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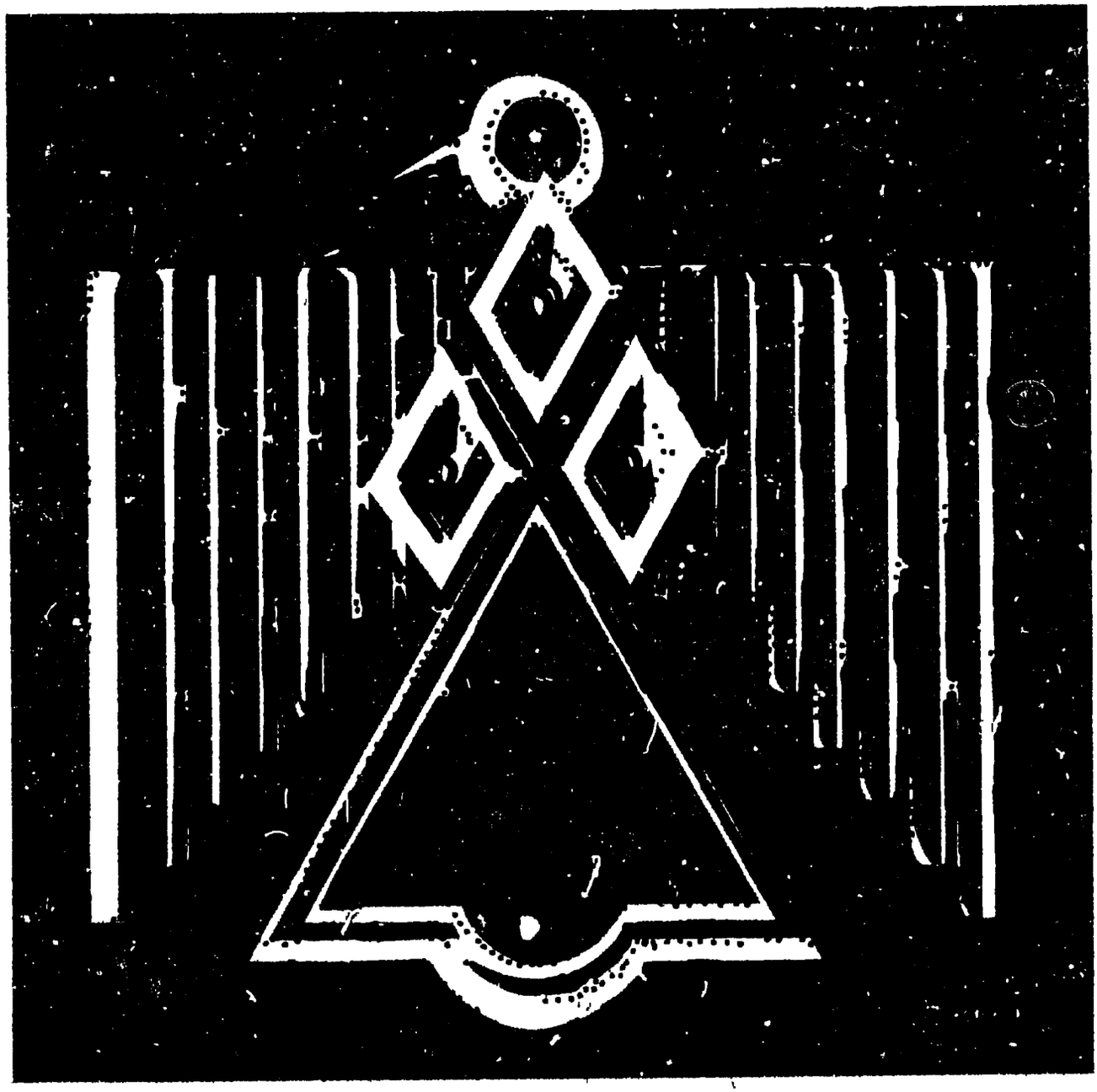

TENNESSEE VALLEY AUTHORITY

FOREWORD

For nearly a decade, TVA has been extending its fertilizer expertise to developing nations by furnishing in-country assistance, providing training for key government and industry leaders, and conducting technical and economic studies of particular interest in these regions Most of this effort has been at the request of the U S Agency for International Development

Part of the overall broadening of assistance has been the development of library facilities at the National Fertilizer Development Center, Muscle Shoals, Alabama, into a worldwide capability This, too, has been supported by AID The Agency was particularly anxious to make available to AID technicians and those trained under AID sponsored programs the most recent literature published on nutrition of the primary food crops–namely rice, maize, and wheat This is a goal not easily achieved in many parts of the world, in many cases, workers find themselves in situations where library facilities at local universities and experimer t stations are quite limited or in some cases totally absent

Nutrition of Maize is the first in a series of bibliographies being prepared on basic food crops Although not exhaustive, it contains many of the most important articles written in the past 5 years on the use of fertilizer on maize The short abstract included with each title should enable the researcher to decide whether the article is relevant to his interests All references in this bibliography were selected from primary or secondary sources in the Technical Library of the NFDC The complete text of most articles is on file in the NFDC Technical Library

The bibliography itself is arranged into sections according to geographic regions suggested by the *Worldmark Encyclopedia of Nations,* 3rd ed (Harper & Row, New York, 1967) Within sections, abstracts are arranged alphabetically by country in which the work was done or, if unknown, the country in which the work was published

Nutrition of Maize would not have been possible without the cooperation and assistance of many individuals and organizations Several institutions were particularly helpful in furnishing information and in permitting use of abstracts from their publications They and their identifying notations are

1 The Commonwealth Agricultural Bureaux (Publishers of *Soils & Fertilizers,* shown as SF, and *Field Crop Abstracts*, shown as FCA)
2 Chemical Abstracts Service (shown as CA)
3 Royal Tropical Institute, Amsterdam (shown as Trop Abst)
4 Dissertation Abstracts International (shown as Diss Abstr)

Other abstracts were taken from TVA's *Fertilizer Abstracts* (shown as FA) Also, special appreciation is in order to AID for the financial support that helped insure the success of this project

Funds and time permitting, it is the intent of the Technical Library of the NFDC to collect additional material as it appears in the world literature and to publish a supplement to *Nutrition of Maize* every 2 years If this can be accomplished, researchers and technicians working on maize problems in remote areas of developing countries will have an opportunity to keep up to date with the latest published literature of the field

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AFRICA

GHANA

1 Ofori, C S 1966 *The Effect of Simazine Treatment on the Growth and Nutrient Absorption of Young Maize Plants* Ghana J Sci 6(1/2) 37-40 (Eng) (Ghana Acad Sci, Kumasi)

Simazine applied at three rates, 2 5, 5, and 10 lb active ingredient per acre showed a decrease in yield of maize plant compared with control irrespective of maize variety Some varieties might be more affected than others Varietal differences might be due to pl. t g depts or to various degrees of root mass development of the varieties Root development of maize was restricted in the simazine soil layer, and the ratio of top to roots increased with increasing rate of simazine application Percentage of N in simazine treated plant material increased with increasing rate of herbicide application but total N uptake decreased as result of decrease in plant yield Percentage of P as well as total P absorbed increased with increasing rate of simazine application, while percent K was largely unaffected (BA 50 105998)

2 Ofori, C S 1968 *Pesticide Effect on Phosphorus Absorption from Fertilizer Pesticide Mixtures Applied to a Tropical Soil with Low Available Phosphorus Value* Ghana J Agr Sci 1(2) 99 102 (Eng)

In pot experiments conducted in Ghana, the yield of maize was not significantly affected by application of fertilizer pesticide mixtures Total N and P, and percent N absorbed by the various treated plants were not significantly affected but the fertilizer P uptake was reduced by 13% after application of 1 12 kg aldrin a i /ha The fertilizer dieldrin mixture gave similar results The reduced efficiency of P may have been caused by fixation of P by kaolin which was added as a diluent (Trop Abst 24 1484)

3 Ofori, C S, Nandy, S 1969 *The Effect of Method of Soil Cultivation on Yield and Fertilizer Response of Maize Grown on a Forest Ochrosol* Ghana J Agr Sci 2 19 24 (Eng) (Ghana Univ, Kumasi)

Maize yield increased by 15% on plowing to 9 in depth as compared to unplowed land, deeper plowing (15 in) had no additional effect There was no significant response to N and K, effect of P was significant and increased with plowing depth Application of N significantly depressed pH on unplowed land after three seasons of cropping (SF 32 3995)

KENYA

4 Anon 1968 *Maize Population and Spacing Recommendations for 1968* Kenya Farmer 139 10 11 (Eng)

In 1967, five spacing x N fertilizer trials were conducted in Kenya at altitudes around 2,000 m with the best maize varieties developed at Kitale, viz Kitale hybrid 613B, Embu hybrid 511, and Katumani Composite B, which are recommended for areas with rainy seasons of over 110, 110 90, and 90 70 days, respectively In general, N fertilizer considerably reduced lodging, it increased yields more at high plant densities than at wide spacings A plant density of 36,000/ha is recommended except for the medium and late ripening varieties on fertile soil, when 50,000 plants/ha is better, at least 20% more seed should be sown than is theoretically required Row spacings may be from 60 to 90 cm according to the available implements, narrow inter row spacings give better weed suppression (Trop Abst 23 1576)

5 Drysdale, V M 1965 *The Effects of Variety, Fertilizer and Site on the Nitrogen Content of Maize Grain* Kenya Farmer 106 16 19 (Eng)

Identical N x P x variety x planting density trials with maize were conducted in Kenya on two sites with topsoils containing 0 17% and 0 36% N, respectively The N content of the grain of hybrid 611 was always lower than that of hybrid 621, but both varieties yielded similar amounts of N in the grain per ha The N content of the grain and the yield of both varieties were lower on the poorer soil, they were enhanced by N fertilizer on the poorer soil only P fertilizer had no effect either on the N content of the grain or the yield An increase in the plant population from 18,000 to 49,000/ha resulted in a decrease of the N content of the grain and of the yield of both varieties on the poorer soil, on the richer soil it caused a slight reduction of the N content only in hybrid 611 while increasing the yield of both varieties (Trop Abst 20 2185)

6 Drysdale, V M 1965 *The Removal of Nutrients by the Maize Crop* East Afr Agr Forest J 31(2) 189 90 (Eng) (Natl Agr Res Sta, Kitale)

As the yields of grain increase, there is a concomitant increase in total content of dry matter, N, P, and K of the crop as a whole If it is assumed that the whole crop, composed of the grain, empty cobs, and stover, is removed from a field, a modest crop removes the equivalent of $\leqslant 1$ cwt of superphosphate/acre, 2 3 cwt of $(NH_4)_2SO_4$ or NH_4NO_3/acre, and slightly >1 cwt of K_2SO_4/acre, while a good crop removes, 2, 4 5, and 3 cwt/acre, respectively (CA 66 64670p)

7 Semb, G, Garberg, P K 1969 *Some Effects of Planting Date and Nitrogen Fertilizer in Maize* East Afr Agr Forest J 34 371-81 (Eng) (EAAFRO, Muguga, Nairobi)

Maize was planted in a humic ferrisol at the end of March when the rains started and 2 and 4 weeks later, and fertilized with 0, 45, and 90 kg/ha N as calcium ammonium nitrate Dry matter yields and N uptake were significantly higher for the earliest planted maize than for later planted maize at the tasselling stage and at harvest The grain yield was also higher for the first planted maize There was no significant response to N fertilizer and no interaction between fertilizer and date of planting Soil moisture and rainfall data show that the first planted maize had a far better water supply than the later planted maize, particularly between planting and tasselling (SF 33 4819)

8 Weiss, E A 1967 *Fertilizer Trials on Maize and Wheat* East Afr Agr Forest J 32(3) 326-40 (Eng) (C I B A, Osaka, Japan)

A detailed and comprehensive series of fertilizer trials on

maize and wheat were carried out from 1960 to 1965, to determine the most profitable applications of phosphate and N and the effects of various forms of both, in the seedbed and as topdressings There was a basic difference in crop response from similar levels of fertilizers on the two main soil types which occur in this area Crops grown on soils derived from granite and gneiss require less phosphate in the seedbed and more N top-dressing for optimum yields than those grown on soils derived from phonolites The residual effect of annual applications of phosphate on both soil types was found to be high Various types of phosphate and N fertilizers were compared and the effect of varying ratios of N P in the seedbed investigated N topdressing of maize was essential for maximum yields on all soil types but the optimum amount varied It would appear that even distribution of the fertilizer was more important than the method of application Mechanical spreading was effective and speedy Seedbed applications of Mg sulfate to acid volcanic soils in the Nandi Border area increased yields, the increase being greater in the presence of seedbed N Liming also increased yields on these soils, but the amounts required made its use unprofitable and on other soil types may have little effect on crop yields Potash generally depressed yields and no other fertilizer had any significant effect Foliar nutrient sprays had little effect on below average crops of both wheat and maize (FA 1 615)

MALAWI

9 Brown, P 1966 *Maize Growing in Nyasaland (Malawi) II Fertilizer Requirements* Exp Agr 2(1) 49 60 (Eng)

Fertilizer trials with maize conducted in Malawi have shown that a chronic lack of N is found on all but a few soils Phosphorus also becomes limiting quite rapidly on certain soil types as a result of permanent cultivation, but there has so far been little response to K or Ca Incipient S shortage is automatically corrected by the use of sulfate of ammonia and single superphosphate Trace elements have not been widely tested Samples of organic manure vary widely in moisture and nutrient content, and their N status is frequently low, it is safest to consider manure as primarily a source of P, K, and minor elements, and to supplement it with fertilizer N It should be possible, with good cultivation of synthetic varieties and improved selections, to obtain maize yields of 3 3-4 5 tons/ha with fertilizer dressings of up to 90 kg/ha of the limiting nutrients (Trop Abst 21 1003)

NIGERIA

10 Agboola, A , Udom, G E 1967 *Effects of Weeding and Mulching on the Response of Late Maize to Fertilizer Treatments* Nigerian Agr J 4(2) 69 72 (Eng)

Field trials with maize, variety Nigerian Synthetic 1, showed that application of grass mulch at 10 12 tons/ha, 2 days before sowing, almost doubled the mean soil moisture content in the dry season from 4 3% in the bare plots to 7 8% in treated plots Concurrently, dry grain yields rose by some 50% 100%, to 4 1 tons/ha in the presence of adequate fertilizers, as compared with bare, unfertilized conditions Dressings of fertilizer appeared to have only an effect under mulched conditions, whereas weeding alone increased yields considerably under unmulched conditions (Trop Abst 25 t2051)

11 Agboola, A 1967 *The Influence of Fertiliser Placement on the Yield of Maize* Nigerian Agr J 4(1) 32-4 (Eng)

In Nigeria, fertilizer trials with local maize, variety Lagos white, were conducted during two consecutive seasons N at 160 kg, 45 kg P_2O_5 in water soluble form, and 67 kg K_2O/ha were applied in circular furrows 5 cm from the plant, or in 2 bands on either side and 5 cm from the plant Compared with untreated plots and plots receiving broadcast fertilizer, ear yields increased by 84% and 58%, respectively (Trop Abst 25 2070)

12 Amon, B O E 1967 *The Response by Crops in a Rotation to Nitrogen, Phosphorus and Potassium in the Savannah Zone of Western Nigeria* Publ Comm Techn Cooper Africa 98 339-48 (Eng)

This paper describes NPK fertilizer trials with maize, yams, and cassava, conducted at two locations in the derived savanna zone of West Nigeria The crops were grown in a rotation on soils derived from metamorphic rocks mainly gneisses and granites With all crops, particularly with maize, highly positive responses to N fertilizer applied at rates of 28, 56, and 84 kg/ha were obtained, 56 kg N/ha was the optimum dressing Responses to P fertilizer, applied at rates of 22 and 44 kg P_2O_5/ha, were variable for maize, negative for yams, and positive for cassava Responses to K fertilizer, applied at rates of 67 and 134 kg K_2O/ha, were variable for maize and cassava, and positive for yams (Trop Abst 22 1535)

13 Bromfield, A R 1969 *Uptake of Phosphorus and Other Nutrients by Maize in Western Nigeria* Exp Agr 5(2) 91 100 (Eng) (Ministry of Agr , Ibadan, Western Nigeria)

Maize, variety NS1, was planted on ridges in a sandy loam soil in the dry rainforest zone The final population was 14,520 plants/acre Fertilizer applied was ammonium sulfate at 1 cwt/acre 2 weeks after seedling emergence and another 2 cwt 2 weeks later, 11 2 lb/acre of P as ordinary superphosphate tagged with ^{32}P, and 0 75 cwt/acre of 50% muriate of potash Both the P and K were applied 2 weeks after seedling emergence The soil was high to very high in N, P, and K, due to residual fertilizers Uptake of N, P, and K was determined from 2 weeks after emergence until harvest at 17 weeks Total uptake was 126 lb/acre N with 66% in the ear, 11 4 lb/acre P with 78% in the ear, and 78 lb/acre K with only 17% in the ear Nutrient uptake by the ear was linear for N and K but not P Absorption of P, as measured by ^{32}P, showed two peaks at 3 5 weeks and 11-13 weeks, 20% of the applied P was found in the plants (FA 2 1123)

14 Fayemi, A A 1966 *Effects of Time of Nitrogen Application on Yield of Maize in the Tropics* Exp Agr 2(2) 101 5 (Eng)

A 4 year study, conducted in West Nigeria from 1958 to 1962, showed that split applications of N fertilizer significantly increased maize grain yield by 35% when two equal doses were given 1 month and 2 months after planting, and by 31% when four equal doses were supplied at planting and 1, 2, and 3 months after sowing Yield was significantly

reduced when application was delayed until 2 months after planting High yields of maize were not obtained by supplying the whole of the N fertilizer at one time, either at sowing or at any time later in the growing season However, applying all of the N fertilizer 1 month after planting significantly increased the percentages of N and crude protein of the grain The maize ear weight was favorably influenced by spreading the N application over the 3 month period of maize growth (Trop Abst 21 2038)

15 Federal Department of Agricultural Research *An Index of Agricultural Research and Related Subjects in Nigeria.* Published annually on behalf of the Agricultural Technical Committee, Ibadan, Nigeria (Eng)

16 Goldsworthy, P R 1967 *Responses of Cereals to Fertilizers in Northern Nigeria II Maize* Exp Agr 3(4) 263 73 (Eng) (Ahmadu Bello University, Samaru, Zaria, Northern Nigeria)

Field trials in Northern Nigeria from 1957 to 1964 showed that introduced varieties of maize responded economically to N and P fertilization Ammonium sulfate and superphosphate, each at three levels and in all possible combinations were used, in replicated trials on farmer fields Response was measured on the first or second crop after a bush fallow of 2-4 years Three responsive areas were defined In two of the areas, involving a million acres, optimum economic application is about 59 0 lb/acre of N and 35 4 lb/acre of P_2O_5 At this rate, yield can be expected to increase about 230% or 1,172 lb/acre of grain In the third area, only P is required (FA 1 313)

17 Okonkwo, G T 1966 *Brief Review of Maize Fertiliser Trials in Eastern Nigeria* Sols Afr 11 241-43 (Eng, Fr) (Research and Training Station, Umudike, East Nigeria) (SF 30 1380)

18 Oputa, C O, Waterworth, J V 1967, *NPK Fertiliser Trials on Early Maize (1964)* Nigeria Midwest Reg Min Agr Natur Resources Exp Rep 61 10 pp (Eng)

19 Oputa, C O, Waterworth, J V 1967 *NPK Fertiliser Trials on Late Maize (1964)* Nigeria Midwest Reg Min Agr Natur Resources Exp Rep 64 9 pp (Eng)

20 Waterworth, J V, Oputa, C O 1967 *NPK Fertiliser Trials on Late Maize (1965)* Nigeria Midwest Reg Min Agr Natur Resources Exp Rep 81 10 pp (Eng)

21 Waterworth, J V 1967 *NPK Lime-Trace Element Trial on Early and Late Maize (1964)* Nigeria Midwest Reg Min Agr Natur Resources Exp Rep 62 3 pp (Eng)

RHODESIA

22 Alvord, E D 1969 *The Nitrogen Fertilization of Irrigated Hybrid Maize on Sandveld Soils* Rhodesia Agr J 66 139-43 (Eng)

Experiments in growing maize under supplementary irrigation were carried out on (a) granite sandy loam of pH 5 8, (b) red loamy sand of pH 5 4, and (c) granite sandy loam of pH 5 6 Preceding crops were a *Paspalum plicatulum* Michx pasture, maize, and groundnuts, respectively On (a) and (b) application of different proportions of N at planting and 5 weeks later had no significant effect on yield, but on (c) yields were significantly decreased when the first topdressing of N was applied 8 weeks after planting With a basal dressing of 40 lb/acre, best results were obtained when 2/3 of the total (190 lb acre) were applied 4 weeks after planting, and 1/3 after 8 weeks At 220 lb N/acre, best results were obtained with 3 equal amounts applied 4, 8, and 12 weeks after planting (SF 33 3186)

23 Fenner, R J, Goldring, O L 1968 *The Application of Boron-Containing Fertilizers to Maize* Rhodesia Agr J 65(5) 112 (Eng)

With the increasing use of B-containing fertilizers in maize, it was decided in Rhodesia to investigate the level at which an application of B became toxic to this crop In the greenhouse various amounts of boron were added to 3 types of soil, viz to clay 0, 22, 45, 90, or 134 kg B/ha, to sand 0, 17, 45, 67, or 78 kg/ha, and to acid washed sand 0, 11, 22, 45, or 67 kg/ha The treatments were incorporated to a depth of 15 cm The maize was grown for 4 weeks after emergence Toxic effects were observed only in the acid washed sand containers that received 67 kg B/ha In these containers, maize remained stunted and chlorotic right from emergence It can thus be concluded that under normal farming practices B toxicity is unlikely to occur in maize from the use of the present range of B containing fertilizers (Trop Abst 24 978)

24 Fenner, R J, Rattray, A G H 1966 *The Residual Effect of Nitrogen Applied to "Panicum coloratum" (Makarikari) ley* Rhodesia Agr J 63(4) 93 6 (Eng) (Dep Res Spec Service, Salisbury)

When 0, 80, and 160 lb N/acre/yr were applied to Makarikari grass from 1955 to 1960, the residual effect of 80 lb N on maize yields averaged 2 2 bags (200 lb each) of grain during the first 2 years of maize cultivation and that of 160 lb N was 6 2 bags/acre, there was no effect in subsequent years Direct application of N at 60 and 120 lb N/acre raised yields of maize by 6 6 and 8 8 bags/acre, respectively (FCA 20 897)

25 Grant, P M 1967 *The Fertility of Sandveld Soil Under Continuous Cultivation II The Effect of Manure and Nitrogen Fertilizer on the Base Status of the Soil* Rhodesia Zambia Malawi J Agr Res 5 117 28 (Eng) (Agr Res Council, Marandellas, Rhodesia)

During the first five seasons of cropping to maize on acid granite sand with 60 lb/acre P_2O_5, 50 lb K_2O, and 20 120 lb N, soil pH, exchangeable K, and Ca contents of the plowed layer were maintained, but exchangeable Mg was depleted Concentration of Mg in maize leaves at tasselling decreased to a deficiency level by the fifth season, but concentrations of other nutrients were not affected except for P, which increased with increasing duration of cultivation Annual applications of 400 lb/acre calcitic lime reduced soil acidity, but had no effect on mineral composition or weight of maize leaves Annual applications of 3 6 tons/acre manure progressively increased CEC, exchangeable bases, soil pH and weight, and mineral concentration of maize plants (SF 31 818)

26 Meiklejohn, J 1967 *Microbiological Observations on an Experiment with Compost* Rhodesia Zambia Malawi J Agr Res 5(1) 43 55 (Eng)

In Rhodesia, a trial with maize on a sandy soil had shown responses to compost and N fertilizer, and a positive interaction of these factors Microbiological studies in the second and third years of the trial demonstrated that both com post and N fertilizer increased the number of cellulose decom posing organisms Aerobic N fixing bacteria (*Beijerinckia* spp) were slightly increased in number by the fertilizer only, whereas anaerobic N fixing bacteria (*Clostridium* spp) were increased by either fertilizer or compost The fertilizer increased the number of ammonia oxidizers independently of compost, that of nitrite oxidizers only in the absence of compost, both groups of autotrophic nitrifying bacteria were considerably increased in numbers by compost (Trop Abst 23 251)

27 Rodel, M G W, Mills, P F L, Boultwood, J N 1967 *An Experiment with Maize on Tatagura Soil* Rhodesia Agr J 64(5) 102 3 (Eng)

Nitrogen, phosphorus, and potassium applications

28 Willatt, S T 1969 *Moisture Withdrawal Patterns of Maize at Different Fertility Levels* Rhodesia J Agr Res 7(1) 51-4 (Eng) (Agr Res Council, Malawi, Mlanje)

Changes in soil moisture in field trials at Marandellas, Rhodesia, were measured under maize receiving 20 lb N (low fertility), 120 lb N (medium fertility), and 120 lb N + farmyard manure at 6 tons dry matter/acre (high fertility), using gypsum blocks placed in the maize rows at depths down to 60 in High fertility plants used most water, depleting soil moisture to a depth of 48 60 in in both 1965 66 (a year with drought in the middle of the rains) and 1966 67 (with normal well-distributed rainfall) Low fertility plants exhausted soil moisture only to 48 in in 1965-66, and in 1966 67 did not exhaust moisture at any depth This was reflected in yield differences of 14 7 and 12 0 bags grain/acre in 1965 66 and 30 6 and 4 4 bags/acre in 1966 67 for high fertility and low fertility plots, respectively (1 bag = 200 lb) (FCA 23 181)

SIERRA LEONE

29 Enyi, B A C 1966 *Effect of Magnesium, Phosphorus and Zinc on the Growth and Yield of Maize* Beitr Trop Landw VetMed 4 17 26 (Eng) (Njala, Sierra Leone)

A basal dressing of 300 lb/acre $(NH_4)_2SO_4$ and 60 lb/acre KCl was applied to soil which had previously produced poor maize crops In addition 0 or 150 lb Mg, 0, 250, or 500 lb super and 0, 50, or 100 lb ZnSO were applied 2 days before sowing Mg and P increased total dry and fresh weights, plant height, number of leaves, and grain yield Mg was more effective in the presence of P and vice versa 250 lb super was the optimum rate Applications of Mg and P increased the N, P, and Mg uptake of plants There was no advantage in applying Zn when P and Mg supplies were adequate (SF 30 2225)

SOUTH AFRICA

30 Beyers, C P de L 1968 *Zinc Fertiliser for Maize* Farming S Africa 44(7) 9, 14 (Eng)

In the Republic of South Africa, where maize is locally grown on acid light textured soils, the acidity is corrected by application of lime Under these conditions maize often shows symptoms of Zn deficiency A series of field trials were, therefore, conducted for 3 years to study the effect of various Zn compounds on maize Because of the fact that the Zn deficiency symptoms in untreated maize gradually disappeared, the treatments with Zn fertilizers had no significant effect on green matter yield However, Zn fertilized plots generally gave slightly higher ear yields Zinc sulfate, Zn metal powder, and Zn oxide were equally effective, Zn uptake was highest when the fertilizers were broadcast It is concluded that Zn fertilizer applied at a rate of about 5 kg/ha corrects Zn deficiency for at least 3 years (Trop Abst 24 773)

31 de Villiers, J B M, Laker, M C 1966 *Effect of Preapplied Lime and Zinc on the Uptake of Phosphorus by Sweet Corn* S Afr J Agr Sci 9(1) 107 15 (Afr) (Univ Stellenbosch)

Many South African corn soils are very acid and P deficiency rapidly develops whenever the soil pH drops below 4 5 Lime application generally favors P uptake Field experiments were executed on soil plots previously fertilized during several years with N, P, and K Separate plots received no treatment (control), lime, Zn, or Zn and lime They were planted with Stowell's Evergreen sweet corn in 4 rows, spaced 3 ft apart Each row received 24 33 g KH_2PO_4, but 2 rows also were treated with 201 6 μc ^{32}P/mound Plant material was collected 4, 8, and 15 weeks after planting Roots and tops were separated, dried, wet ashed, analyzed, and assessed for ^{32}P activity The weight was generally higher on treated plots, except on Ca plots 4 weeks after planting Differences remained small Total P uptake was higher on all treated plots, Ca treatments after 4 weeks excepted P concentration in the plants was increased by Zn and Ca, but much more by Ca than by Zn, nevertheless, no effect on P distribution between roots and tops was found The increased P uptake did not necessarily result in ameliorated plant growth, because liming had a detrimental effect on Zn uptake, thus giving a slower growth, at least during the first weeks after planting (CA 65 12818f)

32 Dijkhuis, F J, Dudding, F C, Clayton, J H 1969 *Fertilization of Maize* Fert Soc S Africa J 2 15 18 (Eng)

33 DuPlessis, I S, Mohr, P J 1969 *The Relationship Between Row Width, Plant Population and Fertilization of Maize in the North Eastern Orange Free State* Fert Soc S Africa J 2 10 12 (Eng)

34 du Plooy, J, le Roux, D P 1968 *The Fertilization and Plant Density of Maize Grown Under Conditions of Low Rainfall* S Afr J Agr Sci 11(1) 103 11 (Eng)

An experiment with maize grown at three plant densities and under conditions of insufficient soil moisture was conducted in the Republic of South Africa Over a period of 9 years, a crop planted at a density of 12,000 plants/ha yielded

significantly more than crops planted at twice or three times that density N application at the rate of 20 or 40 kg/ha increased the yields of the higher densities significantly K fertilization did not increase the yield, while calcitic lime had favorable effect only after 7 years Soil moisture appeared to be the limiting factor (Trop Abst 23 2454)

35 Quicke, G V, von Fintel, R G H, De Muelenaere, H J H 1964 *The Effect of Soil Fertilization Practices on the Total Protein and Zein Content of Maize* S Afr Med J 38(29) 645-48 (Afr) (Agr Res Inst, Pietermaritzburg, S Africa)

During two seasons, Teko Yellow maize received three levels of N, P, K, lime, and trace elements or no trace elements N produced small increases in (grain) protein content, while the other treatments tended to reduce it Zein content was increased by N It was concluded that fertilizers could do little to improve grain protein quality (FCA 19 153)

36 Sander, C L, Grobler, J H 1966 *Effect of Exchange Capacity and Exchangeable Cations of Clay Suspensions on the Root and Stem Development of Maize Seedlings* S Afr J Agr Sci 9 539-45 (Afr) (LandbNavorsingsinst Hoeveldstreek, Potchefstroom)

The effect of increased cation exchange capacities (CEC) at the same cation saturation was investigated in different concentrations of kaolin and bentonite suspensions The ratio of adsorbed $K^+ \sqrt{Ca^{2+} + Mg^{2+}}$ on the clay was altered by equilibration, respectively, with 1% solutions of KCl, $CaCl_2$ $2H_2O$ and $MgCl_2$ $6H_2O$ in order to study the effect of the energy of attraction for different cations An increase in cations exchange capacity had no significant effect on root and stem development for the first 3 days While root development in K^+ bentonite was relatively better than that in Ca^{2+} or Mg^{2+} bentonite, it was poorest in K^+ kaolin The effect of the composition of the adsorption complex on seedling growth was thus due to the energy of attraction of the clay for a specific cation and to different cation ratios in the equilibrium solution Evidently, Ca is preferentially adsorbed by bentonite (SF 30 1582)

TANZANIA

37 Addiscott, T M 1969 *Relations of Yields of Maize and Cotton, and Their Response to Phosphate Fertilizer, with Soil Phosphate Potentials in Tanzania* J Agr Sci 72(pt 3) 401 3 (Eng) (Western Res Cent e, Mwanza)

Responses to phosphate fertilizer were not clearly related to the values of monocalcium phosphate potential, $(\frac{1}{2}pCa + pH_2PO_4)_{eq}$, but small responses at the large values of phosphate potential sometimes corresponded with very small values of $\Delta I/\Delta Q$, which represents the rate of change of $\frac{1}{2}pCa + pH_2PO_4$ with change in the amount of P in the soil or with soils of pH $<5\ 0$ or $>7\ 5$ All alkaline soils gave small responses but not all acid soils In only one set of maize experiments was the response to P related to $\Delta I/\Delta Q$ Regressions of yields of maize without P and responses to P on values of $(\frac{1}{2}pCa + pH_2PO_4)_{eq}$ and $\Delta I/\Delta Q$ together did not account for significantly more variation than single regressions $(\frac{1}{2}pCa + pH_2PO_4)_{eq}$ was not found to be more useful than $(\frac{1}{2}pCa + pH_2PO_4)_0$ Both $(\frac{1}{2}pCa + pH_2PO_4)_0$ and $(pH_2PO_4)_0$, determined without adding P to the $CaCl_2$ solution, were equally useful and were just as well related to yields without P as $(\frac{1}{2}pCa + pH_2PO_4)_{eq}$, but the $(pH_2PO_4)_0$ was more useful than the logarithm of the total P concentration measured without added P in all three sets of experiments Yields without P can be estimated from phosphate potentials Since neither phosphate potential nor $\Delta I/\Delta Q$ predicted response consistently, such measurements will probably be useful only when other factors limiting yield are identified (CA 71 60227e)

38 Anderson, G D 1970 *Fertility Studies on a Sandy Loam in Semiarid Tanzania I Effects of Nitrogen, Phosphorus, and Potassium Fertilizers on Yields of Maize and Soil Nutrient Status* Exp Agr 6(1) 1 12 (Eng) (Min Agr Co-Op, Tanzania)

N and P fertilizers applied to maize had considerable effects over a 5 year period, especially when both were given Initial applications of 47 lb P_2O_5/acre with annual dressings of 58 lb N produced a mean yield increase of 55% above the control K gave little response in the first 3 years, but thereafter became more important Ammonium sulfate nitrate at 1,120 lb caused reductions in soil pH, Ca, Mg, K, and total and organic P, but increases in exchangeable Mn and soluble P Double superphosphate at 112 lb increased the total and organic P and 65 lb K_2O reduced organic P Organic C showed a mean loss of 33% over 5 years Recommendations are made regarding P_2O_5, N, and K on this soil (CA 72 89321n)

39 Robinson, J B D, Semb, G 1968 *Advisory Soil or Plant Analysis and Fertilizer Use I Comparison of Soil Analysis Methods* East Afr Agr Forest J 34(1) 117-39 (Eng) (East African Agr Forestry Res Org, Nairobi)

From a series of maize fertilizer trials in Western Tanzania, 124 soil samples, representing 16 soil types, were collected during a 3 year period These were used to compare four analytical methods for extractable P, K, Ca, and Mg P methods evaluated were (*I*) an ammonium lactate acetic acid extraction with ammonium molybdate/stannous chloride color development, (*II*) Truog's weak sulfuric acid extraction with the above color development procedure, (*III*) mixed hydrochloric and sulfuric acid extraction with ammonium vanadate ammonium molybdate used for color development, and (*IV*) the mixed acid extraction followed by color development using an ascorbic acid reagent *IV* was the least satisfactory method of measuring extractable P *I* was variable in the amount of P extracted but had the advantage of simultaneous extraction of K, Ca, and Mg The cations were extracted as in *I* and *III* above and with neutral normal ammonium acetate Analysis was either by the atomic absorption spectrophotometer or by the flame photometer for K and Ca and thiazol yellow color for Mg Ammonium acetate was the least variable extractant for Mg while K and Ca were relatively unaffected by extraction method when soil pH was in the acid neutral range More suitable analytical methods are needed for alkaline soils Within the range of soil type and analytical data encountered, it was possible to convert analytical values from any method into equivalent values for any other method (FA 2 732)

40 Robinson, J B D 1968 *Advisory Soil or Plant Analysis and Fertilizer Use II Evaluation of Soil Analysis Methods with Maize Yield Data* East Afr Agr Forest J 34(1) 140-52 (Eng) (East African Agr Forestry Res Org, Nairobi)

Soil samples from 126 field experiments testing N, P, and K fertilizers on maize (variety Katumbili) in Western Tanzania, were analyzed for N index (two methods), extractable P, K, and Mg (each by four methods) N index group values were related to the average yield of unfertilized maize and to maize responses to 45 and 90 kg N/ha applied as ammonium sulfate P group values were related to the average yield response of maize to 45 and 90 kg P_2O_5/ha applied as single or double superphosphate The ammonium lactate acetic acid extraction provided the best differentiation between responsive and unresponsive soils Although N and P methods did not have a high correlation with yield response, they still can be used to predict profitable use of fertilizer A comparison between analytical methods for extractable K and Mg in the soils was attempted in the absence of maize yield response data Some evidence suggests that there is a need to establish critical calibration relationships covering low analysis soils for these nutrients Some evidence also supports the conclusion that the majority of these soils contain satisfactory levels of available K and Mg and that these nutrients were not limiting to maize yield response when N and P fertilizers were applied (FA 2 733)

41 Robinson, J B D 1969 *Advisory Soil or Plant Analysis and Fertilizer Use III Relationships Between Soil pH and Maize Yield Responses to Nitrogen and Phosphorus* East Afr Agr Forest J 34(4) 436-40 (Eng) (Nairobi, Kenya)

Maize yield responses to two rates of N or P fertilizer and soil pH values have been examined in Western Tanzania No relationship was found for N fertilizer responses Maize yield responses to P fertilizer decreased as the topsoil pH approached 7 0 This should be of use in soil P analysis (Biol Abst 51 132876)

42 Scaife, M A 1968 *Maize Fertilizer Experiments in Western Tanzania* J Agr Sci 70(2) 209 22 (Eng) (Western Res Center, Ukiriguru, Mwanza, Tanzania)

Results of 132 maize fertilizer experiments (NP and NPK) carried out over 3 years in Western Tanzania have been grouped to give 16 'response areas' Responses to N and P were very large in the southwestern half of the research zone, where rainfall is fairly well distributed On granitic soils around Lake Victoria, responses were mainly to N alone In the drier areas, notably Shinyanga district, responses to both N and P were on average very small No significant positive responses to K were found, except for one trial in Karagwe district It was found that all observed responses to N and P could be accounted for in terms of a generalized two factor Mitscherlich Baule yield equation, with constant curvature terms, c_n and c_p Using this equation it is possible to define 'maximum economic requirements' of the nutrients N and P for various maize and fertilizer prices and potential yields The difference between this maximum requirement and the amounts of these nutrients supplied by the soil (given by the Mitscherlich Baule parameters b_n and b_p,) represents the optimum rate of fertilizer application, where profit per acre is at a maximum Empirical equations are presented for estimating b from soil analysis results for areas not adequately covered by these experiments, but such estimates may not always be accurate (FA 1 1080)

43 Scaife, M A 1969 *A Simple Means of Determining Maize Fertilizer Requirements* E Afr Agr Forest J 34(4) 461 63 (Eng) (Western Res Center, Ukiriguru)

Tables are presented by means of which optimal rates of N and P fertilizers for maize may be estimated from the yields of an unfertilized maize crop and soil analysis figures The basis of the method, developed in Western Tanzania, is a two factor Mitscherlich yield equation with 5 parameters, 2 of which are regarded as constant and 2 are estimated from the empirical regression which has been found to exist on soil analysis results The remaining parameter is estimated from the yield of an unfertilized crop, thus completing the yield equation from which economic optima may be deduced (Trop Abst 25 1294)

UGANDA

44 Stephens, D 1966 *Effects of Heavy Applications of Triple Superphosphate on Maize and Cotton in Buganda Clay Loam Soil* East Afr Agr Forest J 31(3) 283 90 (Eng)

Each year for 3 years 170 lb P_2O_5/acre as triple superphosphate was applied in various ways designed to maximize its effects, and it was also applied in conjunction with supplementary fertilizers, farmyard manure, or lime The effects on yields of corn and cotton taken in conjunction with the results of soil and leaf analyses indicate that although the fertilizer P was taken up by the plants, the applied P reduced rather than increased yields It is concluded that on this Buganda clay loam soil the previous poor responses to applied P cannot be improved by applying heavy rates of P (CA 66 64682u)

UNITED ARAB REPUBLIC

45 Amer, F, Salam, M A, Osman, A Z 1966 *Evaluation of Phosphate Placement for Corn Using ^{32}P Labeled Phosphorus* J Soil Sci U A R 6(2) 73 80 (Eng) (Middle Eastern Regional Radioisotope Center, Cairo)

A corn field experiment was conducted on a heavy clay soil near Cairo, using different rates of labeled superphosphate to evaluate broadcast, row, and foliar methods of application Very little difference was seen in utilization of fertilizer P between broadcast and row applications Foliar applied P was considerably higher than soil applied P early in the season, but decreased and almost approached values from soil application later in the season Exchangeable P and water soluble P determinations showed lower availability of fertilizer in broadcast than in row application due to earlier time of application The lower degree of contact between plant roots and fertilizer in the row application compared with broadcast application was compensated for by the higher availability of fertilizer P by plants for both methods of application (CA 67 72902b)

46 Amer, F, Elgabaly, M M, Balba, A M 1964 *The N, P,*

nd K Content of Corn in Relation to Fertilizer Application Alexandria J Agr Res 12(1) 41 52 (Eng) (Univ Alexandria)

A fertilizer trial was conducted in Egypt with the maize variety Hybrid 51, in order to investigate the value of plant analysis in addition to chemical soil tests The application of nitrogenous fertilizer significantly increased the yield, the N content of the grain, and the N and the P content of the leaf A linear relationship was found between yield and N content of the leaf, an increase of 0 1% N in the leaf corresponding with a yield increase of 1 975 hl/ha The responses to P and K were not significant (Trop Abst 20 758)

47 Khalil, M A, Amer, F, Elgabaly, M M 1967 *A Salinity Fertility Interaction Study on Corn and Cotton* Proc Soil Sci Soc Amer 31(5) 683-86 (Eng) (Dep Soils, Coll Agr, Univ Alexandria, UAR)

In glasshouse experiments, the dry matter yield increases of maize in response to N on soils with salinity values of 5, 7, and 9 mmhos/cm were 79%, 71%, and 67%, respectively, of the increases on nonsaline soil Salinity had no effect on the availability of P The reduction in fertilizer response was attributed to decreased photosynthesis and disturbed inorganic nutrition (FCA 22 222)

ZAMBIA

48 Ballantyne, A O 1967 *Maize Production in Zambia with Special Reference to Variety and Soil Fertility* Publ Comm Techn Cooper Africa 98 407 13 (Eng)

The present status of maize production in Zambia is reviewed Yields under rainfed subsistence cultivation methods average 340 to 670 kg/ha, while commercial farmers using appropriate cultivation techniques regularly obtain 7,800 to 9,000 kg/ha Virtually only white dent maize is planted The open pollinated Hickory King and Southern Cross varieties are grown mainly, but they are rapidly being superseded by hybrid varieties in both the commercial and semicommercial sectors Application of N and S is very effective in increasing yields, while P and K are not Improved soil management and crop practices should precede the use of fertilizers in subsistence agriculture The role of shifting cultivation and possibilities for the introduction of improved crop practices in subsistence agriculture are discussed (Trop Abst 22 1529)

ASIA AND AUSTRALIA

AUSTRALIA

49 Anon 1966 *Zinc Deficiency Corrected in North-West Maize Crops* Agr Gaz N S Wales 77(10) 620 22 (Eng)

Acute Zn deficiency was diagnosed on young, irrigated maize planted on large areas of leveled land in New South Wales (Australia) The soil, high in P, contained large quantities of $CaCO_3$ close to the surface Consequently, the pH in the upper layers of the soil after leveling was high, rendering Zn unavailable The symptoms are briefly described Affected plants contained 20 ppm Zn as against 35 ppm for normal plants To save the crop, immediate spraying with 6 7 9 kg $ZnSO_4$/ha in 440 1 of water was recommended to cure the disorder One week after application a striking improvement was observed as new growth was free of symptoms Subsequent yields were as high as 1,450 kg/ha whereas untreated areas did not yield any grain (Trop Abst 22 647)

50 Dickson, T 1968 *Plant Density and Nitrogen Studies with Irrigated Hybrid Maize in the Lockyer Valley, Queensland* Qd J Agr Anim Sci 25(4) 199 210 (Eng) (Agr Brch Div Pl Ind, Queensland Dep Primary Ind, Kingaroy)

In three trials using standard 36 in row spacing and plant populations of 12,000 24,000/acre, higher plant populations gave the highest yields, in two trials with row spacings of 30-42 in and plant populations of 12,000 28,000/acre, yields increased as populations increased up to 24,000 in one trial, and up to 16,000 in the other In only one of three trials was there a significant response to row width, in this trial, yields from 30 in rows were significantly higher than from greater row widths Applications of N depressed yields, probably as a result of early lodging Ear percentages decreased with increasing plant density and were highest for the 30 in row width Grain weight per ear rose with plant density but was not affected by row width or applied N Percent of nubbins (poor-quality ears) increased as plant density was reduced to 16,000, but row spacing and N had no significant effect (FCA 22 966)

51 Duncan, O W 1968 *Correction of Zinc Deficiency in Maize on the Darling Downs, Queensland* Qd J Agr Anim Sci 24 293 300 (Eng)

$ZnSO_4$, applied as 0 5% 1 5% spray, completely corrected deficiency symptoms Sprays of Cu, B, Mg, K, and P were without effect Yield increases from Zn foliar sprays were 24% 76% over the control (FCA 22 4489)

52 Kelly, T K 1970 *Maize Indicates Fertilizer Need* Qd Agr J 96(5) 329 30 (Eng)

P availability declines when soil pH is below 6, K and N availability decline below pH 4 5 When soil reaction is corrected, maize can be used as an indicator of nutrient deficiency

53 Lal, R, Taylor, G S 1970 *Drainage and Nutrient Effects in a Field Lysimeter Study II Mineral Uptake by Corn* Proc Soil Sci Soc Amer 34(2) 245-48 (Eng) (Dep Soil Sci, Univ Sydney)

The mineral uptake by *Zea mays* (corn) was studied in field lysimeters for the following variables constant water table (WT) depths, intermittent flooding, and two levels each of N and the trace elements Zn and Cu The WT depths of 15 and 30 cm and intermittent flooding during early growth decreased the ear leaf concentrations of N, P, K, Zn, Cu, and B and increased the leaf concentrations of Al, Fe, Mn, and Mo Applications of N, Zn, and Cu increased the concentrations of N, P, Zn, Cu, B, Mn, and Fe but decreased that of K Mineral uptake under wet soil conditions was associated with reducing conditions, inhibited soil mineralization, and an increase in soil pH (CA 73 24398)

54 Marley, J M T 1969 *Maize Fertilizer Investigations on Red Loam Soils of the Southern Darling Downs, Queensland* Qd J Agr Anim Sci 26(3) 303 8 (Eng)

In a series of three field trials, marked yield responses were obtained to P, (as superphosphate) applications in one season, and to N (as urea) in the other two seasons Applications of potash and trace elements were of little significance (from author's summary)

55 Van Haeringen, J 1965 *Maize Fertilizer Investigations on the Atherton Tableland, Queensland* Qd J Agr Anim Sci 22(4) 485 96 (Eng) (Queensland Dep Primary Ind, Brisbane)

Up to 200 lb N, 400 lb P_2O_5 and 50 lb K_2O/acre were applied to maize hybrid GH128 grown at 12,000 plants/acre In 1960-63, response to N ranged from 10 to 47 bu/acre, with little residual effect, that to P was 0 19 bu/acre, with a residual response for up to 2 years on soils containing <70 ppm available P_2O_5, there was little response to K (FC/ 20 919)

56 Weir, R G, Noonan, J B, Boyle, J W 1966 *Molybdenum Deficiency in Maize* Agr Gaz N S Wales 77(10) 578-82 (Eng) (Div Sci Serv, Rydalmere)

Maize crops grown on Mo-deficient soils, which are common in New South Wales, especially in coastal and other high rainfall areas, may show patchy growth with yellowing, leaf scorch, and death of seedlings These symptoms were first observed in the Taree district in the early 1950's, but their incidence was irregular It is now demonstrated that incidence of Mo deficiency in crops on deficient soils depends directly on the the initial Mo content of the seed crops from seed containing <0 02 ppm Mo develop severe symptoms, those from seed containing 0 02-0 08 ppm show slight to moderate symptoms, those from seed with >0 08 ppm emain healthy Deficiency is prevented by applying up to 1 lb Na molybdate/acre to parent (hybrid) seed crops (CA 66 94274e)

57 Weir, R G Hudson, A 1966 *Molybdenum Deficiency in Maize in Relation to Seed Reserves* Aust J Exp Agr Anim Husb 6(20) 35 41 (Eng) (Dep Agr, Rydalmere)

Responses of maize seedlings to Mo deficiency were very variable, and this may be due to variations of the Mo level in the seeds In pot trials, Mo deficiency symptoms were prevented by added Mo Without added Mo, the deficiency symptoms were produced and the severity was related to the source of the seed Deficiency symptoms were not more severe with hybrid GH128 In further trials, on soils without added Mo, deficiency symptoms were not exhibited by plants grown from seeds having 0 2%-0 08% Mo, but symptoms were shown with seeds having <0 08% Mo, and the symptoms were very severe if the level was <0 02% Many plants which exhibited Mo deficiency symptoms at 21 days growth recovered before harvesting at 65 days, and this was because they were able to extract Mo from the soil once they had passed the seedling stage Mo fertilization of seed crops raised the Mo content of the seeds, and where seeds contained >0 08% Mo no deficiency symptoms were shown by seedlings (CA 65 1333e)

INDIA

58 Baser, B L, Deo, R 1967 *Effect of Superphosphate on the Uptake of Micronutrients by Sorghum ("Jowar") and Maize Plants* J Indian Soc Soil Sci 15(4) 245-49 (Eng)

The effect of superphosphate applied at various levels on the uptake of micronutrients by maize and sorghum plants, grown on five soils of different regions of Rajasthan State (India) was investigated in pot culture experiments No significant correlation between Mn uptake by maize and the addition of P was obtained The uptake of Fe by both the crops increased, whereas Cu and B contents were found to decrease with higher doses of superphosphate treatment in certain soils (FA 1 1664)

59 Batra, J N, Sood, V P 1967 *Studies of NPK Fertilization of Maize in Hill and Plain Areas of the Punjab* J Res Punjab Agr Univ 4 353 59 (Eng) (Punjab Agr Univ, Ludhiana)

The trials were conducted at two sites on loamy sands (pH 6 9 7 3) and involved no fertilizing or application of 45 180 kg/ha N, 45 90 kg P_2O_5, and 90 kg K_2O in all combinations The maximum economic rate of application of N was 180 kg/ha for hybrid maize, and 135 kg for the local variety Responses to P were significant at the hill site, but responses to K were not significant at either site (FCA 22 4480)

60 Datta, N P, Vyas, K K 1967 *Uptake and Utilization of Phosphorus by Maize from Foliar Sprays* Isotop Plant Nutr Physiol, Proc Symp FAO/IAEA, Vienna, 1966, 371 76 (Eng)

A clear distinction between root and non root absorbed nutrients occurring simultaneously in the plants can be made by the use of isotopes An evaluation was carried out of the magnitude of the nutritional contribution of a number of foliar applied phosphates labeled with ^{32}P The fertilizers used were superphosphate, monocalcium phosphate, dicalcium phosphate, and ammonium phosphate labeled at 0 12 millicurie/g P_2O_5 Spray dose was equivalent to a 5 lb P_2O_5/acre application, volume was just enough to wet the foliage without causing runoff pH of the solutio s were superphosphate 4 0, monocalcium phosphate 4 0, dicalcium phosphate 5 5, and ammonium phosphate 4 0 Spraying was done at three stages of growth (24, 39, and 60 days after germination) Using ^{32}P tagged material, assessments were made of the effect of washing foliage before analysis for loss of P from leaves, and of material sticking to foliage There was no loss of P from leaves from washing to remove unabsorbed materials sticking to leaves from spray Percent uptake of fertilizer P from spray was greater at the early stages of growth, compared with later stages At the early stage of

growth with comparable doses, spray application was 8 fold more efficient than soil application For spraying, ammonium phosphate is the most efficient fertilizer This shows the beneficial effect of spray fertilization The data on maize proved that where higher doses of fertilizer through soil application cannot be economically utilized, only 5 lb/acre dose of spray application at early stages of growth can be more efficiently utilized by the plants Thus, economy in the use of phosphatic fertilizers can be made by spraying (FA 1 142)

61 Gangwar, A C 1969 *Economic Optima in Fertilizer Use for Hybrid and Open Pollinated Maize Crop* Allahabad Farmer 43(3) 155 68 (Eng)

In India, data collected from different research stations for the period 1961 63 were statistically analyzed to determine the economical fertilizer levels for maize The levels of N, P, and K varied from 0 to 180, 0 to 90, and 0 to 90 kg/ha, respectively Maize responded to N fertilizing, whereas P response was obtained at two stations only, there was no response to K Applying higher N levels proved to be more profitable with hybrid maize than with open pollinated maize Since hybrid maize has a higher yield potential, little effect of change in price ratio was observed, with open pollinated maize, however, a rapid change in optimum fertilizer doses, yield and profit were observed with a small change in price ratio (Trop Abst 25 2338)

62 Gaur, O P, Rajput, R K, Garg, K P 1969 *Response of Hybrid Maize (var Ganga 101) to Nitrogen Fertilization on Sandy Loam Soil at Gwalior* Indian J Sci Ind (A) 3(1) 29 33 (Eng) (Dep Agron, Agr Coll, Gwalior, Madhya Pradesh)

In trials with maize hybrid Ganga 101, application of 45 or 90 kg N/ha gave yields of 16 34 and 26 27 hkg grain/ha, respectively, compared with 8 22 hkg on unfertilized plots, there was no further appreciable increase in yield from increasing the N rate to 135 kg/ha N applied in three dressings at sowing, at the knee high stage, and at tasselling gave higher yields (27 13 hkg/ha) than when applied in two dressings (23 44 hkg) or in a single dressing at sowing (18 69 hkg) (FCA 23 187)

63 Gautam, O P, Ahuja, L R, Mukhopadhyay, D 1964 *Response of Hybrid Maize to Micronutrient Elements* J Indian Soc Soil Sci 12 411 21 (Eng) (Indian Agr Res Inst, Delhi)

Hybrid corn was fertilized with N P K, and trace nutrients, the effect on dry matter content, yield, N content of the straw, and protein content of the grain was determined There was no increase in dry matter when trace nutrients alone were applied, but increases of 40%-50% were obtained when Zn and N P K were used The trace nutrients alone decreased the number of cobs and increased the number of barren cobs, but N P K and Zn increased the number of cobs and the number of grains per cob The grain yield was increased 18% 32% by application of N P K and trace nutrients over the yield with N P K alone N P K and Zn gave similar yield increases In poorly drained soils fertilization with Zn increased the yield from 0 5 to 19 3 quintals/ha N P K and Cu, Mo foliar spray, and B soil application increased N content of the straw by 32 4%, 21 3%, and 23 0% respectively over that with N P K alone Crude protein content of the grain was increased 6 6% with Mo foliar spray There was some residual effect from Mg application In general, the greatest benefit was obtained with N P K and Zn fertilization (CA 64 5703e)

64 Goydani, B M, Singh, C 1968 *Performance of Hybrid Maize Under Varying Plant Population with Three Levels of Nitrogen and Their Time of Application* Indian J Agron 13(2) 83 7 (Eng) (Agr Coll Indore, Madhya Pradesh)

In trials in Madhya Pradesh in 1965 (dry year) and 1966 (wet year), hybrid maize sown at a density of 50 thousand plants/ha gave higher yields of grain and stover than when sown at 75 or 100 thousand plants/ha In 1966, grain yields increased from 25 53 to 35 21 hkg/ha as N rates increased from 100 to 200 kg/ha, in 1965, however, yields showed little response to N Higher yields were obtained from applying N in three split dressings (at sowing, at the knee high stage and at tasselling) than applying N in a single (at sowing) or two split dressings (at sowing and at the knee high stage) (FCA 22 2629)

65 Gupta, O P, Ram L 1968 *Response of Hybrid Maize to Micro nutrients in Tarai Soils of Uttar Pradesh* Indian J Agron 12 341-43 (Eng) (Uttar Pradesh Agr Univ, Pant Nagar)

Additional application of 43 kg/ha $MnSO_4$ or 71 5 kg $ZnSO_4$ to the soil increased grain yields by 290 and 350 kg/ha, respectively, over yields on plots given only 120 kg N and 60 kg each of P and K, other treatments (that included Cu, B, Mo, in addition to NPK) did not significantly increase yields, and foliar applications were the least effective (FCA 22 4484)

66 Kanwar, J S 1966 *Effect of Trace Nutrients on the Yield of Crops in Acid Soils of Kangra District of the Punjab* Bull Nat Inst Sci, India 26 63 70 (Eng) (Govt Agr Coll, Ludhiana)

In the title area trace nutrient deficiencies and the effects of applying trace nutrients on wheat, maize, paddy, potatoes, tea, and apples were investigated The effect of trace nutrients with a basal dose of N P K was determined The yield data show that the soil or spray application of Zn significantly increased the yield of these crops Thus there seems to be a widespread deficiency of Zn in acid soils of Kangra district (CA 66 28001n)

67 Khybri, M L, Chakrabarti, D C, Kulkarni, G A 1969 *Response of Maize to Nitrogen and Phosphorus Fertilization in Bhabar Tract of Eastern Nepal and Residual Response on Succeeding Toria Crop* J Indian Soc Soil Sci 17(1) 7 10 (Eng) (Soil Conserv Res, Demon, Training Center, Dehra Dun)

Maize was fertilized with $(NH_4)_2SO_4$ and superphosphate, up to 67 2 kg/ha Toria (*Brassica campestris*) was grown as the succeeding crop to determine the residual effects of the fertilizer Yield increases in maize on N fertilizer plots were 1 08 12 76 quintals/ha, and were highly significant in 1962 and 1963, but not in 1964 There was no yield increase from superphosphate treatment, and no residual effect on toria yield (CA 72 20970f)

68 Mathur, B N, Singh, U B, Shekhawat, G S 1965

Fertilizer Requirements of Maize in Sandy Loam Soils II Residual Effect of Fertilizers Applied for Maize on Succeeding Wheat Indian J Agron 10 183-86 (Eng) (Dep Agr, Rajasthan)

Residual responses of 4 6, 2 3, and 2 9 kg of wheat grain occurred for each kg N applied to the preceding maize crop at rates of 67 2, 134 4, and 201 4 kg/ha respectively There was no significant residual response of wheat to 67 2 or 134 4 kg/ha P_2O_5 applied to maize (SF 30 2811)

69 Moolani, M K, Behl, N K 1968 *Investigations on the Irrigation Requirements of Hybrid Maize Crop in Arid Region of Punjab* Ann Arid Zone 7(1) 105 15 (Eng) (Agron Dep, Punjab Agr Univ, Hissar)

In a 3 x 3 factorial trial with maize hybrid Ganga 101 on sandy loam soil, treatments were 20, 25, or 40 cm water in 2, 3, or 5 irrigations, 0, 80, or 160 kg N/ha and plant spacings of 9, 12, or 15 in in rows 24 in apart Precipitation during the period of crop growth was 31 1 cm Under all treatments, values for consumptive use, seasonal water requirements, rate of water used per day, and irrigation efficiency were 45 53 cm, 57 72 cm, 0 43 0 5 cm, and 70% 81%, values were highest for the 5 irrigation followed by the 3 and 2 irrigation treatments Highest grain yields, 28 5 hkg/ha, were obtained with 5 irrigations, followed by 26 hkg/ha with 3 and 24 hkg/ha with 2 irrigations Application of 80 kg N/ha gave a yield of 27 2 hkg/ha, with 160 kg N/ha, there was only a small further yield increase Yields tended to be higher where plants were spaced at 12 than at 9 or 15 in apart (FCA 22 1783)

70 Nair, K P M, Menon, A G G, George, C M 1966 *Studies on Hybrid Maize ("Zea mays") I Effect of Spacing and Fertility Levels on Yield of Deccan Hybrid Macca* Agr Res J Kerala 4 24 30 (Eng) (Agr Coll, Vellayani)

Application of 148 kg/ha N increased grain yield by 22 4% over that from 74 kg N, and produced an average yield of 4,436 kg/ha, high doses of N also increased stover yield Economic yields of maize spaced 61 cm between rows and 30 5 cm between plants were obtained by applying 148 kg N as $(NH_4)_2SO_4$ over a basal dressing of 3,750 kg dung, 74 kg P_2O_5 as super, and 37 kg K_2O as KCl (SF 30 634)

71 Oommen, P K 1967 *Application of Radioactive Tracer Technique to Studies of Phosphatic Fertilizer Utilization by Maize, as Revealed by Field Experiments* Indian J Agr Sci 37(6) 488 94 (Eng)

A uniform dressing of 90 kg P_2O_5/ha in the form of (partly labeled) superphosphate was applied in various ways to subplots of a N K farmyard manure trial with maize conducted in Uttar Pradesh (India) Placement of the P fertilizer 5 cm below the seed resulted in the best utilization of fertilizer P followed by broadcasting before sowing, while placement on one or both sides of the seed was least effective in this respect However, yields did not reflect these differences Total P uptake was increased by application of N as ammonium sulfate, not by application of K_2SO_4 or farmyard manure (FA 1 1659)

72 Pareek, B L, Jain, S V 1966 *Effect of Micro nutrients on Maize in Alluvial Soil Region of Rajasthan* Indian J Agron 11 291 93 (Eng) (Agr Chem Sect, Rajasthan, Durgapur, Jaipur)

On a sandy loam with low N and medium P and K contents, maize responded significantly to 10 and 20 lb/acre $ZnSO_4$ and 10 lb/acre $MnSO_4$, with yield increases of 4 6, 4 5, and 4 2 mds/acre, respectively (1 md = 82 28 lb) (SF 31 1405)

73 Prasad, R, Gautam, O P, Sinha, M N 1968 *Studies on Nitrogen Enriched Coal as a Nitrogen Carrier for Wheat and Maize* Indian J Agr Sci 38(4) 753 56 (Eng)

An experiment was conducted during the period 1965-67 for agronomic evaluation of N enriched coal with wheat maize rotation at the Indian Agricultural Research Institute, New Delhi No direct response to N enriched coal was observed either in the case of wheat or maize However, a significant first residual effect was obtained when N enriched coal was applied to wheat (From author's summary)

74 Puntamker, S S, Mehta, K M, Sharma, V C 1965 *Uptake of N, P, and K by Maize in Relation to Levels of Nitrogen* Indian J Agron 10 244 52 (Eng)

Maize was grown on deep, well drained clay loam soil Increasing the supply of N to 100 lb/acre generally increased the N concentration in different plant parts at all stages of growth, uptake of P and K was increased by applied N only in the early stages The protein content of grain increased with increasing levels of N but P and K content were not affected Crop yield and nutrient uptake were linearly related Application of P and K had a smaller effect than an N application on yield (SF 30 3009)

75 Rai, K D 1965 *Study of Rain Grown Sorghum and Maize in the Central Rainlands of the Sudan III Effect of Date of Sowing and Fertilisers on Growth and N and P Accumulation* Indian J Agron 10 235-43 (Eng) (G R Station Wad Medani, Sudan)

The effect of N and P fertilizers was beneficial to growth and nutrient accumulation but was much reduced by delaying sowing from July 7 to August 13 The amount of grain produced per unit of N accumulated in the aerial parts of the plants, especially of maize, decreased when sowing was delayed Growth of late sown crops was inhibited by high soil moisture stress in late September and after Fertilizers benefited rain fed sorghum and maize only when soil moisture conditions were favorable (SF 30 3004)

76 Ram, A, Thakur, R N 1966 *Effect of Nitrogen Fertilization on Growth, Yield and Quality of Maize ("Zea mays" Linn)* Indian J Agron 11 315 23 (Eng) (Bihar Agr Coll, Bihar, India)

A review with 84 references (SF 31 1407)

77 Rao, S V, Murthy, K M K 1965 *Manurial cum-Spacing Trial on Maize* Andhra Agr J 12(3) 75-83 (Eng) (Hyderabad)

At Karimnagar a local variety of maize MM 1 was sown at different spacings and fertilized with N, P, K at combinations of 0, 50, and 100 lb/acre, The interaction between nutrients was not significant The highest mean yields from N and P were at 100 lb/acre At 50 lb/acre K had no effect, but at 100 lb/acre it lowered the mean yield The optimum spacing was 1 5 x 1 ft (29,040 plants/acre) FCA 19 2090)

78 Rathore, S S, Singh, H G 1967 *Response of Maize to Increasing Levels of N and P at Varying Plant Densities* Univ Udaipur Res Stud 1965, 3 29 33 (Eng) (Agron Dep, Coll Agr, Udaipur)

Maize gave significant grain yield response to the application of 45 90 kg N/ha, and nonsignificant response to 45 90 kg P_2O_5/ha Plant spacings of 23, 30, and 38 cm between plants in the row had no significant effect on yields Application of 90 kg N/ha increased yields by 155 2% over unfertilized plots and by 47 5% over plots receiving 45 kg N/ha (FCA 22 2628)

79 Saxena, M C, Gautam, O P 1966 *Nitrogen and Phosphate Fertilization of Hybrid Maize I Response of Texas-26 to Nitrogen and Phosphate Fertilization* J Indian Soc Soil Sci 14(2) 139-46 (Eng) (Indian Agr Res Inst, Delhi)

Application of N as $(NH_4)_2SO_4$ gave significant increases in yield of grain and stover Application of P as superphosphate gave less striking responses, but increased the yield of grain significantly P did not produce significant increases in yield of stover The response to fertilization was affected by adverse weather conditions (CA 66 45856n)

80 Saxena, M C, Gautam, O P 1966 *Response of Hybrid Maize to Levels of Nitrogenous and Phosphatic Fertilization* Indian J Agr Econ 21(2) 71-8 (Eng)

A 2-factor (N and P) analysis of the grain production of the hybrid maize variety Texas 26, grown under field conditions at the Indian Agricultural Research Institute, New Delhi, India, indicated a positive complementary effect of N and P fertilization A maximum grain yield was predicted for a fertilizer combination of 164 kg N and 113 kg P_2O_5/ha At prevailing prices, the most profitable level of fertilization was found to be 110 kg N and 58 kg P_2O_5/ha capable of producing a yield of 1,650 kg/ha (Trop Abst 22 445)

81 Sekhon, G S, Kanwar, J S, Garg, A C 1966 *Response of Wheat and Maize Crops to Nitrogenous and Phosphatic Fertilizer Application in Rajpura Tehsil* J Res, Punjab Agr Univ 3(2) 105 10 (Eng) (Dep Soil Sci, Punjab, Agr Univ, Hissar, India)

Wheat and maize were planted on different sites Fertilizer treatments of 28 and 56 kg N/ha were applied alone and in combination with 28 kg P_2O_5/ha to the wheat crop The maize crop received 45 and 67 kg N both with and without 28 kg P_2O_5 Half of the N [as $(NH_4)_2SO_4$] was broadcast at planting to both types of plants and the other half was topdressed later The P_2O_5 applications were applied by drilling before sowing Highest maize yields are found with 67 kg N in combination with 28 kg P_2O_5 The most economical treatments are 56 kg N plus 28 kg P_2O_5 on wheat and 67 kg N plus 28 kg P_2O_5 on maize (CA 67 10801j)

82 Sekhon, G S, Saini, J S, Kanwar, J S, Garg, A C 1968 *Soil Survey of Rajpura Tehsil and Fertilizer Responses to Wheat and Maize in Different Soils* J Indian Soc Soil Sci 16(3) 255 62 (Eng)

Soils of Rajpura tehsil of Patiola District (Indian Punjab) have been classified into 11 series Fertilizer experiments conducted on cultivators' fields with wheat and maize showed on an average a fairly good response to the application of both N and P fertilizers Yields of the unfertilized crops in Maulviwala and Bahera series were considerably higher than the average area yields, and the responses to fertilizer were also rather high in these soils (Trop Abst 24 1477)

83 Shah, V H 1967 *An Analysis of Response of Hybrid Maize to Nitrogen* J Post-Graduate School, Indian Agr Res Inst 5(1) 158 68 (Eng)

The response of recommended maize hybrids to N applications at five levels, ranging from 0 to 180 kg/ha, was compared with that of the locally grown varieties in field trials conducted at eight locations in India, representing four agroclimatic zones In general, high responses were obtained with both the hybrids and the local varieties, but the response of the latter at nearly all N levels in all four zones was only 70% of that obtained with the hybrids The grain yields of the hybrids averaged 14 22 kg/kg N applied as against 9 16 kg with the local varieties From the optimum N levels calculated for each zone it is concluded that the general application of 90 kg N/ha as envisaged for the hybrid growing scheme is much too low and should be increased to 125 kg N/ha (FA 1 1177)

84 Shah, V H 1969 *Fertiliser Needs of Maize* Indian Farming 18(12) 41 5 (Eng)

Response of hybrid maize to dressings of N, P, and K in India is discussed in some detail Attention is paid to actual crop requirements, supplying ability of soils, experimental results, time of application, and sources of N, P, and K Appropriate fertilizing with N, P, and K and good agronomic practices may increase grain yields from 1 to 8 tons ha Deficiency of Zn may occasionally be observed, symptoms are described Soil dressings of 5-40 kg $ZnSO_4$/ha in bands at sowing time may considerably increase grain yields Interactions of Zn with P, N, and K are mentioned Economics of fertilizing are discussed (Trop Abst 25 1291)

85 Shah, V H, Singh, S N 1969 *Response of Six Maize Germ Plasms to Application of Magnesium and Micronutrients* J Indian Soc Soil Sci 17(4) 493 99 (Eng) (Coord Maize Impr Scheme, Indian Agr Res Inst, New Delhi, India)

Six different maize germ plasms were grown in pH 7 8-8 0 soil Fertilizers were applied (N 150 or 175, P_2O_5 75, and K_2O 50 kg/ha) Micronutrients given were Fe spray (2%), $ZnSO_4$ at 8, 16, 24 kg/ha, Fe + $ZnSO_4$ at 24 kg/ha, Fe + Zn + Mg ($MgSO_4$ $7H_2O$, 175 kg/ha), Fe + Zn + Mn ($MnSO_4$ $7H_2O$, 25 kg/ha) The number of barren plants in Zn treated areas was reduced, the cobs/ha increased by 15%, the weight of grain/cob increased by 10%, and the grain yield was 6 quintals/ha Application of Zn was especially profitable when Zn deficiency was noted in the seedling stage Differences between germ plasms due to Mg and micronutrient supply were small (CA 73 108831t)

86 Sharma, K C, Gupta, P C 1968 *Effect of Plant Population and Rates of Nitrogen on the Performance of Hybrid Maize* Indian J Agron 13 76-82 (Eng) (Uttar Pradesh Agr Univ, Pantnagar, India)

In a 2 year field experiment hybrid maize was grown at population levels of 40, 50, 60, and 70 thousand plants/ha and fertilized with 0, 50, 100, 150, and 200 kg/ha N as

$(NH_4)_2SO_4$ Grain yield increased nonsignificantly with plant density up to 60,000 plants/ha In the second season 100 kg/ha N gave significantly higher yields than 50 kg N and the control Barrenness increased with plant density and decreased with increasing rates of N The total number of ears increased with plant density and N fertilizing but grain yield/ear decreased with increasing plant density (SF 33 4816)

87 Sharma, K C, Saxena, M C, Modgal, S C, Arora, K N 1968 *Response of Ganga Hybrid Maize 3 to Different Sources of Nitrogen in Tarai* Fert News 13(4) 24 6 (Eng) (Uttar Pradesh Agr Univ, Pantnagar, India)

Response of Ganga Hybrid Maize 3 to four sources of inorganic N (ammonium sulfate, calcium ammonium nitrate, ammonium sulfate nitrate, and urea) each at levels of 50, 100, and 150 kg N/ha was studied on the medium loam soils of Tarai at the U P Agricultural University Farm, Pantnagar, during agricultural seasons of 1965 and 1966 Yield of grain increased significantly as the level of N fertilization increased Comparative performance of all N sources was more or less the same in 1965, in 1966 ammonium sulfate gave the best performance and urea the poorest The authors suggest that heavy rains immediately after fertilization in 1966 may have leached urea into the soil before it could be hydrolyzed thus leading to the lowered response (FA 1 1346)

88 Sharma, R P R, Singh, A 1969 *Residual Effect of Legumes in Winter Legume Maize Rotation 2 Effect on the Yield and Quality of Maize* Indian J Agr Sci 39 540 52 (Eng) (Indian Agr Res Inst, New Delhi)

Berseem (*Trifolium alexandrinum*), sweet clover (*Melilotus indica*), and peas (*Pisum sativum* var *arvense*), compared with fallow, had favorable effects on the yield of the following maize crop The respective effects of the legumes were estimated to be equivalent to 116 123, 62-83, and 42-46 kg N/ha (SF 33 2378)

89 Singh, A N 1967 *Effect of Variation in Plant Density and Soil Fertility on Yield of Two Varieties of Maize* Indian J Agron 12 314 19 (Eng) (Balwant Rajput Coll Res Sta, Bichpuri, Agra)

Grain yields were little affected by different spacings, but closer spacing gave a significantly higher yield of stover per ha In general, there was an increase in cob length, number of grains per cob, kernel weight, grain and stover yield per plant and per ha with increasing N in the form of $(NH_4)_2SO_4$ from 0 to 134 5 kg/ha, the optimum rate was 89 67 kg/ha N (FCA 22 3656)

90 Singh, K, Narang, M M, Sharma, H K 1967 *Effect of Crop Sequence and Fertilizers on Maize* J Res Punjab Agr Univ 4 500 7 (Eng) (Punjab Agr Univ, Hissar)

Maize yields were highest after fallow and legumes, and lowest after sorghum, net income on irrigated land was in the order cowpea maize wheat > guaran maize wheat > sorghum > maize > wheat > fallow maize > wheat The effects of N (40 120 kg/ha) were most beneficial after nonlegumes (sorghum, guara) and N requirements were less after fallow and legumes, residual effects of P_2O_5 (40-80 kg/ha) applied to legumes benefited the succeeding crops on P-deficient sandy soils (FCA 22 4493)

91 Singh, U B (1, 2), Shekhawat, G S (1, 2), Mathur, B N (1, 2), Bhatnagar, M P (1) 1965 *Fertilizer Requirements of Maize in Sandy Loam Soils 1 Influence of Nitrogen and Phosphate Levels on Yield of Maize 2 Residual Effect of Fertilizers Applied for Maize on Succeeding Wheat* Indian J Agron 10(2) 178-82, 183 86 (Eng) (Govt Agr Res Sta, Tabiji, Ajmer, Rajasthan)

In a maize/wheat rotation, applying N to maize increased yields considerably and gave a residual increase in yields of a following wheat crop Response to P was less marked, and there was no residual effect (FCA 19 835)

92 Singh, U B 1964 *Fertilizer Requirements for Maize in Rajasthan III Contribution and Differential Response of Growth Attributes on Yield of Maize* Indian Agr 8(1) 47 54 (Eng)

The effect of N and P fertilizers on the components of the yield of maize separately was investigated in a factorial field trial conducted in Rajasthan State (India), doses of up to 200 kg N and of up to 134 kg P_2O_5/ha were applied in addition to a basal dressing of K fertilizer Application of N without P increased the plant height, the number of leaves, leaf area and number of ears per plant, the number and weight of grains per ear, the weight of the cob, and the kernel weight Application of P alone reduced the weight of grain per ear and the kernel weight, and had no appreciable effect on the other characters mentioned Plots receiving N + P showed a much greater plant height, leaf area, weight of grains per ear, cob weight, and kernel weight than did those receiving N alone (Trop Abst 20 2184)

93 Sinha, M N 1968 *Relative Ability of Maize Plant to Absorb Phosphorus Placed at Different Soil Zones–Studies with P^{32}* Indian J Agron 13(4) 234 36 (Eng) (Div Agron, Indian Agr Res Inst, New Delhi)

Two weeks after sowing maize, $KN_2{}^{32}PO_4$ solutions were injected into the soil at distances of 10 or 15 cm from the plants and at depths of 5, 10, or 15 cm Two weeks after injecting, P absorption by roots was higher in the treatment where $KN_2{}^{32}PO_4$ was applied 15 cm deep and at a distance of 10 cm from the plants than in the other treatments (FCA 23 190)

94 Swaminathan, M S 1967 *A Resume of the Data on the Response of Dwarf Varieties of Wheat and Hybrids of Maize, Jowar and Bajra to Nitrogen* J Post-Graduate School, Indian Agr Res Inst 5(1) 169 73 (Eng)

A resume is given of the most important data contained in three detailed review articles on the responses of dwarf varieties of wheat and hybrids of maize, sorghum, and pearl millet to N applications as observed in field trials conducted in India It is concluded that the full yield potential of these varieties cannot be obtained with the quantities of N fertilizers available under the envisaged fertilizing program To obtain maximal benefit from these fertilizers, it is therefore essential to allocate them on a pattern based on the response differences shown to exist between the different agro climatic zones and varieties, also taking due account of the influence of management factors such as timing of irrigation, and spacing (Trop Abst 23 687)

95 Thakur, R N, Ram, A 1967 *Effect of Different Times*

of Nitrogen Application on the Protein Content of Maize ("Zea mays" Linn) Sown at Different Spacings Allahabad Farmer 41(4) 223 25 (Eng)

An experiment on the influence of the time of application of nitrogen on the protein content of maize, sown at different spacings, was done in Bihar State (India) The N application treatments (at 90 kg/ha) were full dose at sowing, full dose at earthing, and split application The 5 row x plant spacings ranged from 0 76 x 0 76 m to 0 60 x 0 30 m The highest content of protein in grains was obtained by split application of N in conjunction with a spacing of 0 45 x 0 45 m with a single plant per hill (Trop Abst 23 910)

96 Thakur, R N , Agarwal, K N , Thakur, K , Choudhry, S K , Ram, A 1968 *Effect of Hill Spacing and Times of Nitrogen Application on the Grain Yield of Maize ("Zea mays" L) Under Rain Fed Conditions* Indian J Agr Sci 38(1) 90-6 (Eng)

In Bihar (India), the effect of hill spacing and times of N application were determined on grain yield of maize under rain fed conditions Split application of N, i e 44 46 kg/ha N at sowing + 44 46 kg/ha N at earthing up (40 days after sowing), produced significantly the highest yield With respect to row x plant spacing, the highest yield was obtained with a spacing of 0 45 x 0 45 m with one plant per hill Wider spacing with multiple plant hills accounted for lower grain production (Trop Abst 24 299)

97 Verma, M L 1968 *Effect of Application of Micronutrients on Uptake of Major and Minor Elements by Maize* J Indian Soc Soil Sci 16(4) 351 54 (Eng) (B R Coll , Agra)

The effect of treatment of *Zea mays* with NPK fertilizers, Spartin, and foliar sprays of trace elements on yield and trace element uptake was investigated The yield of grain was increased by NPK + Mn treatment, but the yield of fodder was decreased by all trace element treatments and Spartin N uptake was not affected by trace element treatment, P content of the grain was increased by all treatments, but Cu + NPK gave the highest P content of the dry matter K content of the grain was unaffected by all treatments, but K content of the dry matter was reduced, except by Mn and Cu The content of each trace element was increased by the treatment containing that element Mn content of the grain varied from 40 to 105 ppm, and of the dry matter, from 40 to 80 ppm The contents of B and Mo were increased by the NPK treatment (CA 71 80316m)

JAPAN

98 Kurihara, H , Okubo, T , Sato, K , Iwata, F , Kudo, S , Kinebuchi, M , Asanuma, S 1966 *Agronomic Studies on the Planning of Cropping Systems in Relation to Productivity Changes Following the Cultivation of Newly Reclaimed Volcanic Ash in the Tohoku District of Honshu Island, Japan II Influence of Application of Phosphate and Manure, and Different Cropping Systems on the Growth of Field Crops* Bull Tohoku Natn Agr Exp Sta 33 71 276 (Jap)

Crop yields were low in the first year following reclamation but could be raised to the level of the second and subsequent years by heavy dressings of P or manure Yields of soybean and maize were not appreciably influenced by the nature of the preceding arable crop, except that yields of maize and potatoes were decreased and increased respectively when the preceding crops were maize and potatoes respectively Leys of Ladino clover in comparison with orchard grass resulted in higher yields of maize and potatoes but in lower yields of soybean Heavy dressings of P or manure applied to the preceding crop depressed yields of succeeding crops, especially soybean Yields of soybean were determined mainly by previous manurial practice but those of potatoes and maize were influenced most by fertilizer applications during the cropping year Yields of all crops were influenced by the availability of soil P, but not by exchangeable K or total N Total dry matter production of soybean and maize was also correlated with exchangeable bases (SF 30 1009)

99 Miki, K , Mori, T 1968 *Nitrogen-Supplying Capacity of Upland Soils 4 Immobilization of Fertilizer Nitrogen added with Straw to Soil and Availability of the Immobilized Nitrogen to the Plant* Bull Tokai Kinki Nat Agr Exp Sta 17 67-73 (Jap)

Fertizer N added at the rate of 10 or 20 mg/100 g soil in the presence of 200 or 400 mg straw, was immobilized during the first week but was rapidly remineralized during the third and subsequent weeks Four successive crops of dent corn took up 18% 19% of the added fertilizer N following immobilization and remineralization of the latter Immobilized fertilizer N occurring in the nondistillable organic N fraction amounted to 72% 73%, while 23%-26% occurred in the distillable fraction, little N occurred in the nonhydrolyzable fraction Fertilizer N passing into the nondistillable fraction during immobilization was more easily taken up than N in the other two fractions or N originally present in the soil (FCA 22 4361)

100 Nakano, H , Kushibiki, H 1967 *Studies on Magnesium Deficiency Symptom in Corn Crop 1 Varietal Difference of Magnesium Deficiency Symptom and Effects of Magnesium Fertilizer on Growth and Yield in Corn* Bull Hokkaido Prefect Agr Exp Sta 15 15 21 (Jap)

In field trials during 2 years, 9 maize cv received Mg at 0 and 4 kg/decare Data are given for number of leaves with symptoms of Mg deficiency at various dates, dates of 50% germination and 50% emergence of ear and tassel, tiller number, plant and ear height, stem thickness and lodging percentage at harvest, plant growth (height, leaf number, weight) at various dates, grain yields, and ear and grain characteristics Plant growth, ear and grain characteristics, and grain yields were increased by Mg, but these effects did not coincide with the appearance of Mg deficiency symptoms (FCA 21 2453)

101 Okubo, T , Kurihara, H 1967 *Heavy Application of Phosphatic Fertilizer on Upland Soils 1 Growth and Yield of Corn on Different Soils* Bull Tohoku Natn Agr Exp Sta 35 1 17 (Jap) (Tohoku Nat Agr Exp Sta , Morioka, Japan)

Maize gave higher dry matter and grain yields on alluvial and granitic soils than on volcanic ash soils Low grain yields on volcanic ash soils were due to poor early growth, low grain number per ear and low 1,000 grain weight Heavy applications of P caused large yield increases on the volcanic ash soils, but smaller effects, which disappeared by

the third year after treatment, on the alluvial and granitic soils (FCA 21 1681)

102 Sato, T , Sakai, H , Fujiwara, K , Oba, Y 1968 *Studies on the Productivity and Root Growth of Indian Corn (Choko No 227 Variety) 1 Influence of Nutrition and Ridging* J Jap Soc Grassl Sci 14(4) 234-40 (Jap) (Kawitabi Fm Fac Agr , Tohoku Univ , Narugo, Miyagi, Japan)

The effects of fertilizer application and ridging (the latter in field trials only) on root growth and productivity of maize was studied in pot and field trials Addition of P increased leaf, stalk, and root weights of pot grown maize, but N and K produced only negligible increases In the field, tops of plants receiving additional fertilizer weighed twice as much as those of the unfertilized controls In general, pot cultivation produced heavier roots and field cultivation heavier stalks and leaves Fertilizer was absorbed through aerial roots and where these were cut in fertilized plots, top yields fell by 30% Tops were heavier in ridged plots, while roots were heavier in unridged plots Nonfertilized plants grown in the field varied in N, P, and K content, these being highest in ridged plots but where plants were fertilized, N, P, and K contents in both ridged and unridged plots were similar Although large amounts of fertilizer were absorbed by aerial roots they contained little N P, and K when analyzed Weight of whole plants was highly correlated with root weight except in fertilized, ridged field plots Vigorously growing plants had more aerial roots than slower growing plants (FCA 23 186)

103 Shimose, N 1968 *Physiology of Salt Injury in Crops VIII Salt Tolerance of Corn Lucerne, and Italian Ryegrass* Nippon Dojo Hiryogaku Zasshi 39(12) 554 57 (Jap) (Univ Okayama)

Sand cultures with flowing nutritive solutions containing Na_2SO_4 or NaCl at several levels were studied with corn, lucerne, or Italian ryegrass With regard to salt tolerance, Italian ryegrass was very strong, corn was medium, and lucerne was weak, especially in the sulfate plots The salts hindered the absorption of K, Ca, Mg, or Mn by the plants Italian ryegrass was not affected as much in its absorption of K, suggesting why the plant showed such strong tolerance to the salts In general, the hindrance of the absorption by the plants was greater in sulfate than in chloride plots (CA 70 105504r)

104 Takahashi, T , Yamamoto, T 1969 *Corn Growth After Long Continued Croppings With an Initial Heavy Application of Phosphatic Fertilizers Availability of Residual Phosphorus in a Volcanic Ash Soil* Tohoku Nogyo Shikenjo Kenkyu Hokoku 37 139 56 (Jap)

The residual soil P availability for corn was studied in the Kuriyagawa volcanic ash soil field, to which a mixture of 4 parts fused phosphate and 1 part superphosphate had been added 6 years ago and a band dressing for crop rotation with a very slight amount of superphosphate The increase of the soil P potential caused by the phosphate mixture lasted for at least 6 years, Al type P (NH_4F soluble phosphate) was the best index of soil P potential Corn could absorb P from the Al type P mainly in its later growing stage, but little in its early growing stage Corn yields were good on soils with a higher Al type P content, perhaps because the most important period of nutrient absorption by corn was in later growing stages The effect of the phosphate mixture was closely correlated with the population density of corn, because the P absorption rate of corn in its later growing stage was depressed with high population densities The Al type P in the soils decreased gradually after continued cropping and a second application of the phosphate mixture was necessary The second application would be unnecessary, if the amount of banded phosphate was increased gradually after the first phosphate mixture application (CA 72 54316n)

105 Yamamoto, T , Takahashi, T 1967 *Heavy Application of Phosphatic Fertilizer on Upland Soils 2 Change of Soil Conditions and Nutrients Uptake by Corn* Bull Tohoku Natn Agr Exp Sta 35 19 36 (Jap) (Tohoku Nat Agr Exp Sta , Morioka, Japan)

Heavy P applications, especially on volcanic ash soils, led to increased P uptake by maize N uptake increased in the first year of P application, but subsequently decreased (FCA 21 1682)

LEBANON

106 Fuehring, H D , Mirreh, H F , Ahmad, N , Soltanpour, P N 1969 *Grain Yield of Maize ("Zea mays") in Relation to Nitrogen, Phosphorus, Sulfate, Chloride, Zinc, Boron, Manganese, and Plant Population* Proc Soil Sci Soc Amer 33(5) 721 24 (Eng) (American Univ Beirut)

Excellent climatic conditions for maize production in the Beqa'a Plain of Lebanon led to a series of experiments on a calcareous clay soil typical of much of the Middle East to determine which factors, in addition to N and P deficiencies, may become important as grain yields are increased to 12 18 tons/ha or more Applied N was the only variable having an appreciable first order effect and most of the yield variation was attributed to the various 2 and 3 factor interactions involved Although the soil was well drained and the quality of the irrigation water good, amounts of applied Cl and SO_4^{2-} needed to be minimized due to negative P-Cl, P-S, and N P-S interactions when N and P were applied at necessary levels of about 300 kg/ha Positive interactions of applied Zn with plant population and applied P with population along with the positive Zn B population and P B population interactions indicated a requirement for relatively high levels of applied P, Zn, B, and plant population Positive response to applied Zn and B occurred up to the 90 180 kg/ha level, indicating the need for these elements at high yield levels The micronutrient requirements of maize appear to be especially critical at very high yield levels (CA 71 111984j)

NEW ZEALAND

107 Widdowson, J P 1966 *Zinc Deficiency on the Shallow Soils of Niue II Effects of Zinc Sulfate on the Yield and Nutrient Composition of Crotalaria and Sweet Corn* New Zealand J Agr Res 9(3) 748 70 (Eng) (Soil Bur , Dep Sci Ind Res , Lower Hutt)

Crotalaria (*Crotalaria anagyroides*) and sweet corn (Golden Cross Bantam) were grown on two calcareous soils in pots under greenhouse conditions The pots were treated with ≤40

lb/Zn/acre and ≤4 8 lb of Fe/acre as the ferric Na salt of ethylenediaminebis (*o* hydroxyphenyl acetic acid) In the absence of applied Zn, plant growth was restricted on both soils An application of 20 lb of Zn/acre in the presence of added N P K gave maximum yields of sweet corn which were 2 fold those of the controls Zn (5 lb/acre) resulted in a yield ~85% of maximum A similar response to Zn was obtained with crotalaria on the more alkaline of the two soils The concentration of Zn in sweet corn was not increased when each increment of Zn increased plant yield P, K, Ca, Mg, Cu, Fe, and Mn accumulated in the tissue of Zn deficient corn plants as a result of restricted growth, but fell to normal levels as Zn treatments increased plant growth Zn deficiency is a major factor limiting plant growth on these calcareous soils but its correction can in turn result in Fe and Mn deficiencies (CA 65 20789f)

PAKISTAN

108 Hussain, K A , Ullah, M , Zaman, M , Ahmad, B 1967 *Effect of NPK Fertilizers on the Nutritive Value of Maize Plants and Grains* West Pak J Agr Res 5(2) 44 51 (Eng) (Ayub Agr Res Inst , Lyallpur)

Data are given on the effects of N, NP, and NPK on the nutritive value of maize grain NPK increased the crude protein content to 11 17%, compared with 10 07% in grain from the unfertilized plots Fertilizers slightly decreased the crude fiber content, but had little effect on the contents of moisture, dry matter, crude fat, and N free extract (FCA 22 203)

109 Khan, D H 1969 *Response of Sweet Corn and Rice to Phosphorus, Zinc and Calcium Carbonate on Acid Glenview Soil of California* Soil Sci 108 424 28 (Eng) (E Pak Agr Univ , Mymensingh)

In greenhouse studies with Glenview gravelly loam, Zn deficiency in sweet corn and rice (under both upland and lowland conditions) was induced by added P and $CaCO_3$ (SF 33 3187)

110 Malik, M Y, Sheikh, A A, Shah, W H, Haleem ul Husnain 1968 *Effect of Fertilizer Treatments on the Chemical Composition and Yield of Maize at Different Stages of Growth* West Pak J Agr Res 6(3) 104 9 (Eng) (Livestock Farms West Pakistan, Lahore)

Maize was grown on randomized 1 acre plots fertilized with N from $(NH_4)_2SO_4$ and P from superphosphate, and compared with maize from unfertilized plots Three groups, each containing 4 plots, received, respectively, 20, 40, or 60 lb of N/acre Within each group, the P application was 0, 30, 40, or 60 lb/acre At 30 days, all treatments except 40 N showed a significant increase in N content Application of 20 N + 40 P had a maximum effect on the N content The P content increased with amount of P in the fertilizer N alone did not have a marked effect on the P content of the plant No significant effect on ash, ether extract, or fiber was shown At 60 days, the trends were similar to the above, 20 N + 40 P again being the best combination, both in respect to yield and to N content (CA 71 69799a)

111 Malik, M Y Shah, W H 1968 *Effect of Nitrogen and Phosphorus Fertilizers on the Nutrient Contents and Yield of Maize* Pak J Sci 20(4) 178-81 (Eng)

Corn fodder was grown in experimental plots treated with N and P fertilizers, alone and in combination Samples of the fodder were analyzed chemically at 60 days of age Fertilization of the soil increased the protein content and yield of corn N alone had not as marked an effect on the protein content and yield as that obtained with N P combinations (CA 72 20994s)

PHILIPPINES

112 Aala, F T , Gonzales, T T 1964 *The Effects of Green Manuring and Fertilizers on the Production of Hybrid Corn Seeds* Philipp J Pl Ind 29(3-4) 65-77 (Eng) (La Granja Exp Sta ,)

During three wet seasons hybrid maize was grown as a test crop on plots that had been (a) green manured with 6 12 7 tons yellow mungo (*Phaselous aureus*)/acre or (b) sown to maize The test maize was topdressed with various rates of N, P, and K Green manuring increased the yields of test maize by an average of 7 6% (significant in the second and third year), this response was scarcely affected by level of applied fertilizers (FCA 19 832)

113 Gonzales, T T 1962 *The Effects of Mungo as Green Manure and Ammonium Sulfate on the Production of Hybrid Corn Seed* Philipp J Agr 27(3-4)131-43 (Eng) (Lamao Exp Sta)

During three dry seasons (November April) and three wet seasons (June November), Philippine Hybrid No 3b maize was sown on plots that had been green manured with *Phaseolus aureus*, or not green manured (nature of controls not stated but presumably weed fallow), and all plots were topdressed twice with a total of 0 60 kg N/ha In the dry season trials, the average fresh weight yield of green manure turned in was 9 tons/ha This increased the yield of maize grain by about 50% as much as the first increment of N (30 kg/ha) The highest yields (average 61 3 cavans/ha) were obtained from green manure + 60 kg N In the wet season, when rainfall during the trial ranged from 102 to 200 cm, the increases in yield of maize grain from (a) green manuring and (b) 30 kg N/ha were about equal Yields were markedly depressed when rainfall exceeded 177 cm (1 cavan = 44 kg) (FCA 19 141)

THAILAND

114 Vacharotayan, S , Jantawat, S , Duangpatra, P , Krutkul, T 1965 *Response of Guatemala Corn to Fertilization* Kasetsart J 5(2) 101 19 (Eng)

Results are presented of 10 NPK fertilizer trials with maize conducted in Thailand Grain yield was significantly increased even on newly cleared land, mainly by N also by P, but there was no response to K The yield increases observed varied from 30% to 196% Economic fertilizer treatments usually consisted of 50 100 kg N and 50 60 kg P_2O_5/ha Although straw yield was increased by application of fertilizers, the grain/straw ratio increased with increasing N and to a less degree with increasing P doses K tended to increase straw yield rather than grain

yield Number of ears per stalk and grain weight per ear were significantly increased by N and P The ears matured sooner when fertilizers were applied N tended to reduce the number of days to silking, whereas P tended to reduce the number of days to tasselling (Trop Abst 21 1638)

TURKEY

115 Aydeniz, A 1968 *Influence of Liming on the Effects of Zinc in Corn Plants* Yearb Fac Agr, Univ Ankara 8 8 35 (Eng) (Fac Agr, Univ Ankara, Ankara)

Zn inhibited germination in the absence of $CaCO_3$ between 2 and 128 ppm Zn $CaCO_3$ increased the germination of plants Plants died at 512 ppm Zn but grew normally when $CaCO_3$ was supplied, indicating that $CaCO_3$ also helped the plants to tolerate higher Zn levels The Zn content of the plants increased when the application of Zn was increased The lowest level of Zn in plants was 8 40 ppm, the highest 152 30 ppm Increases in the percentage of $CaCO_3$ decreased the Zn content of the plants (CA 72 89365e)

116 Kacar, B, Fox, R L, Rhoades, H F 1966 *Zinc and Phosphorus Interaction in Corn Production Under Greenhouse Conditions as Influenced by Prior Cropping and Fertilization* Yearb Fac Agr, Univ Ankara 6 68-89 (Eng) (Univ Ankara)

A greenhouse study of corn production as influenced by (1) prior cropping with alfalfa, sugar beets, and corn and (2) initial and final application of Zn and P fertilizers revealed that (a) yields of dry matter are higher following alfalfa than following either sugar beets or corn, (b) application of Zn and P increases yield of alfalfa and sugar beets, (c) yields are quite low when Zn is applied initially without P, (d) initial P application alone results in larger yields, and (e) the maximum dry matter yield is obtained when Zn is applied to the soil after the initial P application An initial application of Zn alone or in combination with P is generally detrimental to yields, whereas the highest yield is obtained with a final application of either P or Zn plus P (FA 1 773)

117 Ozbek, N 1967 *Factors Affecting the Amount of Available Soil Phosphorus, A Value* Isotopes in Plant Nutrition and Physiology Proc Symp FAO/IAEA, Vienna, 1966, 35-46 (Eng) (Univ Ankara)

Greenhouse experiments were done with maize, millet, oats, and lucerne, grown in soil low in available P, to determine the effect of the rate of application, placement, and of the plant species on the amount of available soil P A values (plant P derived from soil x rate of fertilizing/plant P from fertilizer) were calculated The amounts of dry weight, total, and fertilizer P were affected by the rate of application and were higher with band placement than with mixed placement of P Maize produced most dry weight and contained most total and fertilizer P, millet produced and contained the least (SF 31 839)

VIETNAM

118 Tran Van Nao and Bui Huu Tri 1964 *Corn Response to Fertilization in Viet Nam* Saigon, Ministry of Rural Affairs, Publ No III Bheb 106, 26 pp

On Hung Loc soils, the application of 10 tons of manure plus inorganic fertilizer (40-60 kg N, 60-80 kg P_2O_5 and 0-40 kg K_2O/ha as urea, ground rock phosphate and KCl respectively) on Guatemala corn planted 60 x 30 cm (55,555 plant/ha) appeared to be the best treatments On Eakmat soils, P seemed most deficient and the more soluble forms of phosphate were effective, especially when manure was applied A tentative rate of 30-80 30 with 10 tons of manure is therefore recommended for Guatemala corn

119 Tran Thi Nguyet 1966 *Results of Fertilizer Experiments on Corn in 1965* Saigon, Ministry of Rural Affairs, Publ No II DH124, 15 pp (Eng)

Experiments were conducted at two locations to determine the effects of time of application, spacing, level of NPK application, and manure on yield of maize Results were variable

120 Phan Huu Anh 1964 *Results of Fertilizer Experiments in 1962 63* Saigon, Ministry of Rural Affairs Publ No Bheb-89, 152 pp (Eng)

As compared with the control, the application of N tended to increase the yield significantly However, single application of P or K depressed the corn yield appreciably Combination treatments of NP at high rates gave more response than any of the NK or PK combinations In general, complete NPK treatment yielded significantly lower than NP but higher than NK or PK

NORTH AMERICA

CANADA

121 Bishop, R F, Jackson, L P, MacEachern, C R, MacLeod, L B 1964 *A Long Term Field Experiment With Commercial Fertilizers and Manure III Fertility Levels, Crop Yields, and Nutrient Levels in Corn, Oats, and Clover* Can J Soil Sci 44 56-65 (Eng) (Dep Agr, Nova Scotia)

Changes in adsorbed plus easily acid-soluble P in soil were generally proportional to the amounts of P applied All treatments were applied in the corn year and the P content of fertilizers was reflected in the percent total P in tissue samples of corn and the succeeding oat and clover crops Application of fertilizers containing increasing percentages of K consistently increased the percent total K in corn and oats but not in clover However, application rates of manure were invariably reflected in the percentages of total P and K in all crops With 20 tons of manure, corn, oats, and clover contained 0 33%, 0 28%, and 0 27% P and 2 51%, 1 92%, and

1 42% K Application of fertilizers with increasing percentages of N did not produce significant yield differences in any of the crops However, use of fertilizers containing increasing percentages of P or K resulted in significantly increased corn yields All crop yields were significantly higher with 20 tons of manure than with 1,000 lb of 4-8-8 fertilizer With this rate of manure, corn produced 3 18 tons of dry matter, oats approximately 52 bu, and hay 2 tons of dry matter/acre

122 Findlay, W I, Fulton, J M 1964 *The Nutrient Composition of Hybrid Corn as Influenced by Fertilization 2 The Phosphorus Percentage* Can J Soil Sci 44(2) 217 22 (Eng) (Res Sta, Harrow, Ontario)

In field trials in 1957 60, percent P content of ear shoot leaves of hybrid maize cv Pioneer 349 was influenced (with interactions) by season, soil type, levels of applied P and N, and method of placement (band/broadcast) of P but not of N, it was increased by applied N if enough P was either applied or present in the soil Plotting yield (shelled corn) against percent P produced smooth curves with the slope decreasing at higher yields, and gave no sign of a critical percent P value (FCA 18 703)

123 Halstead, R L, Sowden, F J 1968 *Effect of Long Term Additions of Organic Matter on Crop Yields and Soil Properties* Can J Soil Sci 48(3) 341-48 (Eng) (Canada Dep Agr Soil Res Inst, Ottawa)

Annual additions of green rye, straw, lucerne, deciduous leaves, peat, muck, and manure to a sand and a clay soil for 20 years tended to increase the mean yields of maize and potatoes in the field This effect was confirmed in glasshouse trials with oats Straw, lucerne, leaves, and manure had the greatest effect on yield and on uptake of N and P by the oats (FCA 22 1795)

124 Hunsigi, G, Ketcheson, J W 1969 *Effect of Soil Temperature on Phosphorus Fertilizer Reaction in Soil and Subsequent Availability to Plants* Agron J 61(3) 481-83 (Eng) (Univ Guelph, Guelph, Ontario)

The effect of soil temperature and P fertilizer reaction in soil on P uptake by corn was studied in a growth chamber for 3 weeks In the first week, medium temperature (24°) and high temperature (32°) increased the number of lateral roots as compared to low temperature (16°) Increased reaction under the influence of higher temperature did not limit the P uptake (CA 71 12145e)

125 Ketcheson, J W 1968 *Effect of Controlled Air and Soil Temperature and Starter Fertilizer on Growth and Nutrient Composition of Corn ("Zea mays" L)* Proc Soil Sci Soc Amer 32(4) 531 34 (Eng) (Dep Soil Sci, Univ Guelph, Ontario)

In glasshouse experiments, maize plants were grown at air temperatures of 26° C at noon, changing gradually to 16° at midnight (HT_A), or 21° at noon to 12° at midnight (LT_A) Soil temperatures were 21° (HT_S) and 17° (LT_S) At transplantation, a nutrient solution containing 48 mg N, 84 mg P, and 40 mg K/plant was applied to the seedlings as a starter fertilizer The time to maturity was longer under LT_A than HT_A and shorter under HT_S than LT_S Leaf area and grain yield were decreased by increase in air temperature, and increased by increase in soil temperature, indicating that stimulation of growth by increased air temperature tends to be accompanied by reduced yields, whereas growth stimulation by soil temperature tends to increase yields Interactions between air temperature, soil temperature, and starter fertilizer in terms of grain yields were significant The highest grain yield came from the LT_A/HT_S treatment Fertilizer increased yields in all treatments except HT_A/HT_S Lowest yield and greatest response to fertilizer occurred in HT_A/LT_S (FCA 22 1019)

126 Leonce, F S, Miller, M H 1966 *A Physiological Effect of Nitrogen on Phosphorus Absorption by Corn* Agron J 58(3) 245-49 (Eng) (Univ Guelph, Canada)

The addition of $(NH_4)_2SO_4$ to a labeled P pellet did not significantly influence the P absorption but the addition of KNO_3 reduced the P absorption below that of the P-only treatment The lateral roots in the KNO_3 treated area did not develop beyond root stubs and there was some tendency for the roots to be excluded from the $(NH_4)_2SO_4$ treated area The relative absorption of P from the pellet containing $(NH_4)_2SO_4$ was greater than that from the P only pellet NH_4Cl had a similar but less pronounced influence whereas KNO_3 decreased the P absorption Growth of the roots in the presence of higher N content was in all cases less than that with the lower N content The addition of NH_4NO_3 to the labeled P solution greatly increased the labeled P content of the corn plant tops The relative amount of labeled P in the root segment was not significantly influenced by the addition of NH_4NO_3 Application of $(NH_4)_2SO_4$ increased the degree of branching of the fertilized root Autoradiographs indicated a high concentration of labeled P in the roots of the P only and KNO_3 + P treated plants but no such accumulation was apparent in the $(NH_4)_2SO_4$ + P or NH_4Cl + P treated areas NH_4^+ increased the transfer of P from the corn root to the top It has a specific effect on the movement of P across the root symplast into the xylem as evidenced by the fact that the increased absorption occurred only when NH_4^+ was the source of N (CA 65 4593d)

127 Martens, J W, Arny, D C 1967 *Effects of Potassium and Chloride Ion on Root Necrosis, Stalk Rot, and Pith Condition in Corn ("Zea mays" L)* Agron J 59 499 502 (Eng) (Canada Dep Agr Res Sta, Winnipeg)

Application of 150 lb/acre KCl decreased natural root necrosis, but increased stalk rot of stalks inoculated with *Diplodia maydis*, pith density (number of live cells) was significantly increased Application of NH_4Cl (of 140 lb/acre) had similar but smaller effects than treatment with KCl had (SF 31 1311)

128 Stevenson, C K, Baldwin, C S 1969 *Effect of Time and Method of Nitrogen Application and Source of Nitrogen on the Yield and Nitrogen Content of Corn ("Zea mays")* Agron J 61(3) 381 84 (Eng) (Ridgetown Coll, Ridgetown, Ontario)

Fall plowdown, spring preplant, and sidedress applications of N were compared in field experiments on Brookston clay, Brookston clay loam, and Haldimand silt loam soils NH_4NO_3, urea, and anhydrous NH_3 were compared at 56, 112, 168, and 224 kg N/ha Spring application (preplant or sidedress)

produced higher grain yields than fall application in all experiments regardless of the rate of N applied Preplanting the N was as effective in increasing grain yield as the sidedress method Yield results with fall applied N were poorer on the clay soil than the loam soils Spring application of N gave 370 to 2,610 kg/ha higher yield of corn grain than fall application on clay soils, and 200 1,160 kg/ha higher yield of corn grain on the loam soils No rate of N applied in the fall was found that would give the same yield as the optimum rate applied in the spring The three N materials gave similar results whether applied in the fall or in the spring The N content of the grain varied with the time and method of application of N Grain from plots that received N in the fall was markedly lower in percent N than grain from plots that received N in the spring (CA 71 12140z)

129 Zandstra, H G, MacKenzie, A F 1968 *Potassium exchange Equilibria and Yield Responses of Oats, Barley, and Corn on Selected Quebec Soils* Proc Soil Sci Soc Amer 32(1) 76 9 (Eng) (McGill Univ, Montreal, Canada)

K Ca + Mg activity ratios were used to calculate availability indexes on eight Quebec soils These were compared to available K measurements and related to yield responses of oats (*Avena sativa*), barley (*Hordeum vulgare*), and corn (*Zea mays*) to K fertilizers in field experiments Crop growth did not change the potential buffering capacities (PBC^K) of two selected soils, which indicated that the quantity intensity relation regulated the release of K although the activity ratio was greatly reduced The K potential was obtained by multiplying the total amount of exchangeable K ($-\Delta K°$) with the potential buffering capacity to place soils on a comparative basis The K potential fully defined the quantity intensity relation and correlated more closely to crop responses than the activity ratio measurement, the PBC^K, or the available K determination (CA 68 94945r)

COSTA RICA

130 Diez Altares, C, Bornemisza, E 1967 *The Localization of Zinc 65 in Germinating Corn Tissues* Pl Soil 26(1) 175-88 (Eng) (Inter Amer Inst Agr Sci, Turrialba)

Maize was supplied with 50 μc ^{65}Zn 4 5 days after germination and its distribution in plant tissues examined after 2 5 days further growth Most of the ^{65}Zn was recovered in the soluble 'protein' fractions, the highest values corresponded with the solubility groups for basic proteins, albumins and golbulins Prolamines and glutelins also contained an appreciable proportion of ^{65}Zn Amounts of nondialysable ^{65}Zn were highest in leaves and lowest in grains In cell walls, most ^{65}Zn was found in the solubility groups corresponding with protopectins and hemicelluloses After differential extraction, a strongly bound Zn fraction remained attached to the cell wall, this could only be extracted by boiling with 1 5 N KOH (FCA 20 2322)

131 Hardy, F, Bazan, R 1966 *The Maize Microplot Method of Soil Testing* Turrialba 16 267 70 (Eng) (Inter Amer Inst Agr Sci, Turrialba)

Three levels of N, P, and K fertilizers in factorial combination are applied to 2 ft square plots before the planting of maize, which is subsequently thinned to a uniform stand After 28 30 days' growth, the plants are harvested and weighed (SF 30 870)

132 Montenegro C, G 1967 *Ways of Increasing Production of Maize in Alajuela* Central American Cooperative Program for the Improvement of Food Crops, San Jose, 20 2 (Eng)

N and P are recommended

GUATEMALA

133 Aragon H, R, Bressiani, R 1965 *Effect of Fertilization With Minor Elements on the Protein Value of Corn and Sorghum.* Arch Venez Nutr 15(2) 63-86 (Sp) (Univ San Carlos)

The effects of fertilizers on the yield and nutritional quality of protein of two varieties of corn (*Zea mays*) and one of sorghum (*Sorghum vulgare*) were investigated over 2 years A factorial design with random blocks was used in fertilizing plots with N P K (19 13 7), N P K plus minor elements (S, Mg, Ca, Fe, Mn, B, Cl, Zn, I, and Mo), dry chicken manure with and without minor elements, minor elements alone, and with untreated plots as controls The harvested cereals were estimated for protein content by chemical analysis, for lysine, leucine, isoleucine, and tryptophan contents by microbiological analysis, and for nutritional value by biological tests in which the growth of rats fed with cereals was noted Chicken manure and N P K increased the protein content but decreased the biological quality of the cereals Minor element fertilization was without effect on the protein content but increased the biological quality and the contents of the amino acids tested (CA 65 7956b)

HONDURAS

134 Awan, A B 1965 *Effect of Application of Potash Fertilizer on the Yield and Lodging of Maize* Ceiba 11(2) 90 3 (Eng)

A fertilizer trial with two maize hybrids was conducted in the Honduras Republic on a soil poor in N and P but rich in K All plots received urea and triple superphosphate at rates of 80 kg N and 50 kg P/ha, potassium chloride was applied at rates of 0, 40, 80, and 120 kg/ha The leaf K content of the hybrids increased with the dosage of K applied Application of 40 kg K/ha reduced lodging from 11% to 6% in the hybrid Diacol H 205 and from 38% to 10% in the hybrid Zamorano H 1, additional K had no effect on lodging Yields of Diacol H 205 were nonsignificantly increased from 3,941 kg/ha in plots without K to 4,295 kg/ha in plots receiving 40 kg K/ha, not increased by higher K doses Yields of Zamorano H 1 were significantly increased from 3,292 to 5,638 kg/ha by 40 kg K/ha, nonsignificantly increased by an additional 40 kg K/ha (Trop Abst 21 1004)

135 Merida, J E 1967 *Response in Yield and Protein Content in the Grain of Corn to Fertilizer and Lime* Central American Cooperative Program for the Improvement of Food Crops, 13th Annual Meeting, San Jose, 34 5 (Eng)

Little response was noted to lime High levels of P increased yields, but K is not recommended

MEXICO

136 Anon 1969 *High Protein Corn Research in Mexico* Agr Sci Rev, U S Dep Agr 7(2) 19 (Eng)

Studies in Mexico showed that the homozygous maize variety floury 2 has more protein, lysine, and tryptophan than the homozygous normal However, the homozygous opaque 2 has 3 times more lysine and tryptophan than the normal homozygous but less protein The percentage of tryptophan in maize decreased with increasing N application Because tryptophan and lysine values were highly correlated, it appeared to be more efficient to analyze defatted endosperm than whole kernels (Trop Abst 25 1538)

137 Huerta Noyola, R, Nunez Escobar, R 1969 *Importance of Row Width, Plant Density and Nitrogen Fertilizer on the Yield and Other Characteristics of Hybrid Maize H 125 and H 129 in Chapingo, Mexico* Fourth National Congress of the Mexican Soil Science Society, Abstracts, No 3 (Eng)

Best results were obtained with a row width of 61 m with variety H 129 There was little response to N

138 International Maize and Wheat Improvement Center 1969 *The Puebla Project, 1967 68* Progress Report of a Program to Rapidly Increase Corn Yields on Small Holdings Mexico City, 120 pp (Eng)

Field experiments were conducted to determine optimal fertilizer rates and plant densities, dates of planting, and time of applying fertilizers Optimal rates of N varied from 102 to 200 kg/ha, optimal rates of P_2O_5 from 0 to 95 kg/ha, and optimal plant densities from 42 to 70 thousand plants/ha

139 Laird, R J, Rodriguez G, J H 1965 *Application of Fertilizers to Wet Season Maize in Areas of Guanajato, Michoacan and Jalisco States* Foll Tecn Inst Nac Invest Agricolas, Mexico 50 1 71 (Eng)

Results are presented of 47 fertilizer trials with maize conducted in an area of central Mexico S of Leon, at altitudes of 1,550 1,870 m The crop was grown without irrigation in the rainy season Significant responses to N were observed in almost all trials, significant responses to P in 19 trials, responses to Zn in 14 trials Application of 120 kg N plus 40 kg P_2O_5 is recommended for the time being Drought indices were determined according to the criterion of Van Bavel, percentages of yield reduction per drought day were estimated at 0% for the first 33 days, 1 75% for the next 32 days, 5 25% for the next 15 days, 1 33% for the next 30 days, and 0% for the final 15 days of the crop growth cycle (Trop Abst 21 1237)

140 Laird, R J, Ruiz, A B, Rodriguez, J H, Cody, F B 1969 *Combining Data from Fertilizer Experiments into a Function Useful for Estimating Specific Fertilizer Recommendations* Intern Maize and Wheat Imp Cent, Res Bull 12 33 pp (Eng) (Intern Maize and Wheat Imp Center, Mexico)

Fertilizer experiments were carried out with unirrigated corn at 82 locations in the western part of El Bajio, Mexico, during the 4 year period, 1962 1965 The results obtained in the experiments conducted during 1964 1965 are reported here The purpose of this study was to produce a general yield function useful in estimating N fertilizer needs of unirrigated corn for specific producing conditions and to acquire a better understanding of the problems involved in measuring the productivity factors and in calculating a general yield function Eighteen of the soils were heavy textured, 6 were medium textured, and 11 were light textured Eleven of the soils had rooting depths less than 60 cm, 18 from 60 90 cm, and 6 more than 90 cm Grain yields of unfertilized corn varied from 0 20-4 43 ton/ha with an average of 1 50 ton/ha Corn responded significantly to the application of N at all locations except two The application of 120 kg of N/ha increased the average yield by 2 35 ton/ha The yield data corresponding to four levels of N fertilization at 76 locations were combined into a general yield function comprising 23 independent variables These consisted of the linear and quadratic effects of applied N, seven productivity factors, two quadratic effects of productivity factors, and 12 interactions among applied N variables and productivity factors An agronomic approach was followed in deriving the general yield equation The use of the general function in estimating N recommendations for specific producing conditions is illustrated The estimated optimal rates for four soil conditions at ten locations were calculated The simple correlation between the relative yield without applied P and the logarithm of available soil P as determined by the Peech method was 0 607 Using 6 kg of P_2O_5/ha as the limit between responding and non responding soils, this method placed the soils of this study in the correct category in 77% of the cases Based on the observed responses to P fertilization and the magnitude of the N x P interactions, a rule of thumb was suggested for estimating the recommended rate of P fertilization This criterion was used together with the general yield equation for N to calculate general fertilizer recommendations for four soil conditions in four areas receiving different amounts of rainfall It was pointed out that these general recommendations may be used when specific information on site variables is not availabe However, when information on the productivity factors is available for the field for which a recommendation is desired, the general yield equation and the criterion for estimating P needs offer a more adequate means of estimating the best fertilizer treatment (FA 2 1395)

141 Navarro Samano, J 1968 *Cultivation and Fertilizing of Maize* Bol Guanos Fertilizantes Mexico 12(55)1 31 (Eng)

The cultivation and fertilizing of maize in Mexico is reviewed Attention is paid to the choice of hybrids related to altitudes, planting density, rainfall and irrigation, and time of maturation Details are provided of the use of fertilizers under rainfed and irrigated conditions in 60 different locations Methods of fertilizer application are discussed The application of atrazine, simazine, and linuron at 3 kg/ha (50% a i) and of 2,4 D ester at 4 5 kg/ha (50% a i) is recommended to control weed growth Comprehensive details are provided with respect to the control of pests, some 2 7 insecticides are given for the control of each pest separately (Trop Abst 25 46)

142 Leal Diaz, J, Gonzalez E, A 1969 *Application of $(NH_4)_2HPO_4$, $FeSO_4$ and $MgSO_4$ to Maize Foliage ("Zea mays" L) on the Production of Grain* Fourth National Congress of the Mexican Soil Science Society, Abstracts, No 26 (Eng)

$(NH_4)_2HPO_4$ increased yields $FeSO_4$ decreased yields but accelerated maturity, $MgSO_4$ itself had no effect on production of grain, but tended to diminish the detrimental effects of $FeSO_4$ and to increase benefits derived from $(NH_4)_2HPO_4$

143 Leal Diaz J, Gonzalez G, S A 1969 *Foliar Fertilization of Maize ('Zea mays" L) Variety "Sintetico Precoz" With Solutions of H_3PO_4, $(NH_4)_2HPO_4$, and the Formula 18-46 0* Fourth National Congress of the Mexican Soil Science Society, Abstracts, No 25 (Eng)

Best yields were obtained with $(NH_4)_2HPO_4$ in 4% solution applied 48, 63, and 77 days after sowing

144 Ortega T, E 1967 *Correlation Between Analytical Methods for Available P and the Relative Yields of Maize* Bol Guanos Fertilizantes Mexico 12(53) 14 16, 21 7 (Eng)

Fertilizer trials with maize, conducted in Mexico over a 4 year period and a wide range of different soils, showed that the Brays' method (0 03 N NH_4F + 0 025 N HCl) gave the best significant correlation (r = 0 74) between grain yield and soil Adding 80 kg P/ha to soils with a P content of 0 11 kg/ha gave an increase of 500 2,500 kg maize/ha over the control in 83% of the cases this application was economical In contrast, at levels of 11 5 20 kg P/ha only 0 300 kg more maize/ha was obtained in 25% of the cases, and above 20 kg P/ha, dressings of 80 kg P/ha were uneconomical (Trop Abst 25 539)

145 Peregrina R, R P 1965 *Residual Nitrogen from Legumes in Rotation with Maize* Proceedings of the Second Congress of the Mexican Soil Science Society 1 135-43 (Eng)

Highest yields were obtained with heavy applications of N fertilizers (120-40-40 and 160-40-40) Vetch as a preceding crop gave the next best yields followed by clover

146 Rodriguez G, J H, Laird, R J 1967 *A Preliminary Study on the Possibilities to Fertilize Rainfed Maize in El Bajio* Bol Guanos Fertilizantes Mexico 12(52) 12 16, 21 8 (Eng)

A preliminary series of 25 different field trials with rainfed hybrid maize (variety H220 or 230) conducted in 25 locations of Mexico at altitudes of 1,580 1,870 m, showed that at an expected rainfall of 800 900 mm/year a fertilizer response may be predicted in 80% of the years With 640 700 mm/year, responses may be expected in 55% of the years In all trials seed was planted in June in deep clay soils at a density of some 40,000 plants/ha Dosages of 0, 40, 80, and 120 kg N/ha yielded 2 04 3 47 4 41, and 4 85 ton grain/ha, respectively, except when drought occurred in August (Trop Abst 25 538)

147 Rosales Gonzalez, A, Moreno Dahame, R 1965 *The Effect of the Calcium Phosphorus Ratio on the Efficiency of Different Phosphate Fertilizers Applied to Maize, on Soils of the Sierra Tarasca, Michoacan* Proceedings of the Second Congress of the Mexican Soil Science Society 1 129 33 (Eng)

Best results were obtained with poultry manure Superphosphate was more effective than diammonium phosphate Mg did not increase yields, but the application of Ca and K with P gave good results

148 Ruiz B, A, Turrent Fernandez, A, Laird, R J 1969 *Rates of Fertilizers and Density of Population for Maize in the Puebla Valley* Fourth National Congress of the Mexican Soil Science Society, Abstracts, No 22 (Eng)

The experiment entailed a double cube matrix of five levels of N, five of P, and five population densities

TRINIDAD

149 Cornforth, I S 1968 *The Potential Availability of Organic Nitrogen Fractions in Some West Indian Soils* Exp Agr 4(3) 193 201 (Eng)

The effect of four crops of maize on the distribution of organic N in ten West Indian soils given either lime, P, K, Mg and trace elements or no fertilizers was studied in a greenhouse experiment in Trinidad The soils were also analyzed for available N by incubation and chemical methods Variations in the redistribution of organic N fractions during the greenhouse experiment did not permit conclusions to be drawn on the source of N used by maize, although the amount of hydrolyzable N, particularly hexosamine, amino and hydroxy amino N, in the initial samples was closely related to N uptake Part of the chemically stable, non hydrolyzable organic N was broken down by soil organisms during the experiment, this was increased by liming acid soil (Trop Abst 23 2012)

150 Gibbon, D P 1966 *Experiments with Maize in Trinidad* Exp Agr 2 173 78 (Eng) (Univ W Indies, St Augustine, Trinidad)

When weeds and insect pests were controlled by spraying and tillage and when irrigation maintained the soil moisture content at about field capacity, $(NH_4)_2SO_4$ at 140 lb/acre N produced high grain yields when the plant population was at least 20,000/acre (SF 30 633)

151 Wilson, L A, Weir, C C 1970 *Investigations on the Use of the Method of Systematic Variations for Determining Nutrient Requirements of Maize ("Zea mays")* Trop Agr, Trin 47 93 101 (Eng) (Univ West Indies, St Augustine)

The method of systematic variation was used to determine the optimum ratios between N and P, and between K and Mg in sand culture experiments with maize Approximate optimum ratios of 3 1 for N/P and 1 1 for K/Mg were compatible with the highest dry weight yield Relationships between K/Mg nutrient ratio treatments and relative uptake of these elements suggested that there may have been reciprocal antagonism in the uptake of these elements (SF 33 4062)

UNITED STATES

152 Adams, F 1969 *Response of Corn to Lime in Field Experiments on Alabama Soils* Ala, Agr Exp Sta, Bull 391 18 pp (Eng) (Auburn Univ, Auburn, Ala)

Results of 25 field experiments are reported, the sites being located throughout the state and representing the major soil types of the area Critical pH values for corn varied for different soils Corn yields were unaffected by liming over a wide soil pH range Mg deficiency was not evident on soils

where calcitic limestone was compared to dolomitic limestone as a liming material A soil should be limed if its pH is <5 8 (CA 71 90315z)

153 Adriano, D C, Murphy, L S 1970 *Effects of Ammonium Polyphosphate on Yield and Chemical Composition of Irrigated Corn* Agron J 62(5) 561-67 (Eng) (Dep Agron, Kansas Agr Exp Sta, Manhattan, Kansas)

Irrigated corn (*Zea mays*) grown on Zn-deficient, slightly acid Cass fine sandy loam suffered from increasingly severe Zn deficiency when 40 kg/ha P (80 lb/acre P_2O_5) was applied in a band to the side and below the seed Zn deficiency was corrected in the presence of the banded P when Zn was supplied at the rate of 1 1 2 kg Zn/ha as $ZnSO_4$ Banded applications of ammonium polyphosphate (APP) in the presence of inadequate Zn tended to induce more severe Zn deficiencies than did similar applications of monoammonium phosphate (MAP) When adequate Zn was supplied, the two forms of P produced comparable plant growth responses and grain yields Yield depressions noted with the use of banded APP without adequate Zn were associated with higher plant P contents than when the plants were supplied with MAP High levels of plant P were concomitant with low levels of Zn in the plants Banded applications of P resulted in higher plant concentrations of P than did broadcast P applications and induced more severe Zn deficiencies When Zn was limiting, grain yields tended to decrease with increasing P concentrations in young plant tissues In the presence of adequate Zn, concentration of P in young plant tissues was positively correlated with grain yields (CA 73 97960f)

154 Agbim, N N 1968 *Effect of Phosphorus and Magnesium on Zinc Nutrition of Corn* Thesis, Colorado State Univ, Fort Collins, 81 pp (Eng)

Five soils known to be either Zn deficient or responsive to Zn application were used in a greenhouse experiment to study the effects of P and Mg on Zn nutrition of corn A sixth soil, containing an appreciable amount of Zn but responsive to P application, was used as the index soil Soil pH (water paste) was 7 3 7 7 and organic matter 0 3% 1 8% Treatments provided the equivalent of 0 and 150 lbs/acre of P, 0, 10, and 20 lb/acre of Mg, and 0 and 10 lb/acre of Zn Corn tops were harvested 42 days after planting, weighed, and analyzed for Ca, Fe, K, Mn, Mg, P, and Zn Applied P reduced Fe and Zn concentration and Zn uptake but increased both concentration and uptake of Ca and Mg Ca and Zn concentrations were negatively correlated Applied Zn reduced Ca, Fe, Mg, and P concentrations but increased Ca, Mg, and P uptake Applied Mg had no effect on Mg concentration but increased concentration of Fe and uptake of Ca, P, and Zn (FA 1 1212)

155 Alessi, J, Power, J F 1967 *Dryland Corn Growth and Water Relations* N Dak Fm Res 24(12) 4 7 (Eng) (USDA, Mandan, North Dakota)

In a 3 year field trial, maize was sown at various population densities and at various soil moisture levels High soil moisture levels at sowing resulted in high yields of forage and grain as compared with yields under natural dryland conditions The total amount of N absorbed by the crop increased significantly as available soil moisture and yield increased The optimum population density under these dryland conditions was about 10,000 plants/acre (FCA 21 1669)

156 Alessi, J, Power, J F 1965 *Influence of Moisture, Plant Population, and Nitrogen on Dryland Corn in the Northern Plains* Agron J 57(6) 611 12 (Eng) (Montana Agr Exp Sta)

At Sidney, Montana, from 1956 to 1958 and at Mandan, North Dakota, from 1959 to 1961, grain and forage yields of maize were linearly related to available soil moisture at sowing time plus seasonal precipitation These relationships were little affected by plant density, N fertilization, or soil type No grain production can be expected with <6 in of total available water (FCA 19 2128)

157 Allen, S E, Terman, G L 1967 *Response of Maize and Sudangrass to Zinc in Granular Macronutrients* Trans Meet Commns II & IV Int Soc Soil Sci 1966, 255 66 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Sorghum sp, DeKalb SX 11, was grown on Zn deficient Nolichucky sandy clay loam (pH 7 3) and heavily limed Hartsells fine sandy loam (pH 8 0) Zn was applied as $ZnSO_4$, or as $ZnSO_4$ incorporated in 6 + 9 mesh granules of NH_4NO_3 (AN), concentrated superphosphate (CSP), monoammonium phosphate (MAP), or ammonium polyphosphate (APP) to yield N Zn or P Zn ratios of 10 1 Zn uptake by four clippings of forage was Zn alone > AN Zn > CSP Zn > APP Zn = MAP Zn Yield responses declined rapidly after the first clipping but relative uptake values did not change appreciably *Zea mays* L, Funk's G 76, responded well to all sources of Zn applied as fine powders, results were better with AN or CSP than with MAP or APP In granular form, only $ZnSO_4$ and AN Zn supplied sufficient Zn to the crop Results indicate that distribution of Zn in the soil is more important than its water solubility, reaction products of low solubility formed in granules could restrict movement of Zn, reducing its availability (SF 31 1307)

158 Baker, D E, Bradford, R R, Thomas W I 1967 *Accumulation of Ca, Sr, Mg, P and Zn by Genotypes of Corn ("Zea mays" L) Under Different Soil Fertility Levels* Isotopes in Plant Nutrition and Physiology Proc Symp FAO/IAEA, Vienna, 1966, 465 77 (Eng) (Pa State Univ)

There was evidence that concentrations of these and other elements, as well as ionic ratios including P/Zn and Mg/Sr and Ca/Mg, were under partial genetic control (SF 32 1555)

159 Baker, D L, Jarrell, A E, Marshall, L E, Thomas, W I 1970 *Phosphorus Uptake from Soils by Corn Hybrids Selected for High and Low Phosphorus Accumulation* Agron J 62(1) 103 6 (Eng) (Pennsylvania Agr Exp Sta, University Park, Pennsylvania)

Field, greenhouse, and laboratory experiments were conducted over 4 years to relate P accumulations in ear leaves of different corn hybrids and other plant responses to addition of P to soils and root morphology, including the length of the radicle, diameter of the radicle, and the number of seminal roots produced after 4 days in an incubator of high relative humidity at 28° In addition, experiments were conducted to determine the relation of P accumulation in ear leaves and grain yields to P concentrations in seedling plants, seedling growth rate and P uptake from a zone 25 cm (10 in) below the soil surface The concentration of P in seedling plants can be used to predict the availability of P in the soil The

concentrations of P accumulated in ear leaves by the different hybrids could not be explained on the basis of the P absorption characteristics of their roots, but inherent differences among hybrids with respect to depth of rooting are suggested (CA 72 78032t)

160 Bandeen, J D 1965 *Competitive Effects of Quackgrass ("Agropyron Repens") on Corn as Modified by Fertilization with Nitrogen Phosphorus, and Potassium.* Univ Microfilms (Ann Arbor, Michigan), Order No 65-6190, 124 pp, Diss Abst 25(12) 6868 (Eng) (Univ Wisconsin, Madison)

Quackgrass is very competitive, especially for N and K, when grown with corn, because of its ability to remove large amounts of these nutrients before mid July, when corn is achieving its maximum growth rate

161 Barber, W D, Thomas, W I, Baker, D E 1967 *Inheritance of Relative Phosphorus Accumulation in Corn* Crop Sci 7 104 7 (Eng)

The Inheritance of P concentration differences, the measurement of accumulation differences in seedlings, and the effects of soil P variations on accumulation differences were studied Genetically controlled variations in P accumulation existed but effects of soil P were not apparent (SF 30 3654)

162 Bartlett, R J 1965 *Importance of CO_2 in Uptake of Ca by Plants Receiving Only a Nitrate Source of N* Proc Soil Sci Soc Amer 29(5) 555 58 (Eng) (Univ Vermont, Burlington)

A Ca deficiency was induced in maize seedlings (*Zea mays*) growing with roots in contact with $CaCO_3$ in suspension or limestone gravel and sand This was done by supply nitrate and by providing aeration to prevent CO_2 accumulation The probable cause of the Ca deficiency appeared to be the tendency of the nitrate nutrition to maintain the pH of the alkaline medium, thus preventing the $CaCO_3$ solubilization When CO_2 was allowed to build up in the $CaCO_3$ suspension or limestone gravel culture, the pH was lowered during the growth, Ca became more soluble, and the Ca deficiency in the plants receiving nitrate was corrected The substitution of ammonium for nitrate in $CaCO_3$ suspensions corrected the Ca deficiency, which resulted in ammonium uptake, lowered pH, and solubilized Ca CO_2 and ammonium N appeared important in increasing the Ca availability (CA 64 8651h)

163 Beer, C E, Shrader, W D, Schwarke, R K 1967 *Interrelationships of Plant Population, Soil Moisture and Soil Fertility in Determining Corn Yields on Colo Clay at Ames, Iowa* Res Bull 556, Iowa Agr Exp Sta, 15 pp (Eng) (Ames)

In field trials during 6 years, maize at population densities of 8,000 22,000 plants/acre, was irrigated at rates to maintain the available moisture content (AMC) of the soil at levels up to 90% and N was applied at rates up to 120 lb/acre Maximum yields were obtained with a stand of 18 000 22,000 plants/acre, when fertility was not limiting, and when the moisture content of the soil in the rooting zone was maintained at 60% of AMC during the whole growing season On irrigated plots, yields decreased as the amount of irrigation water required to maintain this level increased At the optimum soil moisture content and plant population, yields increased with increase in N up to 120 lb/acre The average yield on plots without irrigation was 108 bu/acre, ranging from 33 to 147 bu/acre, whereas on irrigated plots the average yield was 131 bu/acre ranging from 109 to 147 bu/acre (FCA 21 2445)

164 Beevers, L, Schrader, L E, Flesher, D, Hageman, R H 1965 *Role of Light and Nitrate in the Induction of Nitrate Reductase in Radish Cotyledons and Maize Seedlings* Pl Physiol 40(4) 691 98 (Eng) (Univ Illinois, Urbana)

Induction of nitrate reductase (I) was dependent on the presence of nitrate in the tissue, neither nitrite nor ammonia would induce Induction of *I* was roughly proportional to the concentration of nitrate, and a higher concentration was required in corn than in radish Although induction of *I* occurred in the dark, light increased it Induction was temperature dependent, with a maximum of 31° for radish and 38° for corn Actinomycin D, chloramphenicol, and puromycin inhibited formation of *I* (CA 63 8741c)

165 Blair, G J, Miller, M H, Mitchell, W A 1970 *Nitrate and Ammonium as Sources of Nitrogen for Corn and Their Influence on the Uptake of Other Ions* Agron J 62(4) 530 32 (Eng) (Dep Soil Sci, Univ Guelph, Ontario)

No yield differences in tops or roots were observed between ammonium and nitrate N sources in corn grown for 14 or 28 days in constant flow culture solution There was a greater uptake of N from the nitrate source but approximately 25% of the total uptake remained as nitrate within the plant Higher plant levels of P and S were measured in the ammonium treatment and higher Ca and Mg in the nitrate treatment, indicating a predominately cation anion balance effect (CA 73 55094w)

166 Blanchar, R W, Hossner, L R 1968 *Ionic Balance and Corn Growth in a Port Byron Soil* Agron J 60 602 5 (Eng) (Int Miner Chem Corpn, Libertyville, Illinois)

Zea mays was grown on soil treated with either NH_4^+ N or NO_3 N and various rates of $CaCl_2$ $2H_2O$ The maize tissue was analyzed for Ca, Mg, K, N, P, S, Cl, and NO_3 N Equilibrium extracts of the soil were analyzed for Ca, Mg, K, and electrical conductivity Plant weight was inversely proportional to the negative logarithm of the ionic strength of the soil solution Fertilizing with NH_4^+ N increased the SO_4^{2} content of the plant in the absence of $CaCl_2$ $2H_2O$ Plant Ca content was a linear function of pCa in the soil solution Plant Mg and K contents were related to the functions pMg-0 5 pU and pK pU of the soil solution, where U is the ionic strength (FCA 22 3178)

167 Blanchar, R W, Caldwell, A C 1966 *Phosphate Ammonium Moisture Relations in Soils II Ion Concentrations in Leached Fertilizer Zones and Effects on Plants* Proc Soil Sci Soc Amer 30(1) 43-8 (Eng) (Univ Minnesota, St Paul)

Radioactive pellets of MCP (monocalcium phosphate monohydrate), MCP + NH_4Cl, and MCP + KCl were allowed to react for 2 weeks with Dakota sandy loam (sand 65%, silt 23%, clay 12%, organic matter 3 9%, pH 5 8) The pots containing the fertilizer were then leached with 0, 2, 4, and 8 cm of H_2O Corn was grown in these pots for 2 weeks and analyzed for total and radioactive P Only trace amounts of fertilizer P were

taken up from all nonleached pots When pots were leached with 2 or more cm of H_2O, there was a significant uptake of P When 4 cm of H_2O was used, P uptake from MCP + NH_4Cl pellets was nearly 3 fold that of MCP or MCP + KCl Measurement of H_2O soluble P and other conditions in the fertilizer zone indicated no differences between MCP + NH_4Cl and MCP + KCl pellets In both cases, plant roots were growing in solutions of extremely high P concentration, root accumulation was noted above the pellets in the 1,000 to 2,000 ppm P zone and below the pellet in the 500 to 1,000 ppm P zone No increased root density was found in any portion of the MCP zone P uptake was thus not due to root development and the effect of NH_4^+ on P uptake was probably due to the effect it has on plant functions and not to changes in the availability of P in the soil (CA 65 2958e)

168 Bonds, E , O'Kelley, J C 1969 *Effects of Calcium and Strontium on "Zea mays" Seedling Primary Root Growth* Amer J Bot 56(3) 271 74 (Eng) (Univ Alabama, Tuscaloosa)

Either Ca or Sr in a mineral nutrient medium prevented toxic effects of other nutrient ions on aerated primary roots of maize, other monovalent or divalent cations substituted for Ca did not Ca in the complete nutrient solution, or as $CaCl_2$ alone, stimulated the division of apical meristem cells in these roots, as compared to division in water alone, but Sr did not, however, the replacement of Ca in the nutrient medium by Sr resulted in the development of additional secondary roots, probably in part by decreasing the rate of cell division in the apical meristem of the primary root and thereby diminishing apical dominance (CA 70 114246k)

169 Bradford, R R , Baker, D E , Thomas, W I 1966 *Effect of Soil Treatments on Chemical Element Accumulation of Four Corn Hybrids* Agron J 58(6) 614 17 (Eng) (Pennsylvania Agr Exp Sta , University Park)

Interactions involving soil treatments and 4 hybrids were not significant with respect to dry weights of the plants The greater growth rate of the plants grown on soil limed with dolomitic limestone was attributed to the increased availability of Mg and the retarded growth of plants on the unlimed soil resulted primarily from the presence of toxic concentrations of Mn The concentration of Ca in each hybrid increased with increased rate of calcitic limestone while dolomitic limestone had a negative effect on the accumulations of Ca by each of the hybrids The addition of K had a negative effect on the accumulation of Ca as well as on that of Mg and of Sr The relative accumulation of Sr by the 4 hybrids was very similar to that obtained for Ca There was a significant correlation between dolomitic limestone application and Ca and Sr accumulations Within rates and sources of lime, a positive relation was observed between the accumulations of Sr and Mg for all 4 hybrids The Mg ion from dolomitic limestone was as effective as the Ca ion from calcitic limestone in reducing Sr accumulation by these corn hybrids At the high rate of K, additions of both calcitic and dolomitic limestone caused an increase in the accumulation of K by each of the hybrids which responded equally to applied K (CA 66 10257r)

170 Broadbent, F E , Nakashima, T 1968 *Plant Uptake and Residual Value of Six Tagged Nitrogen Fertilizers* Proc Soil Sci Soc Amer 32(3) 388 92 (Eng) (Dep Soils Pl Nutr , Univ California, Davis)

In pot trials, three fertilizers containing ammonium ^{15}N, two containing nitrate ^{15}N and urea containing ^{15}N were applied to three soils, and plant uptake of surface applied N was measured by growing four crops (two of Sudan grass, one each of tomato and maize) in 314 days Uptake of fertilizer N in plant tops varied from 35% to 71%, with the nitrate fertilizers showing the highest values Residual N in the soil ranged from 18% to 41% and availability decreased with successive crops (FCA 22 1789)

171 Brown, A L , Hills, F J , Krantz, B A 1968 *Lime, Phosphorus, Potassium and Manganese Interactions in Sugar Beets and Sweet Corn* Agron J 60(4) 427 29 (Eng) (Univ California, Davis)

Sugar beets (*Beta vulgaris*) and sweet corn (*Zea mays*) were used as test crops in the greenhouse to study lime, P, K, and Mn interactions in two acid soils from the Sacramento-San Joaquin Delta area Sweet corn showed growth responses to P and K applications but $CaCO_3$ tended to depress growth Supplying P or K or both was more important on these two soils than liming (CA 69 43075v)

172 Brown, A L , Krantz, B A 1966 *Source and Placement of Zinc and Phosphorus for Corn ("Zea mays")* Proc Soil Sci Soc Amer 30(1) 86 9 (Eng) (Univ California, Davis)

The effects of source and placement of Zn and P were studied in several greenhouse experiments A Zn and P-deficient soil was utilized and sweet corn (Golden Cross Bantam T51) was grown as the test plant In order to maintain an adequate supply of N, P, and K, each pot received the equivalent to 200 lb N, 200 lb P, and 250 lb K/2 million lb of soil Zn sources included reagent grade $ZnSO_4$ $7H_2O$, granular $ZnSO_4$, Zn EDTA powder, granular Zn EDTA, Rayplex Zn powder, granular Rayplex Zn, $ZnNH_4PO_4$ powder, and $ZnNH_4PO_4$ (6 16 mesh) Where moderate mixing and incorporation of Zn fertilizer into the root zone was done, $ZnSO_4$ and organic sources such as Zn EDTA were equivalent in their effectiveness for the correction of Zn deficiency However, if the fertilizer was banded under the seed, Zn EDTA was more effective than inorganic sources A small amount of mixing appeared to markedly improve the effectiveness of Zn, P, or both fertilizers Granulation greatly decreased the effectiveness of $ZnSO_4$, $ZnNH_4PO_4$, and Rayplex Zn Hence, granulation, spot placement, or both greatly reduced the effectiveness of the relatively immobile inorganic Zn sources but had no effect on the mobile organic source, Zn EDTA (CA 65 2956b)

173 Brown, J C 1967 *Differential Uptake of Iron and Calcium by Two Corn Genotypes* Soil Sci 103(5) 331 38 (Eng) (U S Dep Agr , Beltsville, Maryland)

Fe inefficient [yellow stripe 1 (ys_1/ys_1)] and Fe efficient (Pa 54) corn showed a differential response when grown on the calcareous Millville soil or the limed Bladen soil (pH 5 0) The ys_1/ys_1 mutant developed Fe deficiency symptoms on both soils, whereas Pa 54 developed no Fe chlorosis on either soil Both plants developed Fe chlorosis when grown on the calcareous Tripp soil The ys_1/ys_1 mutant can be classed with "acid soil plants" Fe deficiency was accentuated by PO_4^{3-}

and the two corn genotypes differentially absorbed and translocated PO_4^3 from organic PO_4^3, a factor that may be associated with the utilization of Fe The two corn genotypes showed a differential uptake of Fe from a Cu deficient Blade soil (pH 5 0) The addition of Cu to the soil decreased the absorption and translocation of Fe much more in Pa 54 than in the ys_1/ys_1 corn The factor affected by Cu appeared to be a point of interest that varied differentially in the two corn genotypes As Cu decreased the absorption and translocation of Fe, it enhanced the distribution of Ca into the top leaves, preventing the twisted and necrotic areas of the leaf often associated or referred to as a Cu deficiency symptom (CA 67 32042q)

174 Brown, J C, Bell, W D 1969 *Iron Uptake Dependent Upon Genotype of Corn* Proc Soil Sci Soc Amer 33(1) 99 101 (Lng) (U S Dep Agr, Beltsville, Maryland)

Genetic variants are responsible for a differential uptake of Fe by ys_1 and Pa 54 corn (*Zea mays*) Different degrees of Fe stress were developed in the plants by supplying them with increasing amounts of FeHLDTA Fe stress enhanced Fe uptake more in Pa 54 than in ys_1 corn Enhanced Fe uptake was also associated with the ability of the plant to lower the pH of the nutrient solution, Pa 54 $>ys_1$ Uptake of P was accentuated more in ys_1 than Pa 54 by adding $CaCO_3$, or by adding KCl instead of K_2SO_4 as a source of K to the nutrient solution Phosphate reduced Fe uptake more in ys_1 than in Pa 54, and increased the incidence of chlorosis in ys_1 (FA 2 1128)

175 Brown, J C, Ambler, J E 1970 *Further Characterization of Iron Uptake in Two Genotypes of Corn* Proc Soil Sci Soc Amer 34(2) 249 52 (Eng) (Soil and Water Conserv Res Div, Agr Res Serv, Beltsville, Maryland)

Two genotypes of *Zea mays* (corn) homozygous yellow stripe ys_1/ys_1 (Fe inefficient) and Pa 54 (Fe efficient), were grown in nutrient solution with two levels of $CaCO_3$ using two plant populations The nutrient solution and plant population were varied to evaluate and compare the two genotypes relative to modifications in their growth medium favorable to Fe transport Plant factors recognized as favoring Fe transport were ability of roots to lower the pH of their growth medium, efflux of material by the root that reduces Fe_3^+ to Fe_2^+, increase of citrate in root sap, and decrease of P in root sap The Fe-efficient Pa 54 corn was more efficient than the yellow stripe ys_1 in all the above factors and transported more Fe to leaves than ys_1 Once the Fe requirement of the plant had been satisfied, the activity of the factors favoring Fe transport diminished and less Fe was taken up by the plant (CA 73 24399v)

176 Brown, L D 1968 *Pop-Up Where, When, and How Much?* Agr Chem 23(4) 22 6 (Eng) (Southwest Potash Corp)

Some 500,000 acres of corn were planted with pop up fertilizers in 1966 Use of pop up instead of row fertilizers can reduce labor requirements during planting, encourage earlier cultivation, and promote earlier planting Pop up fertilizers may be either dry or liquid, with liquids being the easier to handle at low rates of application Application rates are 10 20 lb/acre of N + K_2O regardless of row width Grade or ratio used should be high in P, have a high water solubility and low salt index, and liberate little ammonia, although containing both ammonia and nitrate N Pop fertilizers should contain all three primary nutrients, preferably from high analysis salts (FA 1 929)

177 Bruce, R R, Sanford, J O,, Myhre, D L 1966 *Soil Water and Nitrogen Influence on Growth and Fruiting of a Cytoplasmic Male-Sterile Corn Hybrid and Its Fertile Counterpart* Agron J 58(6) 631 34 (Eng) (Mississippi Agr Exp Sta, State College)

Male sterile plants were measurably and consistently shorter than the fertile plants before meiosis, and the maximum difference in height occurred at or after anthesis, the time when maximum height was attained Throughout the experiment the male sterile strain significantly and consistently outyielded the fertile strain The difference in ear production potential of the two strains was increased by the higher soil water tension (6 bars) regime and insufficient N The top ear length and diameter of plants grown at the low soil water tension (0 3 bar) regime were significantly greater than those of plants grown at the higher soil water tension regime The second ear diameter of the sterile strain plants increased almost linearly with N (90, 180, 270, and 360 lb/acre) level, whereas that of fertile plants seemed to increase up to 270 lb/acre and then decrease (CA 66 10259x)

178 Carter, O G, Lathwell, D J 1967 *Effect of Chloride on Phosphorus Uptake by Corn Roots* Agron J 59 250 53 (Eng) (New York State Coll Agr, Cornell Univ, Ithaca)

Seedlings reared in culture solution were transferred at 20 days to a solution of pH 4 containing 1 2 mM KNO_3, 0 8 mM $Ca(NO_3)_2$ and 0 4 mM $MgSO_4$, and 4-day-old excised roots were provided with 0 2 mM $CaSO_4$ solution of pH 4 One hour absorption periods using concentrations up to 0 1 M KCl had no apparent effect on uptake of P^{32} from 2 260μM KH_2PO_4 by either material (SF 30 4436)

179 Colliver, G W, Welch, L F 1969 *Care is Needed to Avoid Ammonia Injury to Corn* Illinois Res 11(2) 8 9 (Eng) (Univ Illinois, Urbana)

Anhydrous ammonia was injected into field plots of a Flanagan silt loam at rates of 100, 200, 300, and 400 lb/acre of N It was applied at depths of 4, 7, and 10 in and 0, 2, or 4 weeks before planting corn Corn was planted 2 in deep directly on top of each ammonia injection band Twelve days after planting, seeds on control plots were fully germinated For 100 lb/acre of N applied 4 in deep, the stand was 86%, for the same amount applied 7 in deep, the stand was nearly 100% The 300 lb and 400 lb rates had stands of 92% and 87% when applied 10 in deep At lesser depths for these and other rates, stand continued to increase up to 19 days and even slightly after that Rates of 200 lb/acre and greater applied 4 or even 7 in deep caused severe stunting of the plant Root systems also were restricted so that P deficiency symptoms (purple coloration) appeared, these disappeared after a few weeks (FA 2 1333)

180 Colliver, G W, Welch, L F 1970 *Toxicity of Preplant Anhydrous Ammonia to Germination and Early Growth of Corn I Field Studies* Agron J 62(3) 341-46 (Eng) (Dep Agron, Univ Illinois, Urbana)

Field experiments were conducted to study the effects of preplant anhydrous NH_3 on germination and early growth of corn (*Zea mays*) Corn was planted directly over and parallel to NH_3 bands applied at different rates, depths, and times before planting Injurious effects on corn found with certain NH_3 treatments were reduced stand, stunted early growth, restricted seedling root development, and increased occurrence of P-deficiency symptoms These effects were generally most severe for NH_3 applied 0 cm deep immediately before planting at 5 cm deep Increasing the time interval to 1 or 2 weeks between application and planting generally reduced the toxic effects Increasing the depth of application was more effective in reducing injury than was increasing the time interval between application and planting Injury was largely prevented when application depth was 25 cm, for all times and rates of application Injury generally increased as rate of NH_3 application increased Soil (NH_3 + NH_4^+) N concentration near seeds in excess of approximately 1,000 ppm resulted in significant stand reductions (CA 73 44343a)

181 Colliver, G W, Welch, L F 1970 *Toxicity of Preplant Anhydrous Ammonia to Germination and Early Growth of Corn II Laboratory Studies* Agron J 62(3) 346-48 (Eng) (Dep Agron, Univ Illinois, Urbana)

Laboratory experiments were conducted to determine concentrations of NH_3 in soil which are toxic to germination and early root growth of corn (*Zea mays*) In one experiment seeds were germinated in soil uniformly mixed with a given rate of anhydrous NH_3 and in another experiment roots were grown into successive layers of soil containing increasing amounts of NH_3 Germination and early growth was retarded when soil (NH_3 + NH_4^+) N concentration reached 944 ppm (pH 8 1) and essentially completely inhibited when it reached 1,628 ppm (pH 9 0) Roots grew through 3 cm layers of soil containing 1,172 ppm (NH_3 + NH_4^+) N (pH 8 4), but did not grow into layers containing 1,485 ppm (NH_3 + NH_4^+) N (pH 8 7) Radicles stunted by NH_3 were thicker and had more branching than those of control plants Root tips which encountered toxic amounts of NH_3 had a brown, scorched appearance (CA 73 44344b)

182 Colyer, D, Kroth, E M 1968 *Corn Yield Response and Economic Optima for Nitrogen Treatments and Plant Population Over a Seven Year Period* Agron J 60(5) 524 29 (Eng) (Dep Agr Econ, Univ Missouri, Columbia)

In field trials at two sites during 1961 67, yield response of maize to N varied significantly with year and with site Regression analysis was used to determine response surfaces, maximum and optimum economic treatments and yields Optimum N treatments varied from 21 4 to 202 1 kg/ha and optimum planting rates from 12,189 to 54,135 plants/ha The economic optimum rate of N application was 120 kg/ha and the optimum plant population 37,787 plants/ha These compare with 103 kg N and 34,519 plants/ha which were the averages for the 7 singe year calculations (FCA 22 1788)

183 Colyer, D, Kroth, E M 1970 *Expected Yields and Returns for Corn Due to Nitrogen and Plant Population* Agron J 62(4) 487 90 (Eng)

Expected corn (*Zea mays* L) yields, net returns, and variances have been calculated from predicted yield data based on regression analysis of N and population experiments for 7 and 8 year periods in Missouri Data from nonirrigated and irrigated experiments are used for comparative purposes The pattern of expected yields and returns was similar for the two sets of data although maximum yields and returns for the irrigated plots were greater and were obtained at greater input levels for both N and population However, variance patterns, which result from different levels of N use, were quite dissimilar Variance generally increased with larger N inputs for the nonirrigated experiment but decreased for the irrigated site Variances tended to reach a maximum (nonirrigated) or minimum (irrigated) at about the peak of expected yields

184 Cummings, K R 1967 *Plant and Animal Response to Nitrogen Fertilization of "Zea mays" and Sorghum Vulgare var Sudanense* Univ Microfilms (Ann Arbor, Michigan), Order No 67 16,633, 150 pp, Dissertation Abstract B 28(6)2202 (Eng) (Purdue Univ, Lafayette, Indiana)

A 3 year study was conducted with corn using N fertilization at levels of 0, 100, 200, 400, or 800 lb/acre Forage and grain yield tended to increase with level of N, but the increase was small above 100 lb/acre due to 3 years of dry weather Although high levels of N fertilization increased the nitrogenous constituents of plants, no detrimental effects were noted in animals fed these forages

185 Dingus, D D, Keefer, R F 1968 *Effect of Interrelations Among the Elements Zinc, Copper, Manganese, and Magnesium on the Growth and Composition of Corn ("Zea mays")* Proc W Va Acad Sci 40 12 18 (Eng) (West Virginia Univ, Morgantown)

Corn was grown on Monongahela silt loam limed to pH 6 8 and fertilized with N 600 P 800, and K 400 lb/acre Cu 0 1, Zn 0 20, Mg 0-80, and Mn 0-4 lb/acre were applied to the soil Zn all levels increased corn yields, while intermediate levels of Mg and Mn caused some reduction in yield, and Cu had no effect Zn prevented accumulation of Mn, especially in the leaves It also reduced the accumulation of Cu and Mg in parts of the plants Zn deficiency created a Mn Zn imbalance A Mn Zn ratio of 0 6 1 gave high yields and growth was restricted when this ratio was >1 The presence of 4 lb/acre of Mn increased the Cu uptake by the plants The metal contents were determined in the roots, stems, and leaves of 42 day old plants by atmospheric absorption spectroscopy (CA 70 105510q)

186 Dios Vidal, R, Broyer, T C 1965 *Deficiency Symptoms and Essentiality of Molybdenum in Corn Hybrids II* Agrochimica 10(1) 39-47 (Eng) (Univ California, Berkeley)

The effect of Mo on the ears and seed of corn was studied Seeds were germinated for 7 days K_3PO_4 was used as basic fertilizer A first generation seed with an average of 0 045 γ Mo/seed and 70% germination ability was employed No disorder was seen in any Mo cultures Abnormalities appeared in all plants without Mo 60 days after planting Small white spots appeared at the large veins Mo deficiency increased the lengthwise splitting of the modified leaves, and the vertical growth of the ear was stunted Ten days later after the Mo addition (60 days after planting), a recovery was observed and

the plants grew two more ears at the bottom of the stalk Weight of stalk did not differ from controls Mo at 186 ppm in grain is enough for normal production when the plant is young, but deficiency may occur in the last stage of growth Plant leaves with acute Mo deficiency had 0 2 ppm in dry weight, three times that of stem and double that of roots, in a normal plant the Mo is 13 ppm in leaves and four times that of roots Mo affects the direct and indirect enzymic action of gibberellins or auxins (CA 64 14911e)

187 Dobson, J W, Jr, Wells, K L, Fisher, C D 1970 *Agronomic Effectiveness of Ammonium Orthophosphate and Ammonium Polyphosphate as Measured by Ion Uptake and Yield of Corn* Proc Soil Sci Soc Amer 34(2) 323 26 (Eng) (Coll Agr Exp Sta, Univ Georgia, Blairsville)

Ammonium orthophosphate (AOP) and ammonium polyphosphate (APP) were compared as P sources for corn on an acid bottomland and an upland soil, both of which tested low in available P Determinations were made for dry matter and ion accumulation by corn plants (*Zea mays*) harvested 30 days after emergence, and for grain yield No significant differences were found between AOP and APP for any of the parameters measured All significant differences determined were due to rate of applied P In a related study to determine the interaction of P source, Zn, and lime rate on dry matter, ion accumulation and yield of grain, no differences were observed due to source of P Both sources of P were equally effective on corn production for the parameters measured (CA 73 3107h)

188 Doss, B D, King, C C, Patterson, R M 1970 *Yield Components and Water Use by Silage Corn with Irrigation, Plastic Mulch, Nitrogen Fertilization and Plant Spacing* Agron J 62(4) 541-43 (Eng)

Corn was grown on a Lucedale fine sandy loam soil to determine the effects of irrigation, plastic mulch, N rate, row width, and plant population on yield components and water use by corn Irrigation, plastic mulch, and higher plant population increased the dry matter yields of all plant parts Closer row width increased dry matter yields of stalks and leaves but slightly decreased ear yields N rate had little or no effect on dry matter yields of any plant part Stalks comprised an average of 45% of the total plant dry weight, ears 36%, and leaves 19% Plastic mulch decreased average daily water use rates during the early part of the growing season but had little effect during the latter part of the season Row width, plant population level, and N rate had little or no effect on water use rates Daily water use rates during the season for unirrigated corn averaged 0 29 cm for plastic covered plots and 0 31 cm for uncovered plots Average rates for irrigated corn were 0 34 cm for plastic covered and 0 47 cm/day for uncovered plots

189 Dougherty, C T 1967 *Potassium Nutrition and the Distribution of Carbohydrates in the Immature Endosperm of "Zea mays"* Diss Abstr 27(7) 2207B (Eng) (Purdue Univ, Lafayette, Indiana)

An attempt was made to evaluate the role of K nutrition in the carbohydrate metabolism of the endosperm of normal maize and its contribution to grain yield K content of immature endosperm varied only slightly in maize grown over a range of fertility levels capable of producing 110 to 160 bu/acre Lower K concentrations were found in the endosperm of maize yielding 70 to 80 bu/acre when grown at lower K rates Maize grown at higher K rates contained more endosperm K, the highest found was 0 055 M (FCA 21 143)

190 Engelstad, O P, Moreno, E C 1965 *Effect of P Concentration and Distribution on P Uptake and Root Growth of Corn* Soil Sci 99(4) 227 33 (Eng)

Corn was grown in nutrient solutions containing 15, 30, and 60 ppm P Accumulation of P per unit weight of roots was not affected by P concentration The accumulation of P in tops was greater for plants having roots growing in the more concentrated P solutions Yield of corn and P uptake in the greenhouse were not affected by the water solubility of phosphates when their distribution was restricted to a uniform volume of soil When the distribution was not restricted in volume dry matter yields and P uptake were much greater with the water soluble source The effect of water solubility of P was that of increasing the volume of soil contacted by fertilizer P In a placement experiment, the higher P concentration in the vicinity of the band of very water soluble phosphate markedly stimulated root and top growth when the phosphate was banded near the seeds (CA 63 6271c)

191 Engelstad, O P, Terman, G L 1966 *Fertilizer Nitrogen Its Role in Determining Crop Yield Levels* Agron J 58(5) 536 39 (Eng) (Div Agr Dev, Tennessee Valley Authority, Muscle Shoals, Alabama)

The results of over 100 field experiments with maize and cotton indicated that the frequency and magnitude of crop responses to N were generally greater than those to P and K in representative cropping areas of the humid region of the USA N acts as a relatively mobile nutrient and crop requirement and removal tend to be high Since N is also lost from soils by leaching and volatilization, little accumulation occurs in humid areas, applications therefore need to be made largely on the basis of current crop needs (FCA 20 1597)

192 Engelstad, O P, Hunt, C M, Terman, G L 1964 *Response of Corn to Nitrogen in Oxamide and Ammonium Nitrate in Greenhouse Experiments* Agron J 56(6) 579 82 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Recovery of N by a single crop of corn from oxamide mixed with the soil decreased with increase in granule size, but total recovery by three successive crops was similar for several sizes of oxamide Similar high recoveries of N by a single corn crop resulted from mixed application of the fine oxamide, urea, NH_4NO_3, and $(NH_4)_2SO_4$ Recovery from surface applied urea and fine oxamide was much lower (CA 66 36878u)

193 Estrada, J, Cummings, G A 1968 *Effects of Lime and Phosphorus Treatments in Specific Horizons of Acid Soil on Growth and Chemical Content of Corn* Agron J 60 447 50 (Eng) (N C State Univ, Raleigh)

In greenhouse experiments, increasing the supply of P in the A_p and A_2 horizons of a loamy sand gave significant increases in top growth, these increases were greater when P was applied to the A_p rather than to the A_2 horizon Roots responded similarly but relative increases were smaller with

high levels of P Lime applied in the A_2 horizon slightly increased the weight of tops, and that of roots from the A_p horizon Increase in P content was obtained from the second increment (90 to 360 kg/ha) of P Lime application decreased P and Al concentrations, but Al was decreased more by P treatment (FCA 21 729)

194 Fuehring, H D 1966 *Nutrition of Corn ("Zea mays") on a Calcareous Soil III Interaction of Zinc and Boron with Plant Population and the Relation Between Grain Yield and Leaf Composition* Proc Soil Sci Soc Amer 30(4) 489 94 (Eng)

A field experiment on corn with N, Zn, Mn, B, and plant population as variables resulted in important positive interactions of plant population with applied Zn and B, indicating that limited Zn or B may be part of the reason for the severe yield decrease resulting from planting corn too thickly High rates of applied Zn or B (90 180 kg/ha) depressed grain yield at low plant populations (40,000 53,333 plants/ha) but increased yields at high plant populations (80,000 93,333 plants/ha) The logarithm of the nitrate N concentration of the midrib of the sixth corn leaf at the silking stage was closely correlated with grain yield up to ~1,000 ppm The relation between the total N concentration of the leaf blades and grain yield was less distinct The phosphate P concentration of the midrib and the total P concentration of the leaf blades were significantly increased by increasing applications of N The B concentration of midribs at the point of maximum yield varied from <60 ppm at low plant population to 120 ppm at high plant population (CA 65 19259f)

195 Gangwar, M S 1967 *Aluminum Sorption by Plants as Influenced by Calcium and Potassium* Diss Abstr 28(5) 1758B 9B (Eng) (Univ Hawaii, Honolulu)

Absorption and uptake of K, Ca, and Al were studied in maize and kaimi clover (*Desmodium canum*) (FCA 21 2454)

196 Ganiron, R B, Adriano, D C, Paulsen, G M, Murphy, L S 1969 *Effect of Phosphorus Carriers and Zinc Sources on Phosphorus Zinc Interaction in Corn* Proc Soil Sci Soc Amer 33(2) 306 9 (Eng) (Kansas State Univ, Manhattan)

Growth of corn (*Zea mays*) seedlings in solution cultures responded to temperature > Zn rate > P carrier > Zn source P accumulated in roots and shoots of Zn-deficient seedlings at the higher temperature, but was depleted from roots when seedlings were supplied with Zn Nearly similar Zn concentrations were usually present in roots and shoots of seedlings grown at the lower temperature, suggesting that temperature affected soil Zn availability more than uptake or translocation $NH_4H_2PO_4$ was slightly more favorable for growth than NH_4 polyphosphate, but the latter increased P uptake more than $NH_4H_2PO_4$ Chelated Zn was a slightly more efficient source than $ZnSO_4$ P depressed corn grain yields when soil Zn levels were low Applying Zn increased grain yields only to levels produced without P fertilization Concentrations of P in the leaves varied inversely with the rate of Zn fertilization, but concentrations of Zn were not affected markedly by the treatments The polyphosphate and chelated Zn were only slightly better sources than $NH_4H_2PO_4$ and $ZnSO_4$, respectively (CA 70 114269v)

197 Garg, K P, Welch, L F 1967 *Growth and Phosphorus Uptake by Corn as Influenced by Phosphorus Placement* Agron J 59(2) 152 54 (Eng) (Univ Illinois, Urbana)

The yield of forage was increased at each harvest by the addition of P and the increase occurred irrespective of the placement, but the size of the yield increase was greater for seed placement, at least during the early stages of growth, than for either the same quantity of P in mixed or banded placement The percent P was correlated with yield There was little difference in dry matter yield between banded and mixed P Added P increased the P level in the corn Placement with the seed resulted in the highest percent P Mixed placement gave more P in the plant than did banded placement for the 14 and 21 day harvests, but this situation was reversed at the 28 day harvest The difference between the relative efficiency of banded and mixed P is greater at low than at high temperatures The percent plant P decreased with age except for the banded P plants in which it decreased from the first to the second harvest but increased from the second to the third The percent seed emergence and time of emergence were not affected by P placement Added P decreased the percent N with time (CA 66 104397p)

198 Giddens, J, Arsjad, S, Rogers, T H 1965 *Effects of Nitrogen and Green Manures on Corn Yield and Properties of a Cecil Soil* Agron J 57(5) 466 69 (Eng) (Dep Agron, Univ Georgia, Athens)

It is concluded that N applied directly to maize is much more efficiently used by the plant than N applied to rye grown as a preceding green manure Although N was conserved by the green manure, its immobilization, even after 6 years, caused inadequate release of N for maize production (FCA 19 833)

199 Giordano, P M, Mortvedt, J J 1969 *Phosphorus Availability to Corn as Affected by Granulating Manganese with Ortho and Pyrophosphate Fertilizers* Proc Soil Sci Soc Amer 33(3) 460-63 (Eng) (Nat Fert Develop Center, Tennessee Valley Authority, Muscle Shoals, Alabama)

The presence of $MnSO_4$ at a level of 10% Mn in granular ammonium polyphosphate (APP) and triammonium pyrophosphate (TPP) significantly reduced corn (*Zea mays*) forage yields and P uptake relative to treatments where P and Mn were applied separately in greenhouse pots A significant reduction in P uptake resulted when $MnSO_4$ was combined with $NH_4H_2PO_4$, but no yield reduction occurred Chemical extraction of the fertilizers indicated that the solubilities of both P and Mn were reduced when $MnSO_4$ was granulated with APP or TPP A compound of very low solubility, $Mn(NH_4)_2P_2O_7\ 2H_2O$, was identified as the principal reaction product Accordingly, movement of P in soil was restricted to a greater extent when $MnSO_4$ was combined with TPP than with $NH_4H_2PO_4$ (CA 71 29712k)

200 Giordano, P M, Mortvedt, J J, Papendick R I 1966 *Response of Corn ("Zea mays") to Zinc, as Affected by Placement and Nitrogen Source* Proc Soil Sci Soc Amer 30(6) 67 70 (Eng) (Div Agr Develop, Tennessee Valley Authority, Muscle Shoals, Alabama)

Dry matter production and uptake of Zn, N, and P by corn grown in greenhouse pots (using a sandy clay loam) were higher with $(NH_4)_2SO_4$ than with anhydrous NH_3 or

$CO(NH_2)_2$, whether $ZnSO_4$ was mixed, spot placed, or not applied These results are largely explained by the lower soil pH associated with application of $(NH_4)_2SO_4$ and hence, the increased availability of indigenous and applied Zn When the fertilized soil had been incubated for 4 weeks prior to planting, yields were lower when Zn was mixed with the soil, but higher when Zn was omitted or spot placed, as compared with treatment just prior to planting In general, Zn and N uptake varied directly with yield and inversely with P uptake, except where growth was extremely poor due to severe Zn deficiency (CA 66 85143j)

201 Giordano, P M, Mortvedt, J J 1969 *Response of Several Corn Hybrids to Level of Water Soluble Zinc in Fertilizers* Proc Soil Sci Soc Amer 33(1) 145-48 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Fertilizers varying in level of H_2O soluble Zn were prepared by combining fine ZnO and $ZnSO_4$ in various proportions and pressure granulating the powders with ammonium nitrate monoammonium phosphate, or ammonium polyphosphate Forage yields and uptake of Zn by corn (*Zea mays* L) grown on a P and Zn-deficient soil in the greenhouse increased with the level of H_2O soluble Zn in these macronutrient fertilizers Additional crop response was slight to fertilizers with levels of H_2O soluble Zn in excess of about 50% but this varied, depending upon the macronutrient carriers However, the amounts of Zn extracted after cropping from untreated soils and soils initially receiving 12 mg of Zn/3 kg of soil in a highly H_2O soluble form were comparable In a second experiment differential response of several corn hybrids to amount of P and Zn and level of Zn solubility in the fertilizers suggests that the test variety might influence the interpretations of the results from fertilizer evaluation studies No relationship was found between P/Zn ratios in the corn forage and the seed The P/Zn ratios in corn forage were not related to the response of corn to applied Zn (FA 2 1134)

202 Giordano, P M 1966 *Uptake of Molybdenum at Two pH Levels, as Influenced by Anaerobiosis* Plant Soil 25 467 70 (Tennessee Valley Authority, Muscle Shoals, Alabama)

The effect of anaerobiosis (N_2 compared with normal aeration) at pH levels in the nutrient medium of 3 5 and 6 5 on Mo uptake by maize and tomato was studied Species differences appeared to alter the penetration and transport of Mo High nutrient levels in roots did not necessarily indicate the nutrient status of shoots, while analysis of shoot tissue could also be misleading in assessing total Mo removal under certain cultural environments (SF 30 1249)

203 Giordano, P M, Mortvedt, J J 1966 *Zinc Availability for Corn as Related to Source and Concentration in Macronutrient Carriers* Proc Soil Sci Soc Amer 30(5) 649 53 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

ZnO, $ZnSO_4$, and ZnS were tested as sources of Zn at rates of 1, 2, and 4 ppm of Zn for two successive crops of corn (*Zea mays*) grown on Nolichucky sandy clay loam (pH 7 3) Each source was mixed throughout the soil as finely ground material, incorporated into granules of NH_4NO_3 or NH_4 polyphosphate by pressure granulation, and into granules of concentrated superphosphate during the granulation stage of the manufacturing process When mixed with the soil, ZnO and $ZnSO_4$ were more effective than when incorporated with a macronutrient carrier Both ZnO and $ZnSO_4$ were markedly superior to ZnS NH_4NO_3 and NH_4 polyphosphate were comparable carriers when $ZnSO_4$ was the source, but NH_4NO_3 was inferior when ZnO was pressure granulated with concentrated superphosphate, NH_4NO_3, NH_4 polyphosphate, or Nolichucky soil to contain 0 5%, 2 0%, or 8 0% of Zn Soil granules and concentrated superphosphate were applied at 1, 2, and 4 ppm of Zn, while NH_4NO_3 and NH_4 polyphosphate were applied at 2 ppm only Forage yields and Zn uptake varied inversely with concentration of Zn in all carriers (CA 66 36928k)

204 Goodsell, S F 1968 *Potassium in Mature Kernels of Normal and Opaque 2 Maize* Crop Sci 8(3) 281-82 (Eng) (Pioneer Hi Bred Corn Co, Johnston, Iowa)

In 63 paired comparisons, among progenies of *Zea mays* L, opaque 2 kernels averaged 41% higher concentration and 27% more total K than translucent kernels from selfed or sib pollinated ears borne on F_1 plants of inbred X opaque 2 parents Progenies averaging 11 0% protein were 0 37% and 0 52% K for translucent and opaque 2 kernels, respectively Progenies averaging 15 5% protein were 0 38% and 0 53% K for translucent and opaque 2 kernels, respectively The concentration of K was significantly higher for the opaque 2 kernels from 38 samples of 16 inbred X opaque 2 crosses and 25 samples of Illinois High Protein X opaque 2 crosses Data indicate that the high K concentration in opaque 2 kernels may be controlled by the same gene system responsibile for the opaque 2 character (FA 1 1361)

205 Guzman, V L, Burdine, H W, Forsee, W T, Jr, Harris, E D, Jr, Orsenigo, J R, Showalter, R K, Wehlburg, C, Winchester, J A, Wolf, E A 1967 *Sweet Corn Production on the Organic and Sandy Soils of South Florida* Bull Fla Agr Exp Sta 714 12 13 (Eng) (Everglades Sta, Belle Glade, Florida)

Includes a short discussion of soil, moisture, and nutritional requirements On sandy soils a minimum of 160 lb N, 100 lb P_2O_5, and 120 lb K_2O/acre is required for optimum yields of high-quality ears On organic soils N is unnecessary except under prolonged cold and rainy conditions, but trace elements are required (SF 31 2115)

206 Hammond, L C, Robertson, W K 1966 *Effect of Fertilizer Placement on P and K Uptake by Corn* Proc Soil Crop Sci Soc Fla 25 226 31 (Eng) (Florida Agr Exp Sta, Gainesville)

The results of studies on the uptake of P and K by maize from localized and broadcast applications of fertilizer on fine sand generally agreed with the theoretical considerations proposed by De Wit The fairly high uptake of P and K from this soil suggested that broadcast application would be better than localized placement (SF 30 2052)

207 Hassan, N, Olson, R A 1966 *Influence of Applied Sulfur on Availability of Soil Nutrients for Corn ("Zea mays") nutrition* Proc Soil Sci Soc Amer 30(2) 284-86 (Eng) (Univ Nebraska, Lincoln)

Influence of applied S on soil properties and nutrient uptake was studied on three soils ranging from acid to calcareous with growth of corn in the greenhouse The heaviest rate of 5,000 ppm S produced toxic effects on the acid and neutral soils, a consequence of sharp pH reduction and excessive S and Mn uptake Otherwise, S treatment had beneficial effects on P nutrition on neutral and calcareous soils, S and Mn nutrition (up to a modest rate of S) on all soils, Zn in early nutrition on all soils with slight benefit carrying over to late harvest only on calcareous soil, Fe nutrition on calcareous soil, and Cu nutrition until early harvest with all soils and through late harvest with neutral and calcareous soils With a low rate of 50 ppm S, mixing was more efficacious than banding on all soils (CA 65 7955b)

208 Hassan, N A K, Drew, J V, Knudsen, D, Olson, R A 1970 *Influence of Soil Salinity on Production of Dry Matter and Uptake and Distribution of Nutrients in Barley and Corn II Corn ("Zea mays")* Agron J 62(1) 46-8 (Eng) (Dep Agron, Univ Nebraska, Lincoln)

The production of dry matter and uptake of nutrients by corn from soil adjusted to different levels of salinity with a mixture of salts were evaluated and compared with results obtained with barley (*Hordeum vulgare*) Soil salinity levels ranging from electrical conductivity (EC) values of 0 16 millimhos/cm of the soil solution at field capacity were induced following germination of the plants by addition of a solution containing 1 part Na_2SO_4, 1 part $MgSO_4$, and 1 part $CaCl_2$ During the growth period of 93 days, increasing soil salinity increased sulfate S and Cl in the saturation extract and lowered soil pH Exchangeable Na, Mg, and Ca increased markedly, while exchangeable K and available P increased only slightly Increasing salinity had little or no effect on acid-extractable Zn, Fe, Cu, and Mn Production of dry matter by the leaves, stems, and tassels of corn decreased significantly with increasing salinity In the case of the leaves and stems of corn, coefficients of correlation indicate significant negative relations between soil salinity and uptake of P, K, Ca, Cu, Fe, and Mn, and a positive relation between soil salinity and uptake of Na In the case of the corn tassels, significant negative relations exist between salinity and uptake of Ca, Fe, and Mn (CA 72 78029x)

209 Hayes, D D, Douglas, A G, Beaty, E R 1967 *Influence of Fertility and Plant Population on Yield of Corn in Northwest Georgia* Ga Agr Res 8(4) 11 12 (Eng) (Georgia Brch Agr Exp Sta, Calhoun)

In trials in 1965, yields of maize cv Pioneer 309B with N applied at 100, 200, and 400 lb/acre and chicken litter and cow manure at 4 tons dry matter/acre ranged from 167 to 176 bu/acre compared with 155 bu/acre with no N In 1966 the highest yields were obtained from maize sown 12 in apart in rows 20 in apart (FCA 21 110)

210 Hemken, R W, Vandersall, J H, Clark, N A 1969 *The Effect of Nitrogen Fertilization on the Yield and Feeding Value of Corn Silage* Bull Md Agr Exp Sta A 158 7 pp (Eng) (Md Agr Exp Sta)

Application of 225 kg/ha N on a moderate to severely eroded loam soil increased the dry matter and protein yields of maize and increased the NO_3 level in the forage The latter decreased after ensiling and had no detrimental effect on the performance of lactating dairy cows (SF 33 4066)

211 Herron, G M 1969 *Corn Yields, Nitrogen Content and Residual Mineral Nitrogen in Soil as Affected by Irrigation and Applied Nitrogen* Diss Abstr 29(12) 4478B (Eng) (Univ Nebraska, Lincoln)

In field trials in Nebraska in 1964 66 studies were made of the accumulation, movement, and utilization of N in maize grown with optimum production methods and yielding up to 180 bu grain/acre (FCA 23 230)

212 Hough, H, Painter, L I, Singleton, P, Seamands, W, Partridge, J, Moine, C, Robbins, G 1966 *Summary of 1965 Fertilizer Studies in Wyoming* Wyo Univ Agr Exp Sta Bull 454 18 pp (Eng)

Tables of yields of alfalfa, dry beans, shelled corn and corn silage, grass hay, potatoes, small grain, and sugar beets resulting from the soil application of N, P, Fe, Zn, Mg, Mn, gypsum, and manure are given (CA 65 20791a)

213 Hunter, A S, Rosenau, W A 1966 *Effects of Urea, Biuret, and Ammonia on Germination and Early Growth of Corn ("Zea mays")* Proc Soil Sci Soc Amer 30(1) 77-81 (Eng) (Pennsylvania State Univ, University Park)

The effects of N fertilizers on the germination and early growth of corn were studied in soil sand solution culture, and closed laboratory systems In field trials, when more than 10% of 15 lb urea/acre (38 in rows) was substituted by biuret N, seedlings were stunted, injury symptoms occurred, and many plants died At lower percentages of biuret, some plants survived and outgrew the injury In sand cultures, biuret in urea depressed growth and produced the same injury symptoms, i e, older leaves failed to unroll at the tips and younger ones broke out through the encased older ones to produce a bent over plant Seeds soaked for 12 hours in solutions of urea or $(NH_4)_2SO_4$ (250 1,000 ppm) germinated and the plants grew normally Soaking in NH_4OH prevented germination of many seeds, but those that germinated produced normal plants Seeds soaked in biuret solutions, except at high concentrations, germinated, but many died or were deformed In closed systems, urea urease, urea soil, or NH_4Cl NaOH mixtures out of contact with seeds, released sufficient NH_3 in the atmosphere to inhibit germination and affect seedling growth The same occurred in oils containing NH_4^+ to the extent of 32% or more of saturation Substitution of cyanuric acid for 10% of the urea in the field had no injurious effects Biuret did not reduce germination, but affected later development, NH_3 or NH_4^+, however, reduced germination but had little effect on growth (CA 65 2955h)

214 Hutton, C E, Fiskell, J G A 1965 *Soil Acidity Factors Affecting Corn Production in West Florida* Proc Soil Crop Sci Soc Fla 25 36-46 (Eng) (West Fla Exp Sta, Jay)

In a 4 year trial involving application of 0 3 tons/acre of limestone and heavy annual dressings of NPK to a fine sandy loam, maize yields were inversely related to both the level of Al extractable from the soil with CH_3COONH_4 and the Al concentration in the leaf these relationships occurred at all levels of liming and were attributed to soil acidity induced by

fertilizers and to ion absorption from below the limed soil Results of another experiment indicated that acidity factors limiting root growth were also responsible for the reduced efficiency of liming and fertilizing (SF 30 766)

215 Isensee, A R, Berger, K C, Struckmeyer, B E 1966 *Anatomical and Growth Responses of Primary Corn Roots to Several Fertilizers* Agron J 58(1) 94 7 (Eng) (Dep Soil Sci Hort, Univ, Wisconsin)

Maize seeds were sown in trays of soil 1 or 2 in above bands of ammonium nitrate, treble superphosphate and muriate of potash, alone and in all combinations at the rate of 30 lb N, P, and K/acre Contact with fertilizers caused deformity of primary roots and reduced their length by >50% compared with controls Root length and percentage deformity (not defined) were inversely related Root length reductions were greatest with N alone, and least with P and K alone All treatments caused root tip swelling The P treatment caused extensive breakdown of cells and necrosis of the meristematic region (FCA 20 165)

216 Isensee, A R 1968 *Influence of Banded Fertilizers on the Chemical Environment Surrounding the Band and Uptake of Phosphorus by Corn* Diss Abstr 9B(1)14 15, University Microfilms, Ann Arbor, Michigan, Order No 68 7106 (Eng) (Univ Wisconsin)

In laboratory studies, treatments containing urea, $(NH_4)_2HPO_4$ or NH_4NO_3 caused most change in pH, which affected the nitrification rate of NH_4 and so controlled the solution concentrations of NH_4^+, NO_2^-, and NO_3 Combining super with urea (or urea + KCl) lowered the pH, and gave markedly lower NO_2 concentrations than occurred with urea alone $CaH_4(PO_4)_2$ produced the lowest soil and soil solution pH values initially, but due to low solubility did not produce large pH changes with time The solution concentration of Ca and Mg increased with decreasing pH in treatments containing urea of $(NH_4)_2HPO_4$ Most treatments increased the solution concentrations of Ca, Mg, and K, particularly these containing NH_4NO_3 and/or KCl Displacement from the exchange complex generally accounted for only 40% 60% of the increase in the solution concentrations of Ca and Mg The solution and exchangeable concentrations of Ca and Mg were reduced to levels less than in the control near the treatments containing $(NH_4)_2HPO_4$ Highest P concentrations were associated with the $(NH_4)_2HPO_4$ and super treatments Combining KCl with super or $(NH_4)_2HPO_4$ and urea with super drastically reduced P concentrations in the soil solution The uptake of ^{32}P by maize seedlings from banded fertilizer decreased markedly when NH_4NO_3 and/or KCl were combined with super or when KCl was combined with $(NH_4)_2HPO_4$ Combining urea with super markedly reduced ^{32}P uptake (SF 32 2993)

217 Jackson, T L, Westermann, D T, Moore, D P 1966 *Effect of Chloride and Lime on the Manganese Uptake by Bush Beans and Sweet Corn* Proc Soil Sci Soc Amer 30(1) 70 3 (Eng) (Oregon Agr Exp Sta, Corvallis)

Soils, naturally acid (pH 4 7 5 3), low in P and K, waterlogged from mid fall to mid spring, and containing Mn concretions, were treated with lime and fertilizer under field and greenhouse conditions All plants showed extreme chlorosis shortly after seedling emergence The Mn content of the trifoliate bean leaves was high enough to explain the toxicity symptoms Without lime, all applications of KCl resulted in Mn levels >1,000 ppm Increasing levels of Cl increased the level of Mn in all cases With added lime and without added Cl, the Mn was below toxic levels Lime always reduced the Mn content The application of KCl increased the Mn in sweet corn, K_2SO_4 and K_2CO_3 had no effect (CA 65 2955g)

218 Jackson, T L, Hay, J, Moore, D P 1967 *The Effect of Zn on Yield and Chemical Composition of Sweet Corn in the Willamette Valley* Proc Amer Soc Hort Sci 91 462 71 (Eng) (Oregon Agr Exp Sta, Corvallis)

Applying Zn increased yield of ears and Zn content of plants growing in a deep well drained soil of pH 4 9 5 9 and Zn content 1 3 1 9 ppm An abnormally high level of Fe occurred only in plants deficient in Zn A reduction in plant Fe was always associated with the growth response to applied Zn When other factors such as soil acidity or P were limiting growth, plant Fe content was not usually high and was little affected by increasing Zn supply When P needs were met, Zn deficiency became dominant and was associated with high levels of Fe There was no tendency for P to increase Fe content except where Zn deficiency was created or accentuated Lime increased Fe content in Zn deficient plants but decreased it when Zn had been applied The increase in Fe associated with applying lime to plots not given Zn, was accompanied by some increase in yield (SF 31 2118)

219 Jones, J B, Jr 1969 *Effect of Oil Coating a Fertilizer on Yield and the Uptake of Manganese and Zinc by Corn and Soybeans* Agron J 61(3) 476 77 (Eng) (Univ Georgia, Athens)

The use of oil to adhere MnO and ZnO to a granular 8 32-16 fertilizer applied to corn and soybeans on a moderately fertile silt loam and a fertile silty clay loam had no significant effect on the uptake of Mn and Zn by the plants (CA 71 12144d)

220 Jones, J B, Jr 1966 *Effects of Boron, Copper, and Zinc on Leaf Composition and Yields of Corn* Ohio Agr Exp Sta, Res Circ 149 18 pp (Eng) (Ohio Agr Res & Develop Center, Wooster)

Experiments conducted to study the effects of B, Cu, and Zn fertilizers on corn plants showed no significant crop response to these trace nutrients While Cu treatment did not increase the Cu content of the corn leaves, the contents of B and Zn of the plants and leaves increased by application of these elements Use of large quantity of B (0 5-0 75 lb/acre) significantly reduced the corn yields (CA 67 72906f)

221 Jones, J B, Jr 1965 *Molybdenum Content of Corn Plants Exhibiting Varying Degrees of Potassium Deficiency* Science 148(3666) 94 (Eng) (Ohio Agr Exp Sta, Wooster)

Leaves from corn plants exhibiting symptoms of K deficiency contain considerable concentrations of Mo Applications of K fertilizer corrected the deficiency, and a significant reduction in the Mo content of the leaves occurred (CA 62 16632g)

222 Kamprath, E J 1967 *Residual Effect of Large*

Applications of Phosphorus on High Phosphorus Fixing Soils Agron J 59 25 7 (Eng) (North Carolina Agr Exp Sta, Raleigh)

Large initial applications of P to high P fixing soils had a marked residual effect on maize yields 7 to 9 years after application Even when P was added in the row, maize yields were 50% higher where high rates had been applied 9 years before No further increase in maize yields was obtained when available soil P (0 05 n HCl + 0 025 n H_2SO_4 extractant) was >8 ppm (SF 30 2909)

223 Keeney, D R, Baumgardt, B R, Stangel, P J, Beestman, G B, Stauffacher, R H 1967 *Effect of Soil Fertility on the Quality of Crops Grown for Silage Part 1 The Effect of Nitrogen, Phosphorus, and Potassium on the Nitrogenous Fractions of Corn and on the Quality of the Resultant Corn Silage* Res Rep Agr Exp Sta, Univ Wisc 29 8 pp (Eng)

Maize was harvested at the early dent stage and ensiled under laboratory conditions Determinations of various forms of N, carotene, lactic acid, volatile fatty acids, fiber, and lignin showed that highest quality silage was obtained using a balanced fertilizer (FCA 21 726)

224 Keeney, D R, Baumgardt, B R, Stangel, P J, Beestman, G B, Stauffacher, R H 1967 *Effect of Soil Fertility on the Quality of Crops Grown for Silage Part 2 The Effect of Potassium, Variety, and Stage of Maturity on the Carbohydrate and Nitrogenous Fractions of Corn and on the Quality of the Resultant Corn Silage* Res Rep Agr Exp Sta, Univ Wisc 29 11 pp (Eng)

Five varieties were harvested at the silk, early dent and late dent stages of maturity K fertilizing increased dry matter production and fermentable carbohydrate NO_3 N decreased with increasing maturity and was greater with than without K fertilizer Varietal differences in dry matter, carbohydrate, and protein production existed Maximum silage yields were obtained by harvesting at the late dent stage (FCA 21 727)

225 Lal, R 1969 *Drainage and Nutrient Effects on Corn Grown in Lysimeters* Diss Abstr 30B 27 (Eng) (Ohio State Univ)

The effects of various water table depths, intermittent flooding and different levels of N and micronutrients (Zn and Cu) treatments on corn (*Zea mays*) growth, yield and nutrient uptake were evaluated for a Miami silt loam soil contained in lysimeters of 20 gal capacity Constant water table depths were 6 and 12 in as compared with no water table The treatments involving intermittent flooding were comprised of a 48 and 96 hour period of weekly inundation for three consecutive weeks The N applications were made at the rate of 100 and 300 lb of N/15,000 plants Zn and Cu were each applied at the rate of 8 lb/15,000 plants as compared to a check treatment involving no application of either Zn or Cu The concentration of exchangeable Na^+, Ca^{++} and Mg^{++} in soil was increased by high water table level treatments, whereas the concentration of available Zn and P were decreased All the drainage and nutrient treatments had a significant effect on corn grain yield There was no interaction involved among the variables in regard to their effect on corn grain yield The yields were in the order of 67, 83, and 100, respectively, for 6 in, 12 in, and no water table, and 62, 62, and 100, respectively, for 48 hour, 96 hour periods of flooding/week and no flooding The order was 67 and 100 for the lower and upper level of N, and 83 and 100 for lower and upper levels of micronutrients, respectively

226 Larssen, E R 1966 *Effect of Nitrogen Fertilization on Yield and Chemical Composition of Corn and Certain Grass Species* Diss Abstr 26 6282B (Eng) (Univ Connecticut, 1965)

Yields of silage maize were maximal at 150 350 lb/acre of N and declined at rates of 450 550 lb Above 250 lb/acre of N, the additional gain in protein concentration was relatively small and tissue NO_3 approached a level toxic to animals Fat, fiber, and N free extractives were not appreciably influenced, total ash, Ca and P were not significantly affected, K was increased and Mg was decreased by N fertilizing Fiber and Mg increased but P decreased with increased plant population (SF 30 2223)

227 Lavy, T L, Eastin, J D 1969 *Effect of Depth and Plant Age on ^{32}Phosphorus Uptake by Corn and Sorghum* Agron J 61 677-80 (Eng) (U S Dep Agr, Lincoln, Nebraska)

When maize (*Zea mays* L variety "Nebraska 202") and sorghum (*Sorghum bicolor* (L) Moench, variety "Nebraska 505") plants were 23, 39, and 59 days old, carrier free $H_3{}^{32}PO_4$ was injected at depths of 15, 30, and 61 cm into the soil (Sharpsburg silty clay loam) At the 23 day age, most ^{32}P was taken up by roots in the upper 15 cm, when the plants were 59 days old, sorghum took up more ^{32}P than maize Maize roots penetrated to 61 cm earlier than sorghum roots Depth of injection or plant age had little effect on ^{32}P contributed by roots at varying distances from the source Both maize and sorghum had root systems that penetrated to a depth of 152 cm and extended laterally to a distance of 238 cm (SF 33 1521)

228 Long, D C 1968 *Adsorption of ^{32}P by a Selected Soil Aggregate Size Range from Several Eastern and Central Nebraska Soils as Influenced by Cropping to Corn* Diss Abstr 28B(7) 2687 (Eng) (Univ Nebraska)

A procedure has been developed using ^{32}P to determine the method by which plants obtain P from soil aggregates In theory, plants may remove ^{32}P from the soil by three processes mass flow, root interception (root contact), and diffusion About 15 soil aggregates (9 52-4 76 mm diameter) were embedded at random in silica sand in cylindrical quart containers Corn seeds were planted in one half of these containers The plants were allowed to grow for 2 weeks after emergence During the growing period the plants were watered with a nutrient solution containing all the primary and secondary nutrients except P Any P used by the plants had to be obtained from the soil aggregates Under the conditions of this experiment little removal of ^{31}P by mass flow was possible since the aggregates were embedded in sand However, removal of ^{31}P by root interception and diffusion was possible After the growing period the aggregates from each container were removed from the sand and were placed in a flask containing water ^{32}P was added to the flasks and the amount of ^{32}P absorbed by the soil at various times was

measured By plotting the amount of ^{32}P absorbed by the groups of aggregates compared to time, experimental curves were obtained to compare with theoretical curves ^{31}P was removed from the exterior of aggregates primarily by root interception and from the interior of aggregates primarily by diffusion (FA 1 895)

229 Long, O H, Odom, J A, Safley, L M 1964 *Phosphorus and Potassium Fertilization in Crop Rotations* Bull Tenn Agr Exp Sta 376 26 pp (Eng)

In 3 year rotations of maize, wheat and red clover on three major soil series for periods of 10 13 years, yields were increased significantly by P Fused tricalcium phosphate compared favorably with concentrated super PO_4, but rock P was greatly inferior During the latter half of the experimental periods when rates of P (fused tricalcium phosphate) and K were substituted for some P treatments, 80 lb/acre P_2O_5 gave little or no increase over 40 lb/acre for maize but caused continued responses with wheat On a silt loam of moderate K status, K had little effect on yields, but on a second silt loam maize and wheat responded to up to 90 lb/acre K_2O (SF 30 2126)

230 Lunt, O R 1968 *Modified Sulphur Coated Granular Urea for Controlled Nutrient Release* Trans 9th Int Cong Soil Sci 3 377-83 (Eng) (Univ California, Los Angeles)

Field trials were done with urea coated with S and a plasticizing agent and sealed with soft wax Yields and N recovery from maize were as good from a single application of coated fertilizer as from three applications of regular urea in a sandy loam and a loam soil when irrigation was carefully controlled to avoid large leaching losses Under conditions of high leaching or single applications of urea, yield and N recovery from comparable applications of coated urea were superior (SF 32 1363)

231 Lutrick, M C 1964 *Planting Date, Plant Population and Nitrogen Fertilization of Field Corn in Western Florida* Proc Soil Crop Sci Soc Fla 24 231 37 (Eng) (W Florida Exp Sta, Jay)

Plots of maize cv Dixie 18 and Coker 67, sown on five different dates at 2 week intervals from March 1 to May 1, were given 28 lb N/acre at sowing, plus 200 or 400 lb NH_4NO_3/acre as a side dressing The N treatments were subdivided into five plant populations, from 5,000 to 15,000 plants/acre Tasselling took place during 4 weeks in June July Optimum sowing dates for high yields were later for low than for high plant populations Sowing on April 15 and May 1 gave the lowest yields while that on March 15 gave the highest yields at all populations above 5,000/acre Ear height, and hence lodging susceptibility, increased with delayed sowing (FCA 20 152)

232 Maas, E V, Leggett, J E 1968 *Uptake of Rubidum 86 and Potassium by Excised Maize Roots* Pl Physiol 43(12) 2054 56 (Eng) (Miner Nutr Lab, Agr Res Serv, Beltsville, Maryland)

The use of ^{86}Rb as a tracer for K and Rb was evaluated in short term uptake studies with excised maize roots The time course of uptake for ^{86}Rb labeled K from 0 1 meq KCl/l showed that the uptake of ^{86}Rb occurred immediately and continued as a nearly linear function of time throughout the 4 hour experiment The rate of uptake based on species activity of the treatment solution was ~1 μequivalent/g/hr Chemical analysis, however, showed that the K content of the tissue, which initially was 25 μequivalent/g fresh weight, was less after treatment than before In experiments where a constant amount of ^{86}Rb was added to (K + Rb) solutions of varying concentration ratios, chemical analysis revealed no appreciable uptake of K and, generally, the K content of the root tissue decreased In contrast, uptake of Rb was significant and was directly proportional to the increasing ambient concentration of Rb and the corresponding decrease in K concentration The data clearly showed that ^{86}Rb entry does not measure net changes in K content for excised maize roots Similar discrepancies between K and ^{86}Rb uptake were obtained with excised roots of soybeans and pinto beans (CA 71 827r)

233 Maftoun, M 1965 *Effects of Plant Population and Rate and Placement of Fertilizer on Yield and Nutrient Uptake of Corn (Maize) on Leon Fine Sand* Diss Abstr 26(3) 1256 (Eng) (Univ Florida, Gainesville)

An experiment was conducted to determine the effect of fertilizer rate and placement pattern and plant population on the yield and nutrient uptake of two corn hybrids grown on Leon fine sand with water tables controlled at 18 and 30 in depths The treatments consisted of 12 fertility combinations using various rates of broadcast and band applied fertilizer (15 10 15, N P_2O_5 K_2O), 3 plant populations (19 4, 27 9, and 38 7 thousand plants/acre) and 2 hybrids (DeKalb 805 and Florida 200) In general, yields of grain, forage and total dry matter were nearly the same when broadcast fertilizer was incorporated to a depth of 3 in as when incorporated to 6 in No yield differences were observed between localized placement of fertilizer patterns of 25% and 50% (band width 25% and 50% of row width) However, at low rates (100 lb/acre) broadcasting of fertilizer increased the grain and total dry matter yields to a greater extent than band applied fertilizer At higher rates (2,000 lb/acre), localized placement of fertilizer proved to be more effective than broadcast in increasing grain yields Dry matter production was nearly the same for these two treatments The grain response (yield and nutrient content) increased up to medium plant population and decreased thereafter, while forage and total dry matter responses (yield and nutrient content) increased with plant population Early, short stalk hybrid DeKalb 805 was best for grain production, while late, long stalk hybrid Florida 200 was best for forage production Yield maxima (grain and total dry matter) were predicted in the 2,500 and 3,000 lb/acre range of fertilizer application

234 Mamaril, C P, Smith, F W 1966 *Coated Fertilizers II The Response of Corn to Coated and Uncoated Ammonium Nitrate Phosphate Fertilizer* Philippine Agr 49(9) 731-43 (Eng) (Kansas State Univ, Manhattan)

The N and P contents of plants grown at equal nutrient rates did not vary significantly, but plants receiving coated materials generally had the highest uptake of N and P The trend in dry matter production was similar to N and P uptake Coated material had no apparent advantage over uncoated fertilizer with respect to grain yields The N content of the soil

after harvest was not affected by coating the fertilizer, but the P content was low in comparison with uncoated materials

235 Martens, D C 1968 *Plant Availability of Extractable Boron, Copper, and Zinc as Related to Selected Soil Properties* Soil Sci 106 23 28 (Eng) (Virginia Polytechnic Inst, Blacksburg)

Of the combinations of extractable soil nutrients and soil variables evaluated by multiple correlation analyses in greenhouse experiments with samples from Ap horizons of 16 series, B uptake by maize was best predicted by the concentration of water soluble B in the soil and soil pH, Cu uptake by N HCl extractable Cu and organic matter and Zn uptake by 2N $MgCl_2$-extractable Zn B and Cu bound by the soil organic fraction were predominant sources of the water soluble B and HCl soluble Cu respectively (FCA 22 4297)

236 Martens, J W, Arny, D C 1967 *Nitrogen and Sugar Levels of Pith Tissue in Corn as Influenced by Plant Age and by Potassium and Chloride Ion Fertilization* Agron J 59 332 34 (Eng) (Univ Wisconsin, Madison)

Organic N and sugar levels in the second internode pith tissue of three maize lines under three fertilizer treatments on a silt loam soil were determined for a period of 9 weeks, beginning shortly before silking N levels were highest at 11 weeks after planting, or about silking time, and then declined Total and reducing sugars in the pith tissue increased up to 13 15 weeks and then declined Application of 168 kg/ha (150 lb/acre) K as KCl significantly increased organic N levels in two of three lines Reducing sugars were sharply decreased by the KCl treatment Application of 157 kg/ha (140 lb/acre) Cl as NH_4Cl significantly decreased reducing sugar levels in one line and, in general, had effects similar to, but smaller than, KCl treatment (SF 30 4570)

237 Massey, H F, Loeffel, F A 1967 *Factors in Interstrain Variation in Zinc Content of Maize Kernels* Agron J 59 214 17 (Eng) (Univ Kentucky Agr Exp Sta, Lexington)

In 31 inbred lines varying widely in level of kernel Zn, the germ (plus embryo), pericarp and endosperm contained averages of 138, 46, and 9 9 ppm Zn respectively, actual Zn content in these components varied considerably between inbreds In the greenhouse Zn concentration of kernels was not correlated with Zn uptake by plants in Zn deficient or Zn-fertilized soils In the field, however, variation between inbred lines in kernel Zn was related to general level of Zn in the plant though this factor was much modified by the extent to which the inbred could transfer Zn from stalk and leaves to the ear (SF 30 4571)

238 Mikulcik, J D 1965 *Results of Different Chemical Methods of Testing Soils for Phosphorus as Indicative of Growth and Yield Responses of Corn to Banded Phosphorus* Diss Abstr 25(10) 5479 (Eng) (Univ Missouri, Columbia, 1964)

A study was undertaken in 1960 to determine whether or not growth and yield responses to banded P by corn on soils which were quite rich in P could be predicted from the results of four different methods of testing soils for P Several soils throughout Missouri, predominately alluvial soils from along the Missouri and Mississippi Rivers, were selected for this study Rates of 0, 20, 40, and 80 lb of P_2O_5/acre as ammonium phosphate were applied to corn as a banded treatment on these soils All of the soils were tested for P by the Bray 1 and Bray 2 methods, the $NaHCO_3$ extractable method, and the $CaCl_2$ equilibration method In nearly all cases, corn responded to the banded P treatments in terms of accelerated growth The heights of the corn plants tended to increase with each increment of P Plants which had received 80 lb of P_2O_5 tended to be the tallest and those that did not receive banded P tended to be the shortest during the first few weeks of growth The results revealed increased yields as a consequence of treatment on soils very well supplied with P In some instances yields were depressed by the addition of P Subsequent experiments were carried out to investigate the possible reasons for the depressing effect on yields of added P It was found that a lack of B and Zn might have been responsible for this depressing effect (CA 63 4898d)

239 Miller, S F, Boersma, L L 1966 *Economic Analysis of Water Nitrogen, and Seeding Rate Relationships in Corn Production on Woodburn Soils* Tech Bull Ore Agr Exp Sta 98 40 pp (Eng)

q Woodburn soils are moderately acid, well drained medium textured soils possessing a fragipan at 30 50 in below the surface The economic feasibility of irrigating maize in these soils is discussed Factorial trials involved no irrigation or irrigation at three different levels (at moisture stresses of 6, 1 5, and 0 8 bars at 12 in depth), N application at 60 180 lb/acre, and stand densities of 15,000 25 000 plants/acre, calculated optimum inputs were 95 0 136 1 lb/acre N and 13 75 17 64 acre in water (FCA 22 4492)

240 Mortvedt, J J, Giordano, P M 1969 *Availability to Corn of Zinc Applied with Various Macronutrient Fertilizers* Soil Sci 108(3) 180 87 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Glasshouse pot experiments were carried out to measure the response of maize to Zn applied alone as $ZnSO_4$ $2H_2O$ or (a) in various Zn sources combined with granular macronutrient fertilizers, and (b) as granular $ZnSO_4$ band applied with granular macronutrient fertilizers Forage yields of maize and Zn uptake were highest when finely ground $ZnSO_4$ was mixed alone with the soil When applied in granular form with macronutrient fertilizers, $ZnSO_4$ gave better response with N and K than with P fertilizers The effectiveness of granular $ZnSO_4$ was not affected by band application with fertilizers (FCA 23 192)

241 Mortvedt, J J 1968 *Crop Response to Applied Zinc in Ammoniated Phosphate Fertilizers* J Agr Food Chem 16(2) 241-45 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Various granular ammoniated phosphate fertilizers were compared as carriers containing 2% Zn as Zn oxide, Zn sulfate, or Zn EDTA for corn grown in greenhouse pots Forage yields and Zn uptake were very low when the inorganic sources were incorporated with ammoniated fertilizers, but were satisfactory when Zn EDTA was the source of Zn Crop response to Zn in these fertilizers increased with a decrease in Zn concentration in the granule or when finely ground, both of which resulted in better distribution of applied Zn in the

soil The agronomic effectiveness of Zn sulfate incorporated with a NPK fertilizer during the manufacturing process decreased with increasing degree of ammoniation, and was related to the level of water soluble Zn in these fertilizers These results suggest that the agronomic effectiveness of inorganic Zn sources is low when incorporated with ammoniated phosphate fertilizers (FA 1 768)

242 Murdoch, C L, Jackobs, J A, Gerdemann, J W 1967 *Utilization of Phosphorus Sources of Different Availability by Mycorrhizal and Non Mycorrhizal Maize* Pl Soil 27(3) 329 34 (Eng)

In laboratory experiments conducted in Illinois (USA) with sorghum, inoculation of sterilized soil with maize roots infected with a mycorrhizal fungus (*Endogone* sp) considerably increased growth and P uptake between 30 and 60 days after sowing Maize seedlings grown in a soil of low P status did not respond to infection with an *Endogone* species when a readily available P source, such as superphosphate or mono Ca phosphate, was applied However, when maize was fertilized with a less readily available P source, such as rock phosphate or tri-Ca phosphate, growth (as expressed in dry matter yield) and P content of infected plants were much better than those of non mycorrhizal ones (Trop Abst 23 906)

243 Murphy, L S, Webb, B B, Adriano, D C, Ganiron, R B 1968 *Polyphosphates Versus Orthophosphates in the Field and the Lab* Fert Solutions 12(4) 28 31 (Eng)

Research in Kansas has indicated that orthophosphate and polyphosphate are essentially equal in their ability to supply P to plants Banded applications of large amounts of polyphosphate should be attempted only when the Zn supply of the soil is adequate

244 Nelson, C E, Mortensen, M A, Early, R E 1967 *NH_4^+ Versus NO_3 Fertilization of Field Corn and Related Studies* Bull Wash Agr Exp Sta 685 11 pp (Eng) (Washington State Univ, Prosser)

Two field trials and one laboratory experiment involved banding to 7 in of 160 lb/acre N as $(NH_4)_2SO_4$, NH_4NO_3, or $Ca(NO_3)_2$ (in decreasing order of response) to maize grown on non-calcareous virgin soils (pH 7 3) Most N was taken up from $(NH_4)_2SO_4$, which was slow to nitrify, so that little NO_3 N moved upwards from it out of the rooting zone Least N was taken up from $Ca(NO_3)_2$ (SF 31 2031)

245 Nunez Escobar, R 1967 *Plant Population Row Width and Nitrogen Rate as Factors Influencing Yield Leaf Area Nitrogen Uptake and Other Characteristics of Corn* Diss Abstr 28(3) 766B (Eng) (Univ N Carolina, Raleigh)

Maize was grown in rows 21 and 42 in apart at plant populations ranging from 14 500 to 40,100 plants/acre and at levels of N ranging from 100 to 700 lb/acre Where N was adequate, optimum plant population was 26,900 31,500/acre optimum rate of N was about 150 350 lb/acre In a trial with high soil moisture stress before tasselling, high rates of N adversely affected yields by reducing leaf area per plant Grain yields were similar at both row widths except at high soil moisture stress, when maize yielded better at the close row spacing At a given plant population, yield was closely correlated with nitrate N or soluble N content of leaves at silking (FCA 21 1714)

246 Nunez Escobar, R, Kamprath, E 1969 *Relationships Between N Response, Plant Population, and Row Width on Growth and Yield of Corn* Agron J 61(2) 279-82 (Eng) (North Carolina State Univ, Raleigh)

The leaf area index increased linearly as the plant population of corn (*Zea mays* L) was increased from 34,500 to 69,000 plants/ha The leaf area/plant, however, decreased as the plant population increased N rates of 112 280 kg/ha and row width had no effect on leaf area/plant nor the leaf area index The yield of grain/plant was dependent upon the leaf area/plant The efficiency of a given leaf area to produce grain was higher as N rates increased The yield of grain/ha of the long season hybrid was not influenced by row width except under drought conditions where 53 cm wide rows gave higher yields than 106 cm wide rows Highest grain yields were obtained at 280 kg of N/ha and 51,750 plants/ha Maximum yields were obtained with a leaf area index of 3 5 and remained constant up to an index of 4 5 with adequate N (FA 2 887)

247 Parks, W L, Walker, W M 1969 *Effect of Soil Potassium, Potassium Fertilizer, and Method of Fertilizer Placement Upon Corn Yields* Proc Soil Sci Soc Amer 33(3) 427 29 (Eng) (Univ Tennessee, Knoxville)

A quadratic regression model including selected linear interactions was fitted to yields of corn (*Zea mays*) grown on a Hartsells loam having varying K soil test levels and K fertilizer applications in the row and broadcast Inclusion of 3 years of observation in the analysis produced no interaction of year and the parameters for K soil test level or K fertilizer application There were significant single factor and interaction effects on corn yields due to soil test K levels and K fertilizer applied broadcast or in the row The corn yield prediction equation illustrates the effect of row or broadcast K upon corn yield at different K soil test levels

248 Parr, J F, Papendick, R I 1966 *Agronomic Effectiveness of Anhydrous Ammonia–Sulfur Solutions* Soil Sci 101(4) 336-45 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Hartsells fine sandy loam was precropped with Sudan grass or corn to deplete available S to less than 10 ppm and then air dried and limed to pH 6 5 with $CaCO_3$ $MgCO_3$ (2 1) P, K, and Zn were added to satisfy crop requirements Soil moisture was at one third atmosphere Five corn plants were grown for 6 8 weeks in pots of 3 kg soil and dry weight determined With NH_3-S, much of the S was deposited in a zone of high NH_3 concentration but this did not delay oxidation to SO_4 The decreasing order of effectiveness when applied to moist soil was Na_2SO_4 (mixed), elemental S (mixed), NH_3-S, elemental S (placed) for the first crop and NH_3 S, elemental S (mixed), Na_2SO_4 (mixed), elemental S (placed) for the second, indicating rapid (possibly luxury) absorption of S from Na_2SO_4 and elemental S (mixed) and slow oxidation of NH_3-S In the soil NH_3-S gives rise to colloidal S, which oxidizes more rapidly than elemental S (placed) Yields with NH_3-S added to air dried soil were 10% 15% lower than in moist soil, but little difference was found between 4-day-old

and 6 week-old formulations of anhydrous NH_3-S (CA 65 2955e)

249 Parr, J F, Papendick, R I 1966 *Greenhouse Evaluation of the Agronomic Efficiency of Anhydrous Ammonia* Agron J 58(2) 215 19 (Eng) (Div Agr Development, Tennessee Valley Authority, Muscle Shoals, Alabama)

A similar marked response to anhydrous NH_3, $(NH_4)_2SO_4$, and KNO_3 was found in yields of dry corn forage, and after 4 weeks of incubation prior to planting no significant differences among the N sources were found The significantly lower yield from anhydrous NH_3 injected into the root system and applied at the highest rate immediately prior to planting was not observed at the lower N levels where yields were comparable to the other two N sources The lower yield was partly the result of NH_3 toxicity to roots during the early period of growth and also possibly to temporary positional unavailability of the applied N The yields from anhydrous NH_3 were significantly lower than those from urea and NH_4NO_3 when applied in split applications Generally, yields were slightly higher from $(NH_4)_2SO_4$ regardless of incubation period, which had little effect on yield The highest recovery of N was obtained with anhydrous NH_3 applied 4 weeks prior to planting N recovery from anhydrous NH_3 with no incubation prior to planting was significantly higher than from KNO_3 and urea but there were no significant differences within the other incubation periods The highest recovery of N was obtained from NH_4NO_3 when applied in split application Recovery from anhydrous NH_3 was significantly lower than from NH_4NO_3 but significantly higher than from urea There were no consistent trends in N uptake from different N sources among incubation periods although recovery of N was higher in all cases after 4 weeks of incubation Data indicate that much of the N requirement, especially in the early stages of growth, can be fulfilled by direct absorption and utilization of the NH_4^+ ion Anhydrous NH_3 in high concentrations results in the solubilization of soil organic matter Root damage from anhydrous NH_3 and high concentrations of urea in the split application consisted of a shortened root, curtailed abruptly with a scorched tip but no such damage was evident in the NH_4NO_3 treatments When all of the anhydrous NH_3 and urea was applied prior to planting no visible root damage was detected Small decreases in yield can be expected when high levels of anhydrous NH_3 are applied to these soils in the air-dry rather than moist condition Yield decreases from injection of anhydrous NH_3 into air-dry soil did not always correspond to lower percentage recoveries of applied N (CA 65 4592h)

250 Paterson, J W 1965 *The Effect of Aluminum on the Absorption and Translocation of Calcium and other Elements in Young Corn* Diss Abstr 25(11) 6142-43 (Eng) (Pennsylvania State Univ, University Park)

The primary purpose of these investigations was to determine the effects of Al on the absorption and translocation of Ca in young corn The area of corn most affected by Al in relation to Ca nutrition of the plant was the root (CA 63 7352g)

251 Peaslee, D E, Moss, D N 1966 *Photosynthesis in K and Mg Deficient Maize "Zea mays" Leaves* Proc Soil Sci Soc Amer 30(2) 220 23 (Eng) (Connecticut Agr Exp Sta, New Haven)

Rates of photosynthesis in maize leaves were closely related to K or Mg concentrations in the leaf tissue The critical concentrations were ~2 mg/g for K and 200 μg/g for Mg on a fresh weight basis Normal appearing leaves of K stressed plants had sharply diminished photosynthesis rates, whereas Mg deficiency affected photosynthesis rates only after the appearance of chlorosis Apparently Mg deficiency exerted an influence through chlorophyll deterioration, while K deficiency decreased stomatal apertures Application of the deficient nutrient caused marked recovery within 24 hours of K-deficient leaves but not of Mg-deficient leaves (CA 65 7634a)

252 Peck, T R, Walker, W M, Boone, L V 1969 *Relationship Between Corn ("Zea mays" L) Yield and Leaf Levels of Ten Elements* Agron J 61(2) 299 301 (Eng) (Illinois Agr Exp Sta, Urbana)

Corn (*Zea mays* L) yields were obtained at four locations from experimental plots receiving varying dates and combinations of N, P, and K A quadratic polynomial was used to measure the relationship between leaf levels of N, P, and K, and corn yield This function had an R^2 of 0 45 A second quadratic polynomial using leaf (sixth leaf) levels of 10 nutrients, N, P, K, Ca, Mg, B, Cu, Fe, Mn, and Zn was fitted to yield, and resulted in an equation with an R^2 of 0 81 From a potential of 65 linear and second order terms, 37 were fitted using a stepwise regression analysis procedure The additional variation explained by the second regression model was statistically significant Regression analysis of corn yields with leaf levels of 10 elements as independent variables revealed several significant main effects and interactions The significant effect of numerous interactions indicates that the critical level of any particular nutrient varies with leaf levels of other nutrients The significant effect of leaf levels of micronutrients upon corn yields indicates some merit in micronutrient research even though visual deficiency symptoms are not apparent (FA 2 912)

253 Perdomo, J T, Shirley, R L, Robertson, W K 1966 *Interaction of Sulphur and Selenium in Leon Fine Sand as Indicated by Forage Yields and Selenium Uptake* Proc Soil Crop Sci Soc Fla 26 131 35 (Eng) (Univ Florida, Gainesville)

White clover (*Trifolium repens*), grown on Leon fine sand without the addition of Se contained 1 6 ppm Se Application of 25 ppm Se was toxic to clover and decreasingly toxic to millet and maize, uptake of Se by these crops varied with species Applications of S up to 100 ppm depressed Se uptake, 200 ppm S depressed yield and increased Se content of the forage (SF 31 1282)

254 Peterson, J R, MacGregor, J M 1966 *Boron Fertilization of Corn in Minnesota* Agron J 58(2) 141-42 (Eng) (Univ Minnesota, St Paul)

No B deficiency symptoms were observed during either growing season on any field at any growth stage, either on the corn foliage or on the ears, and corn yield of the ears was little affected by any treatment B concentration in corn leaves on

untreated soil was related to soluble soil B Row application resulted in the highest leaf B concentration, followed by foliar sprays and broadcast application Upper corn leaves sampled in mid August were highest in B but showed a marked decrease a month later The middle and lower plant leaves contained considerably less B at the August sampling (CA 65 4599f)

255 Powell, R D, Webb, J R 1969 *Shooting for Maximum Yields How Much Fertilizer Can Corn Take?* Crop Soils 21(6) 14 15 (Eng)

Overall, tests showed there was no advantage in continuous use of high rates of fertilizers above 200 75 150 for producing maximum corn yields in the central Iowa area Continued use of high rates of fertilizer may create other nutrient problems not present with conventional fertilization

256 Powell, R D 1968 *The Yield, Growth and Chemical Composition of Corn as Influenced by Hybrids and High Rates of Nitrogen, Phosphorus and Potassium Fertilizers* Diss Abstr 29B(4) 1238 (Eng) (Iowa State Univ, Ames)

A field study was conducted over a 3 year period on two sites in Central Iowa to determine the effects of high rates of N, P, and K fertilizers on the growth, chemical composition, and yield of corn N was applied in 200 lb increments up to 1,200 lb/acre as ammonium nitrate, P was applied in 75 lb increments up to 450 lb/acre as concentrated superphosphate and K was applied in 150 lb increments up to 900 lb/acre as potassium chloride Thirty-one combinations of these rates were applied annually to the same plots Six hybrids, consisting of all possible single crosses at Wf 9, B 14, Oh 43, and A 257 inbreds, were grown the first 2 years Only the highest yielding hybrids were included in the third year Criteria for evaluation of treatment effects were early season plant heights, silking dates, leaf weight at silking time, chemical composition of leaf and grain samples, and grain yields The soil effects were measured in terms of soil pH, available P, and exchangeable K Yields responded largely to applied N, with applied P and K having smaller and less consistent effects Maximum yields were obtained with the first or second increment of applied N, P, and K in all site years Higher fertilizer rates had little additional effect on yields the first 2 years but caused some decrease the third year The yield level of individual hybrids differed significantly Hybrids having B 14 as a parent were consistently high yielders Most of the increase in leaf N content was obtained with the first increment of applied N, however, leaf P and K levels continued to increase with increasing rates of applied P and K Nitrate N did not accumulate in any significant amount in the leaves N and P levels in the grain increased markedly with N and P fertilization The pH of the surface soil decreased approximately 0 06 pH units/100 lb of applied N Available P and exchangeable K of the soil increased linearly with increased application of these elements Some increase in P and K was also noted at the 9 15 in depth In general, no advantage was evident for applying fertilizer rates in excess of those required to produce near maximum yields, while yield reductions were observed following the third application of the higher rates (FA 2 282)

257 Rehm, G W 1969 *The Effect of Ammonium and Nitrate Nitrogen on Sulfate Uptake by Corn.* Diss Abstr 30B 1456 (Eng) (Univ Minnesota, St Paul)

The effect of ammonium and nitrate ions on sulfate uptake by corn at several stages of growth was studied in the field as well as in the greenhouse and growth chamber Uptake of sulfate was traced with ^{35}S and, in some experiments, uptake of N was followed with ^{15}N When both N and S sources were applied as a starter in the field, uptake of sulfate was significantly increased when ammonium instead of nitrate was used as the N source This effect was observed in young plants up to seven weeks old N source, however, had no effect on the total S, sulfate-S, or total N content of the corn tissue N source also had no effect on corn yield When the N and S fertilizers were separated in a split root study, uptake of sulfate still was significantly influenced by the N source Uptake of sulfate also was influenced by the placement of N In very young plants (10 days old), sulfate uptake was increased when the S and N sources were mixed with the soil With increase in age there was an increase in sulfate uptake when both sources were mixed in the band and a decrease in sulfate uptake when the N and S were mixed with the soil Sulfate uptake at any stage of growth was reduced when the N and S were placed in separate bands The effect of N source was not as pronounced at high N rates as at low rates in the band In general, sulfate uptake was increased when the S source was mixed with ammonium rather than nitrate N Reduced sulfate absorption in the presence of the nitrate ion was due to competition between these two ions It appeared that this competition occurred in the plant rather than in the soil Sulfate uptake was significantly correlated with the amount of total N as well as the amount of protein N in the tissue absorbed from the fertilizer Sulfate uptake thus appeared to be related in some way to N metabolism in the plant (FA 2 536)

258 Rehm G W, Caldwell, A C 1970 *Effect of the Separation of Nitrogen and Sulfur Sources on Sulfur Uptake by Corn.* Proc Soil Sci Soc Amer 34(5) 769 72 (Eng) (Minnesota Agr Exp Sta, Univ Minnesota, St Paul)

The effect of fertilizer N and S sources on the absorption of S by corn (*Zea mays*) was studied in the greenhouse with the use of ^{35}S When the N and S sources were separated by a physical barrier, the NH_4 ion, when compared to the NO_3 ion, produced a significant increase in the S absorption from the fertilizer The data indicate that the influence of the N source on S absorption is the result of physiological reactions or processes within the plant or the root tissue The separation of the N and S sources had no significant effect on the total S and total N content of the tissue (CA 73 108847c)

259 Rehm, G W, Caldwell, A C 1970 *Sulfur Uptake by Corn as Influenced by Ammonium and Nitrate Nitrogen* Proc Soil Sci Soc Amer 34(2) 327 29 (Eng) (Northeast Sta, Univ Nebraska, Concord)

The effect of NH_4^+ and NO_3 on S uptake by corn (*Zea mays*) from a starter fertilizer was studied with the use of ^{15}N and ^{35}S When both the N and S were applied as a starter, the uptake of fertilizer S was significantly increased when NH_4^+ instead of NO_3 was used as the N source The effect was observed in young plants through 4 weeks of age More N was absorbed by the corn plant when NH_4^+ rather than NO_3 was

supplied as the N source The N source, however, had no significant effect on the total S, sulfate S_t or total N content of the tissue and the corn yield (CA 73.3108j)

260 Robertson, J A, Kang, B T, Ramirez Paz, F Werkhoven, C H E, Ohlrogge, A J 1966 *Principles of Nutrient Uptake from Fertilizer Bands VII ^{32}P Uptake by Brace Roots of Maize and Its Distribution within the Leaves* Agron J 58(3) 293 96 (Eng) (Purdue Univ, Lafayette, Indiana)

The accumulation of ^{32}P in most leaves was nearly linear for 6 weeks after the roots were inserted into the labeled soil The amount of fertilizer P absorbed depended on the rate of fertilization and the number of brace roots inserted into the fertilizer, and the amount of ^{32}P varied in different leaves, generally increasing from the fourth to the ninth leaves and decreasing in the tenth and eleventh leaves A relation was observed between the ^{32}P activity in the bases of the leaves and the position of brace roots relative to the leaves There were marked differences of P between and within leaves from the same plant and especially from different plants The sheaths were consistently lower in P than the tip and basal portions of the same leaf There was a strong trend for all leaves on one side of the plant to have a higher percentage of P than the leaves on the other side When the brace roots were in the vertical plane of the leaves, the leave directly above the roots had the higher activity in their tip portion while the opposite leaves had the higher activity in their basal portions When the brace root was approximately perpendicular to the vertical plane of the leaves, the even numbered leaves had the higher activity in the tip portions while the odd numbered leaves had the higher activity in the basal portions The activity for a given location on the leaf varied considerably from one time to the next Over some time intervals there was a tendency for most locations on the leaf to show either an increase or a decrease Over other intervals, there were increases in as many locations as there were decreases There was a lack of significant uptake of ^{32}P in the post tasseling period from bands applied at planting time The unique distribution of ^{32}P in the leaves is explainable by the vascularization of the maize The distribution of activity within the leaf depends on the leaf venation (CA 65 4594d)

261 Robertson, W K, Thompson, L G, Hammond, L C 1968 *Yield and Nutrient Removal by Corn ("Zea mays" L) for Grain as Influenced by Fertilizer, Plant Population, and Hybrid* Proc Soil Sci Soc Amer 32(2) 245-49 (Eng) (Univ Florida, Gainesville)

The fertilizer requirements of corn (*Zea mays* L) on a fine sand with a constant water table depended on the season In one year of three, yields increased to the highest rate of NPK (664 196 556 kg/ha), however, on the average, requirements were half these quantities For well fertilized corn, the ear yield constituted one half the weight of the above ground plant At the highest yield the N, P, and K concentrations in the ear were 1 50%, 0 22%, and 0 32%, respectively The uptake in the fodder of N, P, and K averaged 0 0227, 0 0050, and 0 0185 kg, respectively, per kg of ear corn produced (approximately 1 58, 0 35, and 1 30 lb in the fodder per bushel of grain produced) Of this, 67%, 51%, and 20%, respectively, were in the ear Ear corn yields were not consistently affected by plant density (47,840, 68,890, and 95,680 plants/ha) Number of ears increased with stand, but ear weight and quality decreased Considerable seasonal variations were noted between hybrids Windy conditions, during and immediately after tasselling, lodged tall varieties more than short varieties Although the amounts of P and K applied in the fertilizers were well in excess of those removed in the crop, relatively small amounts of these nutrients could be extracted from the soil by 1*N* NH_4OAc (pH 4 8) (FA 1 1081)

262 Robertson, W K, Hammond, L C, Thompson, L G 1965 *Yield and Nutrient Uptake by Corn for Silage on Two Soil Types as Influenced by Fertilizer Plant Population and Hybrids* Proc Soil Sci Soc Amer 29(5) 551 54 (Eng) (Dep Soil Sci, Florida Agr Exp Sta, Gainesville)

In 1962, on a well-drained soil without irrigation, the short hybrid, Coker 67, responded to fertilizer, but the tall hybrid, Dixie 18, did not In 1963 and 1964, five hybrids were grown under favorable moisture conditions at four rates of NPK (up to 600 + 176 + 500 lb)/acre, respectively, and at three plant densities up to 39,000/acre Multi-eared hybrids yielded more forage than single-eared ones, but tall hybrids did not always yield more than short ones Forage yields increased up to the highest rate of NPK, and up to the highest plant density Percentage of NPK recovered increased up to the highest plant density, but varied widely even between hybrids of the same growth characteristics (FCA 19 2085)

263 Rose, G B, Monk, C D, Wiegert, R G 1969 *Accumulation and Transfer of ^{45}Ca by the Biota of a Tagged Cornfield* Proc Second Nat Symp Radioecology, Ann Arbor, Michigan, May 15 17, 1967, 672 77

This study was made to determine distribution of ^{45}Ca within a corn crop and the magnitude and rates of transfer to field weeds, insects, and soil

264 Rudgers, L A, Demeterio, J L, Paulsen, G M, Ellis, R, Jr 1970 *Interaction Among Atrazine, Temperature, and Phosphorus Induced Zinc Deficiency in Corn ("Zea mays")* Proc Soil Sci Soc Amer 34(2) 240-44 (Eng) (Dep Agron, Kansas State Univ, Manhattan)

Corn was grown with two levels each of P and Zn with and without atrazine in the field on recently leveled P and Zn deficient soil and in nutrient solutions in environmental chambers Severe Zn deficiency symptoms were exhibited by field grown corn receiving no Zn and were accentuated by P fertilization Atrazine had no evident effect on deficiency development P and Zn concentrations in leaves, but not in grain, of field grown corn were increased by atrazine In environmental chambers, corn seedling growth was decreased more by atrazine toxicity than by P or Zn nutrition P and Zn concentrations were increased frequently by atrazine at low but not at high growing temperatures Atrazine had little apparent effect on P induced Zn deficiency development in the field or in environmental chambers (CA 73 3103d)

265 Sanford, J O, Bruce, R R, Myhre, D L 1968 *Corn Stover Residue and Nitrogen Management Modifies Crop Response* J Soil Water Conserv 23 94-6 (Eng) (Agr Res Serv, State College, Mississippi)

In field experiments on Catalpa clay loam, maize was grown without residue, with residue incorporated in the autumn, and with residue incorporated in the spring, N was applied either in the autumn or in spring at 100 lb/acre The average yields for no residue, autumn incorporated residue, and spring incorporated residue treatments were 57, 56, and 42 bushels/acre, respectively The average yields per autumn and spring applied N were 55 and 68 bushels/acre N fertilizer gave the best yields when applied with no crop residue Four annual applications of crop residue increased the organic-C content of the soil from 1 15% to 1 38%, and total N in the autumn incorporated residue plots exceeded the total N in non residue plots by 320 lb (SF 30 4488)

266 Sanford, J O, Grogan, C O, Jordan, H V, Sarvella, P A 1965 *Influence of Male Sterility on Nitrogen Utilization in Corn* Agron J 57(6) 580-83 (Eng) (Mississippi Agr Exp Sta, State College)

Male sterile strains of maize absorbed more N and gave higher yields than fertile strains More N accumulated in fertile than sterile tassels but after pollen shedding this difference tended to disappear Fertile plants produced fewer ears than sterile plants Competition for N between the ear primordia and the pollen is the suggested reason (FCA 19 2118)

267 Schnappinger, M G, Jr, Martens, D C, Hawkins, G W 1969 *Response of Corn to Zn EDTA and $ZnSO_4$ in Field Investigations* Agron J 61 834 36 (Eng)

Field experiments were conducted in 1968 to determine the effect of rates of Zn EDTA and $ZnSO_4$ application on yield and Zn content of corn (*Zea mays* L) grown on Litz silt loam and Norfolk loamy fine sand Placement of Zn EDTA was also included as a variable in the experiment on the Norfolk soil Corn plants on the Norfolk soil "grew out" of Zn deficiency, whereas plants on the Litz soil remained stunted throughout the growing season Highest corn grain yield occurred on both soils where $ZnSO_4$ was broadcast at a rate of 14 kg Zn/ha Rates of 2 24 kg Zn/ha as broadcast Zn EDTA and of 1 12 kg Zn/ha as banded Zn EDTA increased corn yield on the Norfolk soil A higher rate of 4 48 kg Zn/ha as broadcast Zn EDTA was required to increase corn yield on the Litz soil The ear leaves of corn plants on check plots of the Litz and Norfolk soils contained 10 8 and 12 4 ppm Zn, respectively, during the silk stage

268 Schumaker, G A, Robinson, C W, Kemper, W D, Golus, H M, Ameniya, M 1967 *Improved Soil Productivity in Western Colorado with Fertilizers and Lucerne* Tech Bull Agr Exp Sta 91 52 pp (Eng) (Colo State Univ, Fort Collins)

Fertilizing was essential for high yields in (1) a 3 year rotation of maize, beets and barley, (2) a 6 year rotation, as (1) + 3 years lucerne, (3) continuous maize, and (4) continuous sugar beets on a silty clay loam derived from deep alluvial deposits At equal fertilizing rates, (2) produced higher yields than (1), (3) or (4) Although maize directly followed lucerne its yield increased with N fertilizing P responses occurred only with adequate N In (2) applying manure gave yields comparable to equivalent rates of NPK, no K deficiency or yield response to K occurred In (3), incorporating maize stalks from the previous year's crop reduced the subsequent yield significantly Aggregate stability, organic matter and total N contents of the soil were greatest in (2) Inclusion of lucerne increased the N uptake of the maize by 35 lb/acre over that of maize in (1) Higher yields of beets and barley in (2) than in (1) indicated the N contributing effect of lucerne (SF 30 3773)

269 Shah, M P 1966 *Effect of Distribution of Available Soil Moisture on Response of Corn Yields to Fertilizer Nitrogen* Diss Abstr 26(10) 5625 (Eng) (Iowa State Univ of Sci & Technol, Ames)

The effects of distribution of the estimated mean available soil moisture on the yield response of corn to fertilizer nitrogen were investigated by a multiple regression technique Simple correlation studies showed strong, positive correlation between yield response and stand, N, NP, NK, mean available soil moisture (M_O) and NM_O, and a multiple regression involving 10 variables of stand and fertility factors explained over 56% of the total variation in the mean plot yield response Response curves for N showed strong and positive NP and NK interactions With 35 and 50 lb/acre P and K, respectively, yield response of 58 7 bushels was predicted at 195 2 lb N/acre and M_O of 6 13 in The yield response surface for N and M_O predicted a yield response of 101 5 bushels/acre of corn at 240 lb N and 11 40 in of M_O (CA 65 4594h)

270 Sharma, K C, Krantz, B A, Brown, A L, Quick, J 1968 *Interaction of Zn and P in Top and Root of Corn and Tomato* Agron J 60(5) 453 6 (Eng) (Dep Soils Pl Nutr, Univ California, Davis)

In glasshouse experiments with two soils containing 5 6 and 7 0 ppm bicarbonate extractable P and 0 2 and 0 35 ppm Zn, respectively, P was supplied to maize plants at 0, 25, 100, and 400 ppm and Zn at 0, 1, 5, and 25 ppm Zn concentration in plant tops and roots was decreased by applied P, the decrease being greatest for the first increment of P The effect on root Zn was much less than on Zn in plant tops One ppm Zn reduced the P concentration in the plants, the greatest effect being where high rates of P were applied In the presence of P, applied Zn increased the Zn concentration in the roots much more than in the tops It is concluded that P inhibits the translocation of Zn from roots to foliage (FCA 22 1010)

271 Shrader, W D, Fuller, W A, Cady, F B 1966 *Estimation of a Common Nitrogen Response Function for Corn in Different Crop Rotations* Agron J 58 397-401 (Eng) (Iowa Agr Exp Sta, Ames)

In two experiments, rotation intensities varied from continuous maize to a rotation with 3 year meadow, and N rates ranged from 0 to 160 lb/acre annually Maize yields could be fitted to a common N response curve Estimates of N equivalents available to maize in different cropping systems (N needed from whatever form to produce the same maize yield response as 1 lb N supplied as NH_4NO_3), supplied by the different rotations ranged from 10 to 130 lb/acre, in addition to that available to continuous maize (SF 30 515)

272 Shukla, U C, Morris, H D 1967 *Relative Efficiency of Several Zinc Sources for Corn ("Zea mays")* Agron J 59(2) 200 2 (Eng) (Univ Georgia, Athens)

Corn was grown on two soils in greenhouse experiments to

determine the relative efficiency of various Zn sources at different levels of lime and P applications Plant deficiency symptoms, growth (oven dry weights of corn tops), height, Zn content, and Zn uptake were evaluated Corn growth was increased by Zn fertilization on both soils No differences were found among the Zn sources on the Red Bay soil where only a slight response to Zn was obtained Increases in growth up to 154% were obtained from Zn fertilization on the Norfolk soil $ZnSO_4$ was slightly more effective than ZnO or Zn chelate and organic (polyflavonoid) Zn was the least effective source $ZnSO_4$ and ZnO were equally efficient or superior to chelate and organic Zn in increasing the Zn content and uptake of corn on the basis of amounts used Liming resulted in decreased corn growth, plant Zn content, and Zn uptake, especially when no Zn was applied High P fertilization decreased the Zn content of corn but tended to increase growth when applied with Zn (CA 66 104400j)

273 Simpson, O V 1966 *The Effects of Differential Levels of Nitrogen and Phosphorus and Their Placement on Yield, Vigor, Maturity, Quality, and Leaf Composition of Sweet Corn* Diss Abstr 26(11) 6285 (Eng) (Pennsylvania State Univ, University Park)

Nitrogen was applied in the form of ammonium nitrate at rates of 0, 25, 50, and 75 lb N/acre, while phosphoric acid as triple superphosphate was applied at rates of 0, 50, 100, and 150 lb/acre phosphoric acid The increasing levels of P resulted in significant increases in height, total and marketable yield, ear size, and also hastened maturity Increases in the levels of applied N had no significant effects on height or maturity The results of the placement studies indicated that when based on vigor and yield, the split application of the fertilizer and the single band treatment were better than or as good as the double band treatment, and decidedly better than the complete broadcast treatment (CA 65 9675c)

274 Singh, T A, Thomas, G W, Moschler, W W, Martens, D C 1966 *Phosphorus Uptake by Corn ("Zea mays") Under No-Tillage and Conventional Practices* Agron J 58(2) 147-48 (Eng) (Virginia Polytech Inst, Blacksburg)

P fertilization, whether broadcast on the surface of the no tillage treatment or rototilled into the soil of the conventional treatment, increased the corn yield, but the yield increase was significant only in the case of the broadcast application The differences between P uptake from surface-applied and incorporated P were not significant The total P content of the leaves was significantly higher at the first two sampling dates in the first year from the surface-applied P In the second year the uptake of P was significantly higher from broadcast P than from incorporated P at the first sampling but there were no significant differences at the last three sampling dates Data indicate that surface applied P was as suitable as incorporated P in supplying P to corn plants (CA 65 1335c)

275 Smith, R C, Epstein, E 1964 *Ion Absorption by Shoot Tissue, Kinetics of Potassium and Rubidium Absorption by Corn Leaf Tissue* Pl Physiol 39(6) 992 96 (Eng) (Univ California, Davis)

Slices of corn leaf 300 μ wide were used Kinetics and selectivity of absorption of $^{42}K^+$ and $^{86}Rb^+$ resembled closely the characteristics of their absorption by barley root tissue Over the range 0 002-0 2 m*M*, a single Michaelis Menten term of the order of 0 02 m*M*, described the relation between the external concentration and rate of absorption K^+ and Rb^+ were mutually competitive on equal terms In decreasing order, K^+, Cs^+, NH_4^+, Li^+, and Na^+ competed with Rb^+ (CA 62 1972f)

276 Soltanpour P N A 1966 *Interrelations of Nitrogen, Zinc and Iron on the Growth of Three Corn Hybrids* Diss Abstr 27B(2) 348 (Eng) (Univ Nebraska, Lincoln)

Maize was grown for 40 days with 0, 100, 200, and 400 lb N (as urea) and 0, 2 5, 5, and 10 lb each of Zn and Fe (as polyflavonoid) per 2 million lb soil in glasshouse trials Zn increased height, dry matter, yield, percentage dry matter, Zn and Fe, and protein and nitrate N as a percentage of total N, when applied together with N Zn had no effect on P uptake but increased N uptake Applied Fe had much less effect than Zn on growth and chemical composition (FCA 20 1624)

277 Spencer, W F, MacKenzie, A J, Viets, F G 1966 *The Relationship Between Soil Tests for Available Nitrogen and Nitrogen Uptake by Various Irrigated Crops in the Western States* Proc Soil Sci Soc Amer 30(4) 480-85 (Eng) (Dep Soil Sci, U S Dep Agr, Riverside, California)

Data for N uptake by maize, sugar beet, sorghum, and cotton from irrigated plots receiving no N fertilizer were highly correlated with soil test data for initial nitrate N, nitrifiable N released by 2 weeks' incubation, and total N in samples from the 0 6 and 6 12 in depths Data for maize indicated that N test correlations for different crops following legumes should be established separately (FCA 20 924)

278 Stangel, P J 1964 *Relationships Between Fertilization and Various Predictors of Yields of Field Corn* Diss Abstr 25B 2153 (Eng) (Univ Wisconsin, Madison)

The objective of this experiment was to determine the feasibility of using a combination plant tissue soil analysis approach as a means of determining the nutrient requirements of the corn crop Standards used in this study were commonly employed soil test procedures and tissue analysis of the sixth leaf sampled at silking time The predictors used in this study were tested over a wide range of fertility levels established on a Waupun silt loam Simple correlations between nutrient concentration and yield revealed that the concentrations of nitrate N or percent N in the whole plant at either date were as good or better predictors of grain yield than were N concentrations in the sixth leaf Higher correlations occurred between N concentration and grain yield when adequacy of P and K were determined according to soil test than where nutrient concentration yield relationships were determined solely by tissue analysis Yield response zones for P and K were small, thus, it was more difficult to evaluate the tests for these nutrients However, when levels of N and K were adequate, soil test P was the best predictor of grain yield or P uptake When levels of N and P were adequate, percent K in the whole plant or in the sixth leaf was a slightly better predictor of grain yield and K uptake than was soil test K but all tests gave highly significant correlations It was concluded that nutrient concentrations in plants sampled prior to silking were as reliable, and in some cases, more reliable predictors of

grain yield than were nutrient concentrations found in the sixth leaf It was also found that diagnosis could be carried out just as satisfactorily through the use of either a straight tissue analysis or combined tissue N soil P K approach

279 Stukenholtz, D D , Olsen, R J , Gogan, G , Olson, R A 1966 *On the Mechanism of Phosphorus Zinc Interaction in Corn Nutrition* Proc Soil Sci Soc Amer 30(6) 759 63 (Eng) (Univ Nebraska, Lincoln)

Greenhouse and field studies were used to determine the mechanism of P Zn interaction in the nutrition of corn (*Zea mays*) P tended to reduce Zn uptake and thus depressive action of P appeared to be largely physiological in nature, expressed at root surfaces and/or in root cells, and was not chemical inactivation of Zn by P in soil Translocation of Zn from roots to tops is inhibited by elevated P concentration, with a resulting sharp reduction in Zn concentration of nodal and internodal tissues No clearly definable P Zn ratio in tissue was found above which yield restriction could be predicted Corn seemed to tolerate luxurious amounts of P in its tissue provided some modest amount of Zn was present Concurrently placed N promoted Zn uptake at the same time that it improved P utilization An increased level of native or applied K reduced the depressive effects of P on Zn (CA 66 85141g)

280 Tamimi, Y N , Hunter, J E 1970 *Effect of Phosphorus, Calcium Carbonate, and Calcium Silicate Fertilization Upon Incidence of Corn Smut* Agron J 62(4) 496 98 (Eng) (Hawaii Agr Exp Sta , Univ Hawaii, Hilo)

Incidence of corn smut was investigated in two fertilizer experiments with P-$CaCO_3$ and P $CaSiO_3$ In both experiments the effect of P on reduction of corn smut was statistically significant Disease incidence was reduced from an average of 12 6% to 7 4% and 5 8% with application of 84 kg P/ha in the P $CaCO_3$ and P $CaSiO_3$ experiments, respectively Further increases in P did not significantly reduce incidence of smut below that of the 84 kg P/ha dose Rates of $CaCO_3$ or $CaSiO_3$ did not significantly affect the incidence of corn smut, yet percent infection in the P-$CaSiO_3$ treatments was significantly lower than in the P-$CaCO_3$ treatments Soil pH, which ranged from 5 12 to 6 84, also had no significant effect on infection (CA 73 55092u)

281 Terman, G L , Taylor, A W 1965 *Crop Response to Nitrogen and Phosphorus in Metal Ammonium Phosphates* J Agr Food Chem 13(6) 497 500 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

$MgNH_4PO_4$ $6H_2O$, $MgNH_4PO_4$ H_2O, and $FeNH_4PO_4$ H_2O were compared in three granule sizes (6 +9, 14 +20, and 35 +60 mesh) with $NH_4H_2PO_4$ as sources of N and P for two successive crops of corn grown in greenhouse pots $MnNH_4PO_4$ $ZnNH_4PO_4$, and $CaHPO_4$ were also compared as source of P Response by crop 1 decreased markedly with increase in granule size of the fertilizers applied as N sources just prior to planting, after incubation in moist soil for 90 days prior to planting, granule size had only minor effects Crop 2 showed residual effects only to -6 +9 mesh granules Granulation of a nitrification inhibitor with $MgNH_4PO_4$ H_2O significantly decreased recovery of the N by two crops of corn Response by both crops to P in $CaHPO_4$ and the metal ammonium phosphates increased with decrease in granule size $CaHPO_4$ showed the greatest granule size effects and the Mg compounds the least $FeNH_4PO_4$ H_2O was the least effective source at all granule sizes (CA 64 4216b)

282 Terman, G L , Lancaster, J D 1965 *Crop Response to Water Soluble and Water Insoluble Phosphorus Components of Granular Fertilizers* J Agr Food Chem 13(6) 500 5 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

In a greenhouse pot test, variation in neutral citrate soluble P content of 5 A O A C water insoluble phosphates explained 93%, 96%, 80%, and 3% of the variability in percentage recovery of applied P by corn from granular fertilizers formulated with 0%, 25%, 50%, and 75% of the total P from a single water soluble source In other pot tests with corn, response to P was highest from an ammonium phosphate sulfate (91% of P water soluble), less from two nitric phosphates (26% and 27% water soluble, high alkaline citrate solubility), and least from an ammoniated ordinary superphosphate (28% of P water soluble, low alkaline citrate solubility) A O A C available P content was high in all four fertilizers Similar results were obtained with wheat forage and corn growth in field tests in Mississippi (CA 64 4216d)

283 Terman, G L , Parr, J F , Allen, S E 1968 *Recovery of Nitrogen by Corn from Solid Fertilizers and Solutions* J Agr Food Chem 16(4) 685 90 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

Four greenhouse pot experiments were conducted to measure recovery of applied N by corn (*Zea mays*) from various solid N sources and solutions Crop recovery was low from sources containing amino N, such as urea, formamide, hexamine, and oxamide surface applied to both acid and alkaline soils Much higher recovery resulted from mixing these fertilizers with the soils Greatest recovery (least loss, presumably by NH_3 volatilization) resulted from NH_4NO_3 and $NH_4H_2PO_4$ Similar results were obtained with solid and solution sources Volatilization loss as NH_3 increased in the laboratory to a maximum of 9% over a 41-day period at 24°C with increase in proportion of urea in solutions and was less with moist than with drier (70% RH) aeration Much greater loss was indicated by lower N recovery by corn grown after a 1-week drying period (24 32° C) prior to planting Guanyl urea nitrate, guanyl urea phosphate, and potassium dicyandiamide were toxic for corn growth (FA 1 1347)

284 Terman, G L , Allen, S E 1967 *Response of Corn to Phosphorus in Underacidulated Phosphate Rock and Rock Superphosphate Fertilizers* J Agr Food Chem 15 354 58 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

In pot experiments on P deficient fine sandy loam limed to pH 6 2, silt loam limed to pH 6 5 and silty clay loam (pH 5 6) the effectiveness of P in Florida phosphate rock acidulated to varying degrees with H_3PO_4 or mixed with super was closely related to water soluble P contents up to 50% or more of the total P, depending on the soil, granule size, and amount applied Response to the 6 +9 mesh fertilizers tended to be equal to or slightly greater than response to the same amounts of water soluble P as concentrated super granulated with soil (SF 30 3016)

285 Terman, G L, Allen, S E, Bradford, B N 1966 *Response of Corn to Zinc, as Affected by Nitrogen and Phosphorus Fertilizers* Proc Soil Sci Soc Amer 30(1) 119 24 (Eng) (Tennessee Valley Authority, Muscle Shoals, Alabama)

$ZnSO_4$ $7H_2O$ was mixed with the soil, either alone or combined with granules of NH_4NO_3, $(NH_4)_2SO_4$, dicalcium phosphate, concentrated superphosphate, monoammonium phosphate, or ammonium polyphosphate The phosphates depressed the pH of Hartsells fine sandy loam (limed to pH 7 1), increasingly in the order listed Depression in soil pH was closely related to response of corn to 2 and 4 ppm of applied Zn/pot In Nolichucky sandy clay loam (pH 7 3) and Hartsells soil limed heavily to pH 8 0, soil pH remained high and response to Zn with the ammonium polyphosphate, monoammonium phosphate, and concentrated superphosphate sources of P was similar, and greater than with dicalcium phosphate Forage yields and uptake of Zn were in the order Zn mixed alone with the soil > Zn in NH_4NO_3 or $(NH_4)_2SO_4$ granules > Zn in phosphate granules > no applied Zn Results with Zn in dicalcium phosphate granules were poorest Reciprocal relations between concentrations of P and Zn in the corn were largely related to yield levels dependent on sufficiency of Zn Any effects of large applications of P sources on response of corn to Zn sulfate mixed with the soil are largely related to effects on the fertilizers on soil pH (CA 65 2956d)

286 Thompson, L, Jr, Slife, F W, Butler, H S 1970 *Environmental Influence on the Tolerance of Corn to Atrazine* Weed Sci 18(4) 509 14 (Eng) (Univ Kentucky, Lexington)

Corn (*Zea mays* L) in the 2 3 leaf stage grown 18 2' days in a growth chamber under cold, wet conditions was injured by postemergence application of 2 chloro 4 (ethylamino) 6 (isopropylamino) s triazine (atrazine) plus emulsifiable phytobland oil Injury was most severe when these plants were kept under cold, wet conditions for 48 hr after the herbicidal spray was applied, followed by exposure to high light intensity and high temperature Under these growth chamber conditions, approximately 50% of the atrazine treated plants died Since wet foliage before and after application increased foliar penetration and low temperature decreased the rate of detoxication to peptide conjugates, atrazine accumulated under cold, wet conditions This accumulation of foliarly absorbed atrazine and the "weakened" conditions of the plants grown under the stress conditions is believed to be responsible for the injury to corn Hydroxylation and the dihydroxybenzoxazin 3 one content in the roots were reduced at low temperature, but it is unlikely that this contributed to the death of the corn (Biol Abstr 51 132856)

287 Triplett, G B, Van Doren, D M 1969 *Nitrogen, Phosphorus, and Potassium Fertilization of Non-Tilled Maize* Agron J 61 637 39 (Eng) (Ohio Agr Res Dev Center, Wooster)

No tillage (herbicide spray) and conventional tillage (plow, disk, cultivate) were used for maize grown in monoculture for 6 years at three rates of N fertilizer P and K were applied annually with the planter and as surface applications during 2 years Grain yields were higher for no tillage at all N levels Most of the surface applied P remained in the surface 2 5 cm of soil K was also concentrated near the surface P and K concentration in leaves of maize grown without tillage were equal to those in plants grown with conventional tillage when sampled at tasseling, but significantly higher when sampled at the 8 to 10 leaf stage (SF 33 666)

288 Tucker, B B 1970 *Fertilizer Use on Corn* Sci Serving Agr No 2223, 3 pp (Eng) (Oklahoma State University)

On soils low in N, 40 lb of N are needed to increase yields from 50 to 55 bushels/acre, whereas 80 lb of N are needed to increase yields from 175 to 200 bushels/acre Because P is immobile in the soil, only 10% 20% of the added P will be used by the immediate crop For yield levels less than 50 bushels/acre, only small amounts are needed For yield levels of 175 bushels/acre, 100 lb/acre are required Corn requires large amounts of K, but corn harvested for grain removes very little K from the soil if the stover is returned It is estimated that only 0 3 lb of K is removed per bushel of grain If the corn stover is removed or if the corn is harvested for silage, 150 250 lb/acre of K are removed For grain yields of 175 bushels/acre, 150 lb/acre of potash is required

289 Vinande, R, Knezek, B, Davis, J, Doll, E, Melton, J 1968 *Field and Laboratory Studies with Zinc and Iron Fertilization of Pea Beans, Corn and Potatoes in 1967* Mich State Univ, Agr Exp Sta, Quart Bull 50(4) 625 36 (Eng) (Michigan State Univ, East Lansing)

Experiments were conducted in Michigan during 1967 to study the comparative effectiveness of several Zn carriers, interaction of Zn, Fe, and P and of Zn, lime, and P, method of application of Zn carriers, and the residual effect of Zn from carriers applied in 1965 When applied at a 1 5 ratio (0 6 lb of Zn/acre from chelate and 3 lb of Zn/acre from inorganic Zn carriers), chelates were as effective suppliers of Zn as were inorganic forms of Zn such as ZnO or $ZnSO_4$ Relatively insoluble forms of Zn were effective carriers to correct Zn deficiency of pea beans The highest yields were obtained where a combination of Zn and Fe chelate was used or where ZnO was used In the case of pea beans, a foliar application of several carriers was as effective as $ZnSO_4$ mixed with fertilizer Highest yields were obtained when Zn and di Zn EDTA were used as foliar sprays There was a marked response to Zn applied to pea beans and the residual effect of materials applied in 1965 increased plant weight, Zn uptake, and yield in 1967 Similar results were obtained with corn although the response to Zn was considerably less Data show no effect of P level, rate of application of Zn, or type of Zn carrier on the yield of Russet Burbank or Sebago potatoes (CA 69 95502b)

290 Voss, R, Pesek, J 1967 *Yield of Corn Grain as Affected by Fertilizer Rates and Environmental Factors* Agron J 59(6) 567 72 (Eng) (Iowa Agr & Home Econ Exp Sta, Ames)

The title subject was studied in 18 tests on three different soil series in fields belonging to cooperating farmers in central and north central Iowa The grain yields were related to soil test values for N, P, K, and pH, time of planting, yielding ability of the corn hybrids planted, plant population, and weather by multiple regression analyses Factors other than

the applied fertilizer variables primarily affected the response to applied N (FA 1 315)

291 Vretta Kouskoleka, H , Ohlrogge, A J 1968 *Fertilizer P Utilization by Corn and Wheat as Affected by Boron and Copper in the Fertilizer Band* Phos in Agr , No 49 23 34 (Eng) (Inst of Soils and Fertilizers, Greece and Purdue Univ , Lafayette, Indiana)

The effect of B and Cu on uptake of fertilizer phosphate was investigated in greenhouse experiments on corn and wheat and a field experiment on corn The two nutrients were incorporated in monocalcium phosphate and monoammonium phosphate and band placed in two soils B decreased uptake of fertilizer phosphate in all three experiments, the effect being greater with monoammonium phosphate than with monocalcium phosphate in the greenhouse but not in the field Cu decreased it in all three experiments with both phosphate sources The total P content of the crop was not affected by B or Cu in any experiment (FA 1 907)

292 Walker, M E , Etheredge, W J , Moss, R B , Carter, R L 1970 *Best Source and Rate of Nitrogen for Corn Growth* Ga Agr Res 11(3) 10 11 (Eng) (Coastal Plains Sta , Tifton, Ga)

The soil was a sandy clay loam with pH of 4 8 and a low level of P and K The soil was limed to raise the pH to 5 8 All plots received 52 lb of P and 100 lb of K The rates of N used in lb/acre were 50, 75, 100, and 150 N sources were anhydrous NH_3 (82% N), NH_4NO_3 solution (32% N), and NH_4NO_3 (33 5% N) The corn yields showed no significant difference as a result of the application of the three different sources of N The yield varied from 82 to 84 bushels/acre The 150 lb rate of N produced a significantly higher yield than the 50 or 75 rate, but there was no significant difference between the 150 and 100 lb level Thus, the 100 lb level was recommended (CA 73 87031q)

293 Walker, W M , Parks, W L 1969 *Effect of Soil Potassium, Potassium Fertilizer, and Method of Placement Upon Lodging in Corn ("Zea mays")* Proc Soil Sci Soc Amer 33(6) 909 12 (Eng) (Univ Tennessee, Knoxville)

A quadratic regression equation including selected linear interactions was fitted to lodging percentages of corn grown on a Hartsells loam with varying K soil test levels and K fertilizer rates applied in the row and broadcast The study was conducted over a 3 year period and main effect variables for year, soil test K, and fertilizer K, as well as selected linear interactions, were included in a regression analysis Both soil and fertilizer K significantly decreased percent lodging, and there was a significant difference in lodging among years The significant soil K and fertilizer K interaction indicated that the effect of fertilizer K upon lodging varied with soil test level There was also a significant interaction of fertilizer K with year indicating that the effect of K upon lodging varied among years (CA 72 42255d)

294 Wallace, A Romney, E M 1970 *The Effect of Zinc Sources on Micronutrient Contents of Golden Cross Bantam Maize* Soil Sci 109 66 7 (Eng) (Univ California, Los Angeles)

In pot experiments on a Dinuba fine sandy loam (a soil with a history of Zn deficiency) Golden Cross Bantam maize was fertilized with 200 lb/acre N (¼ as $NH_4H_2PO_4$) and 1, 5, 10, and 20 lb/acre Zn as ZnNTA, ZnEDTA, or $ZnSO_4$ Yields were increased most by ZnNTA and least by $ZnSO_4$ Zn uptake, however, was increased most by ZnEDTA, 1 lb/acre ZnEDTA had a greater effect on plant Zn content than did 10 lb/acre ZnNTA or $ZnSO_4$ Fe and Mn contents were decreased more by ZnEDTA than by ZnNTA ZnEDTA also tended to decrease plant Ni and Cu contents (SF 33 4065)

295 Wallace, A , Romney, E M , Hale, V Q , Hoover, R M 1969 *Effects of Soil Temperature and Zinc Application on Yields and Micronutrient Content of Four Crop Species Grown Together in a Glasshouse* Agron J 61(4) 567 68 (Eng) (Univ California, Los Angeles)

Four species of plants were grown together in Dinuba sandy loam in pots which were placed in temperature controlled tanks to give root temperatures of 14, 20, and 26° C Sugar beets had been previously grown and the residues incorporated in the soil to help induce a low Zn status Zn labeled with Zn^{65} had been added to half of the pots Vegetative yields of two crops, Zn^{65} contents, and micronutrient and P contents of the plants were tabulated Yields generally increased with soil temperature with or without Zn application Cotton yields responded to Zn at the low soil temperature, bush bean yields at the high soil temperature, and corn responded at all three temperatures used Zn content tended to increase with soil temperature The Zn application generally resulted in a higher Zn content of plants, the two cases when this was not significantly so were at the high soil temperature Zn content and evidently Zn needs varied considerably The specific activity of the Zn in the four species was remarkably uniform, but for three of them there was a tendency for a decrease at the highest soil temperature Plant P tended to increase with soil temperature, and there was a slight interaction with Zn contents There was some tendency for Cu and Mn in plants to increase with Zn, Fe did also but to a much lesser extent Cu tended to increase with soil temperature but Mn tended to decrease at the high temperature B varied for species only and Al decreased with increasing temperature

296 Wallace, A , Deutsch, A 1968 *Phosphorus Deficiency Decreases Stomatal Activity and Water Use of Plants* Calif Agr 22(8) 15 (Eng) (Univ California, Los Angeles)

In pot experiments with five plant species including maize, P deficiency greatly decreased the ability of leaf stomata to open Water use/unit leaf area in maize was reduced 40% by P deficiency Leaf temperature was increased and water use decreased in all species as a result of the lower transpiration It is concluded that increased leaf temperature is the cause of at least some of the symptoms of P deficiency (FCA 22 1815)

297 Warnock, R E 1970 *Micronutrient Uptake and Mobility within Corn Plants ("Zea mays") in Relation to Phosphorus Induced Zinc Deficiency* Proc Soil Sci Soc Amer 34(5) 765 69 (Eng) (Ortho Div , Chevron Chemical Company, Richmond, California)

Corn plants were grown in greenhouse pots on calcareous soil known to be low in available Zn P was applied to soil at rates of 0 520 ppm with concomitant addition of Zn decreasing from 40 to 0 ppm in inverse concentration. Zn

deficiency occurred at high P and low Zn Maximum growth occurred at 130 ppm P and 2 5 ppm Zn applied Distribution of Zn, Fe, and Mn among leaf, stem, and root tissue indicated that P and Zn fertilization had altered the mobility of these micronutrients within the plant Mobility of Fe and Mn was increased by high P and low Zn Zn mobility varied opposite to that of Fe and Mn Applied P reduced Zn concentration in tissue but not uptake per plant Diethylenetriaminepentaacetic acid (DTPA) extractable Zn in soil was not decreased by P applied, but did increase with Zn applied DTPA extractable Fe and Mn increased at high levels of applied P Zn deficient plants accumulated a large excess of Fe Interference from excess Fe is suggested as contributing to physiological malfunction within Zn-deficient corn plants (CA 73 108846b)

298 Watanabe, F S, Lindsay, W L, Olsen, S R 1965 *Nutrient Balance Involving P, Fe, and Zn* Proc Soil Sci Soc Amer 29(5) 562 65 (Eng) (Colorado State University, Fort Collins)

Corn (*Zea mays*) and pinto beans (*Phaseolus vulgaris*) were used as test crops to study the interactions between P, Fe, and Zn in a calcareous solution culture The addition of Zn to the intermediate Fe level accentuated Fe-deficiency symptoms and depressed the yield of corn This adverse effect on yield was not related to the Fe concentration in the plant, but was associated with a decreased Fe/Zn ratio The antagonistic effect of Zn on Fe was manifested by reduced yields as the ratio of Fe/Zn in the tissue decreased below 1 5 Addition of Fe corrected this adverse effect on yield By increasing the P at the intermediate Fe level, the yield first increased, then P induced Fe deficiency symptoms appeared, accompanied by a depression in yield This phenomenon was not associated with change in Fe concentration but was related to high P concentration in the plant tissue, which resulted in a P/Fe ratio >60 The addition of Fe did not change the Fe concentration but corrected the depression in yield A P/Zn concentration ratio >300 resulted in a slight depression in yield in the presence of an adequate supply of Fe The depression in yield of corn associated with the antagonistic effect of Zn on Fe and of P on Fe and Zn was not found with pinto beans at the concentration levels studied (CA 64 13054c)

299 Welch, I F 1969 *Effect of Nitrogen, Phosphorus, and Potassium on the Percent and Yield of Oil in Corn* Agron J 61(6) 890 91 (Eng) (Univ Illinois, Urbana)

Because changes in the percent of oil in the corn grain were more dependent on genetics than on environment, the effect of fertilizers available for plant use had received less attention than plant selection, therefore, three experiments were conducted in Illinois in 1968 with five rates each of N, P, and K N plots received 90 and 168 kg P and K/ha, respectively P plots received 270 and 85 kg of N and K/ha, respectively All fertilizers were broadcast and disked into the soil before planting Single-cross, commercial hybrids PAG SX 29 and Gildersleeve 50 were planted Wide line NMR spectroscopy was used to determine oil content Fertilizer N P, and K increased the percent of oil in corn grain relatively less than they increased grain yield, the relative increase in percent of oil was 8%, 3%, and 2%, respectively Oil yield was increased an average of 43%, 54%, and 11% by N, P, and K The increase in yield of oil/unit of land area was due more to increased grain yield than to increased percent of oil in the grain (CA 72 42281j)

300 Welch, L F, Boone, L V 1968 *How Fertilizer Affects Field Drying of Corn* Ill Res 10(2) 3-4 (Eng) (Univ Illinois, Urbana)

Delayed harvest due to wet corn increases grain loss and delays fall land preparation Contrary to popular opinion, fertilization does not delay maturity N fertilization up to 240 lb/acre reduced moisture content up to 4% and 5% in some situations and had no effect in others Application of P to a P deficient soil markedly decreased moisture content of harvested grain When P had little effect on yield, moisture content was affected little Added K had a tendency to increase moisture This effect may have been due to K-deficient plants dying and drying out rather than to a direct effect of K on moisture content (FA 1 1082)

301 Welch, L F, Johnson, P L, McKibben, G L, Boone, L V, Pendleton, J W 1966 *Relative Efficiency of Broadcast Versus Banded Potassium for Corn* Agron J 58 618 21 (Eng) (Univ Illinois, Urbana)

The relative efficiency of broadcast K compared with banded K ranged from 0 33 to 0 88 Largest yield increases due to application of K at several rates were 83%, 33%, and 13% on three soils (SF 30 2053)

SOUTH AMERICA

ARGENTINA

302 Amor Asuncion, M J, Wolanski, R, Ghelfi, R, Nobile, F, J B 1967 *The Effect of Various Farmyard Manures on the Growing of Maize* Rev Fac Agron Vet 16(3) 37-45 (Sp)

The effect of four types of farmyard manure on the growth, grain yield, and the contents of P and K of maize grown on a certain soil type in Argentina was studied The application of the manure resulted in a slight though insignificant increase of growth and grain yield, the contents of P and K of the grain and of the vegetative parts of the plants were, however, significantly increased The manuring therefore mainly improved the nutritive quality of the grain and that of the plants for cattle fodder (Trop Abstr 22 1982)

BRAZIL

303 Arruda, H V 1968 *Inorganic Fertilizing of Maize on the Red Soils of the Municipality of Ribeirao Preto* Biologico 34(5) 99 109 (Port)

Results of various fertilizer experiments conducted in maize on red soils in the State of Sao Paulo (Brazil) showed that both N and P were highly effective, however, N gave by far the largest increase of yield Only soils low in K gave a response to the application of K Significant interactions between the fertilizers were not observed N and P increased the weight of ears, but the ratio of weight of seeds to weight of ears was not affected by any of the fertilizers used (Trop Abstr 23 2455)

304 Braga, J M , Yahner, J 1968 *Comparative Study of Rock Phosphate and Single Superphosphate in Maize Cultivation on a Vicosa Soil, Minas Gerais* Experientia 8(5) 143 63 (Port)

Trials with maize, conducted in Brazil, showed no difference in response to rock phosphate, broadcast prior to planting at rates of 0 200 kg P_2O_5/ha, as compared with superphosphate applied at identical rates Increasing levels of P resulted in significant responses in yield to a maximum of 3,800 kg grain/ha at 108 kg P_2O_5 In the second year refertilization with P increased yields significantly, irrespective of sources and levels (Trop Abstr 24 2418)

305 Braga, J M 1968 *Evaluation of the Fertility Status of the Soils of Vicosa, Minas Gerais, by the Use of Micro Plots* Rev Ceres 15(86) 219-43 (Port)

The use of micro plots of maize as a method of determining the soil fertility was studied in the State of Minas Gerais, Brazil On areas of 60 x 60 cm, 30 maize plants were grown during 30 days, and treated with different quantities of fertilizers From the increase of the green weight of the plants the fertility of the soil can be estimated There was a significant correlation between the green weight and the dry weight of the plants, inferring that both values may be used It was shown that useful information can be obtained by this method for soil fertility studies (Trop Abstr 25 43)

306 Braga, J M , Yahner, J 1968 *A Study of Correlations in Chemical Analyses of Soil and Plant in Maize Cultivation* Experientia 8(5) 165 96 (Port)

In Brazil, trials with maize showed that soil P at 49 4, 45 5, and 18 1 ppm found by extraction with 0 01 NHCl + 0 05 NNH_4F , 0 05 NH_2SO_4, and, 0 05 NH_2SO_4 + 0 05 NHCl, respectively, produced 3,000 kg grain/ha The soil levels appeared related to applications of rock phosphate at 140 kg P_2O_5/ha for the highest levels and of 25 kg P_2O_5/ha for the lower level The threshold value for leaf P was 0 29% for a similar grain yield Some 70 kg P_2O_5 as rock P or 25 kg P_2O_5/ha as single superphosphate have a similar effect in maintaining leaf P at 0 29% At low applications superphosphate is considerably more effective in leaf P response, whereas at 200 kg P_2O_5/ha there is little difference between sources (Trop Abstr 24 2415)

307 Gallo, J R , Hiroce, R , Miranda, L T 1968 *Leaf Analysis and Maize Nutrition I Correlation Between Analysis and Yield* Bragantia 27(15) 177-86 (Port)

A correlation between foliar analysis and the yield of maize was established, based on 31 fertilizer experiments conducted at 16 different localities of the State of Sao Paulo, Brazil The correlation between the N, P, K, S, Ca, and Mg contents of leaves and yields are discussed A yield of 80% or more of the maximum was found to correlate with a N content of 2 90% and a P content of 0 230% The K content of the leaves was affected mainly by soil type, and special consideration was given to this fact in obtaining a correlation coefficient for leaf K content and yield (Trop Abstr 25 1283)

308 Gallo, J R , Hiroce, R , Miranda, L T 1965 *Leaf Analysis and Maize Nutrition II Results of Fertilizer Trials with N, P, K, and Micronutrients* Bragantia 24 71-7 (Port)

In field experiments in diffent areas of Sao Paulo, little response in yields were obtained from applications of Mn, Zn, Cu, B, Mo, and Fe Concentrations of these microelements in maize leaves depended on many factors, including inherent soil fertility and ion antagonism NO_3 N content of midribs varied with climate and soil type from 400 2200 ppm Good correlations were obtained between yields and leaf content of total N, P, and K, but there were some indications that leaf K content might be affected by soil type (SF 30 630)

309 Galvao, J D 1969 *Effect of Plant Density and Different Levels of Nitrogen on the Yield of Grain and the Average Earweight of Maize* Experientia 9(2) 1 82 (Port)

In experiments with three different maize varieties in Brazil, the highest grain yields were obtained at plant densities of 40,000 60,000 plants/ha The response to N fertilizing depended on the plant density The plant density had less effect on yield than the level of N applied The maximum level of N to be recommended, appears to be 80 kg/ha The earweight increased with increasing N application, and decreased with increasing plant density (Trop Abstr 25 1043)

310 Godoy, O P , Abrahao, J T M , Godoy, C , Godoy, R , Petta, A 1968 *Furrow Irrigation of Maize* Rev Agr 43(1) 13 21 (Port) (Esc Sup Agr "Luiz de Queiroz," Univ Sao Paulo)

In a plot trial with maize sown on September 3, 1964, the soil was allowed to dry to approximately (a) 75%, (b) 50%, and (c) 25% of field capacity, or (d) wilting point, by applying irrigation water at intervals of 3, 6, 9, and 12 days, respectively In (b), the best irrigation treatment, the grain yield was 22% higher than in the non irrigated control Two split applications at 60 kg N/ha, at 30 and 60 days after germination, increased yields by 28% compared with a single application of 30 kg N/ha at 30 days after germination (FCA 22 961)

311 Miranda, L T , Viegas, G P , Freire, E S 1964 *Manuring of Maize XXIV – Results of a Permanent Trial with Manure, Lime and Mineral NPK* Bragantia 23(15) 153 77 (Port)

A long term factorial farmyard manure x lime x NPK fertilizer trial with maize on terra roxa soil was established at Campinas, Brazil, in 1953 Over the first 9 years, responses to lime were negative in the absence of NPK fertilizer, positive in the presence of fertilizer Responses to farmyard manure were

good and fairly constant, the manure x fertilizer interaction was negative Responses to NPK fertilizer were positive and tended to increase, they were enhanced by lime and depressed by manure (Trop Abstr 21 37)

312 Miranda, L T, Freire, E S 1964 *Manuring of Maize XXV – Method and Timing of Nitrogen Application* Bragantia 23(31) 371-86 (Port)

In the State of Sao Paulo (Brazil) five trials were conducted in each of two successive years to compare methods of applying ammonium sulfate to maize All plots received 60 kg P_2O_5 and 30 kg K_2O/ha in the planting furrows Addition of N fertilizer in the furrows at rates of 30 or 20 kg N/ha resulted in a considerable yield increase in two trials, in a yield reduction in four trials Topdressing with N at rates of 90 or 100 kg/ha, in addition to the basic NPK dressing, increased the yield in eight trials, it did not make much difference whether the topdressing was applied in a single band 20 cm from each row or in a band between each two rows, and whether the whole amount was given 45 days after planting or divided over two equal doses applied 30 and 60 days after planting (Trop Abstr 21 38)

313 Netto, A C, Cobra, A P 1966 *Nitrogen Fertilizing of Maize Using Anhydrous Ammonia* Rev Agr 41(3) 121 6 (Port) (Univ Sao Paulo, Piracicaba)

A sandy regosol (pH 4 9, organic matter 0 516%, N 0 084%, soluble PO_4^{3} 0 110%, exchangeable K 0 045%, exchangeable Ca 1 030%) was treated with P (superphosphate) and K (KCl) at a level of 120 kg/ha Thirty days later the soil was treated with anhydrous NH_3 at N levels of 0, 30, 60, and 120 kg/ha By leaf analysis and by the yield of corn grown on these soils, 30 kg N/ha gave optimal results At 30 and 60 kg N/ha, the yields were 1,263 and 1,624 kg/ha greater than from the control soil (CA 66 75374w)

314 Primavesi, A M, Primavesi, A 1968 *Corn Crop Yield Dependence on Soil Biostructure and Trace Nutrient Fertilization* Bodenkultur 19(4) 302 5 (Ger) (Bundesuniv Santa Maria)

The corn crop yield in Brazil may be increased by applying fertilizer containing N, P, K, Ca, Zn, and B Zn and B are essential The seeds should be soaked in a solution containing 50 mg borax and 50 mg $ZnSO_4$/l H_2O (CA 71 2599s)

315 Wheeler, R G 1969 *Production and Export of Corn and Rice in Brazil–Prospects for the 1970's* USDA, Economic Research Service, in cooperation with AID, Washington, D C, 66 p (Eng)

This is a survey of various aspects of production which includes experimental results suggesting that, in general, application of 75 kilos of P_2O_5/ha could increase yields of corn, rice, cotton, coffee, and sugarcane by 10%-30%, compared with no use of fertilizer A nearly universal response to N has been reported, although much remains to be learned about its use on tropical soils Response to potash is much more limited In the States of Sao Paulo, Rio de Janeiro, Minas Gerais, Parana, Goias, Pernambuco, Espirito Santo, and Rio Grande do Sul, N was the most deficient nutrient, and increases of over 1,000 kilos of corn/ha have been obtained with moderate applications of N (40 70 kilos/ha) The most profitable level of fertilization seems to be between 20 and 80 kilos of N/ha, even with a fairly adverse ratio between the price of N and grain Optimum P applications are estimated between 20 and 90 kilos/ha, while potash applications appear economical only in certain locations

CHILE

316 Pereyra, C E, Nocetti, J A 1968 *Additional Costs and Returns of the Application of Nitrogenous Fertilizers on Maize* Informe Tecn Estac Exp Agropec Pergamino 74 16 p (Sp)

This study on the economics of N fertilizing in maize in Chile aims at giving the farmers a guide as to economic fertilizer use The study considers the additional costs and returns of the application per ha of 100 kg of urea (46% N) or of 50 kg of anhydrous ammonia (82% N) on the basis of theoretical yield responses of increasing magnitude (Trop Abstr 24 43)

317 San Cristobal de R, I 1965 *Influence of Plants Density and N Level on Yield of Hybrid Maize* Agr Tec 25(4) 155-62 (Eng, Sp) (Esta Exp La Platina)

In 1960 1964, the effect of 0, 64, 128, and 192 units N/ha was studied on hybrid maize at densities of 15,000 75,000 plants/ha, in 17 trials in two regions of Chile Results showed a positive N/plant density interaction The highest grain yields were obtained with 60,000 and 75,000 plants/ha and the two highest rates of N (FCA 19 2089)

COLOMBIA

318 Gomez L, J A 1967 *How to Increase Maize Production in the Cauca Valley* Agr Trop 23(3) 133-40 (Sp)

Low maize yields in the Cauca Valley of Colombia are mainly due to neglect of weed control, too dense sowing, and use of inferior varieties Field trials have shown that big yield increases can be obtained by adequate weed control, earthing up is beneficial only insofar as it controls weeds On the other hand, land preparation can often be simplified without loss of yield Responses to N fertilizers were observed on one third of fields in the central part, while responses to N and P are common in the southern part, general use of fertilizers will be required in the near future On the basis of experimental results, a spacing of 60 x 30 cm (56,000 plants/ha) is recommended for irrigated fields, one of 92 x 25 cm (43,000 plants/ha) for rain-fed fields (Trop Abstr 22 1979)

319 Gomez L, J A, McClung, A C 1968 *Influence of Irrigation, Population and N Fertilization on Yield and Other Characteristics of Maize* Agr Trop 24(1) 54 63 (Sp)

In a trial at the Centro Nacional de Investigaciones Agropecuarias, Palmira, Valle del Cauca, Colombia (1,006 m altitude, 1,000 mm average annual rainfall, 24°C average temperature), maize hybrid Diacol H 205 was sown at 6 weekly intervals between May 21, 1963, and August 28, 1964 Sprinkler irrigation was applied to maintain a minimum

of 50% moisture in the upper 40 cm of soil, or no water was applied Irrigation increased grain yields by an average of 1 2 26 tons/ha, and was particularly effective when supplied 15 20 days before earing Sowing at normal dates for the region (September 28, March 9, August 28) reduced the need of irrigating, the increases in yield brought about by irrigation being approximately 1 7, 1 5, and 0 tons/ha for these sowing dates, respectively (FCA 22 178)

320 Gomez, J A 1968 *Response of Maize in Monoculture to NPK Fertilizers* Agr Trop 24 157 61 (Sp) (Inst Colombiano Agropec)

After continuous cropping for 11 years where annual rainfall was 1,000 mm and mean temperature 24°C, maize responded only to N, the highest yield being obtained with 80 kg/ha N (FCA 22 3654)

321 Gomez, J A 1968 *Rotation and Maize Yield Note on the Effect of a Rotation with Soya or Lucerne on Maize Yield* Agr Trop 24 204 20 (Sp) (Centro Nac Invest Agropec, Palmira)

On well drained clayey soil, yields were reduced by continuous cropping with maize for 9 years High yields were maintained when maize was grown in rotation with soya or lucerne, or when N was applied to maize in monoculture In the second year after soya, maize yields were similar to those obtained in monoculture without N, but the residual effect of lucerne was still apparent in the second maize harvest Applying N to maize after the leguminous crop further increased yields, particularly after soya (FCA 22 4494)

PERU

322 Arca, M N 1964 *Comparative Study on the Effect of Seed Rate and Level of Fertilization on the Yields of Different Maize Hybrids and Local Varieties* An Cient 2(2) 105-47 (Sp) (Dep Suelos, Univ Agraria, Lima)

In seed rate and fertilizer trials at five locations in the coastal region of Peru, improved maize hybrids outyielded local varieties Highest yields were obtained from a spacing of 90 x 60 cm (55,555 plants/ha) on soils of good structure, receiving 80 kg N/ha, and 90 x 75 cm (44,444 plants/ha) on coarse soils receiving inadequate moisture Higher plant densities increased lodging (FCA 19 2088)

323 Caja, J L 1967 *Efficiency of the Stable Isotope ^{15}N for Determining Nitrogen in Maize* Boln Estac Exp Agr La Molina, No 18 32 p (Sp) (Estac Exp Agr La Molina, Lima)

Irrigated maize receiving 100 kg/ha N as $(^{15}NH_4)_2SO_4$ absorbed 24-49% of its total N from the fertilizer During the first stages of growth, N uptake was higher from the soil than from the fertilizer The highest proportion of fertilizer N in the plant was obtained when the fertilizer was applied at sowing in two bands at a depth and a distance of 5 cm on each side of the seed Yields were affected more by time than by method of fertilizer application, a single application at sowing being superior to split applications (SF 32 728)

324 Estrada, J A, Cummings, G A 1968 *Effect of Lime and Phosphorus Applications to Specific Horizons of an Acid Soil on the Growth and Content of P and Al in Maize* An Cient 6 65 78 (Sp) (Univ Agraria La Molina, Lima)

In a Norfolk loamy sand, increasing the supply of P or lime in the A_p or A_2 horizon or both, markedly increased maize growth Without lime or P, only limited root growth occurred in both horizons Addition of P to one horizon also increased root growth in the unfertilized horizon Response to P was higher than response to lime but optimum yields occurred only with both P and lime (SF 33 4067)

VENEZUELA

325 Barber, S A 1969 *Maize New Fertilizing Practices* Hacienda 64(10) 50 2 (Sp)

New cultivation methods, new hybrid maize varieties and higher doses of fertilizers require an adapted technique of fertilizing Timing and placement of N, P, and K fertilizers are discussed Broadcasting of P fertilizers is more effective than placement in bands alongside the furrow if doses of more than 55 kg P_2O_5/ha are applied The availability of nutrients in the soil and their uptake by the roots are briefly discussed (Trop Abstr 25 1826)

326 Orihuela, G J, Espinoza, C J 1968 *Effects of Different Sources and Levels of N on the Yield of Maize* Oriente Agropec, Venezuela 1(1) 33-43 (Sp)

In experiments conducted on an acid savannah soil in Venezuela, higher N, P, and K levels gave marked increases in yields of grain, leaves, and stalks of maize With N applied as ammonium sulfate, maximum yields were obtained at a rate of 100 kg of N/ha, whereas with the use of urea yields continued to increase at doses up to 150 kg of N/ha A mixture of goat manure and P fertilizer produced a maximum grain yield at a dose of 10 tons/ha, and a maximum green matter yield at 30 tons/ha (Trop Abstr 25 45)

327 Ramirez, R 1964 *Effect of Nitrogen Fertilizing and Population Density on Maize in Soils of the Maracay Series (Venezuela)* Agron Trop 14 155-67 (Sp) (Centro Invest Agron, Maracay)

In field experiments on loam, sandy loam, and clay loam soils of pH 6 4 7 8, organic matter content 1 19% 1 70%, medium P and high K contents, application of 40 kg/ha N increased maize population from 37,600 to 50,600 plants/ha High populations resulted in fewer ears per plant and lower grain weights per ear (SF 30 3014)

EUROPE

AUSTRIA

328 Cho, C M, Proksch, G, Caldwell, A C 1967 *The Effect of Placement on the Utilization of Nitrogen by Maize as Determined with ^{15}N Labelled Ammonium Sulfate* Isotopes in Plant Nutrition and Physiology, Proc Symp, Vienna 1966, 47 53 (Eng)

A field experiment was conducted with maize to observe the effect of different methods of application of ^{15}N-$(NH_4)_2SO_4$ upon the growth, percentage distribution of fertilizer-derived N, and the degree of utilization of applied fertilizer N in the plant at various stages of growth There was no yield response to different placements The degree of utilization of the applied fertilizer N increased with the age of the maize (FCA 22 3177)

329 Haunold, E, Danneberg, O, Kaindl, K 1965 *Potassium-42 Uptake by Maize Roots* Isotopes and Radiation in Soil Plant Nutrition Studies, Proc Symp, Ankara, p 317 21 (Eng) (Osterreichische Studiengesellschaft Fuer Atomenergie, Vienna)

Excised maize roots grown in Hoagland solution were transferred to a $^{42}KNO_3$ solution The root solution ratio decreased with an increase of K uptake, and depletion of the nutrient solution slowed down at the same time There was more K uptake from a more concentrated solution The uptake of K/mg dry matter of roots was strongly dependent on the concentration of the nutrient solution The aeration and volume of the nutrient solution did not affect the amount of K taken up Roots at the lowest nutrient status showed the greatest capacity for K uptake (CA 65 15797c)

330 Kaindl, K, Haunold, E 1965 *Culture and Field Experiments on the Uptake of ^{15}N Labeled Nitrogen Fertilizers by Maize* Landwirt Forsch, No 19, 140-44 (Ger)

The uptake of $^{15}NH_4Cl$ by maize depended in field experiments on the developmental phase of the plant to which $^{15}NH_4Cl$ was applied, the distance at which the fertilizer was placed from the plant, and on the amount of precipitation In the course of a 50-day growing period, 17% of the total $^{15}NH_4Cl$ mixed into the soil at the time of seeding, but only 3% of that broadcast 3 weeks after seeding were absorbed by the plants In culture experiments, depending on the soil employed, between 34% and 47% of the total $^{15}NH_4Cl$ added was taken up during this same period Plant growth and total uptake depended on the availability of soil N (CA 67 2435c)

BELGIUM

331 van Maercke, D 1965 *Foliar Fertilization with Urea* Meded LandbHogesch OpzoekStns Gent 30(4) 2073-85 (Eng) (Rijkslandbhogesch Gent)

Maize cv Wisconsin 240 was sprayed at end August with 1,000 liters 2 5% urea solution or 500 liters 5% urea solution Both treatments had practically the same effect on leaf N content, which rose considerably during the first 24 hours after spraying Sampling 19 21 days later showed that N contents were similar for all leaves, indicating that translocation of foliar applied N had taken place Changes in yield between sampling dates were small Leaf scorch occurred in maize sprayed with the more concentrated solution (FCA 19 2117)

BULGARIA

332 Antonov, I 1969 *Zinc Fertilization of Corn After a Sugar Beet Crop on Calcareous Chernozem Soil* Rast Nauki 6(6) 47 55 (Bulg) (Sugar Beet Res Inst, Shumen)

In some parts of Bulgaria corn grown after a sugar beet crop on calcareous chernozem soil shows a slower initial development, is smaller, has chlorotic leaves, and tassels and ears form later Soil fertilization with B, Mn, and Zn as micronutrients shows great differences in the development of corn grown after sugar beet crop Corn plants on Zn fertilized plots developed more strongly and produced 41% 69% more grain than those grown on check and otherwise treated plots (CA 72 54295e)

333 Bonev, M 1968 *Intensity of Chemical and Organic Fertilization of Various Densities of Irrigated Hybrid Corn* Pochv Agrokhim 3 39-47 (Bulg)

334 Dimova, R 1965 *The Effect of Manuring on Maize Blossoming and Yields* Rast Nauki 2(4) 99 112 (Bulg) (Vissh Sel' Khoz Inst, Sofia)

In good years on chernozem smolnitza, when male and female flowering in maize hybrids and double hybrids coincided, N increased the proportion of hybrid seed set and the size of the cobs, the yield depended on vegetative growth, which was increased by N With cool rainy weather in spring and delayed sowing, growth was retarded and the male inflorescences flowered before the female ones In the hybrid Ohio C 92, N delayed male flowering under these conditions, but in VIR 42 it delayed female flowering even more NP increased flowering, especially of the female inflorescences in Ohio C 92 With dry spells, male inflorescences flowered much earlier than female ones, P improved the coincidence of flowering times and increased the proportion of hybrid seed set (FCA 19 834)

335 Dimova, R, Simeonova, I 1966 *Some Biochemical and Biological Processes in Maize as Influenced by Mineral Fertilization* Pochv Agrokhim 1(1) 63 72 (Bulg) (Georgi Dimitrov Higher Agr Inst, Sofia)

NH_4NO_3 and superphosphate introduced into the soil prior to maize planting were accumulated in the plants immediately after crop emergence Most of the P was accumulated in the aerial plant parts at the early stages of development N accumulation in the late hybrid, Ohio C 92 was also considerable Plants grew faster when N was applied at the 11 12 leaf stage N fertilizing on chernozem smolnitza soil in the Sofia area contributed to the formation of more and larger ears and to a higher grain yield Sugar metabolism was greater in plants fertilized with N alone or both with N and P, because

of a more intensive growth P fertilized plants produced more organic acids Maximum differences between fertilized plants of the hybrid, WIR-42, and the unfertilized plants were found at an earlier stage than in Ohio C 92 Amounts of free amino acids increased considerably, especially those undergoing greater metabolic changes in the biosynthetic processes (asparagine, glutamine, and alanine) Greater differences occurred during blossoming, when the quantitative relation changed in favor of glutamine (CA 65 14377b)

336 Khristov, A 1967 *Effect of Tillage Depth and Fertilizers on Maize in Monoculture* Rast Nauki, No 4, 77-86 (Bulg) (Inst Khidrotekh Meliorats, Sofia)

On typical chernozem in the north of the Danube plain in Bulgaria, regular occasional plowing to 30 35 cm is necessary Mineral fertilizers are essential, but they may decrease yields in extremely dry years (SF 30 4398)

337 Kolev, V M 1967 *Some Aspects of Nitrogen Metabolism in Urea Sprayed Young Corn Plants* Nauch Tr Vissh Selskostop Inst, Sofia, Agron Fak, Ser Rast 18 183 200 (Bulg)

The dynamics of synthesis of some amino acids during the first 24 hours after spraying the young corn plants with 2% urea solution was studied Decreased amino acid synthesis in the leaves was followed by an activation of that process in the roots In urea sprayed detached leaves, protein degradation was restricted mainly to the phase of amide formation (glutamine and asparagine) Fumaric, succinic, and malic acids were strongly decreased in urea sprayed plants These acids were used in the reductive amination in which aspartic acid was formed Acceleration in the N metabolism was observed when the plants were sprayed with urea and malic or succinic acid solutions together (FA 1 1049)

338 Nikolov, B A 1969 *Nutrition of Corn Leaves with Molybdenum and Manganese* God Soffi Univ, Biol Fak 1967 1968 62(2) 209 18 (Bulg)

$MnSO_4$ at concentrations of 15 3 and 60 g/decare and $(NH_4)_6Mo_7O_{24}$ $4H_2O$ at 15 3 and 60 g/decare were applied to Wisconsin 641 AA corn leaves grown on degraded chernozem before their flowering In dry conditions, no increase in the yield of grain or plant mass was observed, N content and crude protein were increased (CA 73 108821q)

339 Panaiotov, A A 1968 *Effect of the Trace Elements, Zinc and Molybdenum, on Wisconsin 641 AA Corn Growing on Degraded Chernozem* God Soffi Univ, Biol Fak 1966 1967 61(2) 305 14 (Bulg)

The effect of $ZnSO_4$ (0 025%, 0 05%, 0 01%), $(NH_4)_6Mo_7O_{24}$ $4H_2O$ (*I*) (0 02%, 0 04%, and 0 06%), and a mixture of 0 025% $ZnSO_4$ and 0 02% *I* on the yield of the overground mass, corn yield, absolute seed weight, extractable P, and crude protein content was studied in a field trial with Wisconsin 641 AA corn on leached chernozem All concentrations have a positive effect on the overground mass and the yield of crude protein, with the exception of the highest Zn concentration and the lowest Mo concentration The trace elements always have positive effects on the absolute seed weight The availability of P is only improved at 0 05% $ZnSO_4$, 0 06% *I*, and with the mixed solution (CA 73 108818u)

340 Peneva, N, Patarinski, N 1968 *Effect of Zinc Sulfate on the Chemical Composition of Corn Leaves* Pochv Agrokhim 3(2) 61 5 (Bulg) (VSI "Georgi Dimitrov," Sofia)

Corn was grown in pots in calcareous soils When Zn was applied, N, P, and K decreased and dry matter increased The Zn content of the leaves was also influenced by the composition of the soil and the changes in plant nutrition (with trace elements) When the ratios of N, P, and K in leaves with and without Zn are higher than 1, the soil is not sufficiently stocked with available Zn (CA 69 66531e)

341 Petkov, N 1967 *Comparative Testing of the Effectiveness of Aqueous Ammonia and Ammonium Nitrate in the Area of the Rossitsa Irrigation System* Pochv Agrokhim 2(6) 83 7 (Bulg) (Exp Sta Irrig Fmg, Pavlikeni)

On leached chernozem aqueous NH_3 and NH_4NO_3 were equally effective for maize (SF 31 2767)

342 Nikola, P 1966 *Fertilizing of Corn Grown on Leached Chernozem with Irrigation* Pochv Agrokhim 1(5) 481 6 (Bulg) (Exp Sta Irrig Fmg, Pavlikeni)

Fertilization of leached chernozem was carried out with 6, 9, 12, and 18 kg N/0 1 ha, 6, 8, 12, and 18 kg P_2O_5/0 1 ha, and 6 and 9 kg K_2O/0 1 ha Half of the N was given before sowing, and half in two portions, during growth, 2/3 P_2O_5 was spread in the fall before plowing, and 1/3 in the spring All the K_2O was given in the fall Tests were also made with N, P, and K alone The irrigation was twice in 1961 with 160 m^3/0 1 ha, in three portions, and three times in 1962 with 220 m^3/0 1 ha each Corn reacted most with N, less with P, and not at all with K, when used alone The highest yield of grain was with 18 18 9 N P K (kg/ha), 1,433 kg/ha compared to 982 kg/ha for the control (CA 67 2452f)

343 Sarkizov, M 1967 *Use of Peat in Maize Dressing with Irrigation* Pochv Agrokhim 2 53 7 (Bulg) (Exp Sta, Pazardjik)

Maize yields did not increase after applications of 20 tons/ha peat, not composted with fertilizers, after fertilizing with 20 tons/ha peat composted with fertilizers (0 5% N and 0 5% P_2O_5), yield increases were the same as those when 313 kg/ha N and 555 kg/ha P_2O_5 were applied separately (SF 30 4495)

344 Stoimenov S 1968 *The Dates of Ammonium Nitrate Application to Irrigated Maize Grown for Grain and Silage* Pochv Agrokhim 3(6) 85 95 (Bulg) (Inst Tsarev, Knezha)

In trials during 3 years at Knezha, highest yields of grain and silage material were obtained when N fertilizer was applied at the 5 6 leaf stage or before sowing Split application did not increase the yields (FCA 22 2624)

CZECHOSLOVAKIA

345 Belej, J, Kulik, D 1967 *The Effect of High Amounts of Mineral Fertilizers Applied to Corn During a Humid and Cool Year* Acta Fytotech 16 69-83 (Czech)

The paper presents results of experiments carried out in 1964 on the United Agricultural Co-operative Drazovce Nitra district, with various doses and ratios of nutrients combined

after irrigation Irrigation was carried out in two phases once after blooming and then at the time of milky ripeness of the grain, a total dose of 800 m^3/ha when a period of favorable moisture conditions was followed by a period of insufficient rainfall Without irrigation, the greatest rise in grain quantity, as compared with the unfertilized control, was 8 48 q/ha at the ratio of N P_2O_5 K_2O 1 5 1 1 In the case of irrigation, yields were practically the same regardless of the level and ratio of nutrients

346 Bizik, J , Masaryk, S , Ivanic, J 1968 *Changes in the Content of Nitrates in Brown Soils in Relation to the Application of Fertilizers to Corn* Acta Fytotech 17 123-33 (Czech)

The development and fluctuation of nitrate in leaves of corn grown for grain and fertilized with various combinations and doses of fertilizers was studied by the colormetric method The fluctuation of nitrates was observed in two depths, i e from 0 to 20 and from 20 to 40 cm from June to October The development of nitrate depended mainly upon soil temperature and reached a maximum 4 5 weeks after application of ammonium sulfate On the variants with stable dung, the development of nitrate was slower and less expressive than with ammonium sulfate During autumn, no rise in the nitrate content was observed The fluctuation of nitrates is conditioned by the movement of water in the soil Evaporation from the soil causes the movement of nitrates out of lower strata into the surface strata Depending upon manuring and the quantity of precipitation at the end of vegetation, the ratio of nitrates changes in favor of their higher concentration in greater depths At higher doses of N fertilizers, the soil contained considerable quantities of NO_3 in October which, from the point of view of plant nutrition, must be considered a loss

347 Ivanko, S , Michalik, I 1966 *Effect of Previous Nutrition on Uptake and Transformation of Phosphorus in Maize Roots* Biol (Bratislava) 21 339 51 (Ger) (Lehrstuhl Radiobiol Biochemie Ldwirtschaft Hochschule Nitra)

Fifteen-day-old seedlings grown in water cultures supplying NPK or NK were transferred to solutions supplying P^{32} Uptake of P^{32}/g of fresh root and rate of incorporation of P^{32} into high molecular compounds in the first five seconds of exposure were greater in NK than in NPK treated seedlings (SF 31 492)

348 Ondracek, L , Kordik, E , Tumova, E 1965 *Agrochemical Effectiveness of Combined Fertilizers on Maize* Agrochemia (Bratislava) 5(6) 162 64 (Czech)

Twenty field trials on different soil types, i e , chernozems, degraded chernozems, brown soils, alluvial soils, at pH 6 6 7 6 were set up Mean grain yields of corn variety LSP amounted to 46 7 quintals/ha Significant differences were attributed to the P Grain yield increases were higher on soils with lower P content, with higher $CaCO_3$ content, and with lower pH values A correlation was established between the soil P content and grain weight increases The NPK fertilizer prepared using the nitrosulfate manufacturing technology, was the most appropriate one for corn fertilization (CA 67 63354x)

349 Ondracek, L 1968 *Agrochemical Effectiveness of the Combined Nitrocarbonate NPK 3B Fertilizer* Rostl Vyroba 14(3) 251 56 (Czech) (Vyzk Ustav Anorg Chem , Usti nad Labem)

Field experiments in 20 various regions with fertilizing of maize were carried out Combined nitrocarbonate N P K 3B fertilizer containing N 15 5%, P_2O_5 9 0%, K_2O 14 6%, N P K, a mixture of simple fertilizers (Lovosice saltpeter, superphosphate, KCl) and N K, a mixture of mentioned simple fertilizers without superphosphate, were used The nutrient levels of N 102 kg/ha, P_2O_5 60 kg/ha, and K_2O 96 kg/ha were chosen An average increase of corn yield of 0 88 quintals/ha after N P K 3B treatment and 0 73 quintals/ha after N P K treatment, as compared with control, was obtained There was no statistical difference between N K fertilizing in comparison with control and between N P K 3B fertilizing in comparison with N P K A short review of the results with N P K 3B fertilizer obtained in Czechoslovakia is given (CA 69 95519n)

350 Spaldon, E , Belej, J , Kuka, J 1967 *The Influence of High Nutrient Doses on Yields of Corn for Grain* Acta Fytotech 16 53 68 (Czech) (Agron Fak , Vys Sk Pol'nohosp , Nitra)

Maize responded better to fertilizers when it followed cereals rather than lucerne, and responses were greater in a moist year, when fertilizer was best applied in spring In drier years, applying part of the fertilizer before plowing in autumn was more effective Foliar applications of N were ineffective Lucerne was as good a preceding crop for maize as cereals except in 1 year with dry weather after tasseling (FCA 21 181)

351 Vorisek, V , Minarova, E 1969 *Effect of Boron on the Uptake of Nitrogen, Phosphorus, and Potassium by Hydroponically Grown Corn ("Zea mays")* Acta Univ Agr , Brno, Fac Agron 17(4) 679 82 (Czech) (Vys Sk Zemed , Brno)

Corn plants were explanted in growth pots filled with Richter solution at the coleoptile development stage and enriched with B 0 5, Mn 0 5, Cu 0 05, Zn 0 05, and Mo 0 01 mg/pot To different pots, various amounts of additional B were also added Plants were harvested after 11 days B favorably affected the uptake of N P K if used in low concentrations (10 mg B/l), reduced uptake was found with high B concentrations (100 mg/l) P transport from roots to the shoots seemed to be influenced more than that of N and K The ratio of P content in shoots and roots was 4 1 in control plants without B, 9 1 with 50 mg B added and 13 1 with 100 mg B added Large B concentrations adversely affected mineral uptake in the order, K > P > N (CA 73 130231u)

352 Vorisek, V , Mannsbartova, E 1966 *The Pathophysiological Effects of High Boron Concentrations on Culture Plants I Effects on the Enzymic Activity and Chlorophyll Production in "Zea mays" During the Early Stages of Development* Sb Vys Sk Zemed Brno, Rada A 4 483 90 (Ger) (Pflanzenphysiol Landwirtschaftlichen Hochsch , Brno)

Maize seeds were soaked for 24 hours at 20° in H_3BO_3 solutions containing 0 05, 0 10, 0 50, 1 00, and 5 00 g B/l , and the enzyme activity and germinating power of some determined The remainder were planted in quartz sand and

were fed with nutrient solution After three leaves had formed, the catalase, ascorbic oxidase, polyphenoloxidase, peroxidase and dehydrogenase activities, and the chlorophyll and caroten contents were measured Above 0 10 g B/l the germinating power decreased sharply and 5 00 g B/l was toxic Peroxidase and polyphenoloxidase activities decreased as the B concentration was increased and were completely inhibited at 5 g B/l Ascorbic oxidase activity was lowered in the roots but increased in the plant Growth inhibition and decay were caused by inactivation of the oxidases (CA 67 32039u)

FRANCE

353 Berlier, Y , Guiraud, G , Sauvaire, Y 1969 *Study, Using Nitrogen 15, of the Absorption and Metabolism of Ammonium Supplied at Increasing Concentrations to Excised Roots of Maize* Agrochimica 13 250-60 (Fr) (Cent Et Nucl , Cadarache)

On immersion of excised roots of maize in $(NH_4)_2SO_4$ solutions of 2 10 ^{6} to 1 10 ^{2} normality, incorporation of ^{15}N in the different fractions extracted from the roots increased with increasing concentration and leveled off at 2 10 ^{5} to 2 10 ^{4} concentration to increase again at higher concentrations, the diffusable fraction of NH_4^+ ions followed the same pattern A hypothesis of the mechanisms involved is propounded (SF 32 3848)

354 Bertrand, D , DeWolf, A 1968 *Aluminum, A Trace Element Required by Corn* C r hebd Seanc Acad Sci , Ser D 267(26) 2325 27 (Fr) (Inst Pasteur, Paris)

In a study, Al was shown to be a dynamic trace element for corn The optimum dosage was found to be 0 25 0 3 mg/l of culture medium In case of Al deficiency, the medium becomes more acid (FA 2 1377)

355 Bertrand, D 1969 *Fluorine, a Dynamic Micro nutrient for Maize* C r hebd Seanc Acad Sci , Ser D 269 1767 69 (Fr) (Inst Pasteur, Paris)

Maize grown in nutrient solution needed small amounts of F for satisfactory development Depending on Al concentraion in the solution, optimum concentration of NaF was 1 8 2 mg/l Higher rates were highly toxic A slight excess of Al in the solution decreased F toxicity (SF 33 2375)

356 Bertrand, D , DeWolf, A 1966 *On the Maximum Yield of Grain Maize* C r hebd Seanc Acad Agric Fr 52(16) 1186 89 (Fr)

In a preliminary trial in France, three 100 m plots were sown on May 3 with the maize cv INRA 200 at (a) 60,000, (b) 90,000, and (c) 120,000 seeds/ha NPK at 150 75 75 kg/ha together with Mg, Mn, Mo, B, and Ni was applied immediately before sowing Harvest took place on September 27 28 The number of plants/ha and the yield of grain (15% moisture) were, respectively (a) 47,750, and 6,960 kg/ha, (b) 65,000, and 8,530 kg/ha, (c) 81 200 and 9,520 kg/ha (FCA 20 2285)

357 Blanchet, R , Fiorimonti S , Bosc, M , Gelfi, N , Hilaire, A , Viard, R 1968 *Actual Problems of Phosphate Fertilizer Observed Through Several Farming Regions in Toulouse Region* C r hebd Seanc Acad Agric Fr 13 1064 72 (Fr)

Yield was limited by insufficient moisture more than by nutrient lack In dry years, response to fertilizer was not appreciable, but 60 kg/ha P_2O_5 is recommended to replace P_2O_5 extraced from soil by the average yield of 50 to 60 quintals/ha Where water supply is adequate, as under intensive irrigation, 90 100 kg/ha P_2O_5 are required for a yield of 100 quintals/ha

358 Coic, U , Lesaint, C , Provot, M , Le Roux, F 1966 *Comparison of Cations in the Mineral Nutrition of Maize and Tomato* Ann Physiol Veg 8(2) 87 100 (Fr) (Centre Natl Rech Agron , Versailles)

Maize and tomato plants were grown in pot culture, irrigated with flowing solutions containing increased concentrations of K, Na, Ca, or Mg The "normal" concentration of Na was 0 2 meq/l , and that of K, Ca, and Mg, 1 meq/l , respectively The "strong" concentrations were 7 2 and 8 meq/l respectively Mineral cations and organic acid concentrations in the different plant parts and at different stages of growth were determined Yields of maize varied from 173 to 221 g/pot, and of tomato, from 147 to 243 g/pot, fresh weight, growth was inhibited by excess Mg Increased Mg concentrations also produced lesions on the leaves In tomatoes, the content of the different cations was, in general, increased when the concentration of that ion was high in the nutrient solution Ca content was higher when K and Na concentrations were high, but it was reduced when the Mg concentration was high Similar results were obtained with maize The content of Ca and Mg increased with age of the plants Total cation contents were highest when K and Mg contents were high The smallest differences in cation content were found in the roots Na was not antagonistic to the other cations K was antagonistic to Mg, Ca, and Na, in that order Ca was antagonistic to Mg and slightly antagonistic to K An increased Ca concentration always produced an increase in total cation content Mg was antagonistic to Ca in maize and tomato The antagonism was reciprocal in tomato The effect on organic acid content was greater in tomato than in maize In maize a high Mg concentration decreased the content of quinic + shikimic acids and high Ca or Mg concentrations reduced the citric acid content There was little effect on succinic, aconitic, and malic acids In tomato a high Ca concentration increased the total and malic acid content, and a high Mg concentration increased the content of quinic + shikimic acids and succinic acid and decreased the oxalic acid content K^+ is the cation favored to accompany NO_3 and organic acids during their transport by the plant (CA 66 85118e)

359 Collier, D 1966 *The Nitrogenous Fertilizing of Rotational Crops on the Calcareous Clay Soils of Limagne and on the Granitic Mountainous Soils of Auvergne* Ann Agron 17 219-49 (Fr) (Cent Rech Agron du Massif Cent , Clermont Ferrand)

On sugar beet, wheat, maize, barley, and rotational leys grown on calcareous clays, straw decreased yield, green manure increased yield and farmyard manure had no effect during the year of application Only farmyard manure produced beneficial residual effects for the following 2 years Sugar beet, maize, and potatoes on the Limagne clays and on the granitic soils responded to spring applications of N Wheat

and barley also responded to N but earlier applications, i e at tillering, were desirable Applications of farmyard manure to the Limagne soil for 14 years resulted in a positive N balance of about 500 kg/ha compared with the negative balances of approximately 1,300 kg/ha and 1,000 kg/ha associated with incorporation of crop residues and use of fertilizers respectively (SF 30 1272)

360 Combret, M , Blanchet, R , Fioramonti, S 1969 *Effect of Various Irrigation Regimes on the Economics of Maize Cultivation in Soils Containing Different Amounts of Available Water* C r hebd Seanc Acad Agric Fr 55 77 84 (Fr) (Sta Agron , INRA, Toulouse)

In soils containing 85 and 150 mm available water, irrigation increased maize yields from 10 and 30 q/ha in the control (unirrigated) plots to 70 and 80 q/ha, respectively Production cost per q (in the Toulouse region) are discussed with reference to these results and the frequency of irrigation (SF 33 4821)

361 Decau, J , Pujol, B 1969 *Effect of Water and N Nutrition on the Comparative Yield and Protein Quality of the Grain of Maize With or Without the Opaque 2 Gene* C r hebd Seanc Acad Sci , Ser D 268(19) 2343-46 (Fr) (Sta Agron , Toulouse)

In field trials, maize cv INRA opaque 2 showed higher response of grain yield, content of N and lysine in the grain, and yield of lysine/ha, to irrigation and N fertilizer than normal maize (FCA 22 2625)

362 Gautier, P , Langlet, A 1970 *Effect of Placement of a Starter Fertilizer on Maize Yield and Leaf Nutrient Content* C r hebd Seanc Acad Agric Fr 56 51 6 (Fr) (Societe Pechiney Saint-Gobain)

In a NP, NK, NPK fertilizer trial in a maize wheat barley + ryegrass rotation, placement of a starter fertilizer with the seed (N for the NK, and NP for the NP and NPK treatments) increased maize yields and decreased moisture content at harvest Where fertilizers were applied in unbalanced ratios, placement of the starter fertilizer decreased the harmful effects of excess K or P nutrition, but increased the effects of K deficiency (SF 33 4060)

363 Juste, C , Solda P , Laborde, A 1968 *Liming and Development of Reclaimed Acid Soils in the Basses Pyrenees Results of a Long Term Experiment* C r hebd Seanc Acad Agric Fr 54 290 96 (Fr) (Sta Agron , 33 Pont de la Maye)

Results are reported for the first 5 years of a liming experiment with maize on a "touyas" soil previously under heaths The soil is an acid clay loam (pH 4 8), high in organic matter and exchangeable Al, and low in exchangeable bases and P_2O_5 On unlimed plots maize showed symptoms of N, P, Ca, and Mg deficiency, and Al and NH_4 toxicity These symptoms disappeared on liming, the optimum rate being 4,000 kg/ha CaO in a single application Compared with the control, this increased yields by 185 6 q/ha over 4 years, but only slightly increased the initial pH and had little effect on organic matter content Splitting CaO applications produced lower yields, but soil exchangeable K and P_2O_5 content changed little with method of application Liming markedly increased exchangeable Mg (FCA 22 4483)

364 Routchenko, W , Lubet, E 1966 *Role of Cationic Equilibrium and of the Principal Individual Cations in the Manifestation of Ammonia Toxicity of Young "Zea mays" Plants* C r hebd Seanc Acad Sci , Ser D 262(2) 281 84 (Fr)

Maize plants were grown in containers of soil from an area known to be subject to toxic symptoms related to high NH_4^+ levels in the plant sap This soil was low in exchangeable cations and organic matter, but high in available P The analyses of sap from untreated plants were compared to those obtained following the addition of 5 meq solutions of Ca, Mg, NH_4, K, or Na chlorides or various combinations of N, P, K, and Mg amendments per l The healthy plants were characterized by a much higher K content (40% of the total cations) as well as lower NH_4^+ content (2% of the total cations) compared to the plants with toxicity symptoms (24% and 11%, respectively) Addition of K or Mg reduced or eliminated the toxicity, but P and N intensified it The toxicity may be a result of K deficiency producing a change in the production and translocation of carbohydrates necessary for organic incorporation of NH_4^+ If photosynthesis is depressed the toxic effect is intensified (C 64 14910c)

365 Soubies, L , Lenain, L 1967 *Results of Experiments on Deep Placement of Nitrogen Fertilizers for Maize* C r hebd Seanc Acad Agric Fr 53 922 26 (Fr)

In dry climates, where evaporation may cause NO_3 N fertilizers to accumulate at the surface and become unavailable to maize, placement of NH_4 N 15 20 cm deep between the rows, when the crop was about 40 cm high, gave an average grain yield increase of 5 q/ha over surface application (SF 31 1406)

EAST GERMANY

366 Birke, J 1967 *Effect of Irrigation, Sandy Soil Improvement, Differential N Fertilizing and a Preceding Grass/Clover Crop on Plant Height of Silage Maize* Albrecht Thaer Arch 11(1) 35-42 (Ger) (Inst Acker u PflBau Muncheberg)

Silage maize was grown with or without irrigation in 1962 65 following a 1 year Italian ryegrass/alsike clover/red clover ley and given 80 or 160 kg N/ha Some plots had been ploughed in 1959 to a depth of 57 cm and been given 60 tons farmyard manure, 2 hkg basic slag and 3 hkg 40% KCl/ha, others had been ploughed normally In the dry years 1963 and 1964, plant height was increased by irrigation, whereas in 1962 irrigation adversely affected early growth Plant height during the early part of the growing season was reduced by the deep ploughing treatment in all years and by high N in 1962 64 (FCA 20 2284)

367 Burkhardt, H 1967 *Effect of Different Rates of Nitrogen Applied to Fodder Rye and Succeeding Maize* Albrecht Thaer Arch 11 785 94 (Ger) (Hochsch Landw , Bernburg)

Economic increases in yield were produced on chernozem by increasing the application of N to 120 kg/ha, a further increase to 160 kg/ha did not result in any significant increase in yields Ureaform was no more effective than calcium

ammonium nitrate, simultaneous application of K fertilizer improved the efficiency of high rates of N (SF 31 1390)

368 Fiedler, G , Linke, E , Streuber, E 1964 *Results of a 10 Year Static Trial of Nitrogen Forms and Rates of Application* Albrecht Thaer Arch 8(8/9) 649 73 (Ger)

In the 10 year test cereal and vegetable crops were alternated annually, manure was added to half the vegetable crops at 20 tons/ha, N, at 20, 30, or 40 kg/ha, was added at four levels (each double the next lower one) as $(NH_4)_2SO_4$ (*I*), $Ca(NO_3)_2$ (*II*), or $Ca(NO_3)_2$ NH_4NO_3 (*III*), P, at 30 80 kg/ha, was added the first year as calcined phosphate and annually thereafter as superphosphate, K, at 60 160 kg/ha, was added annually as 60% KCl, the levels of N, P, and K used depended on the crop The crops were oats, potatoes, winter rye, corn, summer wheat, winter wheat, and sugar beets Generally the different forms of N gave little difference in yield, increasing N increased yields, manure increased vegetable yields At low levels of N, *II* and *III* gave higher yields than *I* but this was reversed at higher levels The pH fell from 7 6 to 7 2 except for the highest level of *I* where it fell to 6 8 7 1, regardless of manuring Total N in the soil increased with N application, increased with time with manure and decreased without, and was higher at low N levels with *I* than with *II* or *III* Total C at the soil was highest with *I* at very low N dosages, showed little difference at high levels of N, and increased with time especially with manuring Generally *I, II,* and *III* had little effect on P, K, and Mg levels of the soil except that at highest dosages P rose and K fell with *I* There was a general trend to lower N, P, and K levels with higher N dosages (CA 62 11103e)

369 Focke, R , Franzke, W , Winkel, A 1966 *Comparative Observations on the Photoperiodic Response of Maize, Lucerne and Oats as Affected by N Application* Albrecht Thaer Arch 10(9) 815 28 (Ger) (Inst PflZucht , Bernburg)

In pot trials, maize, oats, and lucerne were established in the open and then grown in controlled temperature cabinets under natural daylengths or with the end of the photoperiod extended from 4 to 11 p m by 2500 lux lamps, they also received different levels of N At a given N level, all three species developed better under long photoperiods than short ones Short photoperiods accelerated flowering in maize, as did N application, and led to high root dry weights in lucerne and oats, and a high protein content in lucerne N reduced root growth of lucerne but, under long photoperiods, increased the carotene content Sugar content was influenced by treatment, the lowest value occurred in lucerne under short photoperiods (FCA 20 938)

370 Kunkel, K 1965 *Combined Application of W6658 and Urea in Maize Grown for Silage* Wiss Tech Fortschr 6(2) 84-6 (Ger) (Inst Acker u PflBau, Muncheberg)

Addition of urea at 90 kg/ha to W6658 (simazine) at 1 5 kg/ha in 600 liters water applied in bands over the rows at sowing improved early development of maize and reduced production costs, compared with plots treated with simazine alone Where nitrochalk was applied at 100 kg/ha pre emergence, half the dosage rate of urea sufficed (FCA 21 114)

371 Schulze, W 1964 *Nitrogen Fertilizing and Sugar Formation in Corn* Albrecht Thaer Arch 8(8/9) 711-23 (Ger) (Martin Luther Univ , Halle, Wittenberg)

Corn was grown in pots of 2 kg field soil, 4 5 kg quartz, 2 g K_2O as K_2SO_4, 1 5 g P_2O_5 as $Ca(H_2PO_4)_2$, and 0 5, 1 0, or 2 0 g N as $(NH_4)_2SO_4$ (*I*) NH_4NO_3 (*II*), or $Ca(NO_3)_2$ (*III*) Upper leaf, stalk, and lower leaf samples were taken in the early morning Fructose, glucose, sucrose, dry weight, total N, nitrate N, and P were determined At the 7 week sampling all N treatments increased the sugar levels, especially *I*, at high levels N addition tended to decrease sucrose levels Sucrose levels were highest with *III* P decreased in the order *I, II,* and *III* and generally with increasing N At the 9 week sampling, fructose was increased by *III* only in the upper leaves but by *I, II,* and *III* in the lower leaves and stalks Glucose was increased in all parts by *I, II,* and *III* Sucrose in the top leaves was increased greatly by *I* and *III* and in the lower leaves and stalk by *I, II,* and *III* Dry weight in all parts was increased by *I, II,* and *III*, but was decreased with increased dosage to the greatest degree by *I* and least by *II* At the 11 and 15 week samplings, the main changes were increased dry weight and decreased N and P levels The stalks showed a maximum sugar content at 11 weeks, fructose increased with increasing dosages of *I*, went through a maximum with *II*, and decreased with *III* The glucose level throughout the test generally paralleled that of fructose but to a lesser degree (CA 62 11103c)

372 Specht, G 1966 *Effect of Increased N and Sowing Rates on Green Fodder Maize Under Various Growing Conditions* Albrecht Thaer Archiv 10(2) 89 106 (Ger) (Inst Landw UntersWesen, Potsdam)

In general, the optimum rate of N for fodder maize was 120 kg/ha A plant population of about 250,000/ha was considered best, this would be obtained with seed rates of 90 120 kg/ha, assuming the maize to have a medium 1,000 grain weight and normal germination capacity, and that field losses would be about 33% (FCA 19 2087)

373 Vielemeyer, H P , Fischer, F , Bergmann, W 1969 *Studies on the Effect of the Micro Nutrients Iron and Manganese on the Nitrogen Metabolism of Agricultural Plants I Informative Studies on Nitrogen Fractions and Amino Acid Composition of Total Hydrolyzates in Several Forage Plants.* Albrecht Thaer Archiv 13(3) 291-302 (Ger) (Inst fur Pflanzenernahrung, Jena and Technischen Univ , Dresden)

Hydroponic experiments with the forage plants maize, oats, unflower, marrow stem kale, fodder pea, sugar beet, red and white clover, and alfalfa were used to study the effect of Fe and Mn deficiency nutrition on the content of crude and pure protein as well as of a number of essential amino acids in the total hydrolyzates of the plants in the leaf stage (generally shortly before flowering) The most striking result was the partly considerable accumulation of soluble N compounds in the plants damanged by Fe and Mn deficiency The pure protein contents were in most cases but slightly changed, but strongly reduced in some plants, while in case of Mn deficiency in maize and fodder pea they were significantly increased This resulted in a differing increase of the crude protein contents in the various test plants depending on the plant species and on the development of the deficiency The

paper-chromatographically determined contents of essential amino acids/16 mg of hydrolyzate N declined at differing degrees in case of Fe- and Mn-deficiency in the studied forage plants, with no specific effects on particular amino acids being noted In dependence on the extent of the damage, the decline of amino acid contents in the crude protein led also to a partly considerable reduction of a biological protein value of the forage plants calculated by the method of Oser The reason for the decline of the biological protein value is mainly seen in the accumulation of non amino acid N compounds in the damaged plants which are included in the determination of the crude protein N, since the contents of the studied essential amino acids—as related to the dry matter—are generally but little influenced by the deficiency nutrition (FA 2 1129)

WEST GERMANY

374 Dorr, R 1968 *The Utilization of Nitrogen in the Alkaloids Brucine and Strychnine by Two Different Cultivated Plants* Z PflErnahr Bodenk 119(2) 107 14 (Ger) (Agrik Chem Inst, Univ Bonn)

In studies on the uptake of organic molecules by plant roots, maize and barley were grown in pots on a rendzina and a pseudogley and given 0 5 g alkaloid N/pot Small quantities of the above alkaloids were absorbed unchanged by the roots, and levels of <0 1% alkaloid (dry matter basis) were found in the tops About 31% of the alkaloid N supplied was recovered in the plants, but most of this was absorbed after microbial breakdown in the soil (FA 2 1338)

375 Gericke, S 1966 *Phosphate Manuring of Fodder Crops* Phosphorsaure 26 174 92 (Ger) (Essen Bredeney)

Application of 60, 90, and 120 kg/ha P_2O_5 increased average yields of grasses and legumes in 3,056 regional trials by 35%, 49%, and 61% respectively, corresponding increases were 12%, 22%, and 28% in 59 trials with silage maize, 23%, 33%, and 42% in 1,123 trials with fodder roots and 15%, 18%, and 22% in 2,105 trials with mixed corn, potatoes, and turnips, responses increased progressively during 12 years Responses by roots, cereals, and grasses to 46 95 kg/ha N (851 trials) and to 60 100 kg/ha N (675 trials) were 61% and 57%, respectively Application of 60 and 120 kg/ha P_2O_5 increased average crude protein contents by 44% and 83%, corresponding increases in P_2O_5 and CaO contents were 62% and 117% and 45% and 81% (SF 30 2911)

376 Hoffman, W E 1966 *The Effect of Potassium Nutrition on Potassium Uptake by Rye and Corn Plants* PflErnahr Bodenk 113(2) 112 20 (Russ) (Univ Kiel)

Two sets of rye and corn were planted simultaneously into nutrient solutions of various compositions (hydroponics), a part of the yield was harvested after 3 weeks, and the rest was placed into a complete nutrient solution for several days to study nutrient uptake Neither rye nor corn plants take up larger amounts of Ca after Ca deficiency as compared with controls On the other hand, K deficient plants take up 5 10 fold more K than that which was taken up by plants which had received excess K K deficient plants show a strong selectivity for K as against Ca, when compared with the controls The higher K uptake is induced by K deficiency and has no connection with differences in the content of other cations in the nutrient solution (CA 66 10251w)

377 Jungermann, K 1964 *The Biuret Content of Urea and Plant Growth* Landwirt Forsch 17 93 9 (Ger) (Landw Versuchsanst, Darmstadt)

Samples of urea containing 0 075%-4 7% biuret were applied to corn, sunflowers, and tobacco in pot experiments Only the sample with 4 7% biuret caused yield depressions in corn on sand (CA 62 3366a)

378 Knauer, N 1967 *Effect of Banded NP and P Fertilizing on Growth, Mineral Nutrition and Yield of Maize* Landwirt Forsch 19 196 204 (Ger) (Inst fur Pflanzenbau, Universitat Kiel)

Indications were obtained in one pot and one field experiment that there was little or no advantage in band placement Fertilizers tested were NH_4 phosphate and sulfate, urea and super Banded NH_4 phosphate increased early growth, as compared with broadcast, but did not affect final yield Placement of urea hindered plant growth (SF 30 3621)

379 Marschner, H, Schafarczyk, W 1968 *Comparison of the Net Uptake of Sodium and Potassium by Maize and Sugar Beet* Z PflErnahr Bodenk 118 172-87 (Ger) (Univ Hohenheim)

Excised roots of maize and intact seedlings of maize and sugar beet were first grown in Na free nutrient solutions for 10 21 days In both species, the subsequent uptake of Na from NaCl was decreased on addition of equivalent amounts of KCl, addition of $CaCl_2$ drastically or slightly depressed Na uptake by maize of high and low K content, respectively, but had no effect on Na uptake by sugar beet When KCl and NaCl were simultaneously supplied in equivalent amounts, addition of Ca increased the accumulation of K and decreased that of Na in both plant species Application of 2,4 DNP reduced Na and K accumulation in the roots of both species, but increased K translocation to the shoots, it also increased the translocation of Na in maize and strongly inhibited it in sugar beet Rates of Na uptake and translocation were much higher in sugar beet than in maize (FCA 22 3514)

380 Marschner, H, Schafarczyk, W 1968 *Influx and Efflux of Sodium and Potassium in Maize and Sugar Beet* Z PflErnahr Bodenk 118 187 201 (Ger) (Univ Hohenheim)

In solution cultures initially supplying equivalent amounts of Na and K, with total cation concentrations varying between 0 1 and 50 meq/l, plants of high Na and K contents showed a striking efflux of these nutrients, the exchange of Na and K between the outer solution and plants was restricted to exchange between root and solution in maize, while the exchange process occurred mainly in the shoot in sugar beet Influx selectivity was affected by Ca and Na + K concentration in the outer solution Translocation of Na from root to shoot and vice versa was rapid in sugar beet, but it was very slow and took place only from root to shoot in maize It is postulated that the high Na accumulation in maize roots is mainly the result of low affinity of the translocation system in the symplasm of root cells for Na (FCA 22 3515)

381 Niopek J 1965 *The Effect of Nitrogen, Temperature,*

and Water on Growth, Development, and Production Z Acker u PflBau 121(4) 315 33 (Ger) (Inst PflBau u PflZucht, Giessen)

In pot trials, maize cv Gelber Badischer Landmais and sorghum cv Giessener Rote Besenhirse were grown on soil low in nutrients, at various N levels and (for the first 38 days) at 40% and 80% soil moisture capacity Under N deficiency, the height of both species was reduced and the leaves were shorter and narrower than in plants given N Phasic development (illustrated in the text) was prolonged by N deficiency, in a year of high temperatures, however, all growth phases were relatively short N deficiency and moisture deficiency reduced the number of nodes In maize low N lowered the number of panicle branches, extreme N deficiency prevented cob formation In sorghum, however, the number of flowers was reduced but they formed normal grains, the number of panicle branches was reduced almost to nil It was thought that resistance to water deficiency as well as to N deficiency by sorghum was associated with this formation of normal grains, in addition, plants supplied with water after early water deficiency formed secondary panicles, on the 4th 6th node of the main panicle, which, with adequate N, formed normal grains It was thought that low soil moisture and low temperatures were both responsible for reduced N availability to both species (FCA 19 155)

382 Scheffer, F, Kikuth, R, Lorenz, H 1965 *Acidic Organic Compounds in Shoots, Roots, and Sterile Rhizosphere of Corn, Root Excretion* Z PflErnahr Bodenk 110(3) 201 10 (Ger) (Univ Goettingen)

The effect of the content of various acids in shoots, roots, and substrata during different mineral nutrition, especially with Fe and K deficiency, on the biochemical reaction chain and on the participation of the metabolic products during mineral uptake was studied A method is described for keeping the system sterile A measurable amount of inositol phosphate was formed, the concentration of which increased 8 fold, when K^+ was replaced by Na^+ With Fe deficiency, the citric acid content increased It was not secreted, but remained in the vacuoles (CA 64 11557g)

383 Scheffer F, Kikuth, R, Lorenz, H 1965 *Significance of Inositol Phosphate in the Uptake of K by Maize Plants* Naturwissenschaften 52(18) 518 19 (Ger) (Inst Bodenkunde, Univ Giessen)

From analyses of maize plants it is suggested that an inositol phosphate is a carrier in the uptake of K ions (FCA 19 1446)

384 Shaaban, S 1968 *Effect of Increased Nitrogen Rates on Yield and Nutrient Value of Fodder Maize* Z Acker u PflBau 28 221 38 (Ger) (Univ Giessen)

Crude protein contents and yields markedly increased with an increasing N supply, application of 200 kg/ha increased protein content by 50% compared with untreated controls, and increased crude protein yield by up to 75% and 25% compared with a crop given no or 100 kg N, respectively For fodder maize, application of 100 150 kg/ha N is recommended (FCA 21 730)

385 Teichmann, W 1969 *Field Experiment on the Phosphate Effect of Partially Water Soluble Phosphate Fertilizer* Mitt DLG (Deut Landwirt Ges) 84(7) 168 70 (Ger) (Landwirt Weser Ems, Oldenburg)

During a 6 year experiment on the same soil with corn, beets, and clover, a P fertilizer with 50% water soluble P was compared to a completely water soluble P fertilizer Yields were identical, as was the P content of the plants (CA 71 29685d)

386 Wilberg, E, Michael, B, Pollmer, W G 1968 *Effect of N Fertilization on Opaque-2 Maize Rich in Lysine* Z PflErnahr Bodenk 121(2) 125 32 (Ger) (Inst PflErnahr, Univ Stuttgart Hohenheim)

In pot experiments with Opaque 2 maize and a local variety (normal), N was applied (a) before sowing at 2 g/pot, and (b) at sowing at 2 g/pot and again at flowering at 1 6 g/pot Grain lysine content in Opaque 2 was 30% and 68% higher than in the normal cv for treatments (a) and (b), respectively Treatment (b) increased N contents in Opaque 2 and normal maize by 64% and 97%, respectively, and lysine contents by 46% and 90% In normal maize the lysine percentage in the total N was reduced from 4 4% to 4% by late application of fertilizer, but did not change in Opaque 2 (6%) (FCA 22 1787)

387 Zuern, F 1965 *A Decade of Variety and Fertilization Experiments with Silo Corn and Turnips in Steinach* Bayer Landwirt Jahrb 42 477 86 (Ger) (Lehr Forschungsinst Ver Foerderung Gruenlandwirtsch Feldfutterbaues, Steinach, Straubing)

Comparative cultivation of silo corn and turnips gave dry weight yields of 15,500 kg/ha for silo corn and 14,300 kg/ha for turnips Doubling of K P fertilization from 50 P_2O_5 + 100 K_2O to 100 P_2O_5 + 200 kg K_2O/ha and keeping the N fertilization the same (100 kg N/ha) yields 1,900 kg more corn/ha and 1,870 kg more turnips/ha (CA 66 36902x)

HUNGARY

388 Csermi, I 1968 *Investigations Into the Effect of Phosphorus on Maize Monocultures Grown on Drift Sands in the Danube-Tisza Mid Region* Duna Tisza Kozi Mezogazd Kizerl Intez Bull 3 43 52 (Hung) (Duna Tisza Agr Exp Inst, Kecskemet)

Maize was sown in 1964 and given N at 90 kg/ha, P at 0, 30, 60, 90, or 120 kg/ha and K at 45 kg/ha in 1965 and 1966, or no fertilizer The total N content of maize at the shooting stage was highest in plots receiving N and K plus P at 90 kg/ha, followed by the plots receiving no fertilizer and those receiving N and K only Grain N content was highest in plots receiving N and K only and lowest in unfertilized plots K_2O was high in maize plants at shooting and very low in the grain at harvest Average grain yields were highest in plots receiving 90 kg P/ha (FCA 22 2631)

389 Dorogi, I 1966 *Effect of Urea Sprays on the Metabolism, Yield and Quality of Silage Maize* Masonmagy Agrartud Foisk Kozl 9, Novenyterm, 10 25 (Hung)

Green matter yields were most favorably affected by sprays with 7% solution, followed by 6% and 2% solutions Urea

sprays increased the uptake of N, P, and K by the crop (SF 30 3015)

390 Hussein, T A 1969 *Effect of Fertilizers on the Foliar Surface and Productivity of Corn* Agrartud Kozlem 28(3-4) 213 19 (Hung) (Nyirsegi Mezogazdasagi Kiseri Intez, Nyiregyhaza)

The foliar surface per plant was increased by stable dung and N P K or N fertilizers and decreased by increasing the number of plants The grain crop yield correlated with the total foliar surface area (CA 73 34281q)

391 I'so, I, Hussein, A 1968 *Corn Yield as Influenced by the Date and Method of Nitrogen Fertilizer Application* Acta Agron Hung 17 373 79 (Hung) (Agr Res Inst, Martonvasar)

In 2 year trials on a nearly neutral loam soil, comparisons were made between the effects of NH_4NO_3 broadcast before planting or when the plants were 20 cm tall, banded at the same rates after planting or when the plants were 20 cm tall, sprayed in 1% solution onto the leaves, and foliar spraying with 1% urea Early application of N significantly increased grain yields, whereas spraying with NH_4NO_3 decreased yield (FCA 22 4486)

392 Latkovics, I 1969 *Fertilization Experiments* Agrartud Kozlem 28(1 2) 183-88 (Hung) (MTA Talajtani Agrokem Kutato Int, Budapest)

Experiments were carried out with autumn wheat and corn to ascertain the optimum fertilizer application over a 4 year period Better results with N fertilize were obtained when it was supplied in smaller doses every year than when larger doses were given every other year The same applied for P fertilization Autumn N application gave the best results, and the most useful N fertilizer was urea On acid soils, fertilizer application must be supplemented with liming (CA 72 54187w)

393 Latkovics, I, Mate, F 1966 *Investigation of the Nutrient Uptake of Young Maize Plants by ^{32}P Labeling* Agrokem Talajtan 15(1) 67 74 (Hung) (Hungarian Acad Sci, Budapest)

Superphosphate ^{32}P was applied by itself or with increasing N fertilizer doses to young corn plants in pot cultures on brown forest soil The plant dry matter and the N and CaO uptake increased with the amount of N added The P content and P yield of the corn plant was increased by superphosphate but was not affected by the addition of N containing fertilizers The K_2O content of corn grown on N P treated soil increased in the early stages of development but decreased when the plant reached the harvesting stage The P uptake of corn seedlings from the fertilizer was insignificant at the beginning, but in 2 week-old plants >50% of the P yield originated from the fertilizer (CA 65 4592a)

394 Latkovics, I, Mate, F, Varga, G 1968 *Role of Nitrogen in Mineral Fertilizers on Corn Growth, Studied with the Aid of Nitrogen 15 Labeling* Isotope Stud Nitrogen Chain, IAEA 1967 109 17 (Russ) (Nauch Issled Inst Pochvoved Agrokhim, Budapest)

The role of N in mineral fertilizers in the growth of corn was studied with $^{15}NH_4{}^{15}NO_3$ applied at the rate of 90 kg/ha During the vegetative period, the percentage of N in various parts of the plant decreased in the control and the fertilized plots But application of fertilizer increased the N content in all parts of the plant Application of fertilizer at the beginning of plant development increased the N content mainly in the vegetative organs, whereas application at the end of plant development increased the N content in the regenerative organs On the basis of N balance, 31 7% of fertilizer N was utilized at harvest time, whereas 40 9% was utilized on the basis of isotopic dilution (CA 69 75994k)

395 Pal, I, Lazar, M 1966 *The Effect of Pre Sowing Gamma Irradiation (Co^{60}) on the Phosphate Uptake by Maize Seedlings* Bot Kozl 53(4) 237-42 (Hung) (Agrartudomanyi Egyatem Novenytani es Novenyelettani Tanszek, Godollo)

γ irradiation of the seed had no effect on P uptake during the early stages of seedling growth when it was dependent on seminal sources of P At the 3 to 4 leaf stage, however, the uptake of ^{32}P was stimulated by treatment with 1,000 10,000 r and at the 5 to 6 leaf stage by 1,000 r, but at the 7 to 8 leaf stage ^{32}P content was reduced by treatment with 5,000 10,000 r compared with 1,000 r and untreated controls (FCA 21 131)

396 Pekary, K, Kramer, M 1966 *Residual Effect of Nitrogen Fertilizers on Cereals Grown on the Chernozem Brown Forest Soil of Kompolt* Agrokem Talajtan 15(1) 97-108 (Hung) (Inst Agr Expts, Kompolt)

The residual effect of N fertilizers on barley, corn, and wheat yield was investigated on chernozem brown forest soils in the comparatively dry region of Kompolt (Hungary) Medium and high doses of N fertilizers (70 and 140 kg N/ha) showed a significant residual effect which approached or even surpassed the main effect Best efficiency was obtained by applying 70 kg NH_4CaPO_4/ha (CA 65 2952g)

ITALY

397 Covarelli, G 1968 *Experimental Results on the Placement of Nitrogen Fertilizer in Solution for Maize and Sorghum* Maydica 13 70 80 (It) (Univ Perugia)

In 3 year trials on slightly calcareous clay soil of neutral reaction, aqueous solutions of urea (10% and 20% N) injected to 15 20 cm depth in the rows about 20 days before flowering were more effective than similar amounts topdressed in granular form (FCA 22 4366)

398 Lanza, F, Boschi, V, Onofri, M 1968 *Influence of Hybrid Type, Plant Density and Level of Fertilizer N on Yield and Quality of Maize Grain* Sementi elette 14(3) 158 68 (It) (Staz Agr Sper, Modena)

In trials in 1965 1967, yield and quality of maize grain were not significantly affected by hybrid type, plant density, and applied N, but were mainly affected by climate of the year and soil type However, as a general conclusion, it is recommended that early types should be grown at a density of 6 8 plants/m^2 and that N should be applied at 50 200 kg/ha (FCA 22 969)

399 Macri, F, Olivieri, A 1969 *Study on Organic and Mineral Manuring Applied at Sowing and on Plant Density of Grain Maize* Agricoltura Venezie 23(5) 379 98 (It) (Ist Agron, Univ Padova)

In trials with irrigated maize in 1967 1968, the highest grain yield was obtained by applying 50,000 kg farmyard manure/ha, or by mineral fertilizers supplying equivalent amounts of NPK, at sowing No significant increases in yield were obtained by applying N as a topdressing Yields increased by increasing the plant density from 4 to 10 plants/m², but the greatest increase occurred when the density was increased from 4 to 6 plants/m² (FCA 23 178)

400 Mattei, F 1967 *Influence of Sowing Density and Nitrogen Manuring on the Productivity of Fodder Maize* Italia Agric 104(7) 771 9 (It) (Gruppo Studio Problemi Irrig C N R, Roma)

In a maize trial near Rome, three plant densities (12, 21, and 30 plants/m²) and three rates of N (0, 40, and 80 kg/ha) were tested The crop was sown on July 27 in rows 30 cm apart, and harvested on September 27 Irrigation was given weekly during the growing period The dry matter yield/ha of herbage at the two higher plant densities outyielded that at the lowest N had no effect on yield It was considered that the optimum LAI was about 12 (corresponding to 20 21 plants/m²) (FCA 21 109)

401 Sebastiani, L A 1964 *Effect of Nitrogen and Sulfur Containing Fertilizers on the Sulfur and Nitrogen Content and the Amino Acid Composition of the Protein of Corn Fodder* Ric Sci, Rend, Sez B 5(1) 25 36 (It) (Centro Nazl Meccan Agr Rome)

The effects of N and S fertilizations on the S and N content and the amino acid composition of the protein of corn fodder were investigated The four treatments were controls without fertilization, fertilization with 3 60 quintals SO_3/ha, fertilization with 1 20 quintals N/ha, and fertilization with 3 60 and 1 20 quintals SO_3 and N/ha, respectively N and S fertilization did not influence the forage yield and ash content of dry matter The N content of the dry matter significantly increased with N and S N fertilization The S content increased with S and diminished with N fertilization, the N + S interaction was positive and significant The biological value of the protein increased markedly with fertilization with S and S + N, but decreased with N fertilization The mg of amino acid N/100 g dry substance for control, S, N, and N + S, respectively, for the individual amino acids are aspartic acid 62 96, 72 23, 69 63, 79 95, threonine 35 91, 39 51, 36 35, 43 37, serine 40 57, 42 99, 44 18, 53 93, glutamic acid 71 58, 75 50, 75 69, 76 11, glycine 62 77, 63 95, 68 07, 81 42, valine 46 98, 54 38, 52 52, 54 13, methionine 11 16, 16 85, 10 72, 13 75, leucine 60 49, 67 79, 76 16, 75 63, phenylalanine 32 32, 34 69, 34 70, 35 25, arginine 82 21, 106 30, 109 19, 127 77, cysteic acid 11 70, 10 37, 11 25, 12 60, total NH_2 groups 765 69, 838 47, 897 46, 933,05, total NH_3 + NH_2 924 83, 957 92, 1031 25, 1096 99, proline 41 48, 42 47, 56 41, 52 96, alanine 74 89, 76 52, 90 08, 87 95, isoleucine 33 81, 34 57, 43 39, 41 03, histidine 31 04, 33 18, 39 35, 34 14, tyrosine 20 77, 19 15, 20 26, 18 45, and lysine 45 05, 48 02, 58 82, 44 61 (CA 62 16911b)

402 Toderi, G. 1967 *Nitrogen Fertilizing in Corn, Investment and Irrigation.* Prog Agr (Bologna) 13(8) 819 38 (It)

NETHERLANDS

403 Smilde, K W, Van Luit, B 1969 *Boron in Maize* Landbouwvoorlichting 26(2) 78 80 (Neth) (Inst Bodemvruchtbaarheid Haren)

Deficiency of B in soil was suspected as the cause of poor kernel development and hard rot in corn in some fields in Gelderland, East Overijssel, and North Brabant in 1964 and 1965 Concentrations of B in the soil and leaves were, respectively, 0 18 0 27 and 5 5 11 ppm Fertilization of test plots containing 0 20-0 25 ppm B with 0, 5, 10, or 20 kg borax/ha in 1966 had no definite effect on kernel development or on crude protein, crude fiber, or starch equivalent of the cobs, stems, or leaves In pot tests in soil containing 0 12-0 18 ppm B, and receiving a base fertilization of N, P, K, and Mg, application of 20 kg B/ha had no effect in the first year on weight or kernel development Repetition of the experiment in the following year in the same pots after removal of root residues, repetition of the base fertilization, and no further treatment with B, kernel development, cob weight, and feed value were normal in the pots previously treated with B Plants in the untreated pots showed white stripes in the leaves characteristic of B deficiency, and kernel development was very poor Poor kernel development in corn on sandy soils in dry summers is most likely due to B deficiency In cornfields with B <0 30 ppm/application of 10 kg of borax/ha is recommended (CA 71 29675a)

POLAND

404 Dorywalski, J, Baraniecki, A 1967 *Influence of Deep Ploughing and Manure and Nitrogen Doses on Corn Grain Yield and Its Quality* Poznan Wyzsza Szkola Roln Rocz 31(10) 211 26 (Pol)

The experiment was made on slightly clayey sand which covered the loam, of humus layer depth about 30 cm, sufficiently rich in assimilable P and poor in K, and of neutral reaction The experimental field was ploughed before winter—one part 20 cm deep and one part 35 cm deep, ploughing in at the same time various manure doses 150, 300, and 400 quintals/ha In spring additional N doses were applied, namely 0, 30, and 60 kg/ha P K fertilization was uniform and amounted to 54 kg/ha P_2O_5 and 120 kg/ha K_2O Influence of manure doses in straw and grain yield was not found Higher N dose, applied with manure increased yield and protein content in grain Percentage and yield of protein per hectare depended on climatic conditions during the corn vegetation period

405 Grzesiuk, W, Zawartka, L 1964 *Comparison of the Fertilizing Effects of Urea and Ammonium Nitrate on Potatoes and Corn* Zeszyty Nauk Wyzszej Szkoly Rolniczej Olsztynie 18(1) 115 20 (Pol) (Wyzsza Szkola Rolnicza, Olsztyn)

In the field experiments with potatoes and corn, the fertilizing properties of urea were equal to those of NH_4NO_3

Potatoes reacted vigorously to N fertilization and 50 kg or 100 kg/ha increased yields by 43 2% and 66 2%, respectively, whereas the corresponding increase in corn was only 16 1% The highest yields of both plants were obtained when urea had been applied before and NH_4NO_3 after planting (CA 63 9010g)

406 Jesmanowicz, A 1967 *Influence of High Nitrogen Rates on the Yield of Maize Cultivated for Ensilage* Pam Pulaw No 26, 3-8 (Pol) (Zaklad Fizjol Roslin IUNG, Pulawy)

In trials during 3 years, compared with 40 60 kg, the application of 80 100 kg N/ha to silage maize cv Wigor and Wir 42 resulted in a significant increase in mean fresh weight yield of 56 quintals/ha This increase was little affected by variety, soil type, or climate (FCA 21 2446)

407 Kozakiewicz, A , Ellis, B G 1967 *Water Consumption by Phaseolus vulgaris and Zea mays as Influenced by Manganese Fertilization* Proc Soil Sci Soc Amer 31(1) 123 25 (Eng) (Univ Warsaw)

In a greenhouse experiment using a Houghton muck soil, fertilization with Mn, either with or without liming, increased the efficiency of water utilization by both pea beans (*P vulgaris*) and corn (*Zea mays*) The dry weight of the Mn treated pea bean plants was 14% greater than Mn deficient plants, and these larger Mn treated plants used less total water in 35 days than did the smaller untreated plants (CA 67 2440a)

408 Litynski, T , Mazur, K 1963 *Urea Formaldehyde Preparations as Slow-Action Nitrogen Fertilizers* Roczniki Gleboznawcze 13 277-80 (Pol) (Coll Agr , Cracow)

The fertilizing value of water insoluble urea H_2CO condensation products was investigated Pot tests with Italian ryegrass and oats, and field tests with maize (and wheat), potatoes, and sugar beets were conducted The following molar ratios of H_2CO to urea were used 1 1 (*I*), 1 1 25 (*II*), 1 1 50 (*III*), and 1 2 *I* and *II* did not assure adequate quantities of N nutrients *III* had the same or even better effect in potato growing than urea or NH_4NO_3 (CA 63 14000h)

409 Seidler, M. 1964 *Effect of Potassium Fertilization on the Uptake of Nutritive Constituents by Native Corn Varieties* Pam Pulaw 14 267 98 (Pol) (Fertilizer Inst , Bydgoszcz)

In pot and field experiments, addition of K (1 g K_2O/l) to a soil containing 12 24 mg K_2O/100 g of soil did not increase the yield independently of the length of the growth period K fertilization caused initially a decrease of K uptake by the plant, and it increased the tendency of the corn plant to take up lime, when grown on slightly acid, unlimed soils Uptake of N and P was not influenced by K fertilization, but the uptake of Ca increased The yield of corn was mostly influenced by the weather, with the amount and distribution of rainfall playing a decisive role (CA 62 9733g)

410 Seidler, M 1968 *Effect of Potassium on Development and Yield of Maize* Zesz Nauk, Wyzsz Szk Roln Szczecinie, Roln 4(28) 145 52 (Pol) (Wyzs Szk Roln , Szczecin)

The addition of 1 or 3 g K_2O/22 kg of soil was most effective for the development of maize The increase of K supply (5 g K_2O/22 kg) decreased dry matter and inhibited the Ca^{2++} and Mg^{2+} uptake in all the developmental stages (CA 71 21290a)

411 Smierzchalska, K 1965 *Ability of Various Plant Species to Utilize Phosphorus in Phosphite Powder, as Determined by the Isotopic Method* Postepy Nauk Rolniczych 12(5) 27 38 (Pol) (Polska Akad Nauk, Warsaw)

Adding 0 2 g P_2O_5 in the form of phosphite powder (*I*) or superphosphate (*II*) to 100 g sand soil, pH 6 8 increased the plant material yield (above the soil), respectively, 44 77 and 71 88, 54 173 and 71 226, 44 58 and 48 76, 0 15 and 14 20, 47 and 65, and 85 and 96% in oats, corn, legume, yellow lupine, barley, and mustard seed The amount of P absorbed from *I* was 2 3 fold less than from *II* The amount of plant P (as % of applied) from *I* and *II*, respectively, was 13 1 18 7 and 37 2 53 7, 13 8 27 4 and 32 9-42 9, 16 3 20 8 and 31 5 33 9, 8 7 11 1 and 18 2 24 7, 13 2 and 36 2, and 18 6 and 37 7 in oats, corn, legume, yellow lupine, barley, and mustard seed (CA 65 17652h)

412 Szukalski, H 1968 *Effect of Magnesium Fertilization on the Sowing Quality of Seeds* Rocz Nauk Roln , Ser A 94(3) 405 23 (Pol) (Pracownia Nawozenia IUNG)

Experiments were done in pots, containing soil of pH (KCl) 5 2, hydrolytic acidity 2 8 meq, and Mg, 3 1, P_2O_5 8 1, K_2O 1 5, total N 57 4 mg/100 g Additional soil was fertilized with various amounts of NPK fertilizers, depending on the plants grown Plants were topdressed with N and $CaCO_3$ 0 5 2 0, and $CaCl_2$ 0 3-0 7, H_3BO_3 7 5, $MnSO_4$ 15 0, $CuSO_4$ 15 0, and $ZnSO_4$ 7 5 g , with 10 mg Fe^{3+} citrate The Mg was added in various amounts, in the form of $MgSO_4$ $7H_2O$ before sowing, and as a topdressing Addition of Mg to the soil increased the seed yield and weights, especially with corn The yield of straw was not affected by the addition of Mg to the soil The amounts of Mg in seeds increased by 0 06-0 23 in field beans, 0 07-0 14 in oats, 0 16 0 48 in flax, and 0 08 0 15% of dry weight in corn Application of Mg increased the content of P in flax seeds considerably, and to a lesser extent than in oats and corn The amount of Ca in seeds decreased The reaction of plants to Mg content in seeds decreased in the order corn, field beans, flax, and oats (CA 71 2620s)

413 Wlodkowski, M 1969 *Uptake and Translocation of Phosphorus in Young Zea mays Plants* Rocz Nauk Roln , Ser A 96(1) 83 102 (Pol) (SGGW, Warsaw)

The effect of previous conditions of mineral nutrition on P uptake by young corn seedlings was investigated, as well as the P transport within the root system and to the aerial parts of the plants The ratio of the mass of aerial parts to the roots showed definite differences depending on the previous supply of mineral constituents This ratio was approximately 1 when P was absent from the nutrient solution, but it was >2 when a complete P containing nutrient solution was used The uptake of P by roots of plants grown on tap water was the lowest, while the most intensive was noted in plants grown on nutrient solutions free of P The degree of P transport, especially to the aerial parts, was lower in plants grown on tap water than on complete nutrient solutions or solutions free of P The degree of translocation of P taken up by the main root to other parts of the root system varied, being very low to lateral and much higher to adventitious roots (CA 73 87063b)

414 Wojtowska, R 1965 *Influence of Potassium Fertilizer on the Content and Composition of Nitrogen Compounds in Corn* Poznan Tow Przyjaciol Nauk Wydz Nauk Roln Les Pr Kom Nauk Roln Kom Nauk Les 19(1) 223-45 (Pol) (Katedry Chem Rolnej Wyzszej Szkoly Rolniczej, Poznan)

Pot experiments were carried out for 3 years on two varieties of corn, i e, Zlota Gorecka and Mieszko The soil, with a pH of 5 85, contained 13 mg of P_2O_5 and 6 mg of K_2O/100 g of soil This soil was fertilized with N, P, Mg, Mn, B, and Ca, each corn plant received 0 33 or 0 66 g of K_2O as K_2SO_4 The leaves stems, and ears were gathered in the milk and dough stages of grain maturity for analysis The yields, K_2O content, total N, protein N, and α amino N in the hydrolyzate were determined The amino acids (16) were determined by a paper chromatograph Increasing the treatments from 0 33 to 0 66 g K_2O/plant did not appreciably change the variation of the total N content between each part of the corn crop during the milk and dough stages, however N assimilation was increased In the same growth stage, the larger K_2O treatment effected a decrease of the protein N to total N ratio in every part of the corn crop The differential K_2O treatment effected a change in composition of protein in stem and leaves In the protein of these parts, the larger K_2O treatment increased the cystine, tyrosine, leucine, and isoleucine contents, but decreased the contents of arginine alanine, and phenylalanine These changes were similar for both varieties of corn in the milk and dough stages (CA 67 116201d)

415 Zorawska, B 1968 *Influence of Fertilizing Levels on the Development and Yield of Corn Hybrids for Ensilage* Pamiet Pulawski 31 77 91 (Pol) (Inst Soil Sci Cultiv Plants, Pulawy)

A study was made of the response of corn to various doses of fertilizers (in kg/ha) P, as superphosphate, 50, 100, 150, K, as 40% potash salt, 70, 140, 210, and N, as nitrochalk, 25, 50, 75 The fertilizers were applied before sowing, and the same amount of N fertilizer was added at the stage of 4 5 leaves The lowest doses of the fertilizers caused increases in foliage and dry matter yields, the effects of both higher doses were inconsistent and depended on weather conditions, especially on the amount and distribution of rainfall in July and early August The fertilization had no influence on the course of developmental phases and length of the growth period (CA 70 105507u)

PORTUGAL

416 Gargantini, H, Dos Santos, D, Aloisi, J S 1968 *Comparative Study of Ammonium Sulphate and Anhydrous Ammonia for Maize* Bragantia 27 67 70 (Port)

There was no significant difference between anhydrous ammonia and $(NH_4)_2SO_4$ as form of N for maize on a latosol and on a podzolic soil (SF 33 3185)

ROMANIA

417 Avram, P 1964 *Efficacy of Ammonia Water Applied to Wheat and Maize on the Brown Podzolized Soil of Oradea, as Compared with Ammonium Nitrate* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 32 51-9 (Rom)

Experiments were carried out with ammonia water and ammonium nitrate applied to wheat and maize on brown podzolized soils, previously fertilized with phosphates, phosphates and K, and K The highest increase in yield was produced by the N and the lowest by the K fertilizer No difference was found between ammonia water or ammonium nitrate (CA 66 64675u)

418 Bajescu, N, Corbean, S 1964 *A Study of the Phosphorus Uptake by Maize Carried Out by Means of P^{32}* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B, 32 123 36 (Rom)

The rate of uptake characterized the periods of maximum and of critical P consumption by the plants The curves expressing the two processes have different shapes The curve of P_2O_5 accumulation is S shaped and the curve of P^{32} uptake has the shape of a bell with a peak in the earing stage The distribution of P_2O_5 in the plant varies during the growing season In the early stages, the highest P_2O_5 percentage is contained in the stem and leaves, in the ripening stage, P_2O_5 increases in the ears up to 79 3% The distribution of P^{32} differs from that of P_2O_5 and shows a double variation (a) during the whole growing season the highest P^{32} amounts are found in the stem and leaves, (b) as the plants grow, the P^{32} amount increases in the stem, while it decreases in the leaves and panicle, and is maintained at about the same level in the ears

419 Boeriu, I 1966 *Times and Methods of Applying Fertilizers to Wheat and Maize* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 32 31-8 (Rom)

The soil was a strongly podzolized brown forest soil with a humus content of 1 5%-1 8% and a humic to fulvic acid ratio of 0 7, mobile P and K contents were low and pH was 4 1-4 4 Fertilizer accelerated ripening by 2 3 days in wheat and 5 7 days in maize The time of NP application before planting did not affect maize yields Applications of a little N and P in the row at planting time increased maize yields, utilization of this dressing was better if the basic dressing was low (SF 30 2209)

420 Budan, G 1967 *Effect of Phytotechnical Measures on Corn Production Under Conditions Prevailing in the North Baragan Zone* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 535-40 (Rom)

In the same stand, the corn hybrid DH 311 yield exceeded that of DH 208 by 11% on a moderately fertilized soil (N 48 and P 32 kg/ha) and by 16 2% on a more richly fertilized soil (N 96 and P 64 kg/ha) Taking into account hybrid X stand interaction, the best stand for DH 311 is ~35,000 plants/ha, while DH 208 achieves highest yields at 40,000 plants/ha During the years in which water storage is reduced in the soil at sowing time, stands should be reduced by 5,000 7,000 plants/ha for both hybrids (CA 72 99593s)

421 Bunescu, O, Petrache, E, Coronea, C 1967 *Effect of Fertilizers on Yield and Chemical Composition of Corn in an Uninterrupted Crop* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser. B 35 431-40 (Rom)

The paper presents results of investigations carried out on a chestnut chernozem of Dobrogea, concerning the effect of fertilizers applied to corn grown as an uninterrupted crop The effects of mineral and organic fertilizers on certain agrochemical characters, on yield amount, and on yield chemical composition were investigated N and P fertilizers applied together with moderate rates of barnyard manure enhanced corn production and increased the net income achieved per ha Among the corn kernel components, protein registered highest increase under fertilizer effect The results of fractional protein analysis showed the increase in protein content to be wholly related to an absolute and relative prolamin increase (CA 72 99584q)

422 Buzdugan, I, Nitu, S, Moga, E 1967 *Aspects Concerning Liming Fertilizer Interaction in Corn and Potatoes in an Illuvial Clay Podzol of Horodnic* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 495 507 (Rom)

The experiments were carried out at Horodnic, Botosani district, on a soil with strong acid reaction and in the greenhouse Results obtained in pots emphasize that the application of lime alone, or combined with mineral fertilizers, to the Horodnic podzol gave important favorable changes in acidity indexes Neutralization of active acidity by liming simultaneously enhances both N and P availability in the soil and this phenomenon is further reflected in a more intensive assimilation of these elements by the plants (CA 72 99591q)

423 Coculescu, G, Isfan, D, Handra, M, Tutoveanu, A 1964 *The Efficacy of Fertilizers in Maize Monoculture, on a Prograded Chocolate Chernozem* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 32 103 22 (Rom)

Maize showed a very strong response to N, the rate of $N_{96}P_{32}$ inducing an increase of 11 3 quintals/ha (30%) as compared to $N_{32}P_{32}$ The rate of $N_{96}P_{32}$ gave a yield of 57 0 quintals/ha as against 36 5 quintals/ha obtained on the unfertilized plot The response of maize to P was weaker, while no response at all was recorded in the case of K application The most suitable N P ratio was found to be 3 1

424 Davidescu, D, Caramete, C, Sandoiu, D, Cremenescu, G, Vines, I, Stan, S, Haceadur, L, Bartok, R, Popescu, S 1967 *The Influence of Fertilizers on the Chemical Composition and Quality of the Corn Yield on the Brown Podzolized Soil from Albota Arges* Prob Agr (Bucharest) 19(6) 20 34 (Rom)

The differential absorption of N, K, Ca, and Mg and the changes in corn field with fertilizers and lime were studied The fertilizers applied to corn modified both the yield and composition, which varied as a function of the doses and forms of the fertilizers applied (CA 67 90128h)

425 Davidescu, D D 1965 *The Mineral Fertilizing and Quality of Maize* Proc Fourth Reg Conf Int Potash Inst, 85 97 (Fr) (Inst Agron, Bucharest)

Grain yields increased in unirrigated maize (and in irrigated maize as given in brackets) by 5 7-15 5 kg (up to 25 kg) for each kg N, 3 5 kg (7-24 kg) for each kg P_2O_5, and 2 8 13 kg for each kg K_2O Tabular data are given on the chemical composition (including the ratio of hydrolyzed to non hydrolyzed N or P) in leaves and grain Protein yields increased from 128 kg/ha in grain of unfertilized maize to 214 kg with 100 kg N + 50 kg P and to 302 with NP + 80 kg K, the increase in starch and fats was much lower (SF 30 628)

426 Budan, G, Budan, E, Pascaru, E 1967 *Fertilizer Use in Corn on a Chestnut Chernozem of Braila* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 457 68 (Rom)

Soil fertility potential was high enough to allow yields ranging up to 4,200-4,300 kg/ha in uninterrupted crops and up to 4,400-4,900 kg/ha when growing corn after wheat, without any fertilizers By applying chemical and organic fertilizers, yield gains of 590 and 1,590 kg/ha (13 8 37 3%) in uninterrupted crops, and of 470 1,290 kg/ha in corn grown after wheat could be obtained as compared to the nonfertilized control Administration of N and P chemical fertilizers at 64 and 48 kg/ha, respectively, with fall plowing or when disking in spring gave similar results Application of the same rate with summer plowing gave significant yield decreases as compared to the previous trials In corn grown after wheat, yields increased in proportion to nitrate N content in the soil, as a consequence of fertilizer use Protein N in the kernel was increased when N rates were increased from 48 to 96 kg/ha, administered alone or together with P at 32 and 64 kg/ha (CA 72 99588u)

427 Ghiula, A, Macavei, T, Militescu, L, Pop, C, Vines, I, Bordeiasu, C, Haceadur, L, Stan, S, Popescu, S 1966 *Effect of Some Fertilizers, Trace Elements, Biologicals, and Gibberelins on Corn Yields Under Irrigation Conditions in a Reddish Brown Forest Soil* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 34 455 69 (Rom)

The title effects were examined in an experiment undertaken in 1964 66 on a reddish brown forest soil formed on loess, at Tincabesti (Ilfov district) The soil contained 2 50% 2 85% humus in the 0 30 cm layer, 0 110%-0 130% total N, 0 120%-0 135% total P, 1 7 7 mg available P_2O_5/100 g soil, and 16 22 mg available K_2O/100 g soil The 12 treatments included NPK, barnyard manure, trace elements (Mn, Mg, Zn, B, I, Co, Mo, and U), biological products (azotobacterin, phosphobacterin, silicobacterin), and gibberelins The three bacterial products, applied together, did not increase the yields on the unfertilized soil, on soil fertilized with NPK, or with NPK + barnyard manure The biological products did not significantly affect the chemical composition of the plants and grain in either treatment Gibberelin produced a more vigorous vegetative growth but a higher percent of poorly developed cobs, thus decreasing the yields The grains of the gibberelin treated plants contained less useful substances The trace elements combination did not increase the yields on the unfertilized soil, but caused a significant yield increase of 17 6% 23 6%, when applied in treatments with biologicals, on soil fertilized with N 64, P_2O_5 48, and K_2O 20 kg/ha Thus, for irrigated corn, on the examined reddish brown forest soil, the trace elements reserve is adequate for a balanced nutrition, but on the fertilized soil a certain shortage appears The trace elements gave a slight increase in total useful compounds (protein and starch) of the grains, on the soil fertilized with mineral fertilizers, but did not cause any changes in the unfertilized soil Barnyard

manure associated with NPK assured complete fertilization for corn double hybrids under irrigation on the examined soil, and assured the highest yields of the best quality (CA 71 69757k)

428 Hera, C, Suteu, G 1964 *Determination of the Efficiency of Nitrogen Fertilizers in Maize Crops, by Means of* ^{15}N An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 32 137-49 (Rom)

Determinations of the total N and of the N taken up by the plant from the fertilizer and determinations of green and dry matter were carried out at a 30 cm height and at earing time The fertilizer was utilized by the plants beginning with the first growing stages, and the higher its concentration the more intensive its utilization From isotope analyses, during panicle formation, it appears that 40 5%-47 7% of the total N is absorbed from the fertilizer Application of the N fertilizer in stages increased the yield (CA 66 64676v)

429 Hera, C, Suteu, G, Bologa, M 1968 *Determination of the Utilization Coefficient of Nitrogen Fertilizers by Maize* Stiinta Sol 6(2 3) 103 112 (Eng)

In three experiments, sited on moderately degraded chernozem (pH 7 1, 0 15% N, 2 7% humus, 0 8 mg P_2O_5/100 g, 25 mg K_2O/100 g) labeled N was applied at rates of 33 3 100 kg/ha Results showed that 34% of the N taken up occurred in the stem and 66% occurred in the grain (FCA 21 732)

430 Hera, C, Segarceanu, O, Apostol, V, Tabaranu, T, Nicolae, A 1968 *Results of Experiments with Various Nitrogen Fertilizers on Maize* An Inst Cercet Cereale Plante Teh Fundulea Ser B 34 397-408 (Rom)

In a 3 year wheat maize rotation on a moderately leached chernozem (pH 6 4-6 6), a meadow chernozem (pH 6 6), and a highly leached chernozem (pH 6 3), N applied at plowing at the full rate or half at plowing and half in the spring gave the best results There were no significant differences between forms of N [NH_3, NH_4OH, $CO(NH_2)_2$, NH_4NO_3] (SF 32 3182)

431 Hera, C, Suteu, G, Bologa, M 1968 *Uptake of Fertilizer Nitrogen and Phosphorus by Maize, as Affected by Method and Time of Application* An Inst Cercet Cereale Plante Teh Fundulea, Ser B 34 409 20 (Rom)

Experiments with ^{15}N on a moderately leached chernozem (pH 7 1), irrigated twice with 400 m^3/ha showed that N fertilizer applied as a side dressing at the 5-6 leaf stage gave the best results P uptake was increased by the simultaneous application of N (FCA 22 3176)

432 Hurduc, N 1967 *Formation of the Photosynthetic Apparatus in Maize Under the Influence of Nitrogen Fertilizers Leaf Pigments Synthesis* Trans, Int Congr Soil Sci, 8th, Bucharest, 1964, 4 1271 79 (Eng) (Cent Inst Agr Res, Bucharest)

There was a net difference in the effect of NO_3 as compared with that of NH_4^+ on leaf pigment synthesis in maize seedlings For the first 30 minutes NH_4^+ was more favorable for pigment synthesis and accumulation than NO_3 After this, a positive influence of the NO_3 became evident for the next 6 days An optimum concentration of fertilizers exists for the formation of leaf pigments (CA 71 12162h)

433 Hurduc, N, Stefan, V 1966 *Influence of Fertilizers on Photosynthetic Activity of Maize Plants* Prob Agr, No 9, 27-37 (Rom) (Cent Res Inst, Fundulea)

In field trials during 3 years, the hybrid maize HD311 (grown at a density of 30,000 33,000 plants/ha) received various levels of N, P, K, and farmyard manure Data are given for the effect of fertilizers on leaf area and chlorophyll content at five stages of growth At flowering, 80 kg N + 60 kg P + 20 tons farmyard manure/ha increased chlorophyll content by nearly 30% There was a direct relationship between leaf chlorophyll content (at flowering) and grain yield (FCA 20 921)

434 Nicolae, C, Stefan, I 1969 *Basic Aspects of Corn Growing Technology on the Podzolic Soils Between the Olt and Dimbovita Rivers* Prob Agr 21(4) 18 27 (Rom) (Sta Exp Agr Arges)

In field trials in 1956 68, yields of maize were increased when preceding crops were perennial fodder legumes Yields were increased by 2 6 hkg/ha by cultivating in autumn to a depth of 30 cm Application of 70 kg N + 70 kg P + 80 kg K/ha or 20 tons farmyard manure + 70 kg N/ha gave the highest yields (FCA 23 169)

435 Nicolae, C 1967 *The Effects of Fertilizers, Manure and Crop Residues on Yields of Maize on the Podzolized Brown Soils of the Arges Region* Prob Agr 6 52 9 (Rom)

In trials with the early maize double hybrid HD 101 and the medium early HD 208, soils were limed with 5 tons/ha $CaCO_3$ Twenty tons/ha manure plus N_{64} applied every 2 years on medium or strongly podzolized brown soils gave the best results On better structured, slightly podzolized soils, $N_{96}P_{64}K_{80}$ was suitable when no organic matter was available Responses to 5[illegible] tons/ha cobs plus $N_{96}P_{64}$ were obtained only from the second year onwards (SF 30 3793)

436 Petrescu, O, Picu, I, Isfan, D 1967 *Effect of Increasing Nitrogen Rates on Nitrate and Free Amino Acid Content of Corn and Sugar Beet Leaves in Irrigated Crops* An Inst Cercet Cereale Plante Teh Fundulea, Acad Stiinte Agr Silvice, Ser C 35 445 53 (Rom)

There was not always a direct relation between the amount of N fertilizer applied and the NO_3 and total free amino acid content in corn and sugar beet grown on an irrigated, moderately leached chernozem A positive correlation was shown between the harvest yield and the NO_3 and total free amino acid content in the leaves The absorption and metabolism of NO_3 was higher in sugar beet than in corn (CA 73 97968q)

437 Petrovici, P, Pl[illegible]a, D 1968 *The Effect of Natural and Chemical Fertilizers on Maize in (Station) Experiments Conducted on Eroded Soils* Prob Agr 20(3) 15 22 (Rom) (Agr Exp Sta, Podu Iloaie)

Three years' results are presented Thirty two kg/ha of N and P together gave a 21% yield increase Higher applications were not so effective Ten to 40 ton/ha farmyard manure gave increases of 17%-45% and combined application of fertilizers and manure gave a 46% increase compared with the control (SF 31 4481)

438 Pop, L, Matei, I 1967 *The Efficacy of Some Doses of Chemical Fertilizers Applied to a Maize/Rye Rotation on the Timburesti Sands at Two Sowing Densities* Bul Stiint Univ Craiova 9 117 33 (Rom)

In field trials in 1964-66, rye was sown at 90 and 140 kg/ha and maize at 20,000 and 40,000 plants/ha The soil of the experimental plots contained 85% 90% sand and 0 5% 1 2% humus Ammonium nitrate at 96 kg/ha gave the highest increase in yield and was the most economic rate of fertilizer application In maize, response to fertilizer was greater at the high than at the low plant population, but in rye density of sowing did not affect response to fertilizer (FCA 23 175)

439 Reichbuch, L 1966 *Comparative Efficiency of Ammonia Water and Ammonium Nitrate for Winter Wheat, Corn, Sugar Beet, and Potato* Prob Agr 18(10) 24-32 (Rom) (Sta Exp Agr Suceava)

After 4 years of experiments on a chernozem soil, the following conclusions were drawn the effect of NH_4OH applied to wheat, maize, sugar beet, and potatoes was practically the same as that obtained from the application of NH_4NO_3, the utilization of N alone did not ensure significant yield increases for potatoes and sugar beet, the most efficient fertilization system consisted in applying N in any form together with P for winter wheat and maize and with P and K for sugar beet and potatoes (CA 66 114976r)

440 Stefan, G, Marinov, C 1966 *Experimental Results on the Efficiency of Fertilizers and Irrigation Applied to Maize Grown Under Conditions of the Southern Banat* Prob Agr 18(7) 40 9 (Rom)

Optimum rates are $N_{64}P_{64}$ on chestnut chernozems and $N_{64}P_{32}$ on chernozem showing initial salinization With organic manuring 20 tons/ha dung or 10 tons cobs should be applied in conjunction with N_{64} (SF 30 1382)

441 Stefan, V, Hurduc, N 1967 *Effect of Fertilizers on Water Consumption by Maize During the Growth Period* Prob Agr 19(4) 4-17 (Rom)

Various combinations of N, P, and K fertilizers, with and without farmyard manure, were applied to maize in a 3 year field experiment Highest grain yield and lowest rate of transpiration were obtained with complete NPK fertilizer + farmyard manure Combinations of NP fertilizers increased rate of transpiration during the initial growth stages Fertilizing increased the osmotic pressure of the cellular sap during early development but decreased it after grain formation (SF 30 3795)

442 Suteu, G, Hera, C, Borlan, Z, Bologa, M 1967 *Stimulation of Nitrogen Absorption by Corn by Its Application in Bands with Superphosphate* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 481 93 (Rom)

Band application of ^{32}P labeled superphosphate mixed with ^{15}N labeled $(NH_4)_2SO_4$, NH_4NO_3, or urea at planting, causes, in addition to a stimulation of P absorption from the superphosphate, a stimulation of N absorption from the N fertilizer, by young corn plants, as compared to the treatment where superphosphate and NH_4NO_3 were applied separately Relative degree of stimulation in ^{32}P and ^{15}N absorption depends on the kind of N fertilizer and is less for ^{15}N than for ^{32}P Both effects are attributed to an increase of the absorbing area of the plant roots in the band zone as well as to the increase of the absorption rate of N and P from the fertilizer as a result of N–P interaction The differences occurring in ^{32}P and ^{15}N accumulation in the plant, in relation to the N source may be explained by an interaction of the nutritive ions contained in the band during the absorption process (CA 72 99590p)

443 Toma, A 1967 *Researches Regarding the Influence of Ploughing, Fertilizers and Amendments on Yield in Maize Grown on Acid Soils in the North of Oltenia* Bul Stiint Univ Craiova 9 175 91 (Rom)

In field trials in 1963-68 on a brown, highly podzolised forest soil, 8 maize cv received (a) $CaCO_3$ at 5,000 kg/ha, (b) ammonium nitrate at 96 kg N/ha and superphosphate at 64 kg P/ha, and (c) manure at 30 tons/ha once in 2 years In (a) and (c) the highest yield was obtained after a single autumn ploughing to a depth of 30 cm In (b) a single spring cultivation to a depth of 16 18 cm gave the highest yield (FCA 23 168)

444 Trandafirescu, T, Sandu, G, Savu, I 1966 *Relief Forms and the Efficiency of Fertilizers Applied to Maize on the Sands of the Right Bank of the Calmatui* Prob Agr 18 30 7 (Rom)

Best results were obtained with combined NPK fertilizers on the dune tops, the dune slopes, and the inter dune areas, in decreasing order of efficiency (SF 30 627)

445 Trifu, M 1970 *Effect of Some Micronutrients on the Potassium Uptake of The Double Hybrid 311 Corn* Stud Univ Babes Bolyai, Ser Biol 15(1) 63 9 (Rom)

Boron as H_3BO_3 (0 005% or 0 05%), Zn as $ZnSO_4$ (0 005% or 0 05%), Cu as $CuSO_4$ (0 005% or 0 05%), Sr as $SrCl_2$ (0 005%), and Mn as $KMnO_4$ (0 06%) used to moisten corn seeds for 24 hours increased absorption and accumulation of K in leaves, and the amount of K in tear liquid B and Zn, 0 05%, showed the best results Co as 0 05% $Co(NO_3)_2$ slightly inhibited K^+ absorption During plant growth the micronutrient effect decreased, during ripening the K concentration in tear liquid was near that of controls (CA 73 87068g)

SPAIN

446 Aguirre, A 1965 *Fertilization of Corn* Madrid, Min Agr Serv Ext Agr, Ser Tech, No 15, 34 pp

For a yield of 6,000 kg/ha, N should be applied at the rate of 100 200 kilos/ha, P_2O_5 at 85 150 kilos/ha, and K_2O at 75 150 kilos/ha, or in the ratio 1-1 7 1 5 for the lower amounts Half the N and all the P and K should be applied at time of seeding, of the other half of the N, half should be applied when the plants have reached a height of 40 50 cm and half when the masculine flower appears

447 Carlos Ortega, B, Hernando, V, Sanchez Conde, M P 1968 *Different Effects on Maize of Humic Acid Extracted from Manure or Peat* In "Isotopes and Radiation in Soil

Organic Matter Studies," IAEA/FAO, Vienna, 541 53 (Span) (Inst Edafol Biol Veg , Madrid)

In pot experiments, higher maize yields were obtained with humic acid from manure than with humic acid from peat At low rates of application, peat humic acid decreased yields Both humic acids increased uptake of P and Ca and decreased uptake of K and Mg (SF 33 4058)

448 Sanchez Conde, M P , Hernando, V 1969 *Effects of Sodium and Potassium Nitrates on Corn Plants* An Edafol Agrobiol 28(11 12) 823 33 (Span) (Dep Fert Suelos Nutr Veg , Inst Edafol Biol Veg , Madrid)

Corn seeds (*Zea mays*) were allowed to sprout on wet sand and were transplanted to hydroponic vessels containing $Ca(NO_3)_2$ 10, PO_4^{3} 3, K^+ 1, and $MgSO_4$ $7H_2O$ 4 meq/liter The solutions also contained $NaNO_3$ (0, 2 5, 5 0, or 10 meq/liter), KNO_3 (0, 2 5, 5 0, or 10 meq/liter) or both (1 25, 2 5, or 5 meq each/liter) The solutions were circulated 6 hours/day, and were replaced every 10 days After 42 days, the plants were harvested and analyzed for weight, dry weight, H_2O, NO_3 , PO_4^{3} , K, Ca, Mg, and Na The plants grew best with 2 5 meq each of $NaNO_3$ and KNO_3, and grew well at all levels of $NaNO_3$ They were stunted by 10 meq of KNO_3 The plants were stunted with a K level of 148 meq/100 g of plant The highest levels of K in the plants (176 meq/100 g) were reached with Na K mixtures, but they also caused a lower level of N and a higher level of P The cation anion ratio remained constant (1 16) for all levels of the Na K mixtures The K/Ca ratio in the plants varied with the NO_3 level and was lowered by the presence of Na (CA 73 3054p)

449 Spottorno, J 1964 *Fertilization and Deficiency Symptoms in Corn* Diez Temas Sobre el Maize p 37-46 (Span) (Ministerio de Agricultura, Madrid)

Symptoms of deficiency of N, P, and K are described and illustrated For adequate fertilization, 300-400 kg/ha calcium phosphate, 150 200 kg potassium sulfate or chloride, and 150 200 kg/ha ammonium sulfate or calcium cyanamide are recommended

SWITZERLAND

450 Gisiger, L 1965 *Yield Development and Nutrient Uptake by Grain Maize* Grune, No 17, 593 603 (Ger) (Eidg AgrikChem VersAnst , Liebefeld Bern)

Maize cv Orla 266, sowr in late May or early June, grew most rapidly just before flowering, and in the next 10 days its vegetative organs reached their highest weight At this period of rapid development the dry weight of the plants increased by about 2 2 5 hkg/ha/day and nutrient uptake was highest, namely about 2 kg N, 0 2 kg P, and 1 6 kg K/ha/day In mature plants the yields of grain and straw were 47 and 63 hkg/ha The grain was relatively rich in N, P, and Mg and low in K, Ca, Na, and Mn The leaves contained >40% of the total Ca content and >50% of the Mn, while their proportionate contents of other elements were in approximately the same ratio as the leaf contribution to the dry matter The stems made up about 20% of the total yield, however, they contained <15% of the total N and <10% of the P, but >40% of the K and Na and about 25% of the Ca, Mg, and S It was concluded that, in addition to farmyard manure, about 200 kg of 20% N fertilizer should be applied before sowing, and about 300 kg when the plants were 20-40 cm high, while P and K should be applied according to the soil requirements (FCA 20 918)

UNITED KINGDOM

451 Eddowes, M 1969 *Physiological Studies of Competition in "Zea mays" L III Competition in Maize and Its Practical Implications for Forage Maize Production* J Agr Sci , Camb 72 203 15 (Eng) (Harper Adams Agr Coll , Newport)

Competition among maize plants in the vegetative stage was postponed by N application to the seed bed and by maintaining soil moisture near field capacity (SF 32 3185)

YUGOSLAVIA

452 Anic, J , Durman, P 1967 *The Plant Nutritive Capacity of Lowland Pseudogley in Gornja Posavina* Zeml Bil 16(1/3) 471 78 (Serbo)

The soil belongs to the anthropogenic lowland psuedogley The soil is very poor in available P and moderately supplied with Al K The 4 year average yield on unfertilized soil was 67 Lts/ha of maize grain By means of fertilizing, it is possible to achieve high yields N increased yields most, P to a much lesser degree, and K has almost no influence

453 Baovic, A , Novakovic, S , Saric, T , Micevic, Z 1967 *The Nutrient Value of Different Amounts of Mineral Fertilizers, Dung and Limestone for Wheat Production on a Parapodzol* Zeml Bil 16A 471 78 (Croat)

Good fertilizing increased yields of wheat to 3 32 tons/ha, maize for forage to 34 61 tons, and vetch + rye mixture to 25 23 tons, on a pseudogley (parapodzol) containing >40 mg/100 g mobile Al at 60 cm depth Significant positive effects required NPK dressings of 1,600 2,200 kg/ha, liming depressed yields in the first year and increased them in the second, manuring produced significant yield increases in the first 2 years, but had no residual effect in the third year (SF 31 456)

454 Basovic, M 1966 *The Influence of Boron on the Development of the Maize Grain* Zeml Bil 15(1) 53-8 (Serbo) (Univ Sarajevo)

Application of B increased yield of maize, but its effect was reduced by the presence of large amounts of mobile Al (40 mg/100 g soil) The effect of B was similar after shallow (18 22 cm) and deep (40-45 cm) plowing in the first and second year of the experiment, but in the third year B had more effect after shallow plowing (FCA 21 1684)

455 Basovic, M 1965 *Interdependence of Mobile Al Compounds in the Soil and the Effect of B on Maize Yield* Rad Poljo Fak Univ Saraj 14(16) 157 63 (Serbo)

The application of B to maize grown on a soil with <10 mg Al (mobile)/100 g soil in the 0 20 cm layer increased grain yield and grain B content, but at high Al concentrations B had no effect Application of B to different soil depths had similar

effects on the maize grain yield and grain B content in the second year, but shallow application was markedly better in the third year (FCA 22 2455)

456 Cencelj, J, Jelenic, D 1968 *Effect of Nitrogen Fertilizers on the Lysine Synthesis in Silo-Maize.* Isotope Studies on the Nitrogen Chain, 133-46 IAEA, Vienna, Austria (Eng) (Inst for the Application of Nuclear Energy in Agr, Belgrade)

In investigations on amino acids of silo maize, different N fertilizers were studied to determine their effect on amino acid composition and variation during the growth period The experiment was carried out with silo maize, hybrid W 464A, grown on sandy soil, which had not been treated for 6 years with either fertilizers or manure Before cultivation P and K fertilizers were applied, and the N fertilizers, ammonium sulfate, ammonium nitrate, calcium cyanamide, and urea, were applied at the most appropriate time of application The first samples were taken at the time of flowering, the second after flowering, and the third, fourth, and fifth in the lactic, wax, and full maturity phases, respectively The percentages of crude protein of the maize gradually decreased while the N free extraction matter increased during this period The protein content of the maize was highest with sodium nitrate and urea fertilization and lowest when calcium cyanamide was used Investigations to determine whether or not an increase in crude protein content was correlated with an increased content of lysine have shown that there is a correlation when plants are fertilized with calcium cyanamide The content of essential amino acids was more satisfactory in plants fertilized with urea than with sodium nitrate According to the statistical analysis, the best improvement in lysine content was obtained with urea (0 23%), the least satisfactory with calcium cyanamide (0 17%), and PK fertilizers without N (0 15%) (FA 2 884)

457 Durman, P 1964 *Comparative Investigation of the Uptake of ^{32}P Via Prop and the Main Adventitious Roots of Hybrid Corn* Agron Glasnik 14(11 12) 893 903 (Croat) (Agr Fac, Zagreb)

Uptake of ^{32}P by Iowa 4417 corn plants was studied by immersion of roots into aqueous $KH_2{}^{32}PO_4$ and counting the activity of the foliage in a scintillation spectrometer, specific activity was counts/min/foliage g and time of study was from flowering to the milk stage of the seed After a period of uptake the plants were returned to the soil, and the movement of the pulse followed in a plant *in situ* Generally, a much lower uptake (~60% with a decline to 24%) occurred via prop roots as compared with the main roots, and accumulation was lower in all organs when uptake was via prop roots Thus, the tassel had ~1,200 counts/min/g and the 10th node 1,500 counts/min/g when the tracer entered via main roots, and 700 and 300 counts/min/g, when the tracer entered via prop roots Prop roots probably play only a secondary role in the nutrition of the corn plant (CA 64 10094f)

458 Faller, N 1967 *Effect of N, P, and K on the Contents of These Elements in Young Maize Plants* Agron Glasnik 17(6) 465 72 (Serbo) (Visoka Poljoprivredna Skola, Osijek)

Maize cv Wisconsin 641 AA was grown in sand culture with different rates of N, P, and K Contents of N, P, and K in plants varied greatly depending on rates of nutrients applied and growth stage The ratios N P_2O_5, N K_2O, and P_2O_5 K_2O were determined only for plants cut on June 1 and 11 These ratios varied over the following ranges N K_2O from 0 18 to 4 12, P_2O_5 K_2O from 0 11 to 1 81, and for N P_2O_5 from 0 95 to 5 26 (FCA 22 1808)

459 Faller, N 1968 *Response of Young Maize Plants to Manuring with N, P, and K* Agron Glasnik 30(2) 141-48 (Serbo) (Visoka Poljoprivred Skola, Osijek)

In a pot trial in 1966 with the maize hybrid OPH 98, the following fertilizer combinations were tested (a) NPK, (b) PK, (c) NK, (d) NP, (e) no fertilizer After 6 days of growth, plant height increases were greatest in (d) (9 90 cm increase) and dry matter contents in the above ground parts were highest in (a), 1,382 g/plant There were also differences in the content of major elements in the above ground parts of plants and in their N P_2O_5 K_2O ratios, which were 100 38 215 in (a), 100 51 288 in (b), 100 21 226 in (c), 100 35 99 in (d), and 100 21 151 in (e) (FCA 22 1786)

460 Geric, I, Cupina, T 1968 *Effect of Nitrogen, Phosphorus, and Potassium on the Uptake and Distribution of Carbon 14 in Some Organic Compounds in Corn and Sugar Beets* Zeml Bil 17(1) 127 34 (Croat) (Inst Agr, Novi Sad)

In cultures of corn and even more in those of sugar beets there is a trend toward increasing CO_2 assimilation with increasing N doses The greatest activity in both cultures was with large doses of N and small doses of P and K The differences in the distribution of the absorbed C with different mineral nutrients are greater in corn than in sugar beets In both cultures activity is seen in compounds extracted with EtOH (CA 72 21020h)

461 Jankovic, M, Popovic, Z 1966 *Action of Different Nitrogenous Fertilizers on Crop Yield, and the Effect of These on Chemical Changes in the Soil* Zeml Bil 15(3) 237 53 (Croat) (Inst Proucavanje Zemljista, Belgrade)

The effects of N fertilizers [Ca ammonium nitrate, $(NH_4)_2SO_4$, and NH_4NO_3] on the wheat, corn, and sugar beet crops were studied during 5 years testing under field conditions of parapodzol and brown soils in Mladenovac The N fertilizers increased the crops on both parapodzol and brown soils so that the higher yields were attributed to the effect of N All tested N fertilizers can be used with equal advantage to increase the yield of either parapodzol or brown soils, although $(NH_4)_2SO_4$ was somewhat more efficient The highest yield of corn was achieved by using Ca ammonium nitrate in parapodzol and $(NH_4)_2SO_4$ in brown soils But the general effect of all N fertilizers was about the same The highest yield of corn was obtained when Ca ammonium nitrate was used in parapodzol and $(NH_4)_2SO_4$ in brown soils The N fertilizers chemically changed the soils The Ca ammonium nitrate had a most favorable affect in changing the chemical properties of parapodzol and brown soils It decreased their hydrolytic acidity and the amount of exchangeable Al $(NH_4)_2SO_4$, and particularly, NH_4NO_3 were not suitable for prolonged application to parapodzolic soils because they increased the hydrolytic acidity, content of exchangeable Al, and leaching of bases from adsorbed complexes A similar effect was observed in brown soils although to a noticeably smaller degree (CA 68 94948u)

462 Leskosek, M 1966 *Comparison of Various Nitrogen Fertilizers in Intensive Maize Production* Zeml Bil 15(1) 83 92 (Croat)

The influence of various N fertilizers on corn yields (Wisconsin 641 AA and early hybrids) in corn producing regions of Yugoslavia was investigated during the 1961, 1962, and 1964 seasons in comparative field experiments on calcareous and acid to slightly acid soil [pH(KCl) 5 3-6] Besides P_2O_5 and K_2O, manure was used in 40% of the cases The fertilizers used were Ca NH_4 nitrate, $(NH_4)_2SO_4$, NH_4^+ sulfate nitrate, and urea (in 1964) With 100 160 kg N/ha, applied twice, there was a good yield, 13 14 quintals/ha, or 11 kg corn/kg of N Differences in the effect of the various N fertilizers were insignificant, they did not, on the average, exceed 1 quintal/ha (1 kg corn/kg N) $(NH_4)_2SO_4$ and NH_4^+ sulfate nitrate are probably best in calcareous and alkaline, and saline soils (CA 67 116207h)

463 Petijevic, O, Stepanek, L 1967 *Agrotechnical Ameliorative Measures for Cultivation of Fern-Soils and the Economic Effect of Their Application* Zeml Bil 16(1) 631 38 (Serbo)

Fern soils are very acid, with a poor nutritive value and of low fertility The subject of the research was a three field crop rotation (wheat, maize, and potato), application of 30 qt of $CaCO_3$/ha every year along with NPK at 900, 1,200, and 1,500 kg/ha, the same three doses of NPK plus 200 qt of farmyard manure every year and the three doses of NPK in an organic mineral mixture with 50 qt of farmyard manure In order to estimate the extra profit in different practices, this work studied only the expenses of the application of the mentioned measures subtracted from the value of the yield obtained under their influence It is concluded (1) While maize and potato give very high yields on the cultivated fern soil, wheat shows poorer results in the same conditions (2) Regular fertilizing and small doses of $CaCO_3$ has shown excellent effect (3) The highest doses of mineral fertilizers have shown the best results

464 Popovic, Z, Kovacevic Tatic, R, Stojanovic, Z 1965 *The Potassium Content of Maize and Wheat in Relation to Potash Applications* Proc Fourth Reg Conf Int Potash Inst, 74-8 (Ger) (Soil Inst, Belgrade)

Tabular data are included on yields and K content and uptake (grain and straw) of wheat and maize receiving increasing dressings of up to 200 kg/ha K on chernozem and parapodzol soils (SF 30 607)

465 Saric, M, Curic, R, Petrovic, M 1965 *Effect of Elements of Mineral Nutrition on Phosphorus Metabolism I Effect of Deficiency in Nitrogen, Phosphorus, Potassium, Calcium, and Sulfur in the Nutritive Medium on the Proportions of Phosphorus Compounds in the Above Ground Part of Young Maize Plants* Isotopes Radiation Soil Plant Nutr Studies, Ankara, 579 87 (Eng)

Twenty-day-old maize hybrid plants were immersed in distilled H_2O and complete Reid and York's nutritive solution and in modified forms so as to be deficient in each case in N, P, K, Ca, and S After 20 days, 3 mc ^{32}P/liter was added to all the solutions and distilled water containing the plants and metabolites were determined after 24 hours Plants in solutions containing K had the highest P content, and in solutions containing P the least ^{32}P was highest in plants grown in distilled water alone ^{32}P uptake was inversely proportional to the extent of disturbance in the physiological and biochemical processes Highest P content was in inorganic compounds and metabolism of P was least in plants grown in complete nutritive solution Inorganic ^{32}P was found in plants grown without N and in water Highest P content was in nucleoproteins except in those grown in Ca and K containing solutions In solutions containing P, N, Ca, K, and S, and those without P and S, the plants had the lowest ^{32}P content Highest P content in lipids was in plants grown without Ca and N Total P and ^{32}P content in free nucleotides was highest in plants grown without P Least P content was in nucleic acid (CA 65 16017d)

466 Saric, M, Cupina, T, Geric, I 1965 *Uptake and Distribution of C in Free Amino Acids in Young Maize Plants in Dependence on Mineral Nutrition* Meded Landhogesch Opzoekstns Gen 30(2) 1045 53 (Eng) (Inst Agr Res, Novi Sad)

Different nutrition conditions influence the content and synthesis of free amino acids, the content was lowest in plants grown without N, followed by those without K, S, Ca, and P Of all of the free amino acids, the glutamic acid content was the highest (CA 66 10246e)

467 Saric, M, Cupina, T, Geric, I 1967 *Use of C^{14} in Investigation of Amino-Acid Metabolism in Young Maize Plants Growing Under Different Nutrient Conditions* Fiziol Rast 14 693 700 (Russ) (Otd Fiziol Rast Nauchno Issled Inst Rast, Novi Sad)

Excluding particular nutrients from water cultures decreased the total concentration (dry weight basis) of free amino acids in the sub aerial mass, and also decreased percentage incorporation of C^{14} supplied by $C^{14}O_2$ into these amino acids Excluding N had the greatest, and excluding P the least, effect Glutamic acid was always the predominant free amino acid The effect of nutrient supply on amino acid metabolism differed for different amino acids (SF 30 4416)

468 Saric, T, Novakovic, S 1967 *Influence of Different Ploughing Depth, Liming and Fertilizing by Mineral and Organic Fertilizers on Parapodzol Upon Corn Yield* Zeml Bil 16(1/3) 487 94 (Serbo)

The best plow depth was 30 35 cm Liming and manure both improved yields, but not as much as the chemical fertilizers, which were calcium ammonium nitrate, superphosphate, and potassium chloride Of three rates applied (0, 1,000, 1,600, 2,000 kg NPK/ha), the highest rates gave best results

469 Sestic, S, Teofilovic, K 1966 *Determination of Optimum Quantities of Fertilizers and of the Nutrient Ratio N P_2O_5 K_2O for Fertilizing of Corn Plants on Different Soil Types* Zeml Bil 15(2) 153 66 (Serbo) (Inst Soil Studies, Belgrade)

Optimum fertilizer rates for maize were found to be 140 kg N, 90 kg P_2O_5, and 120 kg K_2O on a parapodzol soil, and 110 kg N, 60 kg P_2O_5, and 200 kg K_2O on a sandy chernozem soil (FCA 21 1677)

470 Stojanovic, M , Miladinovic, M , Duric, B 1967 *The Complex Action of Plowing Depth and Mineral Fertilizing at Different Rates on the Yield of Maize Under the Agroecological Conditions Prevailing in Eastern Serbia* Zeml Bil 16A 129 35 (Croat)

Maize yields increased with increasing plowing depth, highest yields were produced by plowing to 50 60 cm and applying NPK at the high rate of 2,700 kg/ha Heavy fertilizing produced good yields even with shallower plowing to 20 30 cm (SF 31 450)

471 Stojanovic, Z , Kovacevic Tatic, R , Perkovic, M 1965 *Nutrient Uptake by Corn and the Use of Nutrients from Mineral Fertilizers* Zeml Bil 14(2) 187 200 (Croat)

Three year field experiments with chernozems and parapodzols showed that the N and P contents are 2 3 fold and 3-4 fold higher, respectively, in the grain than in the stalk, while K is considerably higher in the stalk Plant N, P, and K uptake from unfertilized soils were 100 105, 40-45, and 80 100 kg/ha, respectively, while fertilized plants absorbed ≥30%-40% more nutrients, depending on the soil and the fertilizer level Quantities of N and P removed from chernozems were on the average twice those removed from parapodzols, while the difference for K was less pronounced (CA 65 16016d)

USSR

472 Abutalybov, M G , Gummatov, M R 1967 *Effect of Mineral Nutrition Conditions on the Manganese Distribution in Corn Plants* Izv Akad Nauk Azerb SSR, Ser Biol Nauk, No 1, 8 13 (Azerb)

Distribution of Mn in corn plants was determined under various nutritional conditions Various parts of the plant cell, obtained by fractional centrifugation of leaf homogenates, revealed the quantity of Mn to be in the following decreasing order chloroplast, mitochondria, nucleus, and cytoplasmic fluid The presence of Fe salts seemed to be necessary for the absorption and distribution of Mn (CA 68 12009b)

473 Abutalybov, M G , Mardanov, A A , Safaraliev, P M 1969 *Regularity of the Uptake and Incorporation of Sulfur-35 into Corn Root Protein* Dokl Akad Nauk SSSR 185(4) 954 56 (Russ) (Inst Bot im Komarova, Baku)

Sprouts of corn plants of 5 or 15 day age grown either in the dark or with illumination for 10 days were analyzed for ^{35}S uptake from Na_2SO_4 in the medium This uptake had a cyclic nature both in the absorption by the roots and in the inclusion into protein Older plants showed the cycles somewhat more clearly than younger plants, but all showed minima maxima alternations spaced about 2 hours apart (CA 71 19556y)

474 Afendulov, K P , Borodin, A K , Perepechai, V E 1966 *Effectiveness of Hill and Band Application of Fertilizers in Maize* Khim sel' Khoz 4(2) 149 51 (Russ) (Chernigov Oblast Sel' Khoz Opyt Sta , Progress)

Various methods of applying P fertilizers were compared in three trials In one trial, placing 30 kg P_2O_5/ha at a depth of 10 cm before sowing gave about double the increase in grain yields given by the same rate applied broadcast at autumn plowing or before sowing In another trial, placing granular superphosphate (5 kg P_2O_5/ha) 3 5 cm to the side of the seed at a depth of 2 3 cm was most effective and increased grain yields by 9 hkg/ha compared with the untreated control Placement of granular superphosphate directly under the seed had little effect and may even have adversely affected plant growth In a third trial, drilling (a) 1 or (b) 2 rows of granular superphosphate (15 kg P_2O_5/ha) 2 3 cm deep at a distance of 5 7 cm from the maize row increased grain yields by (a) 12 and (b) 14 5 hkg/ha, compared with the untreated control (FCA 21 111)

475 Afendulov, K P 1965 *The Effects of Irrigation and Fertilizers on Maize Yields* Vest sel' khoz Nauk, Mosk No 10, 46 9 (Russ) (Obl Gos Opytn St , Donetsk)

The maize hybrid VIR 42 was grown under various irrigation regimes With one irrigation 1 week before tasseling a grain yield of 40 2 hkg/ha was obtained, a second applied during tasseling raised this to 48, a third 10 days later to 56 4, and a fourth after a further 10 days to 64 8 hkg/ha When the irrigation was combined with manuring, the yields were increased still further (FCA 19 1430)

476 Akent'eva, L I 1966 *Effect of Application of Trace Elements on Corn on Eroded Carbonate Chernozem Soils of the Lugansk Region* Mikroelem Sel Khoz Med , Akad Nauk Ukr SSR, Respub Mezhvedom Sb , 120 25 (Russ)

In corn fields on slightly to average eroded lime chernozem soils, application of 8 kg of $ZnSO_4$/ha alone resulted in an increased yield of grain of 20% over the control With a background of 45 kg of P_2O_5/ha, as superphosphate, the increase in yield was 13%, and with a background of 45 kg of N/ha, as NH_4Cl, the increase over the control with N alone was 14% Against a background of both P and N, the increase in yield of Zn was not significant Increases were observed in biochemical activity in the soil, utilization of P by the crop, chlorophyll content and catalase activity of the leaves, and resistance of the grain protein to high temperature Application of 5 kg of Mo/ha yielded an increase of 15% with a N background but none with a P background Increased utilization of N and P and increases in protein and oil content of the grain were observed Co as sulfate at levels of 2 kg/ha yielded increases of 1 5 cwt/ha alone, 2 8 cwt/ha with N background, no effect with a P background, and a reduction in yield of 6 7 cwt/ha against a N–P background Like Zn, Mo and Co increase biological activity in the soil (CA 66 28070j)

477 Alekhina, N D , Andreenko, S S 1967 *The Role of Endosperm in the Nitrogen Metabolism of Maize Seedlings at Different Substrate pH* Nauch Dokl Vysshei Shko , Biol Nauki 5(41) 113 18 (Russ) (Moscow Univ)

Maize seedlings raised on a substrate containing ammonium N utilized more endosperm N at pH 7 0 than at pH 4 7 No pH effect was observed in seedlings grown with nitrate N (FCA 21 134)

478 Al'shevskii, N G 1966 *Effect of Cobalt on the Yield and Some Biochemical Characteristics of Sugar Beets and Corn* Agrokhimiya, No 12, 80 7 (Russ)

Application of Co (0 3-0 5 mg/kg soil) increased the yield

of sweet corn only on light acid and limed soils by 37-79 cwt/ha for plants and 6 11 cwt/ha for ears The presence of Mg in liming fertilizers increased the effects of Co considerably Co increased sugar beet and sweet corn foliage, the number of leaves and their surface area, and their H_2O and carotene contents Co accelerated the development and growth of sweet corn plants and increased the total protein in ears (CA 66 36897z)

479 Andreenko, S S, Alekhina, N D 1966 *Uptake and Conversion of Nitrates by Maize at Different pHs of Nutrient Solution* Nauch Dokl Vysshei Shko, Biol Nauki, No 2, 156 59 (Russ) (State Univ, Moscow)

Maize seedlings were grown in water cultures at pH 6 6 7 0 or 4 4-4 6 At the age of 15 days they were exposed to $NH_4{}^{15}NO_3$ and the uptake of ^{15}N followed at various pHs. The plants originally grown in the neutral solution took up more ^{15}N when transferred to a medium with low pH This phenomenon was not observed in plants cultivated originally at pH 4 4-4 6 and either transferred to a solution with neutral pH or left at the same pH The ratio of root ^{15}N to leaf ^{15}N was 0 49 and 0 26 in maize grown in the neutral and acid solution, respectively Nitrate reductase activity was higher in plants grown at pH 6 6 7 0, especially in roots (CA 65 9673c)

480 Arnautova, N I 1966 *Effect of Ammonium Nitrate Levels on Growth, Development, and Yield of Corn* Agrokhimiya, No 11, 14 20 (Russ)

Field experiments were conducted on a gray forest, clayey soil, by applying NH_4NO_3 by hand, before sowing, in addition to superphosphate and KCl, in amounts between 90 and 100 kg of active substance/ha In 1962 and 1963 the results of tests differed markedly owing to different atmosphere conditions and moisture supply in the soil High levels of NH_4NO_3 of 4 5 quintals/ha inhibited corn germination by ~50% during lack of moisture, the same was true of growth Low NH_4NO_3 levels, 2 quintals/ha, affected favorably the blooming stage Tests made with potatoes grown after corn indicated that higher N levels led to increased potato yields even during the following year Increase of NH_4NO_3 levels from 2 to 5 quintals/ha gave a 2 4 fold increase of corn yield, the same was true of potatoes (CA 66 28042b)

481 Artyukhov, I K, Buryak, I F, Lyutyi, N G 1966 *Comparative Effectiveness of Various Forms of Phosphorus Fertilizers Applied Under Winter Wheat, Corn, and Peas in the Ukrainian Steppe* Agrokhimiya, No 8, 28 35 (Russ) (All Union Res Inst Corn, Dniepropietrovsk)

Plot experiments were made on steppe chernozem with various P fertilizer treatments (1) double superphosphate (47 1% P_2O_5), (2) $CaHPO_4$ (32 8%-40 6% P_2O_5), (3) defluorinated phosphate rock from apatite concentrates (27 7% 31 6% P_2O_5), (4) from Kara Tau phosphate rock (17 4% 21% P_2O_5), (5) ammonium phosphate (53% 62 7% P_2O_5, 12% 12 7% N), (6) phosphate rock meal (19 4%-20 7% P_2O_5), and (7) phosphate slag (10 9% 12 6% P_2O_5) on corn and winter wheat of various varieties P nutrition had a favorable effect on the resistance of wheat to temperature decreases and accelerated its growth Corn reacted differently to the various forms of P, depending on the method of application Fertilization with (2), (3), (1), or (7) (5 kg P_2O_5/ha) increased the grain yield by 3 1-4 5 quintals/ha (CA 65 14374c)

482 Ashkhbabyan, S A 1968 *Effect of Trace Elements on the Yield and Quality of Corn from the Ararat Plain* Min Sel Khoz Arm SSR 11(2) 29 33 (Arm)

The treatment before sowing of maize seeds with solutions of 0 05% trace elements notably increases the yield of the crop, both in the total weight of the plant and in the weight of the ears Among all the trace elements studied, the most effective are Zn and Co, which increase the total weight of the crop by 8 4% and 18%, respectively The weight of the corn grain increases by 179% and 22 1% The trace elements also increase the content of starch in the grains but they do not modify, in an appreciable manner, the percent of the other chemical constituents of the grains (CA 69 85781c)

483 Aslanyan, V E 1968 *Effect of Mixed Fertilizers on the Yield of Potatoes and Corn in the Alkaline Chernozems of the Lori Plateau of Armenia* Biol Zh Arm 21(2) 76-82 (Russ)

484 Babakhanyan, M A 1965 *The Effect of the Concentration of Nutrient Solution on the Yield of Corn* Soobshch Lab Agrokhim, Akad Nauk Arm SSR, No 6, 113 19 (Russ)

The effect of the following major and trace elements in different concentrations on the yield of the corn, Krasnodarskaya No 5, was investigated The N P K (17 23 60) nutrient solution contained (g/liter) KNO_3 1,300, $CaHPO_4$ 700, $MgSO_4$ 500, $FeSO_4$ $7H_2O$ 10, $MnCl_2$ 5, H_3BO_3 5, $CuSO_4$ $7H_2O$ 1, $ZnSO_4$ $7H_2O$ 1, KI 0 1, NH_4 molybdate 0 1, Co acetate 0 1, and $Pb(NO_3)_2$ 0 01 The accumulation of the nutrients in the aerial plant parts differed essentially from that of the roots where the amount of nutrients assimilated increased with the concentration of the nutrient solution The concentration of the nutrient solution affected the rate of growth of plants, which was higher during the first 4 5 days than later on, when the growth rate was lower than in plants grown in solutions of lower nutrient concentrations An increase in the nutrient concentration within a plant was accompanied by a slight increase of the plant dry matter content (CA 65 9680e)

485 Bagaev, V B, Shkel', S E 1966 *Effect of Level of Nitrogen Nutrition on Sensitivity of Maize to 2,4 D at Different Stages of Growth* Izv Timiryazev Sel' khoz Akad, No 5, 91 102 (Russ)

In sand cultures in which maize was sprayed at the 4 leaf stage with the Na salt of 2,4 D, plants receiving 50% and 150% of the normal rate of N were sensitive to 2,4 D in the first half of the vegetative period The harmful effect of 2,4 D increased sharply at the beginning of the second half of the vegetative period, but damage in the second half was decreased by the high rate of N The absolute amounts and the concentrations of N, P, K, protein, and starch in the various parts of the plant were affected by the rate of application of N and by 2,4 D (SF 30 1188)

486 Bagaev, V B, Shkel', S E 1967 *Effect of Level of Phosphorus Nutrition on Sensitivity of Maize to 2,4 D* Izv Timiryazev Sel' khoz Akad, No 2, 99 108 (Russ)

In sand cultures in which maize was sprayed with 2,4 D at the 4 leaf stage, increasing the P concentration of the nutrient solution increased sensitivity to 2,4 D Spraying increased the percentage contents (dry weight basis), but decreased the absolute amounts, of N, P, and K in the plants Spraying affected P metabolism (SF 30 3653)

487 Bagaev, V B, Shkel', S E, Zhukov, Y P 1967 *Maize Sensitivity to 2,4 D Under Differential Potassium Nutrition* Izv Timiryazev Sel' khoz Akad, No 4, 150 61 (Russ)

In pot trials, maize plants sprayed with 2,4 D Na at 1 kg/400 liters/ha yielded less than untreated plants, the degree of reduction depended on the K level in the substrate and on the time of 2,4 D application in relation to flowering (FCA 21 142)

488 Baginskas B 1965 *Influence of Trace Elements on the Yield and Quality of Sugar Beets and Maize* Mikroelementy v Sel'sk Khoz, Akad Nauk Uz SSR, Otd Khim Tekhnol i Biol Nauk, 187 90 (Russ)

Field cultures were conducted on loamy sod glei soils containing (in mg/kg) exchangeable soluble B 0 15-0 25, mobile Mo 0 08 0 14, mobile Co 0 56-0 96, mobile Mn 6 84 24 8, and mobile Zn 0 35 1 9 For an extra root (*a*) addition of trace elements during the vegetative period and for a presowing treatment of the seeds (*b*) (in parentheses) were used (kg/ha) H_3BO_3 3(0 1), $CoCl_2$ 2(0 1), $CuSO_4$ 5(0 1), $MnSO_4$ 5(0 1), $ZnSO_4$ 2(0 05), $(NH_4)_2MoO_4$ 0 2(0 02), and KI (0 02) The crop of maize was raised to 12 2% and 130 1% by (*b*), applying B and Mn, respectively The effect with (*a*) was 10%-20% less than with (*b*) Mo, Mn, and B + Mo had the greatest influence on crude protein increase, and Mo, I, and Co on the vitamin C increase Co increased the assimilation level (by the leaves) from 44 6% to 113 5%, B had the greatest influence on chlorophyll increase (CA 64 13343e)

489 Berzina, A 1965 *Application of Combined Trace Element Containing Tablets* Mikroelementy i Produktivnost Rast, Akad Nauk Latv SSR, Inst Biol, 227 30 (Russ)

Tablets containing trace elements were used for a presowing treatment of seeds and had the following composition (g/tablet) $CuSO_4$ + KCl (0.52 + 0 78), $ZnSO_4$ + KCl (0 55 + 0 92), and $(NH_4)_2MoO_4$ + MnO_2 + K_3PO_4 (0 75 + 0 25 + 0 49, respectively) Seeds of various crops were sprayed with solutions prepared from the tablets The treatment resulted in an improved viability of plants and increased yields Zn enhanced the ascorbic acid content in corn leaves and Cu increased the amount of protein in corn grain (CA 64 20574d)

490 Bluzmanas, P, Grinius, V 1966 *Effect of Trace Elements on Corn Growth and Biosynthesis of Some Vitamins in Corn Leaves* Liet TSR Aukst Mokyklu Mokslo Darb, Biol 6 59-70 (Lith)

Corn growth was stimulated by soaking the seeds before sowing in H_3BO_3, $(NH_4)_2MoO_4$, $CoCl_2$, or $MnSO_4$ solutions BO_3^{3-} and Mn^{2+} increased the riboflavine and thiamine contents in the leaves of corn plants growing from soaked seeds, MoO_4^{2-} stimulated thiamine and nicotinic acid biosynthesis, especially during vegetative growth, while Co^{2+} increased the plant thiamine level in the vegetative growth phase BO_3^{3-} and Mn^{2+} increased the chlorophyll level These four trace elements seem to affect vitamin biosynthesis through the leaf synthetic apparatus (CA 66 75366v)

491 Blyum, B G 1966 *Agrochemical Properties of Urea Formaldehyde Fertilizers* Govoryat Molodye Uchenye 1 317-22 (Russ)

The synthetic product MFU A, obtained by condensation of $CO(NH_2)_2$ with a mixture of formaldehyde and acetaldehyde, exceeded $CO(NH_2)_2$ and urea formaldehyde fertilizers in its effect on yield and utilization of fertilizer N in pot experiments with corn To evaluate the degree of utilization of N from MFU A and urea formaldehyde fertilizers by plants, a 1 5 month pot experiment was conducted with barley in which these fertilizers and $CO(NH_2)_2$ were labeled with ^{15}N At a dose of 0 5 g N/pot, the maximum yield was obtained with $CO(NH_2)_2$, at a dose of 1 g N/pot, the plant yield from all fertilizers was approximately the same, but the degree of utilization of N of slow acting N fertilizers was considerably lower than for $CO(NH_2)_2$ N of MFU A was assimilated better by plants than N from urea formaldehyde fertilizers Thus, $CO(NH_2)_2$, whose N was rapidly mineralized, had advantages over urea formaldehyde fertilizers and MFU A N was washed from soil with $CO(NH_2)_2$ in 5 fold greater quantities by 63 mm of precipitation than from soils with urea formaldehyde fertilizers In a pot experiment with corn, high doses of urea formaldehyde fertilizers and MFU A did not have a harmful effect on the plants (FA 1 124)

492 Blyum, B G 1966 *Effectiveness of Complex Fertilizers Prepared on the Basis of Urea-Formaldehyde Compounds* Agrokhimiya, No 1, 20 7 (Russ)

The complex urea HCHO fertilizer (MFU) contains 38% N, of which 20%-25% is soluble in water Pot tests on barley were conducted with MFU and MFU suspension (MFS), alone and mixed with double superphosphate phosphorite meal, and KCl at various ratios in powdered or granulated form, on sod podzolic clayey limed soil The doses were 0 5 and 2 0 g N/6 kg pot Good yield is obtained when using N P_2O_5 K_2O = 1 0 9 1 Similar yields are achieved with MFU and some mixtures with apatite and K The particle size of fertilizers has a marked effect on its utilization capacity Granulated fertilizers are less effective than powdered ones Complex fertilizers based on MFS are more efficient than those on MFU The effect of slowly acting N fertilizers on the yield of corn plant, grown the year after barley, reveals that complexes with high P and K content in relation to N give better yields than a mixture of individual components Pot tests with corn on sod podzolic sandy soil show a very favorable effect of NPK fertilizers and a marked decrease of yield in case of lack of even one component To compare the effectiveness of complex fertilizers prepared by the wet or dry methods, pot tests were made on sod podzolic, clayey, and sandy soil showing that slowly acting complexes are not so effective as urea Complex fertilizers, regardless of the method they are prepared, exert an approximate similar effect Plants use ~30% of the N (CA 64 11809a)

493 Bondarenko, S F, Grigor'eva, L V 1966 *The Composition of the Readily Hydrolyzed N Fraction in Chernozems and the Action of Nitrogen Fertilizers on Maize*

Yields Pochvovedenie, No 5, 550 5 (Russ)

During the growth of maize, the readily hydrolyzed N in the plow layer of plots fertilized with manure and superphosphate was higher than in the unfertilized plots The composition of the readily hydrolyzed N fraction was also different Under conditions of adequate soil moisture, nitrification is pronounced, nitrate N is dominant over ammonia N during the greater part of the growth period of corn A moisture deficit effects an accumulation of NH_3 P fertilizers accelerate the mineralization of organic N, indicated by the increase of nitrates N fertilizers, applied singly or combined with superphosphate and manure were adequately effective in increasing the amount of readily hydrolyzed N in the plow layer The action of N fertilizers on the yield of maize depends on the meteorological conditions, and tends to increase in years of higher rainfall Combined with manure, these fertilizers are also effective in dry years (CA 65 6245f)

494 Bondarev, V A 1964 *Nitrate Content in Corn* Veterinariya 41(11) 69 72 (Russ)

The nitrate content in extracts of plant material from Bukovin 3, Voronezh 80, and Moscow 3 corn was determined The highest nitrate concentration was in the stalks (1 071 mg %), in the leaf axils and leaves it was 33 mg % [illegible] 1 mg %, respectively, and none was observed in the ears and panicles A decrease in concentration was noted as the plants ripened, which was especially marked after the kernels ripened No appreciable accumulation of nitrate was noted in corn after the addition of 80 tons manure/ha or 200 kg KNO_3/ha to well manured soils, as compared with the control plots The nitrate content of the lower part of the stalk was higher than in the upper areas and exceeded the average for the entire stalk in all the vegetation phases from the shedding of the panicles to the milk phase It was highest in studies run on Moscow 3 when the panicles were shed (2115 4 mg %) and dropped to 889 7 mg %, 656 3 mg %, and 321 mg %, for the milk, milk wax, and wax phases of kernel development, respectively Moscow 3 corn grown on soil treated with 20 tons manure/ha and 600 kg NH_4NO_3/ha showed an increase of 0 5% nitrate in the stalks during the milk phase compared with corn not receiving mineral nitrates (CA 62 12160b)

495 Boyarovich, N M 1966 *Dynamics of Available Phosphates in Soil as Related to Irrigation of Corn* Agrokhimiya, No 7, 26 31 (Russ)

Available phosphates (AP) were determined in various soil horizons of a corn field irrigated 3 or 6 8 times (60 80 liters water/m^2 each time) during growth or left without irrigation The amount of AP decreased toward deeper soil layers The maximum amount of AP was detected at the beginning of the vegetation period Irrigation increased AP in the upper soil layers This increase was less pronounced in a corn field than in a fallow field because of AP uptake by corn (CA 65 12812e)

496 Buryak, I F, Bondareva, K G 1969 *Time and Methods for Applying Mineral Fertilizers to Maize* Kukuruza, No 5, 23 (Russ) (Erastovsk Opytn Stan, Vishnevol, Dnepropetrov Obl)

In trials during 3 years with maize on chernozem soil in the Ukraine, higher increases in grain yield were obtained from broadcast application of 40 kg N + 60 kg P_2O_5 + 40 kg K_2O/ha before autumn plowing (4 3 hkg/ha) than before spring cultivations (3 8 hkg), maize receiving no fertilizer yielded 28 2 hkg/ha However, the highest yield increases of 5 3 hkg/ha were obtained from drilling the same rates of fertilizers to a depth of 10 12 cm during spring cultivations (FCA 22 2623)

497 Butseroga, M M, Pershak, I T 1964 *Effect of Mineral Fertilizers on the Chemical Composition and Yield of Corn* Khim v Sel'sk Khoz, No 9, 7 6 (Russ)

Increased doses of N fertilization jointly with K and P fertilizers produced in corn grain higher amounts of proteins and decreased the percent of fat and starch High K fertilization increased the fat content and P increased both fat and starch High rates of a complete mineral fertilization increased protein of the grain, no increase of fat and starch was observed In general, under complete fertilization, the yield increase of grain was 52 2-60 8 centners/ha (CA 62 4567b)

498 Bykhun, V V, Kushnirenko, L A Krashchenko, G E 1968 *How Plant Density and Fertilizers Affect Yields* Kukuruza, No 11, 16 (Russ) (Pedagog Inst, Poltava)

In trials with maize cv Bukovinskii 3 during 3 years, increasing the density from 40 to 60 thousand plants/ha increased the average grain yield by 6 9 hkg/ha (12% increase) on plots given 60 kg N, 100 kg P_2O_5, and 100 kg K_2O/ha, by 8 3 hkg/ha (15 7%) on plots given 30 kg N, 50 kg P_2O_5, and 50 kg K_2O/ha, and by 3 3 hkg/ha (6 4%) on unfertilized plots, the yield increase was ascribed mainly to an increase in leaf area index (FCA 22 968)

499 Chernyavskaya, N A, Farenik, G G, Goncharenko, D F 1965 *Effect of Zinc in Plant Nutrition* Agrokhimiya, No 9, 81 90 (Russ)

Field experiments were carried out to determine the effect of Zn on the metabolism in corn plants grown on chernozem and podzolic chernozem soils The arrangement of the experiment control, N, P, and N P Zn Zn was an active factor controlling development and metabolism Absorption of Zn from the soils took place during the whole period of growth Young parts of the plants contained higher levels of Zn The use of Zn fertilizer increased the content of Zn, especially in young plants In one case the content of Zn increased from 19 0 mg/kg for the control to 45 6 mg/kg for N P Zn treatment Zn treatment accelerated biochemical processes in corn, resulting in an increase of the content of ascorbic acid, I reducing factor, and activity of the enzymes The application of Zn fertilizers stimulated the initial growth of corn plants, increased the total area of the leaves, and improved the dynamics of corn blooming Zn treatment improved corn yield on the podzolic chernozem, but lowerd the yield of corn grown on chernozem soils (CA 64 7312b)

500 Cherednik, V A 1967 *Irrigation, Fertilizers and Yields of Sweet Corn* Kukuruza, No 7, 13 15 (Russ) (Kubansk Sel'skokhoz Inst, Krasnodar)

The cultivation, manuring, and irrigation of sweet corn cv. Nagrada (Reward) 97 in the Kuban' Province, N Caucasus, are described The highest yields of fresh cobs were obtained when

15 metric tons farmyard manure/ha plus 20 kg N/ha and 30 kg P were applied in autumn and 30 kg N/ha and 40 kg P during the next spring/summer Irrigation increased yields of fresh cobs from 55 to 107 hkg/ha in 1964 and from 64 to 115 kg in 1965 (FCA 21 160)

501 Chirkov, V N, Mansurov, Y A 1969 *Optimum Density of Maize Plants on Soil Given Different Rates of Fertilizers* Kukuruza, No 2, 23 (Russ) (Sel'skokhoz Inst, Tashkent)

Maize hybrid VIR 338 was grown on meadow bog soil at spacings of 60 x 60 cm with 1, 2, 3, and 4 plants/hill, using three rates of fertilizers Increasing the number of plants from 1 to 4/hill delayed maturation by 10 11 days Grain yields were increased from 47 9 74 8 hkg/ha with 60 kg N + 50 kg P_2O_5/ha, to 50 9 78 6 hkg/ha with 120 kg N + 100 kg P_2O_5 + 60 kg K_2O/ha, and to 56 5-81 6 hkg/ha with 200 kg N + 170 kg P_2O_5 + 100 kg K_2O/ha, the highest yields were given by 2 plants/hill (FCA 22 1777)

502 Chumina, O T, Belorusova, L M 1968 *Maize Responses to Fertilizers in Relation to Plant Age* Trudy Inst Bot, Alma Ata 26 13 25 (Russ)

In pot trials, maize plants were given 0 25 g N/kg soil, and P_2O_5 and K_2O each at 0 15 g/kg (a) before sowing, or at (b) the 3-4, (c) the 7-8, and (d) the 11 12 leaf stages In another trial, 50% of the fertilizer was given (e) at the 3-4 leaf and 50 % at the 13 14 leaf stage The highest yield, 312 g dry matter/plant at maturity, was obtained with (e), followed by 303 g with (b), unfertilized plants yielded 48 g dry matter/plant Yields of grain were rather similar (95 6 96 5 g/plant) with (a), (b), and (c) and the highest 1,000 seed weight, 256 g was obtained with (b) The highest N content in the leaves at the 13 14 leaf stage was 5 10% (dry matter basis) with (c) and, in mature plants, was 2 69% with (d), the highest amounts of N/plant occurred at stage (b) At the 13 14 leaf growth stage, the highest content of nucleic acids was 720 mg % in the dry matter with (c) The maximum content of nucleic acids, 1,738 mg %, was found in plants at the 3-4 leaf stage with (a) Contents of different forms of P and of RNA and DNA are also given for plants of different age and fertilized at different dates It is concluded that in pot trials, fertilizers are most effective when applied at the 3-4 to 7-8 leaf stages of growth (FCA 23 191)

503 Chumina, O T, Efimova, V B 1968 *Effect of Essential Nutritive Elements on Maize Plant Metabolism and Productivity* Trudy Inst Bot, Alma Ata 26 26 35 (Russ)

In pot trials, maize plants were given NP, NK, PK, and NPK (control) fertilizers at the 3 to 4 leaf stage and also N or P alone, but supplemented by NK or PK at the 13 to 14 leaf stage N, P, and K deficiencies reduced plant growth, slowed cob development and decreased the contents of N and P in plants and also decreased the accumulation of nucleic acids N deficiency produced the strongest effect, followed by P and K (FCA 23 227)

504 Danilova, N S 1966 *Utilization of Endosperm Nitrogen and Nitrogen of the Nutrient Medium by Maize Shoots* Fiziol Rast 13(1) 91-8 (Russ) (K A Timiryazev Inst Plant Physiol, Moscow)

Utilization of endosperm N by the shoots of maize plants depends upon the N concentration in the nutrient solution, and increasing concentrations of N in the solution results in an accelerated expenditure of all seed storage substances, including N Removal of the endosperm from the shoots decreases the N uptake from the nutrient medium The mutual effect of two N sources is an example of synergetic relations in plant nutrition (CA 64 13338h)

505 Darmenko, M S, Koshlak, L Y 1965 *Physiological Peculiarities of the Effect of Trace Elements by the Presowing Treatment of Seeds* Primenenie Mikroelementov v Sel' Khoz, Akad Nauk Ukr SSR, 94 9 (Russ)

The effect of presowing treatment of seeds by powdering with $ZnSO_4$, $MnSO_4$, H_3BO_3, and $(NH_4)_2MoO_4$ was studied The absorption of elements into seedlings after this treatment was higher than from the soil Mn in corn seedlings was localized especially in embryo and in the primary roots In wheat seedlings Mn, Zn, Mo, and B increased the activity of amylase, protease, and lipase In corn seedlings Mn and Zn increased the activity of catalase and lipase (especially Zn) Trace elements increased intensity of respiration in pea, corn, and sugar beet seedlings and increased the germination ability and growth of winter wheat (CA 63 15495h)

506 Demchinskaya Podkolzina, M I 1970 *Effect of Cl^-, SO_4^{2-}, and CO_3^{2-} on the Composition of Free Amino Acids and the Protein Metabolism of Corn* Agrokhimiya, No 3, 29-33 (Russ) (Vses Nauch Issled Inst Udobr Agropochvoved, Moscow)

The experiments were carried out on corn, growing in Mitscherlich vessels, each containing 8 8 kg of a mixture of soddy podzolic soil and clayey loam with sand (1 1) The effect of Cl, SO_4^{2-}, and CO_3^{2-} was studied against an optimum nutritional background for corn N 3, P_2O_5 2, and K_2O 2 g/vessel The anions were added in single (a), double (b), and triple (c) doses as NH_4Cl, $(NH_4)_2SO_4$, and $(NH_4)_2CO_3$, total N being kept constant The highest values with regard to the composition and content of free amino acids and amides, were obtained with Cl (b) and SO_4^{2-} (a) CO_3^{2-} (a) resulted in the lowest level of free amino acids and a moderate protein synthesis Generally, (a) dosages of Cl and SO_4^{2-} caused an enhanced synthesis of amino acids as compared with CO_3^{2-} With increased CO_3^{2-} concentration the trend was reversed CO_3^{2-} (b) showed the best conditions for N metabolism, higher crop yields and an increase of the protein content (>20% calculated on dry matter) Increase of anion dosage to (c) lowered the effectiveness of SO_4^{2-} and CO_3^{2-} down to that of (a), while with Cl the negative influence led to a disruption of N metabolism and a decrease in crop yield (CA 73 55084t)

507 Derevyanko, S I, Golovchenko, V N 1970 *Effect of Forms of Nitrogenous Compounds on Synthesis of Amino Acids in Seedlings of Corn and Pea Plants* Fiziol Biokhim Kul't Rast 2(3) 309 12 (Russ) (Inst Plant Physiol, Kiev)

Corn and pea seeds were grown in H_2O After 10 days the seedlings were placed for 5 days in Knop's nutrient where ¼ of the total N was substituted by N in organic forms The 15 day-old leaves were macerated in 80% EtOH, and the proteins were precipitated by 5% CCl_3CO_2H The filtrate was chromatographed on a column The amino acids fraction was

eluted by NH_4OH and their chromatogram was developed by 1% ninhydrin and quantitatively determined The organic forms of N were metabolized by plants In the corn plants most amino acids were synthesized using urea and methionine The presence of asparagine increased the content of all amino acids (CA 73 108868k)

508 Dibrova, V S 1968 *Application of Zn Fertilizers to Calcareous Chernozem* Khim sel' Khoz, No 12, 14 17 (Russ) (Donskoi Sel'skokhoz Inst, Persianovka, Rostov Obl)

In field trials with maize on calcareous chernozem during 2 years, applying 3 kg Zn as $ZnSO_4$/ha (with superphosphate) at sowing increased plant uptake of Zn by 57 3% and grain yields by 13% Seed treatment with Zn was not effective In pot trials to determine the optimum depth for Zn application, Zn at 10 mg/kg soil, applied to the soil surface, was leached with water equivalent to the average annual rainfall Almost all the Zn was retained in the 0 to 1 cm layer It was concluded that Zn is effective only when applied to the root zone near the surface (FCA 22 1794)

509 Dibrova, V S 1968 *Application of Zn Fertilizers to Maize* Agrokhimiya, No 11, 102 7 (Russ) (Donsk Sel'skokhoz Inst, Persianovka, Rostov Obl)

In trials with maize cv VIR 156 and VIR-42 on chernozem soil, application of 3 8 kg Zn as $ZnSO_4$/ha, over a basal dressing of 10 kg P_2O_5/ha, increased grain yields by 8 8% 27%, higher rates were more effective than lower rates, and VIR 156 showed a higher response to all rates than VIR-42 Treating seeds with Zn was less effective than applying Zn to the soil (FCA 22 974)

510 Dibrova, V S 1967 *Effect of Zinc Fertilizers on the Biochemical Properties of Corn Under Various Conditions of Zinc Supply* Fiziol Rast 14(4) 670 74 (Russ) (Donsk Sel'skokhoz Inst, Persianovka, Rostov Obl)

Application of Zn fertilizers to a northern *chernozem*, Zn deficient soil increased the foliage and yield of corn The chlorophyll, ascorbic acid, and tryptophan contents of the leaves of the Zn deficient plants were considerably increased by addition of Zn to the soil However, presowing treatment of the seeds with $ZnSO_4$ had no appreciable effect on the biochemical content of the plants (FA 1 156)

511 Dobrolyubskii, O K, Matyushenko, A V, Pikus, G P 1970 *Effect of Zinc on Yield and Chemical Composition of Corn of Different Stages of Ripeness* Fiziol Biokhim Kul't Rast 2(3) 274 6 (Russ) (Agr Inst, Odessa)

Tests were conducted on soil of low Zn content In the blooming phase, the plants were sprayed twice with 0 05% $ZnSO_4$ The corn grain was harvested at three phases of ripeness milk wax, wax, and complete ripeness Zn spraying of the plants had a positive effect on the grain yield No marked difference was observed between the chemical composition of corn grain collected in the wax phase and at complete ripeness, and that of grains grown from seeds of those phases Thus, grains of corn from both ripeness phases have practically the same yield qualities Application of Zn increased N compounds (mainly protein N), P compounds, starch, and to some extent fat content in the corn grains (CA 73 108814q)

512 Dumpe, E 1969 *Plant Growth as a Function of Potassium Requirement* Vop Biol, Mater Konf, 1968, pp 81-90 (Russ) (Edited by Maurina, H Izd "Zinatne" Riga)

Corn was grown in Knop nutrient solution with the addition of trace elements During the first 5-8 days germinated seeds were grown in water, then in 0 5*N* Knop solution, and finally, after 5 days, on *N* Knop solution Every 5-6 days, the nutrient solutions were changed, and plants were sampled The studies were done on the plants, grown on Knop solution containing normal, normal + half the K, and no K An increased amount of K during germination intensifies plant growth The leaf area and the root system increase considerably With K deficiency, growth and development is retarded, but the ratio of the active root surface to the total surface increases (CA 72 54321k)

513 Dzanagov, S K 1968 *Effect of Fertilizers on the Content of CP and Its Amino Acid Composition in Maize* Kukuruza, No 10, 23 (Russ) (Gorskii Sel'skokhoz Inst, Ordzhonikidze)

In field trials in N Osetia, central Caucasus, 90 kg N/ha, applied with P and K, resulted in a yield of 50 hkg grain/ha which contained 470 kg CP, compared with 38 8 hkg grain and 254 kg CP, respectively, for an unfertilized control crop Fertilizer N changed the proportion of various amino acids in the CP, reducing the amounts of cysteine and histidine, but increasing the yields of important amino acids (FCA 22 1007)

514 Dzanagov, K B, Dzanagov, S K, Teziev, T K 1969 *Effect of Mineral Fertilizers on the Level and Amino Acid Composition of Crude Protein in Corn Seed* Agrokhimiya, No 4, 14 17 (Russ) (Gorsk Sel'skokhoz Inst, Ordzhonikidze)

Fall P K plus spring N fertilization (30 120 quintals/ha) increased the yield of corn, the increase being dependent on the level of applied N The content of crude protein increased 1 7 1 9 times over that of the control Various levels of N fertilizer affected differently the amino acid composition of crude protein of the corn seed (CA 71 29635n)

515 El'kenbard, A G 1963 *The Effect of Manganese and Zinc on the Protein Content of Corn by Treatment of the Seed Industrially* Mikroelementy v Zhizni Rast, Zhivotn i Cheloveka, Tr Koordinats Soveshch, pp 177-86 (Russ)

TMTD fungicide (1 kg/metric ton corn seed) was added to 0 05% $MnSO_4$, and mixed For treatment with Zn, 0 04% $ZnSO_4$ was used, and with B 0 02% $Na_2B_4O_7$ In another variation, 5 g phosphobacterin was used/20 kg of seed Control plots and plots seeded with seeds dusted manually with trace elements were used for comparison The simultaneous treatment of the seeds with trace elements, bacterial fertilizers, and fungicide increased the yield and the protein content of corn Application of Zn and Mn increased protein by 20% 30%, sometimes up to 60% The bacterial fertilizers alone increased yield but not the protein content (CA 64 8884a)

516 Epanchinov, V V 1970 *Effect of Mineral Fertilizers on the Accumulation of Some Group B Vitamins in the Soil of the Corn Root Zone* Pochvovedenie, No 5, 68 75 (Russ) (Krasnoyarsk Sel'skokhoz Inst, Krasnoyarsk)

Field and pot experiments were set up with different doses and combinations of N P K Soil analyses were made and corn

yields determined Vitamins of the B group, nicotinic acid, thiamine, pyridoxine, and biotin, were microbiologically assayed The contents of vitamins in the soil adjacent to the corn roots varied with different fertilizer ratios and with the time of the growth period The activity of soil microorganisms involved in vitamin accumulation in the soil was enhanced by fertilizers and the productivity of the corn plants increased The B vitamins favored the more intensive resorption of mineral substances by roots An interrelation may thus be assumed between mineral fertilizers and vitamins (CA 73 87054z)

517 Filev, D S, Pashova, V T, Yaroshevich, I V 1968 *Effect of a Single Application of High Rates of Fertilizers on Productivity of Maize and Soil Properties* Dokl Vses Akad Sel' khoz Nauk, No 12, 2-4 (Russ) (Vses Nauchno Issled Inst, Kukuruzy)

In 1959 1960, 250 tons/ha dung + 50 quintals super, or 500 tons dung + 100 quintals super was applied to an ordinary chernozem in the Ukrainian wooded steppe In 1960 1962, maize was irrigated when necessary, but in 1964 1968 there was no irrigation The single applications of fertilizer increased the contents of humus, total N, and P in 1968, particularly in the 20 60 cm layer of soil, and also sharply increased the contents of hydrolyzable N, mobile P, and exchangeable K Fertilizer increased the urease activity of the soil, and urease activity in the 20-60 cm layer was higher with the higher rate of fertilizer than with the lower rate Fertilizer decreased saccharase and phosphatase activity in the top 40 cm of soil, but increased their activities lower down CO_2 release by the soil was 46% 38% greater with fertilizer than without it Fertilizer increased the contents of nicotinic acid and inositol in the soil and tended to increase the pyridoxine content Fertilizer did not increase average maize-green yield in 1964 1968 (SF 33 3183)

518 Gaevoi, A I 1968 *Effect of Molybdenum on Grain and Fresh Matter Yields of Maize* Khim sel' Khoz 6(8) 15 16 (Russ)

In trials during 2 years, presowing treatment of seeds of hybrid maize VIR-42 with 18 g $(NH_4)_2MoO_4$ in 5 liters water/100 kg seeds, or with water alone, increased the grain yields over those obtained by sowing untreated seeds, by an average of 3 7 and 0 5 hkg/ha, respectively Mo treatment markedly increased the Mo content, 1,000 grain weight, and percentage germination of the resulting grain (FA 2 1139)

519 Gnilitskaya, A B 1967 *Effectiveness of Presowing Treatment of Corn Grains with Copper Sulfate During Application of Mineral Fertilizers in Various Ways* Mikroelem Sel Khoz Med, No 3, 81-6 (Russ) (Lugansk Sel'skokhoz Inst, Lugansk)

Field trials, lasting 3 years, were carried out to study the effect of Cu sulfate treatment on yield and growth of corn in normal chernozem under different climatic conditions, applying several combinations of fertilizers The grains were dusted preliminarily with Cu sulfate at a concentration of 300 mg Cu/kg The effect was investigated on respiratory enzymes, pigmentation, yield of grain, and grain quality Contents of chlorophyll and carotene, catalase activity, and aerial growth were also given The treatment with Cu sulfate apparently raised the yield of corn, during dry as well as climatically balanced years, by 1 43 2 84 centners/ha The response increased with the application of small amounts of fertilizer, the best result being obtained when the fertilizer was plowed in at a depth of 12 14 cm The use of Cu sulfate also resulted in an increase of the protein (0 25% 1 05%) and starch (5 4%-8 0%) content of the grain (FA 2 277)

520 Godnev, T N, Abutalybov, M G, Gummatov, M R 1969 *Effect of the Quantity and Ratio of Iron and Manganese on the Growth and Development of Corn* Vestsi Akad Navuk Belarus SSR, Ser Biyal Navuk, No 2, 42 5 (Beloruss) (Inst Bot, Minsk)

When deprived of Fe the development of corn plants in laboratory experiments was at first normal, but within a few days chlorosis appeared, disappearing only partially with the addition of Fe salts The best results were with 9 mg Fe/l The feeble growth of corn on media deprived of Mn ended gradually in chlorosis also, differing from Fe chlorosis in that yellowing appears at first between veinlets The plants required 4 5 mg/l Mn in form of $MnSO_4$ Excess Mn decreases the plant levels of Fe The normal Fe/Mn ratio is 2 1 Field experiments showed the positive effects of these elements at 20 kg $FeSO_4$/ha and 10 kg $MnSO_4$/ha, despite sufficient levels of them in the soil (CA 71 37988v)

521 Goncharenko, D F 1969 *Effect of Presowing Application Fertilizer on the Growth, Development, and Productivity of Corn* Khim Sel Khoz 7(3) 169 74 (Russ) (Krasnograd Opyt Sta VNII Kukuruzy, Krasnograd)

Application of fertilizers [NH_4NO_3, $NaNO_3$, $(NH_4)_2SO_4$, granulated superphosphate, KCl, and K_2SO_4] at sowing of four corn varieties to heavy loamy soils of the Krasnodarsk district significantly influenced their growth and development, especially in first stages of 5 8 leaves N P fertilizers gave the best results, whereas effects of P alone were worse and full N P K fertilizers in dry years even inhibited growth The best N fertilizers were NH_4^+ and $(NH_4)_2SO_4$ Superphosphate improved the resistance of corn to unfavorable meteorological conditions, whereas K fertilizers slowed down the appearance of pistils and thus worsened pollination In dry years, fertilization at sowing increased the yields, mainly due to increased number of corncobs, whereas in years with favorable conditions, the increased yields were also due to increased number of grains in corncobs (CA 71 29672x)

522 Goncharenko, D F 1969 *Initial Nutrition and Corn Yield as Connected with Fertilization Done at Sowing* Agrokhimiya, No 4, 61-5 (Russ) (Krasnograd Opytn Stan, Krasnograd, Khar'kov Obl)

In field trials in dry areas of the Khar'kov province, Ukraine, the application of small amounts of P (5 kg P_2O_5/ha) as superphosphate in the rows at sowing increased the uptake of N and P by maize plants (hybrid cv VIR 25) and increased grain yields from 35 o hkg/ha (6 year average) unfertilized, to 39 6 hkg NP at 2 5 kg N and 5 kg P_2O_5/ha gave smaller yield increases, still smaller increases were obtained from NPK

523 Gorbunova, L L 1965 *Effectiveness of Potassium Fertilizers on the Leached Chernozem of the Lori Plateau of Armenia* Agrokhimiya, No 7, 47 55 (Russ)

K fertilizer had a positive effect on wheat resistance to cold N P fertilizers doubled the yield of wheat, and the addition of high K doses with N P fertilizers increased the yield an additional 50% For potatoes cultivated on a leached chernozem, the most effective K containing amendment was KCl (60 kg K_2O/ha) When used individually, K_2CO_3 and KCl increased the yield of corn to a greater extent than when used together The relative effectiveness (in decreasing order) of K containing amendments which enhanced the yield of broad beans was K_2SO_4, KCl, K_2CO_3, and K Mg fertilizer (CA 64 10355g)

524 Goryunova, F A, Polugar, E A 1967 *Removal of Nutritional Elements for Maize as a Function of the Preceding Input of Fertilizers* Povyshenie Plodorodiya Pochv Nechernozemnoi Polosy, No 3, 130 34 (Russ)

The increase of fertilizers to a certain limit raises the uptake of N, P, K, and Ca by the plant The requirement and removal of mineral food elements vary with the biological characteristics of the corn brands and hybrids With 300-450 centners/ha of crop, in the green mass of corn, the removal of N ranges 90 190, of K 50 118, and of P 30 70 kg/ha, depending on the fertilizer dose and composition (CA 68 21284q)

525 Grebenikov, P E, Zakharyan, N A 1967 *Effect of Fertilizers on Yield and Chemical Composition of Maize* Khimiya sel' Khoz, No 7, 12 13 (Russ) (Azerbaidzhan Sel' Khoz Inst Baku)

Maize grown on chestnut medium loam soil, poor in P, was given N, P, K, and farmyard manure at different rates and times The highest grain yields, 60 7 hkg/ha, resulted from applying 100 kg N, 100 kg P plus 60 kg K/ha on three dates before sowing, 3 to 4 leaf stage, and at the tillering stage, grain yields resulting from 20 tons farmyard manure/ha applied before plowing did not differ significantly The highest contents of crude protein and ash in the grain resulted from 10 tons farmyard manure/ha plus 60 kg each of N and P/ha, in fresh matter, however, these values were maximum in the treatment which gave the highest grain yield (FCA 21 112)

526 Groshkov, P A, Kravchenko, S N 1966 *Effect of Fertilizers on the Uptake of Nutrients, Growth, and Yield of Corn* Agrokhimiya, No 6, 59-68 (Russ) (Ukrainian Acad Agr, Kiev)

Fertilizers containing N, P, and K have been applied separately and in combinations N has the greatest influence on the rate of the total growth, K the least N prolongs the period of vegetative growth, K the least N prolongs the period of vegetative growth, K and P have the opposite effect P and K increase the rate of growth during the period of spadix formation The greatest uptake of N and K occurs during the period from the 9 10 leaf phase to the phase of panicle formation, 55% 60% of the total N and 60% of the total K are absorbed during this period The greatest uptake of P occurs in the period from the 9 10 leaf stage to the milky stage, during which 50% of the total P is absorbed The most intense growth and the highest yields have been achieved by the simultaneous application of N, P, and K (CA 65 14374h)

527 Gulyakin, I V, Semenov, P Y, Chupnikov, Y K 1965 *The Effect of Manure and Mineral Fertilizers on the Properties of Sod-Podzolic Soils and on the Yield of Corn Crops Grown without Rotation* Dokl TSKhA, No 103, 113 17 (Russ) (Timiryazevsk Sel'skokhoz Akad)

Four year field experiments were carried out to determine the effect of fertilizers on the properties of the sod podzolic soil and on the yield of the corn crop The treatments were control, (1) manure (40 tons/ha), (2) N P K (200 100 240), (3) manure (40 tons/ha) with N P K (200 100 240), (4) manure (20 tons/ha) with N P K (100 50 120), and (5) manure (80 tons/ha) Corn foliage yield data showed that the mineral fertilizers alone were less effective than manure alone or supplemented with mineral fertilizers Treatment (2) increased the content of available N in the soil to a greater extent than it increased the available P Treatments (1), (3), (4), and (5) produced a much better balance between available N and available P, as compared with treatment (2) (CA 65 7956e)

528 Gulyakin, I V, Semenov, P Y 1965 *Use of Nitrogen, Phosphorus and Potassium by Corn Plant, and the Effect of Mineral Fertilizers and Lime* Dokl TSKhA, No 103, 181-84 (Russ) (Timiryazevsk Sel'skokhoz Akad)

Tests were conducted in pots containing 6 kg of soil with applications of NH_4NO_3, $Ca(H_2PO_4)_2$, and KCl fertilizers in doses of 2 g N, 1 g P_2O_5, and 1 g K_2O/pot The soil was limed with $Ca(OH)_2$ Large doses of N and K inhibited the plant processes of synthesis resulting in a decrease of crop yield The use of Ca^{++} did not give any improvement Corn uses the most of the N and K during the first stage of growth (CA 65 9676d)

529 Guseinov, B Z, Mamedova, Z Y, Mamedov, A M 1966 *Effect of Trace Elements on Nitrogen Metabolism of Corn Under Various Levels of Soil Moisture* Izv Akad Nauk Azerb SSR, Ser Biol Nauk, No 4, 3 6 (Russ)

The effect of low doses of B, Mn, and Mo on total N, protein N, nonprotein N, and ammonia N was studied in roots, stems, and leaves of young corn seedlings and of mature flowering plants grown in the same soil under conditions of 40% and 60% relative humidity Although all these applied elements increased the protein content in all instances, there were some differences according to developmental stage and moisture content of the soil In young seedlings at a high moisture level, Mn was the most effective, and Mo was the most effective at a low moisture level In mature corn plants, applied Mo was effective at both moisture levels (CA 66 85107a)

530 Gvozdikovskaya, A T, Parshikov, V N 1969 *Absorption of Nitrogen, Phosphorus and Potassium by Plant Roots at Different Temperature Gradients* Ukr Bot Zh 26(3) 62 6 (Ukr) (Inst Fiziol Rosl Akad Nauk Ukr SSR, Kiev)

In young plants of maize grown in sand and solution cultures, the maximum uptake of NH_4^+, K^+, NO_3^-, and PO_4 was observed under temperatures ranging from 27 to 30°C, 25 to 28°, 29 to 32°, and 23 to 27°, respectively (FCA 23 228)

531 Il'in, S S 1965 *Utilization of Nutrients from Fertilizers*

and Soil in Crop Rotation Khim v Sel'sk Khoz 3(12) 2 6 (Russ) (Ped Inst , Kazan)

Field tests of crop rotation were conducted on gray sod medium podzolic soils of Kazan district Crops rotated were peas winter rye, corn summer wheat Fertilizing increases the content of N, P, and K in plants, the greatest amounts of nutrients from the soil are taken up by the corn plant and pea, much less by winter rye, and the least by summer wheat Assimilation of atmosphere N is also improved due to the symbiosis of nodule bacter with legumes The first crop rotation gave only a slight assimilation of nutrients from the soil but repeated fertilizing during the second crop rotation increased the absolute as well as the relative utilization of fertilizer components (CA 64 11810b)

532 Ishevskaya, I M 1965 *The Effect of Perennial Application of Fertilizers on the Growth Development and Yield of Corn Crop* Dokl TSKhA, No 101, 99 104 (Russ) (Timiryazevsk Sel'skokhoz Akad)

The effect of perennial application of fertilizers on the corn crop was studied The arrangement of the experiment was control, N, N K, N P K, manure, manure with N P K More vigorous corn growth was observed in all plots treated with fertilizers or manure as compared with the grown of control plants The increase of the foliage yield as compared with the controls for N P K, manure and for manure with N P K was 209, 395, and 389 centners/ha , respectively The assimilation of N, P_2O_5, and K_2O by the corn plants from the soil was affected by the type of the fertilizers The highest increase of N content to 1 25% from 1 13% of the control was observed in the N P K plots The highest increase of P_2O_5 0 67% was observed in the plot treated with manure, compared with the control 0 38% The highest increase of the content of K_2O from 0 39% (control) to 2 20% was observed in the plots treated with manure supplemented with N P K The protein of the whole plants was increased by fertilizers in all plots, with the highest increase to 5 95% in plots treated with N P K compared with the control 4 30% (CA 65 6242c)

533 Ishevskaya, I M 1965 *The Effect of Prolonged Additions of Superphosphate on the Yield and Chemical Composition of Corn* Dokl TSKhA, No 102, 53 60 (Russ) (Timiryazevsk Sel'skokhoz Akad)

Prolonged additions of superphosphate containing N and K increased the rate of growth, the yield of corn and silage material, the total and organic P, the total and protein N, and K (CA 65 9676a)

534 Ivanko, S , Maksianova, A 1968 *The Effect of Nutritional Conditions on Root Metabolism and the Quantitative and Qualitative Composition of Nitrogenous Compounds Translocated from the Roots to the Aerial Parts of Plants* Isotope Studies on the Nitrogen Chain, 149 68 IAEA, Vienna, Austria (Eng)

Experiments were carried out with maize cultivated under normal conditions of nutrition and under conditions of N and P deficiency The results obtained show that a deficiency of these elements has a very marked effect on root metabolic processes connected with the uptake, conversion, and translocation of N Under conditions of N deficiency the amount of amino acids translocated from the roots to the aerial parts of the plant drops sharply This is accompanied by a marked change in the qualitative composition of the amino acids, which ultimately affects the operation of the synthesizing mechanism of the aerial organs After addition of N to 30-day maize plants, rapid amino acid synthesis in the roots was observed, and the amount of free amino acids translocated from the roots to the aerial parts increased by a factor of 12 in the 2 hours following addition of the N With the use of ^{15}N, introduced into the nutrient medium as ammonium nitrate and calcium nitrate, it was found that the N taken up by the roots was preferentially incorporated into the amino acids and amides originating from the ketonic acids of the Krebs cycle Of the total amount of amino acids translocated from the roots to the aerial parts, more than 50% was accounted for by glutamine, alanine, and aspartic acid The results obtained give grounds for believing that variations in the conditions of nutrition affect the N metabolism of plants mainly through the metabolism of nitrogenous substances in the roots (FA 2 885)

535 Ivanko, S , Mikhalik, I 1967 *Study of the Uptake, Assimilation, and Transport of Phosphorus by Corn Roots* Isotopes in Plant Nutrition and Physiology , Proc Symp FAO/IAEA, Vienna, 1966, 289 301 (Eng)

Maize plants were grown on complete Knop's nutrient solution and on the solution without P Plants of both types were transferred after 19, 24, 29, and 40 days to a complete nutrient solution with an activity of 0 5 μC ^{32}P/ml With exposures of from 5 seconds to 5 hours, a positive correlation was observed between uptake of total P and the incorporation of ^{32}P into high molecular organic P compounds (precipitated by 7% trichloroacetic acid) The roots of the 19 24 day old plants grown without P absorbed twice as much P as the roots of the NPK plants After 29 days there appeared in the P deficient plants a critical phase, manifested in a reduced capacity to take up P and incorporate it into high molecular organic compounds By vacuum filtration introduction of ^{32}P into the roots, it was established that the P introduced is incorporated into the following low molecular organic compounds nucleotides, triose phosphates, and hexose phosphates It is concluded that uptake of ^{32}P by maize roots is directly related to its use in the synthesis of low molecular and high molecular organic compounds There is also a positive correlation between the transport of P compounds from the roots to the above ground organs of the plant and the curves for the uptake of P and its incorporation into organic compounds in the [illegible] roots The critical phase when the roots lose their ca[illegible] for uptake, for synthesizing P organic compounds, and for transporting them to the parts of the plant above ground is directly dependent on the P content of the nutrient medium (FA 1 285)

536 Ivanov, N P 1968 *The Effect of Organic Fertilizers on the K Uptake of Plants* Izv Akad Nauk Belorus SSR (Ser Biol Nauk), No. 4, 32-4 (Beloruss) (Belorus Inst Zhivotnov , Smolevichi, Minsk Obl)

In pot trials with maize, K uptake was studied using ^{86}Rb Organic fertilizers and lime decreased the uptake of K by maize plants More K accumulated in young than in old leaves (FCA 22 1817)

537 Kalmykov, A G, Nedbailo, E P• 1965 *Effect of Fertilizer on the Yields in Corn–Winter Wheat Crop Rotation* Pochvovedenie, No 6, 84 9 (Russ)

The experiment was conducted on a carbonate chernozem soil in the State Farm "Samarskii" using as test crops corn for silage purposes and winter wheat as the follow up crop NH_4NO_3, superphosphate, and KCl were used as fertilizers at the rate of 30 kg/ha and manure at the rate of 5 tons/ha The supply of K was adequate for the normal development of corn At 9 10 leaves, the amount of K in the soil was decreased, this is explained by the increased K requirement by the plant At the stage of milk wax ripeness of the plant, the soil K was increased Hydrolyzable N increased at the beginning of the vegetative period up to the flowering stage, this is explained by the more intensive microbiological activity of the soil The decrease in the hydrolyzable N that followed up to the end of the vegetative period may be explained by the strong drying up of the soil and the consequent depression of the microbiological processes Corn takes up soil P from the beginning to the end of the milk wax ripeness stage at the end of the vegetative period, the soil P content is decreased On the carbonate chernozem soil, corn was very responsive to P and N P fertilization The highest yield per unit of fertilization was obtained by introducing superphosphate and manure with the planting, KCl had no noticeable effect on yield The dynamics are identical with those of hydrolyzable N, but the decrease at the early period of vegetation is more acute Under the conditions of the preceding applied fertilization of corn, the yield of the follow up crop winter wheat increased about 10% Additional application of superphosphate in the autumn had little effect on the winter wheat, since P fertilizers are nonlabile in carbonate soils (CA 63 9008g)

538 Karasyuk, I M, Lopatin, L V 1967 *Comparative Efficiency of Liquid Nitrogenous Fertilizers During Application Under Corn* Visn Sil's'kogospod Nauki 10(1) 52 6 (Ukr) (A M Gorkii Agr Inst, Uman)

Plants were grown on unfertilized soil (1) on soil fertilized with standard P K fertilizers (2), and on (2) soils with the addition of N fertilizers (3) of 30, 60, and 90 kg/ha N fertilizers used were NH_4NO_3, urea, $(NH_4)_2SO_4$, NH_4OH, and $(NH_4)_2CO_3$ Application of NH_4OH and $(NH_4)_2CO_3$ increased considerably the height of grown plants, increased the surface area of their leaves, and increased the amount of chlorophyll The chlorophyll contents of plants were on soil (1) 1 1% 1 2%, on soil (2) 1 28% 1 47%, on soil (3) with addition of NH_4NO_3 1 36% 1 80%, with urea 1 50%-1 80%, with $(NH_4)_2SO_4$ 1 84% 2 03%, with NH_4OH 1 92% 2 02%, and with $(NH_4)_2CO_3$ 1 83%-2 17% The increased amount of chlorophyll increased the photosynthetic energy and N availability to the plants, followed by better conditions for evaluation of assimilation products, formation of reproductive organs, and accumulation of protein in seeds Average amounts of protein in seeds were in plants grown on soil (1) 8 7%, on soil (2) 9 0%, on soil (3) with the addition of NH_4NO_3 9 4% 10 4%, with urea 9 8%, with $(NH_4)_2SO_4$ 9 2% 9 8%, with NH_4OH 9 2 10 1%, and with $(NH_4)_2CO_3$ 9 5 10 4% Yield of seeds increased on soil (2) 2 8%, on soil (3) with the addition of NH_4NO_3 3 0% 5 8%, with urea 5 1% 8 2%, with $(NH_4)_2SO_4$ 4 4% 7 2%, with NH_4OH 7 4% 9 1%, and with $(NH_4)_2CO_3$ 7 4% 10 3% Introduction of NH_4OH increased soil pH to 6 8, and introduction of NH_4NO_3 only to 5 8 Increase of pH gives better conditions for development of soil microorganisms, and improves nutrition of plants Fertilizing in the presowing periods gives lower crop of seeds than fertilizing in autumn (CA 66 104415t)

539 Khomenko, A D 1968 *Agrochemical Characteristics of the Use of Complex Mineral Fertilizers* Vestn Sel'skokhoz Nauki (Moscow) 13(11) 1 9 (Russ) (Inst Fiziol Rast, Kiev)

From 1958 to 1967 >100 field studies were made with complex fertilizers and winter wheat, beet, corn, potato, in different Ukrainian soils and climates Use of nitrophos, nitroaminophos, and diaminophos increased the sugar content of beets by 0 4%, the protein content of winter wheat by 1 0%, and the starch content of potatoes by 0 5% N P K (1 4 2) gave higher yields of root crops H_2SO_4 based nitrophos and nitroaminophos gave higher yields of beets than normally obtained with simple mixtures of N P K fertilizers Beets consume 12% more nitrophos and 4% more nitroaminophos than the corresponding normal consumption of simple N P K mixtures in the same proportions On relatively dry soils the complex fertilizers gave better yields and quality Comparative studies of use of nitrophos and superphosphate in otherwise similar conditions showed that more P was absorbed by the plant more evenly from the nitrophos than from the superphosphate The explanation for this is that the nitrophos contains both H_2O soluble and citrate soluble P, while the superphosphate contains only H_2O soluble P (CA 70 114280s)

540 Khomenko, A D, Sosnova, O N, Dubik, E A, Guseva, E E 1968 *Effect of Complex, Atrazine Containing, Manganese- and Mineral Fertilizers on Corn Plants* Mikroelem Sel Khoz Med, No 4, 129 36 (Russ) (Inst Fiziol Rast, Kiev)

Experiments were carried out on leached chernozem and gray forest soils to study the effect of Mn fertilizers and atrazine on corn yields The basic fertilizer was either in the 1 1 1 or in the 1 1 5 1 ($N\ P_2O_5\ K_2O$) ratio, with atrazine applied at 2 5 kg/ha The fertilizer contained 1% Mn as $MnSO_4$ Mn in the chernozem increased the assimilating surface of corn leaves An increased amount of soluble sugars appeared in the leaves, chlorophyll content and the photochemical activity of chloroplasts were enhanced Atrazine inhibited corn growth at the start, but during formation of reproductive organs growth was intensified The NPK + Mn + atrazine fertilizer gave the highest plant weight On gray forest soils atrazine stimulated the development of plants and the Mn atrazine combination increased the grain size In a field test Mn atrazine increased the grain yield by 420 kg/ha and that of stalks by 990 kg/ha (CA 71 60233d)

541 Khomenko, A D, Sosnova, O N 1968 *Effect of Complex Fertilizers Containing Added Polymers and Biologically Active Substances on Corn and Potato Growth* Visn Sil's'kogospod Nauki 11(7) 49 53 (Ukr) (Inst Fiziol Rast, Kiev)

Granulated complex fertilizers containing a derivative of urea, double superphosphate, K_2SO_4, trace elements, the Mn containing herbicides, atrazine and simazine, and the insecticide, heptachlor, were more effective in producing

potatoes and corn than simple ones The pesticides not only controlled weeds and insects, but also stimulated N absorption by the plants (FA 2 117)

542 Khomenko, A D, Sosnova, O N, Yavorskaya, T K, Odeyanenko, L V 1968 *Effect of Complex Fertilizers Containing Pesticides on the Growth and Productivity of Corn, Sugar Beets, and Potatoes* Fiziol Biokhim Osn Pitan Rast, No 4, 46 56 (Russ) (Inst Fiziol Rast, Kiev)

In pot experiments, atrazine, 2 5 kg/ha, strongly stimulated the growth of corn when added to the soil in combination with N P K or nitrophos fertilizers (CA 71 80310e)

543 Klimashevskii, E L 1966 *The Mechanism of Response of Various Varieties of Corn to Root Nutrition* Dokl Akad Nauk SSSR 168(5) 1212 13 (Russ)

Determination of monosaccharides (*I*) in and uptake of ^{32}P by six varieties of corn plants were reported, using high N or high P fertilizers A correlation was found between the level of *I* in the roots and the assimilation of mineral fertilizer elements by corn plants, the varieties that respond most readily to P also have the highest level of *I* in the roots Varieties which have the higher intensity of root respiration also take up the larger amounts of P (CA 65 9675n)

544 Klimashevskii, E L, Karpov, E A, Pisetskaya, N F 1965 *The Relation Between the Activity of the Root System of Various Corn Plant Varieties and Hybrids and Their Reaction to Fertilizing* Khim v Sel'sk Khoz 3(1) 4 8 (Russ)

Field and vegetative experiments were carried out in 1961 1965 on various soils on 200 m^2 plots applying N P K (60 90 60) Ten, 15, and 20 kg pots and fertilizer doses of N 0 15, P_2O_5 0 30, and K_2O 0 15/kg of soil were used for vegetative tests The characteristic properties of the root surface were determined Individual varieties of corn plants reacted very differently on fertilizing, showing an increase of the above ground dry matter during both vegetative and field tests (up to 479% of the control without fertilizers) The development of the plant depended on the physiological active surface rather than on the root system volume, and this factor is proposed to be the indicator determining the reaction of the corn plant variety to fertilizing The amount of the bleeding sap of the roots transferred to the above ground parts calculated in units of active surface (in dry state) was used as the degree of the root system activity ^{32}P was used for experiment (120 μc/l of Knop nutritive solution) The proper selection of plant varieties for culture purposes is of great importance (CA 62 16908g)

545 Klimashevskii, E L 1966 *Unequal Resistance of Different Varieties of Corn to Nutrient Solution Acidity* Agrokhimiya, No. 4, 98 106 (Russ)

Comparative studies were made of the accumulation of organic substances in the foliar parts, photosynthesis activity, and physiological activity of the root systems of different varieties of corn grown in limed and unlimed acid soils treated with N P K fertilizer Hydroponics experiments were also made in studies of the root systems The degree of resistance to high soil acidity differed for each variety Low resistant varieties showed an initial increase in adaptation at a soil pH of 4 2-4 38, later the growth rate was similar to that at pH 6 12 The ratio of the dry weights of the foliar parts and roots was higher in the more resistant varieties Differences in resistance to high acidity and responsiveness to liming were also a function of the correlation of the photosynthesis and respiration processes, this ratio was lower (3 41 3 44) in resistant varieties than in non resistant ones (4 41 4 59) In resistant varieties the decrease in photosynthesis rate and yield was less at low pH than in non resistant varieties Inhibition of the rate of transfer of photosynthesis products from the leaves to the ripening ears and the decrease in chlorophyll content due to the toxic effect of high soil acidity were less marked in the resistant varieties The chlorophyll bond with the protein lipid complex was stronger at pH 4 0-4 3 in the resistant varieties The decrease in cation exchange absorption capacity and the disruptions in biosynthetic processes in the roots due to soil acidity (pH 4 1 4 3) were less in resistant varieties The low resistant varieties had a lower Ca absorption and less Al in the roots, and more Al in the foliar parts Nitrate and ammonia N metabolism in the roots varied with soil acidity and the variety of corn (CA 65 4592d)

546 Kniga, M I, Kniga, N M, Nasonova, M G, Shevchenko, I M 1970 *Effect of Photosynthesis on Corn Productivity in Relation to Soil Fertilizing* Dokl Vses Akad Sel'skokhoz Nauk, No 2, 11 13 (Russ) (Khar'kov Zoovet Inst, Kharkov)

Indexes of photosynthesis were studied at various stages of growth of corn in relation to the fertilizer modifications applied N P K, N P, N K, and P K The levels of fertilizers were N 90, P 25, and K 20 kg/ha Application of N P K, N P, and N K increased productivity In the stage of cob formation the level of dry matter in the leaves reached 31% (N P K), with the content of chlorophyll increasing simultaneously N P K had the best effect on the amount of leaf carotene (CA 73 34291t)

547 Kniga, M I, Kniga, N M 1969 *Incorporation of Potassium and Nitrogenous Substances by Corn as Affected by Fertilizers* Dokl Vses Akad Sel'skokhoz Nauk, No 5, 5 8 (Russ) (Khar'kov Zoovet Inst, Kharkov)

Mineral fertilization was studied by using N P K, N P, N K, and P K at the following levels N 90, P_2O_5 60, and K_2O 40 kg/ha The linear growth of corn was positively affected by N N P had a better effect on the crop yield (dry matter) than did N K and P K modifications A marked decrease in total as well as water soluble K was noted in the aerial parts of the plant during the vegetation stage with all the fertilizers and the highest concentrations of both forms of K in the dry matter and ash of the plant were given by the P K modification Application of fertilizers favored increased total and protein N, depending on the combination of fertilizers used K nutrition without participation of N had only a slight effect on N content Correlation coefficients of K and total N contents were given for three growth stages flowering, milky, and wax ripeness (CA 71 60211v)

548 Kodra, V A 1967 *Simultaneous Use of Humus Superphosphate Granules, Bacterial Preparations, and Trace Elements in Presowing Fertilizers Under Corn* Nauch Tr Aspir, Odess Sel'skokhoz Inst, No 1, 40 8 (Russ)

Response of corn plants to simultaneous use of

superphosphate, bacterial preparations, and trace elements was studied in field trials and greenhouse experiments during 1963 1965 The variants were (1) control without fertilizer, (2) humus superphosphate granules (HSP), (3) HSP + bacteria + B + Mo With (2), the bacterial activity of the soil was intensified and the content of available forms of nutrients increased, absorption and synthesizing activities of the root system were higher from very early growth The yield of seeds increased 22 5% compared with control In the plant sap, concentrations of NO_3 and NH_4^+ decreased, while that of organic N increased as a result of treatment (2) In (3) the amount of organic N increased 29% compared with (1), and yield of seeds increased as much as 7 centners/ha, 15% higher than controls (CA 71 111963b)

549 Kolosova, N A 1965 *Effect of Acidity of Substrate on Plants* Agrokhimiya, No 2, 81-6 (Russ)

Acid, acting on plants outside the nutrient medium in the initial period of vegetation (up to 25th day of growth), markedly decreased the productivity of plants (barley) With increased concentration of H^+, synthesizing processes in the roots were inhibited, incorporation of N, P, K, and Ca in plants was reduced, the growth of the root system suppressed, and carbohydrate, protein, and, to a certain degree, P metabolism were disturbed, causing a decreased content of disaccharides, simple proteins, and nucleoproteins The negative effect of acid medium had long lasting consequences In acidified soils, the mobility of Al, Mg, and other toxic elements increased Plants were most sensitive to the effect of acidity during the early stages of development, productivity of barley decreased to 50% After the first 20 days of growth, acid had no substantial effect on the yield of barley Al 3 mg, in 100 g of sand decreased the total weight of the plants more than 80% and yield of the grains fell to 12 5% Unfavorable factors, insufficient light and insufficient supply of carbohydrates, increased the harmful effect of acidity on plants Insufficient light, besides other unfavorable results, reduced the positive effect of lime on the growth and yield of clover Indian corn, with increased fertilizer loads, endured, without harm, soil with pH 4 7-4 8 (CA 63 9000h)

550 Kolpina, L S, Sivtsev, M V 1967 *Effect of Molybdated and Manganated Superphosphate on the Yield of Corn in Crimea* Mikroelem Sel Khoz Med, No 3, 71-4 (Russ) (Krym Sel'skokhoz Inst, Simferopol)

Field tests were carried out for 3 years with corn on chernozem containing total Mn, available Mn, total Mo, and available Mo at 892, 619, 0 60, and 0 042 mg/kg soil, respectively It was fertilized with 50 kg superphosphate/ha with addition of 200 g ammonium molybdate or Mn sulfate The germination was 93 2% with Mo, 94 8% with Mn, and 83 9% in controls, the loss of seeds through insects and mold was 6 6% with Mo, 5 2% with Mn, and 13 5% in controls The amount of foliage was 25% 32% higher with Mo and Mn than in the control and the surface of the leaves was 20% 22% higher, both due to greater synthesis of chlorophyll Although increased, the yield of kernels was less influenced, increasing 8%-14% above the control The percentage content of raw protein was increased (FA 2 385)

551 Kolpina, L S 1965 *The Influence of Trace Elements on the Yield and Quality of Corn Grains Under Conditions of the Crimean Mountain Foot Hills* Primenenie Mikroelementov v Sel'sk Khoz, Akad Nauk Ukr SSR, 156 61 (Russ)

The experiment was carried out during 1955 1961 on the carbonate soils of the Crimean Agricultural Institute Seeds of corn, hybrid VIR-42, used for the test plant were pretreated by soaking in aqueous solutions of $ZnSO_4$, $MnSO_4$, borax, and ammonium molybdate (*I*) The pretreated seeds were used in eight variants control, $ZnSO_4$, $MnSO_4$, borax, *I*, $MnSO_4$ + $ZnSO_4$, $MnSO_4$ + borax, and $MnSO_4$ + *I* Seeds soaked in solutions of salts of trace elements produced higher weights of the individual corncobs, the individual weight of the grain, and also the absolute weight of the grain Pretreatment of seeds also increased the yield of corn, the highest yield was obtained from $MnSO_4$ pretreatment Furthermore, the trace elements have shown their influence on the chemical composition of the seed such as fat, protein, and cellular tissues Tables show the influence of the pretreated seeds on yield and quality of the plant (CA 63 13994b)

552 Korchagin, V A, Proshkin, V A 1968 *Fertilization of Corn in the Steppe Districts of the East Bank of the Middle Volga River* Khim Sel'skom Khoz 6(7) 10-13 (Russ)

553 Korovin, A I, Dul'binskaya, D A 1968 *Characteristics of P and N Nutrition of Maize at the Pre Emergence Stage Under Low Temperature* Agrokhimiya, No 2, 107 11 (Russ) (Vost Sibir Biol Inst, Irkutsk)

Low contents of P in the organic acid soluble and nucleoprotein fractions, and N in the albumin fraction in the endosperm and coleoptile during germination at 10 12°C were associated with low mobilization and utilization of these elements from the seed reserve and with slow absorption from the soil Phosphorylating activity of the mitochondria cells in the coleoptile was low at low temperature (10 12°) (FCA 21 1700)

554 Korovin, A I, Panitskii, V V, Dul'binskaya, D A, Kozlyukova, N B 1966 *Effect of High Doses of P and N Fertilizers on Metabolism and on Corn Yield* Izv Sib Otd Akad Nauk SSSR, Ser Biol Med Nauk, No 3, 52-6 (Russ) (Vost Sib Biol Inst, Irkutsk)

A field experiment was carried out with corn to study the possibilities of an intensification of the metabolism of P and N and the growth of the plants in Siberia The experiment was performed on a woodland soil, containing sufficient nutrients, in five variants without fertilizers, N P K, 90 kg of each, N P K, 270 kg of each, N + P K, 270 kg of N and 90 kg each of P_2O_5 and K_2O, P + N K, 270 kg of P and 90 kg each of N and K_2O The highest yield was obtained with the fifth variant The content of P and N in the plants at the beginning of growth depended to a considerable degree on their content in the soil The content of inorganic P depended on the dose of fertilizer and the relation between P and N The highest contents of acid soluble, nucleoproteinic, and lipid P were found in the variants with high doses of P These fractions decreased with increased dose of N The highest content of N, especially proteinic, was found in variants with high doses of P, the highest nonprotein N in variants with high doses of N A certain level of P in the plants is required for the incorporation of nonprotein N into proteins The weak growth of corn in the

cold period at the beginning of growth in East Siberia was caused by slow transfer of P from the soil into the plants Application of high doses of P fertilizers in N P K is a way to intensify the transfer of P into the plants (CA 67 2446g)

555 Korovin, A I, Glyan'ko, A K 1968 *Effect of Temperature in the Root Zone on Uptake of Ammonium- and Nitrate-Nitrogen by Plants* Dokl Akad Nauk SSSR, 180 1495 96 (Russ) (Sibir Inst Fiziol Biokhim Rast Sibir Otd Akad Nauk SSSR)

Eighteen day old wheat and maize seedlings in 25% nutrient solution were transferred for 120 hours to 50% nutrient solution at 1 0 1 5°C, 5°, 10 11°, and 15 16° Changes in the concentrations of NH_4 N and NO_3 N in the nutrient solution showed that uptake of NO_3 N by wheat exceeded that of NH_4 N at 15 16°, whereas below 10° the reverse was true The initial pH of the nutrient solution was 5 25, but after 72 hours had become 4 45 at 10 12° and 5 7 at 20 22° Nitrate reductase activity in wheat roots at 5 7°C was only 50% of that at 20 22° (SF 31 4309)

556 Korovin, A I, Maricheva, E A, Frolov, I N 1968 *Effect of Temperature in the Rooting Zone on Nutrient Uptake by Plants* Dokl Akad Nauk SSSR 183 227-29 (Russ) (Sibir Inst Fiziol Biokhim Rast Sibir Otd Akad Nauk SSSR)

Up to the 4 leaf stage, maize was grown in half strength nutrient solution at 15°C by night and 25° at mid day The seedlings were then transferred first to tapwater for 24 hours, secondly to tapwater at 1, 5, 10, 15, 20 25, or 30° for 24 hours, and finally to half strength nutrient solution for 5 days Nutrient uptake during these 5 days was the same when measured by the changes in the concentration of the nutrient solution as when measured by the nutrient concentrations in the seedlings on the 6th day Uptake increase as the root temperature increased, but increases in uptake were different for different nutrients at different temperatures There was practically no growth by cell division below 8° Uptake of N, S, P, and Ca was greatest at 20 25°, but K uptake was greatest at 30° (SF 32 1385)

557 Korovkina, A V, Kozhemyakina, G A 1965 *Ratio of Nitrogen and Phosphorus in Fertilization and Growth of Corn* Vestn Sel'skokhoz Nauki, Min Sel'sk Khoz SSSR 10(4) 94 6 (Russ) (K A Timiryazev Agr Acad, Moscow)

In pot tests on sod podzolic soil, fertilization of corn with a basal formula of 2 g N and 1 5 g K_2O led to a depression of growth and increase in sensitivity to low temperature during the initial 25 days of growth in comparison with unfertilized controls Growth was improved by addition of P_2O_5 in an N/P_2O_5 ratio of 0 5 1 in the initial phase and 1 1 in the later stages of growth The depressant action of N can be avoided by adding it in half doses on the 15th and 30th days of growth At an N/P_2O_5 ratio of 4 1 the plants contained 2 88% N and the uptake was 665 3 mg, in contrast to 2 31% and 1,238 mg at a ratio of 1 1. (CA 65 1338e)

558 Kostyuk, M D 1967 *Absorption and Distribution of Carbon-14 Under Different Conditions of Root Nutrition of the Corn* Dopov Akad Nauk Ukr RSR 29(8) 743-46 (Russ)

The influence of different concentrations of K in Prianishnikow's nutrient mixture on leaf respiration, absorption, and distribution of carbon 14 in plant organs was studied The increasing of K concentration in nutrient mixture results in lowering respiration intensity, increasing photosynthetic C absorption, and intensifying assimilate outflow This tendency of metabolism leads to an increase in plant productivity (FA 1 1669)

559 Kozhekov, D, Lazareva, M, Abasova, L, Kulikova, V, Kovaleva, Y 1968 *Influence of Coal Humic Fertilizers on the Yield of Corn and Sugar Beets on Sierozemic Soils* Sov Soil Sci, No 8, 1128 37 (Eng) (Kirghiz Scientific Res Inst Agr)

Experimental data are presented on the influence of coal humic fertilizers on the yield of corn and sugar beets in the Sierozemic soil zone of the Chu River valley in the Kirghiz SSR It was found that coal humic fertilizers at low rates of application do not assure constant increased yields At high rates of application, the increased yield results chiefly from the N and P present in the fertilizers No stimulating effect of the humic fertilizers was observed (FA 2 1400)

560 Kravchenko, S N 1966 *Effect of Mineral Fertilizers on Yield and Quality of Corn* Khim Sel Khoz 4(10) 5 8 (Russ)

On dark gray podzolized soils, N P K fertilizers enhanced the growth of maize, when given singly, N was of greatest effect, followed by P and K P in all combinations accelerated spring flowering and seed formation by 4 6 days Highest protein content (20%) in the leaves was attained by simultaneous application of N and P fertilizers Mineral fertilizers increased the size and seed number of the cobs and the seed weight (maximum 338 g/1,000 seeds) The greatest crop increases were found with N P K in combination with manure The quality of the corn was influenced but little, highest protein (46 6% increase) and fat content were found with N P and N P K (CA 66 18354r)

561 Kremnina, A N 1969 *Effect of Mineral Nutrition on Water Exudation by Maize Roots* Fiziol Rast 16(4) 626 31 (Russ) (Vses Inst Kormov, Lugovaya, Moscow)

In sand and soil pot cultures, the inflow of water from maize tops to the roots was greater and exudation of root water to the substrate less rapid when N, P, and K fertilizers were applied simultaneously than when they were applied separately D_2O (heavy water) was used to measure exudation (FCA 23 226)

562 Kuznetsov, N I 1966 *Effect of Copper, Molybdenum, and Cobalt on the Yield and Quality of Corn* Mikroelem Zhivotnovod Rast, Akad Nauk Kirg SSR, 141 50 (Russ)

Wetting of corn seeds with a 0 01% $CuSO_4$ $5H_2O$ solution increased crop yield and the protein content of the crop The application of Mo to light chestnut soils and in gray soils reduced the yield and the crop protein content, but wetting of corn seeds with a 0 01% $(NH_4)_2MoO_4$ solution in meadow soils increased yields Wetting of corn seeds with $CoSO_4$ increased yields only slightly, while the crop protein content increased, however, the fat and ash contents remained constant (CA 66 64689b)

563 Kuznetsov, N I 1965 *Fertilization of Corn with Boron.*

Mikroelem Zhivotnovod Rast, Akad Nauk Kirg SSR, No 4, 93 103 (Russ)

Corn plants were treated with various forms of B fertilizers B had a positive influence on grain and green mass yields of corn grown on three soil types (gray, light brown, and meadow soil, respectively) Protein and fat contents in grain were increased and ash decreased under the influence of B B was effective either when seeds were rinsed in 0 02% H_3BO_3 or when plants were sprayed with the solution Good results were also obtained when B was added to soil The uptake of B rose with increase of doses of basal fertilizers (N, P, and K) (CA 63 7614g)

564 Ladonina, T P 1966 *The Effect of Mineral Fertilizers on the Absorptive Ability of Roots* Sel'skok Biol 1(4) 559 63 (Russ) (All Union Sci Res Inst Fertilizer and Soil Sci, Moscow)

Corn roots were cut in 1 cm lengths and placed in 0 2% Ca nitrate for 1 hour After rinsing, the adsorbed nitrate in the roots was determined by soaking the roots for 2 hours in distilled water and determining the nitrate in the water The roots took up ions by a metabolic process of active absorption and by passive diffusion The former process occurs in the zone of the root hairs and the latter in the older root portions In soils with natural fertilization, metabolic processes predominate, with application of mineral fertilizers, the amount of passive uptake increases (CA 66 54629t)

565 Lapshina, A N, Mosolov, I V 1967 *Metabolism and Corn Yield as Related to Nutrition and Soil Moisture* Agrokhimiya, No 7, 56 61 (Russ) (Vses Nauch Issled Inst Udobr Agropochvoved im Pryanishnikova, Moscow)

The effects of dry and wet conditions were studied Corn plants were grown at 65%-70% relative humidity till the appearance of the seventh leaf, later the plants were kept at 40%-90% relative humidity They were fertilized with K_2O and P_2O_5 (2 g each/plant), and 1 5 or 3 0 g NH_4NO_3 Both dry and wet conditions decreased the weight of aerial parts of corn plants and the protein content in grain, the weight of roots was slightly increased under the dry conditions Doubling the amount of N increased the weight of grain, and the protein yield and nonprotein N in leaves and roots (CA 67 107729e)

566 Lepnev, D A 1967 *Effect of Organic Manures on Yield of Maize and Nitrification Processes in Leached Chernozems of the Caucasian Foothills* Agrokhimiya, No 2, 58 61 (Russ) (Kursk Sel' Khoz Inst)

Dung applied at 20 tons/ha under the plow increased average grain yield over a 3 year period at least three times more than 10 tons did Simultaneous application of dung and NPK under the plow increased yield more than did dung applied under the plow followed by topdressing with NPK NO_3 N accumulation in soil in spring was greatest when dung + NPK was applied under the plow NH_4 N accumulation was always greatest in the first half of the vegetative period Dung at 5 and 10 tons/ha applied simultaneously with NPK was not more effective than corresponding rates of NPK applied alone under the plow (SF 30 3007)

567 Levchenko, L A 1965 *Effect of Form of Phosphate Fertilizers on the Absorption Ability of Corn Root System and Incorporation of Phosphorus in Nucleic Acid Metabolism.* Pitanie i Udobr Rast, Akad Nauk Ukr SSR, Resp Mezhvedomstv Sb, 164 68 (Russ) (Inst Plant Physiol, Kiev)

The development of the root system of corn plants is affected by the form of P fertilizers Under the influence of slightly soluble superphosphate, the total and absorption areas of the root system of 12 day old plants were smaller than without P, and in the presence of powdered phosphorite, they were greater In 25 day old corn, P in either form decreased both the total and absorption areas of the root system P nutrition increased the P content of nucleic acids of corn roots (CA 65 7960a)

568 Litvak, S I 1966 *Use of Various Forms of Nitrogen Fertilizer in Potato and Corn Fields of the Poles'e Area of Ukrainian SSR* Khim Sel Khoz 4(12) 891 92 (Russ)

All forms of N fertilizers used (NH_4NO_3, aqueous NH_3, urea) increased the yield of potatoes and of fresh corn foliage Aqueous NH_3 and $(NH_4)_2CO_3$ were equal to NH_4NO_3 The most effective fertilizer, especially for potatoes, was synthetic urea The ash and ash elements decreased in potato tubers and corn foliage under the effect of N fertilizers (CA 66 94324w)

569 Los, L I, Pyatnitskaya, L K, Samsonova, A S 1966 *The Content of Certain Trace Elements in Vegetable Foods* Vopr Pitaniya 25(2) 84 5 (Russ)

Corn, millet, and peas, grown in the region of Saratov, were studied and their content of certain trace elements was determined by spectral analysis The soil was pretreated with N, P, and K compounds, and further soil enrichment was effected by various major-element and trace element fertilizers The seeds were also treated and sprayed with $(NH_4)_2MoO_4$, $Al_2(SO_4)_3$, $MnSO_4$, and various industrial wastes containing Zn, Fe, Cu, and Al A control group was grown without any special treatment of seeds or soil The content of trace elements in the studied products was not affected by the kind of fertilizers applied or by the type of treatment of soil or seeds

Av content of trace elements (in mg %, on wet basis)

	Corn	Millet	Peas
Cu	0 146	0 203	0 590
Mn	0 284	0 312	0 602
Mo	0 055	0 053	0 603
Ni	0 140	0 433	0 257
Pb	–	0 042	0 013
Cr	0 032	0 032	–
Zn	0 826	0 941	2 30

(CA 65 1335a)

570 Lukovin, S K, Kuznetsov, N I 1969 *Effect of Fertilizers on Yield and Quality of Maize Grown on Grey Chestnut Soil* Khimiya sel' Khoz 7(3) 17 20 (Russ) (Issyk Kul'sk Opytno Selekts Stan Kirgiz Inst Zemled, Przheval'sk)

In pot trials with maize, application of N, P_2O_5, K_2O or N + P_2O_5 + K_2O, each at 90 kg/ha, markedly increased the contents of crude protein, fat, ash (unchanged with K_2O), total N and protein N in the grain, the contents of other N fractions were increased by P_2O_5 and K_2O, but decreased where N alone or N + P_2O_5 + K_2O was applied P_2O_5, K_2O,

and N + P_2O_5 + K_2O increased cellulose content, but N alone decreased it (FCA 22 2619)

571 Lyubinskii, N A, Gvozdikovskaya, A T 1967 *The Respiration and Absorption of Phosphorus and Potassium by Maize Roots as Influenced by the Light Spectrum.* Ukr Bot Zh 24(1) 15 20 (Ukr) (Inst Fiz Rosl Akad Nauk Ukr SSR, Kiev)

The uptake of P and K by roots of young maize plants illuminated with short wave light (380 580 mμ) was about 50% higher than under light of 580 730 mμ wavelength The short wave light also stimulated root respiration, whereas the long wave light had little or no effect on the release of CO_2 and inhibited the uptake of O_2 (FCA 20 1620)

572 Lyukova, L A, Dudnik, V N 1966 *Effect of Molybdenum on Growth, Nitrate Reductase Activity, and Nitrogen in Corn* Mikroelem Sb l Khoz Med, Akad Nauk Ukr SSR Respub Mezhvedom Sb, 37-42 (Russ)

Using two varieties of corn, Zakarpatskaya Zeltaya (ZZ) and Bukovinskoi hybrid No 3 (B), when corn seeds were soaked for 10 24 hours in solutions containing 5 50 mg of $(NH_4)_2MoO_4/l$, seed germination and the growth of the resultant plant were improved, while at concentrations >50 mg of $(NH_4)_2MoO_4/l$ no stimulatory effects were noted, rather inhibitory effects resulted In pot studies, while the ZZ variety required the application of solutions containing 10 15 mg of $(NH_4)_2MoO_4/l$, the B variety required a higher Mo level [25 mg of $(NH_4)_2MoO_4/l$] The foliage weights increased with Mo applications, with the ZZ variety giving greater yields than the B variety Nitrogen reductase activity increased as a result of applied Mo, with increasing N reductase activity, plant nitrate N decreased, but total N, albumin N, ammonium N, and the content of some free amino acids increased (CA 66 18358v)

573 Lyukova, L A 1965 *The Effect of Trace Elements on the Content of Some Physiologically Active Compounds in Corn* Primenenie Mikroelementov v Sel'sk Khoz, Akad Nauk Ukr SSR, 57-62 (Russ)

The effect of trace elements ($MnSO_4$ + $CuSO_4$ + H_3BO_3 + $CaSO_4$, $ZnSO_4$ + H_3BO_3 + $CuSO_4$ + $CaSO_4$ and Mo) and nicotinic acid on the auxin, vitamin B_6, and nicotinic acid content was studied in corn leaves The elements were applied by soaking of seeds in the solutions The trace elements and nicotinic acid stimulated the growth of corn (most effective Mo and nicotinic acid) Mn, Zn, B, and Cu and especially Mo increased the nicotinic acid in leaves and stems Vitamin B_6 was enhanced mostly by nicotinic acid and Mo, less with the Zn mixture The synergistic effect of vitamin B_6 and nicotinic acid increased the activity of auxin and its concentration, Zn was also important (CA 64 1306e)

574 Maiboroda, N M, Vyruchek, A A 1967 *The Utilization of Cement Dust for Liming the Soil* Khim Sel' Khoz 5(8) 16 17 (Russ) (Sel'skokhoz Inst, Krasnoyarsk)

In a field trial in Krasnoyarsk Province, Siberia, cement dust containing 42% 52% CaO, 0 4% 1 7% MgO, 0 5%-1 1% K_2O, and 0 01%-0 08% Mn was applied to maize grown as green fodder on grey forest soil At 1 metric ton/ha the dust increased yields of fresh material from 83 5 to 107 hkg/ha and from 130 5 to 170 5 hkg/ha when the crop was also given 10 metric tons farmyard manure/ha (FCA 21 115)

575 Mal'tsev, V T 1966 *Fluctuations in the Nitrogen Compounds in Peat-Podzolic Soils* Vestn Sel' Khoz Nauk (Moscow) 11(2) 124-25 (Russ)

Dynamics of NH_3 and NO_3 in fallow soil and in soil under corn and wheat was studied N P K (60 30 30) was added in spring before sowing, and the maximum content of nitrate N in fallow soil in July was 105 6 kg/ha in the 0 50 cm layer The N content decreased in September or October Corn up to the fruit bearing stage used little nitrate N The highest amount of N in the fertilized soil occurred during the 4 5 leaf stage The foliage increased, after fertilizing, from 25 4 31 5 kg/ha Ammoniation processes in fallow soil and under corn are weaker than nitrification processes, the highest amount occurring in spring Under wheat, the ammonium N content of the soil is usually higher than the nitrate N content (CA 64 20578e)

576 Mel'nichuk, P P 1966 *Content of Nitrogen Compounds and Free Amino Acids in Bleeding Saps of Plants During Various Periods of Growth and Development of Corn Under Various Nutrition Conditions* Fiziol Biokhim Osn Pitan Rast, Akad Nauk Ukr SSR, Respub Mezhvedom Sb, 12 17 (Russ)

Amino acids and amines are synthesized in the leaves and also in the root system Growing at various levels of N nutrition affects the transformation of N and the biosynthesis of free amino acids and amides in plant roots NH_4^+ and nitrates predominate in the initial growing period, later amines and amides form The maximum of the latter occurs during the flowering period The N content decreases at the time of corn ripening and becomes about 0 81 5 79 mg/100 ml sap The amount of N in the sap is directly dependent on the amount of N fertilization Maximum biosynthesis of amino acids in corn plants occurs during flowering The greater part of the amides, asparagine and glutamine, is synthesized in the roots The amount of asparagine in the corn sap is higher than that of glutamine and free amino acids In the later development stages the content of amides and amino acids decreases gradually and during the milky stage only traces are found During the corn grain formation, the plants use up stores of N accumulated in leaves and stems, which does not always suffice for the production of high yields with a high protein content Thus, the extra root N fertilization in this period increases the synthetic activity of leaves and protein accumulation in the foliage and the corn grains (CA 67 32010c)

577 Mel'nickenko, V F, Bystrenkova, M V 1965 *Fe and Al in Corn Plants* Agrokhimiya, No 12, 78 83 (Russ)

The accumulation of Fe and Al in corn plants is connected with a prolongation of the growth period Maximum Al and Fe concentrations occurred in the leaves during all phases of growth In seeds, the Al and Fe concentration was relatively very low, and decreased up to the end of the growth period, when the Fe concentration was lowest and when Al was not detected (CA 65 5867e)

578 Mishustina, N E 1969. *Effect of the Reaction of the*

Nutrient Solution on Growth and Nutrient Accumulation by Maize Agrokhimiya, No 10, 58 63 (Russ) (Inst Fiziol Rast Akad Nauk)

In a nutrient solution in which the N P_2O_5 K_2O ratio was 34 10 56, growth up to the 5 leaf stage was optimal at pH 5 6, but at the 8 leaf stage pH 6 was optimal The percentage contents of N, P, and K in the leaves and roots were higher at pH 8 than at pH 6 At the 8 leaf stage, pH 4 5 strongly inhibited K uptake (SF 33 2371)

579 Moslov, I V , Lapshina, A N 1969 *Effect of Inorganic Fertilizers on Crop Yield and Metabolism* Izv Akad Nauk SSSR, Ser Biol , No 2, 243 50 (Russ) (D N Pryanishnikov, All Union Res Inst Fert Agro Soil Sci , Moscow)

The need of plants for elements of mineral nutrition varied at different periods in their development At the stage of intensive growth, the need for N was greater than for P, during blooming and seed formation P should be greater than N In corn, N deficiency affected mainly the weight of ears, grains, and the concentration of protein in the grain Fertilization was most effective during ear formation (CA 70 114254m)

580 Moslov, I V , Lysenko, V F 1968 *Effect of Various Nitrogen Fertilizers on the Metabolism and Yield of Corn* Khim Sel Khoz 6(4) 247-49 (Russ) (Vses Nauch Issled Inst Udobr Agropochvoved , Moscow)

A 3 year experiment was conducted with corn grown in a 1 1 soil sand culture in 10 kg containers fertilized with urea, NH_4NO_3, oxamide, and ureaform Urea, oxamide, and ureaform had greater effects on yield, growth, and development than NH_4NO_3 (FA 2 223)

581 Mosolova, L V 1965 *The Effect of Dose Level and the Potassium to-Calcium Ratio in the Nutritive Environment on the Yield and Quality of Wheat and Corn* Khim Sel' Khoz 3(5) 2 6 (Russ)

The influence of various doses and K to Ca ratios on crop yields and quality of wheat is connected with the level of N sources in soil At low N amounts, the highest yield was attained at the K to-Ca ratio of 1 1 Increased doses of $CaCO_3$ did not raise the yield and protein content in corn At high N amounts in soil, the best results were obtained after fertilization with a K to Ca ratio of 1 4 In soils containing low Ca, an increased dose of K caused a rise of glutelin in corn and a decline of gliadin A strong prevalence of Ca over K resulted in an increased content of gliadin and the albumin globulin fraction (CA 63 9007f)

582 Nikitishen, V I 1966 *Fertility of Leached Chernozem and Fertilizers Effect on Yield of Corn and Sunflower* Agrokhimiya, No 6, 49 58 (Russ)

In field experiments, two with corn and one with sunflower, using N P K (60 60 45), N P (60 60), and N K (60 45) for corn, and N P K (30 60 30), P K (60 30), N K (30 30), N P (30 60), K (30), P (60), and N (30) for sunflower, it was established that the relative order of importance of these three nutrients is N > P > K for corn grown for silage and is P > K > N for sunflower grown for seeds In a study of the fertility of leached chernozems, the results of field trials and the results of chemical analyses correlated well for P as well as for N (CA 65 14374g)

583 Nikopol'skaya, I V 1968 *Maize Response to Fertilizers in the Dry Region of Stavropol' Province* Khim Sel' Khoz 6(9) 2-4 (Russ) (Selekts Opytn Stan , Stavropol')

N, P_2O_5, and K_2O at various rates and in different combinations, with or without 20 tons farmyard manure/ha, were incorporated into chernozem soil by plowing in autumn Application of 30 kg each of N, P_2O_5, and K_2O/ha gave the highest grain yields As the rate of N and P_2O_5 increased to 60 kg and of K_2O to 30 kg/ha, percentage uptake by plants of these elements from fertilizers decreased, but their utilization per unit of grain and straw yield increased Dry matter content in plants increased up to the wax stage N content increased up to the milk wax stage, P content up to maturity, and K content up to tasselling (FCA 22 973)

584 Nizhko, V P , Prikhod'ko, M V 1968 *Incorporation of ^{15}N in Amino Acids and Amides of Corn Seedlings* Dopv Akad Nauk Ukr RSR, Ser B 30(4) 369 72 (Ukr) (Inst Fiziol Rosl , Kiev)

The distribution of ^{15}N in the amino acids and amides of corn shoots with different sources of N in the nutrient solution was studied The enrichment of dicarboxylic amino acids and amides in the roots of the seedlings with ^{15}N was higher with feeding of labeled ammonium nitrate The ammonia N is almost completely used in the roots for the synthesis of these compounds, especially glutamine and asparagine When the seedlings absorb labeled urea, there is considerable enrichment of amino acids and amides in the leaves, and the most ^{15}N is detected in asparagine and aspartic acid The data indicate a difference in the routes of N utilization by plants depending on its original form (FA 1 1348)

585 Odumanova Dunaeva, G A , Khrushcheva, I V 1964 *Influence of Granulated Heptachlor in Combination with Mineral Fertilizers on Corn* Tr Vses Nauch Issled Inst Zashchity Rast , No 20, Pt 1, 36 8 (Russ)

One field experiment and one greenhouse experiment were carried out on corn treated with granulated heptachlor (mixed with plaster of Paris) (1) alone, (2) with addition of granulated superphosphate (25 kg/ha) to heptachlor, with superphosphate and no heptachlor, and (3) with heptachlor alone In all treatments more corn was harvested than in the control Heptachlor alone produced highest yields at 5 kg/ha, when combined with superphosphate, 25 kg heptachlor/ha was also good With addition of Mo, 1 kg heptachlor/ha proved best With addition of B, 25 kg heptachlor/ha proved best (CA 65 16021e)

586 Okhrimenko, M F 1965 *The Effect of Trace Elements on Some Biochemical Indicators of Corn* Primenenie Mikroelementov v Sel'sk Khoz , Akad Nauk Ukr SSR, 63 8 (Russ)

The effects of Mn, Zn, Cu, Mo, and Co on the yield of corn, chlorophyll, ascorbic acid, protein N, and dry matter contents were studied Trace elements increased the chlorophyll, especially Mn Ascorbic acid increased most under the effect of Mn Mn increased the protein N in leaves, Zn was effective in the early stages of vegetation only Cu was effective during the later stages of development Co acted in all growth periods and so did Mo, showing the highest activity at the end of

development The dry matter in the leaves increased most under the effect of Mn and Cu, Mo and Zn acted in the second half of growth Zn in the later growth period decreased the dry matter content (CA 64 1306f)

587 Olifer, V A, Kalinina, Z G 1969 *Characteristics of the Biological Cycle of Minerals and Nitrogen Under Maize on Ob Chernozems* Agrokhimiya, No 10, 32 6 (Russ) (Sibir Nauchno Issled Inst Zhivot Novosibirsk)

In 1966, the sub aerial mass of maize removed from the soil more than 80% of the mineral elements and N taken up from it A green yield of 500 q/ha removed 112 kg/ha N, 15 kg P, and 85 kg K from unfertilized soil and up to 140 kg N, 104 kg K, and 18 kg P from fertilized soil (SF 33 2374)

588 Olifer, V A 1966 *Role of Wheat, Corn, and Peas in the Biological Turnover of N and Mineral Elements in Chernozems* Agrokhimiya, No 6, 20 6 (Russ)

Each title crop has different N and mineral requirements The major elements in the wheat plant are Si, N, and K, with most in the straw, then grain, and the least in the roots, Si is concentrated in the straw and the N in the grain In corn, the major elements are K, N, and Si, most occurring in the aerial plant parts N, K, and Ca are the predominant elements in pea plants Harvesting of these crops results in a soil deficit of N, K, P, and Ca, but this loss can be replaced with application of a fertilizer to the soil (CA 65 9669f)

589 Ozolina, G, Lapina, L P 1965 *Levels of Nucleic Acids in Corn and Flax as Affected by Levels of Copper and Nitrogen* Mikroelementy i Produktivnost Rast, Akad Nauk Latv SSR Inst Biol, 75 102 (Russ)

The effect of Cu deficiency on the content of nucleic acids and their distribution in corn and flax plants was studied The nucleic acids, especially DNA, were higher in plants grown at a normal Cu level than in Cu deficient plants, these differences were more apparent in young organs Cu deficiency changed the distribution of nucleic acids between the organs Fertilization with Cu increased, and fertilization with N decreased nucleic acid content Increasing N fertilization increased the symptoms of Cu deficiency (CA 64 20567d)

590 Pallidina, T A, Zhabitskii, P F 1965 *Nitrogen Exchange in Irrigated Corn* Agrokhimiya, No 10, 13 17 (Russ)

Field and pot experiments with corn included two levels of N P K fertilizer, 60 60 40 and 120 120 80, and three levels of irrigation 600, 1,200, and 1,800 m^3/ha Increment of the water supply combined with the higher fertilizer level increased plant growth, leaf surface, plant dry matter, and yield Among the free amino acids in the vegetative organs were aspartic and glutamic acids and alanine which were present in great quantities The leaf parenchyma contained more amine N than the other organs, but with time its quantity diminished Proline was present in the corn and pedicle, but was not found in the other plant organs Augumentation of the water supply resulted in an intensification of protein synthesis, thereby diminishing the content of amine N The protein zein content did not depend on irrigation (CA 64 8879c)

591 Panasyuk, B O, Uteush, Y A, Kaliberda, V M 1969 *Nitrogen Nutrition of Corn and Beans During Mixed Planting* Nauk Pr, Ukr Akad Sil's'kogospod Nauk, No 14, 182 87 (Ukr) (Ukr Sil's'kogospod Akad, Kiev)

Sandy light clayey soil was fertilized with 10 tons/ha of organic manure, with the addition of mineral fertilizers containing NH_4NO_3, superphosphate, and KCl in doses $N_{45}P_{60}K_{60}$ for spring, and $N_{30}P_{45}K_{45}$ for autumn sowing Corn, French beans, and soybeans were sown separately or mixed Samples of corn and bean plants were analyzed during various phases of the growth and development for N contents The results of analyses revealed that the mixed planting of corn with soybeans in the spring, and with the French beans in autumn, increased accumulation of N in the corn green mass on account of N compounds of leguminous plants, and increased the corn productivity (CA 73 55136m)

592 Parshikov, V N, Gvozdikovskaya, A T 1967 *The Effect of Light on Metabolism in Maize at Different Levels of Nitrogen, Phosphorus and Potassium Nutrition* Ukr Bot Zh 24(2) 3 8 (Ukr) (Inst Bot Akad Nauk Ukr SSR, Kiev)

In water and sand cultures, a positive correlation between root respiration and the absorption of ammonium N and nitrate N was observed in maize both in light and in darkness In light, K increased the uptake of P by roots and the incorporation of K into organic P compounds (FCA 20 2316)

593 Pavlov, A N, Kolesnik, T I 1966 *Some Features of the Utilization of Nitrogen Applied at a Late Period in the Synthesis of Proteins in Maize and Oat Grains* Fiziol Rast 13(4) 652 56 (Russ) (K A Timiryazev Inst Plant Physiol, Moscow)

The label of ^{15}N introduced as $(^{15}NH_4)_2SO_4$ during a late period of growth of maize was found primarily in an inferior protein, zein, but in oat plants ^{15}N was found in a full valued protein, globulin No difference in the utilization of N was observed when N was fed through the roots or through the leaves Kinin treatment retarded the flow of nitrogenous substances to the grain and the total N and protein content in the leaves of maize increased The effect of kinin was observed only under conditions of comparatively low content of nitrogenous substances in the plant Practically no kinin effect occurred when the N supply was sufficiently high (CA 65 17648d)

594 Pershak, I T 1964 *Influence of Mineral Fertilizers on Ripening, Yield and Quality of Corn* Visn Sil's'kogospod Nauki 7(10) 40-4 (Ukr)

The best crop of corn was obtained, in the vicinity of Kiev, when fertilizer was applied twice, in the fall and late in spring during the growth period Thus, the yield could be increased up to 66% Faster ripening was observed if the fertilizer were especially rich in P, N, and K Fertilizers rich in N increased the quantity and quality of the protein corn grain (CA 62 4568e)

595 Pershina, M N 1967 *Ash Composition of Crops in the Arid Steppe Zone as Related to Soil Formation and Soil Fertility* Trans Meet Commns II & IV Int Soc Soil Sci 1966, 139-43 (Russ) (Timiryazev Agr Acad, Moscow)

Nutrients removed by wheat and maize accumulated

differentially within the plants Wheat stubble returned 15%-25% of the nutrients removed to the soil and maize stubble returned 13% 33% (SF 30 4424)

596 Petrov Spiridonov, A E, Mazel, Y Y 1965 *Effect of pH on Absorption of Calcium by Plants* Dokl TSKhA, No 109, Pt 1, 159-65 (Russ) (K A Timiryazev Agr Acad, Moscow)

The absorption of Ca by excised roots and roots of whole plants (corn and sunflower) was investigated at various pH values of the nutritive solution Ca was estimated radiometrically by using ^{45}Ca Absorption of Ca increased at higher pH values The most pronounced increase occurred at pH 2-4 and >9 At pH >4, excised roots absorbed more Ca from a solution containing other mineral nutritive salts (4-fold diluted Knop solution) than from a solution containing HCl + NaOH and $CaCl_2$ at the same pH In whole corn plants, Ca absorbed by the roots remained principally in the roots during at least 14 days of the experiment In sunflower plants, Ca absorbed appeared mainly in upper organs of the plant within 7 days The pH of the solution had a definite effect on distribution of the Ca absorbed between fractions eluted from dried roots with H_2O, 2*N* $NaNO_3$, 2*N* AcOH, and 2*N* HCl This effect was more pronounced in corn plants (CA 65 15795h)

597 Petrova, L K 1967 *Expediency of the Use of Urea on Light, Sod Podzolic Soils* Khim Sel' Khoz 5(6) 409 10 (Russ)

Efficiency of urea as compared with NH_4NO_3 was studied in sugar beet, mangel wurzel, potatoes, corn, barley, and oats As could be seen from comparative yields of roots and their sugar content in sugar beet, yields of roots and green fodder in mangel wurzel, yields of potato tubers and their starch content, and yields of grain in corn, barley, and oats, urea generally gave the same or better results as compared with NH_4NO_3 The efficiency of urea as a fertilizer depends on the mode of application and weather conditions In an example, surface applications gave worse results probably due to gaseous losses of NH_3 resulting from hydrolysis, whereas sufficient rainfall improved the incorporation of urea into soil Liming decreased the efficiency of urea due to increases of soil pH (FA 1 128)

598 Pochinok, K N, Gulyaev, B I, Okanenko, A S, Makhovskaya, M A, Pogol'skaya, V I, Smelyanskaya, E P 1965 *Intensity and Productivity of Photosynthesis and Utilization of Solar Energy by Corn Under the Conditions of Various Density of Drill and Nutritive Level* Fotosintez i Pigmenty kak Faktory Urozhaya, 21-47 (Russ)

Corn plants were grown at various distances (60 X 60, 60 X 30 cm) on fields fertilized with N, P, and K (60, 75, and 60 kg/ha, respectively) with or without manure (40 tons/ha) From 1 to 3 plants were grown on one spot Control fields were not fertilized Soil samples were analyzed for N, P, and K Initially, leaf area developed slowly (5% during the first month after germination), but during the following 40 days it reached a maximum which was dependent on the density of drill Increasing the number of plants on one spot caused a faster daily increase of leaf area Photosynthesis was greatest in fields with a single plant on one spot and the use of fertilizers increased photosynthesis by 10%-35% The yield of foliage and grain was greatest when 3 and 2, respectively, plants were grown on one spot The accumulation of K was related to growth The uptake of N by leaves and stems depended on growth reaching a maximum by the 70th 80th day, ~80% of the N taken up during vegetative growth was contained in the grain The quantity of absorbed light energy was highest in the upper leaves, maximum energy was absorbed by single plants growing on one spot (CA 64 10091g)

599 Polikarpochkina, R T 1968 *Role of Zinc in the Nitrogen Metabolism of Corn Plants* Agrokhimiya, No 3, 77 80 (Russ) (Sib Inst Fiziol Biokhim Rast, Irkutsk)

Corn was cultivated in the absence of Zn^{++} or with the addition of Zn^{++} every 10 days At the end of the second month the weight of plants without Zn^{++} was 30%-40% lower than that of fertilized corn plants The aerial parts of corn deprived of Zn^{++} had 30% less protein, but RNase was strongly activated and the contents of free amino acids, especially asparagine and aspartic acid, were considerably increased (glutamine and glutamic acid were lower, however) This indicated that the protein synthesis was seriously affected by lack of Zn^{++} but that the synthesis of amino acids was not Since glutamic dehydrogenase activity was lower in plants lacking Zn, it was considered that this enzyme contains Zn^{++} (FA 1 1214)

600 Protsenko, D F, Mishustina, P S Shevchuk, N V 1969 *Effect of Trace Elements on the Nitrogen Metabolism of Corn.* Mikroelem Sel Khoz Med, No 5, 57 67 (Russ) (Inst Fiziol Rast, Kiev)

Treatment of seed of cold resistant and normal corn varieties before sowing with $CuSO_4$ and $MnSO_4$ (P A Vlasyuk and M S Darmenko, 1959) increased the protein and total N and decreased the nonprotein N contents in the leaves and roots of both varieties The content of N compounds in the cold resistant varieties was higher than in the normal varieties The presowing treatment increased the germination power, improved the quality of grown plants, and increased the yield considerably when they were grown in turf soil (CA 73 44366k)

601 Przhegorlins'kii, V I 1966 *Comparative Efficiency of Granulated and Powdered Superphosphates* Agrokhim Gruntozn, No 2, 138-40 (Ukr)

A comparison of relative efficiencies of powdered and granulated superphosphates applied at 250 kg/ha with autumn plowing or spread during early stages of development to corn cultures grown under field conditions on podzolic chernozem soils showed that the response to powdered superphosphate was better as measured by the development and yields of grain (FA 1 144)

602 Przhegorlins'kii, V I, Petrenko, O A 1965 *Effect of Principal Fertilizers on Crop and Quality of Corn Grains* Fiziol Biokhim Osn Pitan Rast, 91-101 (Russ) (Poltavsk Sel'skokhz Inst, Poltava)

The effectiveness of manure and mineral fertilizer application under tilled soils in autumn and scattered fertilization under cultivated soil before sowing in spring was compared The protein content of the grain depends not only

on the fertilizer dose and method of application, but also on atmospheric conditions and especially precipitation distribution Manure should be applied only under a deeply tilled soil Autumn application increased the grain yield by 240 kg/ha compared with spring application under cultivated plowed soil Mineral fertilizers should also be applied under tilled soil Presowing fertilizer application is more economical than scattered application A full application of N P K (45 45 45) in two stages, one part under the tilled soil and the other as nutrition dose for the plants, is recommended This resulted in a yield increase of 230 kg/ha over a one time application of the total dose One fertilizer dose during the 3 5 leaf stage resulted in a 600 kg/ha grain increase, and two doses resulted in a 1,000 kg/ha increase (CA 67 72894a)

603 Putkaradze, S A 1966 *Comparative Effectiveness of Superphosphate and Phosphate Slag on Red Soil* Agrokhimiya, No 4, 30-4 (Russ)

N K (0 1 g of each/kg of soil), alone or combined with either superphosphate or phosphate slag at a rate of 0 2 g of P_2O_5/kg of soil, was applied to red soil Superphosphate tended to increase soil acidity, whereas phosphate slag reduced it The yields of corn, lupine, and oats obtained with the slag were higher than those produced with superphosphate In field trials, about 14% more tea was obtained with the slag than with the superphosphate The contents of P, tannin, caffeine, and extractable substances in green tea leaves were a little higher with the slag, which also resulted in better quality of the final product (CA 65 2953g)

604 Pyl'neva, P N 1965 *Role of Urea in Plants and Its Uptake by Roots* Agrokhimiya, No 1, 28 33 (Russ) (Res Inst Fertilizers and Soil Sciences, Moscow)

Corn plants previously grown in NH_4NO_3 solution were made N deficient by cultivation in water The plants were then given urea solution and the concentrations of some N containing compounds determined in the plant sap at various intervals The concentration of total N, amide N, and all amino acids were higher, the concentration of ammonium N was lower (CA 63 2347b)

605 Safaralieva, R A, Lyatifov, D K 1969 *Effect of Mineral Fertilizers on Carbohydrate Metabolism in Maize Plants* Izv Akad Nauk Azerb SSR, Ser Biol Nauk, No 2, 9 13 (Russ)

Sugar content in maize leaves at different stages of growth was studied in field trials in relation to mineral nutrition, which included (a) presowing basal application of P, NP, or NPK, (b) preflowering dressing with N, P, K, NP, NK, PK, and NPK, (c) combinations of (a) and (b), and (d) no fertilizer At the 2 to 3 leaf stage, sugar content was low and NP increased it from 3 87% for (d) to 5 26% (air dry basis) which was more than the increase with P or NPK At the 5 leaf stage, sugar content increased to 4 77% for (d) and NPK gave the highest further increase to 6 05% At full flowering, sugar content in (d) decreased again to 3 99% but presowing or preflowering application of P increased it to 5 68%, whereas other mineral fertilizers were less effective Under (c) the addition of P to the basic application of NPK produced the greatest increase in sugar content, whereas the addition of N decreased it Sucrose was the major sugar fraction and changed considerably in response to the application of fertilizers, whereas monosaccharides were present in smaller and less variable quantities (FCA 23 217)

606 Sagutonova, T N 1967 *The Effect of Fertilizers and of Cultivar on the Dynamics of Carotenoids in Grain of Yellow Maize* Vest Sel' khoz Nauk, Mosk, No 5, 22-4 (Russ) (Gorskii Sel'skokhoz Inst, Ordzhonikidze)

The contents of carotenoids in developing and maturing maize grains were monitored in seven yellow hybrid maize cultivars grown in N Ossetia, Caucasus The contents of carotenoids and of carotene decreased during ripening, more so in late than in early cv The ripe grain of plants given fertilizer contained more yellow pigments than those of unfertilized plants, but there was no correlation between pigment content and type of fertilizer (FCA 20 326)

607 Salamov, A B, Byasov, K K 1969 *Increasing Maize Yields* Kukuruza, No 2, 20 1 (Russ) (Severo-Osetin Sel'skokhoz Opytn Stan, Mikhailovskoe)

Trials during 3 years were carried out to determine the effect of different microelements (in addition to N, P, and K, rates not given) incorporated with presowing cultivations on grain yield and quality of maize grown on (a) calcareous leached podzolic chernozem, and (b) meadow chernozem Co increased yields by 8 4 hkg/ha on (a) and by 9 8 hkg/ha on (b), in the following year, residual Co increased yields by 6 and 8 8 hkg/ha, respectively These increases were obtained from applying 8 kg Co (266 kg cobalt salt)/ha on (a) and 4 kg Co/ha on (b) Mo increased yields by 3 6 hkg/ha on (a) and by 12 1 hkg/ha on (b), these increases were obtained from applying 3 kg Mo/ha on (a) and 6 kg Mo/ha on (b) On (a), a higher increase in yield in the following year was obtained from the residual effect of Mo than in the year of its application, but the reverse held on (b) Application of 8 kg Zn/ha increased yield by 3 2 7 3 hkg/ha Co increased grain protein content by 0 3% 0 5%, starch content by 1 3%-3 5%, and fat content by 0 2% 0 5%, respective values for Mo were 0 4%-0 7%, 3% 5%, and 0 2% 0 4%, and for Zn were 0 74%-0 85%, 3 2%, and 0 46% (FCA 22 1792)

608 Samtsevich, S A, Ulasevich, E I 1967 *Effect of Various Calcium Compounds on the Microflora of Soil and Rhizosphere of Corn* Agrokhimiya, No 7, 62 8 (Russ) (Otdel Mikrobiol Akad Nauk, Minsk)

A 3 year greenhouse experiment (1960 1962) was carried out to study the effect of various compounds of Ca and Na [$CaCO_3$, Na_2CO_3, $CaSO_4$, Na_2SO_4, $CaCl_2$, $Ca(OH)_2$, and marl] on the development of microorganisms in soil and the rhizosphere of corn The various Ca compounds applied to the soil had a uniform effect on the development of soil and rhizosphere microorganism The number of bacteria increased 1 5 3 0 fold Na_2CO_3 and Na_2SO_4 neutralized the soil acidity Liming improved the growth of the plant Na_2CO_3 and $CaSO_4$ applied jointly caused an increase in the height of the plant and its weight by 35%-70% Na_2SO_4 had no marked effect on the number of bacteria in the soil and root zone (CA 67 116209n)

609 Savel'eva, L V 1969 *Effectiveness of Presowing Treatment of Corn Seeds with Trace Elements* Mikroelem

Sel Khoz Med, No 5, 99 106 (Russ) (Kamenets Podol'sk Sel'skokhoz Inst, Kamenets Podolski)

Presowing treatment with 0 5% $MnSO_4$ improved growth and development of the plants, increased grain yield and silage mass, and improved the fodder quality The average yield during 3 years was 300 kg/ha The treatment is recommended on slightly leached chernozems After wetting the seeds with 0 5% Mo salt, the average yield was 180 kg/ha (CA 73 4436^{8}n)

610 Savost'yanov, V K 1965 *The Effect of Fertilizers on Eolian Loamy Sands of Northern Kirakassia* Agrokhimiya, No 7, 75-83 (Russ)

N fertilizing increases the yield of wheat grown on eolian loamy soils of the Shirinsk steppe The optimum levels for wheat and corn are 45 kg/ha and 30 60 kg/ha, respectively, increasing the yields by 20%-50%, and increasing yield of corn foliage by 18% 77% P containing fertilizers are only effective for spring wheat, the optimum level is 30 kg P_2O_5/ha, resulting in a yield increase of 28%-44% Corn shows no response The simultaneous addition of N and P is particularly effective K fertilizer is unnecessary since the upper illite fraction is very rich in K available to plants The fertilizer action is promoted by soil moisture Excess amounts result in antagonism between NO_3 and PO_4^{3}, resulting in a decrease of wheat production (CA 64 7314e)

611 Sdobnikova, O V 1966 *Efficiency of Fertilizers and Their Application in North Kazakhstan* Vestn Sel' khoz Nauki Mosk 11(7) 45 53 (Russ)

A systematic survey of total amounts of N, P, and K in virgin soils showed that a deficiency of available P was the major reason for low yields of field crops Fertilization of spring wheat, corn, potatoes, and cabbage with low levels of superphosphate gave a marked increase in grain and fodder yields (CA 65 20790g)

612 Shabalin, I N, Yablokova, L P, Tyryshkina, R F 1965 *Effect of Trace Elements on Growth, Development, and Yield Quality of Corn Under Irrigation in the Kullundin Steppe* Izyskanie Mestn Udobr Otkhodov Prom Khimiz Sel Khoz Sib, 134-44 (Russ)

The effect of trace elements on accumulation of protein in leaves, stems, and grain of corn and on the growth, development, and quality of the yield was studied The effect of trace elements was most prominent in an acceleration of development during the ripening period in the phase of milky and waxy ripeness Zn and Al had no appreciable effect on growth and development of corn Trace elements increased the yield of ripe ears, decreased their moisture content, and increased the content of crude protein Co, Li, Mo, Mn, and B caused the greatest increase in protein in the grain (0.3%-1 07%), Mn, Al, Zn, Li, and B caused the greatest increase in the leaves, and Mn, Co, Li, and Zn caused the greatest increase in [illegible] stem The growth period was shortened by 3 5 days by [illegible] and Li B, Mn, Li, and Zn increased green mass and [illegible] and the yield of a ripe fraction by 12% 25% (CA 66 [illegible])

613 Shchukina, A I 1965 *Drought and Attendant Changes in the Water Regime of Maize* Fiziol Rast 12(6) 1069 74 (Russ) (Pedagog Inst, Kuibyshev)

Maize was grown in pots (a) with normal rates of N and P, (b) as (a) + K, (c) as (a) but from seed soaked in K_2SO_4 and hardened, (d) as (c) but from seeds soaked in water At the preflowering stage the soil moisture was reduced to 40% for 14 days to imitate drought Treatments (b), (c), and (d) resulted in higher yields of grain compared with (a), and the plants, especially those under (b), contained considerably more colloid and osmotic bound water, which explains their better resistance to drought (FCA 19 1457)

614 Shevchenko, M N 1966 *Efficiency of Fertilizers on Peat Soils of the Volyn District* Visn Sil's'kogospod Nauki 9(7) 42 9 (Ukr) (Inst Plant Physiol, Kiev)

The investigated soils contained 2 08%-2 37% N, 0 03% 0 06% K_2O, 0 18% 0 40% P_2O_5, 1 30%-4 65% Ca, 0 0002%-0 0003% Cu, and 0 0001% 0 0002% B Addition of K fertilizers increased the crop of carrots 28% 110%, sweet corn 24%-80%, and sugar beets 57% 260%, the total amount of carotene (*I*) and sugar (*II*) in these products was also increased Addition of P fertilizers was not effective, unless they were combined with K fertilizers Addition of PK fertilizers increased the crop of carrots 33%-180%, sweet corn 80% 120%, and sugar beets 300% 600% It also increased the total amounts of *I* and *II* in roots and leaves The amount of ascorbic acid (*III*) was not affected Addition of N fertilizers to PK fertilizers increased crops only 2 5% Addition of Cu to PK fertilizers increased the carrot crop by an additional 5 5% 18 0% It increased the quality of products The amounts of *I*, *II*, and *III* did not change Sweet corn and sugar beet were not affected by the addition of Cu The introduction of Co, Mo, I, and Zn did not affect either the yield or plant quality The following fertilizer compositions are optimal $K_{180}P_{30}$ + Cu, $K_{180}P_{60}$ + Cu + B, and $K_{120}P_{60}$ + Cu (CA 65 17653d)

615 Shevchenko, V P 1967 *Effect of Fertilizers on Chemical Composition and Yield of Maize Grown on Peat Soil* Khim Sel' Khoz, No 7, 10 12 (Russ) (Zhitomir Oblast Sel' Khoz Opytn Stn, Korosten')

Maize sown on peat soil received N, P, and K at different rates In general, P raised the contents of P and N in the plants, and K that of K and N Applying 90 kg P/ha increased the yield of fresh matter by 26% and that of dry matter by 16%, corresponding figures for 180 kg K/ha were 24% and 9% Uptake of N, P, and K by the plants was significantly higher in plots treated with fertilizers than in untreated plots (FCA 21 113)

616 Shevchenko, V P, Ivanovs'ka, P T, Panasyuk, B O 1968 *Effects of Fertilizers Upon Yields of Corn and the Fertility of Some Reclaimed Soils in the Polesie* Visn Sil's'kogospod Nauki 6 42 8 (Ukr)

617 Shevchuk, N V 1966 *Effect of Trace Elements on Physiological and Biochemical Processes in Corn* Mikroelem Sel Khoz Med, Akad Nauk Ukr SSR, Respub Mezhvedom Sb, 84 8 (Russ)

Seeds of the cool resistant corn hybrid, Bukovinskii 3, and a cool susceptible variety, Odeskaiya 10, were treated prior to sowing with dusts of $CuSO_4$ and with a M[illegible] phosphate mixture, using methods of Ulasyuk and Darmenko Sowings

were performed on peat soil in square shaped plots of 56 m^2 size Phenological observations were made and the physiological role of Cu and Mn was estimated in connection with the content of green pigments at different development phases, with the content of albumin, crude protein, total N, albumin N, and nonalbumin N, and with the beginning of ripening and productivity of both corn types Treated plants exhibited higher amounts of green pigments (chlorophyll a and b) Both trace elements caused higher concentrations of albumin in the leaves Also, grain yields were higher, the weight of 1,000 grains increased, and ripening was hastened Plants of the cool resistant hybrid started earlier to develop leaves during the first period of growth than the cool susceptible variety (CA 66 18360q)

618 Shkel, S E 1965 *Effect of Level of Nitrogen Nutrition on the Sensitivity of Corn to 2,4 D at Various Growth Phases* Dokl TSKhA, No 106, 49 55 (Russ)

Corn was cultivated in soil containing 0 118, 0 235, or 0 353 g N/kg soil, when the fourth leaf appeared, the plants were sprayed with 2,4 D, 47 6 mg/plant From the 10th day after treatment, growth and development were retarded so that after 20 days their weight was ~60% of the controls Later their growth was accelerated and 45 days after treatment the plants grown on two higher doses of N matched the controls, 2,4 D decreased the weight of roots of plants grown under the influence of low N and increased that of plants grown on high N, in comparison with the 2,4 D untreated controls (CA 65 7921f)

619 Shlavitskaya, Z I, Kvetkina, A A 1968 *Zn Deficiency and Its Diagnosis in Maize Grown After Sugar-Beet 1* Vest Sel' khoz Nauki, Alma Ata, No 12, 20 7 (Russ) (Kazakh Inst Zemled, Politotdel, Alma Ata, Obl)

In irrigated trials in Alma Ata province, maize grown after sugar beet was deficient in Zn Zn contents in maize plants harvested in 1963 at the wax ripe stage were 17 2 mg/kg dry matter (= ppm) in monoculture, 18 3 ppm after lucerne, and 12 6 ppm after sugar beet In fully ripe maize plants harvested in 1964, Zn contents were 12 3, 19 2, and 5 7 ppm, respectively (Zn content in soil is not given) (FCA 22 1819)

620 Sirota, L V, Rusinova, I P 1968 *Mobilization of Soil Nitrogen During Fertilization of Sod Podzols with Nitrogen* Isotopenpraxis 4(12) 461 65 (Russ) (Vses Nauch Issled Inst Sel'skokhoz Mikrobiol, Leningrad)

Three year experiments were conducted with corn and buckwheat in order to study increased uptake of soil N upon addition of N fertilizers $(NH_4)_2SO_4$, KNO_3, and ion-exchange resins of both forms isotopically labeled with ^{15}N were each tested, both under normal growing conditions, and with "isolated" feeding in which N fertilizer was added to an outer container and, if desired, $Na_3{}^{32}PO_4$ to the inner container in samples with roots divided between the two containers Increased absorptive capacity of the root system as a primary result of fertilizing appears to partly account for the greater uptake of soil N and P Both the plant physiological characteristics and the form of the added fertilizer effected the added N uptake For buckwheat, NH_4^+ and NO_3 forms were equally effective, but for corn, NH_4^+ was more so, and also resulted in greater uptake of soil P However, the coefficient of absorption of the NO_3^- form was significantly higher than that of the NH_4^+ form under the same conditions (CA 71 29662u)

621 Slukhai, S I, Nizhko, L V 1970 *Effect of Magnesium Nutrition Conditions on the Initial Growth of Corn and the Level of Nutrients in Plants* Fiziol Biokhim Kul't Rast 2(1) 76 81 (Russ) (Inst Plant Physiol, Kiev)

Sprouts of maize need a supply of Mg by the 8th 9th day, or else the growth, especially of the root system, is depressed Simultaneously, contents of P and Ca in the plant increase due to the Mg shortage, while K remains unaffected The effect of Mg on the uptake of other elements is nonspecific (CA 73 55112a)

622 Titev, G M, Garms, E I, Erimbetov, S 1966 *Effect of Different Moisture States of Soil Under Various Levels of Mineral Nutrition on the Physiological Indexes and Productivity of Corn* Vest Sel' khoz Nauki, Alma Ata 9(2) 20-6 (Russ)

The experiment was conducted in vessels, 20 kg dry soil capacity, using corn as the test plant Two nutrient levels of N P K (1 1 1 and 3 3 3) were used, in which N P_2O_5 K_2O (68 88 44 and 190 270 157 kg/ha) was mixed with the soil The sources of the N, P, and K were NH_4NO_3, K_2HPO_4, and $Ca(H_2PO_4)_2$ + $CaHPO_4$ $2H_2O$, and K_2HPO_4, respectively The soil contained (mg/kg of soil) 39, 19 5, and 527 of N, P_2O_5, and K_2O, respectively, Four moisture levels (50%, 60%, 70%, 80% soil moisture capacity) were used With an improvement of the soil water regime plant height, foliar area, and yield of green and dry matter increased, photosynthesis productivity was increased, and the transpiration coefficient was lowered The highest yield was produced by the plants growing under 70% soil moisture capacity The highest transpiration coefficient occurred at 50% moisture, decreasing with an increase to 60% 70% soil moisture Improvement in the level of N P K nutrition from (1 1 1) to (3 3 3) resulted in an increase of the absolute weight of grain yield, it also resulted in ⩽ 35% increase of the productivity of photosynthesis (CA 64 20577b)

623 Tomashevskii, D F, Vakal, L S 1966 *Fertilization of Corn Grown in the One Crop System* Agrokhimiya, No 12, 36-42 (Russ)

Three series of tests were made on corn grown on thick low humus weakly alkaline chernozem soils The soils were treated with NH_4NO_3, granulated superphosphate, and KCl, 2/3 of which was applied in the autumn and 1/3 in spring Soil analysis showed that the addition of fertilizers had the greatest effect on the nitrate and available P content, but little effect on the content of readily hydrolyzable N The nitrate content (as determined colorimetrically with phenoldisulfonic acid) increased on adding 60 kg/ha NH_4NO_3, but higher concentrations did not produce comparable increases Soil P content, but not crop yield, increased upon adding higher concentrations of superphosphate (90 120 kg/ha) The exclusion of N fertilizer reduced the plant chlorophyll content Plant analyses showed that an increase in P (90 or 120 kg/ha) with normal (60 kg/ha) doses of N and K fertilizers narrowed the P N uptake ratio and more P was concentrated in old leaves than in young ones, whereas 90 or 120 kg/ha N

fertilizer with normal amounts of P and K fertilizers increased the P N ratio and more P occurred in young leaves Increased amounts of N in N P K fertilizers increased the protein N content of the leaves and the kernel quality, but reduced the cellulose content of the kernel Omission of K reduced the kernel fat content The effectiveness of the N and K fertilizers was retained throughout the 4 year duration of the tests In the fourth year, a double amount of P fertilizer (120 kg/ha) increased grain yield considerably The authors concluded that on chernozems of the type studied containing over 16 18 mg P_2O_5/100 g soil, N fertilizers should be applied before K fertilizers and the P fertilizers should be reduced considerably or omitted (CA 66 45844g)

624 Tonkonozhenko, E V 1966 *Effects of Trace Elements on the Yields of Agricultural Crops Under the Conditions of the Krasnodar District* Khim Sel' Khoz 4(5) 9 14 (Russ)

During 1963, four field experiments were carried out with beets, peas, rice, and corn Mg, B, Mo, and Cu were applied in different amounts in different forms The soils of the Krasnodar district were high in trace elements, but no direct correlation existed between the trace element content in soil and that in the crops A favorable influence of these elements, when applied as fertilizers, upon yields and quality of cropped plants was observed Pronounced effects of applied trace elements appeared with beets, peas, and rice, but not with corn (CA 65 9678c)

625 Tregubenko, M Y, Filippov, G L 1966 *Water Metabolism in Maize in Connection with Mineral Nutrition Under Steppe Conditions in the Ukraine* Fiziol Rast 13(6) 1059 65 (Russ) (All Union Sci Res Inst Maize, Dnepropetrovsk)

Addition of P and N to steppe soil decreased the amount of weakly bound water and increased the amount of strongly bound water and suction pressure in the cells of corn plants grown under field conditions Addition of N only did not have any appreciable effect Improvement of N and P nutrition of the plants decreased the transpiration rate and this, coupled with the increased water retaining capacity of the leaves, produced conditions for conservation of a higher tissue water content and a better drought resistance and ultimately greater crop yield (CA 67 36913b)

627 Trepachev, E P, Ivlev, M M 1965 *Uptake of Nutrients by Corn and Its Yield* Vest Sel' Khoz Nauk, Mosk 10(1) 29 35 (Russ)

In eight groups of corn silage obtained in the nonblack soil region of the U S S R, there were wide variations within groups in the ranges of values between maximum and minimum contents of dry matter, N, P, and K, with greatest variations within groups with low yields of green and dry matter The variations can be explained by differences in soil and in climatic and agricultural technology conditions There is no strict relation between yield and content of nutritional substances The ideal ratio of N P K for corn is 3 1 3 5 The observed ratios differ widely with low yields and sometimes also with high yields On light sandy soils the requirement for K at low yields is 17% 19% less than on average or heavy sandy soils, and with high yields is less by 29% There is no difference in nutritional requirement with respect to variety of corn planted Yields of dry substance were 50% greater in the warm year of 1961 than in the cold wet year of 1962 Highest yields were obtained at pH 5 8 6 5 in presence of high soil concentrations of K and P (CA 65 1332d)

627 Trofimova, T A 1968 *Some Characteristics of the Root Nutrition of Maize* Kukuruza, No 12, 24 (Russ) (Vses Inst Kormov, Lugovaya, Mosk Obl)

Maize plants [illegible] leaf stage were transferred to pots and given nutrie[illegible] on containing ^{32}P, ^{35}S, and ^{45}Ca supplied through either primary or secondary roots Accumulation of ^{32}P and ^{35}S absorbed through primary roots was markedly higher in even than in odd numbered leaves (counting from below), but was markedly higher in odd numbered leaves when absorbed through secondary roots Higher contents of ^{32}P occurred in young leaves than in old ones, irrespective of the root system used for absorption Accumulation of ^{35}S initially was higher in young than in old leaves, but the S was later translocated to the old leaves Accumulation of ^{45}Ca was similar in all leaves, irrespective of the root system through which it was absorbed (FCA 22 1818)

628 Tsvetkova, L G 1969 *Urea Fertilizer* Visn Sil's'kogospod Nauki 12(6) 58 60 (Ukr)

Addition of 45 kg of N/ha as urea or NH_4NO_3 in addition to P_2O_5 60 plus K_2O 60 kg/ha to a chernozem poor in humus increased the yield of fall wheat by the same amount However, the crude protein content of the grain was 2 5% greater after urea than after NH_4NO_3 fertilization and that of gluten was 1 6% greater The protein of maize grain was also ~1 5% greater after urea than after NH_4NO_3 or NH_4OH fertilization (CA 71 111991j)

629 Turturyanu, N A 1965 *Effectiveness of Mixed Fertilizers* Agrokhimiya, No 7, 56 63 (Russ)

The forest soils of Moldavia had a low content of humus, N, P, and K, especially in the rhizosphere, but had a high content of free phosphates when compared with chernozem soils Application of mixed N P K fertilizers doubled the yield of sugar beets when compared with a single fertilizer in forest and chernozem soils The application of N K P (45 45 45) fertilizer doubled the yield of corn on leached chernozems, the increase is 7 8 3 kg dry grain/ha and is 5 3 kg dry grain/ha on typical chernozems The 1 1 1 ratio of the N P K fertilizer is the most effective in improving the yield of sugar beets and corn (CA 64 8879h)

630 Udovenko, G V, Bezlyudnyi, N N 1966 *Effect of Nitrogen Nutrition on Growth and P and Protein Metabolism of Plants* Agrokhimiya, No 8, 11 21 (Russ) (Belorusskij Inst Agr, Minsk)

Tests were conducted with corn and legumes in water cultures After 8 days of growth in tap water, the plants were placed in a Prianishnikov mixture (30% the usual amount, and after a week, in the full amount) The corn was grown in the mixture for 21 days, and the legumes for 14 days A second experiment was made on sand and soil sand cultures with corn of different varieties, with addition of the mixture, but with different fertilizing components After harvest, total P, phosphatide P, nucleoproteins, organic P soluble in acids, and

inorganic P were determined In both cases, ammonium N accelerated the growth of the aerial plant parts, except for NH_4Cl which markedly inhibited the growth process Nitrate N affected favorably the growth of plants and roots, urea gave the same results as the ammonium N forms The protein N content was the lowest after nitrate N nutrition, resulting in poor crops and root masses The Cl also decreased the protein N content The P content depended on the form of N in the nutrient In corn, the maximum P content was with NH_4NO_3 and urea, nitrate N markedly inhibited P assimilation in legumes and corn The growth of corn improved with N increases but for only one application, then a decrease in the weight of the aerial plant parts was observed, although the protein synthesis increased Young plants contained P primarily in the inorganic form, and older plants primarily as organic P (CA 65 14374a)

631 Umurzakov, N U, Lukashev, A A 1967 *The Feeding Area and the Density of Plant Stands of Irrigated Corn* Vest Sel' khoz Nauki, Alma Ata 10(1) 51 6 (Russ)

632 Usenko, Y I, Dudchenko, L M 1966 *Uptake of N, P, and K by Corn Under Regular Application of Fertilizers in the Water Deficient Zone* Agrokhimiya, No 3, 55 60 (Russ)

Organic fertilizers and organic plus mineral ones promote intensification of consumption and uptake of mobile N, P, and K in the water deficient zone (regular black soil with low content of humus, Ukraine) The amount of phosphates is 0 2 0 3 mg/100 g of dry soil Average increases of corn productivity are 1 4 3 8 centners/ha Systematic fertilization not only increases the amount of mobile N, P, and K in the soil, but also their consumption by the plants The low degree of effectiveness of fertilizers can be explained by the deficiency of water during the growth period of the plants (CA 65 2952h)

633 Ushkarenko, V A 1966 *The Application of Fertilizers to Fields Irrigated with Sewage Effluent* Khim Sel' Khoz 4(9) 6 10 (Russ) (Sel'skokhoz Inst, Kherson)

Maize grown on chestnut soil in S Ukraine and irrigated with (a) 3,000 m^3 of treated sewage effluent/ha, containing 52 kg N, 26 kg P_2O_5, and 45 kg K_2O, yielded 505 hkg fresh material/ha compared with 457 hkg/ha under (b) normal irrigation The application of N, P, and K, each at 45 kg/ha, increased the yields of maize in (b) to 539 hkg/ha and those of (a) to 579 hkg/ha (FCA 21 1679)

634 Verkhovod, L A 1969 *Effect of Trace Elements and Growth Stimulants on Plant Growth, Development, and Productivity, and on the Physiological Immunity of Corn to Smut in the Poltava Region* Mikroelem Sel Khoz Med, No 5, 90-4 (Russ) (Poltav Pedagog Inst, Poltava)

The growth of corn was intensified, the size and weight of the cobs and the grain yield increased by trace elements, especially by Mn and by the stimulants, especially hydroquinone Development was accelerated by Mn Resistance to corn smut was higher after treating the seeds with Mn, hydroquinone, B, tannic acid, or Zn (CA 73 44367m)

635 Vlasyuk, P A, Karas, M N 1965 *Dynamics of the Mn Content in Soil and Plants* Agrokhimiya, No 1, 80 8 (Russ)

Introduction of Mn (5 kg/ha) into chernozem meadow soil was followed by a rise of its content in leaves of winter wheat, sugar beets, corn, and peas and also by a crop increase The rise in Mn content proceeded gradually from beginning to end in the leaves of sugar beets and peas, but as an abrupt accumulation in the leaves of wheat and corn At the end of the vegetation period the soil content of available Mn had dropped under sugar beets and corn cultivation, but was somewhat elevated under peas and wheat The highest Mn accumulation (687 706 mg/kg control, 637 mg/kg) occurred in the sugar beet leaves and in corn, less in wheat and peas Mo enhanced the entrance of Mn into the leaves of all the above plants, but Cu only with corn and wheat B enhanced Mn uptake in the grains of wheat, but lessened the Mn content in the leaves Under the influence of prolonged application of B fertilizers, the total Mn in soils in most cases decreased (CA 63 3574)

636 Vlasyuk, P A, Nizhko, V F 1966 *The Effect of Various Forms of Nitrogen on Protein and Amino Acid Composition of Corn* Agrokhimiya, No 2, 16 22 (Russ)

Pot experiments were carried out to determine the effect of $(NH_4)_2SO_4$, $Ca(NO_3)_2$, urea, and urea with Mn on protein and amino acid composition Corn protein was fractionated in the following way albumin was precipitated with Cl_3CCO_2H the globulins by dialysis, the prolamines by diluting the extract with H_2O, and the glutelin at the isoelectric point Amino acids were determined by paper chromatography after acid hydrolysis The composition of corn protein varied with the type of N fertilizer $(NH_4)_2SO_4$ increased the content of glutelin, compared to the other treatments The highest content of globulin was observed with urea + Mn Urea and urea + Mn decreased the content of albumin compared to $(NH_4)_2SO_4$ and $Ca(NO_3)_2$, and increased the content of prolamines There were some significant changes of amino acid composition due to the type of N fertilizer $Ca(NO_3)_2$ increased the content of dicarboxylic and aromatic amino acids, but reduced the content of leucine Urea + Mn increased the content of β hydroxy amino acids and leucine, but reduced the content of dicarboxylic and S containing acids (CA 64 20570g)

637 Vlasyuk, P A, Mel'nichuk, P P, Levchenko, L A 1965 *Transformation of Phosphorus Compounds in Plants Under Various Conditions of Phosphorus Nutrition* Vestn Sel' khoz Nauki 10(10) 31-4 (Russ)

Effect of superphosphate alone or enriched with Mn or phosphate slag, both with addition of K and N fertilizers, was tested by P incorporation into DNA and RNA of the leaves and roots of corn The amount of P of DNA did not change whereas more P in RNA occurred after application of light soluble phosphates Values of acid soluble and lipid P are tabulated (CA 65 4598b)

638 Voinalovich, N A 1965 *Forms of N in Soddy Podzolic Soils, Effectiveness of N Fertilizers on Potatoes and Corn* Agrokhimiya, No 10, 18 23 (Russ)

Experiments were done with three levels of N 60, 90, and 120 kg/ha and a fixed level of P and K, 60 and 90 kg/ha, respectively N applications of 60 kg/ha increased the yield of

potatoes and corn, and additional N, ~120 kg/ha, resulted in additional yield increases However, this additional N resulted in a decrease in yield/kg of applied N for corn foliage and potato tubers, 0 27-0 20 ton/ha and 0 16 0 11 ton/ha, respectively N fertilization increased the mobile forms of N in soddy podzolic soils, due to the nitrification process, the quantity of the exchangeable NH_4^+ decreased during the vegetation period The maximum content of nitrates occurred in the early stages of growth It is supposed that during growth the nitrate is leached from soil (CA 64 5701h)

639 Voinalovich, N A 1966 *Effectiveness of Nitrogen Fertilizers as Connected with Nitrogen Balance of Soil* Agrokhimiya, No 9, 30-4 (Russ) (Res Sta , Korosten)

Plot experiments conducted with corn and potatoes on sandy, sod, and podzolic soils revealed that N fertilizer applied in doses of 120 kg/ha gives the highest yield of corn foliage, 241 q/ha, larger doses increased the foliage but affected the crop yield N on a P K background tended to increase the total N content The chlorophyll and N content of potato plants increased with an increase of applied N (on P K, 60 60, background), the same was true of crops where the yield was 100 q/ha with N P K (120 60 60) Analyses of the soil N content showed that ammonium N varies from 10 to 20 mg/kg of soil, N applications markedly increase the soil ammonium N content and improve nitrification in the soil (CA 66 1913t)

640 Volkova, V D 1968 *Effect of Microelements on Maize Grown on Chernozem Soil in Zaporozh'e Province* Agrokhimiya, No 12, 112 14 (Russ) (Sel'skokhoz Opytn Stan , Zaporozh Obl)

In trials during 3 years, maize received N, K, and P as superphosphate with or without Mo, Zn, B, or Mn Microelement + NPK treatments gave grain yields of 38 7-41 8 hkg/ha, compared with 38 8 hkg/ha for NPK alone, and 34 6 hkg/ha for unfertilized controls, Zn was the most effective microelement followed by Mo and B Microelements increased leaf chlorophyll content, uptake of different nutrients in plant and contents of N, P, K, protein, fat, and starch in grain (Fertilizer rates are not given) (FCA 22 1792)

641 Voronin, N G , Smirnova, A D , Den'sov, E P 1968 *Effect of Mo on Decreasing Corn Smut Infestation* Kukuruza, No. 1, 31 2 (Russ) (Sel'skokhoz Inst , Saratov)

Presowing treatment of maize seed with 0 07% and 0 14% solutions of ammonium molybdate markedly reduced infestation by *Ustilago maydis*, the effect was more pronounced where the crop received NPK fertilizers than farmyard manure The treatment accelerated seedling emergence by 2 3 days and increased fresh matter yields by 6 1%-22 1% (FCA 21 1697)

642 Yanishevskii, F V 1967 *Effectiveness of Liquid Compound Fertilizers* Agrokhimiya, No 2, 3 14 (Russ) (Nauchno Issled Inst Udobr Insektofung)

In pot experiments with maize, spring wheat, oats, barley, and potatoes on a chernozem, a typical serozem, and limed and unlimed derno podzolic soil, aqueous solutions and suspensions of compound fertilizers were generally as effective as a corresponding mixture of solid NH_4NO_3 + granular super + KCl Placement increased the effectiveness of liquid fertilizers on acid soils Alkaline liquid fertilizers were somewhat less effective than slightly acid ones B added to a liquid fertilizer was as effective as B added to ordinary NPK In the field, liquid fertilizer was as effective as ordinary NPK for potatoes, barley, and oats on derno podzolic soil (SF 30 2056)

643 Zderchuk, I S , Molotkovskii, G K 1968 *Effect of Soil Moisture and Mineral Nutrition on the Sexuality of the Tissues of the Three Line Maize Hybrid Dneprovsk 98 and Its Parental Forms* Fiziol Rast 15 674 79 (Russ) (Chernovits Gos Univ)

In pot experiments with derno-podzolic soil, an optimal supply of soil moisture and of N or NPK stimulated the development of female tissue in the hybrid, whereas insufficient soil moisture and N stimulated masculinization (SF 32 734)

644 Zinkovskii, V N , Adin'yaev, E D 1969 *Role of Mineral Fertilizers in Improving Yield and Quality of Grain of Irrigated Maize* Agrokhimiya, No 5, 9 12 (Russ) (Gorskii Sel' Khoz Inst Ordzhonikidze)

On cis Caucasian carbonate chernozem and on meadow chernozem of the central foothills of the north Caucasus, N and P increased the percentage protein content of the grain and K increased the starch content (SF 32 3999)

645 Zolotarev, V P 1965 *Effectiveness of Slow-Acting N Fertilizers in Soddy Podzolic Soils* Agrokhimiya, No 1, 42 5 (Russ)

Large single doses (300 kg/ha) of urea CH_2O fertilizers on the title soils under corn cultivation were able to provide a 3 year supply of N equal to corresponding yearly doses of easily soluble N fertilizers This fertilizer proved to be especially useful in successive years of excessive humidity and drought (1962 1963), when this form of N supply secured good crop increases The effectiveness of the urea CH_2O fertilizers was directly parallel to their indexes on N availability (19 8 52 1), i e to the effect of the processes of forming H_2O soluble N forms (CA 65 3571e)

REVIEWS AND BOOKS

646. Asian Agricultural Survey 1969. Part II Production of Farm Crops 197 264 (University of Washington Press, Seattle) (Eng)

647 Cunard, A C 1967 *Maize Agronomy Part 1–Nutrition and Silage* World Crops 19(1) 20 7 (Eng)

This paper is the first of a series of literature reviews outlining the importance of maize as a world crop Its initial sections present data on the value of maize grain for human nutrition, showing that in this respect maize compares favorably with wheat and rice, its relatively high fat content is highly important The effect of agronomic factors such as

seasons, moisture availability, fertilizer applications, and plant population densities on the nutritive quality of maize grain is discussed as well The second half of the paper is concerned with maize as a silage fodder, discussing yields as affected by agronomic factors, suitable varieties, the quality of the silage, and the improvement of its rather low protein content by growing and/or ensiling maize in combination with legumes (Trop Abst 22 1096)

648 Cunard, A C 1967 *Maize Agronomy Part 2–Nutrients and Nutrient Uptake* World Crops 19(3) 24-8 (Eng)

This part is concerned with the roles of N, P, and K in the nutrition of the maize crop, factors governing their uptake, the pattern of uptake, the effects of K deficiency, potential yield increases obtainable by applying major element fertilizers, and the timing of fertilizer applications The three elements together increase yield by their interactive effects, the main role of N is that of accelerating vegetative growth and increasing grain yield, the main effects of P are on the development of the root system and the acceleration of maturity, while K regulates the moisture balance between plant and environment and reduces lodging and breaking (Trop Abst 22 1981)

649 Cunard, A C 1967 *Maize Agronomy Part 3–Growth and Fertilizer Usage* World Crops 19(4) 50-60 (Eng)

The third part of this review of literature describes growth and development of the maize plant, in particular of its root system in relation to soil moisture and fertility Fertilizer application is discussed in connection with the pattern of root development, the fact that over 90% of roots are found in the top 60 cm of soil, and the movement of NH_4 and NO_3 ions in the soil It is concluded that N should only be applied when the root system is sufficiently extensive to absorb most of it and when the rate of nutrient uptake is increasing The historical development of fertilizer usage based on nutrient removal or on nutrient levels in various parts of the plant is reviewed, stressing the complex nature of the problem and the importance of factorial trials with various levels of N, P, and K (Trop Abst 23 15)

650 Jacob, A , Uexkull, H V 1963 *Fertilizer Use (Nutrition and Manuring of Tropical Crops) 2 Maize or Corn* Verlagsgesellschaft fur Ackerbau mbH Hannover, 123 35 (Translated by C L Whittles) (Eng)

651 U S Agency for International Development, Agricultural Research Service 1969 *Major Cereals in Africa* Sixth Annual Report of the AID ARS Project 196 pp (Eng)

652 Matz, S A 1969 *Corn* IN Cereal Science Westport, Conn , The Avi Publ Co , Inc , 39 77 (Eng)

653 Pesek, J 1968 *Potassium Nutrition of Soybeans and Corn* IN The Role of Potassium in Agriculture American Society of Agronomy *et al* 447 68 (Dep Agron , Iowa State Univ , Ames) (Eng)

A review with 33 references (SF 32 1416)

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Acta Univ Agr, Brno, Fac Agron (*Acta Universitatis Agriculturae, Brno, Facultas Agronomica*)
Agr Chem (*Agricultural Chemicals*)
Agr Res J Kerala (*Agricultural Research Journal of Kerala*)
Agr Sci Rev (*Agricultural Science Review*)
Agr Tec [*Agricultura Tecnica (Santiago de Chile)*]
Agr Trop (*Agricultura Tropical*)
Agrartud Kozlem (*Agrartudomanyi Kozlemenyei*)
Agricoltura Venezie
Agrochemia (Bratislava)
Agrochimica
Agrokemia es Talajtan
Agrokhim Gruntozn (*Agrokhimiya i Gruntoznavstvo*)
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Allahabad Farmer
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An Cient (*Anales Cientificos, Lima*)
An Edafol Agrobiol (*Anales de Edafologia y Agrobiologia*)
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Ann Arid Zone (*Annals of Arid Zone*)
Ann Physiol Veg (*Annales Physiologie Vegetale*)
Arch Venez Nutr (*Archivos Venezolanos de Nutricion*)
Aust J Exp Agr Anim Husb (*Australian Journal of Experimental Agriculture and Animal Husbandry*)

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C R Hebd Seances Acad Agr Fr (*Comptes Rendus Hebdomadaires des Seances de l'Academie d'Agriculture de France*)
C R Hebd Seances Acad Sci, Ser D (*Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie D*)
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Experientia

Farming S Afr (*Farming in South Africa*)
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Fert Sol (*Fertilizer Solutions*)
Fertilizer News
Fiziol Biokhim Kul't Rast (*Fiziologiya i Biokhimiya Kul'turnykh Rastenii*)
Fiziol Biokhim Osn Pitan Rast (*Fiziologo Biokhimicheskie Osnovy Pitaniya Rastenii*)
Fiziol Rast (*Fiziologiya Rastenii*)

Fotosintez i Pigmenty kak Faktory Urozhaya
Fourth National Congress of the Mexican Soil Science Society, Abstracts (*Fourth National Congress of the Mexican Soil Science Society held at Monterrey, Nuevo Leon, August 25-27, 1969*)

Ga Agr Res (*Georgia Agricultural Research*)
Ghana J Agr Sci (*Ghana Journal of Agricultural Science*)
Ghana J Sci (*Ghana Journal of Science*)
God Soffi Univ, Biol Fak (*Godishnik na Sofiiskiya Universitet, Biologicheski Fakultet*)
Govoryat Molodye Uchenye
Grune

Hacienda

Ill Res (*Illinois Research*)
Indian Farming
Indian J Agron (*Indian Journal of Agronomy*)
Indian J Sci Ind (*Indian Journal of Science and Industry*)
Informa Tecn Estac Exp Agropec Pergamino (*Informa Tecnologia Estacion Experimental Agropecuaria Pergamino*)
Int Maize Wheat Improve Cen Res Bull (*International Maize and Wheat Improvement Center, Research Bulletin*)
International Maize and Wheat Improvement Center The Puebla Project, 1967 68 Progress Report of a Program to Rapidly Increase Corn Yields on Small Holdings Mexico City, 1969
Isotopenpraxis
Isotopes and Radiation in Soil Plant Nutrition Studies Proceedings of a Symposium Jointly Organized by the International Atomic Energy Agency and the Food and Agriculture Organization of the United Nations, held in Ankara, 28 June 2 July 1965 IAEA, Vienna, 1965
Isotopes in Plant Nutrition and Physiology Proceedings of a Symposium Jointly Organized by the International Atomic Energy Agency and the Food and Agriculture Organization of the United Nations, held in Vienna, 5 9 September 1966 IAEA, Vienna, 1967
Ital Agr (*Italia Agricola*)
Izv Akad Nauk Azerb SSR, Ser Biol Nauk (*Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Seriya Biologicheskikh Nauk*)
Izv Akad Nauk SSSR, Ser Biol (*Izvestiya Akademii Nauk SSSR, Seriya Biologicheskaya*)
Izv Min Sel' Khoz Arm SSR (*Izvestiya Ministerstvo Sel'skogo Khozyaistva Armyanskoi SSR*)
Izv Sib Otd Akad Nauk SSSR, Ser Biol Med Nauk (*Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Biologo Meditsinskikh*)
Izv Timiryazev Sel'skokhoz Akad (*Izvestiya Timiryazevskoi Sel'skokhozyaistvennoi Akademii*)

J Agr Food Chem (*Journal of Agricultural and Food Chemistry*)
J Agr Sci (*Journal of Agricultural Science*)
J Indian Soc Soil Sci (*Journal of the Indian Society of Soil Science*)
J Jap Soc Grassld Sci (*Journal of the Japanese Society of Grassland Science*)
J Post-Grad Sch, Indian Agr Res Inst (*Journal of the Post Graduate School, Indian Agricultural Research Institute*)
J Res Punjab Agr Univ (*Journal of Research, Punjab Agricultural University*)
J Soil Sci U A R (*Journal of Soil Science of the United Arab Republic*)
J Soil Water Conserv (*Journal of Soil and Water Conservation*)

Kasetsart J (*Kasetsart Journal*)
Kenya Farmer
Khim Sel' Khoz (*Khimiya v Sel'skom Khozyaistve*)
Kukuruza

Landwirt Forsch (*Landwirtschaftliche Forschung*)
Liet TSR Aukst Mokyklu Mokslo Darb, Biol (*Lietuvos TSR Aukstuju Mokyklu Mokslo Darbai, Biologija*)

Maydica
Meded Landbouwhogesch Opzoekingssta Staat Gent (*Mededelingen van de Landbouwhogeschool en de Opzoekingsstation van de Staat te Gent*)
Mikroelem Prod Rast (*Mikroelementy i Produktivnost Rastenii*)
Mikroelem Sel Khoz, Akad Nauk Uz SSR (*Mikroelementy v Selskom Khozyaistve, Akademiya Nauk Uzbekskoi SSR*)
Mikroelem Sel' Khoz Med (*Mikroelementy v Sel'skom Khozyaistve i Meditsine*)
Mikroelem Sel' Khoz Med, Akad Nauk Ukr SSR (*Mikroelementy Sel'skom Meditsine, Akademiya Nauk Ukrainskoi SSR*)
Mikroelem Zhivotnovod Rast (*Mikroelementy v Zhivotnovodstve i Rastenievodstve*)
Mikroelem Zhizni Rast, Zhivotn Cheloveka, Akad Nauk Ukr SSR, Tr Koord Soveshch (*Mikroelementy v Zhizni Rastenii, Zhivotnykh i Cheloveka, Akademii Nauk Ukrainskoi SSR, Trudy Koordinatsionnogo Soveshchaniya*)
Mitt DLG (*Mitteilungen der Deutsche Landwirtschafts Gesellschaft*)
Mosonmagy Agrartud Foisk Kozl (*Mosonmagyarovari Agrartudomanyi Foiskola Kozlemenyei*)

N Dak Farm Res (*North Dakota Farm Research*)
Naturwissenchaften
Nauch Dokl Vyssh Shk, Biol Nauki (*Nauchnye Doklady Vysshei Shkoly, Biologicheskie Nauki*)
Nauch Tr Aspir, Odess Sel'skokhoz Inst (*Nauchnye Trudy Aspirantov, Odesskii Sel'skokhozyaistvennyi Institut*)
Nauch Tr Vissh Selskostop Inst, Sofia, Agron Fak, Ser Rast (*Nauchnye Trudove Selskostopanski Institut, Sofia, Agronomicheski Fakultet, Seriya Rastenievudstvo*)
New Zealand J Agr Res (*New Zealand Journal of Agricultural Research*)
Nigeria Midwest Reg Min Agr Natur Resources Exp Rep (*Nigeria Midwestern Region Ministry of Agriculture and Natural Resources, Experiment Report*)
Nigerian Agr J (*Nigerian Agricultural Journal*)
Nippon Dojo Hiryogaku Zasshi

Ohio Agr Exp Sta, Res Circ (*Ohio Agricultural Experiment Station, Research Circular*)

Oriente Agropec, Venezuela (*Oriente Agropecuario, Venezuela*)

Pak J Sci (*Pakistan Journal of Science*)
Pamiet Pulaw (*Pamietnik Palawski*)
Philipp Agr (*Philippine Agriculturist*)
Philipp J Agr (*Philippine Journal of Agriculture*)
Philipp J Plant Ind (*Philippine Journal of Plant Industry*)
Phosphorsaure
Phosphorus Agr (*Phosphorus in Agriculture*)
Pitan Udobr Rast, Akad Nauk Ukr SSR, (*Pitanie i Udobrenie Rastenii, Akademiia Nauk Ukrainskoi SSR*)
Plant Physiol (*Plant Physiology*)
Plant Soil (*Plant and Soil*)
Pochvovedenie
Pochvozn Agrokhim (*Pochvoznanie i Agrokhimiya*)
Postepy Nauk Rolniczych
Povysh Plodorodiya Pochv Nechernozem Polosy (*Povyshenie Plodorodiya Pochv Nechernozemnoi Polosy*)
Poznan Tow Przyj Nauk Wydz Nauk Roln Les Pr Kom Nauk Roln Kom Nauk Les (*Poznanskie Towarzystwo Przjaciol Nauk, Wydzial Nauk Rolniczych i Lesnych Prace Komisji Nauk Rolniczych i Komisji Nauk Lesnych*)
Poznan Wyzsza Szkola Roln Rocz (*Poznan Wyzsza Szkola Rolnicza Roczniki*)
Primen Mikroelem Sel'sk Khoz, Akad, Nauk Ukr SSR (*Primenenie Mikroelementov v Sel'skom Khozyaistve, Akademiia Nauk URSR*)
Probl Agr [*Probleme Agricole (Bucharest)*]
Proc Amer Soc Hort Sci (*Proceedings of the American Society for Horticultural Science*)
Proc Fourth Reg Conf Int Potash Inst [*Proceedings of the Fourth Regional Conference of the International Potash Institute Belgrade, Yugoslavia, 1965 (Das Kalium und die Qualitat Landwirtschaftlicher Produkte)*]
Proceedings of the Second Congress of the Mexican Soil Science Society, Department of Information, National School of Agriculture, Chapingo, Mexico 1965
Proc Soil Crop Sci Soc Fla (*Proceedings of the Soil and Crop Science Society of Florida*)
Proc Soil Sci Soc Amer (*Proceedings of the Soil Science Society of America*)
Proc W Va Acad Sc (*Proceedings of the West Virginia Academy of Science*)
Prog Agr (*Progresso Agricolo Bologna*)
Publ Comm Techn Cooper Africa (*Publications of the Commission for Technical Cooperation in Africa*)

Qd Agr J (*Queensland Agricultural Journal*)
Qd J Agr Anim Sci (*Queensland Journal of Agricultural and Animal Sciences*)

Rad Poljopr Fak Univ Saraj (*Radovi Poljoprivrednog Fakulteta Univerziteta u Sarajevu*)
Rast Nauki (*Rastenievudni Nauki*)
Res Bull, Iowa Agr Exp Sta (*Research Bulletin Iowa Agricultural Experiment Station*)
Res Rep Agr Exp Sta Univ Wisc (*Research Report, Agricultural Experiment Station, University of Wisconsin*)
Rev Agr, Piracicaba [*Revista de Agriculture (Piracicaba, Sao Paulo*]
Rev Ceres (*Revista Ceres*)
Rev Fac Agr n Vet, Argentina (*Revista de la Facultad de Agronomia y Veterinaria de Buenos Aires, Argentina*)
Rhodesia Agr J (*Rhodesia Agricultural Journal*)
Rhodesia, Zambia Malawi J Agr Res (*Rhodesia, Zambia and Malawi Journal of Agricultural Research*)
Rhodesian J Agr Res (*Rhodesian Journal of Agricultural Research*)
Ric Sci, Parte 2 Rend, Sez B (*Ricerca Scientifica, Parte 2 Rendiconti, Sezione B*)
Rocz Glebozn (*Roczniki Gleboznawcze*)
Rocz Nauk Roln, Ser A (*Roczniki Nauk Rolniczych, Seria A*)
Rostl Vyroba [*Rostlinna Vyroba (Praha)*]

S Afr J Agr Sci [*South African Journal of Agricultural Science (Suid-Afrikaanse Tydskrif vir Landbouwetenskap)*]
S Afr Med J (*South African Medical Journal*)
Sb Vys Ak Zemed Brne, Rada A (*Sbornik Vyskoe Skoly Zemedelske v Brne, Rada A*)
Science
Sel'skokhoz Biol (*Sel'skokhozyaistvennaya Biologiya*)
Sementi Elette
Soil Sci (*Soil Science*)
Sols Afr (*Sols Africains*)
Soobshch Lab Agrokhim, Akad Nauk Arm SSR (*Soobshcheniya Laboratorii Agrokhimii, Akademiya Nauk Armyanskoi SSR*)
Sov Soil Sci (*Soviet Soil Science*)
Stiinta Sol (*Stiinta Solului*)
Stud Univ Babes Bolyai, Ser Biol (*Studia Universitatis Babes Bolyai, Series Biologia*)

Tech Bull Colo Agr Exp Stn (*Technical Bulletin, Colorado Agricultural Experiment Station*)
Tech Bull Ore Agr Exp Stn (*Technical Bulletin, Oregon Agricultural Experiment Station*)
Tr Inst Bot, Alma Ata (*Trudy Instituta Botaniki, Alma Ata, Akademiya Nauk Kazakhskoi SSR*)
Tr Vses Nauch Issled Inst Zashch Rast (*Trudy Vsesoyuznogo Nauchno Issledovatel'skogo Institut Zashchity Rastenii*)
Trans Meet Commns II and IV Int Soc Soil Sci (*Transactions of the Meeting of Commissions II and IV of the International Society of Soil Science, Aberdeen, September 1966*)
Trans 9th Int Cong Soil Sci (*Transactions of the Ninth International Congress of Soil Science Adelaide, Australia, 1968*)
Trop Agr, Trin [*Tropical Agriculture (Trinidad)*]
Turrialba

Ukr Bot Zh (*Ukrains'kii Botanichnii Zhurnal*)
Univ Udaipur Res Stud (*University of Udaipur Research Studies*)

Vestn Sel'skokhoz Nauki, Alma Ata [*Vestnik Sel'skokhozyaistvennoi Nauki (Alam Ata)*]
Vest Sel'skokhoz Nauki, Moscow [*Vestnik Sel'skokhozyaistvennoi Nauki (Moscow)*]
Vestsi Akad Navuk Belarus SSR, Ser Biyal, Navuk (*Vestsi*

Akademii Navuk Belaruskai SSR, Seryya Biyalagichnykh Navuk)
Veterinariya
Visn Sil's'kogospod Nauki (*Visnik Sil's'kogospodars'koi Nauki*)
Vop Biol, Mater Konf (*Voprosy Biologii, Materialy Konferentsii*)
Vop Pitan (*Voprosy Pitaniya*)

W Pak J Agr Res (*West Pakistan Journal of Agricultural Research*)
Weed Sci (*Weed Science*)
Wiss tech Fortschr (*Wissenschaftlich-Technischer Fortschritt fur die Landwirtschaft*)
Wyo. Univ Agr Exp Sta Bull (*Wyoming University Agricultural Experiment Station Bulletin*)

Yearb Fac Agr, Univ Ankara (*Yearbook of the Faculty of Agriculture, University of Ankara*)

Z Acker u PflBau (*Zeitschrift fuer Acker-und Pflanzenbau*)
Z PflErnahr Bodenk (*Zeitschrift fuer Pflanzenernaehrung und Bodenkunde*)
Zeml Bil (*Zemljiste i Biljka*)
Zesz Nauk Wyzsz Szk Roln Olsztynie (*Zeszyty Naukowe Wyzszej Szkoly Rolniczej w Olsztynie*)
Zesz Nauk Wyzsz Szk Roln Szczecinie (*Zeszyty Naukowe Wyzszej Szkoly Rolniczejw Szczecinie*)

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