection by the 2 isolates. Both isolates induced discrete necrotic local lesions on inoculated primary leaves of *P. vulgaris* cv. Monroe. The trifoliate leaves of Monroe also gave a similar response on inoculation. This host was used for bioassay of virus multiplication. Preconditioning of bean seedlings prior to inoculation was found necessary for increased sustenance at higher temp. Heat treatment at 35°C (20 days) resulted in mild mosaic and low seed transmission as against that in plants treated for varied durations at 30, 37, 40, or 45°C. Treatment at 37 and 40°C induced a local lesion response in the inoculated primary leaves of Bountiful bean against Type and NY15 infections, resp. However, localization did not restrict either infection from becoming systemic. GA, oxycarboxin and carboxin delayed and significantly reduced multiplication of either strain when applied as foliar spray. Benomyl, thiabendazole, and kinetin in similar trials had no effect on virus multiplication. The effect of chemicals is considered to be due to a host mediated response. *(Summary by Dissertation Abstracts International)* E04

0374

14221 KITAJIMA, E.W. **Citopatologia e localização de vírus de milho e de leguminosas alimentícias nas plantas infetadas e nos vectores.** *(Cytopathology and localization of viruses affecting maize and some food legumes in Latin America).* Fitopatologia Brasileira 4(2):241-254. 1979. Port., Sum. Port., Engl., 44 Refs. Illus.

Phaseolus vulgaris. Viroses. Cytology. Electron microscopy. Etiology. Brazil.

A brief literature review is presented on the different types of viruses, mycoplasma-like organisms, and cytologic studies on the infections caused by them in 3 different species of plants *(Phaseolus vulgaris, Zea mays,* and *Vigna unguiculata).* Information is given to help diagnose the diseases caused by these viruses. *(Summary by C.P.G. Trans. by L.M.F.)* E04

0375

3681 HUBBELING, N. **Inheritance and interaction of genes for disease resistance in beans** *(Phaseolus vulgaris* L.). Recent Advances in Botany 1961:438-443. 1971. Engl., 14 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. Races. *Pseudomonas phaseolicola.* Bean yellow mosaic virus. Bean common mosaic virus. Host-plant resistance. Genes. Hybridizing.

A special selection scheme was developed in the Netherlands to determine multiple resistance to the following diseases: anthracnose *(Colletotrichum lindemuthianum);* halo blight *(Pseudomonas phaseolicola);* common bean mosaic; yellow bean mosaic; and stipple streak virus. The results obtained by several researchers with 4 groups of physiological races of *C. lindemuthianum* are discussed and consecutive trials during at least 4 generations are necessary to avoid unexpected interactions of genes of host plants with genes of different races of the parasite. Regarding *P. phaseolicola,* it was confirmed that the symptom expression is highly governed by temp. conditions. It was concluded that at least 16 genes are desired for resistance to these 5 diseases, making it impossible to find them in one plant of the 2nd generation of crosses between 2 var., which mutually possess resistance to 5 diseases. To gradually increase the no. of desired genes, a special scheme for selection and mutual recombination of resistant plants is needed. *(Summary by I.B. Trans. by L.M.F.)* E04

0376

14368 GRASSO, S. **Investigations on the action mechanism of a virus inhibitor from** *Phytolacca americana.* Rivista di Patologia Vegetale 13(4):77-84. 1977. Engl., Sum. Engl., Itl., 21 Refs.

Phaseolus vulgaris. **Bean southern mosaic virus. Virus inhibition. Disease control. Inoculation. Leaves.**

A protein isolated from *Phytolacca americana* has inhibited the transmission of southern bean mosaic virus (SBMV) and cowpea mosaic virus (CPMV) when inoculated resp. on bean and *Chenopodium amaranticolor* plants. The activity resulted to be related both with the concn. of the inhibitor and with the intervals of time between its application and the virus inoculations. A mixture of SBMV and the inhibitor has given no infection on the test plants but the infectivity was partially regained after separating its components by a washing process phosphate buffered saline and differential centrifugation. On the basis of such results it has been concluded that the inhibitor can explicate its activity also in vitro, apparently as a consequence of an ionic bond between virus and inhibitor. A partial interference of the inhibitor on virus particles in the 1st stages of their replication seems also to occur. *(Author's summary)* E04

0377

14215 JAGER, C.P. DE and BREEKLAND, L. **Evidence for intrastrand complementation in cowpea mosaic virus infection.** Virology 99:312-318. 1979. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Viroses. Cytogenetics. Genetics. RNA. Laboratory experiments. Leaves. Etiology.**

In supplementation tests both middle component (M)-RNA and bottom component (B)-RNA of cowpea mosaic virus mutant N142 were shown to carry mutations affecting local symptoms in bean cv. Pinto U1114 and cowpea. The M- and B-RNA mutations were separately incorporated into the 2 reciprocal hybrids of N142 and wild-type Sb, designated as $M_{142}B_{Sb}$ and $M_{Sb}B_{142}$. Mixtures of the 2 hybrids induced normal local symptoms in bean and cowpea as a result of reassortment of components. This was also the case with a mixture of $M_{Sb}B_{142}$ and mutant N123. The latter mutant was earlier shown to contain a M-RNA mutation for defective symptom expression in bean and cowpea. Although both $M_{142}B_{Sb}$ and N123 carried M-RNA mutations, mixtures of these isolates induced normal local symptoms. Subculturing showed no wild-type virus to be present in the inoculated leaves. Thus, intrastrand complementation was assumed to result in restoration of normal symptom production. It is concluded that the results of genetic mixing expt. with multicomponent plant viruses must be interpreted cautiously. Subculturing expt. should be performed to determine whether restoration of wild-type symptoms results from exchange of nonmutated components or from intrastrand complementation. *(Author's summary)* E04 G02

0378

15810 CANER, J. *et al.* **Avaliação dos danos causados pelo vírus do mosaico dourado do feijoeiro (VMDF), em três regiões do Estado de São Paulo.** *(Evaluation of the damage caused by the bean golden mosaic virus (BGMV), under field conditions, in three different areas of the state of São Paulo).* Biológico (Sao Paulo) 47(2):39-46. 1981. Port., Sum. Port., Engl., 12 Refs., Illus.

Phaseolus vulgaris. **Bean golden mosaic virus.** *Bemisia tabaci.* **Crop losses. Yields. Yield components.**

The damage caused by BGMV showed an unequal distribution of the disease 50-60 days after sowing: 16, 92, and 91% of infection in Sales Oliveira, Monte-Mor and Ourinhos, Brazil, resp. A relationship between whitefly infestation (evaluated by counting the no. of eggs on the underside of a certain leaflet) and the infection % could not be established. At the

end of the expt., the total and av. no. of normal and distorted pods as well as the total and av. no. of normal, and abnormal and aborted seeds were evaluated. The production of normal pods and seeds was greater in Sales Oliveira than in Monte-Mor, while in Ourinhos production was null. This was probably due to the fact that in Sales Oliveira the % of infection, approx. 2 mo. after sowing, was relatively low (16%). *(Author's summary)* F04

0379

3981 HONDA, Y., YAMAGUCHI, A. and MATSUI, C. **A variety of bean suitable for cytological investigation with southern bean mosaic virus.** Phytopathology 58: 1436. 1973. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Bean southern mosaic virus. Cytology. Cultivars. Symptomatology.**

Bean var. Bountiful was used for systemic infection by BSMV. Although it was possible to recover the virus from BSMV-infected Bountiful bean, systemically infected plants sometimes revealed chlorosis and systemic vein necrosis, and the leaves were apt to drop off. These unfavorable characters were more severe in mixed infections by BSMV and the tobacco mosaic virus strain b (TMV-b). No chlorosis, external necrosis, or fallen leaves were observed in Otebo bean plants (common in Japan and used in bioassays of the common strain of TMV) even when Otebo bean was infested systemically by SMBV and TMV-b. The use of Otebo bean is recommended as an effective systemic plant for cytological investigations with BSMV. *(Summary by W.M.S. Trans. by L.M.F.)* F04

0380

14751 DAS, P.D. **Interaction between structural components in virions of Southern bean mosaic virus.** Ph.D. Thesis. Columbia, Missouri, University of Missouri, 1974. 143p. Engl., Sum. Engl., 69 Refs., Illus.

Phaseolus vulgaris. **Bean southern mosaic virus. Proteins. Virus inhibition. Biochemistry. Analysis. Laboratory experiments.**

BSMV preparations became markedly opalescent and virions aggregated when dialyzed against deionized water. Water-dialyzed BSMV kept unfrozen (4°C) resembled virions maintained in 0.02 *M* phosphate buffer pH 7.0, in sedimentation value (115 S), UV absorption, serology, as well as resistance to proteolytic enzymes, protein denaturants including detergents, and ribonuclease. However, infectivity of unfrozen virions was ca. 2/3 that of the buffer-maintained BSMV. Addition of Mg^{2+} to water-dialyzed BSMV caused disappearance of opalescence and virion dispersion, but did not cause any additional effect. Irreversible alterations occurred in several characteristics when water-dialyzed virions were frozen, maintained at -17°C for at least 7 days, and then thawed. Frozen:thawed BSMV sedimented symmetrically at 98-100 S. Its serological titer was reduced by ½. Such virions became sensitive to treatment with SDS, sodium desoxycholate, formamide (2.5 *M*), urea (2.0 *M*), NaCl (1.0 *M*) and proteolytic enzymes (pronase, trypsin, chymotrypsin), but not ribonuclease. Infectivity of frozen:thawed BSMV was only 1/3 of unfrozen virions. The specific infectivity of RNA isolated from frozen:thawed virions, however, was comparable to RNA isolated from buffer-maintained or unfrozen BSMV. Polyacrylamide gel electrophoresis showed that freeze:thawing did not cause fragmentation of capsid protein. Virions were protected from freezing damage when Mg^{2+}, NaCl or sucrose was added prior to but not after freeze:thawing. Encapsidated and "free" BSMV-RNA's were rapidly inactivated with hydrozylamine-HCl (HA) and sodium bisulfite (SBS) treatment. Macromolecular integrity of BSMV or isolated viral RNA's was not significantly affected even with prolonged exposure (7 days) to SBS. Furthermore, the extent of cytidylic acid deamination of encapsidated and "free" BSMV-RNA with SBS was identical. Apparently, in situ BSMV-RNA, in contrast to TMV-RNA, does not exhibit any intimate or extensive association with the coat protein. Results suggest that freeze:thawing of BSMV alters capsid stability and virion conformation. *(Summary by Dissertation Abstracts International)* F04

0381

14786 YOSHII, K. **El mosaico dorado de fríjol en el Golfo Centro de México.** *(Bean golden mosaic in the Golfo Central of Mexico).* Veracruz, México, Instituto Nacional de Investigaciones Agrícolas, 1981. 7p. Span., Sum. Span., 5 Refs.

Paper presented at Reunión Anual de PCCMCA, 27a., Santo Domingo, República Dominicana, 1981.

Phaseolus vulgaris. **Bean golden mosaic virus.** *Bemisia tabaci.* **Cultivars. Host-plant resistance. Plant breeding. Selection. Mexico.**

BGMV (transmitted by the whitefly, *Bemisia tabaci*)- tolerant bean material were evaluated under field conditions in n. Veracruz, Mexico in 1980. Materials were obtained by a collaborative project between the Instituto de Ciencia y Tecnología Agrícolas (ICTA) in Guatemala and the Centro Internacional de Agricultura Tropical (CIAT) in Colombia. Mexican var., Jamapa, Laguna Verde, Negro Primavera, and Mantequilla Tropical were similar in susceptibility to Rabia de Gato, a local material considered as the most susceptible in Guatemala. Tolerant Guatemalan var. ICTA-Quetzal, ICTA-Jutiapan, and ICTA-Tamazulapa were tolerant to BGMV in Mexico. Under a severe BGMV attack, line D-145 resulted even more tolerant than those already mentioned. This line was also tolerant to other diseases such as rust (*Uromyces appendiculatus*), angular leaf spot (*Isariopsis griseola*), and anthracnose (*Colletotrichum lindemuthianum*). More than 800 families F_4, from 94 crosses among the best lines, were subjected to progeny trials; 6 were even more promising than line D-145; this suggests that lines with high levels of tolerance can be obtained by the accumulation of tolerant genes by crosses between more tolerant lines of different genetic composition. *(Author's summary. Trans. by L.M.F.)* F04

0382

3963 WILSON, V.F. and DEAN, L.L. **Flour of infected bean seed as a source of virus.** Phytopathology 54:489. 1964. Engl., 3 Refs.

Phaseolus vulgaris. **Bean common mosaic virus. Virus transmission. Seeds. Inoculation. Laboratory experiments.**

Three lots of bean seed were used to study the mechanical transmission of virus: a lot of virus-free Red Mexican bean seed; another lot of the same var. obtained from plants showing distinct symptoms of bean virus 1, type strain BV_1; and the 3rd lot was produced from Pinto UI-111 plants infected with bean virus 1, A strain (BV_1 A). The particular strain of virus in each instance was verified by inoculating differential var. A sample from each of the 3 seed lots was chopped and used in transmission studies; both virus-infected and virus-free seed were stored at approx. 2°C for 31 mo. before further inoculations were made. The inoculum was prepared by mixing 1 part bean flour with 2 parts distilled water. Virus-free Red Mexican bean seedlings were used as controls. The inoculum was tested by inoculating 108 plants grown in the greenhouse. The primary and partially-expanded 1st trifoliate leaves were dusted with 320-mesh silicon carbide. The inoculum was applied by gently rubbing the paste on the leaves. All plants developed symptoms of virus infection, except those inoculated with flour prepared from virus-free bean seed. Flour prepared from infected seed provided an efficient source of inoculum for a seedborne virus infecting beans. *(Summary by W.M.S. Trans. by L.M.F.)* F04

0383

15413 THOMAS, J.E. and BOWYER, J.W. **The purification and identification of tobacco yellow dwarf and bean summer death viruses.** Australasian Plant Pathology 8(3):36-38. 1979. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Snap bean. Bean summer death virus. Analysis. Identification. Plant vascular system. Disease transmission.** *Orosius argentatus.*

Preparations from *Datura stramonium* plants infected with TYDV (tobacco yellow dwarf virus) and BSDV (bean summer death virus) strains 1 and 2 continued similar isometric particles ca. 20 nm in ϕ which occurred predominantly in pairs. Both viruses produced identical cytopathological effects in the french bean cv. Spartan Arrow, occur only in the phloem of infected plants, have the same leafhopper vector and are related serologically. It was concluded that they are strains of the same virus. *(Summary by Review of Plant Pathology)* E04

0384

16088 FLORES, E.M. and MARIN, W.A. **Morphological changes in bean leaves (*Phaseolus vulgaris* L.) induced by rugose mosaic virus infection.** Revista de Biología Tropical (Costa Rica) 28(1):121-133. 1980. Engl., Sum. Engl., Span., 20 Refs., Illus.

Phaseolus vulgaris. **Bean rugose mosaic virus. Leaves. Symptomatology. Plant injuries. Cell structure. Chloroplast. Plant tissues. Electron microscopy.**

Electron and light microscopy show that the foliar tissues of beans affected by BRMV disease undergo strong histologic and cytologic changes. The leaf blade is rugose and irregular, the stomata are malformed, the cuticle is striated, the mesophyll is packed, and the intercellular spaces are missing. There are few, small and clear-colored chloroplasts; occasionally, they are degenerated. Sclerotic cells filled with phenolic substances are frequently found in severely affected areas. There is a general lack of correlation between growth of the organ and development of the tissues. Hypertrophy, hyperplasia, hypoplasia, and eventual necrosis are the outstanding characteristics of this viral infection. *(Author's summary)* E04

0385

16060 BAILISS, K.W. and PLAZA-MORALES, G. **Effects of postinoculation leaf water status on infection of French bean by tobacco necrosis virus.** Physiological Plant Pathology 17:357-367. 1980. Engl., Sum. Engl., 32 Refs., Illus.

Phaseolus vulgaris. **Tobacco necrosis virus. Leaves. Water content. Disease control.**

A rapid but transient postinoculation increase in leaf water deficit increased tobacco necrosis virus lesion no. in detached and attached leaves of *Phaseolus vulgaris.* Increase in lesion no. in detached leaves was proportional to the degree of water stress and only occurred when stress was imposed within 3 h of inoculation and when infectible sites were abundant. Infectible sites disappeared at similar rates in stressed and unstressed leaves. Lesion no. were unaffected in leaves inoculated after stress and restoration of the prestress leaf water potential. Leaf detachment per se and a rapid postinoculation increase in leaf water potential reduced lesion production. It was concluded that postinoculation changes in leaf water balance exert an effect on the very early stages in the infection process, probably by affecting passive virus entry into abraded epidermal cells via leaf water fluxes. *(Author's summary)* E04

0386

11685 DIAZ CH., A. DE J. Enfermedades virosas. *(Viral diseases). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.192-225. Span., 44 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Viroses. Disease transmission. Vectors. Disease control. El Salvador.**

A study on viral diseases is given: the 1st part deals with the general principles of plant viruses (types, symptoms on foliage, flowers, fruits, stems, and roots, mechanical and biological

virus transmission, and disease control) and the 2nd with the major viral diseases of grain legumes, including beans, and maize in El Salvador. Viral diseases on grain legumes (golden mosaic, common mosaic, bean rugose mosaic, bean southern mosaic, bean chlorotic mottle, cowpea mosaic) and viral diseases on maize (stunting, fine streaking) are discussed. Information on geographic distribution, symptomatology, transmission, and control methods is given for both. *(Summary by W.M.S. Trans. by L.M.F.)* E04

See also 0213

E05 Nematodes

0387

13600 JOHNSON, A.W. *et al.* **Effects of film mulch, trickle irrigation, and soil pesticides on nematodes and yield of polebean.** Plant Disease Reporter 63(5): 360-364. 1979. Engl., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris. Nematodes. Nematode control. Yields. Soil population. Roots. Irrigation.

Polebeans were grown in field plots of Tifton loamy sand naturally infested with ring *(Criconemoides ornatus)*, stubby-root *(Trichodorus christiei)*, and root-knot *(Meloidogyne incognita)* nematodes. Trickle-irrigated plots were treated various soil pesticides and left exposed or covered with biodegradable paper film mulch with trickle irrigation. Soil was assayed for nematodes and plant roots were examined for root galls. Ring or stubby-root nematodes at the existing populations did not affect growth or yield of plants. Fewer root-knot nematodes were recovered from soil treated with DD-MENCS (with and without film mulch), ethoprop, sodium azide + ethoprop, or methyl bromide-chloropicrin (2:1) (MBR-CP) (all with film mulch) than from nontreated soil. Roots of plants in plots treated with DD-MENCS (with and without film mulch) and MBR-CP + film mulch were free of galls 105 days after planting. Sodium azide, ethoprop, sodium azide + ethoprop, and metham were less effective than DD-MENCS or MBR-CP in controlling root-knot nematodes. Chloroneb or chloroneb + benomyl was not effective. Plant growth and yield were greatest when root-knot nematodes were controlled. Yield was increased over 2-fold by DD-MENCS in nonmulched plots and 3-fold in film-mulched plots treated with DD-MENCS or MBR-CP in comparison with yields from nonmulched control plots. Film mulch alone doubled yields in nontreated plots. *(Author's summary)* E05

0388

14748 SANTOSO, I. **The effect of various factors on the expression of genetic resistance to root-knot nematode** *(Meloidogyne incognita* (Kofoid and White) Chitwood) in snap-bean *(Phaseolus vulgaris* L.), tomato *(Lycopersicon esculentum* Mill.), soybean *(Glycine max* Merr.), and lima bean *(Phaseolus lunatus* L.). Ph.D. Thesis. Honolulu, Hawaii, University of Hawaii. 1973. 111p. Engl., Sum. Engl., 111 Refs., Illus.

Phaseolus vulgaris. Meloidogyne incognita. Host-plant resistance. Genes. Genetics. Roots. Soil temperature. Inoculation. Planting. Field experiments. Ecology. Climatic requirements. Cultivars. Hawaii.

Cv. of vegetables resistant and tolerant to root-knot nematode *(Meloidogyne incognita)* bred in Hawaii were tested to determine the factors which lower the effectiveness of the resistance. Emphasis was placed on possible formation of pathogenic races of *M. incognita* which could result from continuous cropping of resistant cv. and the effect of high soil temp. on expression of resistance. Cv. tested were Manoa Wonder snap bean, Healani tomato, Kailua soybean, and White Ventura N lima bean. Field tests were conducted in 3 root-knot nematode infested fields (fields P-1, P-2, and Q-1) at the Poamoho Exptl. Farm where galling of the resistant cv. had occurred. Tests were conducted throughout the yr to obtain

seasonal effects on the performance of the cv. Root-knot nematode populations established in the greenhouse on a susceptible tomato cv. from galled roots of both resistant and susceptible cv. from fields P-2 and Q-1. These were used in tests to investigate the formation of a more virulent race of root-knot nematode, the effect of soil temp. and level of inoculum on the rate of galling, and the development of a root-knot nematode population which can parasitize resistant cv. of more than one crop. Data used to measure the resistance were the gall formation and egg-mass production of the root-knot nematode on the plant roots. Manoa Wonder snap bean showed considerably increased galling when exposed to the field P-2 *M. incognita* population. This population showed an increase in pathogenicity on Manoa Wonder under continuous planting. No increase of pathogenicity was observed in the field Q-1 population. Effectiveness of the genetic resistance was reduced when the soil temp. was kept at 29° ± 1°C, but was effective under fluctuating soil temp. (21° - 33°C), although scattered galls were sometimes found. The attempt to induce a root-knot nematode population which is able to parasitize more than 1 resistant cv. was not successful. *(Author's summary)* E05

0389

15824 SINGH, D.B. *et al.* **Cultivars of French bean resistant to root-knot nematode, *Meloidogyne incognita*, in India.** Tropical Pest Management 27(1):29-31. 1981. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. Meloidogyne incognita. **Host-plant resistance. Cultivars. Snap bean. Selection. Field experiments. India.**

Root-knot nematode, *Meloidogyne incognita*, can limit production of french beans. The cheapest and best method of control is the use of resistant var. Although screening for resistance has been carried out in different parts of the world no such work has been carried out in India. The screening and evaluation of 302 cv. of french bean for resistance to *M. incognita* in replicated trials in the field and glasshouse under Indian conditions is described. Results showed 31 cv. were resistant in both field and glasshouse conditions while 64 cv. were moderately resistant. These 95 cv. will be important to breeders interested in nematode-resistant cv. of french bean. *(Author's summary)* E05 G00

0390

11682 ESCOBAR, J.A. **Nemátodos asociados al maíz y fríjol.** *(Nematodes associated with maize and beans). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centró Nacional de Tecnología Agropecuaria, 1976. pp.306-333. Span., 25 Refs., Illus.

Phaseolus vulgaris. Zea mays. Nematodes. *Pratylenchus* spp. *Trichodorus* spp. *Meloidogyne* spp. Nematode control.

A nematological study conducted in El Salvador, based on samples of soil cultivated with maize and beans, is reported. The concept of nematology is defined and the morphology, internal structures, reproductive apparatus, biological cycle, ways of feeding, plant-parasite relation, and forms of dissemination are described. The genus of identified nematodes, root lesion nematode (*Pratylenchus* spp.) and stubby root nematode (*Trichodorus* spp.) on maize and root knot nematode (*Meloidogyne* spp.) on beans are given along with general aspects, mechanical and physiological damage to foliage and roots, plant response to nematode attack (immunity, tolerance, intolerance, resistance, susceptibility), resistance mechanisms of the plant (external, superficial, internal); control by cultural practices and other methods; nematocide application (advantages and disadvantages). Tables are included on damage, nematocides, and nematode attack of root knots. *(Summary by W.M.S. Trans. by L.M.F.)* E05

0391

14758 ITAM, R.A. **Influence of nematode population density and soil temperature on the reproduction and pathogenicity of the lesion nematode, *Pratylenchus penetrans*, on the common bean, *Phaseolus vulgaris*.** Ph.D. Thesis, New Brunswick, New Jersey, Rutgers University, 1972. 126p. Engl., Sum. Engl., 62 Refs., Illus.

Phaseolus vulgaris. Pratylenchus. **Nematodes. Soil population. Soil temperature. Soil requirements. Mineral and nutrients. Host-plant resistance. Cultivars. Planting.**

In preliminary pathogenicity tests, 8 greenhouse-grown cv. of the common bean, exhibited equivalent tolerance to nematode damage 35 days after infection with 3000 *Pratylenchus penetrans*/plant. Overall plant growth was maintained despite the infection; and the final nematode population densities were 37% to 77% higher than the initial densities. Two of the snap bean cv., Astro and Greenpod 64467, differing in relative plant size and host suitability, were selected for further studies. Invasion tests, performed at soil temp. of 22°, 27°, and 32°C in 3 constant-temp. tanks, showed seedling tolerance to *P penetrans* 7 days after infestation with nematodes at initial densities of 500, 1500, and 5000 nematodes/seedling. More nematodes entered the roots as the initial nematode density increased; but the same proportion of nematodes penetrated the roots at each nematode density. Soil temp. of 27° favored higher seedling growth and root invasion than did 22° or 32°C. Astro bean roots attracted more nematodes than Greenpod 64467 bean roots. Pathogenicity tests, performed also in 3 constant-temp. tanks, showed that, at each soil temp. level, top and root growth of snap beans were not significantly reduced 35 days after infection with 1000, 3000, or 10,000 *P. penetrans*/plant. But at each inoculum level, total plant growth decreased with increasing soil temp. of 22°, 27°, and 32°C. Final nematode population increased directly with increasing initial nematode densities, and was higher at 27°C than at 22°C. Reproduction was inhibited at 32°C. Nematode inoculum multiplication rate was higher for the 3000 initial density level than for the 1000 or 10,000 density level. It was concluded that although the host suitabilities of Astro and Greenpod 64467 snap beans varied with soil temp., their tolerance to *P. penetrans* infection was generallly maintained. At 32°C, nematode physiology, as well as host plant physiology, was adversely affected. Mineral analysis of plant tissue was performed at the conclusion of the pathogenicity tests, partly by the autoanalytic technique, and partly by atomic absorption spectrophotometry. P, K, Ca, and Mg contents of the infected bean plants were not significantly altered from those of the check plants. This was regarded as further proof of the tolerance of Astro and Greenpod 64467 snap beans to the 3 density levels of *P. penetrans* infection. Soil temp. effects, however, increased the P and K contents of roots; and Ca content was highest in the shoots at 27°C, and in the roots at 22°C. Pathogenicity tests, performed under outdoor conditions, showed that the yield of bean pods, 42 days after infection, was not significantly reduced by *P. penetrans* infections originating from initial densities of 1000, 3000, and 10,000 nematodes/plant. However, the tops of infected beans were significantly ($P = 0.05$) shorter than those of uninfected plants. Greenpod 64467 snap beans were shorter; but they produced more pods than Astro beans. Further pathogenicity tests in the greenhouse showed that preplant infestation of the soil with nematodes did not alter the tolerance of Astro and Greenpod 64467 snap beans for *P. penetrans*. Nematode reproduction occurred at all 3 initial density levels of 1000, 3000, and 10,000 nematodes/plant, without significant reductions in plant growth. Forty-two days after inoculation, final nematode no. were positively correlated with increasing initial inoculum densities; whereas the rates of nematode population growth varied inversely with the initial densities. Histopathological examination of infected roots showed that only the cortex was damaged. Browning and necrosis of cortical and epidermal tissues, and the resulting cavities, were observed. Lateral root initiation from pericyclic tissue adjoining damaged root portions was observed too. Astro and Greenpod 64467 snap bean roots could not be histologically distinguished. It was proposed, on the basis of these findings, that the regeneration of new roots by infected ones was the mechanism of tolerance of snap beans to *P. penetrans* parasitism. Based also on these results, it was deduced that *P. penetrans* infection on snap beans may not be a serious problem on the field. *(Author's summary)* E05

See also 0468 0476

E06 Physiological Disorders

0392

13592 LUNA, J.E. **Achaparramiento y/o deformación en poroto.** *(Stunting and/or deformation in beans).* Metán, Argentina, Instituto Nacional de Tecnología Agropecuaria. Hoja Informativa no. 9. 1980. 7p. Span., Sum. Span., 6 Refs.

Phaseolus vulgaris. **Plant physiological disorders. Cultivation. Diseases and pathogens. Injurious insects. Soil requirements. Argentina.**

In the south of the province of Salta and in all NE Argentina, a disease known as stunting and/or deformation occurs. It was initially diagnosed as a viral disease, possibly transmitted by an insect such as *Circullifer tenellus, Bemisia tabaci* or *Agalliana ensigera.* This possibility was eliminated after an analysis of ecologic conditions and the behavior of the aforementioned insect pests; it is concluded that the disease is induced by physiological disorders due to different causes. Furthermore, the symptoms are given of the BGMV and bean chlorotic mottle virus in order to differentiate them from curling, due to cultural practices (inadequate planting), insect attacks, inferior soil conditions and situations that originate physiological disorders. *(Summary by C.P.G. Trans. by L.M.F.)* E06

E07 Mycoplasmoses

0393

14279 KITAJIMA, E.W. and COSTA, A.S. **Microrganismos do tipo micoplasma associados a moléstias do tipo amarelo em algumas plantas cultivadas e ornamentais, no estado de São Paulo e no distrito federal.** *(Mycoplasma-like organisms associated with yellows-type diseases in cultivated and ornamental plants in the state of São Paulo and the Federal District).* Fitopatología Brasileira 4:317-327. 1979. Port., Sum. Port., Engl., 24 Refs., Illus.

Phaseolus vulgaris. **Mycoplasmoses.** *Orosius argentatus.* **Electron microscopy. Plant tissues. Etiology. Brazil.**

Using electron microscopy of thin sections, mycoplasma-like bodies were consistently found in the phloem vessels of leaf or flower tissues of several ornamental plants [*Gomphocarpus* sp., *Chrysantemum partenum* and periwinkle *(Vinca rosea* L.)]as well as bean and cassava plants exhibiting symptoms of yellows type disease, in the state of São Paulo and Federal District, Brazil. Similar findings were made in some cultivated leguminous crops (soybeans *Crotalaria juncea,* and *C. paulinea*) with witches'-broom symptoms at the IRI Expt. Station, Matão, São Paulo. Some of these diseases could be graft transmitted to healthy plants. *(Author's summary)* E07

F00 PEST CONTROL AND ENTOMOLOGY

0394

3590 GOULD, H.J. **Control of bean seed fly in East Anglia.** Plant Pathology 14(1, suppl.):16-18. 1965. Engl.

Phaseolus vulgaris. **Injurious insects. Seed treatment. Storage. Stored grain pests. Insect control.**

In 1962-64 a no. of materials was evaluated to compare the protection of dieldrin seed dressing. Materials used were: Dieldrex-B, heptachlor, γ-BHC, thiram, Bayer 38156, trichlorphon, fention, diazinon, malathion, dimethoate, and Bayer 37289. In 1962-63 a climbing french bean var. Fropax was used and an American one, Harvester in 1964. When a seed dressing formulation was not used, miscible or dispersible powder was used with 2% methyl cellulose at 500 ml/35 *l*. Thiram at 1 oz/35 *l* was included in all treatments since the addition of fungicides controls diseases and reduces the insecticidal damage. Germination counts showed that the treatments did not affect seed viability. All the materials evaluated, except thiram, Bayer 38156 and malathion, significantly reduced the attack. Dieldrex-B gave an almost complete control of the insect; the 2 organo-chlorine materials, heptachlor and γ-BHC, gave good results while granular materials did not. *(Summary by C.P.G. Trans. by L.M.F.)* F00 L00

0395

10331 POUZAT, J. **Interactions entre la plante-hôte *Phaseolus vulgaris* L. et l' insémination dans la régulation de la vitellogènese chez la bruche du haricot *Acanthoscelides obtectus* Say. (Col. Bruch.). Modifications provoquées au cours des générations.** *(Interaction between beans as host plant and insemination in the regulation of Acanthoscelides obtectus viteliogenesis. Modifications during various generations).* Compte Rendu de l'Academie des Sciences de Paris (Série D) 279: 339-342. 1974. Fr., Sum. Fr., 8 Refs.

Phaseolus vulgaris. Acanthoscelides obtectus. **Insect biology. Insect control. Stored grain pests.**

Only descendants of females that do not lay eggs in the absence of bean seed (> 90% of the females) are collected to maintain the source of *Acanthoscelides obtectus.* However, severe modifications of the effect of insemination and the host plant on vitellogenesis are produced depending if the eggs are collected from all the females that fulfill this condition or only from those that lay the most eggs, immediately after the introduction of the seed. *(Author's summary. Trans. by L.M.F.)* F00

0396

5416 GREENE, G.L. and MINNICK, D.R. **Snap bean yields following simulated insect defoliation.** Proceedings of the Florida State Horticultural Society 80:132-134. 1968. Engl., 7 Refs.

Phaseolus vulgaris. **Yields. Defoliation. Integrated control. USA.**

The effect of leaf removal on snap bean yields and quality was studied to recommend insect control practices. Expt. were conducted between 1966-67 on 2 soils (sandy and peat) in Florida (USA). A random block design with 3 treatments and 4 replications was used. The plots consisted of a single row of 50 plants of snap bean var. Harvester. Insect defoliation was controlled by the application of insecticides. Plants grown in sandy soil received the following treatments of hand defoliation: 0, 25 (removal of the 2nd trifoliate leaf at the base of the petiole),and 50% (removal of the 2nd and 3rd trifoliate leaves). This operation was carried out 1 wk. prior to bloom and at bloom. On the peat soil, defoliation was 0, 33, and 67% by removing 0, 1,and 2 leaflets of each trifoliate petiole. Plants were harvested to determine quality and yield. The treatments did not affect pod quality. The results of the expt. indicate that yield reduction begins when defoliation reaches 33-50% . The large difference between yields of the 2 groups is due to the greater fertility of peat soil. *(Summary by C.P.G. Trans. by L.M.F.)* F00 D00

0397

14228 HOHMANN, C.L., SCHOONHOVEN, A. VAN and CARDONA, C. **Manejo de pragas do feijoeiro *(Phaseolus vulgaris*, Linnaeus, 1753) através da utilização de cobertura de solo associada a resistência varietal.** *(Bean pest management through background soil associated with varietal resistance).* Anais da Sociedade Entomológica do Brasil 8(2):239-250. 1979. Port., Sum., Engl., Port., 10 Refs., Illus.

Phaseolus vulgaris. Empoasca kraemeri. **Cultivars. Host-plant resistance. Mulching. Integrated control. Pest control. Yields. Field experiments. Colombia.**

An expt. to study the background soil effects associated with var. resistance in bean pest populations, virus incidence and yield was carried out at the Centro Internacional de Agricultura Tropical (CIAT), Palmira, Colombia from Jan.-March, 1978. The effect of the treatments and of the var. on *Empoasca kraemeri* populations of nymphs and adults was positive. The var. x treatment interaction was only significative for nymph populations. The treatment with Al foil was the most effective for the var. P 14 and Diacol-Calima. Considering the larval plant damage and Chrysomelidae populations it was observed that the background soil with rice mulching is attractive to insects. A virus complex was present, and it was not possible to clearly evaluate the effects of the treatments. The yielding of the var. Diacol-Calima was superior with the aluminium background and rice mulching. These treatments yielded 2.3 and 1.3 times more than the control , resp. Var.P 14 showed a major pest- and disease-tolerance. A significative influence of the nymphs and adults of *E. kraemeri* and of the virus incidence on the yields were indicated by the correlation analysis. Adults of Chrysomelidae did not affect the yield significantly. *(Author's summary)* F00 F01

0398

14316 CARTIN L., V.M. **Influencia del cultivar y del tiempo de almacenamiento del fríjol *(Phaseolus vulgaris* L.) sobre el ataque de *Acanthoscelides obtectus* (Say) y *Zabrotes subfasciatus* (Boh.) (Coleoptera: Bruchidae).** [*Influence of bean cultivars and length of storage on the attack of Acanthoscelides obtectus and Zabrotes subfasciatus (Coleoptera: Bruchidae)*]. Tesis Ing. Agr. Costa Rica, Universidad de Costa Rica. Escuela de Fitotecnia, 1979. 80p. Span., Sum. Span., 69 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. Zabrotes subfasciatus. **Insect biology. Host-plant resistance. Storage. Deterioration. Timing. Protein content. Cooking. Seed characters. Seed coat. Cultivars. Costa Rica.**

In order to investigate the susceptibility of some common bean cv. to the attack of *Acanthoscelides obtectus* and *Zabrotes subfasciatus* as well as lots of this same legume with different lengths of storage, several trials of preference and non-preference in oviposition were conducted in lab. conditions (30°C, approx. 75% RH, and in the dark). For non-preference, indices of cv. susceptibility were estimated, finding significant differences. These

indices did not correlate positively or negatively with either grain protein content or thickness of seed coat. There is no evidence that they are due to differences in size, color, or source of cv. Negative correlations were found among these indices and cooking time of the beans, being significant only with *Z. subfasciatus*. Differences in susceptibility are basically due to the rate of insect growth and development. The less susceptible cv. showed longer cooking time and the bruchids that developed on them took longer time to complete their life cycle. *A. obtectus* showed no preference in oviposition for any cv. *Z. subfasciatus* showed more preference for cv. Pavamor. In non-preference trials, *Z. subfasciatus* deposited more frequently on clean beans than on dirty ones, both with different lengths of storage. A large oviposition was also obtained on recently harvested beans. Beans with deficient external appearance, irregular size, rough and unclean surface were scarcely attacked by this insect. Similar trends were observed in preference trials in oviposition. A tendency towards greater oviposition on beans with short lengths of storage suggests that the gustatory stimulus that incites bruchids to oviposite on this legume can gradually lose its efficiency due to the changes that occur to beans during storage. The negative effect that the presence of dust particles on grains seems to exert on bruchid oviposition could be used as a preventive measure, thus reducing egg-laying. *(Author's summary. Trans. by I.M.F.)* F00 L00

0399

14703 ZUNGOLI, P.A. *Eupteromalus viridescens* **(Hymenoptera: Pteromalidae) a new parasite association for** *Pediobius foveolatus* **(Hymenoptera: Eulophidae) and** *Epilachna varivestis* **(Coleoptera: Coccinellidae).** Proceedings of the Entomological Society of Washington 81(4):663-665. 1979. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Injurious insects. Biological control.** *Epilachna varivestis.* **USA.**

A native pteromalid, *Eupteromalus viridescens* was discovered while dissecting dead parasitized larvae (mummies) of the Mexican bean beetle (MBB), *Epilachna varivestis*, in a study to investigate the parasite, *Pediobius foveolatus*. Of the 1757 MBB larvae that were field collected in Queen Anne and Wicomico Counties, Maryland (USA), in 1977 and 1978, resp., 329 were parasitized. Nine mummies had *E. viridescens* associated with them, and 8 of these were in conjunction with adult *P. foveolatus*. This is a new host association for *E. viridescens* which appears in this instance to be a hyperparasite. *(Author's summary)* F00

0400

14391 BIEMONT, J.C. **Influence de la plante-hôte et de la copulation sur la levée de l'inhibition du développement ovarien liée a la rétention des ovocytes chez** *Acanthoscelides obtectus* **(Col., Bruchidae).** *(Effects of the host plant and mating on suppressing the inhibition of ovarian development together with the retention of oocytes in Acanthoscelides obtectus).* Annales de la Societé Entomologique de France 15(1):93-99. 1979. Fr., Sum. Engl., 13 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. **Insect biology. Oviposition. Insect control. Stored grain pests. Seeds.**

In virgin females of *Acanthoscelides obtectus*, ovarian production reaches its peak (ca. 35 oocytes) on the 4th day of adult life, and this level is maintained for approx. 30 days. When females were allowed to pair 12 days after adult emergence and were kept in the presence of bean seeds, oviposition occurred within 24 h. The results are presented of studies to isolate the effect of the individual elements (pairing, food-plant, and oviposition) from studies of the conditions of the oocytes. It was found that pairing did not of itself stimulate oogenesis and that the presence of the food-plant provided a temporary stimulus for virgin females. The implications of these findings are discussed. *(Summary by Review of Applied Entomology)* F00

0401

14753 HERZOG, D.C. **Some biological implications of polymorphism in the bean leaf beetle, *Cerotoma trifurcata* (Forster).** Ph.D. Thesis. Baton Rouge, Louisiana State University, 1973. 176p. Engl., Sum. Engl., 94 Refs., Illus.

Phaseolus vulgaris. Cerotoma trifurcata. **Insect biology. Temperature. Parasitism. Oviposition. Insect control. Laboratory experiments. Statistical analysis.**

Polymorphic forms of the bean leaf beetle, *Cerotoma trifurcata*, were studied in an attempt to identify variant physiological and behavioral characters and ecological tolerances correlated with observed polymorphisms. Color forms and marking pattern types of lab.-reared bean leaf beetles showed no statistically significant differences in mating frequency; however, trends were observed which were consistent between males and females. Polymorphic forms showed little variability in the duration of adult life history stages or in fecundity. Reproductive females lived significantly longer than the nonreproductive females, but within color forms this difference in longevity could be demonstrated only within beige forms. Within reproductive females, only beige could be demonstrated as living longer than crimson, while within the nonreproductive females only salmon could be demonstrated as living longer than beige. Bean leaf beetle color forms and marking pattern types collected from the field differed significantly in wt. Those beetles exhibiting marking confluence were smaller than those of other patterns. Within the color forms, only the heaviest, crimson, could be separated from the lightest, salmon and beige. Differences in parasitism by *Celatoria diabroticae* were noted among the color forms, yellow apparently being the most susceptible, and pink the least susceptible to parasite attack. Mating frequency, longevity of reproductive forms, and wt. all showed strong correlations with intensity of red pigment. Correlations among these variables attained significance only in longevity x wt. Differential color form and marking pattern type response to temp. was observed, but no temp.-related trends could be established. Yellow forms showed most rapid progressive mortality at all temp. In general, marking pattern variants showed a greater similarity of response than did the color forms. Techniques for rearing the bean leaf beetle in the lab. are described. *(Author's summary)* F00

0402

14231 LATHEEF, M.A. and IRWIN, R.D. **Effects of companionate planting on snap bean insects, *Epilachna varivestis* and *Heliothis zea*.** Environmental Entomology 9(2):195-198. 1980. Engl., Sum. Engl., 16 Refs.

Phaseolus vulgaris. **Intercropping. Integrated control. Injurious insects.** *Heliothis zea. Epilachna varivestis.* **USA.**

The effects of companionate planting on insect pests of snap beans were investigated in Chesterfield Co., Virginia (USA), during 1977-78. Significantly fewer Mexican bean beetles (*Epilachna varivestis*) occurred on bean plots bordered by *Tagetes patula* than on borderless controls ($P < 0.01$). However, this effect was overshadowed by the allelopathic response of *Tagetes patula* to beans ($P < 0.01$). No such effect was observed on bean plots bordered by *Calendula officinalis, Petunia hybrida, Satureja hortensis, Chrysanthemum cinerariaefolium, Nicandra physalodes* and *Tropaeolum minus*. The corn earworm, *Heliothis zea*, occurred significantly more on bean plots bordered by *C. officinalis* and *S. hortensis* ($P < 0.05$). *N. physalodes* was completely defoliated by the 3-lined potato beetle, *Lema trilineata*. Companionate planting described in this study does not appear to be a useful control of strategy for insect pests of *P. vulgaris* in home garden plots. *(Author's summary)* F00

0403

14386 HUIGNARD, J. and BIEMONT, J.C. **Vitellogenesis in *Acanthoscelides obtectus* (Coleoptera:Bruchidae). II. The conditions of vitellogenesis in a strain from Colombia. Comparative study and adaptive significance.** International Journal of Invertebrate Reproduction 1(4):233-244. 1979. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. **Strain. Oviposition. Seeds. Adaptation. Ecology. Environmental factors. Climatic requirements. Insect biology. Entomology. Colombia.**

The reproductive activity of an *Acanthoscelides obtectus* strain originating in the high Colombian plateau (altiplanos) was compared to that of an European strain. Colombian females exhibited greater individual variations than their European counterparts. Some females did not synthesize vitellogenin during the 140-day period of observation, while other performed synthesis but not incorporation into oocytes. Under these conditions, 40-50% of the females could form a limited no. of oocytes. The presence of *Phaseolus vulgaris* seeds stimulated vitellogenin synthesis and incorporation by most females. This initiation of ovarian activity enabled mating to occur, which in turn led to max. stimulation of oogenesis. This host plant-mating interaction leads to the production and release of a large no. of eggs. The observed variability of reproductive activity and its dependence on stimulatory factors probably reflect an adaptation to the ecological conditions prevailing in the high-alt. environment of these insects. *(Author's summary)* F00

0404

14381 STAMOPOULOS, D. and HUIGNARD, J. **L'influence des diverses parties de la graine de haricot** *(Phaseolus vulgaris)* **sur le développement des larves d'***Acanthoscelides obtectus* **(Coléoptère Bruchidae).** [*Influence of different parts of the grain of the kidney bean on the development of larvae of Acanthoscelides obtectus (Coleoptera Bruchidae)*]. Entomologia Experimentalis et Applicata 28: 38-46. 1980. Fr., Sum. Fr., Engl., 22 Refs., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. **Seeds. Hypocotyls. Cotyledons. Embryo. Seed coat. Diets. Insect biology. Laboratory experiments.**

The larvae of the 1st instar of *Acanthoscelides obtectus* penetrate seeds of the kidney bean, and feed on reserves contained in the cotyledons. They can also develop in an artificial diet made by compressing the flour of the cotyledons. The presence of the pulverized embryo has no effect on the larvae, even at a higher concn. than that found in the seeds. The presence of the seed coat flour of *Phaseolus vulgaris* (var. Soisson) in the artificial diet does not allow normal development of most larvae. The significance of mortality which occurs in different larval instars, still remains hypothetical. It is possible that the seed coat presents a chemical barrier which has important functions and which vary the stage of development. *(Author's summary)* F00

0405

12303 RUSSELL, L.M. **Whiteflies on beans in the Western Hemisphere.** Beltsville, Maryland, U.S. Department of Agriculture. Agricultural Research Service, 1975. 22p. Engl., 20 Refs., Illus.

Paper presented at Workshop on Bean Production, Cali, Colombia, CIAT, 1975.

Phaseolus vulgaris. Bemisia tabaci. **Entomology. Insect biology. Ecology. Colombia.**

A literature review is presented on the biology of the whitefly *Bemisia tabaci* and several species of *Trialeurodes* in different parts of the world. The life cycle of *B. tabaci* varies between 15-75 days according to the time of the yr, the place and climatic conditions (temp.). Tables are included on the stages of development and the life cycle of male and female *B. tabaci* and drawings on *Trialeurodes* spp. *(Summary by C.P.G. Trans. by L.M.F.)* F00

0406

13174 REIS, P.R. **Pragas do feijoeiro e seu contrôle.** *(Bean pests and their control).* Informe Agropecuário 4(46):45-48. 1978. Port., 8 Refs.

Phaseolus vulgaris. **Noxious animals. Pest control. Insect control. Brazil.**

The morphology and damage caused by the following pests are described: *Empoasca* spp.; *Elasmopalpus lignosellus; Diabrotica speciosa; Agrotis* spp.; *Tetranychus* spp.; *Polyphagotarsonemus latus; Zabrotes subfasciatus; Acanthoscelides obtectus;* and *Lagria villosa.* Tables are included on their control (pesticides, recommendations on a.i., doses, application); application of insecticides to beans packed in bags or under plastic tents; and for the application of insecticides to dry beans in silos. Finally, a list of 11 a.i. and their commercial names is given. *(Summary by I.B. Trans. by L.M.F.)* F00

0407

15470 ALOMIA DE GUTIERREZ, B. and SCHOONHOVEN, A. VAN **Proteja su cosecha de fríjol contra el ataque de los gorgojos.** *(Protect your bean crop against bruchids).* ICA Informa 14(5):16-19. 1980. Span., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. Zabrotes subfasciatus. **Stored grain pests. Insect biology. Insect control. Chemical control. Storage. Cooking.**

Information on bruchids on bean grain (*Zabrotes subfasciatus* and *Acanthoscelides obtectus*) is given for farmers, explaining aspects such as: oviposition behavior, morphological characteristics of the adult, type of damage, and adaptation to temp. Practices to avoid or prevent damage by bruchids are also described, along with control measures at different levels (household, on-farm, and commercial) and some recommendations are given on the precautions to be taken when managing insecticides. To protect the grain at a household level, it is recommended to apply 3-5 ml of vegetable oil/kg of beans; in warehouses, the application of aluminum phosphide and methyl bromide in tablets is recommended, 4 tablets/t of grain. Beans preserved in oil maintain their culinary quality and germination ability for up to 6 mo. *(Summary by C.P.G. Trans. by L.M.F.)* F00

0408

15475 WADDILL, V.H., McSORLEY, R. and POHRONEZNY, K. **Field monitoring: basis for integrated management of pests on snap beans.** Tropical Agriculture 58(2):157-169. 1981. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Pests. Integrated control.** *Diabrotica balteata. Liriomyza* **spp.** *Anticarsia gemmatalis. Trichoplusia ni. Urbanus proteus.* **Nematodes. Snap bean.**

Insects, diseases, and nematodes were monitored on snap beans in 4 expt. conducted in Florida (USA). Although the insect defoliators *Anticarsia gemmatalis, Urbanus proteus, Trichoplusia ni, Liriomyza sativae,* and *Diabrotica balteata* were present, defoliation did not surpass the action thresholds of 20 and 10% for pre-bloom and post-bloom, resp. Insecticide costs were reduced by 48 and 83% in 2 field tests where field monitoring was utilized in making management decisions. Max. initial nematode densities/100 cm^3 soil were 20 for *Rotylenchulus reniformis*,15 for *Helicotylenchus dihystera*,and 72 for *Quinisulcius acutus.* Chemical treatments reduced nematode no. but bean yields were not significantly increased. *(Author's summary)* F00 E00

0409

16079 ROGERS, D.J. **Host plant resistance to** *Ophiomyia phaseoli* **(Tryon) (Diptera: Agromyzidae) in** *Phaseolus vulgaris.* Journal of the Australian Entomological Society 18(3):245-250. 1980. Engl., Sum. Engl., 11 Refs.

Phaseolus vulgaris. Ophiomyia phaseoli. **Host-plant resistance. Oviposition. Insect biology.**

In lab. and glasshouse studies in Australia, 15 entries representing 13 bean cv. were evaluated for nonpreference and antibiosis resistance to *Ophiomyia phaseoli*. The no. of viable eggs/plant exhibited significant variation amongst the cv. No significant differences were found in the developmental period of larvae and pupae or in the size of the adults emerging from the cv. Significant correlations were found between the no. of viable eggs/plant and leaf hairiness, stem ϕ, and internode length. Low egg counts were associated with high leaf hair density, thin stems, and long internodes. *(Summary by Review of Applied Entomology)* F00

0410

15815 OLIVEIRA, A.M. and SUDO, S. **Competition between populations of bean weevils *Zabrotes subfasciatus* Bohemann, 1833 and *Acanthoscelides obtectus* Say, 1831 feeding on the same food source (Col., Bruchidae).** Anais da Sociedade Entomológica do Brasil 8(1):57-62. 1979. Engl., Sum. Engl., Port., 7 Refs.

Phaseolus vulgaris. Zabrotes subfasciatus. Acanthoscelides obtectus. **Populations. Stored grain pests. Cultivars. Storage.**

When the numbers of *Zabrotes subfasciatus* and *Acanthoscelides obtectus* occurring together in samples of beans of 11 cv. that had been stored for 12 mo. were analyzed in studies in Brazil, it was found that neither species showed any preference for a particular cv., but that populations of *Z. subfasciatus* were significantly greater than those of *A. obtectus*, indicating the competitive superiority of the former. *(Summary by Review of Applied Entomology)* F00

0411

16051 LEITE FILHO, A.S. and RAMALHO, F.S. **Biologia da cigarrinha verde, *Empoasca kraemeri* Ross & Moore, 1957 em feijão e em feijão-de-corda.** *(The biology of the leafhopper, Empoasca kraemeri, on bean and cowpea plants).* Anais da Sociedade Entomológica do Brasil 8(1):93-101. 1979. Port., Sum. Engl., Port., 9 Refs., Illus.

Phaseolus vulgaris. Vigna unguiculata. Empoasca kraemeri. **Insect biology. Oviposition.**

The biology of the leafhopper *Empoasca kraemeri* was studied on bean var. IPA-7419 and cowpea var. Pitiuba. The work was done under lab. conditions at 27 ± 1°C, 70 ± 10% RH, and a 12 h photoperiod. The duration and viability of the nymphal phase, sex ratio, longevity of the males and females, incubation period, preoviposition period, oviposition period, total of eggs laid/female, and daily oviposition rate were determined on both host plants. The biology of *E. kraemeri* was very similar on both hosts studied. *(Author's summary)* F00

0412

15429 RAMALHO, F.S. and RAMOS, J.R. **Distribuição de ovos de *Empoasca kraemeri* Ross & Moore, 1957 na planta de feijão.** *(Distribution of eggs by the leafhopper Empoasca kraemeri on bean plants).* Anais da Sociedade Entomológica do Brasil 8(1):85-91. 1979. Port., Sum. Engl., Port., 11 Refs., Illus.

Phaseolus vulgaris. Empoasca kraemeri. **Insect biology. Oviposition. Leaves. Brazil.**

The distribution of eggs by the leafhopper *Empoasca kraemeri* was studied on bean plants, var. IPA-7419 at Bebedouro, Petrolina, Brazil, under furrow irrigation. There was a progressive trend for lower oviposition from the basal to the apical leaves of the plants. The secondary and tertiary veins of the leaf were preferred for oviposition. The intermediate 1/3 of the stem was also preferred for oviposition. There was a significant negative correlation between the no. of trichomes of a leaf and the no. of eggs layed on it by *E. kraemeri*. *(Author's summary)* F00

0413

16040 TURNER, J.W. and BRIER, H. **Effect of leafhopper control on yield of peanuts and navy beans.** Tropical Grain Legume Bulletin 16:23-25. 1979. Engl., Sum. Engl., 2 Refs.

Phaseolus vulgaris. Austroasca spp. **Injurious insects. Insect control. Yields.**

The leafhoppers *Austroasca viridigrisea* and *A. alfalfae* attack peanuts and navy beans in southern Queensland (Australia). Current grower practice is to spray when leafhopper no. or damage is noticeable. The damage is considered to be more severe when plants are under moisture stress. *A. viridigrisea* which was the dominant species in these expt. is a mesophyll feeder producing typical stippling. *(Author's summary)* F00

0414

16053 HO, S.H. **A comparison of the excretion rates of *Aphis fabae* on artificial diet and on bean plants.** Annals of Applied Biology 96:133-136. 1980. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Aphis fabae. **Insect biology. Insect control. Laboratory experiments.**

The performance of *Aphis fabae* on an artificial diet was assessed by comparing the aphid's excretion rate on the diet with that on bean plants to investigate the possibility of using this diet in toxicological studies. No significant difference was found in the rates of honeydew excretion, but the diet-fed aphids were noticeably smaller than those fed on beans. *(Author's summary)* F00

0415

16042 MICHELS JUNIOR, G.J. and BURKHARDT, C.C. **Economic threshold levels of the Mexican bean beetle on Pinto beans in Wyoming.** Journal of Economic Entomology 74(1):5-6. 1981. Engl., Sum. Engl., 6 Refs.

Phaseolus vulgaris. Epilachna varivestis. **Insect control. Costs. Production.**

Caged bean plants were infested with 5, 10, 20, and 40 larvae of *Epilachna varivestis*/plant and were compared to uninfested checks to determine the economic threshold level. Class damage and yield data indicated increased damage and loss with increases in population. A yield loss-treatment cost analysis determined the threshold level which ranged from 1-1.5 larvae/plant. *(Author's summary)* F00

See also 0143 0365 0366 0369 0428 0552

F01 Injurious Insects, Mites and their Control

0416

4376 DAVIS, J.J. **Bean fly and its control.** Queensland Agricultural Journal 95: 101-106. 1969. Engl., Illus.

Phaseolus vulgaris. Melanagromyza phaseoli. **Entomology. Insect biology. Chemical control. Australia.**

Aspects related to the form of attack, habits, biology and control measures of the bean fly *Melanagromyza phaseoli* are given. Larvae penetrate the plant tissue through tunnels and complete 3 stages within the plant. Time required for the complete life cycle varies from 3 wk. in the summer to 12 wk. in the winter. Its presence in the crop has its limitations depending on the season. Leaf spraying with 0.1% DDT 3, 5, and 12 days after the emergence of the seedling and seed treatment with 1 part by wt. of endrin a.i. to 500 parts by wt. of bean seed are suggested. *(Summary by C.P.G. Trans. by L.M.F.)* F01

0417

12304 SCHOONHOVEN, A. VAN **Breeding for resistance to** *Empoasca kraemeri.* *In* Bean Plant Protection Workshop, Cali, Colombia, 1975. Trabajos presentados. Cali, Centro Internacional de Agricultura Tropical, 1975. 11p. Engl., 9 Refs.

Phaseolus vulgaris. Empoasca kraemeri. **Plant breeding. Host-plant resistance. Cultivars. Colombia.**

A literature review is presented on the resistance of some bean var. to *Empoasca* attacks and the possibility of breeding through interspecific crosses. Since the main objective of CIATs entomology program is the development of resistance to *Empoasca kraemeri* (interspecific crosses and an extensive hybridization program); 395 selections were tested, among which none presented antibiosis. Var. ICA-Tui presented non-preferential resistance. Levels of resistance are expected to rise through a recurrent selection of F_2 plants in 14 selections entered in a diallel crossing program. *(Summary by C.P.G. Trans. by L.M.F.)* F01 G00

0418

12666 PHILLIPS, T.L. and PEAIRS, F.B. **Un tamizado para resistencia genética contra un picudo de la vaina del fríjol.** *(Screening for genetic resistance to the bean pod weevil).* Danlí, Honduras, Ministerio de Recursos Naturales. Programa de Investigación Agropecuaria, 1977?. 8p. Span., 5 Refs.

Phaseolus vulgaris. Apion. **Cultivars. Host-plant resistance. Plant injuries. Honduras.**

Some insects such as *Empoasca kraemeri* and a bean pod weevil, supposedly *Apion* sp. are found among the limiting factors to bean production in Honduras. The National Bean Program in Honduras conducted a study with 2 purposes: (1) to test dry bean lines and other available legumes in the program of resistance to the weevil and (2) test the use of a trap crop to manage the pod weevil. Var. Acacias 7 was the most susceptible and var. Porrillo, the most resistant in the evaluation of var. resistant to insect attack. Some considerations are included on pest management along with the results of the evaluation of 14 bean var. with regard to damage-resistance. *(Summary by C.P.G. Trans. by L.M.F.)* F01

0419

14325 GOULD, F. **Rapid host range evolution in a population of the phytophagous mite *Tetranychus urticae* Koch.** Evolution 33(3):791-802. 1979. Engl., Sum. Engl., 17 Refs., Illus.

Phaseolus vulgaris. Tetranychus telarius. **Adaptation. Alternate hosts. Population management. Biological control.**

A satisfactory understanding of the proximal determinants of herbivore host range exists but information on the evolutionary processes which mold these proximal determinants is lacking. An attempt was made to gain detailed information on microevolutionary processes involved in host range evolution which could influence the macroevolutionary patterns of host range found in natural systems. A population of the 2 spotted spider mite, *Tetranychus urticae*, was divided in 2. One-half was reared on a monoculture of Henderson bush lima bean (a favorable host). The other half was placed in a simple plant community composed of lima beans and a somewhat toxic host, mite-resistant cucumber. The 2 lines of mites were allowed to adapt to their resp. plant communities, and their fitness on the 2 host-plants was monitored over a 21-mo. period. The line maintained in the cucumber/bean community had higher fitness on cucumber and lower fitness on bean than the line maintained in the bean monoculture. Additionally, the line maintained in the cucumber/bean community had higher survivorship on 2 of 3 other marginal hosts tested (tobacco and potato but not plantain). These results indicate that host range evolution can be a rapid process and suggest that cross-adaptation to sets of plants as well as the ecological proximity of a set of plant species to an herbivore population may be an important factor in evolution of host range patterns. *(Author's summary)* F01

0420

10669 RAMOS O., A. and CUELLAR G., B. **Evaluación de algunas dosis de tres insecticidas para el control del chrysomelido *Diabrotica* sp. cerca *limitata* (Sahlberg) del fríjol *(Phaseolus vulgaris* L.) en el Alto Putumayo, Intendencia Nacional del Putumayo.** *(Evaluation of some rates of three insecticides for controlling the chrysomelid Diabrotica sp. cerca limitata in beans in the Alto Putumayo, National Intendency of Putumayo).* Ciencias Agrícolas 6:138-142. 1974. Span., Sum. Span., Engl., 18 Refs.

Phaseolus vulgaris. Diabrotica balteata. **Injurious insects. Insect control. Chemical control. Experiment design. Statistical analysis. Timing. Population management. Colombia.**

The present trial was carried out between Nov. 1976-May 1977, at Sibundoy Valley, Putumayo (Colombia), for determining the effectiveness of 3 commercial doses of 75 and 50% carbaryl WP, parathion E and dimethoate E, recommended against *Diabrotica* sp. cerca *limitata* attacks in bean var. Diacol Calima. Two applications of the insecticides were made, 45 and 90 days after sowing. Carbaryl WP and parathion E were more effective than dimethoate E; commercial doses and of 75% controlled insect pests better than 50% of the commercial dose. After 40 days of the 1st application, differences were not observed between insecticides and doses for insect control, because residual effect of the products decreases after 15 days of application; however, carbaryl WP showed higher residual effect. With the 2nd application differences were observed between doses but not among products. In the relation production-insecticide, the commercial doses of the 3 insecticides allowed better yields (2416, 2183, and 2050 kg/ha for carbaryl WP, parathion E and dimethoate E, resp.) as compared to the control (1371 kg/ha). *(Author's summary)* F01

0421

13565 CARDONA, C. **The biology, habits and nature of damage caused by chrysomelids in beans.** Cali, Colombia, Centro Internacional de Agricultura Tropical. Seminarios Internos. Serie SE-14-80. 1980. 7p. Span., Sum. Engl., Span.

Phaseolus vulgaris. Diabrotica balteata. **Insect biology. Plant injuries. Yields. Field experiments. Colombia.**

Studies on the biology and damage caused by bean pests *Diabrotica balteata* and *Cerotoma facialis* have been conducted at CIAT since 1977. The biology of the 2 species is similar in many aspects. Life cycle is as follows: eggs, 6-7 days; 1st larval instar, 3-4 days; 2nd instar, 2-3 days; and 3rd instar, 4-5 days. Prepupae last 2-5 days and pupae, 5-9 days. Adult life-span lasts from 16-44 days, during which females lay between 150-474 eggs. Both species preferrably oviposit in soil cracks near the roots of the host plant. Although adults of both species feed on the foliage of bean plants, their larvae can also cause damage to germinating plants. Adults can also act as vectors of several viral diseases. In trials related to the damage caused by larvae of *Diabrotica* and *Cerotoma*, it was concluded that the 2nd and 3rd instar larvae can cause severe damage to germinating plants, but only up to 14 days after planting. *Cerotoma* is more specific to beans than *Diabrotica*. Survival of *D. balteata* larvae is less in beans. Eight field expt. were conducted to study the influence of adult feeding on bean yields. Both *Diabrotica* and *Cerotoma* can cause significant reductions in production only when high levels of infestations (4 adults/plant) occur during the 1st 2 wk of the crop, and to a lesser extent when infestation coincides with the flowering stage (29-36 days). Implications of critical periods on the rational management of these pests are discussed. Graphics and tables on the results are included. *(Full text. Trans. by L.M.E.)* F01

0422

14326 EVERSON, P. **The relative activity and functional response of *Phytoseiulus persimilis* (Acarina:Phytoseiidae) and *Tetranychus urticae* (Acarina: Tetranychidae): the effect of temperature.** Canadian Entomologist 112(1):17-24. 1980. Engl., Sum. Engl., 37 Refs., Illus.

Phaseolus vulgaris. **Injurious mites.** *Tetranychus telarius.* **Biological control. Leaves. Culture media. Temperature. Mite control.**

The activity of the predacious mite *Phytoseiulus persimilis* was greater on a glass substrate than on a bean leaf substrate. Temp. did not affect its relative activity on the 2 substrates. The phytophagous mite *Tetranychus urticae* was inactive on the bean leaf substrate. It was active on the glass substrate and its activity varied with temp. The functional response of *P. persimilis* and *T. urticae* was examined at 4 temp. (15, 20, 25, 30°C). Each functional response to increasing temp. rose curvilinearly to a plateau. From Holling's disk equation, rate of successful search increased and handling time decreased. *(Author's summary)* F01

0423

14331 STEWART, R.K. and KHATTAT, A.R. **Economic injury levels of the tarnished plant bug, *Lygus lineolaris* [Hemiptera (Heteroptera): Miridae], on green beans in Quebec.** Canadian Entomologist 112(3):306-310. 1980. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Injurious insects.** *Lygus lineolaris.* **Economic injury thresholds. Flowering. Podding. Pods. Yields. Chemical control. Costs. Canada.**

Caged microplots of "Contender" green beans were artificially infested with various densities of *Lygus lineolaris* to determine the effect of feeding on yield and quality, and to establish economic injury levels. Plants infested at bloom or pod set stage were more severely injured than those infested at the flower bud stage. Higher infestation levels reduced crop yield, but the % of CP in bean seeds was not affected. Based on 1975 crop values and chemical control costs, economic injury levels ranged between 0.3 and 4.4 insects/10 plants depending on crop use, chemical control and plant stage infested. *(Author's summary)* F01

0424

14332 STEWART, R.K and KHATTAT, A.R. **Pest status and economic thresholds of the tarnished plant bug, *Lygus lineolaris* (Hemiptera (Heteroptera): Miridae), on green beans in Quebec.** Canadian Entomologist 112(3):301-305. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. **Injurious insects.** *Lygus lineolaris.* **Economic injury thresholds. Insect biology. Insect control. Pesticides. Planting. Spacing. Timing.**

Adult and nymphal populations of the tarnished plant bug, *Lygus lineolaris*, on "Contender" green beans were sampled during the summers of 1971-72. Sweep net and D-Vac suction apparatus samples were taken concurrently, and both estimates were compared by regression analysis. The tarnished plant bug reached levels above the economic injury levels for both early and late crops in 1971-72. The economic threshold was determined as 0.5 insect/10 plants below the economic injury level. *(Author's summary)* F01

0425

15428 DIAZ C., J.M. **Evaluación de dos insecticidas granulados y tres dosis de aplicación en fríjol común (*Phaseolus vulgaris* L.) en el suroriente de Guatemala.** *(Evaluation of two granulated insecticides and three application rates in common beans in SE Guatemala).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos. Facultad de Agronomía, 1978. 38p. Span., 26 Refs.

Phaseolus vulgaris. **Pest control. Chemical control. Experiment design. Statistical analysis.** *Empoasca kraemeri. Bemisia tabaci.* **Injurious insects. Guatemala.**

An expt. was carried out in 7 different localities of the state of Jutiapa, Guatemala to: (a) evaluate 3 rates of 2 systemic granulated insecticides (carbofuran and phorate) applied at planting and (b) determine the most economic rate of application. A random block exptl. design was used with 6 replications and 7 treatments. Treatments evaluated were: no insecticide; 10, 20, and 30 kg carbofuran/ha; and 10, 20, and 30 kg phorate/ha. No significant differences were found among treatments in 5 localities, while in the other 2, there was a higher insect control possibly due to the greater amount of rainfall that mechanically eliminated the insects and allowed greater plant assimilation of the herbicide. Economic analysis showed that rates of 10 kg/ha of both insecticides registered the highest cost/benefit ratio (8.89 for phorate and 4.96 for carbofuran). Exptl. results and those of statistical analyses are given in table form. *(Summary by C.P.G. Trans. by L.M.F.)* F01

0426

11633 SALDARRIAGA V., A. *et al.*, comp. **Plagas del fríjol.** *(Bean pests). In*—— Guía para el control de plagas 1972. Bogotá. Instituto Colombiano Agropecuario. Programa de Entomología. Manual de Asistencia Técnica no. 1. 1972. pp.67-70. Span.

Phaseolus vulgaris. **Insect control. Mite control. Chemical control. Colombia.**

The principle pests of bean crops are presented along with the insecticides used for their control and several observations on doses, restrictions, application time, and method. The pests described are: *Empoasca* spp., *Cerotoma* spp., *Diabrotica* spp., *Epitrix* sp., *Systena* sp., *Tetranychus* sp., *Maruca testulalis, Heliothis* sp., *Hylemia* sp., *Myzus* sp., *Aphis* sp., *Trichoplusia ni, Pseudoplusia includens,* and *Autoplusia egena. (Summary by C.P.G. Trans. by L. M.F.)* F01

0427

12305 SMITH, F.F. **The importance of *Empoasca* species as bean pests, types of injury, their biology and control.** *In* Bean Plant Protection Workshop, Cali, Colombia, 1975. Trabajos presentados. Cali, Centro Internacional de Agricultura Tropical, 1975. 7p. Engl., 17 Refs.

Phaseolus vulgaris. Empoasca kraemeri. Empoasca fabae. **Insect biology. Insect control. Disease transmission. Plan injuries.**

A biological description and symptomatologic and toxicogenic aspects of the bean pest *Empoasca* spp., its geographical distribution, and some control measures are given. The great no. of existing species and their worldwide dissemination are highlighted, among them *E. kraemeri, E. fabae, E. devastans,* and *E. papayae* of economic importance. The species that feed on the spongy mesophyll and palisade tissue and those that feed on the phloem and vascular tissues are differentiated. Among control measures the selection of resistant var. and the use of chemical products, such as DDT and soil systemic insecticides or foliage sprays, are indicated. *(Summary by I.B. Trans. by L.M.F.)* F01

See also 0316 0397

G00 GENETICS AND PLANT BREEDING

0428

11637 TINGEY, W.M. **Leafhopper resistance of dry bean cultivars.** New York's Food and Life Sciences 9(3):3-5. 1976. Engl., Illus.

Phaseolus vulgaris. Empoasca kraemeri. Empoasca fabae. **Host-plant resistance. Plant breeding. Cultivars.**

Leafhoppers are pests that limit production in bean crops. Two species, *Empoasca fabae* in N. America and *Empoasca kraemeri* in Central and S. America, are the most limiting. Scientists from Cornell U., in cooperation with the CIAT, are trying to determine the genetic sources of resistance to *Empoasca.* Several var. were planted at the Thompson Vegetable Research Farm (Freeville, N.Y.) in a split-plot, randomized complete block design with 4 replications. Leafhopper infestations on 8 var. were observed throughout the season, ranging from 28-131 nymphs/30 trifoliate leaves. The most tolerant var. was Redkloud, recently developed at Cornell. Its mechanism for resistance is still unknown. Another factor of resistance is the presence of epidermal hairs (trichomes). These make the survival of nymphs difficult by penetrating the body wall, the joints of the legs and the rear of the abdomen. *(Summary by C.P.G. Trans. by L.M.F.)* G00 F00

0429

11694 VILLA A., R. **Mejoramiento varietal del fríjol.** *(Varietal improvement in beans). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador. 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.97-102. Span., 7 Refs.

Phaseolus vulgaris. **Plant breeding. Germplasm. Selection. Hybridizing. Cultivars. El Salvador.**

Bean Improvement in El Salvador has the following objectives: obtain high-yielding, disease-resistant var. with a short vegetative cycle, uniform maturity and indehiscent pods. Methods of improvement used include: (1) the introduction of germplasm developed in other parts; (2) mass selection and selection of pure lines; and (3) hybridization, which is combined with genealogical selection and methods of population. Regressive crossing is also used in some cases. The var. obtained and recommended were Selección 184, Centa 105, Rojo 70, Porrillo 70 and Rojo de Seda. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0430

11979 BEEBE, S. **Pudriciones radicales.** *(Root rots).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 7p. Span.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. **Mycoses. Rots. Roots. Plant breeding. Host-plant resistance. Colombia.**

Root rots occur in all the zones where beans are cultivated in the world. *Fusarium* spp.,

Pythium spp., *Rhizoctonia solani*, *Sclerotium rolfsii*, and *Macrophomina phaseoli* are found among the responsable microorganisms. Each pathogen developes according to its own optimum conditions. Problems are greater under humid conditions, except for *Sclerotium*. At CIAT resistant materials are found, susceptible to be improved. The steps to follow in a breeding program are: (1) test promissory materials for each pathogen; (2) include these evaluations in the choice of parents; and (3) test progeny in advanced generations to recover a resistance equal or superior to that of the parents. Information on resistance trials on different var. are presented in table form. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0431

11983 HIDALGO, R. and SONG, L. Diversidad genética en especies de *Phaseolus*. *(Genetic diversity in Phaseolus species)*. Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 29p. Span., 13 Refs., Illus.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Genetics. Taxonomy. Plant geography. Agronomic characters. Germplasm. Colombia.

A report is given on the 4 cultivated species of the genus *Phaseolus*, studying geographic distribution, taxonomy and morphology, agronomic characteristics and germplasm collection. The areas where *Phaseolus vulgaris* is extensively cultivated are North, Central and South America, Europe and E. Africa. The differentiation among the 4 species are described according to seed type, germination, leaf characters, flowers and inflorescence, pod shape and size, determinate and indeterminate growth habits, changes in the characters of cultivated vs. noncultivated forms, adaptation of the 4 species and the objectives of research conducted on each one. Germplasm evaluation has been carried out since 1970 and includes ca. 800 selected materials. Tables and figures are presented, illustrating this information. *(Summary by C.P.G. Trans. by L.M.F.)* G00 B00

0432

11984 DEBOUCK, D. Algunos aspectos morfológicos y agronómicos de otras especies de *Phaseolus*. Posibilidades para hibridación interespecífica. *(Some morphological and agronomic aspects of other species of Phaseolus. Possibilities of an interspecific hybridization)*. Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 15p. Span., 6 Refs., Illus.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Plant breeding. Hybridizing. Genetics. Colombia.

The morphological and agronomic aspects of the species *Phaseolus vulgaris*, *Phaseolus lunatus*, *Phaseolus coccineus* subesp. *coccineus* and *Phaseolus acutifolius* var. *latifolius* are described and the general characters of wild species are also presented. A list of wild species is included along with historical aspects of taxonomic classification and an analysis is given on the changes occurred, genetic distances and the possibilities of hybridization among ancestral and cultivated forms of the 4 species mentioned, and various characters considered valuable for classification within the genus. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0433

11991 DAVIS, J.H.C. Orientación del mejoramiento de fríjoles volubles. *(Guidelines on breeding climbing beans)*. Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 7p. Span., 3 Refs.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Plant breeding. Backcrossing. Hybridizing. Selection. Germplasm. Cultivars. Colombia.

The method of selection used by CIATs climbing bean program is between the pedigree method (lineage) and the bulk population method. This method reduces the variation of each hybrid population in F_2 by individual selection. The evaluation of the germplasm bank was conducted in Popayán (1850 m above sea level), Antioquia (2200 m above sea level) and Pasto (2700 m in alt.) to find disease-resistance, appropriate growth habit and adaptation. The selected var. were tested for resistance to BCMV races and anthracnose in the greenhouse. The appropriate method was backcrossing in this case. Crossbreeding followed by selection in the field is used to increase yield potential, the level of tolerance to certain diseases and adaptability. In maize/bean associations, it is recommended to select crosses or lines of 2 crosses together. The strategy of selection used is summed-up in table form. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0434

11992 DAVIS, J.H.C. Conceptos básicos de genética de fríjol. *(Basic concepts on genetics in beans).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 11p. Span., 6 Refs., Illus.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Genetics. Plant breeding. Cultivars. Agronomic characters. Host-plant resistance. Selection. Colombia.

Some basic definitions on genetics in relation to bean cultivation are presented in which a description is given on how to use this information in a breeding program. Examples are given on the management of quantitative characters (yield and plant height) controlled by different genes and qualitative ones controlled by a single gene. Indeterminate growth habit is controlled by a dominant gene. Determinate plants are the result of a recessive homozygote gene. Seed coat shine is due to a dominant allele (*Sh*) and opacity, to 2 recessive alleles. One of the genes involved in the production of pigmentation in the seed coat seems to also intervene in the production of phaseollin, an effective substance against *Rhizoctonia* and root rots; therefore, white-seeded var. are susceptible to root rots. The hipersensitive reaction to BCMV is produced by a dominant gene. Genes resistant to β and γ races of anthracnose have been found in the same chromosome. The selection of qualitative characters that are controlled by many genes should begin with the earliest generation possible. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0435

11993 TEMPLE, S.R. Estrategia general del mejoramiento genético del fríjol en el CIAT. *(General strategy of bean improvement at CIAT).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 17p. Span.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Plant breeding. Genetics. Selection. Germplasm. Colombia.

CIATs bean improvement program has the objective of generating and fomenting the production of high-yielding materials and extensive combinations of resistance to factors that adversely affects the production of the crop. The general strategy is to (a) make bean cultivation more productive, profitable and reliable, (b) increase the physiological potential to

yield and (c) identify limiting production factors through an international network of specialists. Other directions taken by the program are to increase the no. of progeny and crosses, the use of agroeconomic data to define priorities, progressive selection of characters resistant to insects, pathogens and adverse environmental conditions, separation of climbing and bush beans, and the extensive use of the bean information system (SIFRI) at a national and international level. Key aspects of the bush bean breeding program are also defined and considerations are given on the priorities of the incorporation of disease-resistance. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0436

11994 TEMPLE, S. *et al.* Orientación del mejoramiento de fríjol en los climas cálidos. *(Guidelines for bean improvement in warm climates).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 12p. Span.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Plant breeding. Diseases and pathogens. Host-plant resistance. Agronomic characters. Injurious insects. Cultivars. Colombia.

The main priority of efforts in genetic improvement of beans is to increase the production in areas where it is currently cultivated. The environment in those areas has unfavorable climatic conditions for the crop and instead, favorable for the disease-insect complex attacking it. Through the collaboration of technicians in pathology, entomology and plant breeding, the material existing in CIATs germplasm bank was evaluated in a sequential order. A list is presented of the factors limiting productivity and production in warm climates such as BCMV, bacterioses, *Empoasca*, rust, BGMV, web blight, rots, excess or shortage of moisture, low fertility of the soil and the adaptation to high temp. A description is given on the characters desired for improvement, the difficulties for their attainment and the progress made up to 1979 on the obtainment of multiple resistance for warm climates. A frequency table is included on the characters selected from materials proceeding from the germplasm bank and hybrids, evaluated according to the different disciplines. *(Summary by C.P.G. Trans. by L. M.F.)* G00

0437

11999 VOYSEST, O. Ensayos internacionales de rendimiento de fríjol para monocultivo. *(International bean yield trials for monoculture).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 15p. Span., Illus.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol., 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. Germplasm. Plant breeding. Experiment design. Agronomic characters. Field experiments. Selection. Colombia.

CIAT is currently the world center for all the germplasm of the genus *Phaseolus.* The bean program has the main objective of increasing bean production and productivity. Germplasm improvement involves a program of evaluation and identification of genetic diversity, improvement through more effective methods, trials on exptl. lines and advanced selections under a wide range of ecological conditions. Var. stability and adaptation, and the elimination of factors that adversely affect production such as diseases, insects and drought is sought along with the increase in the plant yield potential. The identification process of promising lines begins at the Bean Team Nursery (VEF) where material is evaluated according to the former aspects and afterwards, the best selections are passed on to a preliminary yield trial (EP) where they are evaluated for yield, disease- and pest-resistance of minor importance, tolerance to drought, low levels of P and resistance to high temp. EP trials are conducted in 2 regions of Colombia (Palmira and Popayán) and are later sent

to the International Bean Yield and Adaptation Nursery (IBYAN). Material forming the IBYAN is grouped in 3 categories: (1) material resulting from EP (lines from CIATs bean program, var. from the germplasm bank and lines or var. sent by national programs); (2) material chosen by the coordinator of the trial, and (3) national, international and elite controls, that are high-yielding plants showing desirable characteristics. An explanation is given on how exptl. trials are conducted, the analysis and evaluation of IBYAN results for the obtainment of promissory lines and var. Tables are presented on the characteristics of commercial var. and var. requirements for main production areas. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0438

12626 VOYSEST V., O. IBYAN 1976. Resultados del primer Vivero Internacional de Rendimiento y Adaptación de Fríjol (*Phaseolus vulgaris* L.). *(Results of the first International Bean Yield and Adaptation Nursery)*. Cali, Colombia, Centro Internacional de Agricultura Tropical, 1977?. 202p. Span., Illus.

Phaseolus vulgaris. Cultivars. Plant breeding. Selection. Adaptation. Yields. Production. Germplasm. Agronomic characters. Diseases and pathogens. Injurious insects. Statistical analysis. Colombia.

In 1976 CIAT's bean program initiated international trials on bean yields and organized the International Bean Yield and Adaptation Nursery (IBYAN) with the following objectives: (a) to evaluate the yield and adaptation of promising germplasm selections under different environmental conditions, representative of the principal bean-producing regions of the world; (b) evaluate the best var. of each region comparing them with the samples of select germplasm; and (c) provide new sources of germplasm so that each region or national program could incorporate them into their breeding program. All the expt. were conducted with the same exptl. design. All the information is presented as tabulated data on the main results, indicating the trials conducted on 25 var. in different agroclimatic regions of the 31 participant countries. Data reported includes: bean yield; harvested plants; days to flowering; growth habit; plant height; lodging; dehiscence, the no. of pods/plant; the wt.of 100 seeds; seed quality; days to physiological maturity; the date of crop maturity and the attack of diseases such as anthracnose, bacterioses, rust, angular leaf spot, web blight, powdery mildew, the complex of root rots, and insect pests found in the different regions. *(Summary by C.P.G. Trans. by L.M.F.)* G00 G01

0439

12668 NAGL, W. Temperature-dependent functional structures in the polytene chromosomes of *Phaseolus*, with special reference to the nucleolus organizers. Journal of Cell Science 6:87-107. 1970. Engl., Sum. Engl., 61 Refs., Illus.

Phaseolus vulgaris. Chromosomes. Cell structure. DNA. RNA. Cotyledons. Cytology.

During the endopolyploidization of the suspensor cells of *Phaseolus coccineus* and *P. vulgaris*, polytene chromosomes and an important nucleolar apparatus develop within the nuclei. The nucleolus-associated regions of the 4 nucleolus-organizing chromosomes and the regions of the secondary constrictions (intranucleolar chromatin threads) show a temp.-dependent, reversible variability in their structure. They split up and are dispersed at optimal temp.,and they are compact and partly banded at too low or too high ones. Many nucleolar extrusions, and additional nucleoli which originate on distended elements of the heterochromatic parts of different giant chromosomes, occur at temp. > 15°C. The polytene chromosomes of *P. coccineus* are able to form lateral loops projecting at right angles to their axes, shortly after temp. elevation due to the uncoiling of the superficial chromomeres. Several loops synthesize droplets; moreover, they form nucleolus-like bodies in a hitherto unknown manner. The duration of the lampbrush state is about 3-4 h. Cytochemical staining methods indicate the presence of DNA in all parts of the polytene chromosomes, including the intranucleolar secondary constriction and the lateral loops, and the presence of RNA in all types of nucle-

oli and nucleolus-like bodies. The structural modifications described are compared with the structure of salivary gland chromosomes of Diptera and lampbrush chromosomes in oocytes and spermatocytes. It is suggested that the structural changes are an expression of temp.-dependent changes in gene activity. *(Author's summary)* G00

0440

14304 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. **Informe anual del programa de fríjol 1979.** *(Bean Program 1979 Annual Report).* Cali, Colombia. Serie 02SB1-79, 1980. 115p. Span., 17 Refs., Illus.

Also in English.

Phaseolus vulgaris. **Research. Plant breeding. Diseases and pathogens. Viroses. Micoses. Bacterioses. Pests. Pest control. Climatic requirements. Nitrogen fixation. Nutritional requirements. Plant habit. Technology. Germplasm. Cultivars. Intercropping. Colombia.**

In 1979, CIAT's Bean Program, with only minor modifications, continued to pursue its strategies as described in the Annual Report, 1977. The areas of research developed by the Program include: (1) agro-climatic study of the crop; (2) germplasm screening for desirable variability that covers resistance to viral diseases, resistance and tolerance to fungal and bacterial diseases, resistance and tolerance to insect pests, tolerance to moderately acid soils and water stress, variability from inter-specific hybridization, photoperiod screening, ability to fix N, and nutritional and quality factors; (3) hybridization and progeny evaluation (bush and climbing beans); (4) evaluation and improvement of agronomic practices (N-fixation, biology and control of insect pests, and sugarcane-bean association); (5) validation of technology in on-farm trials. Temp. adaptation, growth habit stability, and seedling vigor were studied. The Program carries on regional activities of technology transfer in Central America and an ICTA/CIAT Collaborative Project was developed to study BGMV, a factor that limits production in this area. Other activities are training and communications, that include the preparation of technicians and professionals and the dissemination of scientific information for applied technology. The major effort on germplasm improvement (all improved lines are resistant to BCMV), improvement of screening methods for tolerance to low P and high Al saturation in soils, and of biological N-fixation under higher temp. conditions were highlighted. A noticeable impact of CIAT's Bean Program on bean production in L.A. is expected within the next 5 yr. *(Summary by C.P.G. Trans. by L.M.F.)* G00 D00

0441

14756 HAMAD, I.A. **Inheritance of yield, yield components, number of days to flowering, plant height and incidence of interlocular cavitation of pods in snap beans** *(Phaseolus vulgaris* L.). Ph.D. Thesis. Madison, The University of Wisconsin, 1975. 118p. Engl., Sum. Engl., 81 Refs., Illus.

Phaseolus vulgaris. **Yields. Yield components. Agronomic characters. Inheritance. Hybridizing. Plant habit. Flowering. Plant development. Plant breeding. Selection.**

Five snap bean cv. (Green Isle, Tempo, Bush Blue Lake 274, GalaGreen and Cascade) were selected as parents and crossed in all possible combinations to produce a diallel set without reciprocals. In the 1st expt., parents, F_1's and F_2's were evaluated for yield/plant (as total wt. of immature pods/plant), no. of pods/plant, individual pod wt., no. of days to flowering, plant height and incidence of interlocular cavitation of pods. Additive genetic variance was predominant for all traits except yield/plant, no. of pods/plant and individual pod wt. Dominance variance was predominant for all traits except plant height and interlocular cavitation. Overdominance was observed for yield/plant, no. of pods/plant and individual pod wt. No. of days to flowering, plant height and interlocular cavitation exhibited partial dominance. Narrow-sense heritability estimates were calculated as the ratio of additive to total phenotypic variance. The low estimates obtained for yield/plant, no. of

pods/plant and individual pod wt. indicated that early generation selection for improved yield would be inefficient and would result in limited gain. Heterosis for yield/plant, no. of pods/plant, individual pod wt. and no. of days to flowering was calculated as % superiority of the F_1 hybrid over the better parent. The ranges were 23-73% for yield/plant, 21-65% for no. of pods/plant, 1-15% for individual pod wt. and 14-30% for days to flowering. In the 2nd expt., parents and F_2's were evaluated for seed yield/plant (as total no. of seeds/plant), no. of dry pods/plant, 100-seed wt., and no. of seeds/pod. Additive genetic variance was predominant for all traits. Inheritance of seed yield exhibited gene interaction when Tempo was included, but without Tempo the inheritance was additive. Overdominance for high no. of pods was observed. Seed yield and seeds/pod showed partial dominance while 100-seed wt. showed little or no dominance. Seed yield/plant was positively correlated with no. of pods/plant and seeds/pod. No significant correlations were observed between seed yield/plant and 100-seed wt. No. of pods/plant was positively correlated with 100-seed wt. but negatively correlated with seeds/pod. Positive and negative correlations were found between 100-seed wt. and seeds/pod. The positive correlation between no. of pods/plant and 100-seed wt. suggest that both traits could be improved sumultaneously. Negative correlations among the yield components may cause difficulty in combining desirable levels of these components for high yield. *(Summary by Dissertation Abstracts International)* G00

0442

13599 NATARAJAN, S. and ARUMUGAM, R. **Studies on variability in french beans (*Phaseolus vulgaris* L.).** Madras Agricultural Journal 66(2):89-93. 1979. Engl., Sum. Engl., 7 Refs.

Phaseolus vulgaris. **Plant breeding. Genes. Yield components. Selection.**

Studies on the variability of french beans revealed wider variations for wt. and no. of pods/plant and length and ϕ of the pod. The genetic analysis showed high genotypic C.V. genetic variance and genetic C.V., heritability, as well as genetic advance for wt. of pods and no. of pods/plant. Thus, the no. and wt. of pods/plant with additive gene effects would serve as useful indices for selection in french beans. *(Author's summary)* G00

0443

10283 LEAKEY, C.L.A. **The improvement of beans *(Phaseolus vulgaris)* in East Africa.** *In*——, ed. Crop improvement in East Africa. Farnham Royal, England, Commonwealth Agricultural Bureaux, 1970. pp.99-128. Engl., 45 Refs.

Phaseolus vulgaris. **Plant geography. Production. Consumption. Plant breeding. Cultivars. Cultivation. Fertilizers.** ***Rhizobium.*** **Disease control. Selection. Hybridizing. Seed characters. Research.**

The work on the improvement of beans in E. Africa is described along with extense information on the origin, use, and production of *Phaseolus vulgaris*, its contribution to human nutrition, wild and cultivated forms, and biotic factors limiting productivity. Research in Uganda has been centered on the selection and improvement of beans for horticulture and in Tanzania, on the selection of white haricot beans for exporting; Uganda and Kenya are also interested in this work. The Uganda bean program is described: objectives, cv., selection, techniques of hybridization, hybridization programs, and selection in new hybrid populations. Selection and improvement of white haricot beans for canning are included. The agronomy of beans in relation to bean improvement is explained extensively. Research in Uganda and Tanzania will also benefit Kenya. *(Summary by I.B. Trans. by L.M.F.)* G00

0444

11954 EMPRESA PERNAMBUCANA DE PESQUISA AGROPECUARIA. **Projeto feijão; relatorio anual de pesquisas 1978.** *(Bean project annual report on research, 1978).* Recife, Pernambuco, Brasil, 1979. 54p. Port.

Phaseolus vulgaris. **Plant breeding. Mineral deficiencies. Temperature. Host-plant resistance. Viroses. Bacterioses. Mycoses. Intercropping. Nutritional requirements. Cultivars.** *Empoasca kraemeri.* **Integrated control. Nematodes. Protein content. Nutritive value. Brazil.**

The results obtained in the 1978 crop yr program for the state of Pernambuco (Brazil) are presented; rainfall distribution was irregular, but on the other hand, improved seed was used and the fluctuation among prices paid to producers was low. Drought occurred and in Caruaru, coincided with bean flowering. Among the problems encountered, the occurrence of *Isariopsis griseola* and *Fusarium oxysporum* was highlighted. Cv. IPA-74-19 and IPA-1 were outstanding yieldwise in Pernambuco and Alagoas. The former also showed high nutritive quality and resistance to rust. "Gordo" and "Mulatao de Moita" showed good performance in monoculture and in association with maize. Bean and maize populations of 200,000 and 16,666-25,000 plants/ha, resp. produced good results. Climbing beans in association with maize were highly profitable. Productivity and nutrient content of soil and plant leaves increased due to the accumulative and residual effects of P fertilization. Pathogens constituted the main cause of variation in production, as well as low productivity on some soils. *(Summary by I.B. Trans. by L.M.F.)* G00 D00

0445

14798 GEPTS, P. **Hibridaciones interespecíficas para el mejoramiento de** *Phaseolus vulgaris* L. *(Interspecific hybridization for the improvement of Phaseolus vulgaris).* Cali, Colombia, Centro Internacional de Agricultura Tropical. Serie SE-10-81. 1981. 17p. Span., Sum. Span., 16 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Hybridization. Selection. Agronomic characters. Plant anatomy. Plant fertility. Colombia.**

A study was initiated to determine the barriers that limit the transferences of genes between *Phaseolus vulgaris* and *P. coccineus.* The factors that determine the outcome of this crossing are the direction (success is greater when *P. vulgaris* is used as the mother parent) and the combination of parents. Early generations show reduced viability and fertility. This reduction is more pronounced in progenies *P. vulgaris* x *P. coccineus* subspecie *coccineus* compared with progenies *P. vulgaris* x *P. coccineus* subspecie *polyanthus.* It also depends on the combination of parents. In later generations a progressive restoration of viability and fertility was observed. The combination of parents greatly affects the type of segregation of the characteristics in progeny observed in F_2 of *P. vulgaris* x *P. coccineus* subspecie *coccineus* crossing. Moreover, results seem to indicate that in progenies *P. vulgaris* x *P. coccineus* subspecie *polyanthus* there are more possibilities of recombination. Interesting materials were selected for improvement of plant architecture (resistance to lodging, long hypocotyl and epicotyl, small folioles) and disease resistance (tolerance to BGMV). Some suggestions are made on future activities of the project of interspecific crosses: multiplication and evaluation of the *P. coccineus* collection, studies on segregation, projects on crosses for specific objectives. *(Author's summary. Trans. by L.M.F.)* G00

0446

14797 BAUDOIN, J.P. **L'amélioration du haricot de Lima (*Phaseolus lunatus* L.) en vue de l'intensification de sa culture en régions tropicales de basse altitude.** *(Lima bean improvement for crop intensification in low altitude tropical regions).* These Ph.D. Gembloux, Faculté des Sciences Agronomiques de L'Etat, 1981. 359p., annexe 37p. Fr., 338 Refs., Illus.

Phaseolus lunatus. **Taxonomy. Ecology. Plant geography. Diseases and pathogens. Nutritive value. Hybridizing. Plant breeding. Research.**

A detailed monograph on *Phaseolus lunatus* is given and the possibilities of improvement in order to attain adaptation to more intensive cropping systems in humid tropical regions and low alt. subregions are analyzed. Botanical, taxonomic, agronomic, and genetic considera-

tions are included along with research on breeding in different regions of the world. The application of an intraspecific breeding program in a low alt. humid tropical region (Ibadan, Onne, in Nigeria) is reported in detail and the results obtained are discussed. Regarding interspecific hybridizations with *P. lunatus*, phylogenetic relations and studies on hybridizations among *Phaseolus* species are discussed as well as the objectives and 1st results obtained in hybridizations with *P. metcalfei*, *P. polystachyus*, and *Phaseolus* sp. NI 402. Numerous conclusions are given and the major problems that occur in *P. lunatus* crop intensification and their possible solutions are defined. The need for further research and a closer collaboration between specialists and national and international scientific institutions is emphasized. *(Summary by I.B. Trans. by L.M.F.)* G00

0447

12602 TURNER, J.W. **Insects and navy beans.** Queensland Agricultural Journal 105(4):290-298. 1979. Engl., Illus.

Phaseolus vulgaris. Maruca testulalis. Heliothis armigera. Nezara viridula. **Injurious insects. Injurious mites. Insect biology. Insect control.**

The different pests of navy beans, their biological aspects, damage caused, plant-insect interactions, and control measures are briefly described. Among the injurious insects the following are mentioned: the bean fly (*Ophiomya phaseoli*); mites (*Tetranychus* spp.); lucerne jassid (*Austroasca alfalfae*); vegetable jassid (*A. viridigrisea*); corn ear worm (*Heliothis armigera*); bean pod borer (*Maruca testulalis*), green vegetable bug (*Nezara viridula*); pod sucking bugs (*Riptortus* spp.); green looper (*Chrysodeixis eriosoma*); soybean looper (*Trichoplusia orichalcea*); lucerne seed web moths (*Etiella* spp.). Periodic monitoring and inspection and spray, ground, and aerial applications of insecticides are given as control measures; a table of the a.i. of chemical products required for pest control is included. *(Summary by I.B. Trans. by L.M.F.)* G00

0448

8688 KLOZOVA, E. and KLOZ, J. **The identification of hybrids of *Phaseolus vulgaris* L. x *Phaseolus coccineus* L. using immunochemical methods.** Biologia Plantarum 6(3):240-241. 1964. Engl., 6 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Hybridizing. Identification. Seeds. Proteins. Analysis.**

The protein characters of hybrids and parents were analyzed by immunoelectrophoresis. In the F_1 generation protein characters are of an intermediate type; segregation begins in the F_2 generation and interspecific protein characters have various degrees of matro- or patroclinicity in different individuals. It is possible to use immunochemical methods to detect the hybrid character of the future plant already in the seed. Furthermore, the protein characters in F_1 and F_2 are in agreement with laws valid for other interspecific characters (morphological). *(Summary by I.B. Trans. by L.M.F.)* G00

0449

11695 TULMANN N., A. *et al.* **Efeitos da radiação-gama em plantas de feijoeiro (*Phaseolus vulgaris*, L.) em florescimento.** *(Effects of γ-radiation on flowering bean plants).* Energia Nuclear e Agricultura 2(2):133-138. 1980. Port., Sum. Port., Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Irradiation. Mutation. Flowering. Harvesting. Planting. Seedlings. Plant injuries.**

The possibility of utilizing the ^{60}Co source for γ-irradiation of bean plants in the flowering stage was shown by an expt. conducted at the Centro de Energia Nuclear na Agricultura

(CENA), São Paulo, Brazil. Pots with 2 bean plants in the flowering stage, var. Carioca, line $6E_1$, were placed individually in the center of the source. Doses used were 1, 2, 3, 4, and 5 Krad. The development of these plants after irradiation till harvest and seedling emergence of their progeny was observed. The effects of γ rays and the advantages of irradiation of plants in the flowering stage discussed, and recommendable procedures for research workers who need to use the ^{60}Co source of CENA are suggested. *(Author's summary)* G00 C02

0450

3620 MIRANDA C., S. Herencia del tipo de raíz en *Phaseolus coccineus* L. y *Ph. vulgaris* L. *(Heredity of the type of root in Phaseolus coccineus and P. vulgaris).* Agricultura Técnica en México 2(6):255-257. 1966. Span., 1 Ref., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Roots. Inheritance. Hybridizing.

The heredity of the type of root in the interspecific cross *Phaseolus vulgaris* x *P. coccineus* was studied. Var. of *P. coccineus* (Chihuahua-12-B and Puebla 142-I), of a natural interspecific hybrid (Chiapas-180-A, Puebla-153-D, Veracruz 111, Veracruz 112-A, and Veracruz 112-B) and *P. vulgaris* (Canario 101, Oaxaca-83, Puebla-157-J, and Puebla-157-K-1) were used. In the crosses between *P. vulgaris* x *P. coccineus* all plants had tuberous roots and were perennial. In the F_2 phenotypic segregation was 3:1, the tuberous type of root dominated over fibrous ones. In crosses between *P. vulgaris* with the natural hybrid, all of the F_1 showed semifibrous roots and in the F_2 segregation was 3:1, dominating semifibrous roots. Plants with a fibrous root system died when their growth cycle was completed. It is concluded that a series of allelomorphic factors determines the dominance of tuberous roots over fibrous and semifibrous types of root. *(Summary by C.P.G. Trans. by L.M.F.)* G00

0451

3611 ADAMS, M.W. and DUARTE, R. Nature of heterosis for a complex trait in a field bean cross. Crop Science 1:380. 1961. Engl., 4 Refs.

Phaseolus vulgaris. Heterosis. Genes. Leaves. Plant breeding. Cultivars.

Heterosis was observed for a total leaf area in the intraspecific cross *Phaseolus vulgaris* var. Algarrobo (a mottled kidney bean from Colombia) by var. Michelite (a navy bean). Leaf area measurements and leaf counts were made 2 wk. after the onset of flowering. The F_1 coincides with the mid-parent for mean leaf size, suggesting additivity for the genes governing this component. The F_1 did not differ significantly from Michelite for leaf no., indicating that dominant genes control this var. characteristic. The F_2 supported this interpretation of the dominance. Total leaf area of F_1 greatly exceeds the better parent, and in fact, the sum of both parents, though not significantly. A statistical-genetic model is given where epistasis is postulated attributable to the joint action of 2 genes (one additive, one dominant). In this case, the genes involved do not interact at an intercellular level but at a level of morphological integration, a kind of somatic interaction. *(Summary by C.P.G. Trans. by L. M.F.)* G00

0452

4707 VIEIRA, C. and WILKINSON, R.E. The importance of field resistance and genetical diversity in bean breeding programs in South-Central Brazil. *In* Bean Improvement Cooperative. Annual report no. 15:94-97. 1972. Engl.

Phaseolus vulgaris. Plant breeding. Genes. Host-plant resistance. Cultivars. Agricultural projects.

Local conditions of Brazil for bean improvement are described, emphasizing that the control of most diseases should be attained through the use of resistance since a considerable amount seems to be present in many of the local bean var. It is noted that many of these

var. could be actually mixtures and it is necessary to preserve this genetic diversity. The use of multilines is proposed in order to maintain the desirable characteristics of the local var.; some equilibrium could be maintained among components of the mixtures as determined in trials carried out in Viçosa. The multiline system is especially recommended for incorporating rust resistance into beans. *(Summary by I.B. Trans. by L.M.F.)* G00

See also *0012* *0015* *0235* *0258* *0263* *0266* *0276* *0324* *0364* *0389* *0417* *0491* *0492* *0494* *0495* *0552* *0563* *0592*

G01 Breeding, Selection and Germplasm

0453

4711 ECHANDI Z., R. **Naturaleza de la resistencia a la pudrición radical seca en fríjol causada por** *Fusarium solani* f. *phaseoli. (The nature of the resistance to Fusarium root rot in beans caused by Fusarium solani f. phaseoli).* San José, Universidad de Costa Rica. Departamento de Fitomejoramiento, 1970. 3p. Span., 9 Refs.

Phaseolus vulgaris. Fusarium solani phaseoli. **Host-plant resistance. Plant breeding.**

The localization and incorporation of resistance to *Fusarium solani* f. *phaseoli* in commercial var. are studied. The best known source of resistance is var. Scarlet Runner of the sp. *Phaseolus coccineus;* there also exists a line of *Phaseolus vulgaris* from Mexico known as N 203 with a high level of resistance. The resistance derived from *P. coccineus* was evaluated as dominant and is inherited in a quantitative form, whereas N 203 resistance is controlled by 2 independent genes, one dominant and the other recessive. The nature of resistance is due to the presence of substances that inhibit the growth of the fungal pathogen in root tissues and can be extracted with an organic solvent like ethyl ether. The inhibitor substances are also found in the plant canopy. *(Summary by C.P.G. Trans. by L.M.F.)* G01 E03

0454

6056 PESSANHA, G.G. **Estudos sobre misturas de cultivares de feijão (*Phaseolus vulgaris* L.).** *(Study on bean cultivar combinations).* Tese Ph.D. Viçosa-MG, Brasil, Universidade Federal de Viçosa, 1980. 96p. Port., Sum. Port., 64 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Spacing. Fertilizers. Agronomic characters. Yields. Selection. Brazil.**

Four studies were conducted on bean cv. combinations: (1) the effects of plant populations, (2) the effects of mineral fertilization, (3) behavior adaptability and stability of the combinations in the Zona da Mata area of Minas Gerais (Brazil),and (4) the mechanism of competence in combinations. It was confirmed that the level of population and fertilization, and the planting time affect the behavior of the combinations. These do not present a greater stability in their behavior than the components in monoculture. Cv. combinations can produce av. slightly higher than its components in monoculture. The intergenotipic competition of the combinations began 20 days after plant emergence. The most competitive cv. in the combinations presented greater plant height, wt. of the total DM and leaf area. With regard to reproductive characteristics, the no. of seeds/area was the most important. In cv. combinations with different seed sizes, small-seeded ones had an advantage over the others in intergenotipic competition, since a greater no. of descendents are left for the next generation. *(Author's summary. Trans. by L.M.F.)* G01 D05

0455

10309 ALMEIDA, L. D'A. DE *et al.* **Competição de cultivares de feijoeiro em Mococa e Monte Alegre do Sul.** *(Competition of french bean cultivars in Mococa and Monte Alegre do Sul).* Bragantia 36(10):125-129. 1977. Port., Sum. Port.

Phaseolus vulgaris. **Cultivars. Selection. Yields. Brazil.**

Competitive trials with french bean cv. on Orto reddish-yellow podzolic soil were conducted for 4 yr in the municipalities of Mococa and Monte Alegre do Sul in order to choose the best cv. for cultivation during the "das águas" season of the Serrana de Mantiqueira region, state of São Paulo (Brazil). Cv. Carioca, Bico de Ouro, Rosinha G-2, Pintado, Chumbinho-opaco, Preto G-1 and Rico 23 were used. According to the av. of 8 expt., cv. Carioca presented a production significantly higher than the others. Pintado, Chumbinho-opaco and Rico 23 formed an intermediate group. Bico de Ouro, Preto G-1 and Rosinha G-2 had the least production. In Mococa cv. Carioca presented a production significantly higher than the rest; in Monte Alegre do Sul its production was similar to those of Rico 23 and Pintado. Cv. Carioca can be recommended for planting in this region. *(Author's summary. Trans. by L.M. F.)* G01 D05

0456

11645 UNIVERSIDAD DEL NORTE. (CHILE). **Proyecto Frejol.** *(Bean project). In* ___. Cinco años de investigación agrícola, Arica, Chile, Departamento de Agricultura, 1974. pp.55-68. Span.

Phaseolus vulgaris. **Plant breeding. Cultivars. Selection. Diseases and pathogens. Injurious insects. Chemical control. Chile.**

The CICA in Chile has carried out a bean improvement project since Cristal Bayo, the only var. cultivated until the decade of the 70s, has shown a yield decrease due to pest and disease incidence. The project includes a study on soils, fertility, irrigation, phytosanitary and weed control, the introduction of new var. and an intent to raise the level of technology used in cultivation. Several tables summarizing the principal insect pests and beneficial pests, classified by order and species, are presented along with a list of chemical materials used for controlling the red spider mite, *Tetranychus urticae.* Genetic material from the INIA (Chile), Spain and Peru were tested and the names of introduced and selected var. are given as well as considerations on aspects of plant pathology, nematodes and fertilization. *(Summary by C.P.G. Trans. by L.M.F.)* G01

0457

2913 KELLY, J.D. **The heritability of protein and methionine in beans (*Phaseolus vulgaris*): research report.** Cali, Colombia, Centro Internacional de Agricultura Tropical, 1974. 30p. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Plant breeding. Protein content. Methionine. Inheritance. Cultivars.**

The progress and partial results are given of the research on the variability of protein and met. contents in beans. Crosses were made between 3 PI lines and Bush Blue Lake 240 (BBL 240), using the latter as female parent. The resulting generations were grown in Wisconsin, USA (1972) in a completely random design and selections of F_1 and F_2 hybrid material were grown at CIAT, Colombia (1973). Heritability estimates were based on the regression of hybrid material on the parent material. A rat feeding trial was conducted to evaluate the BV of 4 parent lines, with a large variability in protein and met. contents. Frequency distribution of % protein indicates the partial dominance for high protein content in hybrids (BBL 240 x PI 207227); broad sense heritability estimate was 69.1%, while the narrow sense estimate was 0. The presence of a overdominance component for low protein content was observed in cross BBL 240 x PI 229815. Broad sense heritability was 71.2% and narrow sense estimate was 0. There is a possible dominance for high protein content in cross BBL 240 x PI 302542. Broad sense heritability was 31.9% and narrow sense estimate, 49.4%. A partial dominance was found for low met. content in BBL 240 x PI 207227. Regression analysis showed the difficulty of early selection as all the seed on the F_2 plant is segregating, and the environmental effects on the progeny. In the feeding trial, BBL 240 had the highest BV with respect to the level of met. *(Summary by I.B. Trans. by L.M.F.)* G01 H01

0458

14311 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. **Programa de fríjol; ensayos preliminares 1980.** *(Bean program; preliminary trials 1980).* Cali, Colombia. Serie 20 S/E B4-80. 1980. 37p. Span., Engl., Sum. Span., Engl., Illus.

Phaseolus vulgaris. **Plant breeding. Germplasm. Genetics. Agronomic characters. Plant habit. Dwarf beans. Climbing beans. Seed. Seed characters. Yields. Hosts and pathogens. Host-plant resistance. Cultivars. Colombia.**

Bush materials of EP 1980 were grouped into 7 classes based on their grain types. The climbers were also included in the testing system. The growth habits and grain types are given for materials tested in EP 1980. Yield trials at all locations were conducted with both adequate and high inputs. The stress due to low soil P and high Al was not sufficient for detecting genotypic differences at CIAT-Quilichao. Marked differences were observed at CIAT-Palmira and Popayán in the performance of materials at the 2 input levels. Moreover, an outbreak of powdery mildew at Popayán maximized the yield and maturity differences between plots with the 2 levels of inputs. Among commercial grain types small-seeded black and cream lines seem to have higher yields than red and white-seeded materials. Also yields of medium and large-seeded types, in general, were lower than small-seeded types. The yield advantage of the longer growing season at Popayán vs.CIAT-Palmira site was only noted for plots which were grown at high input levels at the former site. Of 105 materials tested, 34 were insensitive to photoperiod and the remainder showed variable degrees of sensitivity to an 18 h photoperiod at CIAT-Palmira. The frequency of materials with resistance to disease and insect pests is given for each grain type. All EP entries were resistant, as a prerequisite, to the Florida and NY 15 strains of BCMV. Twelve lines expressed moderate resistance each to *Sclerotium* and *Fusarium* root rots in glasshouse trials. Of these only BAT 527 and BAT 910 were moderately resistant to both. None of 105 lines tested expressed a promising level of resistance to *Rhizoctonia solani.* *(Author's summary)* G01 D05 D04

0459

14384 WEBSTER, D.M., TEMPLE, S.R. and SCHWARTZ, H.F. **Selection for resistance to *Xanthomonas phaseoli* in dry beans.** Crop Science 20(4):519-522. Engl., Sum. Engl., 12 Refs., Illus.

Phaseolus vulgaris. Xanthomonas phaseoli. **Host-plant resistance. Hybridizing. Selection. Culture media. Inoculation. Leaves. Symptomatology. Seedlings. Inheritance. Statistical analysis.**

Seedling and adult resistance in dry beans to *Xanthomonas phaseoli* was evaluated on field and greenhouse plants of F_4 families derived from 2 susceptible x resistant crosses. Over 90% of the variation among disease scores of field-grown families was attributable to the regression on scores of greenhouse-grown seedlings. Two greenhouse inoculation methods, leaf-clipping and water-soaking, accurately predicted field resistance of families. The greenhouse comparison of seedlings and flowering plants revealed that the differences among families were much greater than the interaction of families with developmental stage. Heritability of disease severity in greenhouse tests, estimated by parent-offspring regression (F_2/F_3) was comparable for both inoculation methods. Correlation estimates of 0.27 for leaf-clipping and 0.28 for water-soaking were obtained when P.I. 207262 was the resistant parent. A regression estimate of 0.62 was obtained for the heritability of disease severity after leaf-clipping inoculation when "Jules" was the resistant parent, indicating plant selection from crosses with "Jules" would be effective for identification of resistant lines. *(Author's summary)* G01 E02

0460

14376 ROMERO, I. and GARCIA, A. **Efectos mutagénicos en fríjol variedad Jamapa.** *(Mutagenic effects on bean variety Jamapa).* México, Northrup King y Cía. 1979?. 17p. Span., 6 Refs.,

Paper presented at Reunión Anual del PCCMCA, 26a. Guatemala, 1980.

Phaseolus vulgaris. **Cultivars. Irradiation. Genes. Laboratory experiments. Selection. Yields. Protein content. Plant anatomy. Plant breeding. Agronomic characters. Mexico.**

Artificial means exist to incite genetic changes and it is not improbable that these means will be used to reestablish genetic variation. The technique to obtain greatest variation by physical mutagenic agents has been used in a great amount of crops and mutants of agricultural interest, including commercial var., have been obtained by this process. In the present study, the effects of Co 60 γ rays were used to obtain greater variation in grain yield and in the amount of protein in beans. Three generations (M_1, M_2, and M_3) were used with 12 different doses of radiation from 0-40,000 rads; individual selection was practiced in each generation and yields of these materials, as well as vigor and early-maturation, were taken as a basis. An increase in the C.V. of both yields and protein was obtained, indicating that the technique of irradiation was effective in generating genetic variability and subsequently in selecting the characters of agronomic interest. On the other hand, it was feasible to select good-yielding genotypes with acceptable protein %, since a 13.63% differential in selection was observed for yields and 15.88% for protein %, compared to non-selected bean var. Jamapa. Finally a stepwise analysis was conducted in order to select a regression model that could explain yield response in such a way that the following model was selected as the best: $K = 51.01 - 0.065P^2 + 0.097F^2 - 2.57U^2$, where P is the protein %, F are the days to flowering, and U, the ranking of *Uromyces. (Author's summary. Trans. by I.M.F.)* G01

0461

14382 HARDWICK, R.C. and ANDREWS, D.J. **A method of measuring differences between bean varieties in tolerance to sub-optimal temperatures.** Annals of Applied Biology 95:235-247. 1980. Engl., Sum. Engl., 31 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Temperature. Host-plant resistance. Adaptation. Cultivars. Statistical analysis. Stems. Maturation. Harvesting. Timing.**

Bean *(Phaseolus vulgaris* and *P. coccineus)* plants were grown in controlled environments at (day/night) temp. of either 25°/20°C or 20°/15°C. The lower temp. tended to reduce the weight of stem relative to the weight of leaf. An interporlation procedure was devised for estimating the magnitude of this effect, which varied between cv. It is suggested that the interpolation parameter can be used as an indication of var. cold tolerance. Thus estimated values of the parameter (h) normalized so that 1 unit = 1 S.E.D., were large and positive in a cv. Seafarer previously characterized as cold intolerant (h = 4.19), large and negative in the relatively cold tolerant *P. coccineus* cv. Hammond's Dwarf Scarlet (h = -3.03), and near to zero (h = 1.11) in the standard commercial var. of *P. vulgaris* cv. Prelude. The expt. with cv. Seafarer and Prelude was repeated 3 times and similar values of h were obtained on each occasion. There was only a small variation of h with harvest date; over a period in which plant wt. increased at least 3.5 and up to 9 times. In the 3rd expt. a modification of the harvesting procedure was adopted so that plants could be tested for cold tolerance and then grown on for seed production. This semi-destructive test was applied to, and the results are reported for 9 cv. which are of interest as potential dry-bean cv. for the UK. *(Author's summary)* G01 C02 D01

0462

14383 HARDWICK, R.C. and ANDREWS, D.J. **Selection for cold tolerance in *Phaseolus vulgaris* - yields of selected lines grown in warm and cool environments.** Annals of Applied Biology 95:249-259. 1980. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. Climatic requir

Phaseolus vulgaris. **Climatic requirements. Temperature. Host-plant resistance. Cultivars. Selection. Yields. Planting. Germination. Growth. Plant breeding. Scotland.**

Forty-eight F_4 families of a cross between 2 cv. of *Phaseolus vulgaris* were grown in warm and cool environments in the field. The F_2 and F_3 generations had been assessed for cold tolerance using the test described by Hardwick & Andrews (1980). The mean seed yields of the F_4's were 333 and 167 g m^{-2} in the warm environment (blackened soil surface, clear polyethylene mulch, windbreaks) and cool environment (whitened soil surface, no mulch or windbreaks) resp. The ratio of yields in the 2 environments was larger in families selected for cold sensitivity than in those selected for cold tolerance (values of ratio 2.28 to 1 and 1.76 to 1, resp.). The warm treatment decreased the no. of days between sowing and emergence from 15.6-8.6, increased the estimated wt./seedling axis at emergence from 544-904 mg/plant, and increased the weight/plant at flowering from 3.75-4.7 g. Plants from the warm treatment had bigger leaf wt., smaller stem wt., more branches and bigger specific leaf areas than plants of the same wt. from the cool treatment. Differences in yield were due mainly to differences in the no. of seeds produced/plant. Eleven F_5 families were grown in a simple yield trial the following yr. The season was cooler and yields were reduced. The reduction in yield was greater in the cold sensitive than in the cold tolerant families. *(Author's summary)* G01 C02 D01

0463

14366 POMPEU, A.S. and PARADELA FILHO, O. **Novas linhagens de feijoeiro *(Phaseolus vulgaris)* dos grupos Rosinha e Roxinho, resistentes ao fungo da antracnose *(Colletotrichum lindemuthianum)*.** [*New dry bean lines of Rosinha and Roxinho groups resistant to the anthracnose fungus (Colletotrichum lindemuthianum)*]. Summa Phytopathologica 5(3/4):153-158. 1979. Port., Sum. Port., Engl., 10 Refs.

Phaseolus vulgaris. Colletotrichum lindemuthianum. **Plant breeding. Host-plant resistance. Genes. Hybridizing. Cultivars.** *Uromyces phaseoli.* **Inoculation. Brazil.**

With the objective of developing new resistant cv. to the anthracnose agent, crosses were made between Rosinha G_2, Roxo Minas (susceptible parents) and Cornell 49-242 (resistant) under greenhouse conditions. Seedlings from the crosses and backcrosses to susceptible cv. were inoculated beginning in the F_2 and F_1 generations, resp. The pedigree method was used for the identification of the resistant and the homozygous plants, as well as for other characteristics. A spore suspension of isolates α and Brasilian I groups containing approx. 10^5 spores/ml was sprayed on the seedlings with a De Vilbiss atomizer. From these crosses more than 1000 resistant lines were obtained with pink, purple, brown, yellow, and black seed coat colors. These lines were evaluated for other characteristics under field conditions. Some of them were discarded while other lines were found within the Roxinho group that had resistance to the rust fungus, indeterminate growth habit with short guides, and uniform seed coat color. The best lines are being evaluated for yielding ability to select those for regional trials in Brazil. *(Author's summary)* G01 D05

0464

14721 AYAD, G. and ANISHETTY, N.M. **Directory of germplasm collections. I. Food legumes.** Rome, International Board for Plant Genetic Resources, 1980. 22p. Engl.

Phaseolus vulgaris. **Germplasm. Plant geography. Storage. Research.**

A directory is presented of food legume germplasm collections, including beans, that exist in the following countries: Afghanistan, Algeria, Argentina, Australia, Bangladesh, Belgium Bolivia, Bulgaria, Canada, China, Colombia, Costa Rica, Cuba, Czechoslovakia, Ethiopia, Germany, Democratic Republic, Germany, Federal Republic, Greece, Guadaloupe, Hungary, India, Indonesia, Iran, Italy, Japan, Kenya, Malawi, Malaysia, Mexico, Netherlands, Nigeria, Pakistan, Papua New Guinea, Philippines, Poland, Romania, Rwanda, Spain, Sweden, Syria, Thailand, Turkey, United Kingdom, USA, USSR, and Venezuela. The institution, person in

charge, details of samples, geographical representation of the collection, forms of evaluation, documentation, and storage are given. *(Summary by C.P.G. Trnas. by L.M.F.)* G01 A00

0465

14336 MIRANDA, P. *et al.* IPA-74-19 uma nova variedade de feijão "mulatinho" *(Phaseolus vulgaris* L.) para Pernambuco. *(IPA-74-19, a new cream bean variety for Pernambuco).* Pesquisa Agropecuária Pernambucana 3(1):105-111. 1979. Port., Sum. Port., Engl., 4 Refs., Illus.

Phaseolus vulgaris. Plant breeding. Cultivars. Selection. *Uromyces phaseoli.* Host-plant resistance. Seed color. Plant habit. Agronomic characters. Yields. Protein content. Cooking. Brazil.

IPA-74-19 cv. was originated from a cross between Costa Rica and L3-0-50 cv. Costa Rica has black seeds and L3-0-50 has brown seeds. At the beginning, the genealogical method was utilized. The test was initiated in the F_4 generation and the best lines were grown in isolated plots. The mass selection method was utilized up to the F_7 generation. The production tests, using the homozygote material, started in the F_8 generation and continued up to F_{11} which made possible to detect various lines with high production capacity. The 19(2-12) line, besides to demonstrate its production capacity and to show the seed tegument dressed with the brown color, revealed to be resistant to rust *(Uromyces phaseoli).* This line, now called IPA-74-19, presents an undetermined growth, type 2. Its productivity was 41% higher than that "Rim de Porco" bean which is traditionally cultivated in the state of Pernambuco (Brazil). *(Author's summary)* G01 D05

0466

15208 EVANS, A.M. Germplasm collections of *Phaseolus* beans. Bean Improvement Cooperative Annual Report 23:7-9. 1980. Engl.

Phaseolus vulgaris. Germplasm. Plant geography. Research.

A list is given of the institutions in countries of Central, South, and North America, Europe, and Africa that have germplasm collections of *Phaseolus.* Countries included are: Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, USA, Belgium, France, Germany, Hungary, Netherlands, Norway and Sweden, Romania, Turkey, United Kingdom, USSR, Burundi, Kenya, Malawi, Rwanda, Tanzania, and Uganda. *(Summary by C.P.G. Trans. by L.M.F.)* G01 A00

0467

5825 KLOZOVA, E. and KLOZ, J. Protein characters in species hybrids of the genus *Phaseolus* studied by means of serological methods. Acta Agriculturae Scandinavica, Supplement 16:225-228. 1966. Engl., Illus.

Phaseolus vulgaris. Phaseolus coccineus. Hybridizing. Protein content. Seed characters.

Protein characters in seeds of hybrids between *Phaseolus vulgaris* var. *nanus* cv. Veltruská Saxa (as mother) and *P. coccineus* var. *coccineus* semine nigro flore rubro or *P. coccineus* var. *coccineus* cv. Weisse Riesen (as father) were investigated and compared with the interspecific morphological characteristics of Lamprecht (position of cotyledons and shape of stigma) during 3 generations. The protein character that distinguishes *P. coccineus* from *P. vulgaris* behaves in the same manner as interspecific morphological characters and thus, can be considered as another interspecific character. Regularities were also established in the behavior of protein characters after crossing not only in the F_1 generation but also in subsequent generations when they again behave as morphological characters. No correlation was found between the interespecific morphological and protein characters. *(Summary by I.B. Trans. by L.M.F.)* G01 H01

0468

15808 OGBUJI, R.O. **Pathogenicity of** *Meloidogyne incognita* **Race 1 on lima bean cultivars.** Tropenlandwirt. Zeitschrift für die Landwirtschaft in den Tropen und Subtropen 82(1):19-23. 1981. Engl., Sum. Engl., Germ., 7 Refs., Illus.

Phaseolus lunatus. Meloidogyne incognita. **Strains. Host-plant resistance. Selection. Cultivars. Nigeria.**

Seven cv. of lima bean were screened for resistance/susceptibility to *Meloidogyne incognita* Race 1 from Nsukka (Nigeria). Only one cv. (Acc 2405 C) was resistant to the pathotype. Results with other races of *M. incognita* may not necessarily be identical. *(Author's summary)* G01 E05

0469

15254 RAMOS N., F.T. **Herencia de tres diferentes tipos de reacción a roya (***Uromyces phaseoli***) en fríjol común (***Phaseolus vulgaris* **L.).** [*Inheritance of three different reaction patterns to bean rust (Uromyces phaseoli) on common bean (Phaseolus vulgaris)*]. Tesis Mag. Sc. Bogotá, Colombia, Universidad Nacional. Instituto Colombiano Agropecuario, 1981. 54p. Span., Sum. Span., Engl., 43 Refs., Illus.

Phaseolus vulgaris. Uromyces phaseoli. **Host-plant resistance. Cultivars. Inheritance. Backcrossing. Genes. Selection. Colombia.**

The inheritance of resistant (R), intermediate small pustule (Ip), and intermediate necrotic pustule (In) reactions to bean rust *Uromyces phaseoli* was studied in crosses to susceptible parents (S) at the exptl. station of the Centro Internacional de Agricultura Tropical in Palmira, Colombia, during 1979-80. Seven parents were used to make 9 different combinations of which 4 crosses were designed to study the inheritance of the R reaction, 2 for the Ip reaction, and 3 for the In reaction. Results indicated that the R reaction was controlled by a single dominant gene, the Ip reaction by one recessive gene, and the In reaction by one recessive gene. Parents with R and Ip reaction types, and their progenies were stable in expression throughout the crop growth cycle and in 3 planting seasons under different environmental conditions, while the source of the In reaction (BAT 153-IC) and its progenies showed race x genotype interaction, associated with a sensitive reaction to physiological changes in the plant. Results from a cross R x In types suggested the existence of an allelic series in which the order of dominance is R > S > In, and in which the level of expression of the In genotype, and the degree of dominance of S over In appears to be conditioned by the physiological stage of the plant. The stability of the R and Ip reactions, and their apparent non-specificity to rust races, suggest relatively greater value than for the In reaction in breeding programs seeking more stable resistance. In particular, the Ip reaction seems to favor an ecological balance between the host and the pathogen, allowing coexistence and a possible reduction in the pressure favoring mutation and/or recombination of the fungus. *(Author's summary)* G01 E03

0470

4706 IBRAHIM, A.M. and COYNE, D.P. **Genic-cytoplasmic inheritance of cotyledon position (hypogeal versus epigeal) in the interspecific cross** *Phaseolus vulgaris* **x** *Phaseolus coccineus. In* Bean Improvement Cooperative. Annual Report no. 18. 1975. p. 33. Engl.

Phaseolus vulgaris. Phaseolus coccineus. **Plant anatomy. Cotyledons. Backcrossing. Genetics. Genes. Inheritance. Germination.**

The inheritance of cotyledon position was studied in the greenhouse of *Phaseolus vulgaris* (epigeal) and *P. coccineus* (hypogeal) in the following generations derived from certain crosses: F_1 *P. vulgaris* GN 1140 x *P. coccineus* PI 176675, F_1 *P. vulgaris* GN Jules x *P. coccineus* PI 176675, F_1 *P. coccineus* PI 176675 x *P. vulgaris* GN 1140, F_1 *P. coccineus*

PI 175858 x *P. vulgaris* GN 1140, F_2 *P. coccineus* PI 175858 x *P. vulgaris* GN 1140 and BC_1, BC_2 cross *P. vulgaris* GN 1140 (♀) x *P. coccineus* PI 176675 (GN 1140 was used as the recurrent parent). Seeds were planted 1 in. deep in the soil and cotyledon height was measured from the soil surface to cotyledon level. Germination was epigeal in the F_1 *P. vulgaris* (♀) x *P. coccineus* and hypogeal was dominant in the reciprocal F_1. A continuous distribution of cotyledon position heights was noted in both the BC_1 and the BC_2 generations and a discontinuous segregation (hypogeal vs. epigeal) was observed in the F_2 *P. coccineus* x *P. vulgaris*. Results indicate a genic-cytoplasmic control of the cotyledon, expression of position, and the feasibility of transferring genes controlling the hypogeal germination into the *P. vulgaris* genome. Several backcrosses should be made in the cytoplasm of both species to determine if a higher level of expression of the trait can be more readily obtained in *P. coccineus* cytoplasm. *(Author's summary)* G01

0471

15209 FAWOLE, Y., GABELMAN, W.H. and GERLOFF, G.C. **Heritability of efficiency in phosphorus utilization in beans (*Phaseolus vulgaris* L.) grown under phosphorus stress.** Bean Improvement Cooperative Annual Report 23:18. 1980. Engl.

Phaseolus vulgaris. **Nutritional requirements. P. Inheritance. Backcrossing. Mineral deficiencies. Host-plant resistance. Cultivars.**

The heritability of efficiency in P utilization under deficiency stress was investigated using 6 bean cv. derived from crosses between selected efficient, moderately efficient, and inefficient lines. Total plant dry wt. and total plant P efficiency ratio (mg plant dry wt. produced/mg P absorbed by the plant) were used as indices of efficiency. Estimates of broad sense heritability showed that efficiency in P utilization was a highly heritable trait. Estimates of narrow sense heritability were high for total plant dry wt. in all lines studied. *(Summary by C.P.G. Trans. by L.M.F.)* G01 D01

0472

14759 SILVERA C., G.A. **Incorporation of germplasm of the Seafarer navy bean into several Central and South American bean cultivars, in relation to breeding for improvement in adaptation.** Ph.D. Thesis. East Lansing, Michigan State University, 1974. 98p. Engl., Sum. Engl., 16 Refs., Illus.

Phaseolus vulgaris. **Germplasm. Genes. Backcrossing. Ecology. Adaptation. Cultivars. Experiment design. Statistical analysis.**

The Seafarer navy bean has been successfully grown in diverse areas of the world. The adaptive values of several of its characteristics (the determinate growth habit, early maturity, and small leaflets) were determined, in an attempt to relate them to wide adaptation. Those traits were incorporated into 8 Central and South American bean var. by means of backcrosses. Selection was practiced in backcross self generations to recover the Seafarer traits and the seed type of the C. or S. American var. Six different selection classes were also established, composed of combinations of alternative states of the traits (determinate, early, small-leafed; determinate, late, large-leafed). The adaptive value of each selection class and the contribution to adaptation of individual traits was determined. Data were collected from 2 locations in S. America: La Molina, Peru and Palmira, Colombia, and from one location in N. America, East Lansing, Michigan. Yield was the variable most affected by the environment, as determined from the analysis of variance over the 3 locations, and seed wt. was the most affected among the yield components. The no. of seeds/pod was least subject to the influence of the environment. Seafarer was the highest yielding genotype, showing wide adaptation to all locations. Genotypes with the determinate, early, small-leafed characteristics were found to be better adapted to all environments, as determined from the performance of the selection classes and from the contribution to adaptation of the individual traits. Lines selected from backcrosses to Seafarer produced larger yields and a greater no. of pods/

plant and seeds/pod. They showed a tendency to be widely adapted. It is suggested that the 3 traits present in Seafarer, plus daylength neutrality, are mainly responsible for its wide adaptation. The contribution to adaptation of daylength neutrality was not determined, but this trait directly conditions wide adaptation in other crops and its contribution might be a decisive factor in explaining wide adaptation in beans. *(Extracted from author's summary)* G01

0473

15843 HARDWICK, R.C. and ANDREWS, D.J. **Seedling growth in *Phaseolus vulgaris* L. The early growth of cultivars selected for seedling cold tolerance.** Annals of Botany 47:203-214. 1981. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Temperature. Host-plant resistance. Seedlings. Growth. Selection.**

A test for selecting cv. of *Phaseolus vulgaris* which exhibit rapid seedling emergence at low temp. is described and this test is used to identify 3 cold-tolerant cv. The growth of these cv. are compared with that of 3 control cv. Both at 25/20°C and at 20/15°C day/night temp., these cv. emerged more rapidly than the controls. This was due to more rapid hypocotyl elongation, not to earlier germination. Rapid hypocotyl elongation was associated with high RGR of the seedling axis and rapid loss in wt. of the cotyledons. After emergence, cotyledons of all cv. continued to lose wt. at a constant exponential rate. RGR of the axes were not constant but declined with time. There was no evidence that genotypic differences in growth rates before emergence were reflected in growth rates after emergence. A simple quantitative analysis suggested that the decline in axis RGR after emergence was due to a declining contribution from cotyledonary reserves. There were significant differences between cv. in the initial wt. of the seedling axis. Axis wt. (A) was not linearly proportional to seed wt. (S), but the curvilinear allometric relationship $A = 0.0773\ S^{0.697}$ satisfactorily accounted for most of the variation in initial axis wt. between cv. In all cv., axis wt.at emergence were smaller in the cool regime than in the warm, because low temp. depressed axis RGR relative to the rate of emergence. The biggest difference between the Q_{10} of RGR, and of emergence rate, and hence the biggest effect of low temp. on axis wt. at emergence, occurred in the cold-susceptible cv. Seafarer. However, genotypic cold tolerance during the period when growth is dependent on reserves did not appear to guarantee cold tolerance during the main period of growth. *(Author's summary)* G01

0474

15472 TEMPLE, S.R. and MORALES, F.J. **Conversión de cultivares de fríjol (*P. vulgaris*) susceptibles al BCMV, a cultivares resistentes mediante la incorporación de la resistencia hipersensible.** *(Conversion of BCMV-susceptible bean cultivars to resistant cv. by the incorporation of hypersensitive resistance).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1981. 7p. Span., Sum. Span., Engl., 10 Refs.

Paper presented at Reunión Anual del PCCMCA, 27a., Santo Domingo, República Dominicana, 1981.

Phaseolus vulgaris. **Bean common mosaic virus. Host-plant resistance. Cultivars. Backcrossing. Selection. Colombia.**

All commercially grown bean var. in Central America of small shiny red grain type are susceptible to one or more strains of BCMV. An attempt was made to recombine the important var. characteristics of var. such as Honduras 46, Rojo Zamorano, Nahuizalco, Rojo de Seda, and Desarrural, in addition to the hypersensitive resistance to BCMV. A system of rapid backcrossing was used in which F_1 plants were mechanically inoculated with BCMV to eliminate susceptible segregants, thus carrying the dominant resistance gene forward in the

heterozygous state. BCMV-resistant families combining the principal grain and plant types of the recurrent parent (commercial red var.), were recovered after the 3rd backcross. Evaluation of these lines for BCMV, however, indicates that other deficiencies of the commercial var. have also been transferred at a very high frequency, such that these partial products must be crossed with sources of resistance to other important constraints. *(Author's summary)* G01

0475

15804 REELEDER, R.D. and HAGEDORN, D.J. **Inheritance of resistance to *Pythium myriotylum* hypocotyl rot in *Phaseolus vulgaris* L.** Plant Disease 65(5): 427-429. 1981. Engl., Sum. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Pythium spp. **Rots. Hypocotyls. Host-plant resistance. Inheritance. Statistical analysis. Cultivars.**

Resistance to *Pythium myriotylum* hypocotyl rot was found in several lines of *Phaseolus vulgaris*, including PI 203958 (N203), State Half Runner, Ore. 70-169-1M, and Wis. (RRR) 46. Broad sense heritability values, as determined from crosses between PI 203958 and the susceptible cv. Cascade and Tenderwhite, were 0.643 and 0.651, resp. The value of the cross Wis.(RRR) 46 x Tenderwhite was 0.290. Distribution of the F_2 populations appeared to be normal for all crosses. *(Author's summary)* G01 E03

0476

7287 HARTMANN, R.W. **Manoa wonder, new root-knot nematode resistant pole bean.** Hawaii Agricultural Extension. Circular no. 67:5-10. 1968. Engl., 2 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Hybridizing. Selection. Host-plant resistance. Nematodes. Yields.**

A new climbing bean is reported, derived from a selection of the progeny of a cross between Alabama no. 1 and Hawaiian Wonder and resistant to the root-knot nematode (*Meloidogyne incognita*), occurring in the tropics and Hawaii and limiting crop yields. Although yields vary considerably from farm to farm due probably to the presence of nematodes, the new selection, Manoa Wonder, is superior in yields, straightness, and stringiness; even though it is not immune to *M. incognita*, it is recommended for infested regions. *(Summary by I.B. Trans. by L.M.F.)* G01 E05

0477

15205 **RELEASE OF snap bean germplasm line 78BP-3.** Bean Improvement Cooperative Annual Report 23:127-128. 1980. Engl.

Phaseolus vulgaris. **Cultivars. Germplasm. Plant breeding. Plant anatomy. Yields. Trade.**

Line 78BP-3 is an F_8 bulk out of Contata x 70BC-1490; the 1st is resistant to BCMV, BYMV, and anthracnose and the 2nd to the curly top virus. Plants are short (52 cm tall x 52 cm wide) and upright with medium sized leaves, short pods (8-11 cm), slim, round, and fairly smooth. In spite of its small pods, av. yields are 4-7 t/ha; it has a firm texture for canning, good flavor, and tends to form seeds in older pods. The wt. of 100 seeds is 18.1 g (2500 seeds/lb). Plant characteristics (high yields, good canning quality, and disease resistance) make it attractive for the producer. *(Summary by C.P.G. Trans. by L.M.F.)* G01

See also 0438

G02 Cytogenetics

0478

14379 FASSEAS, C. and BOWES, B.G. **Ultrastructural observations on proliferating storage cells of mature cotyledons of *Phaseolus vulgaris* L. cultured in vitro.** Annals of Botany 46:143-152. 1980. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. **Cytology. Cell division. Cell structure. Cotyledons. Leaves. DNA. Electron microscopy. Laboratory experiments.**

Explants of mature cotyledons of *Phaseolus vulgaris* form callus rapidly when cultured in vitro with their adaxial surfaces embedded in a solidified nutrient medium containing coconut milk, kinetin and 2,4-D. Proliferation is confined to the highly polyploid storage cells and commences near the adaxial epidermis, which is soon ruptured by the callus developing internally. Callus formation progresses to the abaxial tissue and within 3-4 wk. sub-culturing is possible. The in vitro grown storage cells undergo thinning of their walls, loss of food reserves, hypertrophy, development of various new-walls and nuclear activation leading to division. The induction of nuclear and cell divisions within this mature storage tissue contrasts with normal germination in which these cells undergo rapid senescence after depletion of their food reserves. Nuclear division in early callus growth is apparently mainly amitotic. It is preceded by the development of multiple nucleoli. The nuclear envelope also becomes more complex and deeply lobed; leading to formation of a nuclear isthmus and final separation into two nuclei. No chromosomes are visible during nuclear fragmentation. Amitosis is accompanied by freely-forming walls, which may develop adjacent to a nuclear isthmus and perhaps participate in nuclear fragmentation. Large labyrinthine wall bodies frequently occur on these walls. Mitoses are only observed in already divided storage cells. A cell plate forms between the 2 daughter nuclei, and microtubules are present at its margins in contrast to freely-forming walls where none are evident. *(Author's summary)* G02 B00

0479

15421 HAQ, M.N., LANE, G.R. and SMARTT, J. **The cytogenetics of *Phaseolus vulgaris* L., *Phaseolus coccineus* L, their interspecific hybrids, derived amphidiploid and backcross progeny in relation to their potential exploitation in breeding.** Cytologia 45:791-798. 1980. Engl., Sum. Engl., 8 Refs., Illus.

Phaseolus vulgaris. Phaseolus coccineus. **Cytogenetics. Hybridizing. Backcrossing. Genetics. Chromosomes.**

Chromosome no. in *Phaseolus vulgaris* and *P. coccineus* is 2n=22. In F_1 hybrids pairing is predominantly bivalent, the formation of occasional multiple figures indicating some structural differentiation. Multivalent formation is observed in the derived amphidiploid; frequency declines from C_1-C_5 with corresponding improvement in seed fertility and pollen stainability. Factors favouring homologous pairing are evidently selected. Meiosis and seed fertility in F_2 and most F_1 backcrosses are more or less normal except for the BC_1 F_1 (*P. vulgaris* x *P. coccineus*) x *P. coccineus* which had very low fertility. Introgression is possible reciprocally between the 2 species because the F_1 interspecific hybrid, initially made on *P. vulgaris* can be backcrossed as pollen parent to both original parents used as seed parent.

It is, however, very difficult to transfer 2 characters 'cotyledon' and 'stigma' positions between species which may be related to chromosome structural differences. The fertility of the amphidiploid may be raised to the diploid level by recurrent selection. *(Author's summary)* G02

See also 0377

G03 Polyploidy

0480

5817 MOH, C.C. **Seed-coat color changes induced by ethyl methanesulfonate in the common bean (*Phaseolus vulgaris* L.).** Mutation Research 7:469-471. 1969. Engl., 2 Refs., Illus.

Phaseolus vulgaris. **Genetics. Mutation. Seeds. Seed coat. Seed color. Genes.**

A potent mutagenic agent was used to explore the possibility of a change of seed-coat color in black bean var. San Fernando. Seeds were treated with 0.04, 0.06, or 0.08 *M* aqueous unbuffered EMS (ethyl methanesulfonate) solution (1 ml/seed, 6 or 12 h at 20°). Positive results were obtained; it is indicated that the white-seed mutants, induced by EMS, were due to the change from the dominant pigmentation factor (P) to its recessive, or merely due to a P deletion. This induced mutation technique will greatly facilitate the breeding process for the obtainment of seed-coat colors in beans. *(Summary by I.B. Trans. by L.M.F.)* G03

H00 NUTRITION

0481

4947 RUTGER, J.N. **Variation in protein content and its relation to other characters in beans (*Phaseolus vulgaris* L.).** Ithaca, New York, Cornell University. Department of Plant Breeding and Biometry, 1971?. 11p. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Protein content. Agronomic characters. Cultivars. Ecology.**

CP content and its relation to other characters of the plant were studied in bean lines cultivated in nurseries of the state of New York (USA). Over 1000 lines were evaluated with regard to maturity, seed wt., yields, protein and oil content. Exptl. conditions affected protein content significantly; this varied between 19-31% with an av. of 24.6% for 343 lines that were selected for a 2nd evaluation. Protein content was positively correlated to late-maturing lines and negatively to seed wt. and oil content. Yield and growth habit did not show a significant correlation. The frequency of high protein lines was higher in the Central American collection. Information is presented in table form. *(Summary by C.P.G. Trans. by L.M.F.)* H00

0482

14704 BENDER, A.E., MOHAMMADIHA, H. and ALMAS, K. **Digestibility of legumes and available lysine content.** Qualitas Plantarum-Plant Foods for Human Nutrition 29(1):219-226. 1979. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. **Digestibility. Dietary value. Nutritive value. Protein content. Amino acids. Lysine. Cooking. Toxicity.**

While legumes are regarded as good sources of protein they are poorly digested so improved digestibility would be a desirable objective in a breeding program. From the point of view of protein quality they are limited by the sulphur amino acids (SAA) so an increase in these is a primary nutritional objective of a breeding program and their lysine content is regarded as being of secondary importance. However, some traditional methods of preparation are far more severe than that necessary to cook the food and may result in loss of lysine. These 2 problems are being investigated. True digestibility of the nitrogen (TD-N) of cooked, white haricot beans was measured by feeding to rats at 20, 40, and 80% levels in the diet (5, 10, and 20% protein), for 10 day periods when 23 days old and again when 63 days old. TD-N at the 3 dietary levels was 80, 74, and 67% for the young animals and 63, 55, and 51% when more mature. True digestibility (TD) of DM was much higher at 97, 92, and 83% for younger and 95, 90, and 81% for older animals. The considerable difference between TD-N and TD-DM together with the apparently greater TD-N by the younger rats suggests that the extra faecal N does not come from the undigested food but possibly from residues of digestive juices. Results suggest that it is necessary to standardize the conditions for measuring TD. Five legumes were boiled for 2 h and 8 h; available lysine fell by 5-10% after 2 h and by 15-20% after 8 h. Improvement in flavour appeared to parallel development of the Maillard reaction and loss of available lysine. SAA were still limiting so that net protein use (NPU) does not reveal loss of available lysine. However, in diets where legumes are used to supplement cereals in such proportions that lysine is limiting this loss may become of nutritional importance. *(Author's summary)* H00

0483

14731 HWANG, D.L-R. **Isolation and characterization of growth inhibitors from Great Northern beans.** Ph.D. Thesis. Lincoln, The University of Nebraska, 1975. 67p. Engl., Sum. Engl., 109 Refs., Illus.

Phaseolus vulgaris. **Plant-growth substances. Inhibitors. Growth. Protein content. Carbohydrate content. Nutritive value. Heat treatment. Analysis. Laboratory experiments.**

Growth inhibition factors other than trypsin inhibitors and hemagglutinins have been isolated and characterized from the protein portion of the *Phaseolus vulgaris* var. Great Northern beans. Three components of the growth inhibition factors were fractionated from a Sephadex G-75 gel filtration column. The approx. mol. wt. of each component was 58,000, 12,000, and 7200, resp. The carbohydrate content was 48.6% , 25.8%, and 14.9% while the protein was 50.00% , 71.56% , and 71.25% of each of the resp. components. Only the 3rd component showed high trypsin inhibitor activity. The trypsin inhibitor activity of this fraction was less than 25% of the activity of commercial trypsin inhibitors. No pancreatic enlargement or hyperplasia was observed when each of these three fractions was fed to rats at a 1% level. The hemagglutinating activity of all 3 components was zero to negligible. Based on the PER, inclusion of each of the above components at a level of 1% in the diet of rats produced growth retardation by 35.2%, 50.7%, and 41.5%. *(Summary by Dissertation Abstracts International)* H00

0484

14369 OBIZOBA, I.C. **Utilization of sorghum, wheat, and navy beans by human adults: mineral and vitamin metabolism.** Nutrition Reports International 20(6): 777-786. 1979. Engl., Sum. Engl., 34 Refs.

Phaseolus vulgaris. **Human nutrition. Diets. Protein content. Amino acids. Ca. P. Mg. Fe. Vitamin content. Mineral content. Metabolism.**

Five healthy college women, 19-25 yr old, were fed 4 isonitrogeneous mixed plant protein diets in which whole wheat flour (WF); 3 var. of sorghum, Purdue normal (PN), high lysine (HLY), and Nigeria normal (NN), and navy bean flour (B), in various blends, provided 6.7 g N + 0.8 g N from low N foods daily for 24 days. Mean daily Ca balances were +147, + 158, +250, and +188 mg/day, resp. Ca balances of subjects fed diet containing navy beans (WF:PN:B, 50:30:20) were higher than for those fed the other diets. However, this may be due to higher lysine intake provided by the mixture. Diet WF:HLY (50:50) produced the lowest P balance due to high fecal excretion of the mineral. The mixture containing 70% WF had higher Mg content and induced more positive Mg balance during the exptl. period. The diet containing 50% sorghum and 50% wheat produced the lowest Fe balance, however, this might be attributed to higher phytate content of the diet. The mixture containing 70% WF induced higher niacin levels in the subjects, this may be due to higher dietary intake. The mean balances produced by the diets are higher than the normal range reported for this compound. The subjects fed WF:HLY:PN (25:25:50) diet had negative riboflavin balance. On the other hand, the same diet had higher folic acid content and induced higher balances of the nutrient in subjects fed the diet. *(Author's summary)* H00

0485

13532 LOZANO, E., RUIZ, A. and RUIZ, M.E. **Desarrollo de sub-sistemas de alimentación de bovinos con rastrojo de fríjol (*Phaseolus vulgaris* L.). II. Balance metabólico a varios niveles de energía y proteína suplementaria.** *(Development of cattle feeding sub-systems with bean straw. II. Metabolic balance at several levels of energy and protein supplement).* Turrialba 30(1):63-70. 1980. Engl., Sum. Engl., Span., 19 Refs., Illus.

Phaseolus vulgaris. **Animal nutrition. Composition. Nutritive value. Digestibility. Proteins. Food energy. Costa Rica.**

In order to effectively develop cattle feeding systems based on the use of common black bean crop residue, a N balance and digestibility study was conducted using 15 Romo Sinuano bull calves averaging 150 kg in liveweight (LW) and 12 mo. of age. During 35 days, the animals were gradually adapted to management in individual cages and feeding regimes consisting of bean straw ad libitum,blackstrap molasses,and a protein supplement containing 92% CP. The latter 2 feed ingredients were varied such that at the end of the adaptation period 13 treatments resulted from the modified factorial combination of the following levels: 0, 100, 200, 300, and 400 g CP/100 kg LW/day (variable X_1) and 0, 0.5, 1.0, 1.5, and 2.0 kg of molasses, as fed/100 kg LW/day (variable X_2). Daily record of feed intake were kept. In addition, feces and urine were collected during 7 days. The chemical analyses were conventional. Bean straw consumption, in the absence of both protein and molasses supplementation, was 1.82 kg/100 kg LW/day. The intake tended to increase with additions of X_1 and slightly diminish as X_2 increased. The max. value for total DM consumption was 3.7 kg/100 kg LW/day. The variable X_1 was transformed to Z (total CP intake, g/100 kg LW/day) considering the N contributed by all feed ingredients. Absolute N retention increased nearly linearly due to direct effects of both variables Z and X_2 according to the function $Y_1 = -13.65 + 0.13Z + 4.38X_2 - 0.00002Z^2 - 0.006ZX_2$ ($R^2 = 0.99$, $P < 0.01$), where Y_1 = g N retained/100 kg LW/day. The efficiency of this retention is described by the function $Y_2 = -14.36 + 0.21Z + 9.37X_2 - 0.0002Z^2 - 0.03ZX_2$ ($R^2 = 0.93$ $P < 0.01$), where Y_2 = N retention as % of the N consumed. At an intake of 365 g CP/100 kg LW/day, the efficiency of retention was 33% regardless of the molasses level. At higher CP intakes, the efficiency increased when molasses was absent or fed at low levels but decreased when molasses was fed at high levels. This result could be attributed to the laxative effect imparted by the molasses, decreasing the CP digestibility. This was supported by the CP digestibility data showing improvement as CP consumption was increased although the extent of it was attenuated by increments in molasses intake. Since 60% of the supplementary CP was of non-protein nature (urea) the increases noted in apparent CP digestibility are explainable by an increase of the N solubility in the rumen. It is concluded that in cases like this the evaluation of N sources should be based on N retention parameters. The relatively high intakes obtained and the data on N retention allow the conclusion that the common bean crop residue is a forage that could be utilized advantageously in ruminant feeding. *(Author's summary)* H00

0486

14263 WILKINSON, R.E. *et al.* **Turnip green, cucumber, snapbean, and southern pea response to pesticides in intensive-cropping sequences.** Journal of Agricultural and Food Chemistry 27(4):900-905. 1979. Engl., Sum. Engl., 13 Refs.

Phaseolus vulgaris. **Intercropping. Fat content. Protein content. Pesticides. Toxicity. USA.**

Fatty acid contents and % total N determinations were made for turnip greens, cucumber, snap beans, and southern peas grown in intensive-cropping sequences utilizing multiple pesticide applications. Relatively minor changes in fatty acid quantity and quality or % N were found. The major observation is the stability of crop quality in plants exposed to multiple pesticide applications or residues. *(Author's summary)* H00 D02

0487

14733 NOCHUMSON, S. **A nucleoside triphosphate phosphohydrolase found in preparations of red kidney bean phytohemagglutinin-purification and characterization.** Ph.D. Thesis. Philadelphia, Pennsylvania, The Hahnemann Medical College and Hospital of Philadelphia, 1975. 111p. Engl., Sum. Engl., 126 Refs., Illus.

Phaseolus vulgaris. **Enzymes. ATP. Biochemistry. Analysis. Protein content. Human nutrition. Ca. Na.**

The red kidney bean has been found to be a good source for an enzyme which catalyzes the hydrolysis of the γ-phosphate of purine and pyrimidine nucleoside triphosphates (NTPa-

se). Throughout the purification of the NTPase a complete separation from a hemagglutinin protein proved difficult and was suggestive that both the enzyme and hemagglutinating activities were inherent to the same molecule. However, by adsorbing the hemagglutinin to human red blood cells it was possible to effectively separate the 2 activities. The enzyme, although devoid of any lectin-like activity was very active in hydrolyzing nucleoside triphosphates (1500 μmoles P_i/min/mg. protein). The enzyme reaction can be stimulated by either Ca ions or by Na ions in the absence of any divalent cations. A mol. wt. of 125,000 for the enzyme has been estimated using gel filtration chromatography. During SDS polyacrylamide gel electrophoresis a single band was found corresponding to a mol. wt. of 65,000 indicating that the enzyme is a dimer. The enzyme has a visible absorption spectrum consisting of a single broad absorption peak having a max. at 565 mu. In the presence of dithionite the absorption peak disappears. An EPR (electron paramagnetic resonance) scan of the enzyme has detected the presence of iron III in the oxidized enzyme and iron II in the dithionite reduced enzyme. A quantitative determination for iron resulted in a min. mol. wt. of 70,000 suggesting 2 g. atoms of iron/mol of enzyme. The enzyme is also a glycoprotein containing 4% neutral sugars. A possible role in ion transport has been suggested for the enzyme. *(Author's summary)* H00

0488

14255 DAVIS, D.R., BLACK, K.W. and NELSON, T.S. **Protein quality of canned pinto and kidney beans.** Arkansas Farm Research 28(2):10. 1979. Engl.

Phaseolus vulgaris. **Harvesting. Maturation. Canned beans. Nutritive value. Animal nutrition. Diets. Protein content. Amino acids. Methionine.**

Pinto and kidney beans can not be grown to complete dryness in Arkansas owing to rainfall pattern. Mature beans were harvested 1 wk. apart for 4 wk., canned in water, stored 1 mo. dried, powdered and used to provide 10% protein in the diet of 10 male albino rats for 21 days. In a 2nd trial 0.4% DL-met. was added to the diet. Reference standard was diet with 10% casein. Growth was most on casein and least on bean diet without extra met. though with met., growth was near that on casein diet except for 2 bean samples, thought to have germinated and to have lost protein quality. Only aspartic acid and met. concn. in beans, of 17 amino acids, varied significantly between harvest dates; changes in neither were critical . Results indicated that once the beans were mature, date of harvest had no apparent effect on quality of protein; addition of met. corrected their amino acid imbalance and improved their protein quality. *(Summary by Nutrition Abstracts and Reviews)* H00

0489

13186 SRIKANTIA, S.G. **Use of legumes and green leafy vegetables in the feeding of children: a review of experience.** PAG Bulletin 3(2):30-40. 1973. Engl., 26 Refs.

Phaseolus vulgaris. **Human nutrition. Inhibitors. Consumption. Cooking. Composition. Nutritive value.**

The possibility of utilizing different legumes and green leafy vegetables in feeding children and the amounts that can be used according to the age (infants below 6 mo., infants from 6-12 mo., and children from 1-3 yr) are reviewed. Toxic factors (endogenous and exogenous toxins), flatulence, cooking time, and food beliefs and taboos are mentioned among the problems related to the inclusion of legumes in the diets of infants. Methods of preparation of legumes are included. Among the risks of consuming green leafy vegetables by children are infections and infestations when they are consumed raw, low acceptability, and nitrite poisoning. The nutritive value of legume and green leafy vegetables is emphasized. The use of legumes is recommended for normal children and even for sick or mal-nourished ones. There is no limit to the amount that can be given to children provided they are suitably processed. *(Summary by I.B. Trans. by L.M.F.)* H00

0490

14275 SEIDL, D.S., ABREU, H. and JAFFE, W.G. **Purification of a subtilisin inhibitor from black bean seeds.** FEBS Letters 92(2):245-250. 1978. Engl., 17 Refs., Illus.

Phaseolus vulgaris. **Human nutrition. Inhibitors. Enzymes. Proteins. Laboratory experiments. Venezuela.**

The method of purifying of a low mol. wt. protein which inhibits subtilisin (SI). until it reaches electrophoretic homogeneity, and its properties are described. The process of purification consisted in preparing an extract which was precipitated by acetone, chromatography on a DEAE-Sephadex A-25 column, and on a Sephadex G-75 column. Purification obtained was 800-fold and the extractable inhibitor content represented ~ 0.006% of seed dry wt. In contrast with some other inhibitors of subtilisin, SI does not possess inhibitor activity against either trypsin or chymotrypsin. It does not inhibit elastase, pepsin, papain, or ticin. The specificity spectrum of SI is restricted to subtilisin and pronase. *(Summary by I.B. Trans. by L.M.F.)* H00

0491

3709 MEINERS, J.P. and LITZENBERGER, S.C. **Breeding for nutritional improvement.** *In* Milner, M., ed. Nutritional improvement of food legumes by breeding. New York, John Wiley & Sons, 1975. pp.131-141. Engl., 19 Refs.

Phaseolus vulgaris. **Human nutrition. Plant breeding. Nutritive value. Protein content. Amino acids. Selection. Production.**

Research on genetic improvement of several food legumes, including beans, for nutritional quality is reviewed. The necessity of locating genetic variability for a given attribute is emphasized as the 1st step in a breeding program. Breeding for higher protein content, better amino acid balance, and other nutritionally related characters is included. The current state of germplasm collections of food legumes is examined. Among priorities, the obtainment of higher yields, improved adaptation, resistance to diseases and pests, responsiveness to fertilizers, and other management input factors are mentioned. The genetic base should be kept as broad as possible. *(Summary by I.B. Trans. by L.M.F.)* H00 G00

0492

15890 LUSE, R.A. and RACHIE, K.O. **Seed protein improvement in tropical food legumes.** Vienna, International Atomic Energy Agency. Series SM-230/53. 1979. Engl., Sum. Engl., 22 Refs.

Reprint from Seed protein improvement in cereals and grain legumes 2:87-104. 1979.

Phaseolus vulgaris. Phaseolus lunatus. Vigna unguiculata. **Seed. Protein content. Digestibility. Inhibitors.**

Food legumes are an important source of low-cost protein in all tropical areas. An excellent strategy to combat protein malnutrition is to raise legume productivity (kg of edible material/ha) by plant introduction and breeding and by better management. An important alternative, however, is to increase the production of nutritionally available protein (kg of quality protein/ha) actually utilized by the population. This approach involves factors of amino acid balance, protein digestibility, consumer acceptance, and adaptation to food processing. The quality characteristics that need to be improved in a no. of widely used tropical food legumes are discussed with examples based on work in Africa and in L.A. These quality factors include content of the S amino acids in cowpea, household processing in soybeans,

digestibility in field beans, and consumer acceptance in newly introduced food legumes such as lima and winged beans (*Phaseolus lunatus* and *Psophocarpus tetragonolobus*). Concerted multidisciplinary efforts are needed to improve the yield potential and yield stability of tropical legumes. Farming systems should be designed that utilize trellised food legumes, low capital input, and relatively high labor input. Intermediate level technology should be developed for the processing of legumes into high-protein foods that are attractive yet inexpensive. Supporting all these activities will be the continued screening of large collections of plant germplasm – with both natural and induced variation – for the characteristics of productivity, adaptability, and product quality that are needed. *(Author's summary)* H00 G00

0493

15889 YADAV, N.R. and LIENER, I.E. **Optimizing the nutritive value of the protein of navy beans (*Phaseolus vulgaris*) by complementation with cereal proteins.** Haryana, India, Agricultural Research Communication Centre, 1977. 10p. Engl., Sum. Engl., 28 Refs., Illus.

Reprint from: Legume Research 1(1):17-26. 1977.

Phaseolus vulgaris. **Proteins. Nutritive value. Digestibility. Food technology. Amino acids. Diets. Inhibitors.**

A navy bean flour prepared by dry roasting in a salt bed as a medium of heat exchange was found to have a higher PER than beans which had been autoclaved in the conventional manner. This difference was attributed to a small but significant improvement in the digestibility of the protein. The PER of the roasted beans was higher than the autoclaved beans even in the presence of supplemental met. When various proportions of roasted beans and maize were fed at a level of 8.3% protein in the diet, a mixture in which 40-60% of the protein was provided by either beans or maize had a PER essentially the same as casein. Diets containing roasted beans and various cereal grains (oats, barley, buckwheat, wheat germ, and rice) were formulated in proportions calculated to give the highest chemical scores. In most cases the PER's were not significantly different from that of casein, and, in the case of rice, the PER was higher than that of casein. Supplementation of such diets with their 1st limiting amino acid failed to produce a further enhancement of the PER. *(Author's summary)* H00

0494

4946 SILBERNAGEL, M.J. **Bean protein improvement work by USDA – bean and pea investigations.** Prosser. Washington State University, Irrigated Agricultural Research and Extension Center, 1971?. 14p. Engl.

Phaseolus vulgaris. **Seed. Protein content. Methionine. Fertilizers. N. P. Zn. Cultivars. Amino acids. Seed treatment. Plant breeding.**

The importance of research on improving legume protein quality, especially that of beans, is emphasized. Several investigations conducted to fulfill USDA objectives in this area are described and utilized to obtain information on protein and met. content of different bean samples. The following factors were studied: seed quality; differences in location and photoperiod; genetic differences between var. and even within the same var.; differences due to the N carrier or rate and those caused by N and P variation; Zn fertilization; effects of Zn seed treatments with and without soil Zn; and irrigation needs. None of these was a determining factor of the protein and met. content of bean seed. Some crosses are being made between lines of known protein content. It is noted that years of extensive research are needed to develop a bean that is as good a source of dietary protein as meat. *(Summary by I.B. Trans. by L.M.E.)* H00 G00

0495

15410 MUTSCHLER, M.A. and BLISS, F.A. **Inheritance of bean seed globulin content and its relationship to protein content and quality.** Crop Science 21:289-294. 1981. Engl., Sum. Engl., 25 Refs., Illus.

Phaseolus vulgaris. **Protein content. Inheritance. Cultivars. Amino acids. Methionine. Plant breeding.**

Globulin-1 (G1) protein, the major storage protein fraction of common bean, was measured in mature seed using rocket immunoelectrophoresis. Percentage total protein was measured by infrared reflectance. Heritability estimates were calculated for the protein traits and seed yield, and correlations between traits were determined using parental, F_2, and F_3 populations. Among the 6 parents grown in the field in 1977, Endogava Z.N. had the highest % protein (27.8% protein), while PI 229815 produced the most G1 protein (136.5 mg G1/g flour). Both were low yielding, producing 12 and 13 g seed/plant compared to the highest yielding parent, Bonita that produced 66 g seed/plant. Bonita showed the most favorable combination of traits, with levels of 24% protein and 108 mg G1/g flour, in addition to high yield. Swedish Brown and WI 74-2047 had the lowest levels of total protein (17.4 and 18.5% , resp.) as well as G1 protein (75 and 61 mg/g flour, resp.). Analyses of 5 of the 15 F_2 populations derived from crosses among the 6 parents were presented in detail. Inheritance of both % protein and mg/g flour was quantitative with broad sense heritability estimates, ranging from 0.19-0.65 and 0.37-0.95, resp. Narrow sense heritability estimates ranged from 0.59-0.86 and 0.43-0.74 for % protein and mg G1/g flour, resp. in 4 populations. Mean F_2 values of populations resulting from crosses between parents that differed widely for protein amounts were usually intermediate between the 2 parents. The av. values of the 5 F_2 populations resulting from one common parent produced rankings similar to those based on parental values for % protein and mg G1/g flour. Moderate positive correlations between mg G1/g flour and % protein were observed in F_2 and F_3 populations. There was no correlation between yield and mg G1/g flour and low negative correlation between yield and % protein. No obvious consistent relationship between available met. and G1 content was seen, perhaps because of variation in other constituent fractions or the confounding effects of seed tannins. Implications of genetic manipulation of protein fractions and total protein on protein quality improvement are discussed. *(Author's summary)* H00 G00

See also 0027 0124 0511 0512

H01 Foods and Nutritive Value

0496

3764 JAFFE, W.G. **Factors affecting the nutritional value of beans.** *In* Milner, M., ed. Symposium on Nutritional Improvement of Food Legumes by Breeding, Rome, Italy, 1972. Proceedings. New York, N.Y., United Nations, 1972. pp.43-48. Engl., 10 Refs.

Phaseolus vulgaris. Nutritive value. Aminoacids. Cooking. Digestibility. Plant breeding.

In expt, conducted with rats, it was found that diets containing raw beans were toxic while those with cooked beans were not. However, in the latter, the addition of met. was necessary. The presence of different types of hemagglutinins in red and white bean var. originate significant differences in toxicity. Soaking and cooking destroy the agglutinating activity and reduces their toxic action. Studies conducted on antinutritional factors contained in bean seeds presented the following results: a bean globulin, different from the trypsin inhibitor, interfered with the hydrolytic action of 7 proteases tested and can not be destroyed by autoclaving, affecting digestibility. The digestibility of starch by pancreatic amylase was evaluated in vitro. An amylase inhibitor, present in most bean species, is destroyed by heat; little is known about its physiological importance. Other adverse factors that are not destroyed by heat are: phytic acid, which interferes with Fe absorption, and flatulence-producing factors, which are being studied. In conclusion, any study related to the genetic improvement of the nutritional value of beans should be directed not only at a protein and sulfur-containing amino acid level but also at the content of toxic hemagglutinins and digestibility. *(Summary by C.P.G. Trans. by L.M.F.)* H01

0497

4499 BRESSANI, R., FLORES, M. and ELIAS, L.G. **Aceptabilidad y valor de leguminosas de grano en la dieta humana.** *(Acceptability and value of grain legumes in human diets).* Guatemala, Instituto de Nutrición de Centro América y Panamá, 1973. 86p. Span., 43 Refs., Illus.

Paper presented at Seminario sobre Potenciales de Fríjol y otras Leguminosas de Grano, Cali, Colombia, 1973.

Phaseolus vulgaris. Consumption. Nutritive value. Cooking. Inhibitors. Protein content. Methionine. Lysine. Guatemala.

A study is presented on grain legumes as a source of proteins for populations of tropical regions and several aspects related to their consumption or acceptability are considered: consumption rates, preferred species, relation of consumption to age and economic income, method of preparation or cooking, important factors for the acceptability of the grain including: (1) antiphysiological factors (trypsin inhibitors, hemagglutinins, goitrogenic and flatulence factors), the hypocholesterolemic property and problems with protein digestibility. Protein content and the quality of grain legumes were also studied, varying according to the species, locality and form of handling. Met. deficiency and the nutritive value of the legumes are taken into account for mixed diets based on cereals and cassava. Legume proteins are deficient in met. but rich in lysine, while cereals contain a sufficient amount of

sulfur-containing amino acids but are deficient in lysine. The former information includes tabulated data, tables and the results of the expt. conducted in relation to the most important aspects. The need for var. improvement to obtain a higher level and better quality protein is indicated. *(Summary by C.I.G. Trans. by L.M.F.)* H01

0498

11634 KON, S. Pectic substances of dry beans and their possible correlation with cooking time. Journal of Food Science 33:437-438. 1968. Engl., 10 Refs.

Phaseolus vulgaris. Cooking. Nutritive value. Digestibility. Water content.

The var. Sanilac, cultivated in Michigan (USA) was used to investigate if the deterioration of the cooking quality of beans stored at a high moisture and temp. is due to changes in the pectic substances present in beans. Shortly after harvest, the beans were divided into 2 lots with moisture contents of 8.1 and 13.3% by drying at room temp. under vacuum. Both lots were stored at 90°F for 4 yr. In pectic substance fractionation, 2 forms were used to extract the precipitated marc: in 0.05 *N* NaOH and 1% EDTA solution at pH 6.0 and in boiled distilled water, cooled and incubated with α-amylase (40 mg/g marc) at 40°C for 12 h at pH 7.0. Cooking time, pectin substance fractionation, total pectin and the anhydrouronic acid content were determined for the samples. Results showed a marked increase in cooking time (29 min vs. 210 min) for beans with a higher moisture. There were no significant differences in the content of pectic substances in fractions extracted from both lots. It is suggested that the α-amylase treatment affects the solubility of pectic substance, wherefore higher values were obtained for total pectin extracted with α-amylase treatments. *(Summary by C.P.G. Trans. by L.M.F.)* H01

0499

11679 ELIAS, L.G. Algunos aspectos bioquímicos y nutricionales del maíz y del fríjol. *(Biochemical and nutritional aspects of maize and beans). In* Miranda M., H., comp. Cursos de Producción de Maíz y Fríjol, Santa Tecla, El Salvador, 1976. Notas. Santa Tecla, Centro Nacional de Tecnología Agropecuaria, 1976. pp.1-44. Span., 44 Refs., Illus.

Phaseolus vulgaris. Zea mays. Protein content. Amino acids. Lysine. Methionine. Nutritive value. Diets. Storage.

The nutritional condition of populations in developing countries is described along with the chemical, biochemical and nutritional characteristics of maize and beans and ways to improve diets on the basis of cereals and legumes. In Guatemala the principal sources of nutrients are cereals and legumes. The PER is 2.5 for casein and 0.58-1.72 for rural diets in Guatemala. In L.A., *Phaseolus vulgaris* is the bean that is most consumed in all its var., forms and colors. Legumes are good sources of lysine while cereals contain met. Maize, deficient in lysine and tryptophane, has been improved by increasing the amino acid content in grains of Opaco-2 maize; however, the softness of the grain endosperm and the consequent damage during storage has reduced its commercial production. White-seeded beans present a higher PER than black-seeded beans since they do not contain pigments in their seed coat. Tannins reduce protein digestibility forming tannin-protein complexes. The MC in seeds, room temp., RH, and the length of storage affect the conservation of stored beans. Storage should be effected with a MC between 10-11% and temp. ≤ 25°C. Tables and figures, summarizing the information, are given. *(Summary by C.P.G. Trans. by L.M.F.)* H01 C03

0500

13546 ELKINS, E.R. **Nutrient content of raw and canned green beans, peaches, and sweet potatoes.** Food Technology 33:66-70. 1979. Engl., 6 Refs.

Phaseolus vulgaris. **Canned beans. Nutritive value. Vitamin content. Mineral content. Composition. Analysis.**

Nutrient characteristics of green beans, clingstone peaches and sweet potatoes were studied 0, 6, 12 and 18 mo. after heat processing and storage. All 3 products showed excellent retention of riboflavin, niacin and carotene during heat processing and storage. Ascorbic acid was lost by oxidation at canning and by nonoxidative reaction with storage, whereas the primary loss of thiamin was at processing. Slight losses of carotene may occur and carotene was partly isomerized during processing, the isomers containing less vitamin A activity than the original *all-trans-β*-carotene. Blanching of green beans leached water-soluble minerals but there may also be mineral uptake from blanching water and canning brine. Peaches and sweet potatoes only showed increases in Fe from canning and peaches plated out Cu on the bare tinplate of the can. *(Summary by Nutrition Abstracts and Reviews)* H01

0501

14757 LO, T.N. **Partial characterization of a navy bean esteroprotease inhibitor and its use in the study of the fragmentation of fibrinogen by trypsin.** Ph.D. Thesis, Bloomington, Indiana University, 1974. 172p. Engl., Sum. Engl., 137 Refs., Illus.

Phaseolus vulgaris. **Inhibitors. Enzymes. Proteins. Amino acids. Trypsin. Plant toxins. Dietary value. Human nutrition. Animal nutrition.**

A proteinase inhibitor, isolated from the navy beans, was shown to inhibit human plasmin as well as bovine trypsin and chymotrypsin but it failed to inhibit bovine thrombin, bovine plasmin, bacterial plasmin, and human urokinase. Bovine trypsin, plasmin, and thrombin are serine esteroproteases capable of catalyzing the hydrolysis of amino acid esters containing side chains of lysine or arginine; yet they interacted differently with the navy bean inhibitor (NBI). Selected proteinase inhibitors may serve as tools for the differentiation and study of closely related enzymes. Since the NBI inhibited human plasmin but not bovine plasmin, this again indicates the need for caution in extrapolating results obtained with an enzyme system of a given species to the counterpart system of another species. Although the NBI is an esteroprotease inhibitor it did not inhibit the serine esterases, bovine erythrocyte acetylcholinesterase and horse serum cholinesterase. Negative results were also obtained with other esteroprotease inhibitors including the Bowman-Birk inhibitor of soybeans and the Kazal pancreatic trypsin inhibitor. Other proteins of navy beans obtained by complete ammonium sulfate fractionation also failed to inhibit the 2 esterases SDS-gel electrophoretic analysis revealed that tryptic digestion of the α (A) chains of the fibrinogen preceded that of β (B) chains. The γ chains survived 2 h digestion at a trypsin: fibrinogen *M* ration of 0.01. The latter chains might have resided in a tightly packed structure that was less accessible to trypsin whereas the α (A) chains, and to a lesser extent, the β (B) chains appeared to be more highly exposed. Progressive fragmentation of the fibrinogen correlated with impairment of clottability. Two h fragmentation by trypsin resulted in a non-clottable product. However, if trypsin was preincubated with the NBI at pH 7.05 prior to the addition of fibrinogen buffered at pH 7.05, the clot interfering action of trypsin was inhibited; the protective action of the NBI on clotting was less effective if the preincubation pH was lowered to 3. Nevertheless, the pH 3 preincubation mixture, when incubated for 2 h with a fibrinogen solution buffered at pH 7.05, maintained sufficient structural integrity of fibrinogen for proper clotting. Presumably, peptide bonds that participated in the functional activity of this biologically important protein were protected from hydrolysis by the inhibitors. In view of the above clotting results, it was of particular interest to find that the fragmentation pattern obtained with a pH 3 preincubation mixture of trypsin and inhibitor differed from the pattern obtained with pH 7.05 preincubation. The fragmentation patterns were studied by means of SDS gel electrophoresis. These results are in

keeping with those of Bowman who found that preincubation at pH 3 produced an inhibitor with less potent activity and altered electrophoretic mobility. Controlling mechanisms beyond protein synthesis are believed to be involved in dynamic processes such as blood coagulation and fibrinolysis. Proteinase inhibitors may play important roles in the regulation of these processes. *(Author's summary)* H01

0502

14203 CAMPOS, M. DE and OLSZYNA-MARZYS, A.E. **Aflatoxin contamination in grains and grain products during the dry season in Guatemala.** Bulletin of Environmental Contamination and Toxicology 22(3):350-356. 1979. Engl., 17 Refs.

Phaseolus vulgaris. **Anti-nutritional factors. Storage. Composition. Nutritive value. Analysis. Guatemala.**

Samples were collected from the 3 zones (hot and humid north, hot and dry interior, and temperate and humid highlands) of Guatemala. A total of 264 samples (some from the local market in Guatemala City and some from commercial samples of national and imported grain) were collected from different storage facilities. Whole grain samples were finely ground and immediate moisture determinations were made in about 50% of the samples. All the samples were analyzed and the results (positive samples, level of contamination, max. value, aflatoxins present) are tabulated, showing aflatoxin contamination in food and feed during the dry season. Samples analyzed and no. of positive samples, resp., were: white corn, 68, 7; yellow corn, 50, 7; corn meal, 13, 4; cottonseed meal, 14, 2; protein supplement meal, 19, 6; rice with bran, 18, 9; rice grain, 6, 2; black beans, 17, 1; other beans, 9, 0; peanuts grain, 10, 1; shell peanuts, 2, 1; peanut butter, 2, 0; mixed nuts, 1, 0; untoasted coffee beans, 1, 1; and meat meal, 4, 1. No positive samples were found (no. of samples examined in parentheses) for coffee pulp (1), coffee beans (1), wheat grain (3), wheat flour (7), red and white sorghum (7), sorghum flour (1), sesame seed (3), biscuits (2), cheese cake mix (1) and sugar (1). A high proportion of the 264 samples analyzed were contaminated with aflatoxins (17%); 8% exceeded the 20 ppb level. The highest value (240 ppb) was found in a silo-stored yellow corn sample that came from a hot and humid area. Aflatoxin B_1 alone or in combination with other aflatoxins, was found in all the positive samples. Aflatoxin G_1 was found in corn, peanuts, rice, beans and meat meal, while aflatoxin G_2 was detected only in rice and beans. Highest incidence of contamination was found in samples coming from the hot and humid region. *(Summary by Food Science and Technology Abstracts)* H01 L00

0503

14208 COLLINS, J.L. **Quality of canned and frozen snap beans grown in Tennessee.** Tennessee Farm and Home Science 110:12-14. 1979. Engl., 4 Refs.

Phaseolus vulgaris. **Canned beans. Nutritive value. Food technology.**

Freshly harvested snap beans of 25 var. had an av. of 14.2% waste (snips, soil, skins leaves), 6.9% pod sieve size 1, 82.4% pod sieve size 2 and 10.7% pod sieve size 3, and Hunter L (lightness), a (greenness) and b (yellowness) values of 41.5, 9.1 and 16.1, resp. Beans of pod sieve size 2 were either canned or frozen. Canned beans were prepared by blanching in water at 170°F for 3 min, filling size 303 cans with 295 g beans, covering beans with boiling water and adding 1 teaspoon salt/can. The cans were sealed and processed at 240°F for 20 min; after processing the cans were cooled in tap water, dried and stored for 6 mo. before evaluation. Frozen beans were prepared by blanching in 190°F water for 3 min, cooling in water, freezing on a tray in an air blast freezer at -20°F, filling into 300 g bags and held at 0°F for 6 mo. before evaluation. Results of evaluation of color, firmness, epidermal sloughing and appearance of frozen and canned beans after 6 mo. storage are tabulated. Av. values for the 25 var. of canned and frozen beans were resp.; Hunter L values 32.6 and 30.1, 'a' values 0.5 and 11.9 and 'b' values 15.5 and 14.2; and panel scores for appearance, 2.5 and 2.7 (1 = poor; 4 = excellent). Av. epidermal sloughing values (ml) and av. firmness (kg

force) for canned beans were 3.7 and 35.3, resp. *(Summary by Food Science and Technology Abstracts)* H01

0504

13596 BROWN, R.G. and KIMMINS, W.C. **Linkage analysis of hydroxyproline-poor glycoprotein from** *Phaseolus vulgaris*. Plant Physiology 63(3):557-561. 1979. Engl., Sum. Engl., 18 Refs., Illus.

Phaseolus vulgaris. **Biochemistry. Composition. Proteins. Amino acids. Tracers. S. Seed. Nutritive value. Laboratory experiments.**

Hydroxyproline-poor glycoprotein extracted from *P. vulgaris* cv. Pinto contained a single polypeptide chain with lysine at the N-terminus. Removal of carbohydrate attached to serine by alkali treatment produced 2 polypeptide fractions. Labelling with ^{35}S indicated that most serine residues having a carbohydrate substituent removed by alkali occurred on the polypeptide fraction of lower mol. wt. Following alkali treatment 2 additional N-terminal amino acids, proline and glycine, were detected suggesting that alkali treatment also cleaves peptide bonds. Methylation analysis of native and degraded glycoproteins extracted 24, 27, and 36 h after wounding, demonstrated the following structural features of carbohydrate attached to serine. Arabinose could be (1→2)-, (1→3)-, or (1→5)-linked, glucose occurred as a chain of β-(1→4)-linked residues, and galactose occurred as a non-reducing terminal unit. *(Summary by Field Crop Abstracts)* H01 C03

0505

14211 BILIADERIS, C.G., GRANT, D.R. and VOSE, J.R. **Molecular weight distributions of legume starches by gel chromatography.** Cereal Chemistry 56(5): 475-480. 1979. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Enzymes. Starch content. Analysis. Composition. Laboratory experiments.**

The distribution of the mol. wt. of the components of 9 purified legume starches (smooth and wrinkled field peas; adzuki, garbanzo, mung, red kidney, navy, and faba beans; and green lentil) was investigated by gel chromatography. The Sepharose 2B columns were calibrated with dextrans of known mol. wt. Evidence was provided (% β-amylolysis and λ max of I-polisaccharide complexes) that the amylopectin fraction was excluded from the gel in all the starches. It was concluded therefore that the av. mol. wt. of this component was greater than 20×10^6. The distribution of components differed at different mol. wt. ranges. The elution patterns of their components fractionated within the range of 0.2-0.9 Kav (primarily amyloses) were quite similar for all the legume starches except those of smooth and wrinkled seeded peas. The amount of polysaccharide material of both smooth and wrinkled pea starches was greater in the intermediate mol. wt. range, $2 \times 10^6 <$ mol. wt. $< 20 \times 10^6$, as compared with those of the other legume starches. Correlation analysis between set-back viscosities (obtained from viscoamylograms) and % components fractionated between 0.2-0.9 Kav showed significant correlation ($P = 0.05$). *(Author's summary)* H01 C03

0506

14307 FONSECA, H. *et al.* **Efeito da radiação gama (^{60}Co) nas propriedades organoleticas e nutritivas do feijão (*Phaseolus vulgaris* L., cv. mulatinho).** *(Effect of gamma radiation (^{60}Co) on the organoleptic and nutritive properties of common bean cv. mulatinho).* Piracicaba-SP, Brasil, Centro de Energia Nuclear na Agricultura. Boletim Científico no. 018. 1974. 20p. Port., Sum. Port., Engl., 6 Refs., Illus.

Phaseolus vulgaris. **Irradiation. Nutritive value. Composition. Vitamin content. Storage. Deterioration. Brazil.**

The influence of γ radiation on the organoleptic and nutritive properties of kidney beans is studied. Seed samples of this vegetable were irradiated with 15 krad (1 rad = 100 ergs/g of irradiated material) and stored for 5 mo. Immediately after irradiation and monthly, sensory evaluations and chemical analysis of the vitamins thiamin (B_1) and riboflavin (B_2) were accomplished in the samples studied. The results showed an evident influence of radiation during its application since the higher losses ocurred immediately after this treatment, mainly in riboflavin, which from the total losses observed, 47.9% occurred during irradiation. The total losses (av.) of thiamin were 58.7% in the irradiated samples and 51.9% in the controls, and for riboflavin, 25% in the irradiated samples and 16.7% in the controls. Thus, riboflavin is much more sensitive to γ radiation. In terms of organoleptic properties it was observed the development of an undesirable flavor and a hardening of the texture in the irradiated samples. However, at the end of the expt. no difference was found between control and irradiated samples. *(Author's summary)* H01

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14220 FRANCA, M.H. DE C. and ZUCAS, S.M. **Misturas de arroz e feijão suplementadas com retinol, metionina cálcio e os níveis hepáticos de retinol e caroteno.** *(Mixtures of rice and beans supplemented with retinol, methionine and calcium and values for retinol and carotene in liver).* Revista de Farmacia e Bioquímica da Universidade de São Paulo 15(1/2):131-147. 1977. Port., Sum. Engl., Port., 48 Refs.

Phaseolus vulgaris. Dietary value. Diets. Methionine. Ca. Brazil.

For 43 days 108 Wistar rats, initially 30 days old and weighing 45-46 g, were given diets in which protein was supplied by rice and beans in the ratio 3:1 without or with supplements of retinol, Ca or met. singly or in different combinations. The diets were given freely or were restricted to 60% of free intake. Values for retinol and carotene in liver were nearest to those in rats given casein as protein source when all 3 supplements were added to the rice and beans diet. Ca and met. singly or together gave values for carotene in liver about double those for controls given casein but only Ca and retinol together increased retinol in liver to values approaching those in controls. *(Summary by Nutrition Abstracts and Reviews)* H01

0508

14734 EL-FAG, N.A. **The effect of germination on the nutritive value of red kidney beans.** Ph.D. Thesis. New Brunswick, Rutgers University, 1976. 93p. Engl., Sum. Engl., 136 Refs., Illus.

Phaseolus vulgaris. Nutritive value. Digestibility. Antinutritional factors. Plant toxins. Protein content. Proteins. Inhibitors. Diets. Heat treatment. Plant anatomy. Germination.

Phaseolus vulgaris comprises a significant portion of the human diet in many parts of the world. The salient characteristic of these beans is their high protein content. The expanded use of these beans is limited because of the indigestibility of a portion of the bean protein. Germination of kidney beans improves the digestibility coefficient. The protein globulin in kidney beans possesses a potent trypsin inhibitor, and milder inhibitors of chymotrypsin, pepsin, and papain. The active inhibiting fractions of the protein globulin have mol. wt. of 5200 and 8000. The inhibitor can be inactivated by heat exposure (100°C for 30 min). *(Author's summary)* H01

0509

14393 LEE, W.N. and KRAMER, A. **The effect of container on the sensory and nutritional quality of raw, frozen, and canned packaged foods.** Journal of Food Quality 2(4):257-268. 1979. Engl., Sum. Engl., 3 Refs.

Phaseolus vulgaris. **Canned bean. Nutritive value. Composition. Vitamin content. Nutrient loss. Storage. Deterioration.**

Shelf-life of raw broccoli can be extended for 1 mo. if stored at 0-5°C in evacuated pouches if blanched. If not blanched, evacuation accelerates onset of spoilage. Practical shelf-life (PSL) of raw green beans can be extend for 1 mo. if stored at 0°C, but not at 5°C. Further substantial reductions in thiamine and ascorbic acid were noted during 1 mo. storage at 0-5°C of raw green beans. For the broccoli there was practically no reduction in thiamine in the unblanched and only a slight reduction in the blanched after 1 mo. storage at 0 or 5°C for the unblanched samples. All of the blanched samples lost 2/3 or more of their ascorbic acid content during 1 mo. storage. Frozen green beans and broccoli maintained high quality life (HQL) at least for 6 mo. when stored at -20 or -30°C. At -10°C storage, HQL was retained for only 3 mo. but PSL continued for 6 mo. or longer. There was practically no change in total solids or thiamine in the frozen samples. When stored at -10°C there was a substantial loss in ascorbic acid after 3 mo. and a still greater loss after 6 mo. of storage. Sensory quality of short-processed green, beans and broccoli (similar to retortable pouch processing) were higher in original sensory quality and retained higher quality for 1-3 mo. as compared to conventionally canned vegetables. After 6 mo. storage at 21-35°C sensory quality of both short and conventionally processed vegetables was further reduced, leaving negligible differences. Only factor that significantly affected sensory quality retention was storage at low temp. Total solids, thiamine, and ascorbic acid, were substantially reduced in the canned product immediately after processing but could be accounted for by the dilution caused by the liquor added. After 6 mo. storage at low temp. there was little further loss in nutrients at 0 or 5°C, but substantial further losses when canned samples were stored at 21 or 35°C. Rate of nutrient loss was not significantly affected by length of the heat process. Ascorbic acid was in most instances affected to a greater extent than other nutrients or sensory attributes by blanching, heat processing, and storage temp. *(Author's summary)* H01

0510

14396 KON, S. and BURTEA, O. **Process development adds scope to bean products.** Food Product Development 13(7):48-49. 1979. Engl., 1 Ref., Illus.

Phaseolus vulgaris. **Food technology. Cooking. Canned bean. Water content. Starch content. Composition.**

Small white beans (12% moisture content) are conveyed to a cyclone funnel for air cleaning, then to a hopper filled with water where they are tumbled for about 15 min, dumped into a water-filled hopper where they soak for another 30 min (steam is injected into both hoppers) removed from the hopper by belt conveyor and are pumped up to a steam cooker which is composed of 3 units each equipped with a screw conveyor set for 20 min passage time, and for a total cooking time of 60 min. After cooking, the beans (now having 60% moisture content) are slurried, drum dried and flaked (2% moisture content, SO_2 content < 400 ppm and combined BHA and BHT content < 50 ppm). The flakes when packed in a plastic bag and put in cardboard boxes, keep for > 1 yr. Bean flakes can be milled to a powder for more economical packaging with no appreciable cell breakage. *(Summary by Food Science and Technology Abstracts)* H01

0511

14706 KON, S and WAGNER, J.R. **Simplified process makes legume-based foods.** Food Product Development 13(7):47, 49. 1979. Engl., 3 Refs., Illus.

Phaseolus vulgaris. **Food production. Food technology. Food energy. Nutritive value. Dietary value. Protein content. Fat content. Storage. Deterioration.**

Bean chips were prepared by soaking California small white beans for about 75 min at 90°C, passing them through a meat grinder; oat flour and hot water were added in a

proportion of 1 g oat flour: 2 g soaked beans: 0.6 ml hot water and the entire mass was mixed until dough developed. The dough was sheeted (1.3 mm), cut into round discs of 2.65 cm in Ø, dried in an oven equipped with air circulation for 10 min at 135°C, deep fried in a high oleic acid safflower oil, containing no preservatives, at about 200°C for 15 s. Analyses showed the bean chip to have 2.5 x the protein content of either maize or potato chips and only half the oil content of either. Because legumes are somewhat deficient in S-containing amino acids they must be supplemented to obtain a nutritionally complete protein. California small white beans and oats complement each other and have an acceptable amino acid pattern. The chips were packed in pouches, and stored at room temp. No off-flavour could be detected until the end of the seventh month. *(Summary by Food Science and Technology Abstracts)* H01 H00

0512

14330 PATEL, K.M., BEDFORD, C.L. and YOUNGS, C.W. **Amino acid and mineral profile of air-classified navy bean flour fractions.** Cereal Chemistry 57(2): 123-125. 1980. Engl., Sum. Engl., 19 Refs.

Phaseolus vulgaris. **Food products. Food technology. Protein content. Amino acids. Mineral content. Ash content. Water content. Methionine. S. Nutritive value.**

Navy bean flour (NBF) was fractionated into protein concentrate (PC) and starch residue (SR), using an Alpine Microplex air classifier. NBF and the resulting fractions were analyzed for amino acids and minerals. The overall yields of the PC and the SR were 34.7 and 61.9%, resp. The NBF and its fractions had a relatively high lysine content and the low sulfur amino acid content characteristic of legume proteins. Compared to the flour, the PC was lower in cystine, met. and tryptophan but higher in valine. Compared with the FAO reference amino acid pattern, the total sulfur amino acids were the 1st limiting factors whereas all other essential amino acids considerably exceeded the reference pattern in the NBF and in both fractions. The NBF and the two fractions contained from 2-17 times more minerals than did wheat flour. Pronounced shifting of all minerals except Ca into the PC fraction was noted. *(Author's summary)* H01 H00

0513

14274 RUIZ, M.E. *et al.* **Desarrollo de sub sistemas de alimentación de bovinos con rastrojo de fríjol (*Phaseolus vulgaris*, L.). I. Disponibilidad, composición y consumo del rastrojo de fríjol.** *(Development of bovine feeding subsystems with bean residue. I. Availability, composition and intake of bean residue).* Turrialba 30(1): 49-55. 1980. Span., Sum. Engl., Span., 23 Refs., Illus.

Phaseolus vulgaris. **Animal nutrition. Composition. Analysis. Diets. Protein content. Intercropping. Costa Rica.**

An expt. was conducted to determine the production of common black bean residue under different cropping situations found in Central American small farms. Lab. analyses were carried out to characterize the chemical composition and in vitro digestibility of this residue. Finally, a switchback design was used to test the voluntary intake of the bean residue by 6 yearling steers weighing 223 kg, and fed 3 rations differing in blackstrap molasses content (0.6, 8.8 and 17.9 % on dry basis) but kept isonitrogenous (8% CP) by additions of urea (1.24, 1.30 and 1.32%, resp.). The remaining ration component was the crop residue. It was found that when bean is grown as a single crop, a production of 700-1151 kg DM/ha/crop of the residue can be expected. In multiple cropping (usually associated with maize and/or cassava), the bean residue output varies between 527-1225 kg DM/ha/crop. The residue produced is well dried (90% DM) and as such, could be stored for long periods. Its chemical analysis showed a low content of CP (4.1%), while the cell wall constituents accounted for 68.8% of the total DM. It is also characterized by a high lignin content (17.0%), associated with a 46.0% in vitro DM digestibility. Considering that the bean residue is made up by 55.2% of stems and 44.8% empty pods, comparative analyses were also carried out. No

differences were found in CP content, but a lower lignin concn. (12.8 vs. 19.8%) and a higher DM digestibility (56.5 vs. 37.0%) were found in the empty pod component. The animals preferred the empty pods to such an extent that physical analysis of the remaining feed in the trough showed a proportion of 8.1% empty pods and 91.9% stems, with little variation due to the level of supplementary molasses. Total DM and black bean residue intakes were 2.53 and 2.48; 2.63 and 2.36; and 2.96 and 2.39 kg DM/100 kg livewt./day, corresponding to molasses levels of 0.6, 8.8 and 17.9% of the ration. It is concluded that black bean residue is well accepted by bovines and that with small additions of an inexpensive source of N it could allow the feeding of animals during the dry season to at least maintain body wt. *(Author's summary)* H01

0514

14210 HANG, Y.D., STEINKRAUS, K.H. and HACKLER, L.R. **Amino acid composition of high protein fractions prepared from mung beans, pea beans, and red kidney beans.** Journal of Food Science 45:388-389 1980. Engl., Sum. Engl., 5 Refs.

Phaseolus vulgaris. Composition. Amino acids. Protein content. Analysis.

Bean fractions containing 4-83% protein were prepared from mung beans, pea beans, and red kidney beans by aqueous extraction followed by acid precipitation. The yields of bean fractions containing the highest concn. of protein ranged from 64-76% depending on the beans used. Amino acid scores of the bean fractions compared favorably with those of the FAO reference pattern of amino acids. The sulfur amino acids, met.,and cystine were 1st limiting in the bean fractions. In addition, the fractions prepared from mung beans were also deficient in threonine. *(Author's summary)* H01

0515

14702 REDDY, S.J., PUBOLS, M.H. and MCGINNIS, J. **Effect of gamma irradiation on nutritional value of dry field beans *(Phaseolus vulgaris)* for chicks.** Journal of Nutrition 109(7):1307-1312. 1979. Engl., Sum. Engl., 17 Refs.

Phaseolus vulgaris. **Irradiation. Nutritive value. Diets. Digestibility. Enzymes. Protein content. Cultivars.**

The effect of γ irradiation (^{60}Co) of different var. and breeding lines of dry field beans on chick growth was determined using a chick growth assay in which the diet contained approx. 50% beans. Total protein (N x 6.25) in beans was not changed appreciably by irradiation (21 Mrad) but protein solubility in water was decreased. Irradiation increased in vitro enzymatic digestibility of bean protein by pepsin and by a mixture of tripsin, chymotrypsin and peptidase. In the bioassay the diet was formulated to derive half of the total protein (22.6%) from beans. Autoclaved Pinto and Pink beans gave significantly better growth than Red Mexican and White Pea beans. The differences between Red Mexican and White Pea beans were not significant except for Red Mexican breeding line no. RS-59. The nutritional value of all var. of beans, based on chick growth, was significantly improved by γ irradiation. The irradiation treatment of beans tended to increase N retention by chicks and decrease uric acid N excretion in relation to N. intake. *(Author's summary)* H01

0516

14390 JANSZ, E.R. and PIERIS, N. **Studies on some local legumes. II. Cyanogenic glucosides.** Journal of the National Science Council of Sri Lanka 6(1):1-9. 1978. Engl., Sum. Engl., 15 Refs.

Phaseolus vulgaris. Phaseolus lunatus. Vigna unguiculata. **Anti-nutritional factors. Cyanogenic glucosides. Biochemistry. Analysis. Enzymes. Linamarase. Toxicity. Nutritive value. Sri Lanka.**

The seeds of nearly 50 selected legumes (mainly those commonly found in Sri Lanka) were screened for the presence of cyanide and cyanogenic glucosides. Only 4 of these contained significant amounts of cyanogenic glucosides; all were var. of *Phaseolus lunatus* (sieva bean or lima bean). Methods of processing to eliminate the cyanogenic glucoside were investigated with success. Local strains of *Vigna sinensis, Phaseolus vulgaris* and *Pisum sativum* were found to contain less cyanogenic glucoside than previously reported for strains grown elsewhere. *(Author's summary)* H01

0517

14254 BUESCHER, R.W. and DOHERTY, J.H. **Carbon dioxide inhibits phaseollin accumulation and improves quality of frozen snap beans.** Arkansas Farm Research 27(3):11. 1978. Engl.

Phaseolus vulgaris. CO_2. Phaseollin. Phytoalexins. Digestibility. Dietary value.

Initial phaseollin content of broken bean pods was 2.9 μg/g fresh wt. and after exposure for 24 h at 27°C to air or to air containing 30% CO_2 was 29.7 and 6.2 μg/g fresh wt., resp. Exposure for 12 h to CO_2 enriched air gave intermediate results. Broken-end discolouration followed a similar trend. *(Summary by Field Crop Abstracts)* H01

0518

14398 BUESCHER, R.W. and ADAMS, K. **Influence of packaging and storage on quality of pre-snipped and cut snap beans.** Arkansas Farm Research 28(4):14. 1979. Engl.

Phaseolus vulgaris. Canned beans. Storage. Nutritive value. CO_2. O. Deterioration.

Snap beans (var. Early Galatin) were washed, sized, snipped (destemmed) and cut into 3.3 cm lengths before storage for 0, 7 or 14 days at 7°C in (a) open pans, (b) perforated polyethylene (PE) bags, (c) sealed PE bags or (d) as (c) but with internal atmosphere adjusted to 35% CO_2/20% O_2. Atmospheric composition was measured in all packages. In (a) it was similar to the ambient air; in (b) CO_2 levels increased and O_2 declined slightly, a trend which was more marked in (c), where CO_2 levels reached 17% and O_2 dropped to 6% after 14 days; in (d), CO_2 levels dropped to 24% and O_2 to 5% after 14 days. Packaging had a significant effect on quality as measured by wt. loss, shear press values, pH, titratable acidity, colour difference meter 'a' - value and sensory scores. Package (c) provided the best conditions for 14 days holding of prepared snap beans. *(Summary by Food Science and Technology Abstracts)* H01

0519

14257 TABEKHIA, M.M. and LUH, B.S. **Effect of germination, cooking, and canning on phosphorus and phytate retention in dry beans.** Journal of Food Science 45:406-408. 1980. Engl., Sum. Engl., 22 Refs.

Phaseolus vulgaris. Germination. Cooking. Digestibility. Dietary value. Human nutrition. USA.

The effects of germination, cooking and canning on the changes in total P, inorganic P and phytate retention in black-eyed, red kidney, mung, and pink beans were determined in this study. Soaking the dry beans in water for 12 h at 24°C resulted in a slight decrease in phytate. After germination for 96 h or longer there was a significant breakdown in phytic acid, and an increase in inorganic P. Cooking the dry beans at 100°C for 3 h had little effect on phytate retention. Heat processing the dry beans at 115.5°C for 3 h in cans resulted in some increase in inorganic P and a reduction in phytate. *(Author's summary)* H01

0520

14722 AHLOOWALIA, B.S. 'Shel' - a new variety of dry beans. Farm and Food Research 10(2):58. 1979. Engl., Illus.

Phaseolus vulgaris. Cultivars. Seed production. Composition. Agronomic characters. Pods. Seeds. Plant anatomy. USA.

The appearance, composition, cultivation, and possible uses of 'Shel' a new var. of dry bean developed primarily for grain seed production are described. The pods are 10-12 cm long and have 4-6 seeds each. The seeds are cream colored with purple specks, but the seed coat may turn chocolate brown on drying and after storage. 'Shel' contains 20-22% CP and 58% carbohydrates. Preliminary canning tests in 2% salt, or in tomato sauce and as chili-beans with minced beef, suggest an excellent canning quality. *(Summary by Food Science and Technology Abstracts)* H01

0521

15419 SATHE, S.K. and SALUNKHE, D.K. Solubilization and electrophoretic characterization of the Great Northern bean (*Phaseolus vulgaris* L.) proteins. Journal of Food Science 46(1):82-87. 1981. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. Composition. Proteins. Biochemistry. Analysis. Laboratory experiments.

Protein content of dry bean cv. Great Northern, was 26.10% (dry wt. basis). The isoelectric pH of the NaCl extractable proteins was about 4.4. Several salts, NaOH, and HCl were employed to solubilize the Great Northern bean proteins. Among all the protein solubilizing agents, Na_2CO_3, K_2SO_4, SDS, and NaOH at resp. concn. of 0.5, 5, 5% (all wt/vol.), and 0.02N were found to be better protein solubilizers than the rest; solubilizing 93.6 g of Lowry protein/100 g of Kjeldahl protein. Albumins and globulins accounted for 21.18 and 73.40%, resp. of the total bean proteins. Protein content of albumins, globulins, protein concentrates, and protein isolates was 81.68, 92.26, 85.44, and 92.43% (dry wt. basis), resp. SDS-polyacrylamide gel electrophoresis (SDS-PAGE) of the bean flour, albumins, globulins, protein concentrates, and protein isolates revealed the presence of 22, 14, 10, 14, and 11 subunits, resp. The bean flour, albumins, globulins, protein concentrates, and protein isolates were characterized by the predominance of subunits with apparent mol. wt. of 294,000, 266,000, 123,000, 146,000, and 135,000 daltons, resp. Isoelectric focusing of the bean flour, albumins, globulins, protein concentrates, and protein isolates indicated 15, 13, 15, 16, and 11 subunits, resp. Molecular sieve chromatography of the bean flour proteins, albumins, and globulins followed by SDS-PAGE was also employed to study the complexities of these proteins. *(Author's summary)* H01

0522

15420 SATHE, S.K. and SALUNKHE, D.K. Functional properties of the Great Northern bean (*Phaseolus vulgaris* L.) proteins: emulsion, foaming, viscosity, and gelation properties. Journal of Food Science 46(1):71-74, 81. 1981. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. Proteins. Composition. Analysis. Bean flour. Electron microscopy.

Functional properties of the Great Northern bean flour, albumins, globulins, protein concentrates, and protein isolates were investigated. Protein concentrates had the highest water and oil absorption capacity (5.93 and 4.12 g/g, resp.) among all the samples studied. Protein concentrates registered the highest emulsion capacity (72.6 g oil emulsified/g) while albumins had the highest emulsion stability (< 5 ml separation of phase in 780 h at room temp. of 21°C). Foaming ability of the Great Northern bean proteins was fair and concn. dependent. *(Author's summary)* H01

0523

15411 PHILLIPS, D.E. *et al.* **Protein quality in seed meals of *Phaseolus vulgaris* and heat-stable factors affecting the utilisation of protein.** Journal of the Science of Food and Agriculture 32:423-432. 1981. Engl., Sum. Engl., 22 Refs., Illus.

Phaseolus vulgaris. **Seed. Protein content. Digestibility. Nutritive value. Amino acids. S. Analysis.**

The polyphenol content of several cv. of *Phaseolus vulgaris* was measured. The true digestibility (TD) and BV of the cooked meals of 2 high-polyphenol cv. and one low-polyphenol cv. were determined by N-balance expt. with growing rats. Removal of the testa caused a significant ($P < 0.05$) increase in TD of Canadian Wonder and Masterpiece (high-polyphenol) of 7.2 and 8.4%, resp., but no significant increase in that of Processor (low-polyphenol). Testa removal caused no significant change in BV. Supplementation of the 3 cv. with met. and cystine raised the BV to values similar to those obtained with egg albumin. Supplementation of Masterpiece with tryptophan caused no further increase in BV. The polyphenol content of the bean meals did not appear to affect the utilization of their S-containing amino acids. Isolated Masterpiece globulins were found to be highly digestible (TD 95.4%) but with a low BV (28.36%) which was caused by a low S-containing amino acid content. The effects measured by rat feeding expt. could not be accounted for by trypsin inhibitors of phytohemagglutinin activity as the heat treatment used prior to the N-balance studies was sufficient to destroy their activity. For the samples Masterpiece, Canadian Wonder, and Processor, both with and without testa, and the isolated globulin fraction, the BV was highly correlated ($P < 0.001$) with the total protein S-containing amino acid content. *(Author's summary)* H01

0524

14769 MUÑOZ G., J.A. **Cambios químicos y nutricionales del fríjol (*Phaseolus vulgaris* L.) en su proceso de germinación.** *(Chemical and nutritional changes in beans during germination).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1975?. 43p. Span., Sum. Span., 31 Refs., Illus.

Phaseolus vulgaris. **Nutritive value. Germination. Seeds. Amino acids. S. Protein content. Fat content. Fibre content. Mineral content. Digestibility. Inhibitors.**

The effect of germination on the nutritive value of black beans was studied. Samples were taken at 0, 3, 6, and 9 days for each germination stage. An increase in water content and a reduction in protein, fat, crude fiber, and ash contents, expressed on a fresh basis, were observed. A reduction in protein content was correlated with an increase in lysine, total S-amino acid contents and of the biological activity of growth inhibitors. A decrease in protein solubility in NaOH 0.01 N was observed while the soluble fraction of KCl at 5% increased. The soluble fractions in water ethanol at 70% remained constant. A decrease was observed in the nutritive value during germination and protein digestibility was not significantly affected. Results suggest that during germination, the decrease in nutritive value is due to the lower total S-amino acid content; they also indicated that of the S-amino acids analyzed, met. remained constant while cystine decreased significantly. A positive correlation ($R = 0.91$) was found between the PER and total S-amino acids and ($R = 0.95$) between the PER and cystine. It was also concluded that in this physiological stage, the seed has an enzymatic system capable of hydrolyzing some of the growth inhibitors. Finally, results showed the importance of carrying out biochemical and physiological studies in order to evaluate the importance of toxic factors, different protein fractions, and amino acid composition on digestibility, and the nutritive value of legume seeds, that constitute an important protein resource for L.A. countries. *(Author's summary. Trans. by L.M.F.)* H01

0525

15403 LINARES B., S. *et al.* **Características tecnológicas y nutricionales de 20 cultivares de fríjol común (*Phaseolus vulgaris*). I. Características físicas del grano.** *(Technological and nutritional characteristics of 20 common bean cultivars. I. Physical characteristics of the grain).* Turrialba 31(1):1-10. 1981. Span., Sum. Engl., Span., 18 Refs., Illus.

Phaseolus vulgaris. **Cultivars. Seed characters. Food technology. Nutritive value. Plant habit. Seed coat. Cooking.**

The objective of this work was to estimate the possible effect of var. on the physical, organoleptic, and culinary characteristics of 20 bean var. (10 black, 4 red, 3 beige, and 3 white) and the information obtained was correlated on the basis of yields. The following 10 physical characteristics were measured in each var.: color, brilliance or shine of the seed coat, wt., vol., cooking time, thickness of broth, % of seed coat, % of cotyledon, water absorption, and hardness of the seed. In general, a high variability was found in the different parameters measured, between and within var. Yield/unit area was higher for black and beige var. The negative correlation between this parameter and wt. and vol. suggests that smaller seeds have higher yields. The physical parameters that showed better practical possibilities were size of the seed and cooking time. A positive significant ($P < 0.01$) correlation ($r = 0.96$) was found between wt. and vol., and since dry wt. is a less variable and easier parameter to measure, it was taken as representative of seed size. Cooking time, a relevant parameter since it determines acceptability, was negatively ($P < 0.05$) correlated with seed wt., and positively and significantly ($P < 0.01$) correlated with % of seed coat. These relationships indicate that cooking time is influenced by seed size and, possibly to a higher degree, by the % of seed coat. Hardness of the seed, as measured by the Instrom penetrometer, was positively correlated with % of seed coat; on the other hand, it was found that a seed with a shinier seed coat absorbs less water and requires more time for cooking. From these results, it was concluded that cooking time, perhaps the main factor determining acceptability by the consumer, is determined by several physical characteristics of beans, such as color, shine of the seed coat, size, % of seed coat, and probably other characteristics not considered in this work. *(Author's summary)* H01

0526

14766 CONDE M., C.A. **Cambios químicos y nutricionales del fríjol *Phaseolus vulgaris* L. durante el proceso de maduración del grano.** *(Nutritional and chemical changes of beans during grain maturation).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1975?. Span., Sum. Span., 55 Refs., Illus.

Phaseolus vulgaris. **Plant development. Maturation. Nutritive value. Cooking. Protein content. Digestibility. Seeds. Pods. Amino acids. Analysis. Animal nutrition. Diets.**

The effect of maturation on the chemical composition and nutritive value of black bean grain was studied. Four samples were harvested the 1st 72 days after planting and the others at 8-10 day intervals between samples. Sample no. 4 was divided in 4 "A" and 4 "B". Sample 4 "A" was harvested and immediately lyophilized, grinded and stored, and sample 4"B" was harvested and then sun-dried for 3 days. A part of each one of the 5 samples was cooked in autoclave for 15 min. The 5 samples were divided into 5 raw and 5 cooked ones. During maturation, an increase was observed in protein, fat, crude fiber, and ash content while water and free amino acids decreased. An increase in the amount of lysine and total S-amino acids increased as well as the activity of growth inhibitors. The fraction soluble in NaOH increased; solubility in KCl decreased, while the fractions soluble in water and alcohol remained constant. The nutritive value decreased with maturation; this, instead, did not have any effect on protein digestibility. Results indicate that the reduction in nutritive value can be explained by the presence of residual toxic factors, that are heat-resistant and present in the different pigments formed during maturation. It was also concluded that digestibility was not affected by the parameters under study. Finally, results demonstrated the importance of carrying out biochemical and physiological studies in order to evaluate the role

toxic factors, the different protein fractions, and amino acid composition play on digestibility and nutritive value of legume seeds. *(Author's summary. Trans. by L.M.F.)* H01

0527

16402 SENESI, E., CRIVELLI, G. and BERTOLO, G. **Recherches sur le comportement des legumes a la congelation rapide. V. Aptitudes variétales de petits pois et haricots verts.** *(Research on quick freezing of vegetables. V. Suitability of pea and French bean varieties).* Revue Generale du Froid 69(3):163-165. 1978. Fr., 2 Refs., Illus.

Phaseolus vulgaris. **Storage. Temperature. Adaptation. Cultivars. Snap bean.**

Forty-seven pea and 51 French bean var. were examined for changes during quick freezing (10 and 20 min resp. in forced-air tunnels at -35°C) and 6 mo. of cold storage at -20°C in polyethylene bags. The results of sensory evaluations of the top 3 pea var. and top 7 bean var. are shown in tables (overall evaluations 65.7-74.6 points). The main defects were broken skins and color changes in peas, loss of consistency (wilting), and detached epidermis in beans. The bean var. most suitable for quick freezing are: Lit 551, Rofin, Rubicon, Silver, and Ulysse. *(Summary by Food Science and Technology Abstracts)* H01

0528

15856 ALLI, I. and BAKER, B.E. **Constitution of leguminous seeds: the microscopic structure of proteins isolated from *Phaseolus* beans.** Journal of the Science of Food and Agriculture 31:1316-1322. 1980. Engl., Sum. Engl., 14 Refs., Illus.

Phaseolus vulgaris. **Composition. Seeds. Proteins. Analysis. Biochemistry.**

Proteins were isolated from citric acid and sodium hydroxide extracts of *Phaseolus* beans. Examination of the proteins under the light microscope revealed that they had different micro-structures. Bipyramidal crystalline and spheroidal protein were obtained from the citric acid extracts of the white kidney bean, the navy bean and the baby lima bean. Cubical crystalline, rosette-type and needle-like structures were isolated from the navy bean under certain conditions. Analysis of the proteins revealed the presence of phytic acid and carbohydrate material. There was some indication that neither of these 2 materials affect the microscopic structure of the proteins. *(Author's summary)* H01

0529

15415 GONZALEZ, A.R. and WILLIAMS, J.W. **Effect of water stress on quality of raw and processed snap beans.** Arkansas Farm Research 27(6):3. 1978. Engl.

Phaseolus vulgaris. **Water requirements. Drought. Plant development. Pods. Maturation. Harvesting. Yields.**

Studies were carried out with the bean cv. Early Gallatin, Gallatin Valley 50, and Cascade. Water stress during pod development did not affect harvest time and pod length but decreased yields and pod wt. The 3 cv. reacted similarly to water stress. *(Summary by Horticultural Abstracts)* H01

0530

16072 HOLMES, Z.A. *et al.* **Vitamin retention during home drying of vegetables and fruits.** Home Economics Research Journal 7(4):258-264. 1979. Engl., Sum. Engl., 25 Refs.

Phaseolus vulgaris. **Technology. Composition. Vitamin content. Dry matter.**

Effect of home drying on retention of several vitamins was measured using green beans, tomato puree, zucchini squash, and raspberry and boysenberry leathers. The % of apparent vitamin retention was calculated on the basis of vitamin content/g of solids before and after drying. Little vitamin C was retained in the dried green beans (2%) and tomato puree (7%), while more was retained in the dried zucchini (33%), raspberries (74%), and boysenberries (20%). Retention of carotene, which was measured only in dried green beans and tomato puree, was almost negligible (5%). Except for the dried blanched green beans, the retention of free folacin was higher (83-130%) than that of total folacin (48-92%) in the dried products. The ratio of free to total folacin was almost equal in the dried foods. These results suggest that during the preparation and drying of these vegetables and berries some polyglutamyl folacin was converted to mono-, di-, and triglutamyl folacin (free folacin). From 60-96% of vitamin B_6 (unchromatographed extracts) was retained during drying. *(Summary by Food Science and Technology Abstracts)* H01

0531

15407 SPLITTSTOESSER, D.F. and CORLETT JUNIOR, D.A. **Aerobic plate counts of frozen blanched vegetables processed in the United States.** Journal of Food Protection 43(9):717-719. 1980. Engl., Sum. Engl., 7 Refs., Illus.

Phaseolus vulgaris. Canned beans. Food products. Contamination. USA.

Aerobic plate counts were determined for 575 packages of frozen vegetables processed by 24 factories located in 12 states of the USA. The type of vegetable and the method of processing both influenced microbial populations; peas yielded some of the lowest counts while French style green beans gave higher figures than the cut var. Using the 3-class sampling plan of the International Commission on Microbiological Specifications for Foods, the acceptance rate for the 115 lots would have been 74% for the maximal acceptable aerobic plate count (m) value specification of 10^5/g. An acceptance rate of 84% was found for the M (aerobic plate count) value specification of 10^6/g. *(Author's summary)* H01

0532

14298 INSHINO, K. and ORTEGA D., M.L. **Fraccionamiento y caracterización de las proteínas de reserva más abundantes en las semillas de *Phaseolus vulgaris* L.** *(Fractionation and characterization of the most abundant reserve proteins in Phaseolus vulgaris seeds).* *In* Avances en la enseñanza y la investigación en el Colegio de Postgraduados de Chapingo. México, 1973. pp.32-33. Span.

Phaseolus vulgaris. Composition. Protein content. Proteins. Analysis.

A protein content of 29.8%, consisting of 75% globulin protein formed by 4 components named α, β, γ, and δ, was found in bean var. "negro mecentral". Component α is a non-sulfurated glycoprotein, containing 4.95% carbohydrates and 1.19% hexosamine; it was isolated homogeneously by gel filtration. This component shows a min. solubility at pH 4.1; it was not separated by a treatment of 8 M urea but it was partially separated in an alkaline treatment (pH 12.5) during 24 h. *(Summary by C.P.G. Trans. by L.M.F.)* H01

0533

16087 MA, Y., BLISS, F.A. and HALL, T.C. **Peptide mapping reveals considerable sequence homology among the three polypeptide subunits of G1 storage protein from French bean seed.** Plant Physiology 66:897-902. 1980. Engl., Sum. Engl., 20 Refs., Illus.

Phaseolus vulgaris. Seed. Proteins. Protein content. Analysis. Enzymes. Snap bean.

The major storage protein, G1 globulin, of bean cv. Tendergreen seeds was subjected to

limited proteolysis with trypsin, chymotrypsin, papain, proteinase K, and protease V8 and to cleavage with cyanogen bromide and 2-(2-nitrophenylsulfanyl)-3-methyl-3'bromoindolenine. Mapping of peptides separated from each of the 3 G1 subunits by polyacrylamide gel electrophoresis revealed that many proteolytic cleavage sites were present at similar positions on the subunits. Evidence was adduced that the G1 subunits are homologous in amino acid sequence for about 61% of their length. The remaining region (possibly COOH-terminal) of the subunits appears to be heterologous, with the α subunit bearing an additional met. residue. *(Author's summary)* H01

0534

16086 BROWN, J.W., BLISS, F.A. and HALL, T.C. **Microheterogeneity of globulin-1 storage protein from French bean with isoelectrofocusing.** Plant Physiology 66:838-840. 1980. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. Snap bean. Seed. Proteins. Biochemistry. Analysis.

The major storage protein fraction, globulin-1 protein, of French bean was analyzed by 2-dimensional electrophoresis. The protein pattern suggested a more complex system for globulin-1 protein than the model of 3 polypeptides, α, β, and γ, differing in mol. wt. Isoelectrofocusing analyses of the individual proteins showed that each exhibited charge microheterogeneity over a similar pH range. Isoelectrofocusing banding patterns may help to understand the relationships between the globulin-1 polypeptide subunits. *(Author's summary)* H01

See also 0060 0078 0457 0467

I00 MICROBIOLOGY

0535

14294 RAMIREZ, C. and ALEXANDER, M. **Evidence suggesting protozoan predation on *Rhizobium* associated with germinating seeds and in the rhizosphere of beans (*Phaseolus vulgaris* L.).** Applied and Environmental Microbiology 40(3): 492-499. 1980. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Seed. Germination. Soil population. Rhizosphere. Roots. Inhibitors. USA.**

Changes in populations of microorganisms around germinating bean seeds, in the rhizosphere of bean, and in a model rhizosphere were studied. Strains of *Rhizobium phaseoli* that were resistant to streptomycin and thiram were used, and as few as 300 *R. phaseoli* cells/g of soil could be enumerated with a selective medium that was devised. A direct role was not evident for bacterial competitors, lytic bacteria, antibiotic-producing microorganisms, bacteriophages, and *Bdellovibrio* in the suppression of *R. phaseoli* around germinating seeds and in the rhizosphere. Protozoa increased in no. in the soil upon planting of the seeds. The extent of colonization of soil by *R. phaseoli* was inversely related to the presence of large no. of bacteria and protozoa. Colonization of *R. phaseoli* was improved upon suppression of protozoa with thiram and also when the soil was amended with other protozoan inhibitors and mannitol to simulate seed and root exudation. The data support the view that the decrease in no. of *R. phaseoli* is caused by an increase in protozoan predation, the protozoa increasing in no. because they prey on bacteria that proliferate by using seed and root exudates as nutrients. *(Author's summary)* I00 i01

I01 *Rhizobium* spp., Nitrogen Fixation and Nodulation

0536

11997 GRAHAM, P.H. **Nitrógeno: fuentes químicas y biológicas en la fertilización del fríjol.** *(Nitrogen: chemical and biological sources in bean fertilization).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 24p. Span., 3 Refs., Illus.

Paper presented at Curso Intensivo de Adiestramiento Posgrado en Investigación para la Producción de Fríjol, 4o., Cali, Colombia, 1979.

Phaseolus vulgaris. **Fertilizers. N. Nodulation.** *Rhizobium.* **Cultivation. Colombia.**

A report is presented on N fertilization and fixation in bean crops. The selection of N sources, the time of application and the amount applied guarantees a higher utilization of N by the plant. When the total amount of N required is applied prior to planting, the plant only uses 26% of the fertilizer supplied. Nodulation and N-fixation are affected by the supply of an appropriate rhizobium, its specificity with the host, soil pH and temp., nutritional factors, the use of toxic products, cultural factors and the existence of *Rhizobium* in the soil. Graphics are presented on the levels of N-fixation. *(Summary by C.P.G. Trans. by L.M.F.)* I01 D01 C01

0537

14340 GRAHAM, P.H. *et al.* **Survival of** *Rhizobium phaseoli* **in contact with chemical seed protectants.** Agronomy Journal 72(4):625-627. 1980. Engl., Sum. Engl., 10 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Seed. Seed treatment. Nodulation. Cultivars. Roots. Rots. Field experiments. Laboratory experiments. Colombia.**

In the multiple cropping systems used for bean production in L.A., seed treatment is often needed for control of soil pathogens and pests but can be incompatible with *Rhizobium* inoculation. The interaction between *Rhizobium* and seed protectant is studied. One lab. and 3 field studies are reported. The survival of *R. phaseoli* on bean seeds treated with PCNB, thiram, or captan was measured under lab. conditions using standard serial dilution and plate count techniques. At Popayan, Colombia (typic dristandept, pH 4.8) the nodulation and nodule development of bean seeds treated with PCNB, thiram, captan, and furadan were evaluated, and different inoculation methods, including a granular soil-applied inoculant, compared. Nodulation of beans protected with PCNB or thiram, and inoculated with seed or soil-applied rhizobia was also studied at La Selva, Colombia (typic dristandept, pH 5.1). While contact with PCNB, thiram or captan on seeds reduced *Rhizobium* survival (with captan most toxic) PCNB-treated seeds maintained counts of 10^3 rhizobia/g seed until almost 48 h after inoculation. Field results demonstrated the delicate balance between inoculant and seed protectant. At Popayan, nodule no./plant was not affected when thiram, furadan, or PCNB-treated seeds were inoculated and promptly planted, but delay between inoculation and planting did reduce the nodulation of seeds protected with PCNB or thiram. At La Selva, all fungicide treatments lowered nodule no./plant. Seed protection with PCNB enhanced nodule development at Popayan and reduced root rot incidence at La Selva.

Despite the somewhat acid soil conditions the best nodulation at both Popayan and La Selva was attained with granular soil-applied inoculants. Further studies on this method of inoculation for beans are warranted. *(Author's summary)* 101

0538

14233 SAITO, S.M.T., MATSUI, E. and SALATI, E. $^{15}N_2$ fixation, H_2 evolution and C_2H_2 reduction relationships in *Phaseolus vulgaris*. Physiologia Plantarum 49 (1):37-42. 1980. Engl., Sum. Engl., 23 Refs., Illus.

Phaseolus vulgaris. Nodulation. Nitrogen fixation. Roots. *Rhizobium*. Age. Plant physiological processes.

Three parameters – $^{15}N_2$ fixation, C_2H_2 reduction and H_2 evolution – were measured in a study of N_2 fixation in nodules of bean cv. Venezuela-350 of different ages and kept under controlled light and temp. conditions. C_2H_2 reduction was positively related to the N fixed. A standardization of sampling is necessary to keep exptl. errors to a min. To decrease the variation between replications, the nodules should be carefully incubated (adequate time and temp.), and the samples for chromatography should also be carefully stored. No significant difference was found in C_2H_2 reduction in the systems studied – nodulated roots, disturbed whole plants and intact plants – during the 1st h of measurement. H_2 evolution was detected in nodules over 20 days of age and was positively related to N_2 fixation and C_2H_2 reduction. This measurement was essential to account for the equilibrium between the 3 parameters in the electron balance ratio. Under phytotron conditions, max. H_2 evolution occurred 20-30 days after planting. Nodulated roots from different plants were used to determine the N_2 fixed and C_2H_2 reduction, and on av. the ratios $C_2H_2:N_2$ varied between 7.3-8.3 for all ages. In vivo $C_2H_4/(3N_2 + H_2)$ electron balance values were > 1, varying from 1.32-1.43. These data suggest that overestimation of actual N_2 fixation might be occurring when using the C_2H_2 reduction technique, even if taking account for H_2 evolution. In this case, this method should be used with great care to avoid an overestimation of on av. 32-43% of the actual value. Variation was smaller between the measures of the 3 parameters when younger nodules were used. *(Author's summary)* 101

0539

14232 WATERS JUNIOR, L. *et al.* **Translocation of ^{14}C- photosynthate, carbohydrate content, and nitrogen fixation in *Phaseolus vulgaris* L. during reproductive development.** Journal of the American Society for Horticultural Science 105(3): 424-427. 1980. Engl., Sum. Engl., 19 Refs., Illus.

Phaseolus vulgaris. **Tracers. Translocation. Carbohydrate content. Nitrogen fixation. Nodulation. Flowering. Leaves. Roots. Stems. Pods. Sugars. Starch content. Plant development. Timing.**

Leaves at nodes 4 or 8 of greenhouse grown bean cv. Puebla 152, were briefly exposed to $^{14}CO_2$ at 35, 48, 63, or 70 days after planting. Prior to flowering, > 85% of the recovered ^{14}C-activity translocated in 24 h from node 4 was in roots, nodules, and the lower stem. At flowering, radioactivity translocated to the lower stem decreased but correspondingly increased in nodules. Roots assimilated 45% of translocated-^{14}C throughout the life of the node-4 leaf. About 80% of the ^{14}C-activity exported from node 8 at flowering was in middle and upper stem sections, but during pod-fill > 85% moved into the pods and < 1% to the nodulated root system. Starch concn. in the lower stem increased continuously from flowering, but in other plant parts declined after early pod-fill. At mid pod-fill, the concn. of soluble sugars in nodules and roots declined and reached a common value in stem sections. N (C_2H_2) fixation decreased rapidly after peaking at early pod-fill. This decline, which was accompanied by loss of lower leaves, occurred in the presence of a high concn. of starch in the stem. *(Author's summary)* 101 C01

0540

13176 LEAL, N.R., MENDONÇA, C.A. DE and DOBEREINER, J. **Influencia da inoculação de *Rhizobium phaseoli* na produtividade de feijão-de-vagem (*Phaseolus vulgaris*).** *(Influence of Rhizobium phaseoli inoculation on snap bean productivity).* Lavoura 77:8-9. 1974. Port.

Phaseolus vulgaris. Rhizobium phaseoli. Nodulation. N. P. K. Fertilizers. Productivity. Brazil.

The results are presented of a trial conducted in Papucaia (Brazil) to determine the effectiveness of *Rhizobium* inoculation in snap bean cultivation. A Latin square design was used with 5 replications in 11.2 m^2 plots. Treatments were: (a) control; (b) PK (90 + 21 = 111 g/m); (c) NPK (30 + 90 + 21 = 141 g/m) + saltpeter; (d) IPK (90 + 21 = 111 g/m) + saltpeter; and (e) IPK (90 + 21 = 111 g/m), utilizing Chile saltpeter, simple superphosphate and K chlorate as sources of N, P and K, resp. The inoculum (I) was applied at 100 g/30 kg of seed. Treatments (c) and (d) received 2 applications of saltpeter, each one of 7.5 g/linear m. Av. productions were 7974, 8870, 9172, 9422 and 9394 kg/ha for treatments (a), (b), (c), (d) and (e), resp. Treatments (c), (d) and (e) showed significant differences in production. Treatment (e) nodules were greater in no. and seed size in comparison to treatment (d). Results are presented in table form. *(Summary by C.P.G. Trans. by L.M.F.)* 101 D01

0541

13595 FRANCO, A.A. and DAY, J.M. **Effects of lime and molybdenum on nodulation and nitrogen fixation of *Phaseolus vulgaris* L. in acid soils of Brazil.** Turrialba 30(1):99-105. 1980. Engl., Sum. Port., Engl., 23 Refs., Illus.

Phaseolus vulgaris. Ca. Mo. Fertilizers. Nodulation. Nitrogen fixation. pH. Soils. Soil requirements. Developmental stages. Brazil.

In 3 greenhouse expt. the effects of levels and types of Mo fertilizer on growth and N fixation of effectively nodulated *Phaseolus vulgaris* cv. Venezuela 350 were studied in acid and limed soils. Ammonium molybdate and molybdic acid proved equally good sources of Mo but fritted trace elements were of poor availability. In a red-yellow podzolic soil, pH 5.1, liming increased plant growth, nodulation, N fixation and nodule efficiency. Without lime, plants grew poorly, fixed little N and did not respond to Mo. With low lime levels (to pH 5.3-6.0), Mo application significantly increased nodulation, N fixation and plant growth. Liming to a pH above 6.0 resulted in plants which grew well, fixed abundant N, and did not respond to Mo. These responses were similar in various soils, when other major limiting growing factors had been removed. *(Author's summary)* 101 D01

0542

14237 COOKSON, C., HUGHES, H. and COOMBS, J. **Effects of combined nitrogen on anapleurotic carbon assimilation and bleeding sap composition in *Phaseolus vulgaris* L.** Planta 148(4):338-345. 1980. Engl., Sum. Engl., 15 Refs., Illus.

Phaseolus vulgaris. Nodulation. Nitrogen-fixing bacteria. Amino acids. CO_2. Analysis. Sap.

Dwarf french beans were grown with or without inoculation with rhizobia (strain 3644), and with or without a combined N source (nitrate or ammonium ions). The distribution of radioactivity into products of dark $^{14}CO_2$ assimilation was studied in roots or nodules from these plants. A detailed study was also made of the distribution and rates of excretion of N in xylem bleeding sap in 28-day-old plants grown on the various sources of N. Whereas detached nodules accumulated radioactive glycine, serine and glutamate when incubated with $^{14}CO_2$, bleeding sap from plant roots fed $^{14}CO_2$ contained low levels of radioactivity in these compounds but higher levels in allantoin. Chemical analysis showed allantoin to be the major compound transported in the xylem of nodulated plants, whether or not they were fed on combined N. In contrast uninoculated plants accumulated mainly amino acids

in the bleeding sap, the amount and chemical composition of which depended on the combined N source. *(Author's summary)* 101 C03

0543

14793 MARTINEZ-RODAS, R. **Nitrogen fixation and carbohydrate partitioning in *Phaseolus vulgaris* L.** Ph.D. Thesis. East Lansing, Michigan State University, 1977. 164p. Engl., Sum. Engl., 65 Refs., Illus.

Phaseolus vulgaris. **Nitrogen fixation. Carbohydrate content. Starch content. Plant vascular system. Nodulation.** *Rhizobium phaseoli.*

The ontogenetic relationships that may exist between symbioticN fixation and carbohydrate partitioning were studied in 4 dry bean cv. Total soluble carbohydrate and starch contents of the primary nodule population were found to be closely correlated in time with N fixation activity. The decline in N fixation activity was found to be correlated with loss of nodule dry wt., decreased total soluble carbohydrate and starch of nodules and an increase in soluble carbohydrate and starch in leaves and stems during the early stages of reproductive growth. Starch concn. was found to decline 1 wk.prior to the occurrence of N fixation maxima, suggesting that hydrolysis of this polysaccharide may contribute energy to the fixation of N_2. Temporary sites of starch accumulation were found to be restricted primarily to parenchyma cells of secondary xylem and pith and to uninfected cells in nodules. Reduction of carbohydrate movement to the nodule, due to "competition" by reproductive sinks, may not be the cause of the observed decline in N fixation. It is suggested that a developmentally compensated genetic program predisposes the nodules to the observed decline in N_2 fixation. Thus, loss of nodule competency in N_2 fixation may not be triggered by a reduction in carbohydrate movement to such structures but by an activating signal(s) affecting both nodule and lower leaf senescence, probably hormonal in nature. Dry bean plants exposed to 1200 ppm CO_2 at various developmental stages exhibited higher N fixation rates, higher nodule fresh wt., higher total soluble carbohydrate and slightly higher organic N contents. CO_2 treatment during the 4 wk.prior to reproductive growth was found not to extend the duration nor prevent the decline of N fixation. The view that the rate of N fixation per se is limited by photosynthate available to the entire symbiotic system is supported. *(Author's summary)* 101

0544

14779 AGUILERA M., R.G. **Evaluación del efecto simbiótico de 14 cepas de *Rhizobium phaseoli* en 3 variedades mejoradas de fríjol negro de Guatemala.** *(Evaluation of the symbiotic effect of 14 strains of Rhizobium phaseoli in 3 improved varieties of Guatemalan black beans).* Tesis Ing. Agr. Guatemala, Universidad de San Carlos de Guatemala, 1975. 45p. Span., 23 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Strains. Cultivars. Nitrogen fixation. Nodulation. Soil temperature. Dry matter. Guatemala.**

The effect of 8 Colombian strains of *Rhizobium* (ICTA no. 1, 2, 3, 4, 5, 6, 7, and 8) and 6 Guatemalan strains (ICTA no. 21, 22, 23, 24, 25, and 26) on 3 improved bean var., Ipala 72, San Pedro Pinula, and Negro Jalpatagua, recommended for their high yields and resistance to diseases was evaluated. A split-split plot design was used with 3 replications in which each exptl. unit consisted of a Leonard jar with 2 plants each. Materials and lab. methods are described in detail. Among the conclusions are: (1) strains ICTA no. 24, 25, 23, 26, 6, 2, 5, and 8 obtained the best plant development in any var.; (2) the total DM wt. of nodules, that coincided with plant development and DM, can be an index of symbiotic efficiency; (3) strain ICTA no. 26 is recommended for var. Ipala 72 and strain ICTA no. 8 for var. Negro Jalpatagua and San Pedro Pinula; (4) strains with a greater infective capacity of var. regarding the no. of nodules/plant were: ICTA no. 6 for Ipala 72; ICTA no. 5 for San Pedro Pinula; and ICTA no. 1 and 5 for Negro Jalpatagua. *(Summary by I.B. Trans. by L.M.F.)* 101

0545

15835 GRAHAM, P.H. **Some problems of nodulation and symbiotic nitrogen fixation in *Phaseolus vulgaris* L.: a review.** Field Crops Research 4:93-112. 1981. Engl., Sum. Engl., 145 Refs., Illus.

Phaseolus vulgaris. Rhizobium phaseoli. **Nitrogen fixation. Nodulation. Genes. Cultivars. Soil fertility. Soil temperature. pH. Al. Seed treatment. Intercropping. Colombia.**

Beans are a crop of the small farmer, commonly grown under conditions of low soil fertility and with min. technical inputs. *Rhizobium* inoculants are seldom used to reduce dependence on combined N, since the response of beans to inoculation has proved too variable. The potential for N fixation in beans, and the major genetic, edaphic, and agronomic factors that limit this potential are reviewed. L.A. production conditions are emphasized, and areas proposed in which research is needed to overcome current constraints to N_2 fixation in the crop. *(Author's summary)* 101

0546

15426 THOMAS, R.J. and SCHRADER, L.E. **Ureide metabolism in higher plants.** Phytochemistry 20:361-371. 1981. Engl., Sum. Engl., 122 Refs., Illus.

Phaseolus vulgaris. **N. Metabolism. Plant physiological processes. Nutrient transport. Plant assimilation. Nitrogen fixation. Nodulation. Stems. Leaves. Roots. Plant tissues. Sap.**

The synthesis, transport and assimilation of the ureides, allantoin and allantoic acid, in higher plants are reviewed. Evidence indicates that in nodulated legumes ureides are synthesized from products of N_2-fixation via purine synthesis and degradation. Their synthesis in other plants also appears to be via purine degradation but is dependent on the inorganic N source fed to the plant; greatest ureide production is associated with ammonium assimilation. The use of ureides rather than amides for N-transport from the root to the shoot via the xylem stream results in an improved C economy of the plant. Good evidence for the transport of ureides in the phloem is lacking for most species examined although it is assumed to be important, particularly in fruit and seed development. Ureides are stored and assimilated mainly in the shoot. The precise pathways, localization and regulation of ureide assimilation are poorly understood and require further investigation. Similarities exist between the properties of the enzymes involved in ureide assimilation in higher plants and in microorganisms. However, the evidence that light appears to be involved in ureide assimilation in green tissues suggests that different regulatory mechanisms may exist in plants compared with microorganisms. The economically important legume crops such as soybeans, cowpeas, and *Phaseolus* sp. are all ureide producers. To aid our understanding of the productivity of these plants knowledge of how ureide-N is converted into seed protein is essential. *(Author's summary)* 101

0547

15826 RENNIE, R.J. and KEMP, G.A. **Selection for dinitrogen-fixing ability in *Phaseolus vulgaris* L. at two low-temperature regimes.** Euphytica 30:87-95. 1981. Engl., Sum. Engl., 28 Refs.

Phaseolus vulgaris. Rhizobium phaseoli. **Nitrogen fixation. Cultivars. Selection. Temperature. Planting. Timing.**

Eleven cv. of *Phaseolus vulgaris*, inoculated with a commercial inoculum of *Rhizobium phaseoli*, were grown in a N-free medium in the phytotron at 2 temp. regimes corresponding to mid-May or early June seedings. Cv. differed in their abilities to support N_2 fixation under the 2 temp. regimes. Early June seedings fixed more N_2 than mid-May ones when grown for the same growth period. The amount of N_2 fixed was correlated with leaf area and leaf and shoot wt. It is proposed that the relationship between N_2 fixation and these quantitative yield characters may help bean breeders in selecting plants with superior N_2-fixing abilities. *(Author's summary)* 101

0548

15496 MINCHIN, F.R. *et al.* **Carbon and nitrogen nutrition of nodulated roots of grain legumes.** Plant, Cell and Environment 4:5-26. 1981. Engl., Sum. Engl., 177 Refs.

Phaseolus vulgaris. **Nitrogen fixation. N. CO_2. Metabolism. Roots. Nodulation. Plant respiration. Plant physiological processes.**

The spatial and temporal relationships between C metabolism and N nutrition in grain legumes are of great academic interest with the added bonus that any data for economically important species may ultimately prove useful to breeders and growers. So far there are no data which can be used to relate differences in C usage by any symbiotic association with differences in economic yield. Much research has focussed on the dependence of N_2 fixation on photosynthate supply, on the C-N relationships of nodulated roots and nodules and on diurnal and seasonal profiles of N_2 fixation. In all these aspects a plethora of responses have been described, often based on insufficiently proven measurement techniques; consequently unequivocal conclusions cannot be drawn. Little is known about within-species differences due to cv., strain of *Rhizobium* or environment, or about the proportions of any heritable variations which might be sufficiently large to merit inclusion among the selection criteria of grain legume breeders. Some studies conducted on various grain legumes, including *Phaseolus vulgaris*, are given. *(Author's summary)* 101

0549

14717 PAZ, L.G. DA **Influência do pH e da nutrição mineral na nodulação e fixação do nitrogênio molecular pelo feijoeiro (*Phaseolus vulgaris* L.), cultivado em solução nutritiva.** *(Influence of pH and mineral nutrition on nodulation and N_2 fixation by beans cultivated in nutrient solution).* Tese Mag. Sc. Piracicaba-SP, Brasil, Universidade de São Paulo. Escola Superior de Agricultural "Luiz de Queiroz", 1978. 186p. Port., Sum. Port., Engl., 214 Refs.

Phaseolus vulgaris. **Nodulation. Nitrogen fixation. Plant nutrition. N. P. Mo. Nutrient solution. Growth. Roots.**

Three bean var. were grown in nutrient solution during 2 periods (25 and 45 days). The effects of combined N (as NO_3^- at the levels of 0, 0.3, 0.6, 1.2, and 3.0 m*M/l*), pH (4.0, 5.0, 6.0, and 7.0), Ca supply (0.01, 0.05, 0.25, 0.50, 1.25, and 2.50 m*M/l*), salinity (5.0 m*M* NaCl), P supply (0.01, 0.05, 0.20, 0.25, and 1.25 m*M/l*), Al toxicity (5 and 10 ppm), Mn toxicity (10 and 20 ppm), and Fe and Mo deficiencies on nodule growth and N_2-fixation were studied; numeral composition (Ca and P expt. only) was also determined. Main conclusions were that growth was promoted by increasing the level of combined N; only the starter treatments (0.3 and 1.2 m*M/l*) promoted nodulation and N_2-fixation as determined by nitrogenase activity (acetylene reduction technique). Higher DM production was observed at pH 6.0-7.0 whereas at pH 4.0 poor growth could be due to low N_2-fixation. A favourable Ca effect on the parameters under study was observed up to the level of 1.25 m*M/l*. A non-linear response to P supply was also verified. Excess Al and Mn inhibited nodulation, small root growth, and N_2-fixation. No effect was observed in the treatments without Mo. Mite infestation in the treatment without Fe did not allow to draw conclusions. *(Author's summary)* 101 C01

See also 0147 0182 0331 0535

J00 ECONOMICS AND DEVELOPMENT

0550

11876 VILLEGAS, A.J. Granos leguminosas. *(Legume grains). In*____. Cereales y granos leguminosos. Caracas, Banco Central de Venezuela. Colección Agricultura en Venezuela no. 3. 1978. pp.299-471. Span., Illus.

Phaseolus vulgaris. Vigna unguiculata. Productivity. Costs. Economics. Technology. Cultivation. Venezuela.

An extensive study is presented on the legume species of general consumption in Venezuela (*Phaseolus vulgaris, Vigna sinensis* and *Cajanus indicus*), divided into 3 parts: the general situation of the crop; fundamental problems and their solutions. General analysis comprehends the following aspects for each one of the species: production (area planted and type, variation of tendency, geographic distribution, yields and production systems, and elements involved); consumption (apparent, domestic, industrial, per capita and the influence of prices on consumption); markets (supply and demand, prices, margins of profit, channels of distribution and marketing services); foreign trade (imports and exports, commercial policies, subsidies and price levels); services (extension, research on var. and genetic breeding, agronomic practices including plant density, the use of fertilizers, irrigation, pest and disease control and ecological conditions); financing and credit (sources, classes, amount, finality and conditions); applied policies (agrarian reform, marketing policies, policies on import promotion and substitution); technological level (mechanization and the use of pesticides and certified seed). Among the possible solutions to problems, the following fundamental policies were developed: the establishment of a desirable and feasible annual consumption per capita; consideration of the quantity of internal supply and the quantity of national production. Statistics are presented on the tabulated data of each one of the previous aspects of the general study. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0551

13170 MOURA, P.A.M. DE Importância econômica da cultura do feijão em Minas Gerais. *(Economic importance of bean cultivation in Minas Gerais).* Informe Agropecuário *A*(46):3-6. 1978. Port., Illus.

Phaseolus vulgaris. Production. Productivity. Consumption. Storage. Brazil.

Data, tables and graphics are presented on bean production and its perspectives in the state of Minas Gerais, the 2nd bean producer in Brazil. Beans occupy the 3rd place among the most important crops in the country's economy. During the 1977-78 rainy season a total area of 236,655 ha was harvested with a production of 117,006 t. During the dry season 322,729 ha were harvested with a production of 160,480 t (2% reduction in planted area and a 7% reduction in production with respect to the former). Bean consumption in the state is related to population increase. Minas Gerais imports beans from other states, especially Paraná. Fixed bean prices presented av. alterations of 32-40% . Monthly and yearly variations were evaluated by variance analysis and it was concluded that there exists variation in the av. prices among mo. A network of official stores facilitates storage; however, between 1977-78 an excessive bean supply (70% of the stock) was observed in some state agencies. Crop expansion is recommended in Minas Gerais since production costs are

less than the min. price and furthermore, less than market prices. *(Summary by I.B. Trans. by L.M.F.)* J00

0552

13196 ALDANA DE LEON, L.F. **Análisis de la problemática de fríjol en el suroriente de Guatemala.** *(Analysis of the technical bean problems in south eastern Guatemala).* Guatemala, Instituto de Ciencia y Tecnología Agrícolas, 1980. 8p. Span., Ilus.

Phaseolus vulgaris. Plant breeding. Entomology. Production. Consumption. Cultivation. Guatemala.

An analysis is presented of the activities of ICTA (Instituto de Ciencia y Tecnología Agrícolas), through their Bean Production Program in SE Guatemala, which pretend to generate and promote the use of science technology in bean cultivation. This subtropical dry forest region, that produces 40% of the total national bean production, presents an irregular pluvial distribution, does not have pest- and disease-resistant var. and presents low fertility soils. From the evaluation of material from CIAT and the U. of Michigan, promissory var. resulted: Cuilapa 72, Negro jalpatagua, Ipala 72, Tumalba 1 and Porrillo 1. Crosses with Rabia de Gato (early-maturing) produced drought-resistant lines. Approx. 8000 materials from the CIAT Germplasm Bank have been evaluated for resistance to the golden mosaic virus and other diseases. ICTA Intiapan, ICTA Quetzal and ICTA Tamazulapa are promissory genotypes for their adaptability, yield potential, plant architecture and pest and disease resistance. Carbofuran and phorate gave the best results in controlling *Empoasca* and *Bemisia.* Lines tolerant to certain pests have been obtained; however, in 1977 entomological research was paralized. In monoculture, the best results were obtained with 250,000 plants/ha and when associated with maize, 166,000 plants/ha. With respect to fertilization, the best results were obtained with 30 kg N/ha and 40 kg P/ha, at planting and in band application. The future plans of the Program are included. *(Summary by I.B. Trans. by L.M.F.)* J00 F00 G00

0553

13199 AGUIRRE, J.A. and OVIEDO, R. **Análisis económico del cultivo de fríjol en los departamentos de San Vicente, Cabañas, Cuscatlán y San Salvador, El Salvador.** *(Economic analysis of bean cultivation in the states of San Vicente, Cabañas, Cuscatlan and San Salvador, El Salvador).* Guatemala. Convenio IICA/ZN-ROCAP Serie Publicación Miscelánea no. 97. 1972. 38p. Span., 4 Refs.

Phaseolus vulgaris. Economics. Production. Technology evaluation. Technological package. Costs. El Salvador.

An economic analysis is presented on bean cultivation in the states of San Vicente, Cabañas, Cuscatlán and San Salvador, El Salvador, which was conducted at 2 levels: technified cultivation (20 observations) and traditional cultivation (10 observations). The study case method was used and for each farm economic indicators were measured related to the area, yield, labor, inputs and others. Furthermore, the main problems felt by the farmer were analyzed. It is concluded that (1) the application of technology is economically justified; (2) tenancy affects the use of an improved technological level; (3) seed and fertilizer are the technological inputs of highest profitability; (4) crop management is the most profitable of all the operations; (5) the existence of an optimum production level corresponds to the larger sized farms and production vol; (6) the highest technological level permits larger units to operate; (7) the use of the technological package can be improved; (8) the resistance to adopt the technological package many times is due to the lack of economic resources; (9) the soil and climate cause many of the problems found in cultivation; (10) pest control is sometimes excessive and (11) the availability and price of improved seed limits its use. A literature review is included along with data on studies conducted in Guatemala, Honduras, Nicaragua and Costa Rica. *(Summary by I.B. Trans. by L.M.F.)* J00

0554

13501 CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA. **Alternativa para el mejoramiento del sistema maíz-fríjol en relevo practicado por pequeños agricultores de Samulali, Nicaragua.** *(Alternative for improving the maize/bean relay system practiced by small farmers in Samulali, Nicaragua).* Turrialba, Costa Rica. Programa de Cultivos Anuales, 1979. 96p. Span., 11 Refs., Illus.

Phaseolus vulgaris. Zea mays. **Intercropping. Technology evaluation. Climatic requirements. Soil requirements. Economics. Land preparation. Cultivation. Fertilizers. Pest control. Disease control. Harvesting. Yields. Costs. Nicaragua.**

An alternative is presented to improve the technology of managing maize/bean systems, derived from experiences obtained on small farms of the Samulali farm community as part of a joint research program of CATIE/INTA (Centro Agronómico Tropical de Investigación y Enseñanza/Instituto Nacional de Tecnología Agropecuaria). A description is given on the ecologic environment (geographic situation, climate, soils), biotic factors (weeds and pests), socioeconomic factors (infrastructure, land usage and yields, availability of land and labor), and agronomic characteristics of the system including the technology of management presented as an alternative to improve the maize/bean relay system used by farmers, which shows limiting factors with regard to the fertilization regime and the spatial planting arrangement. The new alternative proposes the use of improved planting material (var. NB-2 or hybrids H-5 or X-105A), N and P_2O_5 fertilization (75 and 58.5 kg/ha, resp.), split applications of fertilizers (at planting, 25 and 45 days afterwards), maize harvesting during the 1st and 2nd wk. of Oct. to minimize *Sitophilus* sp. infestation, a 0.2 x 0.2 m planting distance for beans on each row of maize, 2 seeds/site with a density of 250,000 plants/ha, and bean fertilization with band application of 30 kg Na/ha immediately after planting and before maize defoliation. Annexes are included on exptl. evidence, economic analysis of the proposed alternative, its yields and costs, and insects with a higher potential for economic damage to the system. *(Summary by I.B. Trans. by L.M.F.)* J00 D03

0555

12748 ARCIA, G. and SANDERS, J.H. **Ex ante analysis of new bean technology in Southern Huila.** Cali, Colombia, Centro Internacional de Agricultura Tropical, 1980. 24p. Engl., 5 Refs.

Phaseolus vulgaris. **Technology. Technological package. Production. Economics. Cultivation systems. Costs. Colombia.**

The trials conducted by CIATs Bean Economics Program in southern Huila (Colombia) have indicated that in this region monoculture bean yields can be increased 1-1.5 t/ha through improved agronomic practices. This paper is an ex ante analysis of the effect of this new technology on farmers' income, taking into account factors that could potentially limit their adoption. Linear programming, with activities including both current and potential technologies, was used. Farms were divided according to size and soil fertility. A technology proposed by the CIAT (new agronomic practices and storage) for beans is analyzed as compared to the adoption of a new coffee technology, taking into account credit, prices,and the rate of return on capital. It is concluded that improved agronomic practices alone do not affect income; however, in combination with the use of storage, economic incentives to adopt the technological package are produced. This can be accomplished with more flexible credit conditions. In relation to the model used for analyses, the factor risk and probabilistic and stochastic input-output coefficients could be incorporated into the farmers' objective functions. Finally the presence of a new category of farmers able to take risks in production and marketing was detected. The identification of special characteristics of this category will be an objective of future research, that will be based on quadratic programming. *(Summary by F.A.E. Trans. by L.M.F.)* J00

0556

12698 QUEDA, O., KAGEYAMA, A.A. and SILVA, J.F.G. DA **Evolução recente das culturas de arroz e feijão no Brasil.** *(Recent evolution of bean and rice crops in Brazil).* Brasilia, Brasil. Ministerio da Agricultura. Coleção Estudos sobre Desenvolvimento Agrícola no. 8. 1979. 90p. Port., 37 Refs., Illus.

Phaseolus vulgaris. **Economics. Production. Productivity. Consumption. Brazil.**

The situation of traditional agriculture, especially of bean and rice cultivation, is evaluated in the context of the process of national development and capitalist expansion in Brazil. Within the difficult capitalistic development in Brazil, the basic products of current consumption, such as rice and beans, come from small farmers and are destined to urban and suburban working classes. In the case of rice, typical capitalist productions already exist in Rio Grande do Sul and in Central-Western factories. In general, capitalist expansion eliminated food crops, substituting them with crops that produce more income such as soybeans, sugar cane, and oranges. Bean crops, at not being absorbed by entrepreneurial agriculture, are located each time further away from the urban centers, thus increasing the no. of middlemen. Bean production increases due exclusively to the expansion in cultivated area, not to technification or higher productivity. A protection policy for small food crops is recommended. *(Summary by I.B. Trans. by L.M.F.)* 100

0557

6058 RUIZ DE LONDOÑO, N. *et al.* **Estudio agroeconómico del proceso de producción de fríjol** *(Phaseolus vulgaris)* **en Colombia.** *(Agroeconomic study on the process of bean production in Colombia).* Cali, Colombia, Centro Internacional de Agricultura Tropical. 1975?. 174p. Span., Illus.

Phaseolus vulgaris. **Production. Rotational crops. Cultivation systems. Planting. Economics. Yields. Cultivation.**

A methodology is presented on how to study bean production processes and its on-farm application in Colombia. The main objectives are to identify the factors limiting production and productivity, availability and use of resources, credit, technical assistance, markets, pest and weed distribution and intensity, production costs, and crop profit. The study consists of various stages: definition of the problem, antecedents, interviews with technicians and administrators, bibliographic review, definition of objectives and variables, questionnaires, pilot and final surveys, selection of areas (Antioquia, Huila, Nariño, and Valle del Cauca), municipalities, and producers (177 farms with an av. of 25 ha). The av. area of bean crops is 6 ha with great differences among states; more than 60% of the cultivation is shared with other crops such as maize, coffee, plantain, soybeans, cassava, aracacha, peas and potatoes. Except farmers of the Valle, and to a lesser extent, those that only cultivate beans in Huila, the great majority of cultivators did not have adequate mechanical equipment for preparation, planting, harvesting, and irrigation. Seventy % are landowners, 10% tenants, and 17% sharecroppers. It is considered that beans need less irrigation, should be harvested quickly, and that it is the crop that produces the greatest profit; however, it is considered to be the crop representing the highest risk. Planting systems are described: on flat rows; multiple cropping on ridges; multiple cropping without rows; multiple cropping in the same flat row; multiple cropping in different rows, and mixed multiple cropping. Only 12% of the cultivators use improved seed and during the study, 86, 48 and 34% planted red, black, and both types of beans, resp. Data are presented on the intensity of land use; principle pests, diseases, and weeds are evaluated. Information on costs, storage, and marketing are also included. *(Summary by I.B. Trans. by L.M.F.)* 100

0558

11657 DULLEY, R.D., CAMARGO, J.R.V. DE and NORONHA, H.F. DE **Custo de produção e análise da renda da cultura do feijão das águas e da seca, nas sub-regiões de Avaré e Itapeva, 1973.** *(Production costs and analysis of bean crop profitability under irrigated and dry conditions in the Avaré and Itapeva subregions, 1973).* São Paulo, Instituto de Economia Agrícola. Projeto IEA/04, 1976. 41p. Port., 8 Refs.

Phaseolus vulgaris. **Production. Costs. Yields. Productivity. Irrigation. Drought. Economics. Brazil.**

The production costs of bean cultivation under irrigated and dry conditions in the Avaré and Itapeva subregions (São Paulo, Brazil) were estimated and production efficiency was analyzed. The following were determined: (1) physical requirements of production factors/ha; (2) production costs and profitability of 3 sizes of cultivations (I, 0-12.9 ha; II, 12.10-24.19 ha, and III, ⩾ 24.20 ha); and (3) the relationship between the total av. cost and the variables area, production, and yield. Mathematical models were adjusted to the data obtained from cultivators. A positive net profit was obtained, based on the av. yield of irrigated crops with a production between 24.21-2137 sacks, as well as crops grown under dry conditions with an av. production less than 1227.14 sacks. According to av. productions, irrigated beans with yields between 6.47-16.5 sacks, showed a positive net profit, as well as beans grown under dry conditions with yields between 2.89-32 sacks. The highest av. yield for irrigated beans was II (9.98 sacks) and for beans grown under dry conditions, I (11.73 sacks). The av. operational cost/ha was less in III for irrigated beans and in II for beans grown under dry conditions. Labor was the factor that most affected total costs (28 and 20-28%, for beans under irrigated and dry conditions, resp.). Operational cost/ha is approx. 11% less when animal traction is used. *(Summary by I.B. Trans. by L.M. F.)* J00 D00

0559

12927 SANDERS, J.H. and LYNAM, J.H. **New technology production and small farmers: some experience with beans and cassava.** Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 43p. Engl., 20 Refs., Illus.

Phaseolus vulgaris. **Production. Technology. Income. Cultivation. Cultivars. Economics. Colombia.**

The production of new technology as an instrument variable and its performance in an economic environment are analyzed; in this case, L.A. cassava and bean cultivators. In the 1st section, related to the economic signals in L.A. and the objective functions of a research institute, it is suggested that the migration process has not originated a considerable increase in productivity or welfare of the rural migrants and the convenience of a public sector commitment to produce new technology for the small farmers, as main beneficiaries, is indicated. In the 2nd section, farm data from Colombia are utilized to determine the ex-ante income effects of new technology; some simple agronomic innovations will increase cassava and bean producers' income. Finally the efficiency of new technology as an instrument variable is analyzed and to maximize future diffusion of new var. and associated technology, research needs to be directed to the requirements of small farmers in secondary agricultural areas. *(Summary by I.B. Trans. by L.M.F.)* J00

0560

13603 INFANTE, M. **Análisis agroeconómico asociado con la generación y transferencia de tecnología: estudios de casos.** *(Agroeconomic analysis associated with the generation and transfer of technology: case studies). In* Taller sobre Transferencia de Tecnología Agrícola, Guatemala, 1978. Guatemala, Instituto Interamericano de Ciencias Agrícolas. Informes de Conferencias, Cursos y Reuniones no. 175. 1978. pp.4.1-4.35. Span., Illus.

Phaseolus vulgaris. **Technology. Technology evaluation. Economics. Cultivation. Yields. Labour. Marketing. Colombia.**

A model of compilation and interpretation of agroeconomic information is sustained and applied to bean production systems in Colombia. The analysis is based on the following hypotheses: (1) technology is an instrument for development; (2) producers adopt technology which is adequate for the structure confronted and the objectives pursued. The study was

conducted in the principal bean-producing areas in Colombia (states of Valle, Huila, Nariño, and Antioquia). Farms were organized in groups of small, intermediate, and large producers. The model used includes variables related to 4 main aspects: structure (land tenancy, size of the property, relief, installments), objectives and behavior of the producer, and effectiveness of the process (yield/ha, destination of the product, and production costs). These variables are analyzed and it is concluded that (1) technology is a means to attain a greater development of the population; (2) it should be specific to each type of producer; (3) it should be in equilibrium with other services offered to the producer. Interdisciplinary research work is recommended along with technical assistance, credit, marketing, and the organization of producers; production systems, characteristics of the producer, the process confronted and the institutions at their service are noted. Technology should also be adaptable to the objectives of the producer and to the efficiency indices he has of the mentioned technology. *(Summary by F.A.E. Trans. by L.M.F.)* J00

0561

12664 ALVARADO, L. and SANDERS, J.H. **Análisis económico de los experimentos de PROMYF con fríjol en postrera, Honduras 1976.** *(Economic analysis of PROMYF experiments with beans during the second planting season).* Cali, Colombia, Centro Internacional de Agricultura Tropical, 1977. 51p. Span., 3 Refs.

Phaseolus vulgaris. Economics. Technology evaluation. Cultivation. Fertilizers. Herbicides. Cultivars. Yields. Agronomic characters. Pest control. Costs. Income. Productivity. Honduras.

In 1976 expt. were conducted on var. trials, fertilization, insecticides, and herbicides in order to identify new technology that could be introduced into small- and intermediate-scale bean production in Honduras. Factors of a complete technological package were also discarded to identify the most important restraints of production in several localities during the 2nd planting season of the yr (postrera). Results of economic analysis carried out indicate that it is necessary to find a new improved var. if good returns in income are to be obtained. The use of fertilizers and insecticides increased costs. It is recommended to work more in the area of preventive pest control if a drastic reduction in yields is to be avoided. *(Summary by F.A.E. Trans. by L.M.F.)* J00

0562

12926 SANDERS, J.H. and LYNAM, J.K. **Economic analysis of new technology in the bean and cassava farm trials of CIAT.** Cali, Colombia, Centro Internacional de Agricultura Tropical, 1980. 25p. Engl., 2 Refs., Illus.

Phaseolus vulgaris. Economics. Technology. Technology evaluation. Field experiments. Research. Colombia.

The process of economic evaluation of new technology in farm trials of the Centro Internacional de Agricultura Tropical, CIAT - Colombia, is defined and illustrated. The economic component in the design and evaluation of farm trials is analyzed; the basic research problem of these trials is the profitability of synergistic effects of input complementarity and the goal is the ex-ante evaluation of the farm level effect of new technology. The available data on the evaluation of cassava and bean technology at CIAT are used to illustrate the information going back into research design and forwarded to the national organization. In cassava the selection between fresh and industrial starch markets will considerably affect the profitability of a new var. due to the 40-50% price discount in the secondary market. In beans, farm trials concentrated on the evaluation of improved agronomic practices; when these were combined with complementary policy measures as credit and storage, substantial income gains were possible. *(Summary by I.B. Trans. by L. M.F.)* J00

0563

14745 LEPIZ, R. **Programa nacional de fríjol. Informe 1978.** *(National Bean Program. 1978 Report).* México, Secretaría de Agricultura y Recursos Hidraúlicos. Instituto Nacional de Investigaciones Agrícolas, 1980. 220p. Span., Illus.

Phaseolus vulgaris. **Research.** *Uromyces phaseoli. Isariopsis griseola. Whetzelinia sclerotiorum.* **Bean common mosaic virus. Bean golden mosaic virus.** *Empoasca* **sp.** *Epilachna varivestis. Apion godmani. Diabrotica balteata.* **Plant breeding. Germplasm. Cultivation. Cultivation systems.** *Rhizobium phaseoli.* **Mexico.**

The reports made by researchers of the Mexican National Bean program in 1978 in the different exptl. fields of the 9 research centers in the country are summarized. Research conducted by the program are focused on studying the identification of some viruses, the problems caused by rust, common mosaic, angular leaf spot, white mold, golden mosaic, and pests such as: *Empoasca* sp., *Epilachna varivestis, Apion godmani, Diabrotica balteata,* and *Asphondylia* sp. Work was conducted on improving high-yielding var., resistant to important regional diseases and with a commercially acceptable grain. Genetic improvemet was done for irrigation farming and rainy season cropping, intercropping and in monoculture including aspects such as: crossing, advance and selection of segregating material, germplasm evaluation and yield trials. Other studies emphasized the improvement of agronomic practices as well as soil preparation according to different methods of cultivation, amendment of sodium soils, trials with indigenous strains of *Rhizobium phaseoli,* planting date, density, fertilization, weed control, and the intercropping system. Results obtained constitute advances in research on bean cultivation conducted in different regions of the country. *(Summary by C.P.G. Trans. by L.M.F.)* J00 D00 G00

0564

11184 OROZCO S., S.H. **Proyecto de rehabilitación y diversificación agrícola -Predia- Honduras: informe final.** *(Agricultural re-establishment and diversification project -Predia- Honduras. final report).* Tegucigalpa, Honduras, Organización de las Naciones Unidas para la Agricultura y la Alimentación, 1977. 26p. Span.

Phaseolus vulgaris. **Agricultural projects. Cultivation. Technology. Research. Honduras.**

A report is given on the Proyecto de Rehabilitación y Diversificación Agrícola (PREDIA), a part of the emergent program for rebuilding Honduras, that aims to train personnel in the irrigation and production of rice, vegetables, fruits, and oleaginous crops, orientate technicians on the transmission of technology to farmers and peasants, and provide consultancy to agricultural regionals on the solution of technological problems included in the program. The following aspects are discussed: (1) consultancy to the maize and bean program (comparison of var., planting distances, response of beans to N, P, and inoculation, effect of herbicides on weed control, pest control, evaluation of the removal of production factors, multiplication of pathogen-free seed); (2) cooperation and consultancy to the Programa de Investigación Nacional de Fríjol (introduction of outstanding selected material from the Instituto Centroamericano de Tecnología Agropecuaria, ICTA, and the Centro Internacional de Agricultura Tropical, CIAT, cooperation with the breeding program); (3) consultancy to the castor-oil plant project and to the southern region of Honduras, emphasizing pigeon pea and sesame seed crops. *(Summary by W.M.S. Trans. by L.M.F.)* J00

0565

14206 SOBRAL, G. **Demanda de alimentos no Brasil: arroz, batatinha, feijão, carne e leite período 1950-70.** *(Food demand in Brazil, rice, potato, beans, beef, and milk for 1950-70).* Tese Mag. Sc. São Paulo, Brasil, Universidade de São Paulo. Escola Superior de Agricultura Luiz de Queiroz, 1973. 133p. Port., Sum. Port., Engl., 49 Refs.

Phaseolus vulgaris. **Economics. Production. Marketing. Consumption. Statistical analysis.**

An analytical picture of the food consumption level of the Brazilian population is presented including estimates of demand elasticity coefficients for 5 important staple foods (rice, potatoes, beans, meat, and milk) from 1950-70 to provide subsidies for decision making of economic policies related to the demand for foods in Brazil. The economic model used was that of the demand theory. The statistical material consisted of secondary time series datas for all of Brazil, which were obtained from various sources. In the statistical analysis, 5 alternative functional forms were used: (a) bilogarithmic function (Model I); (b) semi-logarithmic function (Model II); (c) inverse logarithmic function (Model III); (d) linear function utilizing 1st differences (Model IV); and (e) bi-logarithmic function employing the ratios between the consecutive observations of the variables (Model V). The adjustment of the models was made by multiple regression analysis, using the regular least squares method. The selection of demand equations was made with the help of the step-wise regression program, and the "t" test as well the "F" test and the test of Durbin-Watson. The most satisfactory results were those obtained from the Model I, II, and III. Main limitations observed were the lack of reliability of the statistical data employed and problems of interpreting some of the coefficients of elasticity (due to multicolinearity among important variables in the models). An attempt should be made to attain an effective collaboration among the institutions for a subsequent planning of the work to be conducted. It was concluded that the price of beans and rice and the degree of urbanization were exerting an influence on product consumption. The highest influence was exerted by the price for beans, followed by price for rice and urbanization. Beans presented a relative price-inelastic demand, and it was noted that beans, rice, and potatoes are substitute products; cassava flour is a complementary product of beans. The degree of urbanization showed a direct relationship with bean consumption and the level of min. wages was not exerting any statistically significant influence on bean consumption. *(Author's summary)* J00

0566

2868 FEIJAO. *(Beans).* Acompanhamento da Situação Agropecuária do Paraná 5(1):62-66. 1979. Port., Illus.

Phaseolus vulgaris. **Production. Productivity. Marketing. Economics.**

The situation of bean cultivation in the state of Paraná, Brazil, is described: although it is considered one of the most important crops, it is a subsistence crop of low productivity, and in 90% of the area it is grown in association with other crops. An increase in the no. of middlemen is noted and the problems of equilibrium between supply and demand are indicated along with the role of imports, the previsions made for crops for several yr, support programs for farmers (improved seed quality and credit), prices, most cultivated var., and the most representative regions. *(Summary by I.B. Trans. by L.M.F.)* J00

0567

12311 BANEGAS F., R. *et al.* **Proyecto de fomento de la producción de maíz y fríjol y transferencia de tecnología en el departamento de El Paraiso, destinado a respaldar una solicitud de donación del Banco Interamericano de Desarrollo.** *(Development project of maize and bean production and the transfer of technology in the state of El Paraíso, intended to back a request for contribution to the Inter-American Development Bank).* Tegucigalpa, Honduras, Secretaría de Recursos Naturales, 1975. 57p. Span., Illus.

Phaseolus vulgaris. Zea mays. **Agricultural projects. Cultivation. Production. Technology. Costs. Honduras.**

A detailed development project for the production of maize and beans (the 2 major grains in Honduras) in the municipalities of Danlí, El Paraíso, and Jacaleapa is given. The project, intended to back a request for contribution to the IDB, also studies the transfer of technology and has the following definite objectives: (1) establishment of a methodology to verify technology and its transfer to small and intermediate farmers; (2) training of personnel to

carry out the project and allow its future expansion; and (3) take advantage of the results of research of international and national centers, especially CIMMYT and CIAT. Data are included on the project background (proposal, executor, and type of project), objectives, criteria, statistics, available infrastructure and services, beneficiaries, description of the project, goals, technology for maize and bean production, detailed work program, resources required, training of personnel, total cost, expected productions in the 3rd yr, administrative organization, the project in relation to the loan 310/SF-HO. *(Summary by I.B. Trans. by L.M.F.)* J00

0568

14750 TELLEZ E., F.F. **El cambio de tecnología en la producción del frejol en Chancay-Lambayeque.** *(Change of technology in bean production in Chancay-Lambayeque).* Tesis Mag. Sc. Lima, Perú, Universidad Nacional Agraria La Molina, 1980. 125p. Span., Sum. Span., 33 Refs., Illus.

Phaseolus vulgaris. **Technology. Technology evaluation. Production. Productivity. Costs. Income. Economics. Peru.**

The characteristics and consequences of the technical change promoted by the Centro Regional de Investigación Agraria (CRIA II), Chiclayo, in the Valle de Chancay, Lambayeque (Peru) were assessed. Transfer of technology to the field consists of new var. and improved practices of land preparation, planting, and phytosanitary control. A linear programming model was used to investigate the resources that limit different crop production in the area and to what extent the use of these resources is enhanced with the improved technology for bean production. It was found that the change in technology increased the productivity of available resources; likewise, the use of underdeveloped resources was increased in the 2nd planting season (April-Sept.). The adoption of improved technology increases farmers' income, but does not improve the distribution of income in the area since this depends on the distribution of land tenancy. Approx. 60% of the farms represent 10% of the total area cultivated in the valley in 1976 and currently the situation remains the same. The estimated coefficient of Gini (0.72) indicates the degree of disparity of land tenancy among the farms. Among the limitations to the adoption are the scarce implementation of transfer and the reduced supply of new seeds. *(Extracted from author's summary. Trans. by L.M.F.)* J00

0569

15202 BRAVO, G.H. **Potential and problems of production of dry beans (*Phaseolus vulgaris*) in the lowland tropics.** *In* Asean Workshop on Grain Legumes, 1st., Cipayung, Bogor, 1974. Proceedings. Bogor, Indonesia, 1974. 19p. Engl.

Phaseolus vulgaris. **Production. Productivity. Cultivation systems. Economics. Technology. Technological package. Indonesia.**

Several problems affecting bean cultivation in the lowland tropics are discussed: non-profitability of the crop; high risk; its disadvantage in competition with other crops; traditional cultivation systems and management; the size of production areas; the lack of an adequate technological package, research on specific aspects and exptl. data, as well as experts and specialists in production systems. These should be trained in other areas in Ecuador, Guatemala, Honduras, Nicaragua, Panama, El Salvador, and perhaps in other countries. Several solutions are given to develop bean yield potential in these countries and solve the aforementioned problems. *(Summary by I.B. Trans. by L.M.F.)* J00

0570

11505 RUIZ DE LONDOÑO, N. **Bean production trends in 1980.** *In* Latin American agriculture: trends in CIAT commodities. Cali, Colombia, Centro Internacional de Agricultura Tropical. Int. Doc. Econ. 1.6, 1981. pp.125-134. Engl., Illus.

Phaseolus vulgaris. **Production. Marketing. Consumption. Economics. Latin America.**

Tropical regions contribute more than 80% of the bean production in L.A. especially Brazil and Mexico which supply 95% of the production of the subregion. In Brazil, the largest producer, the increase in area did not compensate the decrease in yield. Production in Brazil declined at an annual rate of 1.04%. Temperate regions (Argentina, Uruguay, and Chile) nearly tripled their bean production in the period of 1970-79; in Paraguay, both area and yields increased rapidly. Per capita consumption of pulses in L.A. declined substantially in this period, especially in Honduras and Costa Rica, where reduction was 50%. A great amount of net exports of beans (2/3) originated from temperate areas. Principal importer was Cuba, followed by Venezuela and Brazil. For the majority of L.A. countries the increase in demand for beans has been greater than the increase in production. Only Colombia and temperate climate countries increased their production at a rate greater than that required to satisfy demand. Although Mexico and Colombia have been able to increase bean yields, their absolute yield still remains low in L.A. due to associated cropping systems and little increase in land productivity. However, the gap between the av. yield of countries in the area and that of North American countries is not very great. Tables are included. *(Summary by F.A.E. Trans. by L.M.F.)* J00

0571

0663 SAO PAULO. SECRETARIA DA AGRICULTURA. INSTITUTO DE ECONOMIA AGRICOLA. Feijão. *(Beans). In* ——. Prognóstico 77/78. São Paulo, Brasil, 1977. pp.176-181. Port., Illus.

Phaseolus vulgaris. **Economics. Production. Consumption. Marketing. Brazil.**

The international panorama and the internal situation of bean cultivation in Brazil during 1975-76 and part of 1977 are described along with the modifications and fluctuations in prices that affect bean cultivation and commercialization, as well as the effects of climatic conditions, diseases, and low productivity. Although there are good perspectives for beans in the 1977-78 harvest, the increase in cultivated area could not be related to incentives for production with proportional increases in production due to climate conditions, rudimentary cropping characteristics, and the lack of technology. Within the climatic zone favorable to bean cultivation, there are no possibilities of increasing crop extension; under these conditions, the main problems are related to the storage of the product and road infrastructure. *(Summary by I.B. Trans. by L.M.F.)* J00

0572

12672 ALFARO A., G., DORADO B., O. and VILLALOBOS M., C. **Costos de producción de fríjol: La Fortuna-San Carlos.** *(Bean production costs: La Fortuna-San Carlos).* San José, Costa Rica. Ministerio de Agricultura y Ganadería. Departamento de Economía y Estadísticas Agropecuarias. Boletín Técnico no. 68-79. 1979. 22p. Span., Illus.

Phaseolus vulgaris. **Production. Costs. Income. Technology. Cultivation systems. Productivity. Costa Rica.**

A cost analysis of beans covered and tilled on 29 farms of the San Carlos region, Costa Rica, is given in table and graphic form. Data are included on land use, income and profits, technology used, and statistical analysis as well as some indicators selected from the 4 best farms. It was observed that farmers had farms generally < 4 ha, use family labor, and the 2 planting methods (covered and tilled) are commonly used during the same yr). It is indicated that 24 farms, representing 94% of the area under study, reported losses with an av. production of 404.8 kg/ha. Farmers who obtained profits had tilled beans; costs were similar for the best and worst producer in spite of the notable difference in production. There was a negative relationship between total gain/ha and total costs (-0.451). The risks that intense rainfall represents for the crop are emphasized. *(Summary by I.B. Trans by L.M.F.)* J00

0573

11200 HABIT, M.A. **The need to increase food legume production.** Santiago de Chile. Organización de las Naciones Unidas para la Agricultura y la Alimentación. Oficina Regional para América Latina. Technical Papers no. 1-12. 1977. 132p. Engl.

Phaseolus vulgaris. Economics. Production. Consumption. Research.

A compilation of 12 technical papers is presented that summarizes the opinions of various authors on different aspects in order to promote food legume production in developing countries. Aspects considered are: factors limiting production; production in Central America; improvement of the nutritive quality of food legumes by breeding; research needs; legumes in human diets; proposals for mechanisms to facilitate research and cooperation between countries on similar lines of production in problem areas; production to satisfy protein deficiencies; proposals for research on major food crops; limiting factors in bean production (supply and consumption); recommendations for expansion and acceleration of research, and finally, a description of the 6 major food legume crops (*Phaseolus vulgaris, Vigna sinensis, Cajanus cajan, Cicer arietinum, Glycine max,* and *Arachis hypogaea*) including origin and distribution, growth habits, nutritive quality, yields, potential yields, problems of production (var., diseases, and pests) and current research. Tables on production, area, and yields of the basic grain legumes in Central American countries are included along with the type of diet desirable for the av. population, efficiency of the utilization of proteins in maize, combined diets, and amino acid and protein contents in cereals and pulses. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0574

4619 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. **Programa nacional de pesquisa de feijão.** *(National Research Program on Beans).* Brasilia, Brasil, Centro Nacional de Pesquisa-Arroz, Feijão, 1975. 37p. Port., Illus.

Phaseolus vulgaris. Research. Diseases and pathogens. Seed. Cultivars. Technology. Trade. Production. Brazil.

The Brazilian national research program on beans for the 1975/76 crop yr is described. The program guidelines and the activities studied for 8 identified areas are included. A detailed descriptive table is given on the problems that affect the crop, regarding the producer (small, medium, and large scale) and regarding the researcher and extension workers, as well as the problems related to the environment, credit, and policies that affect it. Another table synthesizes the possible solutions to the major problems outlined. Among the priorities of the program are: (1) production of healthy seed; (2) diagnosis of production systems and methods of Brazilian farmers; (3) obtainment of cv. adapted to different regional factors; (4) a list of studies on amendments, fertilizers, and fertility; (5) study and design of storage methods; (6) establishment of an integral cooperation with organisms that pursue objectives similar to those of the national research program on beans; and (7) organization of training programs for technical and assistant personnel. *(Summary by I.B. Trans. by L.M.F.)* J00

0575

4944 KREBS, E.H., HAYENGA, M.L. and LEHKER, J.N. **Various price and supply control programs for navy beans; a simulation analysis.** East Lansing. Michigan State University. Department of Agricultural Economics. Agricultural Economics Report no. 212. 1972. 23p. Engl., 11 Refs., Illus.

Phaseolus vulgaris. Production. Consumption. Costs. Income. Economics. USA.

A computer simulation model was developed and employed to explore the effects of the variations in price and supply control programs (governmental and private industry) in the USA. Farm prices, farmers' navy bean gross income, government expenditures, and per capita consumption, resulting from alternative programs, are compared, namely various

price support levels, a private industry storage program, a marketing quota system, an acreage control program, and a 2-price domestic-export policy. Partial indications of costs and benefits are directed towards 3 primary interest groups, farmers, consumers, and governmental budget officers, to help in decision making on the feasibility of any particular program. The general conclusion obtained from the examination of the different programs is that they would have increased producer gross income from navy beans. Regarding this aspect, the government price support program was superior at the price levels considered for the private programs. The possibility of producers to maintain gross income at high levels depends on: (1) keeping a high level of government subsidy; (2) restricting production; and (3) private price support and storage program or a 2-price system. *(Summary by I.B. Trans. by L.M.F.)* J00

0576

14719 DAVILA H., R.F. El fríjol común (*Phaseolus vulgaris* L.). *(Common beans).* Managua, Instituto Nicaraguense de Tecnología Agropecuaria, 1977. 15p. Span.

Phaseolus vulgaris. Production. Consumption. Costs. Ecology. Nicaragua.

Brief information is given on the following aspects of bean cultivation in Nicaragua: origin of the plant, botany, stages of development, ecology, regional and national production, and marketing. Cultivated var. adapt to temp. of 17-24°C. During 1973-74 the av. national yield was 656 kg/ha. Production prices increased from $68.40 córdobas/q in 1970 to $145 córdobas/q in 1975. Marketing stages, beginning after harvest, are defined and include factors such as: middleman, retailer, wholesaler, transporter, financing agencies, and other loans besides bank loans. National bean production reached a total of 9.6 million q of which 31% is consumed on the farm as seed and as food or feed; the remaining 69% is commercialized. A governmental institution buys 21% of the bean production destined for commercialization and sells them to the consumer at a lower price. Tables are given on the geographic location and alt. of bean-producing areas, degree of adaptability in terms of temp. and rainfall, production in each department, costs of inputs, and the financing of production between 1970-76. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0577

13580 **ORIENTAÇAO DA pesquisa com feijão para a atividáde regional no Sul do Brasil- Santa Catarina e Rio Grande do Sul.** *(Guidelines for research on beans for regional activities in southern Brazil – Santa Catarina and Rio Grande do Sul).* IPAGRO Informa 14:3-9. 1976. Port., Illus.

Phaseolus vulgaris. Research. Production. Economics. Agricultural projects. Brazil.

This paper is useful as a basis for the elaboration of priority research subprojects on beans in the states of Rio Grande do Sul and Santa Catarina in Brazil. The states were divided into 10 and 3 regions, resp. for the evaluation and identification of problems affecting the crop and their possible solutions. Seed production, commercialization of beans, extension programs, cv. improvement, cropping systems, soil amendment, disease and pest control are among research priorities. A research program, based on the aforementioned priorities, is given. The physical sites (exptl. stations) for the development of research work and the concn. of technical personnel are defined. *(Summary by C.P.G. Trans. by L.M.F.)* J00

0578

12671 ALFARO A., G., SALAZAR M., O. and VILLALOBOS, C. **Costos de producción de fríjol: Pacífico seco (Upala).** [*Bean production costs: dry Pacific region (Upala)*]. San José, Costa Rica. Ministerio de Agricultura y Ganadería. Departamento de Economía y Estadísticas Agropecuarias. Boletín Técnico no. 67-79. 1979. 29p. Span., Illus.

Phaseolus vulgaris. **Cultivation. Costs. Income. Productivity. Production. Costa Rica.**

Bean production costs of 30 farmers that planted beans during the period Dec. 1978-March 1979 in Upala (Costa Rica) are analyzed and presented in numerous tables and diagrams. Data are given on costs, income and profits, technology and statistical analysis and the 5 best farms are compared regarding their production. Land preparation, planting and fertilization, weeding, and fumigation are mentioned among the usual cultural practices and the use of a high level of technology is indicated. On the av. 6.17 ha were planted per farmer with considerable variations; av. production was 772.8 kg/ha. Statistically, there was a significative correlation between production and seed quantity as well as one between production and the amount of fertilizer used. Production was related to the amount of insecticides used, although to a lesser degree. It is suggested that the climate, in particular the continued rainfall, is the most serious limitation in the area. *(Summary by I.B. Trans. by L.M.F.)* J00

0579

15366 SANDERS, J.H. and LYNAM, J.K. **Trends and yield constraints in the production systems of beans and cassava in Latin America with emphasis on research design implications.** Cali, Colombia, Centro Internacional de Agricultura Tropical, 1979. 49p. Engl., 21 Refs., Illus.

Phaseolus vulgaris. Economics. **Cultivation systems. Yields. Production.**

The trends and yield constraints in production systems of beans and cassava are analyzed; examples are given of the role of 3 types of information (macro stage, micro stage, and critical inference stage) in the design of research for beans and cassava at the Centro Internacional de Agricultura Tropical (CIAT, Colombia). It is indicated that the principal focus of information processing in international centers is to achieve a more solid empirical support (or rejection) of the critical inferences, which are made explicit and are then evaluated with a more systematic data collection. In commodity programs there is a natural evolution to farm level data collection. In the evolution of crop technologies, the consequences new technologies may have on income distribution are discussed; cassava and beans are essentially produced by small farmers outside prime agricultural areas. The choice of breeding strategy that involves the relationship among several disciplines is also analyzed and it is noted that the different constraints and the different crop characteristics require different strategies for cassava and beans to produce the same output, a stable high-yielding var. not dependent on high levels of purchased inputs. *(Summary by I.B. Trans. by L.M.F.)* J00

See also 0004 0131 0234

K00 FIELD PLOT TECHNIQUE

0580

14224 CHARCHAR, M.J.D.A. and BOLKAN, H.A. **Efeito da incorporação da casca de arroz na população de fungos associados com a rizosfera do feijoeiro.** *(Effect of rice residue amendment on fungal flora of bean rhizosphere).* Fitopatologia Brasileira 5(1):51-58. 1980. Port., Sum. Engl., Port., 17 Refs., Illus.

Phaseolus vulgaris. **Soil population. Mycoses. Soil requirements. Rhizosphere. Brazil.**

The effect of rice residue soil amendment on the fungal population of bean rhizosphere was studied under field conditions. A total of 41 genera of fungi belonging to the classes of Deuteromucetes, Ascomycetes and Phycomycetes were isolated from soil incorporated with rice residues and from the soil used as control. Among the fungi recovered *Aspergillus* spp., *Penicillium* spp., *Fusarium* spp., and *Trichoderma* sp. were predominant. In general, the population of *Alternaria* spp., *Fusarium* spp., *Gliocladium* sp., *Pithomyces* sp., *Rhizoctonia solani*, *Verticillium* sp., *Aspergillus* spp., and *Eurotium* sp. decreased with the incorporation of rice residues, whereas the population of *Rhizopus* sp., *Epicoccum* sp., *Phoma* spp., *Botryodiplodia* sp., *Pestalotia* sp., *Penicillium* spp., *Trichoderma* sp., and *Mucor* sp. increased with the addition of rice residues to the soil. *(Author's summary)* K00 E03

0581

14708 FUENTES, F. *et al.* **Efecto de bordes en experimentos de riego en el cultivo de fríjol** *(Phaseolus vulgaris* **Lin.).** *(Border effects in irrigation trials in bean crops).* La Habana, Cuba, Universidad de la Habana. Centro de Información Científica y Técnica. Ciencias Agropecuarias. Serie 1. Ingeniería Agronómica no. 17. 1975. 14p. Span., Sum. Span., 11 Refs.

Phaseolus vulgaris. **Water requirements. Irrigation. Cultivation. Field experiments. Experiment design. Statistical analysis. Yields. Cuba.**

In 2 irrigation trials with bean crops, the performance of the plants considered within the study areas was studied along with the border effect in the exptl. plots. Data were processed biometrically by 2 statistical methods: paired comparisons of data and variance analysis. In both expt. the existence of a border effect was evident. In similar expt., the need for planning the exptl. plots with sufficient area to eliminate the border effect at harvest is indicated. *(Author's summary. Trans. by L.M.F.)* K00 D01

0582

14723 MARCOS FILHO, J. and GODOY, O.P. **Efeitos de irradiação de sementes sobre a produtividade do feijoeiro** (*Phaseolus vulgaris* L.). *(Effects of seed irradiation on bean productivity).* O Solo 66:18-22. 1974. Port., Sum. Port., Engl., 9 Refs.

Phaseolus vulgaris. **Irradiation. Seed. Productivity. Yield components. Statistical analysis.**

Seeds of *Phaseolus vulgaris* var. Goiano Precoce were exposed to 8 doses of γ radiation (0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, and 6.4 krad). The effect of seed radiation on yield was assessed

by 2 random block designs in field expt. It was found that the treatment of 6.4 krad. decreased pod and seed wt.; the other treatments did not affect yield negatively, moreover, some seemed to favor yields, but this could not be verified statistically. *(Summary by C.P.G. Trans. by L.M.F.)* K00

0583

14773 DAVIS, J.H.C., AMEZQUITA, M.C. and MUÑOZ, J.E. **Border effects and optimum plot sizes for climbing beans (*Phaseolus vulgaris*) and maize in association and monoculture.** Experimental Agriculture 17:127-135. 1981. Engl., Sum. Engl., 8 Refs., Illus.

Phaseolus vulgaris. **Experiment design. Intercropping. Cultivation systems. Field experiments. Research. Statistical analysis.**

Min. competition was observed between adjacent plots of climbing bean var. and maize in association, but there was a large head border effect which was not uniform among var. Head borders of 1 m at each end of the plot are recommended and a net plot size of 11 m^2 with 3 replications for climbing bean var. associated with maize was found to be adequate to detect significant differences in yield of beans of 24% of the mean. For climbing beans in monoculture a somewhat smaller plot (8 m^2) would achieve the same level of precision. Larger plot sizes in general were needed for maize comparisons, especially in association. *(Author's summary)* K00 D03

See also 0015 0162 0163 0199 0211 0254

L00 GRAIN STORAGE

0584

13577 SAMPAIO, L.S. DE V., BARBOSA, M.M. DA S. and FLORES, W.L. **Influência do período de armazenamento em condições ambientais no grau de deterioração de sementes de feijão,** *Phaseolus vulgaris* **L.** *(Influence of storage period under environmental conditions on the degree of deterioration of bean seeds). In* Universidade Federal da Bahia, Escola de Agronomia. Informe Científico Anual no. 1-1977. Cruz das Almas-BA, Brasil, 1977. pp.36-39. Port

Phaseolus vulgaris. **Seed. Seed treatment. Storage. Deterioration. Experiment design. Germination. Brazil.**

A method is given to evaluate the degree of seed deterioration due to the respiratory activity during storage, when the seeds were treated with protectors against damage by insects or pathogenic organisms. Seed treatments, the form of storage, sampling and exptl. design are described. The characteristics of germination % and velocity, the length of the root-hypocotyl axis, dry wt. of the seedlings, trial on age acceleration, and a germination trial with tetrazolium are evaluated. *(Summary by C.P.G. Trans. by L.M.F.)* L00

0585

12928 SANDERS, J.H. and LYNAM, J. **Systems of production of beans and cassava in Latin America with implications for research design.** Cali, Colombia. Centro Internacional de Agricultura Tropical, 1977. 63p. Engl., 28 Refs., Illus.

Phaseolus vulgaris. **Research. Production. Plant breeding. Germplasm. Agronomic characters. Selection. Climatic requirements. Colombia.**

The process of identifying the "relevant constraints" and their incidence on breeding programs and agricultural research of international centers are explained and case histories are provided on the role of these 3 types of information (macro stage, micro stage, critical inference stage) related to research design in beans and cassava at the Centro Internacional de Agricultura Tropical (CIAT). The crucial decisions of the international centers consist in the definition of "relevant constraints", followed by a more mechanical process consisting of germplasm collection, identification of desired characteristics, screening and crossing, and dissemination. Regarding beans and cassava, different "relevant constraints" and different characteristics of the crops indicate the utilization of different strategies with the same output, which is a high-yielding var. not dependent on high levels of inputs. *(Summary by I.B. Trans. by L.M.F.)* L00

0586

13180 SILVA, C.M. DA **Alguns aspectos do armazenamento do feijão.** *(Some aspects on bean storage).* Informe Agropecuário 4(46):64-65. 1978. Port.

Phaseolus vulgaris. **Storage. Water content. Deterioration. Brazil.**

Some important aspects that should be taken into account in bean storage are presented. Harvesting, drying, cleaning, treatment and storage conditions are considered fundamental.

Harvest should be conducted during the dry period after total seed maturity, which should reach a MC < 15% through drying. If storage is prolonged, MC should be 12%. It is recommended to store beans in metal silos and the appropriate measurements for building a rural silo are given. The silo floor should have a min. height of 80 cm off the ground, walls should be wooden and the roof, guarantee protection against sun rays and rain, permitting a controlled ventilation. A distance of 30 cm should be kept between silo walls and the piles of beans. *(Summary by C.P.G. Trans. by L.M.F.)* L00

0587

14727 NANTES, J.F.D. and ANDO, A. Efeitos do armazenamento em sementes irradiadas de feijoeiro (*Phaseolus vulgaris* L.). *(Effects of storage on irradiated bean seeds).* O Solo 66:45-47. 1974. Port., Sum. Engl., 6 Refs.

Phaseolus vulgaris. Seeds. Irradiation. Storage. Germination.

The effects of different storage times and different levels of γ radiation on the % of seed germination and seedling survival of bean var. Carioca were studied. Irradiation was conducted with a ^{60}Co bomb at levels of 0, 10, 20, 30, and 40 krad., seeds were immediately dried and stored in the lab. During different storage periods (0, 15, 60, and 300 days), germination and survival trials were conducted on a total of 500 seeds/trial. Germination and survival counts were made at 7 and 10 days of planting, resp. Results indicated that storage time affects germination and survival in up to 40%, after 15 days. Radiation levels also affected germination and survival %; with 40 krad., germination was affected in 60% and survival in 100%, even for seeds that had not been stored. *(Summary by C.P.G. Trans. by L. M.F.)* L00

See also 0394 0398 0502

L01 Stored Grain Pests

0588

4908 McFARLANE, J.A. and WEARING, A.J.S. **A means of differentiating between *Acanthoscelides obtectus* (Say) and *Zabrotes subfasciatus* (Boh.) (Coleoptera, Bruchidae) in white haricot beans at the pupal stage.** Journal of the Stored Products Research 3:261-262. 1967. Engl., 1 Ref., Illus.

Phaseolus vulgaris. Acanthoscelides obtectus. Zabrotes subfasciatus. **Stored grain pests. Seed. Deterioration.**

Acanthoscelides obtectus and *Zabrotes subfasciatus* can be distinguishable in the pupal stage by observing the damage in form of 'windows' caused by both insects to the seed. The point of difference is that the dark peripheral ring in the 'window' is more prominent when the damage is caused by *Z. subfasciatus. (Summary by C.P.G. Trans. by L.M.F.)* L01

0589

16043 HAMED, M.S. **Effect of heat on the fecundity of the bean weevil *Acanthoscelides obtectus* Say (Coleoptera, Bruchidae).** Zeitschrift für Angewandte Entomologie 91:368-374. 1981. Engl., Sum. Engl., Germ., 15 Refs.

Phaseolus vulgaris. Acanthoscelides obtectus. **Stored grain pests. Insect biology. Oviposition. Temperature. Proteins.**

The fecundity of 3 strains of *Acanthoscelides obtectus* was studied at normal breeding temp. and heat-treated (30 and 36°C) sexes. It was less affected when the males were treated than when the females were treated. On the other hand, normal females of some strains which mated with heat-treated males laid significantly fewer eggs than untreated crosses. It was concluded that the effect of heat on the fecundity of *A. obtectus* depends on complex interaction between the strain, sex, and probably the pre- and post breeding temp. *(Author's summary)* L01

0590

16050 OLIVEIRA, A.M. *et al.* **Incidência de *Zabrotes subfasciatus* Boheman, 1833, e *Acanthoscelides obtectus* Say, 1831 em diversas cultivares de feijão armazenado (Col., Bruchidae).** [*Incidence of Zabrotes subfasciatus and Acanthoscelides obtectus (Col., Bruchidae) in different stored bean cultivars*]. Anais da Sociedade Entomológica do Brasil 8(1):47-55. 1979. Port., Sum. Port., Engl., 8 Refs.

Phaseolus vulgaris. Zabrotes subfasciatus. Acanthoscelides obtectus. **Cultivars. Storage. Timing. Stored grain pests. Brazil.**

Bean cv. stored under natural storage conditions in relation to the incidence and injury by bean weevils (*Zabrotes subfasciatus* and *Acanthoscelides obtectus*) were studied. The cv. named Costa Rica, Mulatinho Paulista, Preto 120, Preto 141, Preto 143, Preto 147, Preto 192, Rico 23, Seleção Cuva, Linhagem Venezuela 350, and Venezuela 350 stored during 6 mo. presented an av. up to 15% of injured grains. On the other hand, cv. Rico 23, at the 3rd mo. of storage already presented 32% of its grains injured. In the same cv., at the 6th

mo., the injury was of order of 61%. At the 9th mo. of storage all the cv. had > 50% of their grains injured. At the 12th mo. of storage 100% of grains in all cv. were completely injured; humidity increased (from 8% at the beginning of the expt.) up to 16% and the seeds were dead. Statistical significance between groups was at the level of 1%. *(Author's summary)* L01

Z00 GENERAL

0591

14400 McLAUGHLIN, S.B. *et al.* **The effects of SO_2 dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (*Phaseolus vulgaris* L.).** Environmental and Experimental Botany 19(3):179-191. 1979. Engl., Sum. Engl., 26 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Toxicity. Plant injuries. Photosynthesis. Transpiration. Growth. Temperature. Leaves. Stems. Stomata. Plant physiological processes.**

The effects of variations in SO_2 dosage kinetics on bean plants Red Kidney were studied at SO_2 levels equal to or below the current secondary ambient air quality standard. Response of photosynthesis transpiration and growth were measured to evaluate the extent and duration of effects following repeated treatment at weekly (expt. I) and daily (expt. II) intervals. Depression of photosynthesis was the most consistent response observed. Transpiration was either stimulated or depressed by SO_2 concn. which reduced photosynthesis. This effect indicates a probable biochemical rather than stomatal basis for observed photosynthetic depressions noted in these expt. Increasing the peak: mean concn. ratio from 1.0-1.7 during exposure had no obvious effect on short-term photosynthetic response but caused apparent stimulation of photosynthesis 1 day later. Increasing the peak: mean ratio from 1.0 to 6.0 caused a threefold av. greater depression of short-term photosynthetic response even though the 3 h av. concn. was reduced by 25% (0.50-0.37). Residual effects from this treatment were generally small on the day after exposure. No strong evidence was obtained to indicate that plants were sensitized to SO_2-induced suppression of photosynthesis by previous exposure to SO_2. Predisposition was not apparent when exposures were repeated at weekly or daily intervals. Visible foliar injury did not occur. Analysis of harvest data at the end of these expt. indicated that plants could undergo a repeated short-term (1 day) cycle of photosynthetic inhibition and still retain an essentially unimpaired capacity for growth during a subsequent recovery period. When exposures were spaced a wk. apart, some indication of a residual effect on growth, particularly with the highest peak: mean ratio (6.0), was apparent. *(Author's summary)* Z00 C00

0592

14342 FEDERER, W.T. **Statistical designs and response models for mixtures of cultivars.** Agronomy Journal 71(5):701-706. 1979. Engl., Sum. Engl., 20 Refs.

Phaseolus vulgaris. **Cultivars. Selection. Experiment design. Statistical analysis. Plant breeding. Research.**

In spite of current interest in growing mixtures (composites) of cv. and in multiple cropping systems, appropriate response models, definitions treatment designs, and statistical analyses are not available when more than 2 cv. are involved. Since the beneficial or detrimental effects of using mixtures of size k equal to or greater than 2 cv. (lines, species) as compared to monoculture needs to be assessed, the objective of this study is to present response models, treatment designs (the selection of entities or treatments for an expt.), definitions

of effects, and statistical analyses for estimating and comparing the various effects involved in expt. on mixtures of k cv. The concepts of general mixing (blending), bi-specific mixing, tri-specific mixing,..., n^{th} specific mixing effects are formulated. Treatment designs are derived from weighing, balanced incomplete block, and supplemented block expt. designs. It is shown that solutions for parameters in the response models are dependent upon the no. and types of mixtures used in the treatment design. A statistical analysis is presented for a particular treatment design involving mixtures of all possible pairs of 8 dry bean cv. plus the cv. themselves. Finally, it is noted that the results may be useful for a no. of other types of expt. involving mixtures, such as herbicide, nutrition, medicine, and education. *(Author's summary)* Z00 G00

0593

14327 ORMROD, D.P. *et al.* **Air pollution effects on agricultural crops in Ontario: a review.** Canadian Journal of Plant Science 60(3):1023-1030. 1980. Engl., Sum. Engl., Fr., 49 Refs.

Phaseolus vulgaris. **Air pollution. Plant injuries. Plant physiological disorders. Chlorosis. Abscission. Leaves. Pods. Symptomatology. Ozone. Canada.**

Photochemical oxidants, sulphur dioxide and fluoride are the major air pollutants affecting agricultural crops in Ontario, but scientific documentation of their effects is limited, particularly for sulphur dioxide and fluoride. Airborne road salt, cement dust, soot, B, Ni, Co, and ammonia have also been implicated in a few localized instances of crop injury. The most widespread injury to agricultural crops is caused by photochemical oxidants, mainly in southern Ontario where tobacco, bean, potato, grape, cucumber, onion, tomato and other crops have been affected. Sulphur dioxide has had significant effects on forests and natural vegetation in Ontario, and may become important in agricultural areas due to the proliferation of coal-fired electric generating stations. The effects of sulphur dioxide in combination with other gaseous pollutants such as photochemical oxidants, and the long-term effects of acid precipitation are current concerns. In addition, there have been a few cases of fluoride injury to crops localized around fluoride-emitting industries. Very few estimates of economic losses to agricultural crops have been documented anywhere and to date no assessment of the economic value of air pollution damage to agricultural crops in Ontario has been attempted. *(Author's summary)* Z00

0594

14329 BECKERSON, D.W. and HOFSTRA, G. **Effects of sulphur dioxide and ozone, singly or in combination, on membrane permeability.** Canadian Journal of Botany 58(4):451-457. 1980. Engl., Sum. Engl., Fr., 28 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Ozone. SO_2. Cell structure. Symptomatology. Laboratory experiments.**

The effects of 0.15 ppm sulphur dioxide and (or) 0.15 ppm ozone on membrane permeability, measured by electrical conductivity of solute leakage, were determined for soybean, white bean, cucumber, and radish. Solute leakage increased significantly prior to visible injury for soybean and white bean exposed to 0.15 ppm ozone alone. This results in water-soaked lesions on the upper leaf surface prior to visible colored necrotic lesions and is representative of a "leaky" plasmalemma. The sulphur dioxide-ozone mixture did not increase solute leakage above that of the control for white bean and soybean. Therefore, the presence of sulphur dioxide, in combination with ozone, attenuates or reduces the effects of ozone on increasing membrane permeability of white bean and soybean. Ozone alone did not affect membrane permeability in cucumber and radish. The sulphur dioxide-ozone mixture, which produced more injury than ozone alone, did increase membrane permeability temporarily for radish and cucumber but this occurred only after visible injury symptoms appeared. Overall, the effects of the pollutants singly or in combination on membrane permeability appear to offer an explanation of differences in species responses. *(Author's summary)* Z00

0595

15829 ENDRESS, A.G., SUAREZ, S.J. and TAYLOR, O.C. **Peroxidase activity in plant leaves exposed to gaseous HCL or ozone.** Environmental Pollution. Series A 22(1):47-58. 1980. Engl., Sum. Engl., 31 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Ozone. Enzymes. Plant physiological processes.**

Results obtained from tests with beans and tomato indicated that peroxidase (PRO) levels may be elevated by subjection to air pollutant stress and that PRO activity is sensitive to the internal physiological conditions of the plants. Its extreme sensitivity, however, precludes its use as a reliable indicator of pollutant stress. *(Summary by Review of Plant Pathology)* Z00

0596

15414 HOBSON, B. **Energy budget calculations for Colorado crops.** Fort Collins, Colorado State University Experiment Station. Bulletin no. 570S. 1979. 24p. Engl., 57 Refs.

Phaseolus vulgaris. **Cultivation. Energy consumption. Costs. Economics. USA.**

Yields of crops grown in Colorado (USA), maize grain and silage, sugar beet, wheat, sorghum, *Phaseolus vulgaris,* irrigated and forage pastures, and lucerne are given. Irrigation practices were shown to be energy intensive, but essential for production in the state. Equations are presented for the calculation of energy budgets for all aspects of crop production. *(Summary by Field Crop Abstracts)* Z00

0597

15811 HART, F.X. and SCHOTTENFELD, R.S. **Evaporation and plant damage in electric fields.** International Journal of Biometeorology 23(1):63-68. 1979. Engl., Sum. Engl., 9 Refs., Illus.

Phaseolus vulgaris. **Plant injuries. Leaves. Evapotranspiration. Soil water. Laboratory experiments.**

Beans exposed to intense static electric fields experienced large scale damage although corona occurred from only a few points on the leaves. Increased evaporation loss was the physical mechanism which accounted for these effects. *(Summary by Review of Plant Pathology)* Z00

0598

16099 HUBAC, C. and SILVA, J.V. DA **Indicateurs métaboliques de contraintes mésologiques.** *(Metabolic indicators of mesologic stress).* Physiologie Végétale 18 (1):45-53. 1980. Fr., Sum. Fr., Engl., 36 Refs., Illus.

Phaseolus vulgaris. **Metabolism. Ecology. Stress. Drought. Salinity. Temperature. Host-plant resistance. Amino acids.**

The effects of environmental stress (drought, salinity, and frost) on plants are reviewed. Similar responses to these stresses were observed in plants which resulted in changes in water status and decrease in water potential. Amino acids, particularly proline, soluble carbohydrates (sucrose and fructose), and organic acids, particularly malic and oxalic acids accumulated giving an 'adaptive modification' effected by changes in membrane permeability, or osmotic regulation, or changes to crassulacean acid metabolism. The significance of these biochemical changes in tolerance of stress where there is rapid accumulation of substances in sensitive species and slow accumulation in resistant species is reviewed with reference to research on species including barley, cotton, and *Phaseolus vulgaris.* It is suggested that the degree of resistance of a specie could be predicted by its rate of response to stress. *(Summary by Field Crop Abstracts)* Z00

0599

15828 BLUM, U. and HECK, W.W. **Effects of acute ozone exposures on snap bean at various stages of its life cycle.** Environmental and Experimental Botany 20(1): 73-85. 1980. Engl., Sum. Engl., 27 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Ozone. Developmental stages. Nodulation. N. Growth.**

Plants of *Phaseolus vulgaris*, cv. BBL-290, were exposed to 0, 30, or 60 pphm ozone for two 1.5-h periods 3 days apart at one of 6 different stages (8 + 11, 14 + 17, 20 + 23, 26 + 29, 32 + 35, or 38 + 41 days after seeding). Half the plants were harvested 7 days after the 2nd exposure and the other half 48 days after planting. Ozone reduced RGR, absolute growth rate, pod production, nodulation, and total N content, but increased the amount of N/g of plant tissue. The magnitude of the responses in growth, nodulation, and N content varied with the O_3 concn. and plant age at the time of exposure. Recovery of growth and nodulation at the final harvest was partial for plants exposed at 8 + 11 and 14 + 17 days. N content was correlated with both plant dry wt. and nodule no. *(Summary by Horticultural Abstracts)* Z00

0600

16082 FUHRER, J. and ERISMANN, K.H. **Uptake of NO_2 by plants grown at different salinity levels.** Experientia 36(4):409-410. 1980. Engl., Sum. Engl., 11 Refs., Illus.

Phaseolus vulgaris. **Air pollution. Host-plant resistance. Stomata. Leaves. Salinity. Laboratory experiments.**

Plants of *Phaseolus vulgaris* were grown in a nutrient solution with salinity (NaCl) levels ranging from 20-80 m*M*. They were exposed to the pollutant NO_2 at 31 pphm for 2 h. The uptake of NO_2 was reduced by increasing salinity as a result of increased stomatal resistance. The uptake rate constant measured kinetically was in agreement with the foliar nitrite content following NO_2 treatment. *(Summary by Horticultural Abstracts)* Z00

AUTHOR INDEX

Abawi, G.S. 0352
Acuña, H. 0286
Adams, M.W. 0451
Adams, P.B. 0337
Aguilera M., R.G. 0544
Aguirre, C.H. 0141
Aguirre, J.A. 0553
Ahloowalia, B.S. 0520
Aidar, H. 0230
Ajquejay A., S. 0265
Akil, B.A. 0071
Aldana de León, L.F. 0552
Alfaro A., G. 0572 0578
Alli, I. 0528
Allington, W.B. 0086
Almeida, L. D'A. de 0455
Alomia de Gutiérrez, B. 0407
Alvarado C., A.M. 0135
Alvarado, L. 0561
Alvarez Ayala, G. 0325
Anchorena, A.C. 0277
Andersen, A.L. 0350
Angulo, N. 0258
Aquino, M. de L.N. de 0316
Araujo, E. 0279 0360
Araujo, G.A. de A. 0147
Araya V., R. 0183
Araya, C.M. 0251
Arcia, G. 0555
Arias, O. 0030
Ashenden, T.W. 0042 0106
Ayad, G. 0464

Bailey, J.A. 0362 0363
Bailiss, K.W. 0385
Baker, C.J. 0029
Baker, R. 0306
Ballantyne, B. 0281 0366 0367 0369
Bandara, J.M.R.S. 0331
Banegas E., R. 0567
Barratt, D.H.P. 0041
Bartha, L. 0223
Barthe, J.P. 0358
Bascur B., G.A. 0175
Baudoin, J.P. 0446
Baumgartner, B. 0011
Beckerson, D.W. 0024 0594
Beebe, S. 0430
Bender, A.E. 0482
Bengochea, T. 0022 0023
Bentley, B. 0082
Bertola, M.A. 0123
Biemont, J.C. 0400
Biliaderis, C.G. 0505
Biro, R.L. 0019
Bittencourt, V.C. 0187
Black, V.J. 0005
Blum, U. 0599
Boelema, B.H. 0300
Boomstra, A.G. 0328
Bos, L. 0372
Bravo, G.H. 0569
Bressani, R. 0497
Briarty, L.G. 0009
Brown, J.W. 0534
Brown, K.W. 0043
Brown, R.G. 0504
Buescher, R.W. 0517 0518
Burgos, C.F. 0234
Burke, D.W. 0351 0353
Burns, I.G. 0162

Campbell, C.L. 0332
Campbell, R.E. 0084
Campos, M. de 0502
Cancian, A.J. 0150

Candal Neto, J.F. 0271
Caner, J. 0378
Canvin, D.T. 0031
Cardona, C. 0421
Cartin L., V.M. 0398
Castellanos D., V.H. 0239
Cecilia, F.C.S. 0204
Centro Agronómico Tropical de Investigación y Enseñanza 0554
Centro Internacional de Agricultura Tropical 0440 0458
Chang, G.T. 0058
Carchar, M.J.D.A. 0580
Chorin, M. 0336
Christianson, M.L. 0059
Coertze, A.F. 0004 0144 0145 0146 0193 0196
Collins, J.L. 0503
Conde M., C.A. 0526
Cook, G.T. 0045 0219
Cookson, C. 0542
Córdoba, J.V. 0349
Costa, J.G.C. 0307
Costa, M.S.S. da 0270
Cottingham, C. 0347
Coyne, D.P. 0143
Crispín, A. 0341
Crocomo, O.J. 0007
Cruickshank, I.A.M. 0335
Cunha, J.M. da 0016 0159

Das, P.D. 0380
Daub, M.E. 0290 0303
Dávila H., R.F. 0002 0576
Davis, D.R. 0488
Davis, J.H.C. 0235 0433 0434 0583
Davis, J.J. 0416
Davis, S.D. 0026
Debouck, D.G. 0432
Denny, S. 0134
Dhingra, O.D. 0284 0327
Díaz C., J.M. 0241 0425
Díaz Ch., A. de J. 0385
Dulley, R.D. 0558
Dutra, L.G. 0221

Echandi Z., R. 0244 0453
Echandi, E. 0308
Edje, O.T. 0242
Ekpo, E.J.A. 0291
El-Banoby, F.E. 0302
El-Hag, N.A. 0508
Elias, L.G. 0499
Elkins, E.R. 0500
Empresa Brasileira de Assistência Técnica e Extensão Rural 0236 0238
Empresa Brasileira de Pesquisa Agropecuária 0240 0243 0574
Empresa Capixaba de Pesquisa Agropecuária 0232
Empresa Pernambucana de Pesquisa Agropecuária 0444
Endress, A.G. 0595
Erner, Y. 0012
Escalante E., J.A.S. 0139
Escamilla E., E. 0157
Escobar, J.A. 0390
Espindola, E.A. 0256
Evans, A.M. 0466
Everson, P. 0422

Farlow, P.J. 0192
Fasseas, C. 0478
Fawole, Y. 0471
Federer, W.T. 0592
Feitosa, C.T. 0185
Ferguson, A.R. 0295
Fernandes, B. 0156
Field, R.J. 0126
Filho, E.S. 0321
Flores, E.M. 0384
Fonseca, H. 0506
Forster, R.L. 0345
Forsythe. W.M. 0151
Foster, H.L. 0173
Fracia, M.H. de C. 0507
Franco, A.A. 0541
Freytag, G.F. 0003
Frias T., G.A. 0340
Fries, R.E. 0370
Fuentes, F. 0581
Fuhrer, J. 0600

Gage, J.F. 0246
Gentry, H.S. 0001
Gepts, P. 0445
Gerber, J.M. 0050
Gomes, J. de C. 0177
Gomes, J.C. 0357
González A., J. 0199
González M., C. 0237
González, A.R. 0529
Goth, R.W. 0348
Gould, F. 0419
Gould, H.J. 0394
Graham, P.H. 0536 0537 0545
Grasso, S. 0376
Greene, G.L. 0396
Gregory, E.J. 0260
Grogan, R.G. 0311
Guadamuz M., E. 0018
Guazzelli, R.J. 0148
Guedes, G.A.A. 0152
Guevara G., M. 0118
Guzmán L., P. 0165

Habit, N.A. 0573
Hagedorn, D.J. 0297
Halevy, A.H. 0171
Hamad, I.A. 0441
Hamed, M.S. 0589
Hang, Y.D. 0514
Haq, M.N. 0479
Hardwick, R.C. 0461 0462 0473
Hart, F.X. 0597
Hartmann, E. 0028
Hawker, J.S. 0116
Hayes, A.B. 0006
Heath, M.C. 0317
Hernández C., C.J. 0224
Herzog, D.C. 0401
Hewitt, S. 0098
Hidalgo, R. 0431
Hillman, J.R. 0090
Ho, S.H. 0414
Hobson, B. 0596
Hock, K. 0130
Hohmann, C.L. 0207 0397
Hojat, H. 0101
Holder, C.B. 0089
Holle, M. 0181 0228
Holmes, Z.A. 0530
Honda, Y. 0379
Honma, S. 0261
Hubac, C. 0598
Hubbeling, N. 0375
Huevel J. van den 0338
Huignard, J. 0403
Hulluka, M. 0333
Hunt Junior, E.R. 0015
Hunter, J.E. 0364
Hwang, D.L-R. 0483

Ibrahim, A.M. 0470
Idso, S.B. 0136
Infante, M. 0560
Instituto Interamericano de Ciencias Agrícolas de la OEA 0309
Instituto Nacional de Tecnología Agropecuaria. Argentina. 0202
Ishino, K. 0532
Itam, R.A. 0391
Izquierdo, J.A. 0127

Jaffe, W.G. 0496
Jager, C.P. de 0377
Jansz, E.R. 0516
Jenkins, G.I. 0105
John, W.W. 0025
Johnson, A.W. 0387
Jooste, J.H. 0062 0067 0070
Juárez O., M.G. 0254
Junqueira Netto, A. 0180

Kaiser, W.J. 0301
Kanchan, S.D. 0214
Katherman, M.J. 0294
Kathirgamarajah, S. 0074
Kelly, J.D. 0457
Kenis, J.D. 0040 0112 0120
Khai, F.S. 0078
Kigel, J. 0100
Kimati, H. 0323
Kinbacher, E.J. 0167
Kish, A.J. 0206
Kitajima, E.W. 0374 0393
Kkhae, F.S. 0124
Klozova, E. 0448 0467
Kon, S. 0498 0510 0511
Koontz, H.V. 0049
Krebs, E.H. 0575
Kueneman, E.A. 0215
Kuhn, P.J. 0344
Kurian, P. 0326
Kwok, O.C.H. 0293

Labrada, R. 0222
Latheef, M.A. 0402
Lea, P.J. 0066
Leakey, C.L.A. 0443
Leal, N.R. 0540
Lee, T.E.G. 0038
Lee, W.N. 0509
Legarda-Burbano, L. 0163
Leite Filho, A.S. 0411
Lepiz, R. 0563
Lima, M.G. de 0272
Lima, P.R. de A. 0247
Linares B., S. 0525
Linden, C.T.G. 0057
Lisker, N. 0310
Llanos M., C. 0313
Lo, T.N. 0501
López P., F.M. 0231
Lozano, E. 0485
Lucas, E.O. 0079
Lumsden, R.D. 0320
Luna, J.E. 0195 0198 0200 0201 0392
Luse, R.A. 0492

Ma, Y. 0533
Makus, D.J. 0085
Mangat, B.S. 0046
Marcos Filho, J. 0582
Martínez G., C.L. 0176
Martínez-Rodas, R. 0543
Martini, J.A. 0186
Martmann, R.W. 0476
Masaya S., P.N. 0267
Maurer, C.L. 0343

McFarlane, J.A. 0588
McLaughlin, M.F. 0220
McLaughlin, S.B. 0591
Meiners, J.P. 0491
Meirelles, N.M.F. 0188
Melhoranca, A.L. 0273
Menegario, A. 0138
Mesa C., J.H. 0008
Metivier, J. 0109 0111
Miayasaka, S. 0189
Michels Junior, G.J. 0415
Minchin, F.R. 0548
Miranda C., S. 0450
Miranda M., H. 0275
Miranda, P. 0465
Miyasaka, S. 0248
Moghe, P.G. 0373
Moh, C.C. 0480
Montanheiro, M.N.S. 0128
Moura, P.A.M. de 0551
Mujeeb, K.A. 0115
Mullett, J.H. 0061 0249
Mullins, C.A. 0160 0268
Muñoz G., J.A. 0524
Muraoka, T. 0168
Mutschler, M.A. 0495

Nagl, W. 0439
Naidoo, G. 0056
Nantes, J.F.D. 0587
Nash, S.M. 0359
Natarajan, S. 0442
Natti, J.J. 0298
Nazrala, M.L. 0190
Neptune, A.M.L. 0172
Nochumson, S. 0487

Obizoba, I.C. 0484
Ogbuji, R.O. 0468
Olave L., C.A. 0315
Oliveira, A.C.S. de 0131
Oliveira, A.M. 0410 0590
Oliveira, I.P. de 0153
Ormrod, D.P. 0593
Orozco S., S.H. 0142 0262 0564
Oshima, N. 0296
Otero, C.A. 0155
Owens, T. 0017

Padilla M., L.F. 0266
Palma Z., T. 0174
Palmer, M.V. 0108
Pandey, D.P. 0039 0081
Paniagua G., C.V. 0014
Park, J.K. 0250
Parra, M.A. 0158
Passmoor, M. 0304
Patel, K.M. 0512
Patel, P.M. 0053
Patrick, J.W. 0107 0117
Paz, L.G. da 0549
Pearson, R.C. 0355
Peck, N.H. 0060
Perla A., T.A. 0010
Pessanha, G.G. 0137 0276 0454
Phillips, D.E. 0523
Phillips, T.L. 0418
Piedrahita C., W. 0197
Pinzón R., C. 0322
Pollak, T. 0210
Pompeu, A.S. 0324 0463
Pons, A.L. 0184
Pouzat, J. 0395
Powles, S.B. 0114
Priestley, D.A. 0048
Pring, R.J. 0361
Pringle, J.C. Junior 0169
Processors & Growers Research Organisation (England) 0194 0203 0288
Putnam, A.R. 0212

Queda, O. 0556

Ramalho, F.S. 0412
Ramírez, C. 0535
Ramos N., F.T. 0469
Ramos O., A. 0420
Raven, J.A. 0080
Reddy, S.J. 05[illegible]
Reeleder, R.D. 0475
Reis, M.S. 0225
Reis, P.R. 0406
Rennie, R.J. 0547
Resende, M. 0179
Restrepo M., J. 0021
Ribeiro, S.R. 0339
Rice, R.M. 0096
Robb, J. 0063 0077
Rocha, J.A.M. 0213
Rogers, D.J. 0409
Romero, I. 0460
Ronzelli Junior, P. 0217
Rosen, C.J. 0371
Rowell, B. 0154
Ruegg K., K. 0285
Ruíz de Londoño, N. 0557 0570
Ruíz, M.E. 0513
Rusell, L.M. 0405
Rutger, J.N. 0481

Saad, R. 0076
Saito, S.M.T. 0538
Salazar, J.R. 0149
Saldarriaga V., A. 0426
Sammler, P. 0047
Sampaio, L.S. de V. 0584

Sanders, J.H. 0559 0562 0579 0585
Santos Filho, H.D. 0280
Santoso, I. 0388
São Paulo. Secretaría da Agricultura. Instituto de Economía Agrícola 0571
Sarma, C.M. 0088
Sarma, R. 0119
Sathe, S.K. 0521 0522
Scarisbrick, D.H. 0191 0253
Schein, R.D. 0354
Schoonhoven, A. van 0417
Schroth, M.N. 0278
Schumacher, T.E. 0044
Seidl, D.S. 0490
Senesi, E. 0527
Shaner, D.L. 0035
Shenk, M. 0226
Silva, C.M. da 0252 0586
Silveira, P.M. da 0093
Silvera C., G.A. 0472
Silvernagel, M.J. 0494
Sindhan, G.S. 0356
Singh, D.B. 0389
Smith, D.A. 0330
Smith, F.F. 0427
Smith, P.R. 0368
Sobral, G. 0565
Soto D., J.J. 0257
Soto M., J. 0274
Sotomayor R., I. 0164
Splittstoesser, D.F. 0531
Srikantia, S.G. 0489
Stamopoulos, D. 0404
Stang, J.R. 0259
Stackawicz, B.J. 0283
Sterrett, J.P. 0095
Stewart, R.K. 0423 0424
Stoffella, P.J. 0020 0140 0264
Stolk, J.H. 0227
Suhet, A.R. 0182

Tabekhia, M.M. 0519
Tamas, I.A. 0037 0097
Téllez E., F.F. 0568
Temple, S.R. 0435 0436 0474
Thomas, C.A. 0346
Thomas, J.E. 0383
Thomas, R.J. 0075 0546
Tingey, W.M. 0428
Tompkins, F.D. 0208
Tonin, G.S. 0099
Torres Filho, J. 0269
Trujillo, G.E. 0292
Tsuji, H. 0013
Tulmann N., A. 0449
Turner, J.W. 0413 0447

Universidad del Norte. (Chile) 0456

Vakili, N.G. 0289
Van Der Westhuizen, G.C.A. 0318
Van Holst, G.L. 0113
Van Onckelen, H. 0091
Van Volkenburgh, E. 0087
Vargas, E. 0319
Vendramin, J.D. 0245
Verin-Vergeau, C. 0121
Vides, J.E. 0209
Vieira, C. 0211 0233 0263 0452
Vieira, S.A. 0229 0255
Villa A., R. 0083 0429
Villalobos M., I. 0178
Villegas, A.J. 0550
Villiers, O.T. de 0032 0034
Voth, R.D. 0161
Voysest V., O. 0437 0438
Vries, M.P.C. de 0166

Waddill, V.H. 0408
Walker, S.R. 0218
Wallace, A. 0036 0051 0052 0054 0055 0064 0065 0068 0069 0072 0073 0122
Wallen, V.R. 0287
Walters, H.J. 0365
Wardle, K. 0110
Waters Junior, L. 0539
Watson, D.R.W. 0305
Webster, D.M. 0459
Weiss, A. 0312
Wert, D.W. 0092
White, J.W. 0104
Wieckowski, S. 0102
Wilkinson, R.E. 0486
Wilson Junior, R.G. 0205
Wilson, K.A. 0027
Wilson, V.E. 0382
Wimalajeewa, D.L.S. 0299
Woodward, M.D. 0314 0329
Wright, R.M. 0133
Wyse, D.L. 0216
Wyss, H-R. 0094

Yadav, N.R. 0493
Yarwood, C.E. 0342
Yeang, H.Y. 0103 0125
Yoshii, K. 0381

Zaffaroni, E. 0170
Zagatto, E.A.G. 0129
Zaumeyer, W.J. 0282
Zungoli, P.A. 0399

ABSCISSION
0120
FLOWERS
0127
LEAVES
0040 0047 0082 0112 0593

ACANTHOSCELIDES OBTECTUS
0403 0404 0410 0588 0589 0590
HOST-PLANT RESISTANCE
0398
INSECT CONTROL
0395 0400 0407

ADAPTATION
0136 0403 0419
CULTIVARS
0254 0256 0257 0266 0270 0273 0275
0307 0438 0461 0472 0527

AFRICA
0004 0145 0146 0193 0196 0318 0468

AGRICULTURAL EQUIPMENT
0209 0250
HARVESTING
0206
PLANTING
0198 0205

AGRICULTURAL LIME
0187
FERTILIZERS
0152 0173 0184 0185
PH
0152 0173

AGRICULTURAL PROJECTS
0452 0564 0567 0577

AGRONOMIC CHARACTERS
0002 0008 0014 0021 0104 0137 0142
0147 0195 0227 0235 0239 0254 0258
0261 0265 0269 0271 0273 0276 0431
0434 0436 0437 0438 0441 0445 0454
0458 0460 0465 0481 0520 0561 0585

AGROTIS IPSILON
0566

AIR POLLUTION
0005 0600
PLANT DEVELOPMENT
0042 0591
PLANT INJURIES
0024 0591 0593
OZONE
0024 0593 0594 0595 0599

ALUMINIUM
PH
0152 0545
PHOSPHORUS
0056 0152 0177
TOXICITY
0056

AMINO ACIDS
0030 0076 0078 0111 0283 0457 0482
0488 0491 0493 0495 0496 0497 0499
0501 0507 0512 0524 0598
ANALYSIS
0027 0293 0514 0523 0526 0542
LEAVES
0066 0094 0099 0115 0124 0150 0219
0295 0484
PODS
0124 0526
SEED
0494 0504 0523

ANIMAL NUTRITION
0485 0488 0501 0507 0513 0515 0526

APHIS FABAE
0027 0220 0414 0459 0599

APION GODMANI
0563

APION SP
0418

ARGENTINA
0195 0198 0200 0201 0202 0277 0392

ARGININE
0030 0283

ASH CONTENT
0512

ATP
0046 0487

AUXINS
0006 0071
GROWTH
0088
PLANT DEVELOPMENT
0088

BACTERIOLOGY
0333

BACTERIOSES
0025 0279 0283 0288 0292 0295 0300
0301 0304 0305 0440 0563
DISEASE CONTROL
0143 0280 0281 0285 0286 0287 0296
0298 0299

HOST-PLANT RESISTANCE
0289 0290 0291 0294 0302 0303 0307
0333 0375 0444 0459

BEAN COMMON MOSAIC VIRUS
0382
ELECTRON MICROSCOPY
0373
HOST-PLANT RESISTANCE
0375 0474
PLANT BREEDING
0375 0563

BEAN GOLDEN MOSAIC VIRUS
0213 0378 0563
HOST - PLANT RESISTANCE
0381

BEAN ROOT ROTS
0074

BEAN RUGOSE MOSAIC VIRUS
0176
ELECTRON MICROSCOPY
0384

BEAN SOUTHERN MOSAIC VIRUS
0379
DISEASE CONTROL
0376
VIRUS TRANSMISSION
0376 0380

BEAN SUMMER DEATH VIRUS
0367 0369 0383

BEAN YELLOW MOSAIC VIRUS
0370 0371
HOST-PLANT RESISTANCE
0375

BEMISIA TABACI
0378 0425
HOST-PLANT RESISTANCE
0381
INSECT BIOLOGY
0405

BIOMASS
0020 0123

BORON
MINERAL DEFICIENCIES
0146
TOXICITY
0050

BIOCHEMISTRY
0023 0029 0094 0108 0116 0121 0130
0293 0302 0314 0317 0329 0344 0380
0487 0504 0516 0521 0528 0534

BRAZIL
0016 0030 0093 0131 0137 0138 0147
0148 0150 0152 0156 0159 0175 0177
0180 0204 0211 0213 0217 0225 0229
0232 0233 0236 0238 0240 0243 0245
0247 0252 0255 0256 0263 0269 0270
0272 0273 0276 0279 0280 0307 0316
0323 0327 0339 0357 0360 0374 0393
0406 0412 0444 0454 0455 0463 0465
0506 0507 0540 0541 0551 0556 0558
0571 0574 0577 0580 0584 0585 0590

BUDS
0213 0378 0381 0563

CADMIUM
0053 0055

CALCIUM
0152 0153 0165 0177 0507 0541
LEAVES
0025 0052 0062 0069 0160 0174 0326
0484
MINERAL DEFICIENCIES
0049 0051 0122
PODS
0160
STEMS
0069 0122

CANNED BEAN
0268 0489 0500 0503 0509 0510 0518
0531

CARBOHYDRATE CONTENT
0113 0120 0483 0505 0510 0543
LEAVES
0539

PODS
0539
STEMS
0539

CARBON DIOXIDE
0057 0076 0106 0179 0517 0515 0542
LIGHT
0026 0031 0114
PHOTOSYNTHESIS
0114
PLANT RESPIRATION
0031 0548
TEMPERATURE
0031

CARBON FIXATION
0031 0098 0107 0114 0123

CELL STRUCTURE
0009 0011 0017 0019 0029 0033 0039
0062 0063 0077 0080 0087 0113 0123
0384 0439 0478 0594

CEROTOMA TRIFURCATA
0365
INSECT CONTROL
0401

CHILE
0456

CHLOROPLASTS
0013 0032 0041 0048 0094 0105 0114
0384

CHLOROSIS
0120 0216 0283 0295 0304 0333 0593

CHROMOSOMES
0439 0479

CLIMATIC REQUIREMENTS
0002 0003 0005 0014 0018 0026 0033
0087 0089 0104 0114 0133 0137 0145
0148 0163 0223 0228 0231 0241 0251
0252 0256 0348 0356 0360 0403 0440
0554 0585
PHOTOPERIOD
0021 0045 0082 0086 0098 0102 0136
0246
TEMPERATURE
0045 0086 0126 0136 0175 0192 0210
0212 0216 0246 0253 0312 0354 0388
0444 0461 0462 0547

CLIMBING BEANS
0132 0242 0258 0458

COLEOPTERA
0143 0365 0383 0393 0395 0398 0399
0400 0401 0402 0403 0404 0407 0408
0410 0415 0418 0420 0421 0563 0589
0590

SEED
0588

COLLETOTRICHUM LINDEMUTHIANUM
0241 0279 0323 0358
DISEASE CONTROL
0251 0280 0285 0319
HOST-PLANT RESISTANCE
0258 0324 0335 0339 0357 0362 0363
0375 0463
PLANT BREEDING
0258 0324 0375 0463 0463
RACES
0335 0339 0375

COLOMBIA
0008 0014 0021 0104 0197 0199 0207
0235 0241 0258 0313 0315 0322 0397
0403 0405 0417 0420 0421 0426 0430
0431 0432 0433 0434 0435 0436 0437
0438 0440 0445 0458 0474 0536 0537
0545 0555 0559 0560 0562 0585

COMPOSITION
0027 0056 0060 0061 0115 0125 0129
0142 0161 0175 0182 0249 0370 0371
0485 0489 0502 0520 0521 0522 0526
0528
ASH CONTENT
0512
CARBOHIDRATE CONTENT
0113 0483 0505 0510 0539 0543
FAT CONTENT
0486 0511 0524
FIBRE CONTENT
0524
MINERAL CONTENT
0053 0064 0122 0128 0172 0185 0484
0500 0512 0524
PROTEIN CONTENT
0024 0038 0066 0076 0078 0111 0124
0167 0398 0457 0460 0465 0481 0482
0483 0484 0486 0487 0488 0491 0492
0494 0495 0496 0497 0499 0504 0508
0511 0512 0513 0514 0515 0523 0524
0532 0533 0534
VITAMIN CONTENT
0484 0500 0506 0509 0530
WATER CONTENT
0026 0118 0135 0150 0206 0245 0496
0510 0512

CONSUMPTION
0004 0443 0489 0497 0551 0552 0556
0565 0570 0571 0573 0575 0576

COOKING
0398 0407 0465 0482 0489 0496 0497
0498 0510 0516 0519 0526

COPPER
0296
MINERAL DEFICIENCIES
0054

CORYNEBACTERIUM FLACCUMFACIENS
HOST-PLANT RESISTANCE
0333

COSTA RICA
0018 0132 0151 0163 0165 0174 0181
0186 0225 0228 0234 0237 0251 0398
0485 0513 0572 0578

COSTS
0135 0143 0180 0224 0231 0234 0237
0380 0423 0550 0553 0554 0555 0558
0561 0567 0568 0572 0575 0576 0578
0596

COTYLEDONS
0011 0022 0023 0066 0088 0098 0107
0109 0110 0111 0119 0249 0404 0439
0478
GERMINATION
0038 0470

CROP LOSS
0378
PLANT INJURIES
0024 0061 0199 0217 0219 0326 0418
0449 0591 0593
CUBA
0222 0581

CULTIVARS
0001 0018 0020 0056 0059 0083 0093
0096 0127 0137 0140 0141 0142 0143
0147 0157 0175 0180 0200 0204 0206
0207 0213 0215 0223 0233 0235 0255
0258 0259 0260 0261 0262 0263 0264
0265 0267 0268 0269 0271 0272 0276
0284 0289 0290 0291 0294 0297 0302
0315 0324 0328 0333 0335 0341 0357
0367 0368 0379 0381 0388 0389 0391
0397 0398 0417 0418 0428 0434 0436
0443 0444 0451 0452 0454 0455 0456
0457 0460 0462 0463 0465 0466 0469
0471 0473 0474 0475 0476 0477 0481
0494 0495 0515 0520 0537 0544 0545
0547 0559 0561 0574 0590 0592
ADAPTATION
0254 0256 0257 0266 0270 0273 0275
0307 0438 0461 0472 0527
GERMPLASM
0104 0275 0429 0433 0438 0440 0458
0472
IDENTIFICATION
0002 0008 0014 0339

CULTIVATION SYSTEMS
0014 0057 0131 0132 0137 0156 0170
0181 0217 0224 0226 0228 0229 0231
0232 0233 0234 0235 0236 0237 0238
0239 0240 0241 0242 0243 0258 0267
0402 0444 0486 0554 0555 0557 0563
0569 0572 0579 0583

CULTURE MEDIA
0017 0059 0123 0291 0292 0304 0323
0325 0326 0332 0422 0459

CYTOGENETICS
0377 0479

CYTOKININ
0013 0082 0198

CYTOLOGY
0009 0011 0017 0022 0023 0026 0034
0048 0061 0062 0063 0067 0077 0087
0100 0113 0116 0123 0290 0326 0362
0363 0374 0379 0384 0439 0478 0594

DEFICIENCIES
MINERAL DEFICIENCIES
0049 0051 0059 0122 0371 0444 0471

DEFOLIATION
0089 0396

DETERIORATION
0398 0506 0509 0511 0518 0584 0585
0586

DEVELOPMENTAL STAGES
0028 0030 0033 0039 0038 0095 0098
0123 0188 0214 0279 0300 0324 0328
0351 0541
FLOWERING
0075 0079 0082 0083 0093 0107 0155
0174 0246 0423 0449 0539
GERMINATION
0016 0033 0061 0071 0083 0091 0191
0245 0247 0272 0284 0310 0370 0462
0470 0508 0524 0535 0584 0587
MATURATION
0191 0192 0526
POODING
0075 0083 0093 0423

DIABROTICA BALTEATA
0408 0563
INSECT BIOLOGY
0421
CHEMICAL CONTROL
0420

DIETARY VALUE
0482 0485 0496 0501 0507 0508 0511
0517 0519 0523 0524 0526

DIGESTIBILITY
0482 0485 0492 0493 0496 0498 0508
0515 0517 0519 0523 0524 0526

DIPTERA
0408 0409 0416

DISEASE CONTROL
0248 0277 0282 0322 0443 0554
BACTERIUSES
0143 0280 0281 0285 0286 0287 0296
0298 0299

MYCOSES
0143 0251 0240 0281 0285 0316 0317
0319 0334 0337 0343 0345 0350 0351
0352 0355
VIRUSES
0280 0376 0385 0386

DISEASE TRANSMISSION
0248 0251 0308 0313 0327 0369 0383
0427
SEED TRANSMISSION
0292 0294 0298
VIROSES
0365 0368 0372 0382 0386

DNA
0013 0058 0439 0478

DROUGHT
0043 0150 0156 0161 0171 0175 0272
0529 0558 0598

DRY MATTER
0076 0111 0177 0530 0544

DWARF BEANS
0065 0227 0258 0458
SPACING
0142

ECOLOGY
0003 0018 0101 0212 0214 0248 0257
0266 0285 0337 0343 0352 0383 0403
0405 0444 0446 0472 0481 0536 0540
0541 0576 0598

ECONOMICS
0135 0160 0224 0229 0231 0234 0237
0244 0497 0550 0551 0552 0553 0554
0555 0556 0557 0558 0559 0560 0561
0562 0565 0566 0567 0568 0569 0570
0571 0572 0573 0575 0577 0578 0579
0596

ECUADOR
0410

EL SALVADOR
0083 0149 0209 0386 0429 0553

EMPOASCA FABAE
HOST-PLANT RESISTANCE
0428
INSECT CONTROL
0427

EMPOASCA KRAEMERI
0425 0563
HOST-PLANT RESISTANCE
0207 0397 0417 0428 0444
INSECT BIOLOGY
0411 0412
INSECT CONTROL
0427

ENGLAND
0203 0288

ENZYMS
0022 0027 0028 0029 0031 0040 0048
0075 0091 0094 0109 0111 0116 0120
0121 0126 0130 0167 0293 0326 0329
0358 0487 0490 0501 0505 0515 0516
0533 0595

EPILACHNA VARIVESTIS
0399 0402 0563
INSECT CONTROL
0143 0415

ERYSIPHE POLYGONI
DISEASE CONTROL
0280 0319

ESCHERICHIA COLI
0283

EXPERIMENT DESIGN
0153 0155 0163 0199 0228 0231 0241
0257 0259 0262 0332 0370 0421 0425
0437 0472 0581 0583 0584 0592

FAT CONTENT
0486 0511 0524

FERTILIZERS
0060 0133 0135 0137 0138 0139 0143
0146 0147 0149 0152 0153 0154 0155
0157 0159 0161 0162 0164 0165 0166
0168 0172 0173 0174 0178 0180 0181
0183 0184 0185 0186 0188 0189 0221
0259 0260 0265 0443 0454 0494 0536
0540 0541 0554 0561

FIBRE CONTENT
0524

FLOWERING
0008 0014 0075 0079 0083 0093 0107
0155 0174 0423 0441 0449 0539
PHOTOPERIOD
0082 0246
TEMPERATURE
0246

FOOD ENERGY
0485 0511

FUSARIUM OXYSPORUM
0346

FUSARIUM SOLANI PHASEOLI
0216 0278 0306 0331 0332
DISEASE CONTROL
0319 0343 0351
HOST-PLANT RESISTANCE
0328 0344 0353 0453
PLANT BREEDING
0328 0453

GENES
0058 0096 0276 0375 0388 0442 0451
0452 0460 0463 0470 0472 0480 0545

GERMPLASM
0104 0275 0429 0431 0433 0435 0437
0438 0440 0455 0464 0466 0472 0563
0585

GIBBERELLINS
0117
CELL DIVISION
0160

GREEN MANURES
0189 0190 0221

GROWTH
0009 0019 0028 0041 0042 0057 0067
0065 0068 0069 0073 0077 0079 0080
0090 0095 0097 0098 0099 0099 0101
0102 0103 0104 0105 0106 0110 0111
0113 0116 0117 0151 0163 0272 0475
0549 0597
LIGHT
0033 0060 0067
MINERALS AND NUTRIENTS
0039 0055 0056 0059 0070 0075 0073
0092 0096 0123 0328 0370 0549
PLANTING
0155 0467
SALINITY
0039 0075 0072 0116 0158
SPACING
0157 0220
TEMPERATURE
0054 0060 0123 0175 0216 0220 0462
0473 0591

GUATEMALA
0135 0142 0176 0224 0257 0262 0265
0266 0267 0285 0425 0497 0502 0544
0552

HARVESTING
0037 0060 0083 0131 0140 0143 0155
0196 0206 0223 0230 0232 0238 0243
0252 0259 0260 0261 0269 0449 0461
0488 0529 0554

HEAT TREATMENT
0317 0373 0483 0508

HELIOTHIS ZEA
0402

HEMIPTERA
0423
INSECT CONTROL
0424 0447

HERBICIDES
0032 0034 0035 0045 0046 0119 0129
0160 0193 0194 0205 0207 0209 0211
0212 0220 0222 0226 0561

DISEASES AND PATHOGENS
0216
PLANT INJURIES
0169 0199 0210 0216 0217 0218 0219

HETEROSIS
0451

HOMOPTERA
0207 0378 0381 0397 0405 0411 0412
0417 0425 0428 0444 0563
INSECT CONTROL
0414 0427

HONDURAS
0418 0561 0564 0567

HUMAN NUTRITION
0482 0484 0487 0489 0490 0491 0496
0497 0499 0500 0501 0503 0504 0508
0509 0511 0516 0519

HYDRIDIZING
0096 0375 0429 0432 0433 0441 0443
0446 0448 0450 0459 0463 0467 0476
0479

INCOME
0180 0181 0224 0229 0230 0234 0235
0237 0559 0561 0568 0572 0575 0578

INDOLEACETIC ACID
0088 0100

INHIBITORS
0025 0027 0075 0109 0219 0283 0489
0490 0492 0493 0497 0501 0508 0524
0535

INJURIOUS INSECTS
0203 0254 0392 0394 0413 0436 0438
0456
COLEOPTERA
0143 0383 0395 0396 0399 0400 0401
0402 0403 0404 0407 0408 0410 0420
0421 0563 0589 0590
DIPTERA
0408 0409 0416
HEMIPTERA
0423 0424 0447
HOMOPTERA
0207 0378 0381 0397 0411 0412 0414
0417 0425 0427 0444 0563
LEPIDOPTERA
0316 0402 0408 0447

INJURIOUS MITES
0447
MITE CONTROL
0422
TETRANYCHUS TELARIUS
0419 0422

INOCULATION
0138 0216 0291 0298 0300 0301 0314

0315 0324 0325 0329 0331 0333 0335
0338 0340 0341 0342 0346 0348 0349
0363 0364 0373 0376 0382 0388 0459
0463

INTEGRATED CONTROL
0207 0396 0397 0402 0408 0444

INTER-CROPPING
0014 0137 0217 0228 0231 0234 0236
0237 0239 0402 0440 0444 0486 0513
0545 0583
ZEA MAYS
0132 0170 0181 0224 0229 0230 0233
0235 0243 0258 0267 0554

IRON
0039 0182
LEAVES
0062 0065 0067 0069 0070 0081 0484
MINERAL DEFICIENCIES
0065
ROOTS
0062 0067 0069 0070 0081 0128
STEMS
0069

IRRADIATION
0028 0115 0119 0128 0129 0245 0449
0460 0506 0515 0582 0587

IRRIGATION
0143 0144 0156 0158 0169 0176 0179
0260 0312 0345 0387 0558 0581

ISARIOPSIS GRISEOLA
0279 0313 0327 0356
DISEASE CONTROL
0251 0319
HOST-PLANT RESISTANCE
0315 0325
PLANT BREEDING
0325 0563

LAND PREPARATION
0131 0160 0170 0193 0226 0554

LATIN AMERICA
0570

LEAVES
0005 0006 0008 0013 0014 0023 0026
0033 0034 0040 0041 0042 0043 0047
0048 0052 0053 0065 0067 0068 0069
0072 0077 0079 0079 0080 0081 0082
0087 0088 0090 0095 0098 0099 0101
0102 0104 0105 0108 0110 0112 0114
0115 0116 0119 0121 0125 0126 0139
0150 0157 0158 0168 0171 0172 0175
0179 0185 0219 0220 0241 0242 0249
0312 0322 0348 0371 0376 0422 0451
0478 0539 0591 0593 0597 0600
DISEASES AND PATHOGENS
0216 0291 0295 0299 0302 0303 0304
0305 0308 0326 0333 0338 0346 0361
0372 0373 0377 0384 0385 0459
INJURIOUS INSECTS
0412
MINERALS AND NUTRIENTS
0025 0031 0055 0056 0062 0066 0070
0089 0092 0094 0124 0129 0160 0174
0326 0484 0546

LEPIDOPTERA
0316 0402 0408
INSECT CONTROL
0447

LIGHT
0005 0026 0031 0032 0040 0112 0114
0210 0323 0348
GROWTH
0033 0086 0087
PHOTOPERIOD
0086

LODGING
0018 0140 0254

LYSINE
0482 0497 0499

MACROPHOMINA PHASEOLI
0321 0340 0347 0348
DISEASE CONTROL
0280 0281

MAGNESIUM
0484
PLANT ASSIMILATION
0160 0174

MANGANESE
0039 0128 0146 0161

MANURES
0131 0268 0560 0565 0570 0571

MARUCA TESTULALIS
INSECT BIOLOGY
0447
INSECT CONTROL
0447

MATURATION
0014 0097 0104 0124 0172 0191 0192
0196 0206 0230 0253 0265 0461 0488
0526 0529

MECHANICAL DAMAGE
0012 0019 0044

MELANAGROMYZA PHASEOLI
0416

MELOIDOGYNE INCOGNITA
HOST-PLANT RESISTANCE
0388 0389 0468

METABOLISM
0028 0031 0040 0057 0075 0075 0096
0108 0115 0119 0121 0219 0329 0484
0546 0548 0598

METHIONINE
0094 0457 0488 0494 0495 0497 0499
0507 0512

MEXICO
0139 0152 0254 0341 0381 0460 0463

MICRONUTRIENTS
0036 0039 0051 0052 0053 0054 0059
0060 0064 0065 0068 0069 0072 0073
0081 0096 0124 0152

MINERAL CONTENT
0053 0084 0122 0128 0172 0185 0424
0500 0512 0524

MINERAL DEFICIENCIES
0036 0049 0051 0054 0059 0065 0124
0146 0371 0444 0471

MINERALS AND NUTRIENTS
0025 0051 0051 0055 0058 0059 0062
0063 0074 0122 0122 0129 0153 0156
0326 0345 0370 0391 0487 0507 0541
0546
ALUMINIUM
0056 0152 0177
BORON
0146
IRON
0039 0062 0069 0070 0128 0192 0434

MAGNESIUM
0160 0174 0494
MANGANESE
0039 0128 0146 0161
MOLYBDENUM
0147 0541 0549
NITROGEN
0066 0075 0137 0146 0147 0149 0152
0159 0160 0161 0164 0165 0174 0178
0180 0188 0259 0306 0328 0494 0536
0540 0548 0549
OXIGEN
0025 0031 0089 0092
PHOSPHORUS
0049 0052 0056 0060 0078 0096 0124
0137 0146 0149 0152 0153 0160 0165
0174 0177 0178 0180 0293 0471 0494
0540 0549
POTASIUM
0056 0061 0078 0137 0146 0149 0152
0160 0165 0174 0178 0540
SULFUR
0049 0094

MOLYBDENUM
0147 0541 0549

MORPHOGENESIS
0007 0012 0019 0099

MULCHING
0189 0190 0397

MUTATION
0449 0480 0547

MYCOPLASMOSES
0393

MYCOSES
0011 0143 0258 0278 0278 0279 0280
0281 0284 0285 0306 0307 0309 0311
0313 0314 0315 0316 0317 0318 0319
0320 0321 0323 0330 0334 0336 0337
0340 0342 0343 0344 0345 0347 0349
0350 0351 0352 0353 0355 0356 0357
0358 0359 0364 0375 0449 0453 0463
0465 0469 0563 0580
LEAVES
0241 0308 0326 0338 0340 0361
PODS
0241 0327 0329 0335 0339
SEED
0251 0327
SEEDLINGS
0310 0324 0328 0331 0363
ROOTS
0331 0332 0359 0430

TEMPERATURE
0362 0444

NEMATODES
0387 0388 0389 0390 0391 0408 0444
0468 0476

NICARAGUA
0002 0554 0576

NITROGEN
0068 0075 0080 0123 0306 0321 0328
0548 0549 0599
FERTILIZERS
0137 0146 0147 0149 0152 0154 0159
0161 0162 0164 0165 0168 0172 0174
0178 0180 0183 0184 0186 0188 0259
0494 0536 0540
MINERAL DEFICIENCIES
0146
NUTRIENT ABSORPTION
0076 0160 0161 0162 0174
PLANT ASSIMILATION
0076 0160 0161 0162 0174
PROTEIN CONTENT
0066 0076 0494 0542

NITROGEN-FIXING BACTERIA
CARBON DIOXIDE
0542

NODULATION
0172 0214 0331 0537 0538 0539 0542

0543 0544 0545 0599
MINERALES AND NUTRIENTS
0546
CALCIUM
0541
CARBON DIOXIDE
0548
NITROGEN
0147 0536 0540 0548 0549
PHOSPHORUS
0540 0549

NORTH AMERICA
0019 0020 0024 0037 0050 0085 0[illegible]
0101 0117 0134 0160 0208 0220 0[illegible]
0254 0264 0292 0317 0347 0396 0[illegible]
0486 0503 0520 0535 0575 0596

NOXIOUS ANIMALS
0143 0201 0237 0254 0316 0378 0381
0383 0387 0391 0392 0393 0394 0397
0398 0399 0400 0401 0402 0403 0404
0406 0407 0408 0409 0410 0411 0412
0413 0414 0416 0417 0418 0419 0420
0421 0422 0423 0424 0425 0427 0436
0438 0444 0447 0456 0563 0587 0590

NUCLEIC ACID
0013 0013 0034 0058 0068 0439 0479
0478
RNA
0024 0439

NUTRIEN. ABSORPTION
0031 0039 0049 0052 0057 0058 0061
0064 0065 0070 0074 0076 0077 0081
0084 0089 0096 0150 0161 0162 0166
0174 0187

NUTRIENT LOSS
0249 0509

NUTRIENT SOLUTION
0028 0041 0054 0055 0057 0065 0066
0069 0070 0073 0075 0076 0077 0078
0092 0099 0110 0116 0128 0328 0370
0549

NUTRIENT TRANSPORT
0028 0036 0052 0053 0062 0067 0072
0074 0081 0546

NUTRITIONAL REQUIREMENTS
0071 0075 0078 0133 0135 0137 0146
0147 0149 0152 0153 0154 0157 0159
0160 0161 0164 0165 0172 0173 0174
0178 0183 0184 0185 0186 0188 0203
0221 0260 0370 0440 0444 0454 0471
0494 0536 0540 0541 0554 0561

NUTRITIVE VALUE
0060 0444 0446 0482 0483 0485 0488
0489 0491 0493 0496 0497 0498 0499
0500 0502 0503 0504 0506 0508 0509
0511 0512 0515 0516 0518 0523 0524
0526

ORNITHINE
0283 0293 0295

OSMOTIC POTENTIAL
0067

OROSIUS ARGENTATUS
0369 0383 0393

OZONE
AIR POLLUTION
0024 0593 0594 0595 0599
PLANT INJURIES
0024 0593

PERU
0231 0568

PH
0027 0033 0055 0060 0069 0096 0121
0123 0161 0165 0323 0370 0541 0545
AGRICULTURAL LIME
0152 0173

PHASEOLLINS
0320 0517
ANALYSIS
0329

PHASEOLUS ACUTIFOLIUS
0301

PHASEOLUS COCCINEUS
0003 0445 0448 0450 0461 0467 0470
0479

PHASEOLUS LUNATUS
0003 0297 0301 0446 0468 0492 0516

PHOSPHORUS
0056 0060 0078 0124 0137 0149 0152
0153 0154 0165 0168 0172 0178 0180
0183 0184 0186 0293 0494 0540 0549
MINERAL DEFICIENCIES
0049 0054 0146 0471
NUTRIENT ABSORPTION
0049 0052 0096 0160 0166 0174
PLANT ASSIMILATION
0096 0160 0166 0174 0177

PHOTOPERIOD
0021 0045 0082 0085 0086 0098 0102
0136 0246

PHOTOSYNTHESIS
0021 0032 0034 0035 0043 0059 0105
0107 0114 0591

PHYTOALEXINS
0011 0314 0320 0329 0330 0344 0362
0363 0517

PLANT ASSIMILATION
0026 0028 0031 0039 0044 0045 0061
0064 0074 0076 0077 0079 0081 0084
0089 0092 0096 0119 0160 0161 0162
0166 0174 0177 0187 0210 0546

PLANT BREEDING
0001 0014 0261 0325 0417 0429 0431
0436 0441 0444 0449 0451 0452 0453
0457 0458 0463 0473 0475 0477 0480
0494 0495 0496 0552 0553

BACKCROSSING
0433 0469 0470 0471 0472 0473

HYBRIDIZING
0096 0375 0429 0432 0433 0441 0443
0446 0450 0459 0463 0467 0476 0479

SELECTION
0096 0258 0262 0263 0266 0324 0328
0429 0433 0434 0435 0437 0439 0441
0442 0443 0445 0456 0459 0465 0467
0465 0469 0473 0476 0491 0585 0592

PLANT DEVELOPMENT
0007 0008 0009 0012 0014 0019 0022
0023 0025 0027 0033 0039 0042 0044
0056 0057 0059 0068 0075 0079 0083
0086 0087 0088 0090 0092 0094 0099
0096 0097 0098 0099 0100 0101 0102
0103 0104 0105 0106 0107 0109 0110
0111 0113 0115 0116 0117 0124 0143
0151 0155 0157 0158 0163 0174 0175
0176 0179 0182 0190 0200 0214 0216
0220 0246 0265 0272 0371 0441 0461
0462 0483 0486 0526 0529 0539 0549
0591

PLANT FERTILITY
0016 0096 0160 0445

PLANT GEOGRAPHY
0061 0083 0431 0443 0446 0464 0466

PLANT - GROWTH SUBSTANCES
0006 0013 0019 0022 0023 0025 0037
0039 0045 0047 0071 0082 0084 0085
0087 0088 0090 0091 0095 0097 0098
0099 0100 0103 0108 0109 0111 0117
0120 0171 0219 0373 0483

PLANT HABIT
0021 0132 0141 0142 0195 0239 0258
0269 0440 0441 0458 0465

PLANT INJURIES
0012 0304 0316 0330 0331 0384 0418
0421 0427 0597
AIR POLLUTION
0024 0591 0593
HARVESTING
0449
HERBICIDES
0169 0199 0210 0216 0217 0218 0219
TEMPERATURE
0061 0126 0210 0216 0591
TOXICITY
0050 0061 0326 0591

PLANT NUTRITION
0028 0036 0039 0049 0051 0052 0054
0056 0058 0059 0064 0066 0068 0072
0073 0076 0122 0157 0174 0182 0184
0504 0539 0549

PLANT PHYSIOLOGICAL DISORDERS
0005 0035 0040 0049 0050 0051 0071
0371 0392 0593

PLANT PHYSIOLOGICAL PROCESSE
0027 0038 0041 0042 0046 0080 0087
0091 0094 0130 0150 0171 0175 0216
0293 0295 0314 0538 0595
ABSCISSION
0040 0062 0120
NUTRIENT TRANSPORT
0028 0053 0062 0067 0072 0074 0081
0546
PHOTOSYNTHESIS
0021 0032 0034 0035 0043 0059 0105
0114 0591
PLANT ASSIMILATION
0026 0028 0031 0039 0044 0045 0061
0074 0077 0079 0081 0084 0089 0092
0096 0177 0210 0546
PLANT RESPIRATION
0025 0031 0043 0044 0089 0092 0548

PLANT PIGMENTS
0024 0046 0102

PLANT RESPIRATION
0025 0043 0044 0089 0092 0346 0548
TEMPERATURE
0031

PLANT TISSUE
0007 0009 0017 0033 0056 0062 0070
0074 0081 0092 0098 0099 0112 0113
0129 0156 0161 0304 0314 0320 0330
0333 0346 0362 0363 0371 0384 0393
0546
ENZYMES
0029 0111 0126 0130

PLANT VASCULAR SYSTEM
0019 0063 0090 0095 0098 0383 0543

PLANTING
0018 0131 0143 0146 0155 0188 0191
0195 0201 0202 0212 0213 0239 0241
0243 0248 0252 0253 0262 0356 0389
0391 0449 0462 0547 0557
AGRICULTURAL EQUIPMENT
0198 0205
SPACING
0135 0139 0141 0193 0200 0211 0225
0228 0230 0231 0232 0238 0260 0267
0424

PRODUCTIVITY
0135 0211 0230

PUDDING
0075 0083 0093 0172 0423

PODS
0008 0014 0018 0037 0053 0079 0101
0104 0124 0127 0155 0158 0160 0192
0223 0227 0241 0259 0261 0268 0327
0335 0339 0520 0526 0529 0539 0591
DISEASES AND PATHOGENS
0299 0300 0303 0329
INJURIOUS INSECTS
0423

POLLEN
0192

POTASSIUM
0056 0078 0137 0149 0152 0154 0165
0165 0172 0173 0178 0184 0186 0540
MINERAL DEFICIENCIES
0146
NUTRIENT ABSORPTION
0061 0160 0174
PLANT ASSIMILATION
0061 0160 0174

PROCESSING
0336

PRODUCTION
0004 0229 0244 0415 0438 0443 0491
0551 0552 0553 0555 0556 0557 0558
0559 0565 0566 0567 0568 0569 0570
0571 0572 0573 0574 0575 0576 0577
0578 0579 0585

PRODUCTIVITY
0037 0134 0135 0147 0159 0165 0181
0211 0229 0230 0237 0256 0263 0264
0540 0550 0551 0556 0558 0561 0566
0568 0569 0572 0578 0582

PROTEIN CONTENT
0024 0066 0076 0078 0099 0111 0124
0167 0295 0398 0444 0457 0463 0465
0467 0481 0482 0483 0484 0486 0487
0488 0491 0495 0496 0497 0499 0501
0508 0511 0512 0513 0514 0515 0524
0532 0542 0598
SEED
0038 0492 0494 0504 0523 0533 0534

PROTEINS
0022 0034 0490 0589
AMINOACIDS
0027 0493 0501 0504
ANALYSIS
0011 0027 0041 0167 0380 0448 0521
0522 0528 0532 0533 0534
DIGESTIBILITY
0485 0493 0508

PSEUDOMONAS PHASEOLICOLA
0283 0288 0292 0304
DISEASE CONTROL
0281 0286 0287 0299
HOST-PLANT RESISTANCE
0293 0294 0302 0375

PSEUDOMONAS SYRINGAE
0295 0301 0305
HOST-PLANT RESISTANCE
0290 0297 0303

RAINFALL DATA
0205

RESEARCH
0006 0011 0017 0018 0020 0025 0027
0034 0039 0041 0044 0059 0061 0078
0080 0105 0118 0123 0124 0139 0141
0151 0156 0165 0197 0222 0241 0245
0247 0249 0257 0258 0283 0292 0297
0301 0304 0311 0312 0314 0323 0347
0348 0380 0382 0397 0404 0414 0421
0437 0440 0443 0446 0460 0464 0466
0478 0483 0490 0504 0505 0521 0562
0563 0564 0573 0574 0577 0581 0583
0585 0592 0594 0600

RHIZOBIUM
0138 0331 0445 0535 0536 0537 0538
0540 0543 0545 0547 0563

RHIZOBIUM PHASEOLI
0535 0537 0540 0543 0544 0545 0547
0563

RHIZOCTONIA SOLANI
0308 0309 0310 0332 0336 0340
DISEASE CONTROL
0251 0316 0319
HOST-PLANT RESISTANCE
0330 0341

RHIZOSPHERE
0306 0331 0535 0580

RNA
0024 0377 0439

ROOTING
0020 0098 0351

ROOTS
0007 0018 0020 0029 0030 0044 0053
0054 0055 0056 0057 0058 0062 0067
0068 0069 0070 0073 0081 0089 0092
0099 0110 0119 0128 0151 0162 0216
0264 0331 0332 0359 0387 0388 0430
0450 0535 0537 0538 0539 0546 0548
0549

ROTS
0332 0430 0475 0537

SALINITY
0076 0600
GROWTH
0039 0092 0116 0158
PLANT DEVELOPMENT
0039 0092 0116 0158
TEMPERATURE
0598

SAP
0346 0542 0546

SCLEROTIUM ROLFSII
0340
DISEASE CONTROL
0319

SEED
0009 0011 0085 0107 0142 0327 0537
0582 0588
AMINO ACIDS
0494 0504 0523
CHARACTERS
0016 0061 0133 0247 0249 0271 0458
DISEASES AND PATHOGENS
0251 0574
GENETICS
0458
GERMINATION
0016 0038 0061 0091 0191 0245 0247
0272 0535 0584

INJURIOUS INSECTS
0394
PRODUCTION
0574
PROTEIN CONTENT
0038 0492 0494 0504 0523 0533 0534
STORAGE
0118 0252 0394 0584
YIELDS
0018 0079 0253 0271 0458

SEED CHARACTERS
0016 0061 0133 0204 0220 0246 0245
0271 0398 0443 0458 0467
SEED COLOR
0247 0465

SEED COAT
0247 0284 0398 0404 0480

SEED COLOR
0247 0465 0480

SEED PRODUCTION
0071 0078 0079 0094 0143 0151 0178
0244 0247 0248 0250 0251 0252 0253
0257 0285 0294 0299 0327 0520

SEED TRANSMISSION
0284 0292 0294 0298 0359

SEED TREATMENT
0147 0202 0203 0247 0251 0284 0292
0394 0494 0537 0545 0584

SEEDS
0007 0008 0011 0078 0101 0135 019
0264 0284 0284 0291 0299 0336 037
0382 0400 0403 0404 0448 0480 052
0524 0526 0528 0587

SELECTION
0223 0235 0257 0260 0270 0271 027
0276 0353 0357 0364 0381 0389 045
0455 0468 0474 0547
PLANT BREEDING
0096 0258 0262 0263 0266 0324 0328
0429 0433 0434 0435 0437 0438 0441
0442 0443 0445 0456 0459 0460 0462
0465 0469 0473 0473 0476 0491 0585
0592

SOIL ANALYSIS
0018 0147 0149 0164 0176 0177 0178
0221

SOIL CONSERVATION PRACTICES
0201

SOIL FERTILITY
0149 0154 0157 0162 0164 0187 0189
0190 0214 0265 0306 0321 0331 0545

SOIL IMPOVERISHMENT
0154 0162 0187

SOIL POPULATION
0306 0306 0321 0331 0337 0340 0343
0347 0352 0359 0387 0391 0535 0580

SOIL REQUIREMENTS
0050 0145 0149 0151 0154 0156 0157
0158 0160 0162 0164 0165 0187 0210
0212 0214 0220 0265 0306 0321 0351
0391 0392 0541 0545 0554 0580

SOIL TEMPERATURE
0064 0191 0220 0388 0391 0544 0545

SOIL WATER
0092 0162 0163 0171 0175 0176 0177
0212 0216 0220 0272 0597

SOILS
0156 0174 0177 0178 0187 0273 0359
0541

SOLAR RADIATION
0136

SPACING
0133 0137 0142 0160 0193 0200 0203
0220 0424
PRODUCTIVITY
0135 0211 0230
YIELDS
0135 0139 0141 0157 0204 0208 0215
0221 0224 0225 0228 0230 0231 0232

0233 0238 0259 0260 0265 0267 0454

STARCH CONTENT
0120 0505 0510 0539 0545

STATISCAL ANALYSIS
0014 0018 0058 0074 0101 0104 0126
0135 0136 0153 0155 0162 0176 0178
0217 0228 0257 0259 0266 0267 0332
0362 0370 0401 0420 0425 0438 0459
0461 0472 0475 0565 0581 0582 0583
0592

STEMS
0007 0008 0012 0069 0072 0079 0461
GROWTH
0019 0079 0090 0092 0095 0097 0155
0175 0591
GIBBERELINS
0117

MINERALS AND NUTRIENTS
0055 0092 0122 0546
TRANSLOCATION
0539

STOMATA
0005 0026 0035 0042 0150 0333 0591
0600

STORAGE
0240 0252 0410 0464 0487 0499 0502
0506 0509 0511 0518 0551 0584 0586
0587
DISEASES AND PATHOGENS
0372
INJURIOUS INSECTS
0394 0398 0407 0590
TEMPERATURE
0118 0527

STORED GRAIN PESTS
0394 0395 0396 0400 0407 0410 0588
0589 0590

SUBTERRANEAN CLOVER STUNT VIRUS
0368

SUCROSE
0099

SUGARS
0079 0539

SULFUR
0049 0094 0168 0504 0512 0523 0524
0594

SYMBIOSIS
0104 0469
NODULATION
0214 0538 0543
MINERALS AND NUTRIENTS
0147 0536 0540 0541

PHOSPHORUS
0546

SYMPTOMATOLOGY
0241 0291 0300 0301 0302 0303 0304
0305 0313 0315 0318 0332 0333 0334
0336 0338 0341 0342 0346 0350 0354
0357 0373 0379 0384 0459 0593 0594

TAXONOMY
0003 0004 0008 0010 0311 0431 0446

TECHNOLOGY
0131 0232 0236 0240 0440 0530 0550
0553 0555 0559 0560 0561 0562 0564
0567 0568 0569 0572 0574

TECHNOLOGY EVALUATION
0131 0553 0554 0560 0561 0562 0568

TECHNOLOGICAL PACKAGE
0240 0555 0569

TEMPERATURE
0045 0054 0064 0085 0118 0192 0212
0246 0312 0333 0354 0362 0388 0391
0401 0422 0444 0461 0527 0547 0589
0598
CARBON DIOXIDE
0031
GROWTH
0086 0123 0175 0216 0220 0462 0473
0591
PHOTOSYNTHESIS
0035 0591
PLANT INJURIES
0061 0126 0210 0216 0591
PLANT RESPIRATION
0031
YIELDS
0136 0175 0253 0462

TETRANYCHUS TELARIUS
0419 0422

TIMING
0137 0163 0164 0169 0183 0188 0191
0205 0213 0223 0228 0230 0239 0241
0251 0253 0262 0269 0279 0345 0356
0364 0398 0420 0424 0461 0539 0590

TISSUE CULTURE
0028 0030 0039 0066 0099 0123

TOBACCO MOSAIC VIRUS
0385

TOXICITY
0036 0050 0052 0054 0068 0073 0077
0084 0263 0346 0462 0486 0516 0591
HERBICIDES
0119
MINERALS AND NUTRIENTS
0055 0056 0063

TRACERS
0028 0039 0041 0049 0076 0079 [illegible]
0098 0119 0182 0184 0524 0539

TRADE
0240 0477 0574

TRANSLOCATION
0053 0119 0539

TRANSPIRATION
0042 0074 0150 0158 0171 0176 0216
0591

UROMANUS PROTEUS
0406

UROMYCES PHASEOLI
0349 0563
DISEASE CONTROL
0143 0239 0281 0235 0317 0319 [illegible]
CHEMICAL CONTROL
0350
ELECTRON MICROSCOPY
0361
ETIOLOGY
0241 0350 0350
HOST-PLANT RESISTANCE
0250 0307 0317 0342 0354 0463 0465
0469
RACES
0307

USA
0012 [illegible] 0037 0049 0085 [illegible]
0101 0117 0118 0134 0160 [illegible]
0220 [illegible] 0260 0264 [illegible] 0268 [illegible]
0294 0312 0347 0371 0396 [illegible]
0519 0520 0531 0535 0575 [illegible]

VECTORS
0365 0368 0369 0366

VENEZUELA
0178 0470 0556

VIGNA SINENSIS
0217 0516

VIRUSES
0213 0278 0280 0365 0368 0370 0371
0372 0373 0374 0375 0376 0377 0378
0379 0380 0381 0382 0384 0385 0386
0440 0444 0474 0563

VIRUS INHIBITION
0376 0380

VIRUS TRANSMISSION
0376 0380

VITAMIN CONTENT
0484 0500 0506 0509 0530

WATER ABSORPTION
0069

WATER CONTENT
0026 0118 0135 0150 0226 0245 0365
0498 0510 0512 0586

WATER REQUIREMENTS (PLANT)
0043 0089 0144 0150 0156 0158 0163
0203 0206 0312 0529 0581

WATER STRESS
0003 0445 0448 0450 0461 0467 0470
0479

WEEDING
0129 0139 0142 0143 0160 0169 0170
0194 0197 0199 0199 0203 0205 0209
0217 0219 0220 0222 0226 0231 0243

WEEDS
0197 0214
HERBICIDES
0193 0205 0207 0217 0220 0222 0226

WHETZELINIA SCLEROTIORUM
0311 0312 0313 0320 0364 0563
DISEASE CONTROL
0143 0280 0281 0337 0352
CHEMICAL CONTROL
0334 0345

WILTING
0321

XANTHOMONAS PHASEOLI
0279
DISEASE CONTROL
0143 0280 0231 0285 0286 0287 0296
0299
HOST-PLANT RESISTANCE
0291 0459

PLANT BREEDING
0459
SEED TRANSMISSION
0292

XANTHOMONAS PHASEOLI VAR FUSCANS
0291 0292 0300

YIELD COMPONETS
0008 0014 0018 0021 0093 0101 0104
0139 0147 0155 0175 0190 0186 0204
0208 0225 0228 0231 0242 0256 0265
0267 0276 0378 0441 0442 0532

ZABROTES SUBFACIATUS
0398 0407 0410 0588 0590

ZEA MAYS
0010 0046 0074 0386 0390 0499 0567
INTERCROPPING
0132 0170 0181 0224 0229 0230 0233
0235 0243 0256 0267 0554

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	Kilroentgen(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
NCF	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	≥	Equal to or greater than
μ	Micro	±	Plus or minus
%	Percent(age)	Ø	Diameter
>	More than, greater than	≪	Much less than
<	Less than	≫	Much greater than
≤	Equal to or less than		