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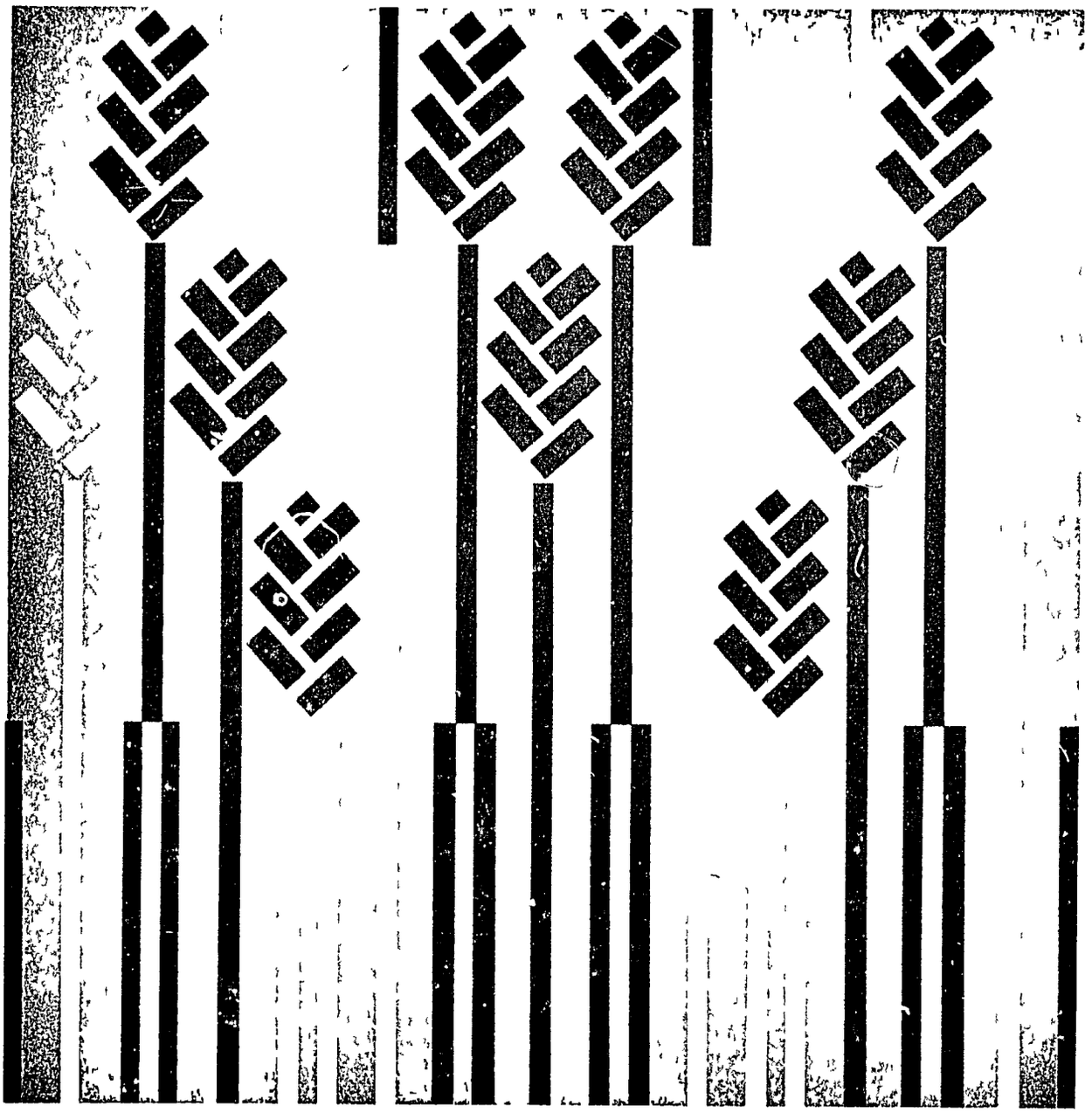

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FOREWORD

Nutrition of Wheat is the third in a series of bibliographies being prepared on basic food crops *Nutrition of Maize* and *Nutrition of Rice* were published in 1971 The bibliographies were prepared at the request and with the financial support of the Agency for International Development A basic goal is to make available to AID technicians and those trained under AID sponsored programs the most recent literature published on these food crops, particularly in regions where library facilities are limited or absent

Nutrition of Wheat contains many of the most important articles written on the subject in the past 5 years 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 Wheat 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

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AFRICA

KENYA

1 Pinkerton, A 1967 *Copper Deficiency of Wheat in the Rift Valley, Kenya* J Soil Sci 18(1) 18 26 (Eng) (Nat Agr Lab , Nairobi)

The area of the Rift Valley, Kenya, within which soils are deficient in Cu for wheat crops has been delineated Deficiency is associated with soils, derived from pumice and ash from the Menengai caldera, which contain <3 ppm Cu by analysis with *Aspergillus niger* In pot tests, the yields of tomato as indicator crop for Cu deficiency were found to correlate closely with yields of wheat Cu sulfate and Cu oxychloride when broadcast were both effective in eliminating the deficiency in wheat and resulted in a marked increase in Cu content of the grain Spraying with either compound, or applying oxychloride as a seed dressing, significantly increased the grain yields, but did not result in maximum yield (CA 67 10803m)

2 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 65, 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 topdressing 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 NP in the seedbed investigated It would appear that this ratio is more critical for wheat than maize and too close a ratio may depress yields The effect of wattle on following crops was discussed in some detail Applications of nitrogenous fertilizers to crops in the year following wattle generally depressed yields, both as a seedbed application and as a topdressing The brushwood line effect is described, with the probable reasons for improved plant growth on these areas It would appear that even distribution of the fertilizer was more important than the met' ̲ pplication Mechanical spreading was effective and speedy Topdressing of wheat was uneconomic except in certain restricted circumstances Seedbed applications of magnesium 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)

LESOTHO

3 Weinmann, H 1966 *Fertilizer Experiments* Rep Crop Res Lesotho 1960 65, 25 50 (Eng) (Maseru Exp Sta)

Discusses the effect of NPK on maize, wheat, and potatoes, comparative effects of P manure and manure ash, effect of fertilizers and manure in a rotation of maize, beans, and wheat (SF 30 1891)

MOROCCO

4 Kelso, T , McKnight, R , Nevins, J , Russel, D A 1967 *Morocco Role of Fertilizer in Agricultural Development with Special Emphasis on Wheat* (Prepared for the Agency for International Development) 186 pp (Eng)

Recommendations are made for improving wheat cultivation using the new high yielding varieties, irrigation, and use of fertilizers

NIGERIA

5 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 198 pp (Eng)

RHODESIA

6 Edwards, I B 1969 *Variations in the Tolerance of Some Rhodesian Wheat Varieties to High Soil Acidity* Rhodesia Agr J 66(5) 120 22 (Eng)

In Rhodesia, six wheat varieties were grown in a soil with a pH of 4 8 The varieties were grown in the field on a red fersiallitic clay soil at a 23 cm row spacing and a seeding rate of 67 kg/ha Fertilizer was applied at the rate of 168 kg N/ha as ammonium nitrate, 134 kg P_2O_5/ha as single superphosphate, and 101 kg K_2O/ha as muriate of potash Observations on the general patterns of growth were made 50 days after sowing Tolerant were the varieties F 1516 and Tokwe, intermediate was Zambesi, and sensitive were S 1138A4A2, Devuli and Mtilikwe The application of 3 360 kg CaO/ha 50 days after sowing (by banding it between the rows) favored the growth of the acid sensitive strains, the beneficial effects were apparent 3 weeks after application of lime, and the development of new tillers resulted (Trop Abst 25 1820)

SOUTH AFRICA

7 De L Beyers, C P 1966 *Effect of Copper Fertilizing on the Copper Content of Certain Crops* S Afr Tydskr Landbouwetensk 9 907 10 (Afr) (Landbounavorsingsinst Winterreenstreek, Stellenbosch)

In a rotation of wheat, oats, peas, millet, lupins, and sweet maize on Cu deficient acid sandy soil, an initial single

application of 20 lb/morgen (2 1 acres) $CuSO_4$ increased the yield of wheat, millet and peas and increased the Cu contents of all six crops Higher rates of Cu gave no significant increases in yield or Cu content over 20 lb/morgen (SF 30 4471)

8 De Kock, J 1969 *Urea as a Nitrogen Fertilizer* Farming S Afr 45(5) 31 2 (Eng) (Agr Res Sta , Vaalharts)

In trials in 1960 65 on sandy, alkaline soils at Vaalharts, N at 80, 160, and 240 lb N/morgen was applied to wheat in the form of (a) ammonium sulfate at sowing, (b) urea at sowing, (c) urea 14 days before sowing, and (d) urea as a topdressing 8 weeks after sowing Average yield (1960 65) for all treatments with 80, 160, and 240 lb N/morgen was 19 4, 23 7, and 24 8 bags grain/morgen, respectively Fertilizer applied as (b) reduced yields compared with (c) and (d) (20 7, 23 4, and 23 5 bags grain/morgen, respectively) though the better urea treatments differed little from ammonium sulfate (22 9 bags grain/morgen) in effectiveness (1 bag = 200 lb, 1 morgen = 0 86 ha) (FCA 23 27)

9 Schutte, K H 1967 *The Influence of Boron and Copper Deficiency Upon Infection by "Erysiphe graminis," the Powdery Mildew, in Wheat Variety Kenya* Plant Soil 27(3) 450 52 (Eng)

The wheat variety Kenya, grown in sand culture experiments conducted on a balanced nutrient (modified Robbins) solution, was found to be fairly resistant to powdery mildew (*Erysiphe graminis*) B deficient plants were, however, very susceptible to the pathogen, showing severe infection of the stem, leaf sheath, and leaf blade Cu deficient plants were also susceptible, though to a considerably less extent, the lesions were here mainly situated on the leaf blades (Trop Abst 23 905)

10 Schutte, K H , Dawson, M C 1964 *Influence of Micro Nutrient Deficiency Upon the Wilting Rate of Young Wheat* J S Afr Bot 30(4) 201 7 (Eng) (Univ Cape Town)

The wilt rate was much slower in control plants of *Triticum vulgare* than in those grown in a medium deficient in B, Cu, Mn, or Zn (CA 66 75338n)

SUDAN

11 Khalifa, M A 1970 *Effects of Sowing Date, Nitrogen and Seed Rate on Wheat Yields in the Sudan Gezira* Exp Agr 6 143 49 (Eng) (Univ California, Davis)

The results of a 3 yr study showed that mid October sowing gave greater grain yield than mid September or mid November sowing because grains were much larger and more numerous per head N increased yields by increasing the number of ears, but the effect was decreased with higher levels of N, and with late sowing Grain yield was only slightly affected by seed rate (SF 33 4046)

TANZANIA

12 Anderson, G D , Houston, B G , Northwood, P J 1966 *Effects of Soil, Cultivation History and Weather on Responses of Wheat to Fertilizers in Northern Tanzania* Exp Agr 2 183 200 (Eng) (North Res Centre, Min Agr , P O Box 3101, Arusha)

In 13 out of 17 experiments over four seasons, ammonium sulfate nitrate topdressed at 1 cwt/acre gave economic increases in grain yield Such applications to the first, second, or third wheat crops after a ley of Rhodesgrass or to land cropped continuously for a number of years nearly always gave an economic increase in yield, but on continuously cultivated land with normal rainfall after planting, an economic return from a second cwt/acre was probable After fallow for one season, economic responses to N occurred only when the preplanting period was very wet Wheat yields after ley, both with and without applied N, tended to be better than those on continuously cropped land Responses to P occurred in only one area, where N and P were both very important, particularly for newly plowed grassland Loss of organic matter and structural deterioration are probably the main causes of falling yields on long cultivated soils Grass/legumes leys are recommended for maintaining the fertility of these naturally fertile soils (SF 30 613)

TUNISIA

13 Capitaine, R C 1968 *Fertilizing a Cereal Rotation in Tunisia* Ann Inst Nat Rech Agron Tunisie 41(3) 36 (Fr)

Effects of fertilizers on cereal rotations in northern Tunisia varied with soil moisture content and with rainfall between sowing and tillering Fertilizer recommendations are given for a wheat–cereals or fodder–legume or fallow rotation (SF 33 2340)

14 Kobelt, V 1969 *Yield Data of Mexican Wheat in Tunisia* Z Ausland Landwirt 8(3)273 80 (Ger)

First experiments in Tunisia showed that Mexican dwarf wheat varieties yielded more than most local varieties, although the differences were not so pronounced as expected Under normal conditions, but without adequate fertilizing, yield differences are likely to be smaller than under experimental farming conditions It is stated that besides the introduction of new varieties wheat yields can be increased by better soil cultivation and plant husbandry, sufficient fertilizer application, and new farming techniques (Trop Abst 25 2042)

THE AMERICAS

BOLIVIA

15 Manzano, A C , Carrera, W M , Waugh, D L 1969 *Fertilization of Wheat in Relation to Soil Analysis* Soil Fertility Evaluation and Improvement Program Special Bulletin No 1, Bolivia (Sp)

Bolivian soils are too variable in fertility to permit a uniform fertilizer recommendation Trials with Coposu variety

wheat on 17 different soils establishing the economic advantage of correlating fertilizer dose with soil analysis Net additional income due to fertilizer treatment based on soil tests ranged from $6 140 to $6 2846/ha with an average of $6 866/ha

BRAZIL

16 Blanco, H C, Venturini, W R, Gargantini, H 1965 *Behavior of Phosphate Fertilizers Applied to Wheat and Their Residual Effect on Soybeans, in Soils of Varying Acidity* Bragantia 24 261 79 (Port)

Super, triple super, and three natural phosphates (Olinda, Araxa, and Alvorada) were tested on wheat and for their residual effect on soybeans in pot experiments with a dark red latosol at varying pH levels Higher wheat yields were obtained from the two supers than from the natural phosphates, but there were no significant differences in the residual effect of the fertilizers Optimum pH values for super and triple super were 5 4 and 5 3 respectively, and 5 1 5 3, 4 7 5 0, and 4 8 5 3 for the Olinda, Araxa, and Alvorada phosphates, respectively High levels of lime, increasing the pH to >5 5, decreased the efficiency of the P fertilizers (SF 30 1286)

17 Cruz, A D, Haag, H P, Sarruge, J R, Malavolta, E 1967 *Aluminum Phosphorus Interaction in Two Varieties of Wheat ("Triticum vulgare") Cultivated in Nutrient Solution* An Esc Super Agr *Luiz de Queiroz*, Univ Sao Paulo 24 119 29 (Port) (IPEAS, Rio Grande do Sul)

Wheat plants of the variety Piratini, considered susceptible to Al poisoning, and of the resistant variety Colonias were grown by the divided root technique in which half of the roots were placed in nutrient and the other half in P free nutrient containing 0 2 6 ppm Al Radioactive P was added to the nutrient between the third and fifth day, all P being removed from the nutrient after the fifth day The plants were harvested on the eighth day No effect of Al was observed on the migration of P into the new leaves in either of the varieties (CA 73 3056r)

18 Cruz, A D, Haag, H P, Sarruge, J R, Malavolta, E 1967 *Effects of Aluminum in Wheat ("Triticum vulgare") Cultivated in Nutrient Solution* An Esc Super Agr *Luiz de Queiroz*, Univ Sao Paulo 24 107 17 (Port) (IPEAS, Rio Grande do Sul)

Wheat of a variety (Piratini) thought susceptible to Al poisoning was grown by the divided root method in which half of the roots were in nutrient, and the other half in a P free nutrient solution containing Al (0 25 60 ppm, $AlCl_3$ adjusted to pH 4) Solutions were renewed every 7 days for 34 days when the plants were collected and analyzed Plants with 20 50 ppm Al were noticeably affected, while those with 0 25 10 ppm Al showed only delayed effects (stunted growth, pale green leaves, many dry leaves, local chlorosis, root atrophy) Uptake of N, P, K, Ca, Mg, and Al was determined, indicating a very significant increase in Al in the leaves, stalks, and roots, the levels of N, K, P, Ca, and Mg were affected differently The effect was negative for N and positive for Ca when correlated with the level of Al in the plant (CA 73 3055q)

CANADA

19 Chapman, F M, Mason, J L 1969 *Effect of Phosphorus and Potassium Fertilizers on the Agronomic Characteristics of Spring Wheat and Their Interaction on Grain Yield* Can J Soil Sci 49 343-47 (Eng) (Dep Agr Substa Creston, B C)

Combined PK fertilizers resulted in a positive interaction and increased the grain yields from 2,461 to 4,036 kg/ha when applied at rates supplying up to 224 kg/ha of each nutrient A slight reduction in yield occurred at the highest combined level of both elements–996 kg/ha Small significant increases in grain yield were obtained from a single application of K, but P alone did not alter the yield Increases in plant height, straw, grain, and kernel weights were obtained The number of days to mature were reduced from 95 to 91 or 92 and there was a reduction in the strength of the straw (SF 33 2345)

20 Ferguson, W S, Gorby, B J 1967 *The Effect of Soil Catena and Phosphorus on the Yield of Wheat in Western Manitoba* Can J Soil Sci 47(1) 39-48 (Eng) (Dep Agr, Brandon)

The yield and plant response to P on black chernozemic soils occurring in catenary sequence was studied A large proportion of the total variance was from fields and the interaction between fields and soils No simple relation between productivity and soil morphology was found Variability was attributed to changes in microclimatic factors, affected by shape, size, and aspect of the drainage areas sampled and by seasonal and yearly fluctuations in weather, plus the effect of these changes on the competitive ability of weeds Response to P was related to topographic position of the soil, with the lowest position, gleyed calcareous black of the Miniota Association, requiring approximately twofold more P to maximize wheat profits as the better drained orthic black locations Similar results were obtained by sampling the Carroll Soil Association However, in the Waskada Association, interaction between plant response and P or topographic position was obtained only 1 yr in 4 (CA 66 75354q)

21 Finlayson, A J, McConnell, W B 1969 *Utilization of Nitrogen 15 and Phenylalanine 2 ^{14}C by Wheat Plants* Can J Biochem 47(4) 415 18 (Eng) (Prairie Reg Lab Nat Res Counc, Saskatoon, Sask)

The distribution of ^{15}N from $^{15}NH_4Cl$ in various parts of wheat plants following injection of the tracer into the stems at intervals during kernel formation was examined More specifically, the incorporation of the ^{15}N and ^{14}C from phenylalanine 2 ^{14}C into the gluten proteins and into the salt soluble proteins was studied The location of ^{15}N in the upper parts of the plant is markedly dependent upon the time of tracer injection and probably the gluten proteins and the salt soluble proteins are formed independently of each other The rate of incorporation of phenylalanine into protein, relative to its metabolism by other pathways, increases as the plant matures (CA 70 103729u)

22 Green, D G, Ferguson, W S, Warder, F G 1970 *Effects of Decenylsuccinic Acid on ^{32}P Uptake and Translocation by Barley and Winter Wheat* Plant Physiol 45 1 3 (Eng)

After 3 days of exposure to 10^{3} and 10^{4} *M* decenylsuccinic acid, winter wheat plants wilted and died

Decenylsuccinate at 10^{3} *M* inhibited ^{32}P uptake by barley roots and wheat roots and resulted in significant ($P \leq 0.05$) leakage of previously absorbed ^{32}P and total P (barley roots) Decenylsuccinate effects on ^{32}P uptake and retention were attributed to increased permeability resulting from injury Decenylsuccinate at 10^{4} *M* did not inhibit root uptake of ^{32}P but decreased movement into the shoot This could be interpreted as an indication of reduced transpiration or inhibition of ^{32}P loading into the transpiration stream Decenylsuccinate did not increase cold hardiness in winter wheat in a nonhardening environment

23 Gupta, U C, MacLeod, L B 1970 *Response to Copper and Optimum Levels in Wheat, Barley, and Oats Under Greenhouse and Field Conditions* Can J Soil Sci 50(3) 373 78 (Eng) (Res Sta, Dep Agr, Charlottetown, Prince Edward Island)

Experiments were conducted on a Charlottetown fine sandy loam soil under greenhouse and field conditions to determine the optimum levels of Cu in cereal crops An application of 0 5 ppm Cu to the soil, under greenhouse conditions, resulted in percent yield increases of about 38, 180, and 500 for kernels of wheat, barley, and oats, respectively Under field conditions, Cu application did not affect the kernel yield or the weight of 1,000 kernels of any of the three crops Under greenhouse conditions, without applied Cu, wheat and barley heads were 10 14 days later in emerging For maximum yields under greenhouse conditions, the optimum content of Cu in plant tissues at the boot stage was 3 2 3 3 ppm for wheat and oats, and 4 8 ppm for barley A Cu content of 2 3, 2 0, and 1 8 ppm in wheat, barley, and oat kernels, respectively, appeared to be sufficient For straw, a Cu content of 3 9, 3 0, and 2 3 ppm in wheat, barley, and oats, respectively, appeared to be adequa e for optimum growth of the crops In general, Cu content of kernels from field tests was higher than that of kernels from greenhouse tests Under field conditions, Cu applications did not increase the Cu content of either the boot stage tissue or of the kernels Exchangeable (oxalate extractable) Cu content of about 1 2 1 8 ppm in soil is indicative of Cu deficiency for growing cereal crops under greenhouse conditions (CA 74 12209r)

24 Halstead, E H, Rennie, D A 1965 *The Movement of Injected ^{32}P Throughout the Wheat Plant* Can J Bot 43(11) 1359 366 (Eng) (Univ Saskatchewan, Saskatoon)

Specific activity (counts/min/g dry matter) measurements, autoradiographs, and densitometer tracings on the autoradiographs indicated that ^{32}P, injected into the stem of wheat plants, moved rapidly into the root system and was distributed uniformly throughout it Although root weights varied with depth the specific activity of the washed root material remained relatively constant The stage of plant growth markedly influenced the translocation of the ^{32}P into the roots Quantitative measurements indicated that approximately five times as much activity moved into the root systems of 40 day old compared with 60 day old plants A soil moisture stress increased the specific activity of the roots A linear increase in the specific activity of the root material was obtained by increasing the number of tillers injected per wheat plant (amount injected constant) The addition of indoleacetic acid, $NH_4H_2PO_4$ or H_3PO_4 to the carrier free ^{32}P reduced, rather than increased, movement to the roots (CA 64 1017h)

25 Hutcheon, W L, Paul, E A 1966 *Control of the Protein Content of Thatcher Wheat by Nitrogen Fertilization and Moisture Stress* Can J Soil Sci 46(2) 101 8 (Eng) (Dep Soil Sci, Univ Saskatchewan, Saskatoon)

Experiments in a growth chamber showed that the protein content of spring wheat could be effectively controlled by N supply and soil moisture stress In the protein range 11 16%, it was possible to increase both protein and yields concurrently, protein contents higher than 16% were realized only where a growth factor such as moisture was below optimum for maximum yields (FCA 20 17)

26 Nielsen, K F, Warder, F G Hinman, W C 1967 *Effect of Chemical Inhibition of Nitrification on Phosphorus Absorption by Wheat* Can J Soil Sci 47(1) 65 71 (Eng) (Dep Agr, Swift Current)

Wheat was grown in loam treated with 2-chloro 6 trichloromethylpyridine (N serve) (*I*), to inhibit nitrification, and fertilized with N and P Increases in ammonium N, together with low nitrate N in soils containing 30 ppm *I* showed that *I* inhibited nitrification but did not affect the formation of NH_4^+ P uptake was affected both by quantity of N applied and the form the crop used Ammonium N increased P uptake more, even though it was not as readily absorbed as nitrate N Other factors to be considered when evaluating P uptake are fertilizer solubility, pH, and the reaction products of the fertilizer and soil (CA 66 75355r)

27 Nyborg, M 1970 *Sensitivity to Manganese Deficiency of Different Cultivars of Wheat, Oats, and Barley* Can J Plant Sci 50(2) 198 200 (Eng) (Res Sta, Dep Agr, Beaverlodge, Alberta)

On the basis of yield and leaf symptoms, data confirmed that oats were very sensitive to Mn deficiency, wheat less sensitive, and barley tolerant Cultivar differences occurred in wheat as well as in oats Relative sensitivity to Mn deficiency from the least sensitive to greatest sensitivity was Olli and Parkland barley, Thatcher wheat, Saunders wheat, Glen oats, Exeter oats, and Victory and Abegweit oats (CA 73 24362c)

28 Nyborg, M 1968 *Sulfur Deficiency in Cereal Grains* Can J Soil Sci 48(1) 37 41 (Eng) (Dep Agr, Beaverlodge, Alberta)

Sulfate as Na_2SO_4 greatly increased the yield of NPK fertilized oats in field tests on four Graywooded soils Oats were less sensitive to S deficiency than second year alfalfa, but nearly equal to first year alfalfa In pot culture tests wheat, barley, rape, and first cut alfalfa, and red clover were about equally sensitive to S deficiency (FA 1 764)

29 Racz, G J, Webber, M D, Soper, R J, Hedlin, R A 1965 *Phosphorus and Nitrogen Utilization by Rape, Flax, and Wheat* Agron J 57(4) 335 37 (Eng) (Univ Manitoba, Winnipeg)

Addition of N or P did not appreciably increase the seed yield of wheat on the fallow plot but when applied in combination on the nonfallow site both seed and total yield were significantly increased Additions of P, N, or PN resulted in larger increases of rape than of wheat or flax on both plots

Rape utilized P and N at a higher rate and in larger quantities than either wheat or flax Addition of P reduced the yields and the addition of N increased the total yields of flax on both sites The P content of all three crops at both sites was increased by the addition of P Its content decreased with maturity in all three crops on the nonfallow site and for wheat and rape grown on the fallow site P utilization increased in the order flax > wheat > rape At maturity the percent P in straw decreased at both sites in the order flax > rape > wheat The P content of the seed decreased in the order flax > rape > wheat on the fallow site, and rape > flax > wheat on the nonfallow site Addition of N decreased the P content of the seed for all crops except the flax grown on the fallow site At both sites, all fertilizer treatments increased the N content of all three crops at the seedling stage At maturity, plant material produced on the fallow site had a higher percent of N than that produced on the nonfallow field The amount of dry matter produced varied with crop and harvest date At maturity rape produced the greatest yield and flax the lowest (CA 63 6272e)

30 Sosulski, F W, Lin, D M, Paul, E A 1966 *Effect of Moisture, Temperature, and Nitrogen on Yield and Protein Quality of Thatcher Wheat* Can J Plant Sci 46(6) 583 88 (Eng) (Univ Saskatchewan, Saskatoon)

Thatcher wheat plants were grown in half gallon pots, using 2,500 ft candles of light for 16 hr/day, in an Oxbow loam with a field capacity of 27% and permanent wilting percentage of 9% Soil moisture ranges of 27 18%, 27 14%, and 27 10% were maintained N was applied as NH_4NO_3 at 0 and 225 kg/ha at temperatures of 18 and 24° Lower temperature and N fertilization favored plant development at medium and high moisture levels, the protein content of the wheat kernels and flour was higher at the lower moisture levels, either with or without N Sedimentation values of flour were positively correlated with protein content, and inversely related to grain yield Glutamic acid and proline contents were positively associated with flour, alanine, arginine, aspartic acid, cystine, glycine, and lysine were negatively correlated (CA 66 18346q)

31 Spratt, E D 1966 *Fertility of a Chernozemic Clay Soil After 50 Years of Cropping With and Without Forage Crops in the Rotation* Can J Soil Sci 46(3) 207 12 (Eng) (Exp Farm, Dep Agr, Indian Head, Saskatchewan)

N + P fertilizer significantly increased the yield of wheat on a chernozemic clay soil previously under a summer fallow/wheat/wheat rotation for 50 yr Where the rotation during the previous 50 yr was summer fallow/wheat/oats/bromegrass/3 yr lucerne/intertilled maize/wheat/oats, wheat yields did not respond significantly to N + P treatment and were 400 kg/ha higher than in the first rotation The inclusion of lucerne and bromegrass in the rotation resulted in improved physical condition and higher contents of N, organic C, and total P in the soil (FCA 20 1596)

32 Spratt, E D, McCurdy, E V 1966 *The Effect of Various Long-Term Soil Fertility Treatments on the Phosphorus Status of a Clay Chernozem.* Can J Soil Sci 46(1) 29 36 (Eng) (Exp Farm, Dep Agr, Indian Head, Saskatchewan)

Yield data since 1945 indicate that various rates of monoammonium phosphate and barnyard manure have changed the relative yield potential of their respective plots Responses of wheat to the treatments have changed over the years, during the first few years of the experiment, all rates of monoammonium phosphate, except the 20 lb/acre rate, gave wheat yield increases of ~2 cwt/acre, but during recent years the 30 and 40 lb/acre rates did not give yield increases as large as they did originally The 80 and 100 lb/acre rates gave yield increases of >3 cwt/acre Availability tests for soil P showed much higher P values for treated than for untreated plots Moderate rates of monoammonium phosphate for 20 years maintained the P fertility of the Indian Head soil near an optimum level (CA 64 16573f)

33 Stevenson, C K, Bates, T E 1968 *Effect of Nitrogen to Phosphorus Atom Ratio of Ammonium Phosphates on Emergence of Wheat ("Triticum vulgare")* Agron J 60(5) 493 95 (Eng) (Univ Guelph, Ontario)

Ammonium phosphates providing five N P atom ratios (1 00, 1 25, 1 50, 1 75, and 2 00 1) were applied in solution in the row with wheat seed at planting in greenhouse experiments The soils used were Oneida clay loam (CEC 18 3 meq/100 g) and Fox sandy loam (CEC 8 2 meq/100 g) each adjusted to pH levels ranging from 5 4 to 7 4 Soil pH, over the range studied, had no effect on emergence with any of the ammonium phosphate materials tested Neither early nor final emergence changed when the N P atom ratio was varied in the clay loam soil when the molarity of the fertilizer solution was held constant (equal rates of P but varying rates of N) In the sandy loam soil early emergence was markedly lower with high N P atom ratio materials than with low ratio materials Final emergence showed the same trend as early emergence with the sandy loam soil but differences between materials were much smaller The difference in results between the two soils is attributed to the effect of cation exchange capacity on the toxicity of ammonia in the soil (FA 1 1677)

CHILE

34 Volke, V 1968 *Effects of Nitrogen and Phosphorus on the Yield and on the Nitrogen and Phosphorus Content of a Winter Wheat Variety (Cappelle Desprez)* Agr Tec (Santiago de Chile) 28(4) 162 69 (Sp) (Univ Austral Chile, Valdivia)

The effects of N and P on yields, and their content in the Cappelle Desprez wheat variety in a "trumao" soil, were analyzed The effects found by means of regression analysis were a positive linear dependence of N and P upon the protein percentage of grains, negative dependence and a positive linear dependence of P upon the P percentage of grains, a positive linear dependence of N and a positive dependence of P upon the N percentage of straw, a positive linear dependence of both nutrients upon yield, a positive linear dependence of both nutrients upon the protein production per given area, and a positive linear dependence of P and negative dependence of N upon the P extraction from grains There is a positive correlation between the N percentage of grains and that of straw, the N and P extracts from grains, the extracts of N of grains and yields, and the extracts of P of grains and yields No correlation was found between the N and the P percentage of grains, the N percentage of grains and yields, the P percentage of grains and yields (CA 71 37949h)

35 Volke, V, Inostroza, O 1967 *Effect of Nitrogen and Phosphorus on Yield Components and Other Characteristics of Winter Wheat Variety Cappelle Desprez* Agr Tec (Santiago de Chile) 27 99 105 (Sp) (Centro Univ Temuco)

In a factorial experiment on a "trumao" soil (Chile), N and P improved tillering and reduced the number of grains per head in winter wheat P increased and N decreased the 1,000 grain weight Ripening was delayed by N and advanced by P applications Both N and P increased yield, which was positively correlated with tillering and plant height and negatively correlated with number of grains per head (SF 31 1394)

MEXICO

36 Borlaug, N E 1969 *Mejoramiento del Trigo su Impacto en el Abastecimiento Mundial de Alimentos* International Maize and Wheat Improvement Center, Mexico Translation and Reprint Series No 2, 40 pp (Sp)

A translation of a paper "Wheat Breeding and Its Impact on World Food Supply," presented by the author at the Third International Symposium on Wheat Genetics, Canberra, Australia, Aug 5 8, 1968 (The English version is published in the proceedings of the symposium) High yielding varieties of wheat will not realize their potential productivity unless they receive sufficient fertilizer The best varieties cultivated with adequate fertilizer and the best cultural practices are capable of yielding up to 6,500 kg/ha The same variety cultivated with no fertilizer has yielded as little as 180 kg/ha In Mexico, high yield varieties of wheat need heavy applications of N and P (120 40 0 or 140-40 0) It does not respond to additional K or micronutrients

37 Borlaug, N E, Ortega, J, Garcia, A, Rodriguez, R 1966 *Preliminary Reports of the First Three Inter American and the First Two Near East American Spring Wheat Yield Nurseries* CIMMYT Misc Reports 1 5, International Maize and Wheat Improvement Center, Mexico 2nd ed (Eng)

Results of tests on 25 varieties of wheat were received from 18 stations in the western hemisphere and from 20 in the Near East Data on yield and incidence of disease are reported

38 *CIMMYT Report 1966 67 1967 68, 1968 69* International Maize and Wheat Improvement Center, Dep Communication Londres 40, Mexico 6, D F, Mexico (Eng)

Annual reports of the International Maize and Wheat Improvement Center in Mexico The Center is a nonprofit scientific and educational institution governed by an international board of directors with the main purpose of assisting all nations in obtaining rapid yield increases of wheat and maize *CIMMYT News* is published bi monthly by the Center

39 Dalrymple, D 1969 *New Cereal Varieties–Wheat and Corn in Mexico* U S Dep Agr Foreign Agr Ser, International Development, Washington, D C 36 pp (Eng)

In 1965, nearly 95% of Mexico's wheat and over 13% of its corn was raised in irrigated districts Fertilizer was used on 64% of the irrigated land and 79% was fully or partially mechanized Estimates of total fertilizer consumption rose from 12,400 tons in 1950 to 196,700 tons in 1960

40 Guide for Technical Assistants in Agriculture in Mexico Secretaria de Agricultura y Ganaderia, Instituto Nacional de Investigaciones Agricolas, Mexico, 1965 408 pp (Sp)

Reports of field trials and fertilizer applications on crops in various locations throughout Mexico

41 MacKenzie, D R 1971 *Results of the Fourth International Spring Wheat Yield Nursery, 1967 68* International Maize and Wheat Improvement Center (CIMMYT), Mexico, Res Bull 18 (Eng)

Fifty wheat varieties representative of the major spring types were tested in the Fourth International Spring Wheat Yield Nursery (ISWYN) Results were obtained from 63 locations throughout the spring wheat regions of the world Data received included yield and other agronomic and disease traits

42 Puente, B A, Alvarado, B A, Moreno, D R 1964 *Fertilizing Wheat in the Comarca Lagunera Region* Agr Tec Mexico 2 102 3 (Sp)

Fertilizer trials on wheat were done in five localities with predominantly clay soils of pH 7 3 7 5, organic matter content 1 52 1 99% and soluble salts giving a specific conductance of 1 03 3 93 millimhos/cm Eighty kg/ha N + 80 kg/ha P_2O_5 increased grain yield from 879 kg/ha (on unfertilized plots) to 2 621 kg/ha There was no significant response to K Two of the sites, where sediments are deposited annually after flooding, showed no response to fertilizers (SF 28 1302)

43 Puente, B A, Anaya, G M, Moreno, D R, Ortega, T E 1963 *The Effect of the Time of Application of Nitrogen on Grain Yield of Wheat and Some Agronomic Characteristics, in the Comarca Lagunera* Agr Tec Mex 2(4) 152 54 (Sp) (C I A N E, Matamoros Coahuila)

Wheat received 80 kg N/ha (the optimum quantity), all at sowing time or after the first to the fourth irrigation, or split between sowing time and after the first two irrigations Applying all the N after the third and fourth irrigations gave the lowest yields, applying it at other times gave similar high yields The highest percentage of N in the grain, 15 05%, was obtained by applying all the N after the third irrigation, 73 days after sowing (FCA 19 15)

44 Zepeda, M J, Ortega, T E 1967 *Fertilization of Wheat in the Fuerte Valley* Instituto Nacional de Investigaciones Agricolas, S A G, Centro de Investigaciones Agricolas de Sinaloa (CIAS), Mexico Cir 18 8 pp (Sp)

45 Zillinsky, F J, Borlaug, N E 1971 *Progress in Developing Triticale as an Economic Crop* International Maize and Wheat Improvement Center (CIMMYT), Mexico Res Bull 17, 27 pp (Eng)

This report summarizes the progress made and some of the problems encountered in the Triticale program at CIMMYT during the past year improving the yield, fertility, grain types, and lodging resistance under N fertilization

UNITED STATES

46 Adriano, D C, Armbrust, D V, Murphy, L S 1969 *Foliar Absorption of Urea by Sandblasted Wheat Seedlings* Agron J 61 575 76 (Eng) (Kansas State Univ, Manhattan)

Four week old wheat (*Triticum aestivum* L) seedlings were exposed to 13 6 m/sec wind velocity and sand at 1 kg/min Urea solution was foliar sprayed at different intervals of time after exposure Total N content of tissues decreased in the order wind plus sand > wind alone = unexposed Urea uptake seemed to be greater when application was soon after exposure to wind and sand (SF 33 658)

47 Ashley, D A 1968 *Nitrate Uptake and Assimilation by Low N Wheat Seedlings from $Ca(^{15}NO_3)_2$ Solution* Diss Abst B 28(12) 4839 (Eng) (N Carolina State Univ, Raleigh)

Initial absorption of ions from pH 6 5 $Ca(^{15}NO_3)_2$ solutions by low N wheat seedlings resulted in acidic solution pH drifts After approximately 3 hr, pH drifts toward alkalinity in the solution occurred Absorption of Ca and nitrate ions was not stoichiometrically related to the accumulation of H or hydroxyl ions as indicated by pH changes in the solution Nitrate uptake, accumulation and assimilation rates increased rapidly during the initial 4½ hr, decreased during the 4½ to 6 hr interval and then increased again after 6 hr The fluctuations in these rates were possibly associated with internal metabolic readjustment in response to internal acidity fluctuations when the Ca and nitrate ions were absorbed A lag occurred in the initial rates of nitrate uptake, reduction, and assimilation Part of the lag phenomenon associated with nitrate reduction and assimilation resulted from the sequential effects of the lag in nitrate uptake, but there also appeared to be a lag specifically associated with each process The reduction and assimilation processes resulted in ^{15}N enrichment of ammonium, amide, alpha amino, chloroform soluble, and ethanol insoluble N fractions within 3 hr The enrichment of each fraction increased with time, the ammonium and amide fractions having highest enrichment and alpha amino and ethanol insoluble fractions following in that order Since nitrate accumulated in plant tissues, reduction of nitrate appeared to be a rate limiting step in the assimilation of nitrate into reduced constituents Amino acids synthesized from nitrate also accumulated to a greater extent than their reduced precursors implicating protein synthesis from the amino acids as a rate limiting step in nitrate assimilation Pulse treatment of seedlings with $Ca(^{15}NO_3)_2$ for 3 hr followed by $Ca(^{14}NO_3)_2$ treatment provided a basis for comparing the efficiency of nitrate reduction in roots and shoots Immediately after exposure to nitrate, roots were more efficient than shoots in nitrate reduction and this was probably associated with the time required for translocation of nitrate to reducing sites in the shoots In the latter phases of the experimental periods the shoots were more efficient than roots in nitrate reduction Data from the nitrate pulse experiment also indicated that substantial quantities of nitrate reduction products in roots may be translocated to the shoots of the low N seedlings Ca absorbed from $^{45}Ca(NO_3)_2$ was distributed throughout the plant within 3 hr A major portion of the Ca absorbed in the initial 3 hr entered the replaceable (1 hr $SrCl_2$ displacement) root Ca pools Subsequent to 3 hr most of the Ca entered nonreplaceable (root Ca remaining after $SrCl_2$ and EDTA displacement) and shoot Ca pools (FA 1 1345)

48 Bauer, A, Young, R A, Ozbun, J L 1965 *Effects of Moisture and Fertilizer on Yields of Spring Wheat and Barley* Agron J 57(4) 354 56 (Eng) (N Dakota Agr Exp Sta, Fargo)

The results are reported of 66 field trials conducted during 1958 60 on nonfallowed soils in N Dakota to measure the effects of seasonal rainfall and stored soil moisture at sowing time on the yields of spring sown wheat and barley given various amounts of N Growing season rainfall ranged from <4 to >10 in Average yields of grain increased as rainfall increased whether N was given or not The magnitude of the response, as well as the amount of N needed for maximum yield, also rose as rainfall increased As the amount of stored available soil moisture at sowing rose, there was an increase in the amount of N, with P, required for maximum grain yields Growing season rainfall, plus stored soil moisture, accounted for approximately 40% of the yield response to N (FCA 19 770)

49 Black, A L 1970 *Adventitious Roots Tillers, and Grain Yields of Spring Wheat as Influenced by Nitrogen Phosphorus Fertilization* Agron J 62(1) 32 6 (Eng) (Soil Water Conserv Res Div, Agr Res Serv, Sidney, Montana)

Factorial combinations of concentrated superphosphate at 0, 22, 45, 90, or 180 kg of P/ha and NH_4NO_3 at 0, 45, or 90 kg of N/ha were broadcast on a Williams loam soil and incorporated with a tandem disk just before seeding spring wheat (*Triticum aestivum*, Fortuna) Samples of roots and tops taken at the end of tillering revealed that most of the effect of P and NP fertilization was accounted for by changes in plant morphology Grain yields increased from 1,984 to 2,706 kg/ha (29 5 to 40 2 bu/acre) when 45 kg of P/ha was added alone and to 3,306 kg/ha (48 2 bu/acre) when 45 kg of N/ha was also applied Higher rates of P, with or without added N, failed to further increase grain yield (CA 72 78027v)

50 Boatwright, G O, Ferguson, H 1967 *Influence of Primary and/or Adventitious Root Systems on Wheat Production and Nutrient Uptake* Agron J 59 299 302 (Eng) (Montana State Univ, Bozeman)

Spring wheat (*Triticum aestivum* Thatcher) was grown under greenhouse conditions under two levels of P and two soil water regimes in the fertilizer zone Plants were grown either with complete root systems, or with primary roots, or with adventitious roots Plants which developed only primary or only adventitious roots initiated late tillers just before reaching maturity Since plants utilizing both root systems failed to initiate late tillers, it appears that late tillering is related to root development rather than to a soil water or P fertilizing factor Early tillering under P fertilizing was significantly greater when plants developed both root systems P fertilizing did not increase tiller formation unless both root systems were present Grain yields were significantly greater when plants developed both root systems than when either individual root system was utilized Plants with only adventitious roots yielded significantly more grain than those with primary roots only P fertilizing significantly increased

grain yields irrespective of root development The dry fertilizer zone resulted in decreased wheat yields when plants developed both root systems, but yields from plants with only primary roots were not affected by the dry fertilizer zone N and P translocation into the grain was significantly greater when plants developed both root systems than when plants were grown with incomplete root systems (SF 31 2107)

51 Boatwright, G O Viets, F G, Jr 1966 *Phosphorus Absorption During Various Growth Stages of Spring Wheat and Intermediate Wheatgrass* Agron J 58(2) 185 88 (Eng) (U S Dep Agr, Bozeman, Montana)

Maximum tiller production, maximum dry matter production for both species, and maximum grain production of wheat resulted when P was supplied in the nutrient culture for the first 5 weeks Longer periods of available P did not increase significantly the number of tillers produced Available P must be present early in plant growth if maximum root development of wheat and wheatgrass is to be achieved A supply of P for the first 4 weeks was sufficient to produce maximum root growth The percent of P was abnormally high in the tops of the spring wheat plants during the first 5 weeks (up to heading) when P was supplied to the nutrient culture continuously The percent of P in the roots of the plants grown in nutrient solutions containing P from the outset was highest in young plants decreased until the hard dough stage, then increased until harvest Dry matter production of intermediate wheatgrass was reduced more than spring wheat when P was withheld during either the initial period of growth or in the later period The small quantities of P absorbed initially by both crops was extremely important for maximum dry matter production When P was withheld for the first 2 weeks, tiller and secondary root development was hindered and the yields for wheat, wheatgrass, and wheat grain were, respectively, only 80, 59 and 42% of the maximum P uptake as measured in the tops of wheat continued after wheat headed to maturity when P was supplied continuously, but this P was not utilized for dry matter or grain production The percent of P in the wheat grain did not change significantly as the period for P increased from 2 to 8 weeks However, when P was provided throughout the growth period, the percent and total P in the grain was less than for the other treatments When P was initially withheld, the percent P in the tops of wheat, and wheatgrass, and in wheat grain increased with increasing increments of time that P was withheld Early P deprivation results in abnormally high P percent when P was ultimately supplied N uptake by spring wheat and intermediate wheatgrass increased significantly as the period of P supply increased from 3 to 5 weeks, but it was not significantly different when P was supplied for periods longer than 5 weeks When P was initially withheld, there was a significant decrease of N uptake by both crops Data indicate that an initial 5 week supply of P provided enough P for maximum wheat yields (CA 65 1335e)

52 Brown, J C 1965 *Calcium Movement in Barley and Wheat as Affected by Copper and Phosphorus* Agron J 57(6) 61 21 (Eng) (Soil Water Conserv Res Div, U S Dep Agr, Beltsville, Maryland)

A definite nutritional relation between Cu, Ca, and P in the Cu responsive Atlas 66 and Monon wheat and Hudson barley plants is demonstrated With increasing concentration of P in the soil, the concentration of Ca decreased and the concentration of P increased in the upper leaves of Cu deficient plants, as indicated by the failure of the new leaves to unroll, and the twisting and dying of the tops Monon wheat does not develop these symptoms unless grown at relatively high P concentrations P decreases the movement of Ca to the new leaves of Atlas 66 more readily than it does in Monon P concentrations are greater in Cu deficient than in Cu sufficient leaves The Cu deficiency symptoms were related to the Ca and P concentrations in the plants Addition of Cu to the soil maintained a higher concentration of Ca and a lower concentration of P in the upper leaves of the Cu sufficient plants, but the concentration of Rb and Zn in the leaves was not affected (CA 64 4206c)

53 Brown, P L 1971 *Water Use and Soil Water Depletion by Dryland Winter Wheat as Affected by Nitrogen Fertilization* Agron J 63(1) 43 6 (Eng) (Soil Water Conserv Res Div, Agr Res Serv, Bozeman, Montana)

Evapotranspiration (ET), daily water use, and soil water depletion by Feekes scale growth stages of N fertilized *Triticum aestivum* (wheat) were measured under dryland field conditions Fall applied N (NH_4NO_3) rates were 0, 67, and 268 kg/ha (0, 60, and 240 lb/acre) Soil water measurements were made at weekly intervals with a neutron moisture meter Soil nitrate N to 183 cm (6 ft) in early spring was 21 kg/ha (19 lb/acre) ET for the sping summer growth period was 22 1, 27 2, and 31 5 cm (8 7, 10 7, and 12 4 in) for the respective N treatments Daily ET reached maximum values at the headed to flower stage Soil water extraction was largely limited to the upper 91 cm (3 ft) with no N With N, the wheat extracted water to 183 cm Stored soil water supplied 6 1, 11 2, and 15 5 cm (2 4, 4 4, and 6 1 in) of water to the wheat grown on the three N treatments This was 30, 55, and 76% of the plant available water to 183 cm At maturity, there was 18 0, 13 2, and 9 6 cm (7 1, 5 2, and 3 8 in) of plant available water remaining in the soil to a depth of 183 cm Grain yields were 1,610, 3,090 and 3,630 kg/ha (24, 46, and 54 bu/acre) In addition to increasing ET, N increased water use efficiency by 56% (CA 74 75652a)

54 Brown, P L, Campbell, R E 1966 *Fertilizing Dryland Spring and Winter Wheat in the Brown Soil Zone* Agron J 58(3) 348 51 (Eng) (Dep Soil Sci, U S Dep Agr, Bozeman, Montana)

Wheat (alternating with fallow) was not fertilized or was given 18 lb P or up to 40 lb N/acre or both Fertilization gave no consistent yield increases in spring or winter wheat In some instances N and NP depressed yields Applied P and NP accelerated spring growth and soil moisture use The failure of accelerated early growth to increase grain yields was attributed to water stress from the heading stage to maturity (FCA 20 780)

55 Carson, F W, Jr 1967 *Some Initial Differences in Wheat Seedling Metabolism as Induced by Ammonium or Nitrate Nitrogen Sources* Diss Abst B 28(2) 427 (Eng) (Univ N Carolina, Raleigh)

Ten day old N starved wheat seedlings were used to study some of the differences in metabolism induced by exposure to

nitrate and ammonium sources of N The 10 days of growth without N caused a high carbohydrate status of the tissues permitting rapid absorption of both forms of N and utilization of the ammonium without the onset of severe toxicities during the period of investigation The seedlings were exposed to either of the two N sources and sampled over a 264 hr period Rapid changes in the pool sizes of P containing components revealed a number of early metabolic differences between ammonium and nitrate nutrition In the shoots, lipid P was higher when nitrate was supplied, whereas only small differences between N sources were evident in the root lipid fraction Within 2 hr, the roots of plants supplied with ammonium increased in RNA content, soluble nucleotides, and a soluble organic P fraction, including sugar phosphates (CA 68 38574g)

56 Chaudhuri, I I, Wiebe, H H 1968 *Influence of Calcium Pretreatment on Wheat Germination in Saline Media* Plant Soil 28 208 15 (Eng) (Utah State Univ, Logan)

Wheat grains were soaked for 6 hr in 1% solutions of $CaCl_2$, $Ca(NO_3)_2$, KNO_3, NaCl, and in water, they were then grown in 1% NaCl Percentage germinations were 92, 81, 31, 16, and 8% respectively Increasing the $CaCl_2$ concentration to 5% and the soaking time to 24 hr, did not have any great effect on percentage germination but the $CaCl_2$ treatment reduced ^{22}Na uptake from the germinating medium by 25% The effect of $CaCl_2$ treatment persisted even when the seeds were dried and stored for 112 days before germination (SF 31 3465)

57 Deering, R E 1968 *Wheat Fertilization A Calculated Gamble* Farm Quarterly 23(5) 44 5, 102 4 (Eng)

Most U S wheat is produced in the Great Plains where annual rainfall is less than 20 in and fertilization is not considered profitable Many of the soils still are relatively high in native fertility but others are becoming low in organic matter and available P On these latter soils, fertilization can be profitable in some years Profits in years of high rainfall may more than compensate for fertilizer costs in other years Stored soil moisture may be measured to decide whether or not to fertilize and how much to fertilize Very high rates of fertilization may hold more promise than the present moderate rates A preliminary test in Montana resulted in 70 bu of wheat/acre from 300 lb/acre of N compared to 37 bu from 60 lb of N and 21 bu from the check plot without N Moisture requirement for the 70 bu was 13 in or 5 3 bu/in On the check plot moisture use was 9 2 in or 2 2 bu/in (FA 2 126)

58 Dewey, W G, Nielson, R F 1969 *Effect of Early-Summer Seeding of Winter Wheat on Yield, Soil Moisture, and Soil Nitrate* Agron J 61 51 5 (Eng) (Utah State Univ, Logan)

Yield reductions in winter wheat planted in June or early July largely cancelled the benefits of the fallow summer on Utah drylands By autumn of the establishment year, most of the available soil moisture and nitrates had been used up In irrigated trials, although irrigation and N applications maintained soil moisture and nitrate levels near optimum, yields of the early seeded plots were significantly below those of late seeded ones Disease, winterkill and physiological old age appeared to be the main factors responsible (SF 32 3975)

59 Dreier, A F, Sander, D H, Grabouski, P H, Daigger, L A 1969 *Winter Wheat and Rye Fertilizer Experiments in Nebraska, 1968* Nebr Agr Exp Sta Outstate Test Circ 133, 37 pp (Eng)

In 13 winter wheat experiments in the Southeastern area since 1961, P alone produced an average yield increase of only 1 bu Forty lb of N when applied alone, gave a yield increase of 7 bu, and a 10 bu increase was obtained from N + P An additional 20 lb of N gave a 2 bu yield and 0 5% increase in protein content In an average of 20 experiments in the East South Central area, the average yield of nonfertilized plots was 22 bu An increase of 2 bu was obtained from P alone, 4 bu from 40 lb of N, and 7 bu from 40 lb of N + P N increased protein 0 8 and 1 1% at the 40 and 60 lb rates respectively Fall and spring N applications gave comparable yields In the Central area, average yields and yield response to fertilizer have varied greatly with season This would indicate that factors other than soil fertility are limiting wheat yields in this area Increasing rates of N fertilizer decreased bushel weights and gave sizeable increases in protein content In 19 experiments in the West South Central area, an average yield increase of 7 bu from 40 lb of applied N was obtained Increases in protein content of 0 6 1 3, and 1 8% resulted from applications of 20, 40, and 60 lb of N, respectively In 25 Western area experiments 40 lb of N gave an average yield increase of 5 bu and 1 5% increase in protein content When applied with P, yield increases of 4 6 and 6 bu were obtained from 20, 40, and 60 lb of applied N, respectively with corresponding increases of 0 8, 1 4, and 2 2% protein The higher N rates reduced bushel weights

60 Eck, H V, Tucker, B B 1968 *Winter Wheat Yields and Response to Nitrogen as Affected by Soil and Climatic Factors* Agron J 60(6) 663 66 (Eng) (S W Great Plains Res Cent, U S Dep Agr, Bushland, Texas)

In 104 field trials on 41 soil types in W Oklahoma, fertilizer treatments were 45 kg N + 20 kg P/ha or 20 kg P/ha Soil moisture at sowing, rainfall during the growing season temperature during ripening, soil moisture in the spring, and rainfall in the spring were significantly and positively correlated with grain yields and with yield response to N It was not possible to use these relationships to predict wheat yields or yield response to N (FCA 22 2440)

61 Eilrich, G L 1969 *Nitrate Reductase Activity in Wheat ("Triticum aestivum") and Its Relationship to Grain Protein Production as Affected by Genotype and Spring Application of Calcium Nitrate* Diss Abst 29(12) 4478B (Eng) (Univ Illinois, Urbana)

1 Seasonal nitrate reductase activity in 15 high protein cv was positively correlated with percent N in the grain produced Nitrate reductase activity after flag leaf extension was correlated with yield of grain protein/ha 2 In a field trial in 1966 67, in which $Ca(NO_3)_2$ was applied at 34 and 68 kg/ha to cv Gage and Ottawa on April 8, 18, and 30, increasing levels of N produced increases in nitrate content, nitrate reductase activity, and soluble protein content of leaf tissue There were no differences between cv and dates of application 3 Cv Ponca and Monon grown at high post vernalization

temperatures (38° day/27° C night following 18°/7° C) caused reduced nitrate absorption, low soluble protein content of tissue, and reduced dry matter accumulation rate, compared with medium post vernalization temperatures (29°/18° C) (FCA 23 60)

62 Fleming, A L, Foy, C D 1968 *Root Structure Reflects Differential Aluminum Tolerance in Wheat Varieties* Agron J 60 172 76 (Eng) (U S Dep Agr Soils Lab, Beltsville, Maryland)

Atlas 66 and Monon wheat varieties were grown in a modified Steinberg nutrient solution with 9 ppm Al for 5 days, they were then placed in Al free nutrient Root growth ceased after 24 hr with Monon, but continued with Atlas 66 When stress was removed, the existing root tips and lateral roots of Atlas 66 continued growing but Monon produced new lateral roots and considerable growth occurred from adventitious roots that had been only slightly damaged by Al The regenerated Monon root system was conspicuously short (SF 31 3578)

63 Foy, C D, Armiger, W H, Briggle, L W, Reid, D A 1965 *Differential Aluminum Tolerance of Wheat and Barley Varieties in Acid Soils* Agron J 57(5) 413 17 (Eng) (U S Dep Agr, Beltsville, Maryland)

Wheat and barley varieties differed widely in their tolerance to acid soils containing high levels of KCl extractable Al Wheat varieties from Brazil showed the greatest tolerance to the acid soils while those from the plains and western states showed the least tolerance High levels of extractable Al resulted in stubby roots, chlorosis, and die back of leaves from the tips, and in some cases a purple coloration of stems Liming the soils to pH 5 8 reduced the solubility of Al to nontoxic levels and greatly reduced or eliminated yield differences between varieties Results indicate that certain varieties have been selected for properties that are closely associated with their abilities to tolerate Al in acid soils (CA 63 15490h)

64 Foy, C D, Burns, G R, Brown, J C, Fleming, A L 1965 *Differential Aluminum Tolerance of Two Wheat Varieties Associated With Plant Induced pH Changes Around Their Roots* Soil Sci Soc Amer, Proc 29(1) 64 7 (Eng) (U S Dep Agr, Beltsville, Maryland)

In nutrient solutions, the Al sensitive Monon variety of wheat lowered the pH, and the Al tolerant Atlas 66 variety raised the pH, resulting in differences up to 0 7 pH unit In acid Bladen soil, this difference was much smaller and a higher root to soil ratio was necessary to produce significant pH changes The factor responsible for the Al tolerance of Atlas was not transferred to Monon in mixed cultures in Bladen soil The relative increase in yield of Monon with high lime compared to yield with low lime was much greater than the corresponding increased yield of Atlas High lime raised the concentration of Ca in Monon tops considerably more than in Atlas Uptake of P by Atlas was greater with low lime than with high lime but lime had the opposite effect on P uptake by Monon Atlas roots were profusely branched with both high and low lime, but those of Monon were profusely branched only with high lime Results indicate that the differential Al tolerance of Atlas and Monon varieties of wheat can be attributed at least in part to plant induced pH changes around their roots (CA 63 12009h)

65 Gingrich, J R 1965 *Effect of Soil Temperature on the Response of Winter Wheat to Phosphorus Fertilization* Agron J 57(1) 41 4 (Eng) (Oklahoma Agr Exp Sta, Stillwater)

Wheat was sown on soils (a) low in P and (b) high in P to which two levels of P or no P were added, and the pots were held at 50°, 65°, and 80° F The dry matter yield at 24 days was unaffected by applied P at 50° F, but was considerably increased at the higher temperatures, the first increment in P being particularly effective in (a) The P content of the herbage was scarcely affected by temperature, but increased with added P (FCA 19 728)

66 Greene, R E 1965 *Investigations of Soil Nitrogen Levels and Nitrogen Fertilization of Hard Red Winter Wheat* Diss Abst 26(3) 1266 267 (Eng) (Oklahoma State Univ, Stillwater)

Spraying wheat with N solutions after an initial N application to the soil increased grain protein content if the topdressing did not exceed 40 lb N/acre, but the increase was small (FCA 19 1956)

67 Guettinger, D L 1965 *Nitrate and Ammonium Nutrition of Wheat* Diss Abst 26(6) 2959 (Eng) (Washington State Univ, Pullman)

Wheat plants grown for 4 weeks in culture solutions in a growth chamber produced more top and root growth with NO_3 N than with NH_4 N The differences associated with source of N were greater when the root zone was maintained at 40° F than when it was allowed to equilibrate to the 70° F light period and the 60° F dark period The lesser growth in NH_4 N solutions was shown to be independent of concentration The utilization of NH_4 appeared to be pH dependent, whereas NO_3 utilization was not Four field trials were conducted to evaluate source of N in two rainfall zones in eastern Washington N fertilizer was applied in the spring to fall seeded wheat At each of the experimental locations, N fertilizer increased the production of dry matter The percentage of N in the above ground portions also increased with N fertilization The NO_3 N increased dry matter production more than did NH_4 N at the start of the growing season and the uptake of N at this time was also greater with an NO_3 source of N than with an NH_4 source (CA 64 10354f)

68 Halstead, E H, Barber, S A, Warncke, D D, Bole, J B 1968 *Supply of Ca, Sr, Mn, and Zn to Plant Roots Growing in Soil* Soil Sci Soc Amer, Proc 32(1) 69 72 (Eng) (Purdue Univ Agr Exp Sta, Lafayette)

In growth chamber experiments, the calculated supply of Ca, Sr, Mn, and Zn to wheat and soybeans occurring via root interception plus mass flow, was highly correlated with their uptake Plant species affected Ca and Sr uptake, but not Mn and Zn uptake Three methods of calculating the quantity of root interception were evaluated by determining the relative degree of correlation between the calculated supply and uptake by the plant The method which estimated the maximum possible root interception gave the highest correlation (FCA 21 2330)

69 Harper, J E, Paulsen, G M 1969 *Nitrogen Assimilation and Protein Synthesis in Wheat Seedlings as Affected by Mineral Nutrition I Macronutrients* Plant Physiol 44(1) 69 74 (Eng) (Kansas State Univ, Manhattan)

Deficiencies of each major nutrient (N, P, K, Ca, Mg, S, and Fe) decreased the specific activity of nitrate reductase from *Triticum aestivum* seedlings Nitrate content was decreased by N, P, K, Ca, and Mg deficiencies and unaffected by S and Fe deficiencies Glutamic acid dehydrogenase activity was decreased by N, P, and S deficiencies, unchanged by K deficiency, and increased by Ca, Mg, and Fe deficiencies Glutamine synthetase activity closely paralleled nitrate reductase activity and was decreased by deficiencies of N, P, K, Ca, Mg, and S Glutamic oxalacetic transaminase was not sensitive to major nutrient deficiencies High leucine ^{14}C incorporation into tissue sections of N, P, K, Ca, and S deficient seedlings did not appear indicative of protein synthesis rates in intact seedlings Nutritional deficiencies apparently depleted endogenous amino acid pools and caused less inhibition of exogenous leucine ^{14}C incorporation into protein (CA 70 76877g)

70 Harper, J E, Paulsen, G M 1969 *Nitrogen Assimilation and Protein Synthesis in Wheat Seedlings as Affected by Mineral Nutrition II Micronutrients* Plant Physiol 44(5) 636-40 (Eng) (Kansas State Univ, Manhattan)

Activity of nitrate reductase from *Triticum aestivum* L seedlings was decreased by deficiencies of Mo, Zn, and Cl Nitrate accumulated in Mo deficient seedlings, declined in Zn deficient seedlings, and was unaffected by the other micronutrient treatments Glutamic acid dehydrogenase activity was decreased by deficiency of Mo, the only nutrient that affected the enzyme Glutamine synthetase activity was decreased only by Cu deficiency, and glutamic oxaloacetic transaminase was not affected by any micronutrient deficiencies Incorporation of ^{14}C leucine into protein by wheat seedlings was increased by Mo deficiency, apparently because of decreased inhibition from endogenous amino acids, and was decreased by Cu deficiency Protein content was not affected significantly by the micronutrient treatments (FA 2 1342)

71 Hough, H, Painter, L I, Singleton, P, Seamands, W, Partridge, J, Moine, C, Robbins, G 1966 *Summary of 1965 Fertilizer Studies in Wyoming* Wyom 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)

72 Huber, D M, Painter, C G, McKay, H C, Peterson, D L 1968 *Effect of Nitrogen Fertilization on Take-All of Winter Wheat* Phytopathology 58(11) 1470 472 (Eng) (Dep Plant Path, Univ Idaho, Moscow)

In field trials in 1967, the percentage of whiteheads resulting from take all (*Ophiobolus graminis*) in irrigated winter wheat, decreased significantly with increasing rates of fertilizer N The grain yield obtained from nonfertilized wheat severely infected with *O graminis* was 28 bu/acre Ammonium sulfate at 40 lb N/acre reduced the disease index from 83 to 35 and gave a yield of 58 bu/acre (FCA 22 1663)

73 Huffaker, R C, Miller, M D, Baghott, K G, Smith, F L, Schaller, C W 1967 *Effects of Field Application of 2,4 D and Iron Supplements on Yield and Protein Content of Wheat and Barley and Yield of Beans* Crop Sci 7(1) 17 19 (Eng) (California Agr Exp Sta, Davis)

In field trials during 3 yrs, the grain yields of wheat and barley were significantly increased by 2,4 D isopropyl ester applied as a dust at 12 lb/acre at the 5 to 7 leaf stage The highest cereal yields were obtained when the isopropyl ester was used in combination with $FeSO_4$ or FeEDDHA The protein content of the wheat was markedly increased by application of 2,4 D iso octyl ester in combination with FeDTPA (FCA 21 2304)

74 Hutton, C E, Fiskell, J G A 1963 *Zinc Response by Soybeans and Wheat on Heavily Limed Soils in Western Florida* Soil Crop Sci Soc Florida, Proc 23 61 70 (Eng) (Florida Agr Exp Sta, Gainesville)

Results of two experiments are reported where combinations of high Ca limestone and high rates of hydrated lime were applied to induce a Zn deficiency in crops grown in a wheat soybean rotation Deficiency symptoms are described Data show the effect of increasing rates of liming materials Yield decreases can be counteracted by one application of Zn Soil data show some movement of Ca as deep as 15 in from high applications of hydrated lime at the surface (CA 62 2210d)

75 Ibrahim, H A 1967 *Studies on the Sprouting Problem in Soft White Wheats* Diss Abst 28B(1) 16 17 (Eng) (Cornell Univ, Ithaca, New York)

In a survey of 259 lines and varieties of wheat, those with red grains usually sprouted less than those with white grains Few white varieties showed any measureable degree of dormancy, cv Avon was more prone to sprouting in the ear than was cv Genesee The best method for testing for sprouting behavior was by placing ears of wheat on wire mesh and spraying with water Resistance to sprouting was greater at higher grain moisture contents Topdressing with 40 lb N/acre decreased the amount of sprouting Germination of seeds from basal spikelets of red and white varieties was less rapid than that of seeds from other ear positions (FCA 21 1575)

76 Jackson, W A, Lugo, H M, Craig, D 1966 *Cesium Uptake from Dilute Solutions by Young Wheat Seedlings as Affected by Selected Cations* Plant Soil 24(1) 33 53 (Eng) (Dep Soil Sci, N Carolina Agr Exp Sta, Raleigh)

Uptake of Cs by roots of wheat seedlings raised in solution culture was reduced by prior treatment with K, and by the presence of K, Rb, and NH_4 in the solution containing the Cs At pH 4, addition of Ca increased uptake of Cs Cs transport to the shoots was reduced by Ca at pH 6, by NH_4, and by K and Rb when the K content of the tissue was high When the K content of the tissue was low, little transport of Cs occurred and solution concentrations of K up to 0 01 meq/l increased transport of Cs Data suggested that separate processes were involved in the uptake and the translocation of Cs NH_4 ions inhibited uptake and transport to similar extents, whereas K inhibited uptake more than transport (FCA 20 63)

77 Jackson, W A, Williams, D C, Laudencia, P N, Carson, E W, Jr 1964 *Effects of Phosphorus Nutrition on Manganese Uptake and Transport in Wheat Seedlings* Trans, 8th Int Congr Soil Sci 4 165 79 (Eng) (N Carolina State Univ, Raleigh)

Shoot growth of wheat seedlings cultured in nutrient solution without added P was restricted by 10 days after germination whereas root growth was not restricted until 18 days The diminution in capacity of roots of low P seedlings as compared with high P seedlings to take up Mn was evident before root growth was restricted The uptake of Mn was affected more by P nutrition than was Cs and Sr uptake The lower capacity of low P seedlings to take up Mn was observed for 0 1 1 0 meq Mn/l The difference in Mn uptake between the two types of seedlings was not attributable to the respiratory substrate supply since the carbohydrate contents of roots and shoots was greater in low P seedlings than in high P seedlings Initially, Mn uptake was rapid and nonlinear with time for both high and low P seedlings In both cases this was followed by a slower rate which was linear at 2 8 hr Adding equivalent amounts of NaH_2PO_4 to the $MnCl_2$ increased to 50% the linear phase of Mn uptake in the low P seedlings, and also slightly increased the Mn uptake in the high P seedlings Equivalent amounts of Na_2SO_4 did not increase Mn uptake Transport of Mn to the shoots occurred at a steadily increasing rate for 8 hr in both seedlings Differences between the high and low P seedlings were even more marked in Mn transport to the shoots than in Mn uptake by the roots The addition of NaH_2PO_4 to the $MnCl_2$ solutions increased Mn transport more than it increased uptake of Mn by roots Addition of NaH_2PO_4 to the roots of seedlings that had previously absorbed Mn induced substantial movements of Mn to the shoots This effect on transport was larger with low P seedlings than with high P seedlings (CA 71 2629b)

78 Jackson, W A, Williams D C, Minotti, P L 1968 *Some Consequences of Nitrogen Nutrition on Uptake and Transport of Strontium and Cesium* Soil Sci 106(5) 381 92 (Eng) (Dep Soil Sci, N Carolina State Univ, Raleigh)

In growth chamber experiments, wheat seedlings were grown for 2 weeks in nutrient solutions containing (a) ammonium N, (b) nitrate N, and (c) no N, and then transferred to solutions containing labelled Cs and Sr The proportion of absorbed Sr transported to the shoots was higher in seedlings from (a) and (b) than in those from (c) Cs uptake was high in seedlings from (a) and low in those from (b), but in the latter, a large proportion was transferred to the shoots There was a very high deposition of Sr in the young third leaf of seedlings from (a) During the uptake period, Cs uptake was decreased in seedlings from (a) and (c) by the concomitant presence of ammonium N, while the presence of nitrate N increased the Sr and Cs uptake in seedlings from (c) (FCA 22 883)

79 Jadav, K L 1970 *Effect of Salinity on Nitrogen Use by the Dwarf Wheat "Triticum aestivum" variety Sonora 64* Diss Abst Int B 30(10) 4460 461 (Eng) (Univ California, Riverside)

Three salinity levels (control, 140 and 280 meq/l) and four N levels (28, 56, 84, 112 ppm N) were combined (3 x 4) in the factorial design to give 12 treatments Three salinity levels were established by addition of appropriate amounts of a mixture of equal weights of $CaCl_2 2H_2O$ and NaCl Field experiment was carried out simultaneously for a N rate comparison with sand cultures The greenhouse experiment gave the greatest grain yield per plant, suggesting that under suitable environmental conditions, higher yields can be obtained than occurred in the outdoor environment in the vicinity of Riverside (b) Almost identical conclusions were drawn from the experiments in all the three habitats with respect to phenology of the species under study, particularly with respect to time of flowering, N concentration and uptake, and effect of these factors on grain yield It was observed that the higher yielding characteristic of the dwarf wheat variety, Sonora 64, seems to be due to its long period of grain development and N absorption after flower emergence, suggesting sufficient water supply after flower emergence stage (CA 74 12212m)

80 Jensen, M E, Sletten, W H 1965 *Evapotranspiration and Soil Moisture Fertilizer Interrelations With Irrigated Winter Wheat in the Southern High Plains* Conserv Res Rep U S Agr Res Serv, No 4, 25 pp (Eng)

Seasonal evapotranspiration (ET) with optimum soil moisture averaged ± 28 in Delayed irrigation, which decreased seasonal ET by 10%, reduced yield by 20% N fertilizer increased seasonal ET by 10%, but increased yields by 60% Rate of ET increased rapidly in spring During the heading stage, Ef reached a mean maximum of 0 28 in /day From heading to maturity, potential ET increased, but ET decreased N up to 12 lb/acre greatly increased grain yields when medium and high moisture levels were maintained High rates of N increased protein content of grain, but the latter decreased when yields were increased by irrigation N increased water use efficiency (SF 30 609)

81 Long, O H, Odom, J A, Safley, L M 1964 *Phosphorus and Potassium Fertilization in Crop Rotations* Tenn Agr Exp Sta Bull No 376, 26 pp (Eng)

In 3 yr rotations of maize, wheat, and red clover on three major soil series for periods of 10 13 yr, yields were increased significantly by P Fused tricalcium phosphate compared favorably with concentrated super, 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)

82 Lutz, J A, Jr, Jones, G D 1969 *Yield of Corn, Wheat, and Red Clover Orchardgrass in Rotation as Affected by Fertility Treatments on Tatum Silt Loam* Va Polytech Inst Res Div Bull 43, 12 pp (Eng) (Virginia Polytech Inst, Blacksburg)

In trials during 1952 67 on silt loam developed from muscovite schist, wheat and orchardgrass red clover responded to P but not to K, although maize responded to K in the later years of the experiment when soil K decreased In general, N, Ca, and Mg contents of the plant material were affected less by soil amendments than were P and K contents The low K

responses were attributable to the soil's capacity to supply large amounts of available K (SF 33 3180)

83 McNeal, F H, Boatwright, G O, Berg, M A, Watson, C A 1968 *Nitrogen in Plant Parts of Seven Spring Wheat Varieties at Successive Stages of Development* Crop Sci 8(5) 535 37 (Eng) (Crops Res Div, U S Dep Agr, Bozeman, Montana)

Data are given on the N content of stems, leaves, husks, and grain of seven spring wheat cv on five dates during the heading to ripe grain stages N percentages in the husks were similar to those in stems and leaves, and decreased with time at approximately the same rate Grain N percentages were similar at the late flowering and milk stages, but increased significantly by the dough stage The average percentage of N translocated from top growth to grain was 66 2% under irrigation and 74 8% under dryland conditions The amount of N in the total top growth increased by 85 1 kg/ha under irrigation and 20 1 kg/ha under dryland conditions during the sampling period Grain N percentage and grain N content were significantly correlated with the grain straw ratio and total top yield, respectively (FCA 22 882)

84 Malik, D S 1968 *Effect of Various Factors on Yield and Yield Components in Wheat and Soybeans* Diss Abst 30(1) 27B (Eng) (Univ Illinois)

Application of N and P increased wheat yield by increasing the number of spike bearing culms under low plant density Under high plant density fertilizer application increased yield by increasing the number of spike bearing culms as well as the number of kernels per culm Under low plant density N and P slightly reduced the number of kernels per culm Application of both N and P was more beneficial than the application of each element alone for increasing yield, number of culms, and kernels per culm under high plant densities Application of entire quantity of N either at planting or in three equal split applications (one third rate each at seeding, before and after heading) produced higher wheat yields than its later topdressing either before or after heading

85 Miller, F L, Anderson, K L 1965 *Relationships in Winter Wheat Between Nitrogen, Lignin Content, and Fertilizer Treatments* Crop Sci 5(5) 391 94 (Eng) (Dep Agron, Kansas Agr Exp Sta, Manhattan)

The effects of applied N and P on the N and lignin contents of the uppermost three internodes of eight varieties of winter wheat were investigated The N content was increased by N and P, and it increased in each internode from the third upwards The lignin content increased in each internode from the third upwards, was unaffected by level of applied N and was decreased by P, thus P tends to weaken the culm (FCA 19 1348)

86 Minotti, P L, Williams, D C, Jackson, W A 1969 *Influence of Ammonium on Nitrate Reduction in Wheat Seedlings* Planta 86 267-71 (Eng) (N Carolina State Univ, Raleigh)

Seeds of wheat (*Triticum aestivum*) germinated in the dark for 3 days in $10^{-4}M$ $CaSO_4$ were grown 14 days in 16 hr of light at 1,800 ft-candles daily in a solution of 0 1 meq KCl, 0 2 meq $MgSO_4$, and 0 5 millimole $Ca(H_2SO_4)_2$/l at pH 5 5 with brisk aeration Oligoelements at one fifth the strength of Hoagland's A Z solution were included In experiments that used this solution, the seedlings were the low N seedlings Those grown in the basic solution + 15 meq/l $NaNO_3$ were the nitrate seedlings The experimental culture solutions were supplemented with N at 0 4 meq/l Experimental periods, generally 24 hr, were under continuous light of 1,800 ft candles N starved seedlings absorbed much less NO_3 when NH_4^+ was present but reduced the same proportion of the absorbed NO_3 Nitrate seedlings reduced the same amount of NO_3 whether or not NH_4^+ was present Nitrate reductase activity was not affected by NH_4^+ or the products of NH_4^+ assimilation NH_4^+ exerts its effect directly rather than by interference with the reduction of the absorbed NO_3 (CA 71 88557m)

87 Minotti, P L, Williams, D C, Jackson, W A 1968 *Nitrate Uptake and Reduction as Affected by Calcium and Potassium* Soil Sci Soc Amer, Proc 32(5) 692 98 (Eng) (N Carolina State Univ, Raleigh)

Nitrate uptake patterns by N depleted wheat seedlings (*Triticum vulgare* variety Atlas 66) exhibited an initial lag phase which was lessened, but not completely overcome, by the presence of Ca solution Maintenance of a more rapid subsequent rate of nitrate uptake, which developed after the initial lag phase depended upon presence of K solution The rapid phase was enhanced when both Ca and K were present and was curtailed by shoot excision and by Ca deficiency Sizeably larger amounts of nitrate were recovered in the shoots after 24 hr in KNO_3 as compared to $Ca(NO_3)_2$ and with the former salt, smaller proportions of the absorbed nitrate were reduced The data suggest a beneficial influence of Ca both on initial nitrate uptake by root tissue and on transport to shoots while a continual K supply was apparently beneficial in nitrate transport (CA 70 10685m)

88 Moeller, W J, Thurman, R L 1966 *Nitrate Content of Fall-Sown Rye, Wheat, and Oat Forages* Agron J 58(6) 627 28 (Eng) (Univ Arkansas, Fayetteville)

Rye accumulated more nitrates than wheat, which in turn accumulated more nitrate than oats at the higher rate of N fertilizer, but oats stored more nitrates than wheat at the lower rate of fertilization All three species contained the highest level of nitrate N at the first cuttings and the amount present might be hazardous to livestock grazing Later cuttings and regrowth cuttings were lower in nitrate and should present no hazard to livestock grazing (CA 66 10258u)

89 Murphy, L 1968 *Let's Take a Look at Fall Fertilization of Wheat* Agr Nitrogen News 18(5) 14 15, 17 (Eng)

Preplant fertilization of wheat in the Great Plains is feasible and provides just as good yields as spring application If all the N is applied preplant, lower protein content may be expected Apply preplant N after preplant irrigation on sandy soils to avoid excessive leaching Incorporating fertilization into tillage operations is a major economic gain

90 Nelson, C E, Mortensen, M A, Early, R E 1966 *Effects of Time and Method of Applying Nitrogen Carriers on Rill Irrigated Gaines Wheat* Wash State Univ, Agr Exp Sta, Sta Circ No 463, 14 pp (Eng) (Washington State Univ,

Pullman)

A study was made of the effects on yield in rill irrigated Gaines winter wheat of fall or spring application by topdressing or shanking 40, 80, 120, or 320 lb/acre the N carriers, $Ca(NO_3)_2$, urea, NH_4NO_3, and $(NH_4)_2SO_4$ Results showed no significant differences in yields with any one N source Topdressing or shanking in the spring gave more grain and less straw per acre than the fall application, but with low N rates, shanking in the spring proved the most effective time and method for application of $(NH_4)_2SO_4$ (CA 66 85145m)

91 Nelson, C E, Early, R E, Mortensen, M A 1968 *Effect of Time of First April and May Irrigations on Topdressed Fertilizer N on Gaines Wheat* Wash State Univ, Agr Exp Sta, Sta Circ 489, 9 pp (Eng) (Washington State Univ, Pullman)

Gaines wheat was seeded in September on Shano silt loam, topdressed with NH_4NO_3 in March, and irrigated every 2 weeks until harvest, starting at three different dates after seeding Grain or straw yields were not significantly affected by the different irrigation treatments possibly because of higher than normal rainfall The effects of "soil test" NO_3 N plus fertilizer N on yield were also studied, the levels ranging 40 360 lb N/acre Grain yields increased curvilinearly from 58 bu with 40 lb N/acre to 110 bu/acre with 240 lb N/acre, and decreased with higher N levels For each 4 7 lb N/acre, yield increased 1 bu/acre through the range where N limited yield (FA 2 372)

92 Nelson, C E, Early, R E, Mortensen, M A 1966 *The Effects on Wheat Yield of Deep Discing and Spring Tooth Harrowing th Soil Following Shanked In Ammonium Nitrogen Fertilization* Wash State Univ, Agr Exp Sta, Sta Circ No 459, 8 pp (Eng) (Washington State Univ, Pullman)

Irrigated spring wheat was grown with $(NH_4)_2SO_4$, NH_4HSO_3, and aqua NH_3 shanked into the soil at 40 160 lb/N/acre These applications did not affect the resulting wheat yields Cultipacking soil after applying the fertilizers resulted in higher wheat yields than deep discing and cultipacking or deep spring tooth harrowing and cultipacking the soil, due to N carriers being brought to the surface by the latter two methods Laboratory work showed that some gaseous NH_3 can be lost from aqua NH_3, less from $(NH_4)_2SO_4$, and none from NH_4HSO_3 The lower wheat yields from deep post fertilization tillage than from cultipacked treatment was attributed to a portion of the NH_3 fertilizer materials being brought into the upper surface of the soil where it was unavailable to the plants under conditions with little moisture (CA 66 94363h)

93 Nelson, C E, Mortensen, M A, Early, R E 1965 *Phosphorus and Zinc Fertilization of Rill Irrigated Wheat on Recently Leveled Land* Wash State Univ, Agr Exp Sta, Sta Circ No 458, 8 pp (Eng) (Washington State Univ, Pullman)

The soil was treated with four fertilizers ammonium sulfate banded together or separately with triple superphosphate ammonium nitrate banded with triple superphosphate or diammonium phosphate The N treatments were all at 160 lb N/acre The field used had a history of Zn deficiency The P levels used were 0, 26 52, or 104 lb/acre The average yield for all treatments in the experiment was 79 6 bu/acre The 26 lb P increment produced 7 2 bu/acre more wheat than did the treatment with no P Additional 26 lb P increments did not affect yields No Zn deficiency was observed in the wheat, nor was there a yield response from Zn when it was applied in combinations with the N or P treatments (CA 67 32052t)

94 Nielson, R F, Van Epps, G A 1966 *Fertilizing Winter Wheat in Utah* Utah Sci 27 68 71 (Eng)

N deficiency occurred on all areas producing dryland winter wheat The deficiency tends to be exaggerated in years of favorable moisture Some dryland soils respond more favorably to NP application than to N alone Little correlation appears between soil tests for P and response to P by winter wheat Placement with the seed at planting produced yields equal to or better than those obtained from broadcast applications Fertilizer response appears more pronounced in years when wheat emerges in the autumn N broadcasting in spring should take place early, so that N moves into the soil during spring storms Response to broadcast P was less than to placed P Placement with the seeds did not reduce stands or yields at rates up to 50 lb/acre N (SF 30 614)

95 Olson, R V, Koehler, F E 1968 "Fertilizer Use on Small Grain," IN *Changing Patterns in Fertilizer Use*, pp 253 71, Proc Symp Soil Sci Soc Amer, Chicago, Ill, Feb 14 15, 1968 Soil Sci Soc Amer, Inc, Madison, Wisconsin (Eng) (Kansas State Univ, Manhattan)

A summary review, with six references, of nutrient and fertilizer requirements, and determination of the latter in wheat, oats, barley, and rye, effects of fertilizer on crop quality, fertilizer practice for hard red winter wheat in the central Great Plains and for soft white wheat in the Northwest (SF 31 2104)

96 Paulsen, G M, Harper, J E 1968 *Evidence for a Role of Calcium in Nitrate Assimilation in Wheat Seedlings* Plant Physiol 43 775 80 (Eng) (Kansas State Univ, Manhattan)

Severely Ca deficient seedlings accumulated high levels of NO_2 and moderate levels of NO_3 and organic N, but contained unaltered levels of hydroxylamine, accumulation of NO_2 was not related to Mo deficiency or altered cellular pH Deficiency of Ca decreased NO_3 reductase, but did not affect NO_2 reductase and NADP diaphorase activities Results suggest that the role of Ca is in the intracellular transport of NO_2 and not in induction or activity of enzymes (SF 31 4315)

97 Pumphrey, F V 1968 *Wheat Yield and Protein Content as Predictors for Nitrogen Fertilization in Northeast Oregon* Ore Agr Exp Sta Spec Rep 259, 8 pp (Eng)

Yields and protein content of winter wheat grown without or with N fertilization in northeast Oregon varied considerably between fields Yield of a particular field was only weakly correlated with percent protein in the grain or the yield increase resulting from N fertilization Yield of a field is of little value as a guide in establishing reliable N fertilizer recommendations Larger yield increases from fertilizing with N were obtained in the higher yielding fields than in the lower yielding fields The major cause of low yields in the low producing fields is not a shortage of N The protein content of the grain not fertilized with N was negatively

correlated with yield increase resulting from fertilizing with N This negative correlation may prove useful as a tool in predicting the need for N fertilization Data indicate that the rate of N applied should be adjusted to produce grain with a protein content of 8 7 to 8 9% Allowance would need to be made for the variety grown and the yearly effects of the fertilizer

98 Roberts, S , Koehler, F E 1965 *Sulfur Dioxide as a Source of Sulfur for Wheat* Soil Sci Soc Amer , Proc 29(6) 696 98 (Eng) (Washington State Univ , Pullman)

SO_2 was injected into the soil as a source of S for wheat in greenhouse and field studies using S deficient silt loam soils Yields were approximately doubled when SO_2 was applied at 25 ppm S in the greenhouse, higher rates ($\gtrless$ 500 ppm) resulted in slight additional growth Plant growth responses to SO_2 and gypsum at 10 ppm S were almost identical In the greenhouse experiments, SO_2 applied at 2,500 ppm greatly reduced plant growth and 5,000 ppm was lethal soon after emergence Concentration of S in plants was directly related to the rate of S application In field trials, SO_2 was applied at 8, 16, 32, and 64 lb S/acre, no adverse effects were noted at the highest rates of application SO_2 compared favorably with gypsum as a source of S with respect to plant growth, total S uptake, and wheat yield in both greenhouse and field trials (CA 64 16572a)

99 Russel, D A , Henshaw, D A , Schauble, C E , Diamond, R B 1970 *High Yielding Cereals and Fertilizer Demand* National Fertilizer Development Center, Tennessee Valley Authority, Bull Y-4, Muscle Shoals, Alabama, 22 pp (Eng)

Yield responses to fertilizer are reviewed for high yielding and native varieties of rice, wheat, maize, and grain sorghum Universally, these cereals respond to N, but less frequently to P and K Generalized yield curves were computed for the response of high yielding and native varieties of these crops but not to P or K because of the scarcity of data The curves define no specific response of either type of variety for any country but are examples of expected relative responses between high yielding and native varieties

100 Schaeffer, R J , Klages, K H W 1966 *Nitrogen Fertilizer Improves Quality of Hard Red Winter Wheat in Eastern Idaho* Idaho Agr Exp Sta Bull 461 19 pp (Eng) (FCA 20 18)

101 Sharma, K C , Krantz, B A , Brown, A I 1968 *Interaction of P and Zn on Two Dwarf Wheats* Agron J 60(3) 329 30 (Eng) (Univ California, Davis)

Two Mexican dwarf varieties of wheat (*Triticum aestivum* L) were used as test crop to study the interaction between P and Zn in Corning clay loam soil The pattern of Zn deficiency symptoms was different in two varieties Zn concentration was markedly decreased with P application In absence of Zn, 100 ppm P resulted in reduced growth over that of 25 ppm P (FA 1 1067)

102 Smika, D F 1970 *Summer Fallow for Dryland Winter Wheat in the Semiarid Great Plains* Agron J 62 15 17 (Eng) (U S Dep Agr , North Platte, Nebraska)

On a Holdrege silt loam a fallow-wheat (*Triticum aestivum*) system provided stable production when compared with continuous wheat which failed more than 30% of the time Fallow wheat was the most efficient method of producing winter wheat when average annual precipitation was less than 43 cm In both cropping systems grain yields were positively related to total precipitation for fallow wheat with and without N fertilizer the correlation coefficients were 0 643 (P = 01) and 0 464 (P = 05) respectively, for continuous wheat with and without N the coefficients were 0 540 (P = 01) and 0 544 (P = 05) respectively N content of fallow wheat grain without N fertilization was as high as that of continuous wheat with fertilizer N (given as NH_4NO_3) (SF 33 4051)

103 Stewart, B A , Porter, L K 1969 *Nitrogen Sulfur Relations in Wheat ("Triticum aestivum"), Corn ("Zea mays"), and Beans ("Phuseolus vulgaris")* Agron J 61(2) 267 71 (Eng) (Soil Water Conserv Res Div , Agr Res Serv , Fort Collins, Colorado)

The N S ratios in the tops and roots of wheat (*T aestivum*), corn (*Z mays*), and beans (*P vulgaris*) were studied in relation to N and S supplies in soil Greenhouse studies showed that when S became limiting, additional N did not affect either the yield or protein level of the plants, but the nonprotein N (nitrates, amides, and amino acids) increased There was a close relation between the amounts of N and S metabolized in the plants The data indicated that one part S was required for every 12 15 parts N to insure maximum production of both dry matter and protein As the use of N fertilizers increases the possibility that S may become limiting also increases, and adequate consideration of S becomes necessary This is especially true in greenhouse studie , where S may become limiting very quickly (CA 70 95788v)

104 Stewart, B A , Whitfield, C J 1965 *Effects of Crop Residue, Soil Temperature and Sulfur on the Growth of Winter Wheat* Soil Sci Soc Amer , Proc 29(6) 752 55 (Eng) (U S Dep Agr , Fort Collins, Colorado)

Holdredge very fine sandy loam from a fallow wheat field which had been farmed to wheat for ~50 year and had never been fertilized was used Soil temperatures were controlled at 55, 60, and 65 ± 0 5° F by placing the pots in thermostatically controlled water baths The number of culms decreased as the temperature increased when no fertilizer was added When fertility was adequate the culm number increased sharply from 55 to 60° F with little difference between 60 and 65° When no fertilizers were added, the mixed straw treatment resulted in a decreased yield as compared to no straw Straw on the surface decreased the nutrient supply slightly or not at all When N and P were added, the decomposition of straw incorporated with the soil immobilized a portion of the available S and a reduction in yield resulted When S was added with the N and P, the presence of straw in the soil did not effect yield Ratios of total N to total S (total N S) and protein N to protein S were determined on the tissue Total N S can be used as a criterion in assessing the S status of plants, a total N S ratio of ~17 1 or less indicates that S is limiting the formation of proteins (CA 64 16572b)

105 Stroike, J E , Johnson, V A , Schmidt, J W , Mattern, P J 71 *Results of the First International Winter Wheat Performance Nursery* Nebr Agr Res Bull 245, 84 pp (Eng) (Univ Nebraska, Lincoln)

The first nursery was grown in 1969 at 23 sites in 16 countries and was comprised of 28 winter wheat varieties and 2 spring varieties Data were reported from 21 sites Specific objectives of the nursery are to (1) Test the adaptation of winter wheat varieties under a range of latitudes, daylengths, fertility conditions, water management, and disease complexes, (2) Identify superior winter varieties to serve as recipient genotypes for high protein and high lysine genes, (3) Test the degree of expression and stability of the high protein and high lysine traits in an array of environments

106 Turman, G L, Ramig, R E, Dreier, A F, Olson, R A 1969 *Yield Protein Relationships in Wheat Grain, as Affected by Nitrogen and Water* Agron J 61(5) 755 59 (Eng)

Highly significant inverse yield protein relationships in wheat grain were found at each level of applied N in an irrigation N rate experiment on hard red winter wheat over a 3 yr period at North Platte Nebraska The chief effect of applied N with adequate water was to increase yields, while the chief or entire effect with severe water deficits was to increase protein content In intermediate situations, N increased both yield and protein content In dryland experiments in 1966 and 1967 showing significant grain yield response to applied N, protein content also increased Where little or no yield response occurred, N mainly increased protein content Content of NO_3 N in the soil to a depth of 180 cm was also important in yield protein relationships Average protein contents of about 20 hard red winter wheat varieties at different locations in Nebraska in 1966 and 1967 were also negatively related to grain yields Protein contents varied more widely among locations than among varieties at each location

107 Tocher, C A S 1965 *Some Aspects of Iron Nutrition of Wheat and Peas* Diss Abst 26(2) 655 56 (Eng) (Washington Univ, St Louis)

Increasing the level of Fe in the nutrient solution from 0 5 to 12 5 ppm increased the Fe level of wheat grain 2½ times However, decreased yields also resulted (CA 63 17077c)

108 Welch, L F, Johnson, P E, Pendleton, J W, Miller, L B 1966 *Efficiency of Fall Versus Spring Applied Nitrogen for Winter Wheat* Agron J 58(3) 271 74 (Eng) (Dep Agron, Univ Illinois, Urbana)

In a 3 yr trial, winter wheat cv Monon was given combinations of 0, 20, 40, and 60 lb N/acre in autumn and spring The relationship between yields and applied N was nearly linear, but the maximum response varied widely between years N gave higher yields when applied in spring than in autumn, 20, 40, and 60 lb of spring applied N/acre were equivalent to 30 0, 59 8, and 89 4 lb N/acre applied in autumn, respectively (FCA 20 779)

109 Whittlesey, N K, Fanning, C D 1969 *Economics of Nitrogen Fertilizer Use on Wheat in Pacific Northwest* Commer Fert 118(2) 21 2, 24 5 (Eng) (Washington State Univ, Pullman)

A change in fertilizer prices will not greatly affect sales of N to wheat farmers in the Pacific Northwest Most of these farmers already are using an amount of N that produces nearly maximum profits Uncertainty about weather, prices, and the way Gaines wheat responds to N is probably the cause for not applying the 10-40 lb/acre that is needed for maximum profit A figure and a table show probable yield response for 0 190 lb/acre of N in 10 lb increments at three soil moisture levels (FA 2 697)

110 Woodward, R W 1966 *Responses of Some Semi-Dwarf Spring Wheats to Nitrogen and Phosphorus Fertilizer* Agron J 58(1) 65 6 (Eng) (Utah Agr Exp Sta, Logan)

Yields and yield increases due to early season N applications were greater from three semi dwarf hard red spring wheat varieties than from similar tall varieties Yield increases resulted primarily from increased tillering Except in very fertile soil, N also increased plant height, lodging, protein percentage, and sedimentation values Increases in protein contents and lodging percentages were higher in tall than in semi dwarf varieties (FCA 20 13)

111 Young, R A, Ozbun, J L, Bauer, A, Vasey, E H 1967 *Yield Response of Spring Wheat and Barley to Nitrogen Fertilizer in Relation to Soil and Climatic Factors* Soil Sci Soc Amer, Proc 31 407 10 (Eng) (N Dakota State Univ, Fargo)

Response to fertilizer N was related to soil moisture and NO_3 N stored in the soil at seeding time and to growing season precipitation and temperature Regression equations relating response to these factors were developed Response was not related to available N released during incubation or to N released by alkaline permanganate (SF 31 1391)

URUGUAY

112 Ministerio de Ganaderia y Agricultura 1969 *Trigo Boln Divulgacion No 1*, Cent Invest Agric "Alberto Boerger," 36 pp (Sp)

113 Reynaert, E E, Castro, J L 1969 *Phosphorus Requirements for Wheat in Some Soils of Uruguay* Boln Tec Cent Invest Agric "Alberto Boerger," No 10, 22 pp (Sp)

Recommended rates of soluble P_2O_5 for wheat in brown and black meadow soils of Uruguay varied between 30 and 60 kg/ha (SF 33 3177)

ASIA

AFGHANISTAN

114 *Agricultural Development in Afghanistan With Special Emphasis on Wheat* A Report by the United States Review Team Kabul, Afghanistan, July 1967 106 pp (Eng)

Only limited amounts of fertilizer have been available in Afghanistan and all must be imported at the present time A survey conducted by the Faculty of Agriculture, Kabul

University, revealed that farmers in the six eastern provinces listed fertilizer as the major limiting factor in wheat production and over one fifth of the farmers interviewed said fertilizer would increase their wheat yields by 50%

AUSTRALIA

115 Beech, D F, Norman, M J T 1968 *Preliminary Assessment of the Adaptation of Semi Dwarf Wheat Varieties to the Ord River Valley* Aust J Exp Agr Anim Husb 8 349 57 (Eng) (P O Box 109, Canberra)

Performance under irrigation of three semi dwarf wheat varieties was compared with that of two Australian varieties at three sowing times and three N fertilizer levels in factorial combination The semi dwarf varieties differed from the Australian varieties in their ability to use a high N uptake for grain production in their greater harvest index and in their lower grain N content Mexico 120 and Chile 1B gave highest yields (SF 32 718)

116 Bhatti, A S, Loneragan, J F 1970 *The Effect of Early Superphosphate Toxicity on the Subsequent Growth of Wheat* Aust J Agr Res 21(6) 881 92 (Eng)

The effects of 19 days' treatment with three rates of superphosphate and four rates of ammonium nitrate application on the growth of wheat in a siliceous sand have been studied both during and after treatment Severe necrosis of leaf tips developed after 7 days at high superphosphate and no ammonium nitrate Plant tops with symptoms had high concentrations of P Decreasing superphosphate or increasing ammonium nitrate gave lower P concentrations and fewer symptoms in plant tops Ammonium nitrate depressed P concentrations by promoting top growth relative to root growth Symptoms were ascribed to P toxicity When plants with severe symptoms of P toxicity were transplanted to siliceous sand and watered with complete nutrient solution containing adequate phosphate, tillering was delayed and dry weights of tops, roots, and grains were depressed about 30% Plants with symptoms of only moderate intensity recovered and grew as well as plants which initially had mild or no symptoms The results suggest that the intensity of P toxicity reported to occur in cereal crops in the field is not likely to depress yields seriously

117 Chaudhry, F M, Loneragan, J F 1970 *Effects of Nitrogen, Copper, and Zinc Fertilizers on the Copper and Zinc Nutrition of Wheat Plants* Aust J Agr Res 21(6) 865 79 (Eng)

The effects of N, Cu, and Zn fertilizers on dry matter yields and on Cu and Zn absorption and distribution were studied in Gabo wheat plants grown in pots of an acid loamy sand from Badgingarra, Western Australia Plants were harvested three times during vegetative growth and at maturity Cu and Zn fertilizers had no effect on vegetative or grain yields unless N fertilizer was also added N fertilizer overcame symptoms of severe N deficiency and increased growth five to eightyfold N induced slight symptoms of Cu deficiency and of Zn deficiency after 80 days' growth and induced severe symptoms of Cu deficiency at maturity N severely depressed the concentrations of Cu and Zn in plant tops and roots by diluting the absorbed Cu and Zn two effects of N on growth contributed to dilution of Cu and Zn—a large increase in total growth and a marked increase in top relative to root growth Deficiencies of Cu and of Zn each depressed vegetative growth and delayed maturity at maturity, each deficiency enhanced straw yields and depressed grain yields Cu deficiency was aggravated by Zn sulfate, which depressed Cu concentrations of tops and roots Zn depressed Cu concentrations mainly by depressing Cu absorption it depressed the amount of Cu absorbed, depressed the rate of Cu absorption per gram root in early growth, and had no effect on the distribution of Cu between roots and tops The combined effects of Zn and N fertilizers induced such severe Cu deficiency at maturity that they almost eliminated grain yield Zn deficiency was aggravated by Cu sulfate, which depressed Zn concentrations of tops and roots Cu depressed Zn concentrations in plants partly by increasing growth but primarily by depressing Zn absorption Cu depressed the amount of Zn absorbed, depressed the rate of Zn absorption per gram root in early growth, and had no effect on the distribution of Zn between roots and tops It is suggested that N fertilizer could induce Cu and Zn deficiencies in cereal crops growing on soils with marginal Cu and Zn supplies Zn fertilizers would aggravate the effect of N on Cu deficiency, and Cu fertilizers would aggravate the effect of N on Zn deficiency

118 Colwell, J D 1968 *Calibration and Assessment of Soil Tests for Estimating Fertilizer Requirements II Fertilizer Requirements and an Evaluation of Soil Testing* Aust J Soil Res 6 93 103 (Eng) (Div Soils, CSIRO, Canberra)

Evaluation of soil test measurements in relation to yield responses of wheat and potatoes to N, P, and K fertilizers established significant ($P < 0.05$ to $P < 0.001$) relationships for the P and K tests but not for the N test (SF 32 540)

119 Colwell, J D, Esdaile, R J 1968 *The Calibration, Interpretation, and Evaluation of Tests for the Phosphorus Fertilizer Requirements of Wheat in Northern New South Wales* Aust J Soil Res 6(1) 105 20 (Eng) (Div Soils, CSIRO, Canberra)

Several tests can be used simultaneously for the prediction of fertilizer requirements, and this is demonstrated by the calibration of the soil tests, $NaHCO_3$ soluble P, $NaHCO_3$ soluble K, and pH, against yield response of wheat to P fertilizer using data from 49 field experiments in northern New South Wales The value of rainfall and clay content as tests was also investigated but their contributions to the calibration equations were nonsignificant The application of economic principles for the estimation of optimal P fertilizer requirements is demonstrated Fertilizer requirements decrease with increase in the value of $NaHCO_3$ soluble P, with increase in pH, and with decrease in $NaHCO_3$ soluble K A statistical and economic evaluation of the tests is made on the basis of the regression surfaces established under the calibration procedure, and it is concluded that the value of testing for P fertilizer requirements is considerable (FCA 23 20)

120 Cox W J 1968 *Rates of Superphosphate for Cereal Grain Production in the Under 20 Inch Rainfall Areas* J Agr W Aust 9 97 100 (Eng)

Results of 102 wheat trials were analyzed to determine the

best rates of superphosphate for individual soil types The ideal rates are highest for mallee soils (up to 300 lb/acre), then scrubplain, white gum, red brown sandy loams, and salmon gum/gimlet soils Rates can be lowered as the total previously applied superphosphate increases No difference in requirement was found for the 12 16 in and 16 20 in rainfall areas It is believed that the same rates would suit oats and barley (SF 31 3637)

121 Cuthbertson, E G 1969 *"Chondrilla juncea" in Australia 2 Preplanting Weed Control and Wheat Production* Aust J Exp Agr Anim Husb 9 27 36 (Eng) (Agr Res Inst, Wagga Wagga, New South Wales)

The response of wheat to N fertilization and to the time and method of skeleton weed control was determined at three sites Preplanting herbicide sprays reduced the response to N fertilizer but the interaction was not generally significant (SF 32 3986)

122 Doyle, R J, Parkin, R J, Gartrell, J W 1965 *Molybdenum Increases Cereal Yields on Wheatbelt Scrubplain* J Agr, W Aust 6(12) 699 703 (Eng)

In four field experiments and two paddock strip trials since 1960, Mo at 1 oz/acre, as roasted molybdenite (2 oz/acre) mixed with superphosphate, increased yields by ≤3 5 bu of wheat and 5 5 bu of oats/acre, on sandy and gravelly scrubplain soils of the eastern wheatbelt (CA 65 11284f)

123 Duncan, O W 1968 *Correction of Zinc Deficiency in Wheat on the Darling Downs, Queensland* Qd J Agr Anim Sci 24 287 92 (Eng)

$ZnSO_4$, applied as 1% spray or drilled in at 1 cwt/acre, increased yields by up to 35% (SF 31 4474)

124 Freney, J R, Lipsett, J 1965 *Yield Depression in Wheat Due to High Nitrate Applications, and Its Alleviation by Mo* Nature 205(4971) 616 17 (Eng) (Div Plant Ind, CSIRO, Canberra)

Wheat grown in high nitrate soils required additional Mo for high grain yield Although high nitrate low Mo resulted in low yields, total protein N to P ratio was not significantly changed at various Mo levels (CA 62 1239 *e*)

125 Greenwood, E A N 1966 *Nitrogen Stress in Wheat Its Measurement and Relation to Leaf Nitrogen* Plant Soil 24(2) 279 88 (Eng) (CSIRO, Div Plant Ind, Nedlands)

The intensity of N deficiency in the wheat variety Gabo was measured over a range of 1 83% of N stress Seedlings were grown in sand using a nutrient solution containing (concentrations in m*M* given) $CaCl_2$ 1, NaH_2PO_4 0 33, $MgSO_4$ 0 75, KCl 1, ferric citrate 1 8 X 10^{-3}, $CuSO_4$ 5 X 10^{-4}, $MnSO_4$ 5 X 10^{-3}, H_3BO_3 1 5 X 10^{-2}, $ZnSO_4$ 1 5 X 10^{-4}, ammonium molybdate 1 X 10^{-5} N was supplied in concentrations 0 125 10 0 m*M* as an equimolar solution of NH_4NO_3 and $NaNO_3$ Relative growth rates of tops fell from 11% to 2%/day within these limits, deficiency symptoms appeared when stress was >40% Stress was calculated in terms of concentrations of total, soluble, and free ninhydrin N of the youngest fully expanded leaf (CA 65 1334e)

126 Halse, N J, Greenwood, E A N, Lapins, P, Boundy, C A P 1969 *An Analysis of the Effects of Nitrogen Deficiency on the Growth and Yield of a Western Australian Wheat Crop* Aust J Agr Res 20 987 98 (Eng)

A wheat crop was grown on a N deficient sandy soil Urea was supplied at rates of 0 (N_0), 56 (N_1), and 336 (N_2) kg N/ha In general, the relative growth rate (*R*) decreased with time During the first half of the growing season *R* for $N_2 > N_1 \gg N_0$, but in August deficient plants recovered rapidly The recovery was associated with the emergence of the second tiller, an increase in net assimilation rate and N uptake, and a decrease in N stress There was no evidence that the recovery was due to an increase in mineralization of soil N N stress in treatment N_0 decreased from 48% in July to 14% in September By contrast, stress in treatment N_1 increased rapidly from 6 to 23% during July and fell to 5% by September Flower initiation in N_0 plants was delayed 14 days and ear emergence was delayed 8 days compared with N_2 plants The grain yields of N_0 and N_1 plants were 30 and 60% respectively of those of N_2 plants The decrease was due mainly to differences in the number of heads per sq meter, although N deficiency also reduced the number of grains per head and the weight per grain The duration of photosynthetic activity after anthesis was not affected by N treatments Harvest index was highest on the N_0 treatment and similar on N_1 and N_2 treatments

127 Lewis, D G, Quirk, J P 1967 *Phosphate Diffusion in Soil and Uptake by Plants II Phosphate Uptake by Wheat Plants* Plant Soil 26 119 28 (Eng) (Inst Agr, Univ W Australia, Nedlands)

150, 300, 600, and 2,400 μgP/g soil were applied as calcium phosphate solution to a sandy loam soil which was then dried and thoroughly mixed For each level of added P, uptake into plant tops was almost constant between 2 and 12 weeks and averaged 65, 135, 290, and 530 μgP/plant/day respectively Uptake rate in wheat growing in field rotation trials, where current additions of P produced no yield increase, approached that of plants at the two highest levels of P addition in the pot tests, but this rate was maintained for only a short time (SF 30 2387)

128 Lipsett, J 1969 *Amount of Phosphorus in Field Grown Wheat in Southern New South Wales* J Aust Inst Agr Sci 35(4) 260 62 (Eng)

A variation in P removal by commercial grain of 1 15 lb/acre was observed In that year, the same variety of wheat contained less P on sites of lower fertility than on a site of high fertility, as judged by reported history, soil analysis, and crop performance The highest concentrations of P in plants occurred on two sites w h moderate levels of bicarbonate extractable P, but the lower of these may also reflect an effect of N deficiency in raising P concentration Addition of N at deficient sites increased yield of grain and P content by 25%, and on the second site addition of N increased removal of P from 9 to 13 lb/acre (CA 73 34297z)

129 Lipsett, J 1968 *Experimental Variation of the Supply of Nitrogen, Phosphorus, and Water to Wheat* J Aust Inst Agr Sci 34 174 77 (Eng) (CSIRO, Canberra)

Wheat plants grown in potted infertile yellow podzolic soil were supplied with a basal nutrient solution, and some plants

with additional P or N High levels of N either did not affect or reduce grain yield, unless high P and water were available Withholding water affected the 1,000 grain weight and interactions with P occurred Varietal differences were small (SF 32 1540)

130 Littler, J W 1968 *Wheat Nutrition and Crop Rotation* Qd Agr J 94(8) 508 9 (Eng)

Urea at 1 cwt/acre, applied on May 29, 52 days before sowing wheat on forest dark gray clay soil, gave higher grain yields than a rate of 0 5 cwt/acre, or when applied on other dates Its application with seed had no adverse effect on germination, but delayed seedling emergence Wheat showed no response to N applied alone, but showed a large response to P, and still higher response to P + N Wheat sown on plots which had been under lucerne for the previous 4 yr yielded more than on plots not previously under lucerne, but which received 90 lb N/acre (FCA 22 845)

131 Loneragan, J F, Carroll, M D, Snowball, K 1966 *Phosphorus Toxicity in Cereal Crops* J Aust Inst Agr Sci 32 221 23 (Eng) (Univ W Australia, Nedlands)

Young cereal crops receiving standard rates of superphosphate (150 200 lb/acre) on light textured (sandy) soils in Western Australia showed a high incidence of P toxicity symptoms, associated with P concentrations >0 8% and >1 3% (dry weight) in whole tops and oldest leaves, respectively (SF 30 1316)

132 McClelland, V F 1970 *Effects of Nitrogen Fertilizer on the Yield and Protein Content of Wheat Grown Under Different Cropping Rotations* Aust J Exp Agr Anim Husb 10(45) 450 54 (Eng) (Mallee Res Sta, Walpeup)

N fertilizer increased the yield of wheat grown on land that had been cropped under an intensive rotation Overall, these yield increases were substantial, but yield response was restricted in a dry year Where the same type of land was cropped on a rotation that included medic pasture, N fertilizer had little effect on yield except in a year with abnormally high spring rainfall The application of N fertilizer resulted in a few increases in grain protein content The difference in grain protein content between cultivars was also small, with the grain protein content of Beacon being only slightly higher than for other cultivars There was a substantial increase in grain protein content due to the effect of medic pasture in the rotation The fact that grain protein content did not vary appreciably between years is especially important in the consideration of grain protein content as an index of potential response to N fertilizer (CA 74 12199n)

133 McClelland, V F 1968 *Superphosphate on Wheat The Cumulative Effect of Repeated Applications on Yield Response* Aust J Agr Res 19(1) 1 8 (Eng) (Mallee Res Sta, Walpeup)

The cumulative effects of repeated applications of superphosphate on wheat yield responses, over a period of 26 yr (10 cycles of a rotation system), were examined Since cumulative effects are the sum of current and residual effects and current effects diminish with repeated applications of superphosphate, this approach enabled residual effects to be inferred Residual effects were apparent at all rates of application (30, 60, 90, and 120 lb/acre), being greater at the three higher levels The influence of rainfall in the growing period (April to October) on cumulative effects was also examined April rainfall increased yield at all levels of application, whereas September rainfall increased yield only at 90 and 120 lb/acre of superphosphate The results indicate that, for this particular experimental site, residual P has become more important in determining yield responses than currently applied P (FA 1 1061)

134 Mason, M G 1968 *Trials With Urea and Anhydrous Ammonia for Wheat Growing* J Agr W Aust 9(5) 98 108 (Eng)

In trials on loamy sand, urea applied at sowing gave higher increases in yield of wheat than when applied 2 4 weeks after sowing, but on very sandy soil its application 3 weeks after sowing was more effective On gravelly sand anhydrous ammonia injected at a depth of 4 in at sowing gave higher yields than when injected at 2 in, but highest yields were obtained from injecting it at a depth of 2 in 3-4 weeks before sowing Injection depths of 6 8 in were considered optimum for obtaining the highest yields on sandy soil (FCA 22 850)

135 Mason, M G Parkin, R J Patrick H 1969 *A Comparison of Methods of Urea Application at Ajana* J Agr W Aust 10(2) 56 7 (Eng)

Urea was applied to wheat by mixing with the seed, applying immediately before, immediately after and 2 weeks after seeding Rates of application were 0, 25, 50 75, 100 and 150 lb/acre of urea The soil was a yellow sand and loam, rainfall for the year was 12 46 in Urea mixed with the seed delayed and reduced germination and reduced yields, especially at rates higher than 75 lb/acre Yields were higher when the urea was topdressed immediately before seeding than when topdressed either immediately after or 2 weeks after seeding The most profitable rate of application was 100 lb/acre (FA 2 1111)

136 Mason, M G, Rowley, A M 1969 *The Fate of Anhydrous Ammonia and Urea Applied to a Wheat Crop on a Loamy Sand in the Wheat Belt of Western Australia* Aust J Exp Agr Anim Husb 9 630 35 (Eng) (W Aust Dep Agr South Perth)

Both fertilizers applied at 54 9 lb/acre to wheat grown on deep loamy sand (pH 6 8) increased yields to a more or less similar extent Urea underwent nitrification (and was easily leached to 2 ft depth) earlier than anhydrous ammonia, resulting in greater N uptake and dry weight production (SF 33 3176)

137 Parish, R W, Miller, F L 1969 *Uptake and Effects of Calcium and Phosphate on Maturity, Lignification, and Peroxidase Activity of Wheat Internodes* Aust J Biol Sci 22(1) 77 85 (Eng) (Univ Melbourne, Parkville)

Wheat (cv Gabo) was grown in a controlled environment and supplied with various levels of Ca and phosphate Low levels of phosphate accelerated maturity irrespective of Ca concentrations, while high phosphate levels delayed maturity The converse applied to Ca concentrations, and phosphate effects tended to dominate those of Ca The maturity effects partly explain the lower lignin content of plants grown with

high levels of phosphate observed by other workers The internodes of plants grown with higher levels of phosphate contained greater amounts of P Internode Ca, however, did not increase above a certain value irrespective of nutrient concentration Unlike P, internode Ca was relatively immobile Low-Ca plants contained the most lignin, but only with low phosphate treatments The lignin content of medium and high Ca treatments was not significantly different Increasing the phosphate level with medium and high Ca levels reduced lignification Peroxidase specific activity was lower in low and high Ca and phosphate treatments than in controls, but there was no correlation between this activity and lignin content Plants grown with low Ca levels had a significantly higher percent of total peroxidase attached to the internode cell walls than other treatments Phosphate levels did not affect the amount of wall bound peroxidase The percent of soluble protein loosely bound to cell walls did not differ significantly between treatments Phosphate apparently modifies lignification by affecting maturity, but also by some other means Increasing the levels of Ca probably reduces lignification by releasing peroxidase from the cell wall Phosphate effects again dominated those of Ca (CA 71 19553v)

138 Randall, P J 1969 *Changes in Nitrate and Nitrate Reductase Levels on Restoration of Molybdenum to Molybdenum Deficient Plants* Aust J Agr Res 20(4) 635-42 (Eng) (Div Plant Ind, CSIRO, Canberra)

Plants of wheat cv Olympic were grown in water culture either without added Mo or with 0 005, 0 05 μg (deficient), or 0 5 or 5 μg (sufficient) Mo/plant The effect of Mo on nitrate reductase was assessed by incubating leaf fragments with potassium nitrate, with or without Mo, under lights supplying 2,000 ft candle Enzyme activity was estimated by measuring the nitrite produced by the fragments and released into the solution during 1 hr in total darkness Light stimulated the induction of nitrate reducing activity, while darkness was essential to obtain accumulation of nitrite Mo deficiency in wheat depressed nitrate reductase activity and dry matter yields Mo caused a rapid increase in nitrate reductase in tissue from deficient plants but had no such effect on tissue from nondeficient plants It is suggested that the difference in response patterns between deficient and nondeficient plants induced by Mo treatment could form the basis for a plant test for Mo deficiency (ΓCA 23 71)

139 Rixon, A J 1969 *Influence of Annual and Perennial Irrigated Pastures on Soil Fertility as Shown by the Yield and Quality of a Subsequent Wheat Crop* Aust J Agr Res 20 243 55 (Eng)

Yields of wheat were greater when grown after perennial pastures than after annual pastures N at 112 kg/ha canceled the differences in grain yields, indicating that different degrees of N mineralization following annual and perennial pastures caused the yield differences At all levels of available N, there was a 2 1 ratio between N in the grain and in straw plus chaff Grain protein and gluten protein contents increased with N uptake and were inversely related to the extent of mottling

140 Rovira, A D, Bowen, G D 1968 *Anion Uptake by the Apical Region of Seminal Wheat Roots* Nature, London 218 685 86 (Eng) (CSIRO, Glen Osmond)

Patterns of anion uptake in the apical region of roots of wheat plants grown in nutrient solutions containing ^{32}P-orthophosphate, ^{36}Cl chloride, or ^{35}S sulfate differed for the different anions Differences between ions were also observed in the maintenance of uptake along the root Anion uptake by the apical 7 cm of roots of 14 day wheat plants showed two major peaks with each anion at 4 7 mm and 20 30 mm from the apex, separated by a zone of lesser but still appreciable uptake With PO_4, the two peaks were almost identical in height, with Cl the second peak was almost double the first, and with SO_4 the first peak was the major peak Relatively high PO_4 uptake occurred over the whole 7 cm behind the apex, but uptake of Cl and especially SO_4 declined more steeply (SF 31 3492)

141 Rovira, A D, Bowen, G D 1970 *Translocation and Loss of Phosphate Along Roots of Wheat Seedlings* Planta 93(1) 15 25 (Eng) (Div Soils, CSIRO, Glen Osmond)

Wheat seedlings were grown in tubes in complete nutrient solution for 5 days in 12 hr illumination of 19,200 lumens/m^2 at 18° and 12 hr darkness at 15° Only plants from tubes shown by culture tests to be free of microorganisms were used for experiments Plants for experiments were held 1 hr in 5 X $10^{-4}M$ $CaSO_4$, then transferred to 5 X $10^{-4}M$ $CaSO_4$ + 5 X $10^{-6}M$ KH_2PO_4 For ^{32}P experiments, the roots were placed in such a solution containing $KH_2{}^{32}PO_4$ 15 minutes and then washed in running water 5 7 minutes to remove phosphate in free spaces ^{32}P retained within the roots after drying 30 minutes at 45° was measured by scanning Similar scans were made of paper moistened with the unlabeled solution and folded around the roots This measured the loss of ^{32}P from the roots into the ambient solution Uptake of ^{32}P was highest in the apical cm and in the lateral root zone, although it was appreciable along the whole length of the root In 24 hr translocation removed 68% of the ^{32}P from the apex, 84% from the midroot portion, and 87% from the lateral root zone Losses of ^{32}P were small (3 4% in the first hr and less thereafter, indicating reabsorption) and their patterns were like those of uptake The patterns of loss of ^{32}P observed in these experiments differed markedly from those found for losses of Cl and organic compounds (CA 73 106381x)

142 Russell, J S 1967 *Nitrogen Fertilizer and Wheat in a Semi Arid Environment 1 Effect on Yield* Aust J Exp Agr Anim Husb 7 453 62 (Eng) (CSIRO, Cunningham Lab, St Lucia)

The mean yield responses of wheat over 6 yr at 16 locations were 8 7, 7 2, and 5 1 lb grain for each lb N applied at rates of 11 5, 23, and 46 lb/acre as $(NH_4)_2SO_4$ The soil groups represented were mainly solonized brown soils and red brown earths, with some brown soils of heavy texture, and solodized solonets and terra rossas (SF 31 2109)

143 Russell, J S 1968 *Nitrogen Fertilizer and Wheat in a Semi Arid Environment 2 Climatic Factors Affecting Response* Aust J Exp Agr Anim Husb 8 223 31 (Eng) (CSIRO, Cunningham Lab, St Lucia)

A stepwise multiple regression analysis showed that climatic variables explained 46 5, 64 3, and 64 3% of the variation in the response to N fertilizer of wheat grain yield, grain + straw

yield, and grain N yield, respectively, at 52 sites in South Australia Winter rainfall, and high maximum temperatures in the latter part of the growing period, had marked positive and negative effects, respectively, on yield response to applied N (SF 31 3645)

144 Russel', J S 1968 *Nitrogen Fertilizer and Wheat in a Semi Arid Environment 3 Soil and Cultural Factors Affecting Response* Aust J Exp Agr Anim Husb 8 340-48 (Eng) (CSIRO, Cunningham Lab , St Lucia)

Multiple regression analysis of 10 dependent variables showed the initial NO_3 content in the 0-6 in horizon to be the main soil variable, and sowing date the main cultural variable, affecting response of wheat to N fertilizing at 52 sites in the semi arid regions of South Australia (SF 31 4472)

145 Sims, H J , Rooney, D R 1965 *Gypsum for Difficult Clay Wheat Growing Soils* J Agr (Victoria) 63 401 9 (Eng)

Spring applications of gypsum to stiff red clays and clay loams in wheat growing areas of the Wimmera and elsewhere in Victoria, at rates of 5 cwt 5 tons/acre, improved the physical condition of soils and subsequent crop yields for up to 7 yr (CA 64 11803c)

146 Smith, A N 1965 *The Influence of Superphosphate Fertilizer on the Yield and Uptake of Phosphorus by Wheat* Aust J Exp Agr Anim Husb 5(17) 152 57 (Eng) (Agr Res Inst , Wagga Wagga)

Trial plots of wheat were established on a medium clay loam having a pH of 4 9 Superphosphate was broadcast, 3 weeks before sowing, at rates of 0, 90, 270, 810, and 2,430 lb/acre The stages of growth at which samples were taken were jointing, ear emergence, milk stage, and maturity The samples were separated into leaf, stem, and head and the dry matter content determined The yield of grain after thrashing was calculated on the basis of a 13 5% moisture content All samples were milled to pass a 40 mesh sieve and analyzed for P and protein At jointing the proportion of P in the leaf is 53 62% of the total, roughly the same proportion that the leaf dry matter bears to the total At ear emergence, the proportion of P in the stem rises to 65 70% of the total It then falls to 26-43% at milk stage and 6 14% at harvest The P content of the head at harvest is 82 91% of the total The uptake of P with increasing rate of superphosphate application rises rapidly so that large amounts of P are being removed from the soil At the highest application rate, the removal of P at harvest is equivalent to 130 lb of superphosphate/acre Approximately 80% of this P is removed in the grain while the other 20% is returned to the soil as straw, chaff, and leaf The most noticeable effect in the dry matter and grain production is the relatively small increase that occurs in the grain yield with heavy superphosphate compared with the large increases in dry matter produced, up to milk stage, under the same conditions This failure of a crop to live up to its early vegetative promise is not uncommon in Australia (CA 63 18978f)

147 Smith, A N 1966 *The Role of Inorganic Soil Phosphates in Supplying Phosphorus to the Wheat Plant* Agrochimica 11(1) 79 91 (Eng) (Agr Res Inst , Wagga Wagga)

Ca phosphate at rates up to 94 ppm P, was added to clay and clay loam soils Water was added to 60% of field capacity Wheat was grown in half the pots in each experiment and the other half were kept free of vegetation After a period of growth, the root and shoot material were weighed and analyzed for P content The water soluble Al, Fe, and Ca phosphate fractions in the soil were determined by a modified Chang and Jackson procedure Organic phosphate was determined There were marked similarities in the pattern of P supply The majority of the added P became $AlPO_4$, which was the major source for plant growth There was a decrease in the NH_4Cl and NH_4F fractions and in NaOH soluble P in the soil where wheat was grown The NaOH fraction increased in the pots with no crop Between 88 and 95% of the inorganic fractions of applied P was recovered (CA 66 64659s)

148 Smith, A N 1968 *The Uptake of Phosphorus by Wheat and Clover from Four Inorganic Soil Phosphate Fractions After the Addition of Contrasting Types of Phosphatic Fertilizer* Plant Soil 29 144 55 (Eng) (Agr Res Inst , Wagga Wagga)

Basic slag, calcined rock phosphate, monocalcium phosphate, and rock phosphate were applied to acid, clay loam soil at 0, 50, and 100 ppm P Yield response was assessed using subterranean clover, and residual values using clover or wheat Basic slag and monocalcium phosphate were equally efficient in producing increased yield in the first period and basic slag slightly better during the residual phase Calcined rock phosphate was slightly inferior to rock phosphate at first, but was equal during the second stage both were markedly inferior to the other two fertilizers when clover was the test crop There were significant differences in the forms of phosphate used by the different species and by the same species at different times The better residual value of basic slag can, in part, be ascribed to the greater solubility of the residual fertilizer in the soil over the reaction products of fertilizer and soil (SF 32 581)

149 Swartz, G L , White, B J 1966 *Interaction of Moisture Storage at Planting and Nitrogen Fertilization on Wheat Yield on a Black Earth* Qd J Agr Anim Sci 23 397 406 (Eng)

None, 45, 90, and 180 lb/acre N as urea were applied at five levels of available moisture Although growing season rainfall was above average there was no response to N on unirrigated plots and in absence of N there was only a vegetative response to extra moisture Grain yield responses of 5 6 bu/acre/cwt urea were achieved both with additional N and with additional water but the highest application rates of N and of water depressed yields Additional water generally had a greater effect on vegetative growth than on grain yield but the effect of N was more evident in grain yield (SF 31 660)

150 Syme, J R 1966 *Fertilizer and Varietal Effects on Take All in Irrigated Wheat* Aust J Exp Agr Anim Husb 6(22) 246-49 (Eng) (Agr Res Inst , Wagga Wagga)

Irrigated wheat cv Pinnacle and NBJ 115 was grown with 0 120 lb N and 93 or 200 lb P as superphosphate/acre Without N, about 60% of the crop area was affected by take all (*Ophiobolus graminis*) and yields were lowered by about 22 bu/acre Applied N considerably reduced this yield loss, superphosphate did so only at the higher levels of N NBJ

115 yielded more than Pinnacle, especially at high N, and although a smaller area of it was affected by take all its yield loss in bu/acre was similar Pinnacle had the higher number of ears/m² and 1,000 grain weight, while NBJ 115 had the higher grain/straw ratio and number of grains/ear, take all reduced all of these yield components while N increased the number of ears/m² (FCA 20 796))

151 Syme, J R 1967 *Growth and Yield of Irrigated Wheat Varieties at Several Rates of Nitrogen Fertilizer* Aust J Exp Agr Anim Husb 7(27) 337 41 (Eng) (Agr Res Inst, Wagga Wagga)

In an irrigated wheat experiment, two Australian varieties and two introduced semi dwarf varieties were compared in growth and yield Three rates of N fertilizer were used The semi dwarf wheats yielded more grain than *Heron* and *Olympic* in the sampling harvest The increase over *Heron* was 26% for *Mexico 120* and 15% for *Chile 1B* This higher yield resulted from a longer duration of grain growth, probably associated with earlier flowering The semi dwarfs produced fewer tillers, both at the maximum and at maturity Their higher yield was derived not from increased total dry matter production but from an increased harvest index N fertilizer stimulated tillering and early growth and increased the weight of grain set at flowering Relative growth rates at each fertilizer level then remained approximately equal until maturity Although there was a large response to N, there was no varietal interaction, possibly because of the relatively low level of production and absence of severe lodging (FA 1 591)

152 *Trace Element Deficiencies in the Eumungerie District* 1968 Agr Gaz N S Wales 79(9) 559 60 (Eng)

In a trial on solodized solonets soil in New South Wales, application of Cu and Zn, each at 7 lb/acre mixed with fertilizers, significantly increased wheat grain yields K, Mn, and Mo had little effect on yield, and Fe decreased it It was suggested that high yield increases could be obtained by using suitable pasture species to improve soil structure before growing cereals (FCA 22 1643)

153 Wetselaar, R, Beech, D F 1968 *The Effect of Wet-Season Land Treatment and Nitrogen Fertilizer on Safflower, Linseed, and Wheat in the Ord River Valley 1 Soil and Crop Nitrogen* Aust J Exp Agr Anim Husb 8 59 65 (Eng) (CSIRO, Kununurra)

Crop N yields were highest after 18 months' clean fallow, and were highly correlated with NO_3 N accumulating in the soil profile during the preceding fallow period, crop N yield with urea averaged only 76 7% of that with $(NH_4)_2SO_4$ (SF 31 2829)

INDIA

154 Agrawal, S C, Singh, S P, Gupta, K P 1968 *Role of Potash Application in Reducing Black Rust of Wheat* Indian J Agron 13 99 102 (Eng) (Wheat Res Sta, Powarkheda)

In field experiments A 090, a black rust susceptible wheat, was fertilized with 22 4, 44 8, 67 2, and 89 6 kg/ha K as muriate of potash and inoculated with a uredospore mixture of several races of *Puccinia graminis tritici* Increasing applications of K reduced susceptibility to black rust and reduced the intensity of infection (SF 33 4806)

155 Asana, R D, Ramaiah, P K, Rao, M V K 1966 *The Uptake of Nitrogen, Phosphorus, and Potassium by Three Cultivars of Wheat in Relation to Growth and Development* Indian J Pl Physiol 9 95 107 (Eng) (Indian Agr Res Inst, New Delhi)

Tiller production, particularly secondary tillers, dry matter, and uptake of N, P, and K by *Triticum aestivum* varied between three varieties Differences in the dry weight and nutrient uptake between varieties were small and due largely to number and weight of tillers Tillering was limited more by apical dominance than by nutrient uptake Hormonal and metabolic effects were apparently involved in the high apical dominance of NP 828 as seen in the early onset of the reproductive phase, low P content and some increase in tillering due to P spray The high mortality of secondary tillers and consequent low ear/tiller ratio of NP 824 was due to limited root growth and nutrient uptake Dry matter or grain weight per unit of N absorbed was lowest and dry matter and grain yield highest for NP 824 With equal nutrient uptake stem growth decreased relatively more than grain yield under late sowing In the breeding of a genotype with high efficiency for nutrient utilization, developmental and metabolic aspects should receive equal consideration (SF 31 3644)

156 Banerjee, P K, Sinha, H 1966 *Nitrogen Manganese Interrelationships in Soil and Plant* Ranchi Univ J Agr Res 1 33 7 (Eng) (Ranchi Agr Coll, Kanke)

In pot experiments with paddy and wheat grown on acid sandy loam (pH 5 5), $(NH_4)_2SO_4$ was superior to $NaNO_3$ (at 100 lb N/2 million lb soil), and both applied in conjunction with 50 lb $MnSO_4$ increased the availability of soil Mn Liming reduced soluble and exchangeable Mn in soil and Mn uptake by plants (SF 31 4360)

157 Bathkal, B G 1965 *Studies on N and P Fertilization and Methods of Application for Wheat Under Rain Fed Conditions* Indian J Agron 10 201-6 (Eng) (Agr Coll, Nagpur)

Twenty lb/acre N significantly increased grain and straw yields on a typical black cotton soil Ten lb/acre P_2O_5 significantly improved, but 20 lb/acre slightly depressed yields Results were better when fertilizers were drilled with the seed, than when they were banded 2½ in from the drill row Yield and fertilizer responses were poor in dry years (SF 30 2999)

158 Bhaid, S U, Srivastava, K N, Naik, M S, Das, N B 1968 *Effect of Nitrogen Fertilization on Protein, Lysine, and Tryptophan Contents of Indian and Mexican Wheat Varieties* J Post Grad Sch, Indian Agr Res Inst 6(2) 143 47 (Eng) (Indian Agr Res Inst, New Delhi)

Effect of soil and spray application of urea on the proteins of Indian and Mexican wheat varieties was studied The Mexican variety Lerma Rojo was more responsive than the Indian variety NP 824 as regards yield and protein contents Foliar application of urea enhanced the protein content up to 20 and 37% in the Indian and the Mexican varieties, respectively However, the increased protein synthesis was

accompanied by a decrease in the concentrations of both lysine and tryptophan Thus the main effect of N seems to be to enhance the synthesis of protein fractions which are deficient in these essential amino acids The effect of increased protein synthesis, on the relative deficiency of lysine and tryptophan, is especially well marked in the Mexican variety where a highly significant negative correlation between protein and the two amino acids was observed (CA 73 55123e)

159 Bhargava, B S, Motiramani, D P 1967 *Effect of Fertilizers on the Chemical Composition of Wheat at Different Stages of Growth* J Indian Soc Soil Sci 15(1) 23 7 (Eng) (Agr Coll, Gwalior, Madhya Pradesh)

A study of the effect of fertilizer NPK on the chemical composition of wheat at different stages of growth showed that ammonium sulfate increased significantly the content of N, Ca, and Mg at the three stages of growth tillering, flowering, and harvesting Application of ammonium sulfate also increased significantly the content of P at tillering and flowering stages of growth and decreased P content at harvesting stage particularly in grains Ammonium sulfate also decreased K content at tillering stage and in grains Application of superphosphate decreased significantly the content of N and K at tillering and harvesting stages of growth Superphosphate increased significantly the Ca content at all stages of growth and Mg content at tillering and in grain Muriate of potash decreased significantly the N content at all stages and Ca and Mg at tillering and harvesting stages K content was increased due to K fertilizers at flowering and harvesting stages of growth (FA 1 913)

160 Chowdhury, S L, Bains, S S 1967 *Fertilizing Wheat in an Intensive Cereal Rotation* Fertilizer News 12(4) 11 16 (Eng) (Indian Agr Res Inst New Delhi)

Studies were made of the effect of N (0, 30, 60, and 90 kg/ha), inter row spacing (20, 30, and 40 cm), and sowing method on plant growth and lodging in wheat Application of N increased the number of vegetative tillers and also tiller survival, number of ears, and capacity of ears to mature Lodging and grain losses caused by lodging were greatly decreased by applying N in split rather than single dressings (application time not given) Values for lodging and grain losses were significantly lower on plots where wheat was sown on ridges than on flat seedbeds, but differences in spacing had little effect (FCA 22 2443)

161 Dani, H M, Saini, H S, Allag, I S, Sarren, K 1970 *Role of Boron in Nucleic Acid Metabolism of Germinating Wheat Seedlings* Curr Sci 39(3) 55 7 (Eng) (Panjab Univ, Chandigarh)

Wheat seeds soaked for 4 hr in distilled water (control), or 0 125%, 0 25%, and 0 50% solutions of H_3BO_3 and $Na_2B_4O_7$ $10H_2O$, respectively, were transferred to polythene dishes for germination Treatments with 0 125% H_3BO_3 and $Na_2B_4O_7$ were optimum for accelerating seed germination and seedling growth B helps in mobilizing nitrogenous hydrolyzates from germinating seeds to young shoots Both H_3BO_3 and $Na_2B_4O_7$ increased RNase activity in young shoots and isolated germinating seeds at all levels of concentration as compared with controls RNase, therefore, appears to be associated with the biosynthesis of RNA in actively growing tissues There was also an increase in ribonucleotide concentration both in shoots and seeds with an increase in the concentrations of these compounds (CA 72 99603v)

162 Dani, H M, Saini, H S, Saini, S S, Sareen, K 1970 *Effect of Boron on Starch and Protein Contents of Wheat Grains* Curr Sci 39(10) 235 36 (Eng) (Panjab Univ, Chandigarh)

Wheat grown in soil supplemented with B and N contained 8 78% more starch than did controls Supplements of B or N alone, a mixture of N, K, and P, or a mixture of N, K, P, and B did not significantly increase starch content Protein was increased 3 71% by B, 5 60% by a mixture of N and B, and 5 10% by a mixture of N, K, P, and B (CA 73 55106b)

163 Das, B, Panda, D R, Biswas, T D 1966 *Effect of Fertilizers and Manures on Some of the Physical Properties of Alluvial Sandy Calcareous Soil* Indian J Agron 11 80 3 (Eng) (Indian Agr Res Inst, New Delhi)

In experimental plots treated continuously for 30 yr with farmyard manure (FYM), rape cake, or fertilizers, FYM and, to a lesser extent, rape cake significantly increased organic C in soil and improved soil physical properties NPK treatments and combinations of fertilizers containing P also improved soil physical properties FYM, followed by rape cake and combinations of fertilizers with P, gave the highest yields of maize, wheat, oats, gram, and peas (SF 30 1051)

164 Das, K C, Raheja P C, Yawalkar, K S 1966 *Development Studies in Crop Plants V Variations in Morphological Characters Induced by Nitrogen Fertilization in Relation to Lodging of Six Varieties of Wheat* Indian J Agron 11 9 18 (Eng) (Indian Agr Res Inst, New Delhi)

The cause and effect of lodging on six wheat varieties grown under four N levels were studied in a combined varietal and fertilizer trial Extent of lodging differed significantly among the varieties and with levels of N applied Morphological differences were observed among the varieties, but generally they were little affected by N levels N applications progressively reduced the breaking strength of the basal internodes (SF 30 1367)

165 Deo, R, Kanwar, J S 1968 *Effect of Saline Irrigation Water on the Growth and Chemical Composition of Wheat* J Indian Soc Soil Sci 16(4) 365 70 (Eng) (Punjab Agr Univ, Ludhiana)

A sandy loam soil was leached with water containing 50 meq of Ca, Mg, K, or Na/l, alone or in various combinations, and the effect on yield and cation uptake in wheat grown in pot cultures of the soils was studied When single cations were used, the yield was decreased in the order K > Mg > Na > Ca K accumulated in the plants in concentrations ≤4 fold greater than that of the control In the Ca system, Ca accumulated in the plants, in the Na and K system, the content of these ions increased and Ca decreased In mixtures of K + Mg or K + Ca, the yield decreased and the K content of the plants increased as the proportion of K increased Mg was more inhibitory than Ca The Ca content was less in the K + Mg system than in the K + Ca system The Na + Mg system was more inhibitory to growth than the Na + Ca system, and the Na content of the

plants increased with increasing proportions of Na in the water The Ca content of the plants increased as the proportion of Na in the Na + Mg system increased, but decreased in the Na + Ca system (CA 71 80317n)

166 Dev G , Randhawa, N S , Singh B 1968 *Selection of Fertilizer for Supplying Phosphorus to Wheat* Prog Farming 5(1) 39 41 (Eng)

Ammonium phosphate gave the highest response followed by diammonium phosphate and superphosphate, dicalcium phosphate and rock phosphate The use of P in water soluble form gave additional profits ranging from Rs 644 to Rs 1,044 over controls where only N was applied

167 Dubey, S K , Singh, R B , Lal, J P 1969 *Effect of Micronutrients on the Yield of Irrigated Wheat* Indian J Agron 14(1) 35 7 (Eng) (Reg Res Sta , Rewa)

Field experiments indicated no significant difference in wheat yield due to application of micronutrients by two methods (soil and foliar) In addition, no significant difference in yield was obtained by use of NPK or micronutrients However, of all the micronutrients, application of Mo as foliar spray gave the highest yield Zn gave some response when applied to soil Mn proved equally effective by soil application (10 lb) or foliar spray (CA 72 89327u)

168 Garg, K P , Tomaria, P S 1970 *Effect of Nitrogen, Phosphorus, and Potash on Yield and Quality of Wheat Variety Sonora C4* Indian J Agr Sci 40(2) 155 58 (Eng) (Rafi Ahmed Kidwai Agr Coll , Sehore)

An experiment with 27 treatment combinations comprising three levels each of N (67 0, 100 5, or 134 0 kg N/ha), P (67 0, 100 5, or 134 0 kg/ha), and K (44 7, 67 0, or 89 3 kg K_2O/ha) was conducted during the winter season of 1966 67 at the Farm of Rafi Ahmed Kidwai Agricultural College, Sehore Campus to determine the dose of N, P, and K for better yields and quality of wheat variety Sonora 64 The yield of wheat grain improved with increasing levels of N from 67 0 to 134 0 kg/ha, N applications gave significant improvement in protein, Ca, and Mg content of wheat grains In grain yield, the nature of response to N was linear P fertilization did not modify yield of grain and its attributes except number of ear bearing tillers per plant and number of grains per ear P_2O_5 and Ca content of grain improved with increasing rates of P application (CA 73 76263r)

169 Gautam, O P , Singh, R P , Chattopadhyay, S 1966 *Economizing Irrigation Water by Wetting Active Root Zone of Wheat at Different Stages of Growth in Relation to Nitrogen Fertilization and Sowing Method* Indian J Agron 11 149 57 (Eng) (Indian Agr Res Inst , New Delhi)

Wetting only the active root zone gave a 25% saving in water application Most of the saving was made at the first irrigation when the root system was confined to the upper layer of soil There was an economic response to 67 2 kg/ha N but no N irrigation interaction (SF 30 3001)

170 Gill, G S , Pannun, M S 1968 *Effect of Fertilizers on Late Sown Wheat Under Exhaustive Rotation* Indian J Agron 13 69 75 (Eng) (Punjab Agr Univ , Ludhiana)

In a 2 yr field experiment wheat was sown in November, after "Chari," on a sandy loam soil and fertilized with 0, 33, 66, and 99 kg/ha N, 0, 33, and 66 kg/ha P_2O_5, and 0 and 55 kg/ha K_2O N increased plant height, leaf surface area, and the number of ripe ears per unit length of row 33, 66, and 99 kg N gave yields of 1,848, 2,286, and 2,325 kg/ha, respectively, as compared with 1,062 kg/ha from the control P gave a nonsignificant increase in the number of mature ears per unit length of row and the yield increase due to P was only significant in the first year K had no effect on growth or yields and there were no significant interactions between the fertilizers (SF 33 4794)

171 Grewal, J S , Randhawa, N S , Bhumbla, D R 1968 *Correlation of Soil Test With Response to the Application of Zinc to Wheat* J Indian Soc Soil Sci 16(2) 97 102 (Eng) (Punjab Agr Univ , Ludhiana)

In pot trials, Zn at 0 20 ppm (as $ZnSO_4$) was incorporated into 10 different soils, over a basal dressing of NPK, before sowing wheat Treatment significantly increased the yield of grain and straw and Zn uptake on soils containing <0 5 ppm dithizone extractable Zn, 10 ppm Zn was the optimum rate Regression equations are given for the prediction of increases in yield of grain and straw from applying Zn to soils containing varying levels of dithizone extractable Zn (FCA 22 887)

172 Grewal, J S , Randhawa, N S , Bhumbla, D R 1967 *Effect of Micronutrients on Yield and Their Contents in Wheat* J Res Punjab Agr Univ 4 315 22 (Eng) (Punjab Agr Univ , Ludhiana)

Using wheat as an indicator crop, foliar sprays of $ZnSO_4$ produced significant yield increases in all soils containing up to 0 68 ppm dithizone extractable Zn, but responses to soil applications were only significant in soils that contained up to 0 45 ppm available Zn Sprays of $FeSO_4$ significantly increased yields at exchangeable Fe concentrations (extractable by CH_3COONH_4 at pH 3) of 11 8 and 31 8 ppm in slightly alkaline and acidic soils, respectively There were significant responses to $MnSO_4$ sprays in slightly alkaline soils containing 1 5 3 1 ppm exchangeable Mn and 44 59 ppm active Mn, and in acidic soils that contained up to 12 3 ppm exchangeable Mn and 180 ppm active Mn Spraying with $(NH_4)_2MoO_4$ significantly increased yields in soils that contained <1 ppm available Mo (extractable by NH_4 oxalate at pH 3 3) Responses to $CuSO_4$ were inconsistent (0 6 ppm CH_3COONH_4 extractable Cu appearing to be the critical limit), and there was no response to borax (B supplied in irrigation waters) (SF 31 3901)

173 Gumaste, S , Patil, S V 1968 *Effect of Different Phosphatic and Nitrogenous Fertilizers on Growth and Uptake of Phosphorus by Wheat* Mysore J Agr Sci 2(3) 163 69 (Eng)

Superphosphate, nitrophosphate, and fused magnesium phosphate as phosphatic fertilizers and sulfate of ammonia and calcium ammonium nitrate as nitrogenous fertilizers were tried in both red and black soils There was better growth of the plants in the red soil as compared to the black soil There was better growth of plant and increased uptake of P with the application of single superphosphate as compared to fused magnesium phosphate in both the soils Phosphatic fertilizers

added with ammonium sulfate produced better growth of wheat and increased uptake of P as compared to the same fertilizers when added with calcium ammonium nitrate (FA 2 2089)

174 Gupta, M B S 1966 *Cumulative Effect of Inorganic Fertilizers, Organic Manures, and Their Combination on the Yield and Chemical Composition of Wheat in Calcareous Soil* Indian J Agr Sci 36(3) 105 10 (Eng) (Indian Agr Res Inst, New Delhi)

Initially the chemical fertilizers appeared superior to farmyard manure, but the cumulative effect showed the manure treatment to be superior The linear regression coefficients show a positive value for all the treatments With increased time, the yield increased significantly with the manure as compared with the other two treatments The prolonged use of chemical fertilizers alone had an adverse effect on the N content in the grain The negative values of the linear regression coefficients for N, P_2O_5, and CaO suggest that a deterioration of grain N occurred under all treatments, being maximum under chemical fertilizer alone and minimum under manure treatment The P uptake was probably the same under the three treatments, but the negative values of linear regression coefficients indicate that the percent of P_2O_5 in the grain tended to decrease The percent of CaO in the grain increased very little from that of the original material The addition of organic matter, even at the lower doses, helps to arrest the deterioration of soil N and C caused by the continuous application of artificial fertilizers Its slow decomposition fixes the N besides increasing the soil humus content (CA 66 36916e)

175 Gupta, M B S 1966 *Utilization of Phosphate by Wheat as Affected by the Time of Application in Calcareous Soil* J Indian Soc Soil Sci 14(2) 133 37 (Eng) (Indian Agr Res Inst, New Delhi)

Application of phosphate at the time of sowing or at different times up to 50 days later gave increases in yield of wheat (not significant) and P content Maximum increases were obtained with P applications made from 15 to 25 days after sowing The P_2O_5 content of the dry matter varied from 0 36% in the control to 0 73%, and of the grain, from 0 45% to 0 71% (CA 66 45855m)

176 Gupta, M L, Singh, A P 1969 *Inorganic Soil Phosphorus Fractions in Varanasi Soil* J Indian Soc Soil Sci 17(1) 63 6 (Eng) (Banaras Hindu Univ, Varanasi)

Wheat was treated with N fertilizers, KCl, and superphosphate, and plant and soil samples were taken 30, 60, and 90 days after planting Total P in the plants and soil, soil pH, available P, Al, Fe, and Ca phosphates, and occluded Fe and Al P were determined Ca P was 20 7 43 2 ppm, and Fe 4 5 10 8 ppm Both decreased with time after seeding Al P was 6 5 11 6, occluded Fe P 310-460, occluded Al P 2 6 4 8, and available P 8 6 12 9 ppm Total P in the plants was 2,300 and 5,090 ppm There was little variation with treatments in any of these constituents Fe P was positively correlated with P in the plants Total P removed from the soil was 3 29 6 70 kg/ha (CA 72 20909t)

177 Gupta, O P, Manglik, V P 1967 *Response of Rainfed Wheat to Micronutrients in Tarai Region of UP* Indian J Agron 12(1) 77 80 (Eng) (Uttar Pradesh Agr Univ, Pantnagar)

The response of rainfed wheat cv NP 718 to five micronutrients was investigated in a field trial during 2 yr In a dry year, the addition of Mn, Zn, Cu, and spartin (*sic*) to 30 6 kg each of N, P_2O_5, and K_2O/ha increased the grain and straw yields significantly over NPK and unfertilized controls In a wet year, however, the wheat showed a significant response to NPK and the application of micronutrients had little effect on grain and straw yields Cu tended to influence yields more when applied to foliage and Mn and Mo to soil Foliar application of B, Mn, and Mo and soil application of Cu and B, singly and in combination, had an adverse effect on wheat yields (FCA 21 1516)

178 Jain, G L 1966 *The Effect of Phosphorus With and Without Oligoelements II Uptake of Mineral Elements* Labdev (Kanpur) 4(4) 257 59 (Eng) (Univ Udaipur)

In a field experiment with wheat, treatments were three levels of P_2O_5 (25, 50, 75 kg/ha) as soil applications with 5 kg Fe, Mn, or Zn/ha applied as a spray 45 days after sowing The average Ca, S, Fe, and Zn contents of wheat grain were 0 076%, 0 0992%, 59 86 ppm, and 12 29 ppm, respectively The Ca, S, and Zn contents did not differ significantly among treatments, but Fe absorption was increased by the treatment P_2O_5 (50 kg) + Zn (CA 66 85134g)

179 Joshi, M D, Chaudhry, M L, Bhumbla, D R 1966 *Effect of the Application of Fertilizer on the Yield of Wheat Under Nonirrigated Conditions at Gurdaspur (Punjab)* J Res Punjab Agr Univ 3 241-45 (Eng) (Punjab Agr Univ, Hissar)

On deep sandy loam of pH 7 3, low in nutrients, wheat yields increased with increasing N up to 67 2 kg/ha There was no response to K The most profitable treatment was 44 8 kg N + 33 6 kg P_2O_5/ha (SF 30 2990)

180 Kahlon, A S, Kaul, J L 1968 *Comparative Study of Economics of High Yielding Varieties of Wheat–Punjab State* Indian J Agr Econ 23(4) 79 86 (Eng)

Experiments in Punjab showed that Mexican dwarf wheats have remarkable adaptability and give better economic performance than indigenous wheat varieties The economics of fertilizer use on semi dwarf high yielding wheat Kalyan 227, and two tall growing improved wheat varieties, viz C 273 and C 306, were studied On an average, Kalyan 227 produced 32 7% more than C 306 and 42% more than C 273 (Trop Abst 24 1480)

181 Kanwar, J S, Sekhon, G S, Bhumbla, D R 1967 *Manuring Requirements of a Fixed Crop Rotation I Direct, Residual, and Cumulative Effects of Nitrogenous, Phosphatic, and Potassic Fertilizers and Bulky Organic Manure on the Yield of Wheat* J Res Punjab Agr Univ 4 162 65 (Eng)

Three levels each of farmyard manure, N, P, and K were applied to a rotation of maize, wheat, cotton, and senji (*Melilotus indica*), the senji received no fertilizer at all, and the wheat no farmyard manure N had significant direct, residual, and cumulative effects on wheat, farmyard manure had a cumulative effect, P had a small but significant direct effect but no residual effect, and K had no effect (SF 31 1393)

182 Khanna, S S, Mahajan, K K 1968 *Role of Inorganic Phosphorus Added in a Legume Wheat Cropping Sequence* Indian J Agr Sci 38(4) 757 65 (Eng) (Punjab Agr Univ, Hissar)

Surface soil samples were taken from Ludhiana and Hissar, placed in pots, and mixed with superphosphate at 0, 20, 40, and 60 ppm Dhaincha (*Sesbania cannabina*) and then wheat croppings were made in one series the dhaincha was harvested 60 days after sowing and in the other it was buried in the soil In spots where dhaincha was harvested, available P was significantly increased after about 2 months, and the increase was much more where the dhaincha was buried About 5 40% of the added P was converted into saloid bound, 34 75% into Al phosphate 6 20% into Fe phosphate, and 4 30% into Ca phosphate In spots where dhaincha was buried, the dry matter yield of wheat was the highest There was a positive relation between the forms of saloid bound phosphate and uptake of P by the wheat (CA 70 114253k)

183 Khanna, S S, Parkash, A 1969 *Effect of Applied Potash on the Content of Calcium and Magnesium in Wheat Plants* J Indian Soc Soil Sci 17(4) 483 86 (Eng) (Punjab Agr Univ, Hissar)

Soils of pH 7 5 8 4, electric conductivity 0 22 and above and clay 11 2 34 7% were placed in pots at 8 kg/pot K was added at 0, 30, 60, or 90 kg K_2O/ha as the chloride Basal applications of 100 kg N/ha and 50 kg P_2O_5/ha were added as $(NH_4)_2SO_4$ and superphosphate Seedlings from the pots were oven dried and analyzed In the boot stage, increased K increased wheat plant growth, the increase being less in clay loam soils Increase in K was adversely affected by Ca and Mg Similar results occurred in the milk and grain formation stages A limit of the K/Ca + Mg ratio of 3 at the boot stage was critical (CA 73 108830s)

184 Khare, A G 1968 *Dwarf Wheats Promise High Profits to Madhya Pradesh Farmers* Indian Farming 18(6) 8 9, 11 (Eng)

The dwarf wheat varieties Sonora 64 and Lerma Rojo were tested and compared with local varieties, grown under irrigation in two regions in Madhya Pradesh The grain yields per ha of the dwarf varieties were more than double those of the local variety The straw yields were also higher for the dwarf varieties Although input costs (among others, fertilizers and irrigation) were considerably higher when dwarf varieties were grown, the net income from these varieties was still at least twice as high as that from local varieties (Trop Abst 24 1479)

185 Khera, M S, Datta, N P 1969 *Correlation of Phosphorus Soil Test Anlayses With Wheat Yield Responses* J Indian Soc Soil Sci 17 133 40 (Eng) (Indian Agr Res Inst, New Delhi)

Pot experiments with wheat treated with 0 200 lb/acre P_2O_5 on alluvial soils (sands to sandy loams) showed critical levels of available P (Olsen) to be about 11 kg/ha for NP 823 and NP 824 varieties, and between 30 and 45 kg for Sonora 64 (SF 33 2341)

186 Lodha, B K, Seth, S P Mathur, C M 1969 *Effect of Phosphorus Application on Yield, Quality, and Uptake of Nitrogen, Phosphorus, and Potassium at Different States of Growth of Wheat RS 31 1* J Indian Soc Soil Sci 17(3) 309 12 (Eng) (Agr Chem Sect, Jaipur)

Field plots of wheat were fertilized at a basic rate of 40 kg/ha of N and 20 kg/ha of K, and 0, 20, 40, and 60 kg/ha of P added Samples of leaves, shoots, roots, and ears were taken at tillering, flowering, milk, and harvest stages, and analyzed for N, P, and K The grain was analyzed for protein, Ca, Mg, P, and K Organic C, available N, K, and P, and pH and electric conductivity were determined in the soils before seeding and after harvest but no significant changes were observed Maximum yield was obtained at 40 kg/ha of P fertilization Ca, N, and P contents of the grain were highest in the samples from the 40 kg/ha plots, Mg and gluten N content were highest at 60 kg/ha, and K content was highest in the control The N and P contents of leaf, shoot, and ear were highest at 40 kg/ha N content was lowest in the roots at this level P content of the root increased with time K content of all parts decreased with time (CA 73 87043v)

187 Mehrotra, O N, Sinha, N S, Srivastava, R D L 1967 *Studies on the Nutrition of Indian Cereals I The Uptake of Nitrogen by Wheat Plants at Various Stages of Growth as Influenced by Phosphorus* Plant Soil 26(2) 361 68 (Eng) (Govt Res Farm, Kanpur)

Wheat plants (variety NP 710) grown on a sandy loam were sampled at various stages of growth The experiment included nine treatments (combinations of three levels of N and of P), 0, 28, and 56 kg N [as $(NH_4)_2SO_4$)]and 0, 22 4, and 44 8 kg P_2O_5 (as superphosphate)/ha The uptake of N was increased by the addition of P only when N fertilizer had been applied The rate of N uptake from seedling to tillering was ~45%, from joining to ear initiation 25%, and 30% up to grain formation stages in the life cycle of wheat The maximum uptake and recovery (53%) of N was obtained at the largest rates of N and P fertilizers (CA 67 2438f)

188 Mehrotra, O N, Sinha, N S, Srivastava, R D L 1969 *Nutrition of Indian Cereals III Uptake of Phosphorus by Wheat Plants at Different Growth Phases in Relation to Fertilizer Application* Proc Nat Acad Sci, India, Sect A 39(Pt 4) 489 92 (Eng) (Govt Res Farm, Kanpur)

Absorption of P by wheat plants was highest at the tillering stage The uptake of P by wheat plants appears to be more a function of the increases in dry matter production than the increases in P content of the plants Increases in doses of P when applied alone were associated with a corresponding decrease in the percent recovery of P applied through fertilizer, which was 3 45 and 2 94 at 32 4 kg and 44 8 kg P_2O_5/ha, respectively Application of N along with phosphate fertilizers enhanced the percent recovery of P The best recovery of P (27%) was observed in treatment where 56 kg N and 44 8 kg P_2O_5/ha were applied together (CA 73 108839b)

189 Mehrotra, O N, Srivastava, J P, Nath, S 1968 *Germination, Growth, and Yield of Wheat as Influenced by Presowing Seed Treatment in Phosphate Solution* Indian J Agron 13(1) 52 6 (Eng) (Govt Res Farm, Kanpur)

In laboratory experiments, germination of wheat cv K 68 was little affected by soaking seeds in 2 5 7 5% KH_2PO_4 for 12 hr, but was significantly decreased when concentrations

increased to 10 20% and treatment duration to 18 24 hr In field trials during 2 yr, soaking seeds in 7 5% KH_2PO_4 for 12 hr slightly accelerated maturation and gave the highest grain yields, these being higher than those of unsoaked controls by 7 9% Treatments had little effect on number of ears/plant, number of grains/ear or 1,000 grain weight (FCA 22 844)

190 Misra, N M , Ram, D N 1968 *Yield Behavior of Sonora 64 Versus Indian Wheat Varieties Under Rates and Methods of Urea Application* Indian J Agron 13(1) 13 16 (Eng) (Banaras Hindu Univ)

In trials with wheat, the Mexican cv Sonora 64 outyielded the Indian cv Cross 33 and Hybrid 65 by 33 8% and 24 4%, respectively, the superiority of Sonora 64 being ascribed to increased number of fertile tillers and grains/plant 1,000 grain weight was lower in Sonora 64 than in the other cv Sonora 64 responded to N rates up to 112 5 kg/ha, and the other cv up to 75 kg/ha Compared with a topdressing of urea at the tillering and jointing stages, foliar sprays at the same growth stages increased grain yield by 6 3%, protein content by 20%, and gluten content by 8% (FCA 22 851)

191 Modgal, S C , Misra, R D 1967 *Effect of Crop Stubbles at Varying Phosphate Levels Upon the Performance of Wheat and Soil Properties* Indian J Sci Ind 1 198 201 (Eng) (Uttar Pradesh Agr Univ , Pantnagar)

On a clay loam of moderate fertility the presence of crop stubbles during the 1963 64 rabi season decreased the wheat yield and protein content of the grain, the bulk density of the surface soil also decreased, but the organic matter content was not affected Superphosphate applications tended to counteract the adverse effect of stubble but did not affect the protein content of the grain, and had little effect on soil bulk density or organic matte content (SF 33 4808)

192, Narula, P N , Gupta, M B S , Singh, S 1967 *Time of Phosphate Fertilizer Application and Wheat Yield in Calcareous Soils* Sci Cult 33(8) 385 86 (Eng) (Indian Agr Res Inst , Bot Sub Sta , Pusa)

Applying P fertilizer 25 days after sowing wheat (at the time of the first irrigation) gave higher grain yields than when it was applied at sowing (FCA 21 1514)

193 Narula, P N , Singh, S , Rao, V R , Srivastava, O P 1967 *Response of Wheat Crop to Foliar Sprayings With Micronutrients* Sci Cult 33(11) 488 89 (Eng) (Indian Agr Res Inst , Bot Sub Sta , Pusa)

The role of trace elements in the efficient use of major nutrients and the optimum capacity of plants to absorb such nutrients by foliar rather than soil application were studied, by using wheat varieties NP 406, Sonora 64, NP 851, and Lerma Rojo 64A Two sprayings of Mg, Cu, Fe, Mn, and Zn were applied at the rate of 5 lb sulfate salt/acre with B at half the rate, the first at 40 day seedlings, and the second before the flag leaf stage The application of Mn, Mg, and Zn increased the yield 22 3, 14 7, and 10 1%, respectively, over the controls, while B, Cu, and Fe produced little response Since Mn and Zn, like Fe, take part in the vital oxidation reduction processes leading to N assimilation by wheat roots, foliar sprayings of small concentrations of trace elements may help increase the uptake of these elements by wheat plants in deficient soils and lead to higher yields (CA 69 18310k)

194 Nimbkar Agricultural Research Institute, Third Annual Report 1969-70 Phaltan, District Satara, Maharashtra 51 pp (Eng)

High yielding wheat variety Sonora 64, Kalyan Sona (S 227), Sharbate Sonora 64, Safed Lerma, and Sonalika RR 21 were fertilized with de oiled cake of Neem seed and de oiled cake of Karanj seed to ascertain if they would be a source of NPK The cakes were broadcast prior to seeding and worked into the soil with rakes Chemical fertilizers applied at the rate of 100 kg N, 62 5 kg P, and 50 kg K gave the highest yields on Sonora 64 with the Neem cake being not significantly lower Karanj cake showed the lowest results Nutrients in the oil cake are not released as fast as the crop demands and their large bulk to be transported and handled makes their commercial use unfeasible Hybrid maize variety H69R and Coker 911 fertilized at the rate of 150 kg N, 75 kg P, and 75 kg K/ha were significantly superior in yield to Ganga 3 and Ganga Safed 2

195 Ojha, R J 1970 *Influence of the Sources of Nitrogen on Wheat Grown on Saline Soil* Sci Cult 36(3) 179 80 (Eng) (Indian Agr Res Inst , New Delhi)

The effects of urea, NH_4, KNO_3, and $Mg(NO_3)_2$ on the growth of wheat were tested with and without salinization by a 1 1 mixture of $CaCl_2$ + NaCl Salinity by itself reduced wheat yield by reducing fertile tillers Addition of urea to the saline soil gave better yield than the other N sources, but this yield was not as high as in the unsalinized soil (CA 74 12240u)

196 Oommen, P K , Oza, A M 1968 *Utilization of Applied Phosphorus by Wheat Variety Sonora 64 as Revealed by a Field Experiment Using Radiotracer Techniques* Indian J Agr Sci 38(6) 986 91 (Eng) (Indian Agr Res Inst , New Delhi)

Experiments were performed with wheat variety Sonora 64 on a medium black soil in the winter season N was added as $(NH_4)_2SO_4$ and P as superphosphate The use of superphosphate ^{32}P showed that the percentage utilization of P was high at the tillering, flowering, and harvesting stages when superphosphate had been placed 7 5 cm below the seed Combined application of N and P, placed below the seed, also gave promising results on the uptake of P (CA 71 123001z)

197 Pandey, H N , Mukherji, K K 1968 *Studies on the Irrigation and Manure Requirements of Wheat* Madras Agr J 55 186 90 (Eng) (Agr Res Inst Patna)

For optimum grain yield of wheat on a loam soil, an irrigation 1 month after sowing and a second at the preflowering stage appeared necessary, the depth of each irrigation was 70 mm A single irrigation was significantly better 1 month after sowing than at the preflowering stage Applying 67 2 kg N + 67 2 kg phosphate/ha gave significantly higher grain yields than applying half these amounts (SF 31 4475)

198 Patel, C J , Patel, B P , Patel, A T 1968 *Effect of Nitrogen and the Time of Its Application on Yield of Irrigated Wheat* Indian J Agron 13(2) 92 8 (Eng) (Agr Inst , Anand)

In trials during 3 yr, average grain yield increased from 2,495 to 3,191 kg/ha as the rate of N increased from 33 to 99 kg/ha N applied in three split dressings before sowing, at the first irrigation, and again 1 week before flowering, tended to give higher yields than when applied in a single dressing before sowing or at the first irrigation, or in two split dressings before sowing and at the first irrigation (FCA 22 2446)

199 Patel C J Patel, D H, Patel, D P 1969 *Effect of NPK on the Yield of Irrigated Wheat* Indian J Agron 14(1) 8 14 (Eng) (Agr Inst, Anand)

An experiment was carried out to study the effect of three levels of N (66, 99, and 132 kg/ha), two levels of P_2O_5 (0 and 66 kg/ha), and two levels of K_2O (0 and 66 kg/ha) on yield of NP 824 wheat under irrigation Differences in the yield of grains due to levels of N, K_2O, and their combinations were not significant, but differences due to application of P_2O_5 were significant As to straw yield, differences due to levels of N and P_2O_5 were significant, while the effect of K_2O was not significant Optimum yield of wheat grain could be obtained by applying 66 kg N and 66 kg P_2O_5/ha Application of N >66 kg/ha tended to produce more straw rather than grain, indicating a greater drain of N for production of vegetative growth (CA 72 89324r)

200 *Potash Response to "Mexican" Wheat in Punjab State* Potash News Letter (India) 3(9) 2-4 (1968) (Eng)

During 1967 68 the effect of 120 60-60 vs 120 60 100 (N P_2O_5 K_2O) was demonstrated on Mexican wheat in 54 cultivators' fields in Punjab State, India The demonstrations consisted of two plots, both plots were treated with 60 60 60 at planting time One plot was topdressed 30-40 days and again 70 80 days after sowing with 30 lb/acre of N at each topdressing The other plot received 20 lb/acre of K_2O in addition to the N at each application Yield increases due to the additional K were 93 386 (average 177) kg/acre or 4 16 (average 9) percent Net additional income from the 40 lb/acre of K_2O was 117 50 rupees/acre (FA 1 1668)

201 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 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

202 Rameshwar Reddy, K, Suryanarayana Rao, R 1968 *Studies on the Effect of Soil and Foliar Application of Nitrogen on Wheat* Indian J Sci Ind 2A 173 76 (Eng) (Agr Coll, Rajendernagar, Hyderabad)

Grain and straw yield differences due to soil or foliar application of N were not significant Lerma Rojo variety outyielded Sonora 64 Significant interaction between varieties and methods of application was observed only for straw yield and 1,000 grain weight (SF 32 3982)

203 Randhawa, A S, Anand, S C, Minhas, A S 1967 *Effect of Time of Application of Nitrogen on Wheat Yield in the Submontane Region of Punjab* J Res Punjab Agr Univ 4 185 87 (Eng)

Grain yields were highest when half the N was applied at sowing and the remainder at the start of flowering Generally, splitting the fertilizer dose was more beneficial than applying a single dose at sowing (SF 31 659)

204 Randhawa, A S, Kumar, V, Singh, B D 1967 *Effect of Fertilizer Treatments on the Yield of Rain Fed Wheat in Submontane Regions of Punjab* J Res, Punjab Agr Univ 5(4) 495 99 (Eng) (Punjab Agr Univ, Ludhiana)

The effect of N and P_2O_5, in different combinations, on the grain yield of wheat was investigated under rain fed conditions N at 33 kg/ha gave an average increase of 386 kg/ha, while the same rate of P_2O_5 gave an increase of 124 kg/ha The most economical combination was 66 and 33 kg/ha of N and P_2O_5, respectively This produced a 66 3% increase in yield (CA 69 85783e)

205 Rathore, D N, Singh, B P 1970 *Response of Punjab Wheats to Nitrogen Under Late Sown Conditions* Indian J Sci Ind Sect A, 4(3) 143 47 (Eng)

Investigations were carried out for 2 yr at Ludhiana, Punjab, to study the response of Punjab wheats to N under late sown conditions Wheat variety C 281 gave more yield over the other two wheats C 228 and C 591 during both years by 30% and 11%, respectively N at 33 kg/ha gave maximum grain output, which seems to be optimum dose for C 281 even under late sown conditions Higher doses of N could not increase the grain yield any more Interaction of N with varieties was not found to be significant

206 Sadaphal, M N, Das, N B 1966 *Effect of Spraying Urea on Winter Wheat, "Triticum aestivum"* Agron J 58(2) 137-41 (Eng) (Indian Agr Res Inst, New Delhi)

Foliar application of 1 12% urea to winter wheat, *T aestivum*, increased the number of grains/head and the 100-grain weight Concentrations ~3% eliminated mottling in grains altogether Mottling was inversely related to the protein content Concentrations of urea from 1 6% increased the yield of grain, regardless of season, and the yield response was linear when the spray was applied at heading, an increase of 52 lb/acre having been recorded with each increase of 1% in concentration, the maximum increase being 24% Yield increases were more pronounced in the absence of basal N, P, and K fertilizer application Urea sprays increased the proportion of grain and total dry matter produced and increased the contents of crude and true protein 18 34% Spraying after blooming was more effective than at heading or at blooming for enhancing the rate of the accumulation of protein in the grain N sprays increased the protein yield 24 60% Gluten increased 53 70% In nonsprayed wheat, gluten contained 70% crude protein and 80% true protein, whereas in sprayed wheat it contained 82% crude protein and 90% true protein The Sh and Ca contents were the same in sprayed and nonsprayed wheat, whereas the niacin and P contents in sprayed grain were increased (CA 65 2954a)

207 Samboornaraman, S, Naik, M S, Das, N B 1968 *Effect of Soil and Foliar Application of Zinc on Wheat Grown in Delhi Soil* Indian J Agr Sci 38(2) 347 59 (Eng) (Indian

Agr Res Inst, New Delhi)

There is evidence of beneficial results from addition of Zn to wheat, but this is complicated by soil fixation of Zn and interference with uptake of other minerals Experiments were made to compare spray applications at different periods with soil application and to determine the effects on plant uptake of N, P, and Zn Yellowish brown surface soils of pH 7 9, sandy loam in texture and with available Zn concentrations 0 6 and 4 ppm, were placed in glazed pots containing 11 2 kg soil each Wheat was grown with a basal dose of $(NH_4)_2SO_4$ (112 kg N/ha) and superphosphate (112 kg P_2O_5/ha) Each pot contained five plants Soil application of Zn was at two levels 5 6 and 11 2 kg/ha thoroughly mixed into the soil before sowing Atomizer, foliar application was done in three stages at one level 1 12 kg Zn/ha Plants were taken at tillering (27 days), earing (82 days), and harvest (133 days) After removal of the plants, the soils were analyzed for Zn Plants were analyzed for N, Zn, and P Either soil or spray addition of Zn increased height, number of tillers, and dry weight The spray given at tillering was most effective Zn also increased the yield of grain, protein, P, and Zn Zn depressed the concentration of N and P in wheat plants, but the total uptake was enhanced, due to the increase in dry weight Significant correlation was observed between the uptake of Zn and its availability as determined by NH_4OAc and 0 02*M* EDTA extractions A major portion of the Zn added to the soil became unavailable, due to fixation by the soil In comparison, Zn spray at the tillering stage was more effective, as only about 10% of the amount was required to produce the equivalent effect (CA 69 95498e)

208 Saraswat, V N, Sharma, K C 1968 *Utilization of Nitrogen and Phosphorus by Wheat as Affected by Manurial and Irrigation Levels* Allahabad Farmer 42(4) 225 27 (Eng) (Centr Tuber Crops Res Inst, Trivandrum)

In trials with wheat cv Pb 591, increasing the rate of N from 45 to 135 kg/ha increased the plant N content from 0 92% to 1 07% and grain N content from 1 44% to 1 83%, but had little effect on P content As the P_2O_5 rate increased from 45 to 135 kg/ha, plant P content increased from 0 23% to 0 46% and grain P content from 0 66% to 0 84%, but N content showed little change Uptake of N and P was not affected either by 45 90 kg K_2O/ha or by the first irrigation given 3, 4, or 6 weeks after sowing (FCA 22 1639)

209 Saxena, P N 1967 *Fertilizer Needs of Mexican Wheats* Indian Farming 17(5) 40 (Eng)

The Mexican varieties are relatively more efficient in utilizing applied N as compared to C 306 or other local varieties S 227 gives the best response to N in the 0 60 kg N/ha range while S 308 is the best in the 60 120 kg N/ha range

210 Saxena, P N, Sirohi, A S 1967 *Response of Mexican Dwarf and Indian Tall Varieties of Wheat to Nitrogen Application* J Post Grad Sch, Indian Agr Res Inst 5(1) 123 48 (Eng)

The responses of a number of Mexican dwarf and Indian tall varieties of wheat to N applications ranging from 45 225 kg/ha were studied in field trials, demonstration plots were established at various locations in India representing five different agro climatic zones Whereas there was wide variation in optimal levels of N from zone to zone and from variety to variety, in general the highest responses were obtained with the Mexican dwarf varieties Sonora 63, Sonora 64, and Lerma Rojo At current prices, the optimal N application over all zones for these three varieties averaged 120 125 kg/ha, while the corresponding values for the Indian tall variety C 306 and the indigenous varieties were 91 and 51 kg/ha, respectively (FA 1 1039)

211 Saxena, S S, Srivastava, K M, Upadhyay, B D 1966 *Response of Wheat to Sources of Nitrogen* Indian J Agron 11(1) 33 7 (Eng) (Reg Res Sta, Nawabganj)

In a study of the response of wheat to different N sources, $(NH_4)_2SO_4$, blood meal, and farmyard manure at 55 kg N/ha were compared with a control (no applied N) Over two seasons $(NH_4)_2SO_4$ gave significantly higher grain yield, straw yield, plant height, tiller number, and number of grains per ear than farmyard manure or the control, and also gave significantly higher straw yield and plant height than blood meal Blood meal was the second best treatment, giving significantly higher grain yield and number of grains per ear than farmyard manure or the control Farmyard manure gave no significant improvements over the control (CA 66 28061g)

212 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) (Punjab Agr Univ, Hissar)

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 Increased wheat yields are found with N fertilizer whether or not P is present 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 10801h)

213 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 (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)

214 Sharma, B M, Saxena, M C 1968 *Effect of Crop Sequences and Levels of Nitrogen and Phosphate Fertilization on the Grain Yield of Wheat* Indian J Agron 13(4) 219 23 (Eng) (B R Coll, Bichpuri)

Wheat is grown mainly in fields left fallow or occupied by a green manuring crop in the rainy season Wheat can also be

grown after a Kharif cereal crop, e g Bajra or Juar for fodder However, these fodder crops deplete the soil Chances of deficiency of nutrients can be reduced in the fodder wheat rotation by applying inorganic fertilizers to the wheat crop or by inclusion of a legume as a companion crop This was desirable so as to permit double cereal cropping on this land The grain yield of wheat was highest under the Bajra + Lobia wheat and green manure wheat rotations, and lowest under the Juar wheat rotation Application of 35 or 70 kg N/ha or 45 kg P_2O_5/ha increased grain yield (CA 71 122997s)

215 Sharma, J P, Singh, M 1967 *Effect of Different Levels of Nitrophosphate (ODDA and PEC) on Wheat* Indian J Agron 12(4) 327 31 (Eng) (Indian Agr Res Inst, New Delhi)

The relative efficiency of two nitrophosphates (ODDA and PEC) was tested with NP [combination of $(NH_4)_2SO_4$ and superphosphate] on wheat Three levels were used 13 5 kg N, 11 8 kg P_2O_5, 27 0 kg N, 23 6 kg P_2O_5, 54 kg N, 47 2 kg P_2O_5/ha The methods of application were broadcasting, applying at 2 5 in below seeds, and band placement There was a nonsignificant effect of the different forms of fertilizer on grain and straw yield, both in individual years and on the average Significant increases in yields of grain and straw were obtained with each successive increase in fertilizer dose Addition of phosphate along with N increased grain and straw yields over those with N alone, but the increase was not significant The difference in average yields of grain and straw by band placement id placement below the seed was not statistically significant, but both gave higher yields of grain and straw than did broadcast application (CA 69 75988m)

216 Sharma, K C, Rao, N K A 1966 *Effect of Forms and Levels of Nitrogen and Phosphorus on Wheat Yield* Indian J Agron 11 229 34 (Eng) (U P Agr Univ, Pantnagar)

On sandy loam soil of pH 7 8, grain yield increases in the first year were greater with compost than with N fertilizers but in the second and third years fertilizers were superior The order of effectiveness was $(NH_4)_2SO_4$, $NaNO_3$, urea Poor response to chemical N in the first year was due to soil and climatic conditions which caused lodging Yields increased significantly with superphosphate in all 3 yr Yields were highest with simultaneous application of 67 26 kg/ha (the highest rates used) of N as $(NH_4)_2SO_4$ and of P_2O_5 (SF 30 3783)

217 Sharma, K C, Singh, R, Yadav, C B 1966 *Influence of Fractional Application Versus Full Application of Nitrogen in Wheat* Indian J Agron 11 22 6 (Eng) (U P Agr Univ Pantnagar)

Wheat grain and straw yields were about 7% higher with $(NH_4)_2SO_4$ than with urea at equivalent N rates, but N content of grain was higher with urea Time of application had little effect on yields but caused great variations in N content of grain, delaying N application causing a greater N concentration in the grain (SF 30 1370)

218 Sharma, K C, Singh, S P, Kumar, V 1966 *Comparative Study of Soil Versus Foliar Application of Urea on Wheat* Indian J Agron 11 219 22 (Eng) (B R Coll Exp Sta, Bichpuri)

Over a 2 yr period the average grain yield increased by 40 and 60% with application of 44 86 and 67 26 kg/ha N Application of N, half to the soil at sowing and half as spray (6% solution) at the 7 and 11 weeks' stage gave higher yield than full soil application Protein content increased from 10 22 to 12 12 and 12 47% with successive N levels (SF 30 3624)

219 Shekhawat, G S, Chundawat, G S 1968 *Response of Wheat to Placement of Nitrogenous Fertilizer* Madras Agr J 55(12) 537 39 (Eng)

Field trials showed maximum yields when N was applied in two equal doses, one half broadcast at time of sowing and one half topdressed at first irrigation Application beyond 45 kg N/ha was uneconomical

220 Shekhawat, G S, Sharma, D C, Lodha, M C 1967 *Fertilizer Requirements of Transplanted Wheat* Indian Agr 11(1) 25 8 (Eng) (Dep Agr, Kota)

In trials under late sowing conditions during two seasons, the soil was dressed with different rates of N, P, and K before 1 month old seedlings of wheat cv C 281 were transplanted on December 20 Applying 40 kg N plus 20 kg each of P_2O_5 and K_2O/ha gave higher yields of grain and straw than applying 20 kg N + 10 kg each of P_2O_5 and K_2O/ha and 60 kg N + 40 kg P_2O_5 + 20 kg K_2O/ha The highest yields were obtained when 25% of the total N was in the form of farmyard manure and 75% as ammonium sulfate, followed by application of 100% N as ammonium sulfate (FCA 22 15)

221 Shrivastava, M M P 1969 *Relative Efficiency of Soil and Foliar Application of Major Plant Nutrients on Wheat II Yield Attributing Characters* Indian J Agron 14(1) 21 5 (Eng) (Indian Agr Res Inst, New Delhi)

Experiments were performed to determine relative effects of foliar and soil applications of major plant nutrients (NPK) on yield and quality of wheat grain Foliar application of 22 4 kg N/ha decreased the number of ears/plant and number of grains/ear by 3 13 and 12 32%, respectively An increase of 3 27% was observed in 1,000 grain weight The higher efficiency of foliar application of 44 8 kg N/ha appeared to be due to more ears/plant and more grains/ear (CA 72 89325s)

222 Shukla, G C, Bhandari, A R 1969 *Effect of Mode of Micronutrient Application on Wheat Yield, Uptake of Nitrogen and Phosphorus, and the Relation between Copper, Nitrogen, Zinc, and Phosphorus* Proc Nat Acad Sci, India, Sect A 39(Pt 4) 549 56 (Eng) (Indian Agr Res Inst, New Delhi)

Foliar spray of Cu or Zn improved the yield of grains and straw at Pantnagar Cu, Zn, and all micronutrients in combination when applied to soil or foliage only gave beneficial effect at Patiala All the applied trace elements were effective in improving wheat straw N at Pantnagar Foliar fertilization of Zn, B, Cu, and Mn, and soil dressing with Mn, Mo, and Cu had a beneficial effect on grain N At Patiala, soil application of Mo alone, increased grain N The P content of the straw and of grains, improved only on the slightly acidic soils of Pantnagar A relation between the amounts of Zn, P, Cu, and N present in straw and grain from both places was found (CA 73 108840v)

223 Singh, B P 1969 *Effect of Phosphorus, Molybdenum, and Seed Treatment on the Weight, Uptake of Nitrogen, Phosphorus, Yield, and Quality of Wheat* Indian J Sci Ind 3 137–42 (Eng) (Punjab Agr Univ, Hissar)

On a soil consisting of 60% fine sand, P and Mo applied singly or together increased fresh and dry weight, N and P uptake, protein, and P_2O_5 contents of the grain Seed treatment was least effective (SF 33 4050)

224 Singh, C, Gwal, H B, Katti, G V 1968 *Effect of Placement of Fertilizer and Its Levels on Wheat Under Barani Conditions in Black Cotton Soils of Madhya Pradesh* Indian J Agron 13(1) 64-8 (Eng) (Coll Agr, Indore)

In trials during 2 yr, wheat cv NP 839 grown under rainfed conditions, showed a linear grain yield response to the application of N + P_2O_5 each at 20, 30, and 40 kg/ha Higher increases in yield were obtained from drilling half the fertilizer with the seed and half at 4 cm below the seed than drilling the full rate either with the seed or below it (FCA 22 849)

225 Singh, I J, Sharma, K C 1968 *Response of Some Mexican Red and Indian Amber Wheats to Nitrogen* Indian J Agr Econ 23(4) 86 93 (Eng)

In Pantnagar, the response of Mexican red and Indian amber wheats to N was studied Fertilizer experiments showed that the Mexican red wheats give relatively much higher response to N at levels from 0 to 200 kg/ha than Indian amber wheats The difference in yield response to N increased with higher rates of N The Mexican varieties Sonora 64, Lerma Rojo, and Sonora 63 gave maximum yields at 140, 120, and 100 kg/ha of N, but the Indian varieties obtained their maximum yields at lower levels, viz C 306, NP 876, and NP 887, at 100, 80, and 80 kg N/ha, respectively Attention was paid to the most profitable levels of N application, taking the total revenue and total costs into account (Trop Abst 24 1482)

226 Singh, K, Gandhi, R, Narang, M M 1966 *Effect of Crop Sequence and Fertilizers on Wheat Crop* J Res Punjab Agr Univ 3 280 85 (Eng) (Punjab Agr Univ, Hissar)

On sandy soil low in $CaCO_3$, N and available P_2O_5, P alone, and P + N increased the yield of the recipient crop and the subsequent wheat crop The beneficial effect of preceding crops was in the order guara (as green manure), guara (cut for fodder) > fallow > moong (*Phaseolus aureus*) > groundnut > sorghum Direct application of N to wheat increased yields of grain and straw significantly The response of wheat to N was highest after sorghum and lowest after guara green manured (SF 30 2992)

227 Singh, R M, Govil, B P 1968 *Effect of Increasing Levels of Nitrogen and Phosphorus on the Uptake of Nitrogen and Yield of Wheat* Madras Agr J 55(5) 222 28 (Eng) (Univ Udaipur, Udaipur)

A field experiment was undertaken on the effect of different levels of N and P on N uptake at various stages of growth, and on grain and straw yield, of wheat grown in a sandy clay loam soil of pH 8 3 All of the P and half of the N were mixed and drilled in plots before sowing The remaining N was applied at the time of first irrigation The application of N at 20 30 kg/ha significantly increased the grain and straw yield, but 60 appeared to be the best P had no effect on the yield of grain and straw Though increasing levels of applied N increased the N uptake, P had no effect If a level above 60 kg N/ha is used, an application of P at 40 kg/ha may be considered to balance the fertilization (CA 70 105409t)

228 Singh, R P, Sharma, N N 1969 *Response of Dwarf and Tall Wheat Varieties to Nitrogen Fertilization* Fertilizer News 14(10) 33-4 (Eng)

Wheat varieties S 227 and S 308 gave highest grain yields at 80 120 kg N/ha whereas N at 160 kg/ha depressed the yield significantly At 80 kg N/ha, the Indian tall variety NP 884 yielded nearly as much as the dwarf varieties

229 Singh S D 1967 *Effect of Nitrogen and Phosphorus on Yield of Wheat* Indian J Agron 12(4) 369 74 (Eng) (J V Coll, Meerut)

The effect of N [28, 56, 84 as $(NH_4)_2SO_4$] and P (22 4, 44 8, 67 2 kg/ha as superphosphate) was studied under field conditions of western Uttar Pradesh, on the yield of NP 718 wheat N was broadcast prior to sowing while P was drilled ~8 cm below the seed Seeds were sown at 90 kg/ha in furrows 25 cm apart The grain and straw yield increased at all levels of N The 1,000 grain weight was the highest with the crop receiving 56 lb N/acre P fertilization did not modify the yield (CA 69 75992h)

230 Singh, S P, Tiwari, K P 1966 *A Note on Response of Wheat Varieties to Manuring and Its Economics* Indian J Agron 11(1) 30 2 (Eng) (Wheat Res Sta, Powarkheda)

In 1962 63, four irrigated wheat varieties were given (a) no fertilizer (b) 30 lb N plus 30 lb P_2O_5/acre, or (c) 60 lb N plus 60 lb P_2O_5/acre Grain and straw yields increased from (a) to (c) Cv Hy 65 and C 591 gave the highest grain yields of 1 457 and 1,409 lb/acre, respectively Cv Hy 11 gave the lowest yield of straw Hy 65 had the highest ratio of grain/straw, and Hy 38 the lowest (FCA 19 781)

231 Singh, Y P 1969 *A Study of Differential Response on NP Wheat Varieties to Nitrogen Fertilization* Allahabad Farmer 43(3) 207 14 (Eng)

Field experiments were conducted to study the effects of 0, 34, 56, or 84 kg N/ha on four NP wheat varieties The effects of the treatments on germination, plant height, tillering, dry matter production, ear emergence as well as on yield attributes are discussed The variety [illegible]4 performed best at the higher N levels, the performance of NP 718 being best at the lower N levels, beyond which it tended to lodge Addition of 56 kg N/ha gave the highest yield of grains and caused relatively low losses due to lodging The variety NP 824 was highly resistant to lodging even at the highest rate of N application (Trop Abst 25 2327)

232 Tiwari, K P, Singh, S P 1969 *Effect of Nitrogen, Phosphorus, and Irrigation on Yield Attributes of Wheat* Indian J Agron 14(1) 1 7 (Eng) (Wheat Res Sta, Model Agron Exp Scheme, Powarkheda)

An experiment on wheat was performed with three levels of N (0, 33 6, and 67 2 kg N/ha), three levels of P (0, 33 6, and 67 2 kg P_2O_5/ha), three intensities of irrigations, and three frequencies of irrigations (2, 3, and 4 irrigations/crop season)

N application had a positive response on yield and the plant characters studied (plant height, tiller number per plant, length of earhead, number of grains/earhead, and 1,000 grain weight) Phosphate application had a positive response on yield Various irrigation intensities as well as frequencies had no significant effect on any plant character, except that increasing frequencies of irrigation had a positive effect on 1,000 grain weight There was also a significant positive effect of N plus phosphate on yield, plant height, and tiller number per plant Maximum plant height and tiller number per plant were recorded in treatments with 67 2 1 g N + 67 2 kg P_2O_5/ha Interaction of irrigation intensities with phosphate levels was significant with respect to its effect on 1,000 grain weight (CA 72 89323q)

233 Tiwari, K P, Singh, S P 1967 *A Note on Role of Some Agronomic Practices in Production of Mottling in Wheat Grain* Indian J Agron 12(1) 98 101 (Eng) (Wheat Res Sta, Powarkheda)

Applying 33 6 67 2 kg N/ha reduced grain mottling, the reduction being greater at the higher rate P tended to increase grain mottling Increasing the intensity of irrigation from 2 acre in to 4 acre in and its frequency from 2 to 4 resulted in a significant increase in grain mottling It was suggested that an increase in yield due to any agronomic practice, except from the application of N, dilutes the N content of the grain, which leads to mottling (FCA 21 1504)

234 Tiwari, K P, Singh, S P 1968 *Response of Wheat to Methods of Application, Forms, and Levels of Phosphate in Black Soils of Narmada Valley* Indian J Agr Sci 38(1) 38-46 (Eng)

Two different experiments were conducted to compare the effects of various forms of phosphatic fertilizers and method of application at different levels on the grain yield of wheat One of these was conducted from rabi (winter) 1956 57 to 1959 60 and the other during rabi 1960 61 and 1961 62 Placement of phosphatic fertilizers in the soil 6 3 cm below the seed or in bands was superior to broadcast application Ammonium phosphate proved to be better than single superphosphate in one experiment while single superphosphate gave better response than ODDA and PEC nitrophosphate in the other

235 Tiwari, K P, Singh, S P 1966 *Response of Wheat to Sources and Time of Application of Nitrogen* Indian J Agron 11 341 44 (Eng) (Model Agron Exp Sta, Hoshangabad)

Wheat yield increased with increasing levels of N at 0 20, and 40 lb/acre Applying the full rate at sowing or half at sowing and half at the first irrigation gave higher grain yields than when the full rate was applied at the first irrigation Forms of N [urea, $(NH_4)_2SO_4$, and ammonium sulfate nitrate] did not affect yields significantly (SF 31 1399)

236 Verma, A B S, Nalamwar, R V 1968 *Performance of Four Wheat Varieties Under Three Fertility Levels* Fertilizer News 13(8) 43 4 (Eng)

Two yr data showed that under Jabalpur conditions growing Hy 65 or Hy 633 was as advantageous as growing NP 839 or C 281 The application of 20 kg N plus 20 kg P_2O_5/ha increased the grain yield over control by 338 kg and 687 6 kg during the first and second season, respectively The application of 40 kg N plus 40 kg P_2O_5 gave the extra yield of 7 kg and 439 7 kg over application of 20 kg N plus 20 kg P_2O_5 during 1964 65 and 1965 66, respectively The application of the highest fertility level brought about practically no increase in grain yield over application of 20 kg N plus 20 kg P_2O_5 during 1964 65 due to lack of moisture in the soil

237 Virmani, S M, Dhaliwal, A S, Randhawa, N S 1969 *Preliminary Studies of the Effect of Differential Fertilization on Root Activity of "Kalyan Sona 227" Wheat* Indian J Agr Sci 39 780 84 (Eng) (Punjab Agr Univ, Hissar)

Application of 200 kg/ha N alone [as $(NH_4)_2SO_4$] resulted in 43% of the roots being present in the 7½ cm surface layer (alkaline sandy loam), and the rest equally distributed between the 7½ 15 cm layer and the layers below 15 cm Application of 200 kg P_2O_5 (as superphosphate) or NP, resulted in 37-45% of active roots being in the top 7½ cm, 42 47% at 7½ 15 cm, and 21% in the layers below 15 cm (SF 33 2349)

238 Wright B C 1968 *Agronomic Requirements for the New Dwarf Wheats* Near East Wheat and Barley Improvement and Production Project, FAO Information Bull 5(3) 7 12 (Eng)

In 1967 68 over 2 million ha in India were planted with dwarf wheat varieties The dwarf varieties need other cultural practices than the tall varieties While sowing at a depth of 8 cm or more is common practice with tall varieties and indigenous equipment, the optimum for dwarf varieties with drill and packing was 4 cm The first irrigation given at crown root initiation produced maximum yields In many experiments, the yield of the plot fertilized with 120 kg N/ha did not exceed that of the nonfertilized plot, while an application of 120 kg N plus 40 kg P_2O_5/ha increased yields tremendously (Trop Abst 24 2407)

239 Wright, B C, Bharadwaj, R B L 1969 *Fertilizer Needs of Wheat* Indian Farming 18(12) 15 17, 19 20 (Eng)

Field trials with dwarf wheat showed a good response to dressings of N and P, and sometimes to K under irrigated conditions Some 80 120 kg N/ha was found to be adequate, if two thirds was placed banded at sowing and one third was broadcast at first irrigation Dressings of 40 60 kg P_2O_5/ha meet P requirements on most soils, high response may be expected particularly in combination with N dressings Band placing water soluble P is superior to broadcasting In some areas 40 kg K_2O/ha applied at sowing increases production Development of micronutrient deficiencies is expected In dry areas 30 40 kg N and 20 kg P_2O_5/ha, placed at sowing time, are recommended, followed by additional 40 kg N/ha if rainfall is adequate Economics of fertilizing are discussed (Trop Abst 25 1279)

ISRAEL

240 Lachover, D, Ephrat, J 1967 *Comparative Study of the Direct Effect of Granular and Powdered Superphosphate on Wheat and Its Residual Effect on Vetch ("Vicia atropurpurea")* Qual Plant Mater Veg 14(1 2) 79 97 (Fr)

(Volcani Inst Agr Res, Bet Dagan)

Wheat sown on clay soil at two sites on December 1, 1961, was given (a) 50, (b) 150, and (c) 300 kg P_2O_5 as superphosphate/ha and residual effects of these treatments on *V atropurpurea* sown on October 21, 1962, were examined Increasing rates of P gave only slight increase in P content and grain yield of wheat, but (a), (b), and (c) increased the hay yields of vetch by 16, 53, and 75%, respectively, at one site and 25, 47, and 63% at the other The highest rate of P reduced the dry matter content of vetch from 20 6 to 17% and increased its protein content from 15 8 to 17 7% Powdered and granular superphosphate were equally effective (FCA 21 21)

241 *The Permanent Plot Experiment, Methods, and Results, 1961 66* 1968 Volcani Inst Agr Res, Bet Dagan, 186 pp (Eng)

Report of experiments to find out how yields of various crops, in a conventional crop rotation system on irrigated soils of Israel, are affected by long term cumulative applications of various combinations of N, P, K, and organic fertilizers It contains a detailed description of the method and tabulation of the results

JAPAN

242 Ikeda, T, Higashi, S, Kagohashi, S, Moriya, T 1965 *Studies on the Adaptability of Wheat and Barley on Acid Soil, Especially in Regard to Its Varietal Differences and Laboratory Detection* Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku, No 12, 64 79 (Jap)

Varieties of wheat and barley were grown in soil supplied with various amounts of N, P, K, and Ca Considerable varietal differences in resistance to low pH were noted in both crops There was a tendency for resistance to low pH and tolerance of low P to be associated, particularly in wheat The relationship between resistance to low pH and buffer action of root sap, and Al color staining of root sections, was investigated (FCA 19 2026)

243 Sugiyama, T, Goto, Y, Akazawa, T 1968 *Pyruvate Kinase Activity in Wheat Plants Grown Under Potassium Deficient Conditions* Plant Physiol 43(5) 730 34 (Eng) (Nagoya Univ, Nagoya)

Wheat was grown in sand beds supplemented with a modified Evan's nutrient solution with or without K_2SO_4 An increase in the activity of pyruvate kinase in the first leaves was evident from the 5th day of growth and an ~4 fold elevation in the enzyme activity was observed in 14 day wheat leaves The addition of K_2SO_4 to the nutrient solution given to the K^+ deficient plants on the 10th day resulted in the restoration of the enzyme activity to normal levels after 3 days The increased total and reducing sugar content as well as the decreased amount of chlorophyll in K^+ deficient plants returned to normal after addition of K_2SO_4 in the nutrient medium These findings are discussed in relation to the metabolic pattern of plants at the early stages of K^+ deficiency (CA 69 43126n)

244 Suzuki, T, Fujinuma, Y 1966 *Effect of Fertilizers Applied in Different Places in Soil II Basic Studies on the Fertilization for Volcanic Ash Soil* Nippon Dojo Hiryogaku Zasshi 37(4) 259 62 (Jap) (Nat Inst Agr Sci, Tokyo)

Wheat was cultured in two fields, volcanic ash soil and alluvial soil Fertilizers were applied in two ways, in contact with the seeds and on the soil surface By applying the fertilizers directly in contact with the seeds, wheat germination was injured more in the volcanic ash soil, by increasing the amount of fertilizer, the injury was increased Osmotic pressure of the soil solution of fertilized soil was markedly higher for alluvial soil than for volcanic ash soil There was no difference in grain yield between the two soils When the fertilizer was applied to the soil surface, the yield was markedly lower for volcanic ash soil, but higher for alluvial soils as compared with application of fertilizer to the seed (CA 65 9679a)

245 Suzuki, T, Fujinuma, Y 1966 *Effects of Fertilizers Applied in Different Places in Soil III Fertilization of Volcanic Ash Soils* Nippon Dojo Hiryogaku Zasshi 37(10) 511 15 (Jap) (Nat Inst Agr Sci, Tokyo)

In a field experiment with wheat, there was no difference in the yield of the plot to which 7 mg K/100 g soil was broadcast and that of the plot to which the same amount of K had been applied to the rows, however, application of 35 mg P/100 g soil to the rows effected a better wheat yield as compared to a broadcast application In pot experiments, 80% of the maximum wheat yield was obtained when the level of available N, P_2O_5, and K_2O was 5, 6, and 8 mg/100 g soil, respectively (CA 66 64691w)

LEBANON

246 Fuehring, H D 1969 *Irrigated Wheat on a Calcareous Soil as Affected by Application of Nitrogen, Phosphorus, Potassium, and Zinc I Yield, Composition, and Number of Heads* Agron J 61(4) 591 94 (Eng) (Amer Univ Beirut)

Grain yield of a Mexican semi dwarf wheat (*Triticum aestivum*) was increased economically by N application up to 300 kg/ha for yields in the order of 9 mt/ha Contrary to the effects on an adjacent maize experiment, application of P and Zn tended to reduce grain yield apparently due to overstimulation of tillering and the resulting excessive number of heads per unit area with the normal seeding rate used Each of the variables increased its own concentration in the grain and N had a significantly negative first order effect on P concentration, K had a significantly negative effect on Cu concentration, N had a significantly positive effect on Ca concentration, and P had a significantly positive effect on K concentration However, these first order effects were considerably modified in some cases by various important two way and three way interactions (CA 71 60185q)

247 Fuehring, H D 1969 *Irrigated Wheat on a Calcareous Soil as Affected by Application of Nitrogen, Phosphorus, Potassium, and Zinc II Analysis of the Young Plant in Relation to Yield* Agron J 61(4) 594 96 (Eng) (Amer Univ Beirut)

The base of the plant was suitable for diagnosis of N, P, K, Zn, and Mn nutrition of wheat at the three leaf stage The

critical level of nitrate N was 2,300 ppm, and 2,800 ppm or more appeared to be excessive Desirable levels of P and Zn were related to the amount of tillering needed to produce the optimum number of heads for the potential yield At a normal seeding rate, excess P and Zn resulted in overstimulation of tillering and reduced yields Where low seeding rates are desirable as with expensive hybrid wheats, application of P and Zn just prior to the tillering stage in the right amounts as determined from plant analysis may be one means of compensating for the low initial plant population (CA 71 60186r)

248 Fuehring, H D, Chaudhri, A G 1969 *Progress in Production of Short Statured Wheats Under Irrigation on a Calcareous Soil in the Beqa'a Plain, Lebanon* Amer Univ Beirut, Fac Agr Sci, Publ, No 34, 11 pp (Eng) (Amer Univ Beirut)

Fertilizer trials with irrigated wheat indicate that applications of N at rates of 300 kg/ha are necessary to obtain yields of 6 8 mt of grain with additional spring applications needed if losses occur during the winter due to leaching P applications had little effect on yields although soil test levels by the Olsen method were "low medium" A growth regulator, cycocel, tended to increase grain yields and reduce straw yields (CA 73 97966n)

NEW ZEALAND

249 Williams, W M 1968 *Effects of Two Levels of Nitrate on Cell Division Rates in Roots of Wheat Seedlings* N Z J Bot 6(1) 25 32 (Eng) (Bot Dep, Victoria Univ Wellington)

In experiments with 4 day old wheat seedlings grown in culture solutions, root elongation was significantly greater and cell multiplication 25% greater in solutions containing 0 0033 *M* nitrate than in those containing 0 0066 *M* (FCA 22 60)

250 Wright G M 1969 *Effect of Nitrogenous Fertilizer on Wheat Yield and Baking Quality* N Z J Agr Res 12 727 46 (Lng) (DSIR, Lincoln, Christchurch)

The results of two series of wheat trials in New Zealand (1929 30 and 1957 65) were analyzed for response in grain yield and baking quality to N fertilizing Responses were greater in the early series but the influence of the preceding crop was substantial in both In the recent series the effects on yield responses to time of N application, time of sowing, soil class, and seasonal differences were in that order of decreasing importance Forms of N fertilizer were not compared An economic yield response to a fairly high N rate only occurred where wheat followed a cereal crop and with reasonably high wheat yields Baking quality was improved by added N in most trials The smallest improvement occurred where wheat followed potatoes or pasture and baking scores were already high without added N In autumn or winter sown trials yield responses to early N application were inversely related to soil N content (SF 33 4048)

PAKISTAN

251 Ahmad, I, Rana, A J, Hussain, A 1969 *Effect of Complete Fertilizer With Variable Nitrogen Doses on the Yield and Quality of Wheat* Pak J Soil Sci 5(1) 32 9 (Eng) (W Pak Agr Univ, Lyallpur)

In a sandy clay loam, maximum yields of grain were obtained with 100 lb N/acre as $(NH_4)_2SO_4$ and 100 lb/acre P_2O_5 and K_2O P_2O_5, K_2O, and protein contents of the grain were highest in the presence of 150 lb N/acre (SF 33 1495)

252 Ali, M, Mian, A 1968 *Influence of Sources of Nitrogen, Levels of Phosphorus, and Potassium Fertilization on the Yield and Composition of Wheat* W Pak J Agr Res 6(3) 167 72 (Eng) (W Pak Agr Univ, Lyallpur)

Experiments were conducted at West Pakistan University in 1966 67 on light, nonsaline, calcareous soil, below average in fertility Fertilizer treatments were 100 lb N/acre as $(NH_4)_2SO_4$, $CaNH_4^+$ nitrate, or urea, 50 or 100 lb of P_2O_5/acre as triplephosphate, and 0 or 75 lb of K_2O/acre as K_2SO_4 Various combinations of these were used, both by broadcast and band application 3 in below and away from the seed All treatments increased the yield over the control, in the ascending order N, NP, NPK NK was no better than N alone P with $(NH_4)_2SO_4$, either with or without K, was slightly better than P with the other N sources K gave slightly increased yields in almost all comparisons with no K, 50 lb of P/acre gave better yields than 100 lb of P Placement was better than broadcast Ash content of grain was reduced when N alone was used, probably due to a "growth dilution" effect, but NP and NPK significantly increased ash over the control, N, and NK All treatments increased the N content, especially the complete NPK application The effect of source of N was insignificant Placement increased the N content over broadcast Inclusion of P produced a significant increase of P in grain (CA 71 69800u)

253 Chaudhri, A G 1968 *Effect of N, P, and S on Yield and Composition of Six Semi Dwarf Wheats Grown Under Irrigation* Thesis, Amer Univ of Beirut (Eng) (Ayub Res Inst, Lyallpur)

In a field experiment on a calcareous clay soil, 46 5-47 8 kg/ha each of N, P, and S were applied to irrigated semi dwarf wheats, Jaral 66, Pitic 62, Penjamo 62, TZPP An 64, Sonora 64, and Rouge 66, before planting on November 14, 1966 The application of N significantly increased grain yield and plant height and decreased protein percentage of grain The effects of P, S, and the interactions were generally small Applied P increased protein percentage of grain of two varieties Pitic, yielding up to 6 89 mt of grain/ha, was the outstanding variety, followed by Penjamo The application of N increased soluble nitrate N of Pitic leaves at tillering, but reduced it at the dough stage Applied P resulted in a probably real decrease in nitrate N of the leaves at tillering The application of N significantly reduced the soluble P and S contents of leaves at the boot and dough stages Applied S increased soluble S in leaves at all stages At the boot stage, N application resulted in a slight increase in total N, but the P and S concentrations were greatly reduced The application of S significantly increased total S and probably increased total P concentration of leaves The decreasing effects of applied nutrients, especially N, on soluble nutrients of leaves at boot and dough stages were attributed to their translocation from leaves to heads for grain formation Leaf sheath and stem base

tissues of young wheat plants have been suggested for studying critical levels of nitrate N Split application of N, before planting and at boot stage, has been suggested to obtain higher yield of high protein grain If irrigation facilities and an adequate supply of N fertilizers are provided, the introduction of Pitic or a similar high yielding, short statured variety for general cultivation holds great promise for wheat production in the area (FA 2 2109)

254 Gill, M A, Rana, A J, Khan, M F A 1968 *Effect of Placement of Superphosphate as Influenced by Time of Application of Ammonium Sulfate on Yield, Protein, and Phosphorus Content of Wheat Grain* Pak J Soil Sci 4 31 6 (Eng) (W Pak Agr Univ, Lyallpur)

On a calcareous sandy loam of pH 8, low in organic matter and cation-exchange capacity, placement of superphosphate at 6 in depth, in conjunction with $(NH_4)_2SO_4$ applied at first irrigation, increased grain yields significantly and was better than placement at 4½ in, or broadcasting, and other times of N application Protein content of the grain was affected more by time of N application than by P placement With all placements of P, the protein content was highest when N was applied at preflowering Applying superphosphate at 6 in depth in conjunction with (NH_4) SO_4, half at sowing and half at preflowering, increased the P percentage in the grains significantly (SF 31 3642)

255 Islam, A, Rahman, S 1967 *Effect of Associated Salts on the Availability of Soil Phosphorus and Its Uptake by Wheat Plants* Dacca Univ Stud, Part B 15 31-8 (Eng) (Dacca Univ, Dacca)

The application of $(NH_4)_2SO_4$, $CaSO_4$, and $MgSO_4$ in general increased the availability of P in soils and also increased the uptake of P by wheat plants The introduction of $FeSO_4$ and $Al_2(SO_4)_3$ decreased the availability of soil P and decreased the uptake of P by wheat plants The addition of K_2SO_4 decreased the availability of soil P, while at the same time increasing the uptake of soil P by wheat plants (CA 71 29647t)

256 Khan, A A, Khan, A, Muhammad, S 1967 *Potentialities of Mexican Wheat Variety for Higher Production* W Pak J Agr Res 5(3) 1 4 (Eng) (Agr Res Inst, Tarnab)

In field trials in the Peshawar region, highest yields (23 7 maund/acre) of Mexican wheat cv Penjamo, grown on poor soil, were obtained from a seed rate of 90 lb/acre and a fertilizer rate of 120 lb N plus 90 lb P_2O_5/acre (1 maund = 37 3 kg) (FCA 22 20)

257 Munshi, Z 1970 *Progress With Wheat in West Pakistan* World Crops 22(1) 32-4 (Eng)

Wheat production has increased from about 3 7 million tons in the period 1948 54 to about 7 million tons in 1969 This increase has been partly due to the expansion of the cultivated area by about 43%, and to varietal improvement and extensive use of fertilizers During the same period the yield per ha has increased by about 33% (from 870 to 1,160 kg/ha) This yield increase has been mainly due to the incentives provided by the government, and acceptance by the farmers of the high yielding, semi dwarf varieties such as Mexipak 65, fertilizer use, and adoption of better agronomic practices (Trop Abst 25 2040)

258 Naqvi, S M, Azmi, A R, Ansari, R 1966 *Effect of Barisol and Soluble Phosphorus on Wheat Growth in Pot Culture* Proc Agr Symp A E C Dacca, pp 67 70 (Eng) (At Energy Agr Res Cent, Tandojam)

In pot experiments with wheat grown on a loamy soil, the chelate barisol (K salt of phosphated complex multicarbon alcohols) applied alone or together with KH_2PO_4 significantly increased dry weight and total P content of the crop, the chelate was more effective than the soluble phosphate (SF 31 2762)

259 Niazi, M H K, Ahmad, J, Jabbar, A 1968 *Nitrate Nitrogen Status at Various Depths of Soil from Different Nitrogenous Fertilizers During Growth Period of Wheat Crop in Quetta* W Pak J Agr Res 6(2) 138-40 (Eng) (Agr Res Sta, Quetta)

Analyses were made during 1966 67 to determine the NO_3 content of surface and subsurface soils in wheat plots treated with various N fertilizers at 30 lb of N/acre In general, the fertilizers, applied at sowing, underwent little or no nitrification up to the end of December, after which it proceeded rapidly Maximum NO_3 was found on February 1 and minimum on March 1, after which it was almost constant Comparative availability at both depths showed nearly the same trend In surface soil, NO_3 decreased in the order urea, NH_4^+ phosphate, $(NH_4)_2SO_4$ NH_4NO_3, $(NH_4)_2SO_4$, and farmyard manure N fertilizers could be applied at any time from sowing to the end of December, NO_3 fertilizers applied at the time of sowing may be lost through leaching and might better be applied at the end of December, the demand of the wheat crop for NO_3 was heavy in February N fertilizers were better suppliers of NO_3 at the time required by wheat plants than was manure (CA 71 69740z)

260 Rauf, A, Mian, M A 1967 *Effects of Salts on the Growth Performance of Sorghum 100 and Wheat C 250* Pak J Sci 19(3) 87 96 (Eng) (W Pak Agr Univ, Lyallpur)

The sorghum was very sensitive to chlorides but could better tolerate Na_2CO_3 and $NaHCO_3$, the reverse seemed to be true for the wheat Extreme suppression of germination and high mortality of sorghum in soils treated with NaCl was possibly more due to chloride than sodium ions When Na_2SO_4 and $MgSO_4$ were compared with NaCl and $MgCl_2$, the chlorides were much more injurious than the sulfates The yield of sorghum green fodder was extensively decreased by low levels of NaCl and $MgCl_2$ The adverse effects of Na_2CO_3 and $NaHCO_3$ on sorghum fodder yield were in between those of chlorides and sulfates The adverse effects of progressively increasing salinity developed slowly and gradually with sulfate salinity, whereas they occurred sharply and brought about marked reduction of growth with chloride salinity When salinity was due to NaCl, $MgCl_2$, Na_2CO_3, and $NaHCO_3$, the yield of wheat grain was significantly reduced, especially at higher levels, when salinity was due to Na_2SO_4 and $MgSO_4$, the grain yield increased Straw yield was more affected by all salts than grain yield High level of salinity not only depressed the yield but also lowered the quality of wheat grains as far as shape, size, and weight of individual seeds were concerned (CA 71 105506t)

261 Rauf, A , Mian, M A 1967 *Inducing Salt Resistance by Presowing Seed Treatments* Pak J Soil Sci 3(2) 16 23 (Eng) (W Pak Agr Univ , Lyallpur)

Sorghum and wheat seeds were treated with different solutions and tested for tolerance towards NaCl, Na_2SO_4, or $NaHCO_3$ salinity Germination and survival of sorghum, especially at higher levels of NaCl and Na_2SO_4 salinity, were improved by soaking the seed in $MgSO_4$ solution Soaking the seed in NaCl solution was not useful With wheat, presowing seed treatments did not affect germination or ultimate survival of the plants (SF 31 4305)

262 Shah, B H 1966 *Effect of Sodium and Potassium Chloride on the Growth of Early Seedlings of Some Varieties of Wheat from Pakistan in Nutrient Solution* Agr Pak 17 129 38 (Eng) (Royal Coll Agr , Uppsala 7, Sweden)

Of eight varieties, C 273 gave good performance in presence of both salts H 68 gave good results in presence of KCl C 591 and C 250 grew moderately well with both salts Both salts had a detrimental effect on C 271, C 217, and C 518 C 228 grew moderately well with NaCl and poorly with KCl In all varieties, except C 228 and C 250, transpiration was greater in presence of KCl than in NaCl (SF 30 2996)

263 Vermaat, J G 1966 *Report to the Government of Pakistan on Soil Fertility Investigations* Expanded Tech Assis Prog , FAO Rep 1887 1 100 (Eng)

The purpose of the "rapid soil fertility survey scheme" was to establish soil fertility levels throughout Pakistan and to examine to what extent yields could be increased by the efficient use of fertilizers The main results of nearly 9,000 fertilizer trials on cultivators' fields are presented In West Pakistan yield increases of 50 100% were obtained through combined application of ammonium sulfate and single superphosphate on both wheat and rice, the use of fertilizers on millet and sorghum was not economic, in East Pakistan rice yields were increased by 50 64% through combined N and P, and by 62 92% through combined N, P, and K The application of fertilizers gave much higher yield increases with selected wheat varieties than with local varieties (Trop Abst 21 1626)

TAIWAN

264 Lin, T C 1964 *Effect of Various Nitrogenous Fertilizers on Wheat* J Agr Assn China (Taipei) 45 53 8 (Chin) (Prov Chung Hsing Univ , Taipei)

Significant increases in wheat yields resulted from application of 60 kg N/ha applied as $(NH_4)_2SO_4$, urea, Ca NH_4 nitrate, nitrophosphate, or $(NH_4)_3PO_4$, combined with 75 kg P_2O_5 and 60 kg K_2O/ha Differences between N sources were not significant (CA 66 94318x)

265 Yuan, W L , Lin, T C 1965 *Phosphate Responses of Wheat in Taiwan* Soils Fert Taiwan, pp 40 3 (Chin)

Wheat responds to P Band placement is slightly superior to broadcasting (SF 31 2836)

THAILAND

266 *Annual Report on Fertilizer Experiments and Soil Fertility Research 1966–"Wheat "*, pp 70 1 Bangkok, Div Agr Chem Dep Agr , October 1967 (Eng)

Application of 6 12 kg/rai P_2O_5 is necessary for soils containing available P less than 10 ppm Application of 8 kg/rai N is required for early vegetative growth Although this experiment showed no effect of K on yield, a small amount would be recommended to build resistance to rust disease and lodging

TURKEY

267 Frizzell, J K 1968 *Introduction of Mexican Wheat in Turkey 1967 1968* U S AID, Ankara, 129 pp (Eng)

The second phase of the introduction of Mexican wheats into Turkey is reported The author was chief of a party for an Oregon State University AID contract and was assisted by others in the party in the preparation of the report The report consists of five sections (1) General information on Turkish agriculture and program objectives, (2) Aegean region, (3) Marmara region, (4) Soils and fertilizers for wheat production, and (5) Performance and adaptation of Mexican wheat varieties in Turkey Both N and P fertilizers are required for wheat production NPK factorial experiments showed that the most efficient increases in yield resulted from 12 6 0 or 12 12 0, and occasionally from 20 12 0, kg/decare (0 247 acre) of N P_2O_5 K_2O Application of all N in the fall generally was as good as split applications (FA 2 578)

268 Ross, J G , Akyurek, A , Oruc, N 1968 *Wheat Production in Eastern Anatolia, Investigations at Ataturk University, Erzurum, Turkey, 1967* Plant Sci Dep , Ataturk Univ , Erzurum, 53 pp (Eng)

Three variety fertilizer experiments were conducted in 1967 in Erzurum valley–one on irrigated land, one on dryland under fertile conditions at Ataturk University, and one at Taze Gul village on farmland which was poor in fertility and not irrigated In the first two experiments, wheat varieties from the American midwest were compared with two varieties of Turkish origin recommended for Eastern Anatolia while in the last experiment the best Turkish variety was compared with the farmer's endemic strain Under irrigation, fall application of N and P was combined and compared with spring application of N on all varieties Under dryland only the fall application was made At Taze Gul N and P were applied in the fall and also N in the spring Under irrigation, Warrior yielded 582 kg/decare of grain with 60 kg ammonium sulfate and 30 kg superphosphate (17% P_2O_5)/decare Under dryland, Cheyenne at 396 kg/decare yielded more than any variety fertilized with 30 kg/decare ammonium sulfate and 30 kg/decare superphosphate Under farm conditions at Taze Gul the village variety yielded 260 kg/decare and Turkey 305 only 197 kg/decare with the best fertilizer treatment On the soil in the irrigation experiment, high P fixation occurred and no effect of P application was obtained Spring application of 30 kg/decare of ammonium sulfate gave almost as high yields as fall application of 30 kg/decare of ammonium sulfate and 30 kg/decare of superphosphate Combining grain and straw

value, spring application of N gave a return of 7 84 TL for each TL invested, in comparison to 5 40 TL for fall application of N and P, and 4 73 TL for combined spring and fall application of N and fall application of P Under dryland where fertility was high, fall application of N and P gave a significant increase in yield over the control but only a return of 2 41 TL for each TL invested Under farm conditions at Taze Gul a return of 4 62 TL (only value of grain computed) was obtained for fall application of 20 kg/decare ammonium sulfate and 30 kg/decare of superphosphate Returns from P by itself and N by itself were not as high N and P applied together in the fall appear to give the best results under these conditions Under irrigation, yields of 1,000 1,100 kg/decare are not impossible goals if the ideal cultural and soil conditions are combined with the correct strong strawed adapted genotype The yields presently obtained compare favorably with those obtained in the coastal areas from the new Mexican wheats and indicate the immense potential of the Eastern Anatolian region (FA 2 577)

EUROPE

AUSTRIA

269 Kopetz, L M 1965 *Effect of Fertilizing Measures on the Quality of Wheat* Proc Fourth Reg Conf Int Potash Inst, pp 45 51 (Ger) (Hochsch Bodenkult, Wien)

Effects of N and K fertilizers on gluten content and quality in wheat are discussed High rates of N increased gluten formation but depressed quality (swelling value), unless accompanied by adequate K (SF 30 1363)

270 Primost, E 1968 *The Effect of Fertilizing on Wheat Quality* Landwirt Forsch, Sonderh 22 149 57 (Ger) (Osterr Stickstoffw, Linz)

A review, with 18 references and experimental data on the effects of K and N fertilizing on grain yields and baking quality of wheat (starch, sugar, protein, etc) (SF 31 4469)

BELGIUM

271 Stryckers, J, van Himme, M 1966 *Combination Possibilities of CCC With Herbicides and Nitrogen Fertilizers in Cereals* Meded Rijksfac Landbouwwetensch, Gent 31(3) 1132 154 (Neth) (Cent Onkruidonderzoek, Gent)

The effects were investigated of adding herbicides to CCC applied at 1 5 2 kg/ha to cereal crops CCC had no adverse effect on herbicidal properties, and its presence in the spray gave improved control of *Matricaria recutita* in winter wheat using MCPA and DNOC, *Stellaria media* in spring wheat using MCPA, *Alopecurus myosuroides* and *Apera spica venti* using DNOC and ioxynil, *Poa annua* in spring wheat using DNOC Control of *Poa annua* by DNOC in winter wheat and of *Stellaria media* by ioxynil in spring wheat was adversely affected by CCC Adding urea at 25 kg N/ha to CCC + growth substances tended to emphasize the shortcomings of the herbicides, especially on plots containing *Polygonum persicaria* and *Stellaria media* and where mecoprop was used, though topdressing with N 1 2 weeks later also did this Improvements in control of *A myosuroides* and *A spica venti* in winter wheat with DNOC and *Stellaria media* in spring wheat with DNOC or ioxynil in the presence of CCC were obtained by adding 40 kg N/ha as urea The reduction in straw length given by CCC alone was 25 35% in winter barley and spelt, 2 5% in spring barley, 2 5 15% in rye, 5 25% in winter wheat, 7 10% in black oats, 1 12% in white oats and 0% in yellow oats, figures for CCC and MCPA + CCC, respectively, for spring wheat were Fylby, 28%, 41%, Gaby, 24%, 38%, Phoebus, 31%, 36%, Jufy II, 28%, 33%, Aga, 15%, 32%, Carpo, 25%, 24%, Jufy I, 32%, 32% The effect of CCC on winter wheat was increased by adding 0 5 kg ioxynil Na and still more by 5 kg DNOC ammonium Ioxynil by itself increased straw length Effects on wheat were somewhat reduced by adding 40 kg N/ha as urea to the spray, this did not reduce node thickness, though topdressing 1 2 weeks later did, particularly on the DNOC plots Ear length was decreased by MCPA and increased by N CCC + herbicide reduced the number of fertile tillers, this was partially counteracted by N except for DNOC + CCC + urea in spring wheat and ioxynil + CCC + urea in winter wheat Hoeing adversely affected tillering in winter wheat, this was counteracted by CCC + topdressing with N CCC tended to reduce grain yields even when herbicides were added, unless extra N was applied, 40 kg N/ha as ammonium nitrate, applied 1 week after spraying spring wheat, was more effective than adding urea to the spray Yields tended to be lower with DNOC than with ioxynil Straw yield of spring wheat cv Gaby was reduced by 10% by CCC but not by CCC + urea, though the stems were shortened by 20%, susceptibility to sprouting in the ear was increased by CCC, slightly increased by CCC + MCPA, and reduced by CCC + DNOC In spring barley, CCC at 2 5 5 kg/ha had little effect on straw length but increased grain yields by 8 6%, while CCC + MCPA reduced yields by 4 8% (FCA 20 1501)

BULGARIA

272 Angelov, A, Berova, S 1969 *Effect of Irrigation and Fertilizers on Yield and Quality of Wheat* Rastenievud Nauki, No 6, 69 77 (Bulg) (Inst Pochv "Pushkarov," Sofia)

In 2 yr experiments on leached chernozem smonitza in the Sofia region, soil moisture was maintained at 70, 80, and 90% of field capacity and no fertilizer, $N_{60}P_{60}K_{60}$, $N_{120}P_{120}K_{120}$, or $N_{180}P_{180}K_{180}$ was applied Soil moisture affected the flintiness and contents of protein and wet gluten in the gluten more than it did the absolute weight of the grain, gluten quality, and baking quality The optimal soil moisture was 80% of field capacity The nutrient supply had a greater effect on the physical, chemical, and technological properties of the grain and flour than soil moisture did Technological properties improved with

increasing rate of application of fertilizer Yield and quality were highest with $N_{180}P_{180}K_{180}$ and a soil moisture exceeding 80% of field capacity between shooting and filling of the grain (SF 33 650)

273 Enikov, K , Nestorova, S 1968 *The Effect of Fertilizers on N, P, and K Content of Winter Wheat Grown in Different Edaphic and Climatic Areas of Bulgaria* Pochvozn Agrokhim 3(1) 69 79 (Bulg) (Inst Pochv , Sofia)

The content of N in wheat grain was higher in dry than in wet years, whereas the reverse was observed for P P fertilizers increased the yields but not the content of P in the grain K content in the grain was relatively uniform and did not depend on climate, soil type, or the fertilizers applied (FCA 21 2329)

274 Ermolaev, I 1966 *Doses and Methods of Fertilizing the Fields of Winter Wheat With Superphosphate in Strongly Leached Chernozem* Pochvozn Agrokhim 1(3) 253 56 (Bulg)

An experiment with winter wheat was made in 1961 63 in the Obraztsov Chiflik Agricultural Institute to determine the optimal doses and methods of application of granulated superphosphates The best results were obtained when the superphosphate was delivered in amounts corresponding to 20 kg P_2O_5/ha into strongly leached chernozem after applying the N fertilizer in amounts of 40 kg N/ha The best results were obtained when superphosphate was applied during sowing time (CA 66 114975q)

275 Ermolaev I 1965 *Nitrogen Phosphorus Ratio in Wheat Fertilizing on Strongly Leached Chernozem Soil* Rastenievud Nauki 2(12) 69 74 (Bulg) (Agr Inst "Obraztsov Chiflik," Russe)

Experiments were carried out with nonirrigated winter wheat during the period 1961 63, in order to establish he most suitable N P ratio and the effect of fertilizing on the grain quality A N P ratio of 8 3 was the most favorable under the prevailing conditions Protein and gluten increases in the grain were due mainly to N fertilizing P fertilizing did not substantially affect the grain quality (CA 64 20575a)

276 Gotsova, V , Bocheva, E [illegible]v, B 1965 *Yield and Quality of Irrigated Wheat [illegible] Affected by Fertilizing* Rastenievud Nauki 2(12) 107 14 (Bulg) (Wheat Sunflower Res Inst , Tolbukhin)

Fertilizing irrigated San Pastore and Yubileina III wheat with increasing amounts of N and P (50, 100, and 200 kg/ha) markedly affected wheat yield At increasing N rates, the total protein was increased by 1 70 2 74% and the gluten by 5 40 8 70% P fertilizing alone decreased the protein and gluten contents Combined fertilizing at the highest N rate (200 kg/ha) compensated to a considerable extent for the unfavorable effect of P The increased protein content of grain did not improve the bread baking qualities because of low gluten quality of these wheat varieties Both varieties gave equal results (CA 64 20575b)

277 Hampl, A E 1968 *Effectiveness of Phosphates With Different Levels of Available P in Soils* Agrokhimiya, No 8, 44 9 (Russ)

278 Khristov, K , Kudrev, T 1968 *Phosphorus Intake of Wheat Plants as Influenced by β Indoleacetic Acid, Gibberellic Acid, and Dryness* Rastenievud Nauki 5(1) 3 8 (Bulg) (Inst Genet Selek Rast , Sofia)

Wheat plants, variety P 570 WZ, were raised in gravel culture At the formation of the fifth leaf, they were sprayed with aqueous solutions of β indoleacetic or gibberellic acid at 200 μg/plant Neither substance affected the P intake When other wheat plants were exposed at the heading stage to dryness until reaching the permanent wilting point, then sprayed with β indoleacetic or gibberellic acid at 200 μg/plant their turgidity was restored, and P intake was 150% of controls during the first 2 days upon recovery after dryness Plants treated with β-indoleacetic or gibberellic acid intensified P intake compared with the check plants exposed to dryness Although greater P intake was induced by these growth substances, treated plants did not reach the level of intake of check plants unexposed to dryness The effect of β indoleacetic acid was greater than that of gibberellic acid (CA 69 51087r)

279 Kitipov, A , Lichev, S 1967 *The Toxic Effect of Biuret on Some Farm Crops* Rastenievud Nauki 4(12) 75-87 (Bulg) (Pushkarov Soil Res Inst , Sofia)

In pot experiments with winter wheat and maize on sandy cinnamon podzolic soil (A) and heavy clay chernozem smonitza soil (B), urea was applied at N rates up to 1,200 mg N/kg soil, the urea contained 0 4, 3 12, 3 30, 11, or 13% biuret The effect of biuret toxicity on growth and yields was largely the result of soil properties, primarily mechanical composition and physico chemical properties (sorption capacity) The toxic concentration was nearly twice as high in B as in A, in the latter N rates of >300 mg at levels of 3 12% biuret were damaging to maize N uptake by the plants was less adversely affected than growth (SF 31 2772)

280 Kudrev, T , Pandev, S 1967 *Physiology of the Nitrogen Nutrition of Wheat I Nitrogen Intake, Some Changes in the Total Leaf Surface, and Protein Nitrogen Content of the Leaves* Rastenievud Nauki 4(4) 19 28 (Bulg) (Inst Genet Plant Selection, Sofia)

N intake by Mercury variety wheat was investigated throughout the growing season Wheat plants were raised as gravel cultures in Chesnakov and Basirina nutrient solutions to which some trace elements were added N intake was determined by its quantitative changes in the nutrient solution every fifth day and every second day at the time of increased intake N intake increased from germination to ripening This increase was relatively slow up to the five leaf stage, whereupon it proceeded faster Heading of the wheat was a turning point in the N intake, which then decreased Temporary increases occurred during flowering and grain filling stages The increased intensity of N intake was connected with enlargement of the leaf surface, its decrease was a consequence of a decrease in the total leaf surface of the plants Treatment with vitamins B_1 and B_6, as well as with indole 3 acetic acid, during decreased N intake had a favorable effect N intake was temporarily intensified The general pathway of N intake of plants treated with vitamins B_1, B_6, and indole 3 acetic acid agreed with the control plants (CA 68 10288t)

281 Mitreva, N 1970 *Effect of Nitrogen and Phosphorus Rates and Ratios on the Content and Qualitative Indexes of Wheat Protein* Pochvozn Agrokhim 5(3) 53 60 (Bulg) (N Pushkarov Inst Soil Sci , Sofia)

The amount and fractional composition of protein and the total amount of essential amino acids in wheat grain of the Bezostaia 1 variety dressed with N and P, grown on leached smolnitza in the Sofia area, were studied With N fertilizer, an increase in crude protein, the prolamines (pyrrolidines), and glutelins was found P alone and in combination with low N rates decreased the protein content No significant changes in the content of essential amino acids were observed at increase of protein content from 9 5 to 12% (CA 74 22221c)

282 Nestorova, S 1966 *Effects of the Soil Type and Fertilizer on the Uptake of Certain Nutrients by Wheat* Pochvozn Agrokhim 1(2) 171 82 (Bulg) (N Pushkarov Inst Soil Sci , Sofia)

The effect of soil type and fertilizer on the uptake of N, P, and K by wheat was studied in pot experiments Four soil types were studied calcareous chernozem, strongly leached chernozem, leached chernozem smolnitza, and gray forest soil The uptake of nutrients was investigated in leaves and in the whole plant in the tillering and earing stages Wheat had a P requirement of ~0 3% P_2O_5 in its leaves at the tillering stage This low P content was a limiting factor for increasing yields and impeded N uptake If the P level was raised above 0 70% P_2O_5 in the leaves at the tillering stage, high yields were favored, the highest being obtained in soils with >4% N and >0 70% P and a N to P ratio of 4 2 6 2 Wheat required both N and P in all soil types The soil type and the fertilizers affected the chemical composition, absolute weight, and grain cut The highest N content was in wheat grown on leached chernozem smolnitza, and the highest P content was in wheat from strongly leached chernozem The N content increased with the N fertilizers (CA 65 19259c)

283 Nikolov, B A 1967 *Effect of the Trace Elements, Manganese, Molybdenum, and Copper on Wheat ("Triticum vulgare") Growing in Degraded Chernozem* God Soffi Univ , Biol Fak 61(2) 295 304 (Bulg)

Trials were carried out in 1967 to study the effect of 0 05 and 0 1% $MnSO_4$, 0 01 and 0 02% NH_4 molybdate, and 0 05 and 0 1% $CuSO_4$ as well as with a mixture of 0 05% $CuSO_4$ and 0 01% NH_4 molybdate on wheat leaves Mn at both concentrations equally increased the grain yield up to 106% and increased the crude protein content Mo had no effect on the grain yield or P content, but it increased the crude protein content Cu reduced the grain yield and P content Mixed solutions increased the crude protein content in the grain as well as the grain yield and reduced the P content (CA 73 108824t)

284 Petkov, N 1966 *Nutrient Ratios in Fertilizers for Wheat* Pochvozn Agrokhim 1 379 83 (Bulg) (Irrigation Exp Sta , Pavlikeni)

In 3 yr experiments on leached chernozem, $N_{160}P_{120}K_{100}$ was the most suitable ratio for wheat under irrigation, yielding (average for 3 yr) 4,720 kg/ha grain On leached chernozem developed on red brownish clays, NP increased length of head, number of spikelets and grain per head, kernel, and volume weights There was a further increase at higher N rates (SF 30 1361)

285 Popov, K , Bakurdzhieva, N 1966 *Changes in the Content and State of Plastic Pigments of Wheat Leaves in Darkness and Under the Influence of Mn, Ni, and Cu* Izv Inst Fiziol Rast , Bulg Akad Nauk 15 65 88 (Bulg)

Seeds of spring wheat were treated with Mn, Ni, and Cu sulfates of different concentrations for 16 hr at 23°, and sown in Perlite moistened with distilled water The plants were kept, until the start of the third leaf, at 22° and 5,000 lux illumination The middle parts of the first and second leaves, were put in a dark chamber for 4 days at 20°, and the influence of trace elements on the growth and pigment contents were studied The seeds were treated with up to 2,500 mg % Mn The addition of 1 5 mg % Mn resulted in 117 1% (control 100%) growth of mass over that obtained in soil and 126 1% of roots After 4 days in darkness chlorophyll was, in controls, 68 5% (100% with light), with 1 5 mg % Mn, it was 102 0%, carotenoids were, in controls, 100%, with 1 5 mg % Mn 137 5% With 250 mg % Mn, the foliar growth was 114 6, roots 128 4, after 4 days of darkness chlorophyll was in control 68 5, with 250 mg % Mn 65 3, carotenoids were control 100 0, 250 0 mg % Mn 92 6 Moreover, the effects were determined of the simultaneous treatment of seeds with the following trace elements 2 5 and 250 mg % Mn, 0 1 and 0 6 mg % Ni and 0 5 and 2 5 mg % Cu Reported are the effects on chlorophyll and on both carotenoid fractions (CA 65 20786d)

CZECHOSLOVAKIA

286 Baier, J 1968 *Effect of Nitrogen on Yield of Winter Wheat at the Flowering Stage and Its Dependence on the Ratio of Nutrients Taken Up* Rostl Vyroba 14(41) 523 31 (Czech)

Over a 3 yr period, the effect of N in increasing yield was positively and highly correlated with the ratio of N P_2O_5 in the plant between ratios of 100 28 and 100 49 4 Insufficient rainfall narrowed the ratio of N P_2O_5, but increased the ratio of N Na_2O (SF 32 714)

287 Barak, K 1966 *Testing the Efficiency of Ammonia Treated Superphosphates on Summer Wheat* Sb Vys Sk Zemed Brne, Rada A, No 3, 379 86 (Czech) (Katedry Agrochem Anal Chem , VSZ, Brno)

In a vegetation experiment carried out in pots, efficiencies of four types of NH_3 treated superphosphate containing graduated N amounts were tested in a redzina soil and in a lime cultivated podzol soil, each with neutral reaction With the pH of the soil being equal, the rate of P uptake and its content in dry matter depended, during the growing season, on the supply of assimilable P in the experimental soil The redzina soil showed the higher yields of grain During the harvest, however, the content of P in the cultivated podzol was somewhat higher both in grain and straw although during vegetation it showed a lower P level The NH_3 treated superphosphates with 8 06% and 10 38% N, respectively, were less effective in redzina soils (CA 66 94357j)

288 Dudas, F , Jelinek, K , Pelikan, M 1968 *Method of Fertilization With Nitrogen in Relation to Yield and Quality of Winter Wheat* Rostl Vyroba 14(41), No 5, 489 98 (Czech) (Vys Sk Zemed , Brno)

Winter wheat cv Kasticka Osinatka was given ammonium sulfate or calcium ammonium nitrate applied to frozen soil, or calcium ammonium nitrate in early spring or at the end of tillering Time of application had little effect on yield or baking quality Sedimentation values and farinograph readings were somewhat lower where ammonium sulfate was used (FCA 22 1632)

289 Haman, F 1966 *Contribution to the Knowledge of the Effects of Fertilizing and Different Management Practices on Yield and Chemical Composition of Winter Wheat* Sb Vys Sk Zemed Brne, Rada A 41 50 (Czech)

Two yr field trials with winter wheat showed that a good efficiency of heavy rates of fertilizers requires proper soil cultivatio and favorable moisture conditions, best achieved by a seedbed preparation through two plowings first to 12 15 cm and then to 28 30 cm Adequate amounts of NPK should be applied in the autumn, lack of available N at the start of growth results in grain of low N content and poor baking quality Heavy rates of fertilizing after proper seedbed preparation through double plowing favorably affects the grain/straw ratio (SF 30 616)

290 Hampl, J , Bizik, J 1970 *Relations Between the Changes of Osmotic Potential of Soil Solutions and the Sap of Cells of Corn and Wheat Under the Effect of Fertilizing With Increased Doses of Fertilizers* Pol'nohospodarstvo 16(4) 310 20 (Sloven) (Univ Agr , Nitra)

Wheat and corn were grown in pots containing brown loess and sandy loam soils with various levels of fertilizers Significant correlation was observed between osmotic potentials of soil solutions and those of cell sap, which linearly increased with increased osmotic potentials of soil solutions The osmotic potentials of wheat cell sap averaged 4 2 atmospheres higher than those of corn, and the wheat was significantly more resistant to increased soil osmotic potential Changes in osmotic potential of cell sap were caused mainly by K^+ and Cl The proportion of Ca^{2+}, K^+, and Na^+ to Cl originally with a higher content of cations was decreased to values close to one under the influence of increased levels of fertilizers, especially with the Cl form of K With the osmotic potential of soil solution at 3-4 atmospheres (determined from soil saturated to its full water capacity) or 6 8 atmospheres (determined according to Bizik), germination, growth, and development were inhibited and the formation of dry matter of corn and wheat decreased to ~50% The sorption capacity of soil was primarily responsible for changes in the concentration of soil solution, in addition to the doses of fertilizers applied and the content of water in the soil The complex fertilizers NPK 2 and NPK B gave significantly greater production of dry matter as compared with equivalent amounts of single fertilizers due to the lower content of balast substances and a decrease of osmotic potential of the soil solution as compared with simple fertilizers (CA 74 22223e)

291 Hrbacek, J 1970 *On the Dynamics of Nitrogen in Soil With Respect to the Spring Application of Additional Nitrogen to Winter Wheat* Rostl Vyroba 16(43) 41 6 (Czech) (Agr Res Inst Hrusovany u Brne)

Response to additional N was negatively correlated with the amount of precipitation received in the 28 days, but especially the 14 days, before and after the additional application (SF 33 4047)

292 Hrbacek, J , Ambrozova, M 1966 *Comparison of Row Fertilizer Placement With Incorporation Through the Top Soil in a Three Year Experiment With Three Crops* Rostl Vyroba 39 1165 174 (Czech)

Wheat and sugar beet, grown in the first 2 yr, received fertilizer, barley grown in the third yr did not Incorporation of fertilizer was better, but not significantly so, for wheat and sugar beet, placement produced slightly more straw and tops, respectively Barley yielded better where the fertilizer had been placed in the row Reductions in emergence rates of seedlings were avoided if placement was deep, or if a sufficiently thick layer of top soil was spread over the surface of soil when fertilizer was mixed throughout When fertilizer was thoroughly incorporated to a depth of 13 5 15 cm, emergence rate was diminished only when the fertilizer rate was very high (45 100 q/ha) In pot tests, plants with placed fertilizer had larger tops and smaller root systems than plants without fertilizers, thus a less developed root system is adequate where nutrients and water are abundant (SF 30 2050)

293 Hyza, V , Bezdek, V 1968 *Effect of Mineral Nutrition on the Amount, Properties, and Fractions of Wheat Proteins* Rostl Vyroba 41(5) 479 88 (Czech) (Vyzk Ustav Obilnarsky, Kromeriz)

A variant of winter wheat, grown in pots, fertilized by adding NH_4NO_3, alone or combined with PK, showed an increase of gluten content in proportion to the N dose This led to a decrease in the swelling capacity of the gluten and an increase in the gliadin fraction K acted as a depressant in this respect (CA 70 36689r)

294 Jelinek, K , Baier, J 1970 *The Effect of Different Times of Nitrogen Application on Nutrient Uptake by Winter Wheat* Rostl Vyroba 1' 13 19 (Czech) (Agr Res Inst Hrusovany u Brne)

Data are presented on the uptake of N, P, and K and on their interrelationships within the plant (SF 33 4042)

295 Kos, M 1966 *Effect of Crop Rotation on Yields in Relation to Differential Mineral Fertilizing* Rostl Vyroba 39 1071 78 (Czech)

Though increased doses of mineral fertilizers applied to wheat, maize, and sugar beet reduced yield differences caused by different preceding crops, the latter still considerably affected yields of subsequent crops Sequence of crops rather than fertilizing was decisive where infestation with sugar beet eelworm occurred (SF 30 1349)

296 Neuberg, J , Novotna, L 1967 *The Effectiveness of High Doses of Nitrogen in the Case of Different Densities of the Sowing of Summer Wheat Treated With a CCC Preparation* Rostl Vyroba 13(40), No 5, 569 74 (Czech) (Ustr Vyzk Ust Rostl Vyroby, Prague Ruzyne)

Increased seed and N rates combined with CCC application did not increase yield of summer wheat cv Oktavia Normal or reduced seed rates and application of 90 kg N/ha, with CCC treatment, gave the highest yields (FCA 21 1569)

297 Peska, J 1965 *Changes in ^{32}P Uptake by Winter Wheat During Autumn* Sb Vys Sk Zemed Brne, Rada A, No 3, 371 77 (Czech)

In pot trials with five wheat cv of different frost resistance, the specific absorption of ^{32}P decreased during autumn growth, and was lower in plants held at 0° C than at 5° At the beginning of tillering it was higher for frost resistant varieties, but towards the three to four shoot stage it sank faster in them and, at the end of autumn growth, it was higher in the less resistant ones (FCA 20 50)

298 Vrany, J 1968 *The Rhizosphere Microflora After Foliar Application of Urea* Rostl Vyroba 12 1277 286 (Czech)

After treating wheat, maize, and tomato with 1 2% urea applied to the leaves in pot experiments, there was excess exudation from the roots of C, amino acids, and sugars, compared with untreated plants Larger numbers of bacteria were found on or near the roots of treated plants, and smaller numbers of fungi (SF 31 2520)

299 Zatko, J, Kandera, J 1966 *The Effect of Times of Application of Equivalent Rates of N on Yields of Winter Wheat ("Triticum vulgare" Host)* Ved Pr Vysk Ust Rastl Vyroby Piestanoch 4 187 200 (Czech)

N was applied at different times (P_2O_5 and K_2O being applied before sowing) to winter wheat following 2 yr lucerne on degraded chernozems Highest grain and straw yields occurred when N as $Ca(NO_3)_2$ and NH_4NO_3 $CaCO_3$ was applied on five occasions, i e before sowing (once), on frozen soil (twice), and topdressed (twice) Forced maturing of winter wheat by high spring and summer temperatures, causing small grain size, was reduced by this timing (SF 31 1395)

DENMARK

300 Larsen, I, Nielsen, J D 1966 *The Effect of Varying Nitrogen Supplies on the Content of Amino Acids in Wheat Grain* Plant Soil 24(2) 299 308 (Eng) (Roy Vet Agr Coll, Copenhagen)

Dry matter, total N, NH_3, and 15 amino acids were determined in wheat plants, grown in pots, supplied with different amounts of N Glutamic acid and proline increased with increasing applications of N, whereas lysine and arginine decreased (CA 65 6245e)

301 Molle, K G, Jessen, T 1968 *Increasing Amounts of Nitrogen for Spring Cereals Grown in Lowland Areas, 1960 67* Tidsskr Planteavl 72 489 502 (Den)

The report deals with the results of 32 trials with oats, barley, and spring wheat on fine sandy, clay, and peat soils in Western Jutland Yields of grain and straw, volume weights of grain, single grain weights, length of culm, and degree of lodging are given in tabular form and the influence of climatic conditions on yields indicated Applications of 90 kg N/ha were best for barley and spring wheat, 60 80 kg N/ha were best for oats On the basis of total N and amide N analyses, the influence of N application on protein quality is considered (SF 33 4803)

302 Nielsen, J M 1969 *On the Potassium and Sodium Concentrations in Plants Results of Pot Experiments in Relation to Results of Chemical Analyses of Danish Crops During This Century, and the Possible Effects of Changes in K and Na Concentrations on Plants, Animals, and Man* Kgl Vet Landbohoejsk, Aarsskr, pp 5 18 (Den) (Roy Vet Agr Coll, Copenhagen)

In pot trials in 1962 and 1964, wheat and oat plants given various rates of K and Na showed large differences in Na and K contents and in K Na ratio as a result of fertilizer treatment Increases in K content and K Na ratio were particularly marked where K alone or K + ammonium sulfate was given Analyses of Danish cereal and root crops, clovers, and grasses over the period 1900 65, as reported in the literature showed a general trend towards increased K and reduced Na concentrations and increased K Na ratios in the plants in herbage crops for example, there was a 60 fold increase in K Na ratio In view of current fertilizer practice in Denmark it is anticipated that these trends will continue in the future and that there will be an increased risk of Na deficiencies arising in crops, livestock, and humans (FCA 23 67)

FINLAND

303 Aura, E 1967 *Effect of Placement of Fertilizer on the Development of Spring Wheat* Maataloustieteel Aikak 39(3) 148 55 (Finn) (Univ Helsinki)

The placement of fertilizer was studied in the field trial on a clay soil in southern Finland The placement of fertilizer in the depth of 8 cm gave 28% greater grain yield of spring wheat, and the placement in the depth of 12 cm 26% greater grain yield than the surface dressing The growth of shoots on the soil receiving placement was much better than on the soil receiving surface dressing The placement caused a much greater uptake of nutrients than the surface dressing The uptake of N was relatively most increased by the placement that of K somewhat less and that of P the least The ripening of wheat was speeded up by the placement, which probably was due to the better early uptake of N and to the better uptake of P by means of the placing The superiority of the placement to the surface dressing could be explained by the distribution of nutrients in the experimental soil during the dry early part of the growth season A great deal of fertilizer N, P, and K remained near the surface of the soil receiving surface dressing, and plants were not able to take up nutrients from the dry surface layer On the contrary, the placed nutrients were deeper in more moist soil and better within the reach of wheat roots Any movement of ammonium N was not found by the methods used Nitrate N moved to a greater extent particularly in the irrigated plots (FA 1 1519)

304 Elonen, P, Nieminen, L, Kara, O 1967 *Sprinkler Irrigation on Clay Soils in Southern Finland III Effect on the Quality of Grain Yield* Maataloustieteel Aikak 39 90 8 (Eng) (Univ Helsinki)

In the dry summers, 1964-66, ripening and grain quality

depended greatly on irrigation date, a distinct transitional period occurring before which irrigation hastened ripening, decreased the amount of green grains, and increased hectolitre weights and "falling numbers" (quality of wheat starch estimated by the method of Olerad, 1964) The transitional period was about 2 weeks before ear emergence or about midsummer The optimum irrigation period for yield, ripening, and grain quality was halt way between shooting and ear emergence and its length was about 2 weeks Wheat, barley, and oats responded similarly to irrigation date Fertilizer placement at 8 12 cm depth hastened ripening and increased hectolitre weight Fertilizer rate had no great effect on grain quality Irrigation increased grain number but not grain weight The crude protein content of wheat, barley, and oats decreased markedly with irrigation irrespective of the date of application This decrease was usually greater with higher yields and could be prevented by heavy N fertilizing (SF 31 653)

305 Larpes, G 1966 *The Effect of Fertilizer Placement on Spring Cereals* Maatalous Koetoiminta 20 14 20 (Finn) (Dep Agr Chem Phys, Tikkurila)

In trials in 1964 65 on various soils, placement of up to 1,200 kg NPK at depths of 10 12 cm in the seedbed resulted in grain yield increases in spring wheat of 100 500 kg/ha (average 300 kg), compared with broadcasting the fertilizer The highest yield increases from deep placement were obtained on soils of low fertility and where there were drought conditions in early summer (FCA 21 1511)

306 Raininko, K 1966 *Influence of Late Nitrogen Fertilization on the Quality of Wheat* Maataloustieteel Aikak 36 140 49 (Finn) (Univ Helsinki)

For 3 yr starting in 1962 a late dressing of N (24 or 50 kg/ha) was sprayed at flowering, in 1962 and 1964 the N was applied earlier, after sprouting in some treatments Grain yields were increased by early and late N but only in 1964 was the effect of late N significant Crude protein content of grain and wet gluten content of flour were raised by late N dressings Urea and $Ca(NO_3)_2$ had similar effects, application of the herbicide MCPA with N had no obvious effect Seasonal variations in yield were greater than variations due to treatment Recovery of fertilizer N was related more to season than to treatment (SF 30 2213)

FRANCE

307 Bertrand, D, De Wolf, A 1969 *Wheat, Nitrogen, and Trace Elements Testing in 1969* C R Hebd Seances Acad Agr Fr 55(13) 946 49 (Fr)

New experiments with Champlein variety of wheat confirmed the optimal results obtained in 1967 with N fertilization Co[illegible] in with Mo was profitable only in case of distinct Mo [illegible] v Nitrate reductase activity in the leaves was not correl[illegible] ith the yield as it was for maize (CA 73 24363d)

308 Bertrand, D, De Wolf, A, Baratte, Y 1966 *Investigation on the Optimum Quantity of Manganese Used as Complementary Fertilizer for Wheat* C R Hebd Seances Acad Agr Fr 52(3) 211 18 (Fr)

From a trial on small plots it was concluded that the optimum quantity of Mn for wheat, as shown by grain yields, is <2 kg/ha, including the amount and that already present in the soil and absorbed by the plants (FCA 19 2003)

309 Bertrand, D, Raverdy, M, De Wolf, A 1968 *Some Investigations on Yield Improvements in Graminaceous Crops Wheat* C R Hebd Seances Acad Agr Fr 54 211 15 (Fr)

Mo at 1 6 kg/ha increased wheat yields by 6 3% in a soil of pH 8 Yields increased with increasing rates of N, especially in split applications and in combination with CCC, but magnesium ammonium phosphate had no effect Mo may possibly affect grain quality and chemical composition (SF 31 4470)

310 Chabannes, J, Simon Sylvestre, G 1968 *Effect of Ammonium Nitrate on the Nitrogen, Sulfur, and Phosphorus Nutrition of a Winter Wheat in Relation to the Mineralization of These Elements in Soil* C R Hebd Seances Acad Agr Fr 54(16) 1284 289 (Fr) (Sta Cent Agron, Versailles)

Winter wheat was fertilized with 0, 60, and 120 kg NH_4NO_3/ha, and analyzed for total N, S, and P during the growing season from the time the shoots were 4 6 cm high to harvest (4 5 months) The respective N, S, and P contents (percent dry weight) at the given fertilizer levels (initial and harvest values given) were 0 kg/ha 54 2 and 8 20, 3 7 and 0 9, 5 6 and 1 5, 60 kg/ha 58 7 and 7 7, 4 2 and 0 9, 6 0 and 1 5, 120 kg/ha 61 8 and 10 4, 4 5 and 1 1, 6 2 and 1 5 Total dry matter yields (same respective order) in cwt/ha were 143, 179, 179 Proper use of N fertilizer appeared to be superior to NSP fertilization A deficiency of S in winter wheat was considered serious (CA 71 29646s)

311 Collier, D 1968 *Long Term Residual Effect of Nitrogen in Mineral and Organic Fertilizers in a Calcareous Clay Soil of Limagne* C R Hebd Seances Acad Agr Fr 54 172 75 (Fr)

Maize followed by wheat was grown without fertilizers on plots which for 16 yr had either received no fertilizers or had been dressed annually with mineral N or mineral N + dung The soil contained 35% clay, 20% silt, 7% $CaCO_3$, and 4% total organic matter, with a calcic mull humus No positive long term residual effect of mineral N fertilizer was observed on yields of either maize or wheat, or on yields of radish and uptake of N by ryegrass in pot experiments with surface soil from the same plots, or on the seasonal changes in the mineral N content of each plot (FCA 22 4356)

312 Gilles, P 1969 *The Role of Phosphate Fertilizer in the Winter Nutrition of Wheat* Phosphorus Agr, No 52, 17 23 (Fr) (Societe du Superphosphate, Paris)

Florence Aurore and Rex wheats were grown in deep pots in a phytotron using short days and low (5° C) temperatures Soils high, moderate, and low in available P were used N and K_2O were applied at rates equivalent to 105 and 120 kg/ha, respectively Superphosphate equivalent to 140 kg/ha of P_2O_5 was mixed with the soil, applied at a depth of 5 cm, or topdressed at tillering, there also was a no P treatment Leaves and roots were harvested at 3 months (beginning of shooting) and measured for yield and P content Treatment had no effect on tillering P applied at a depth of 5 cm produced the

greatest weight of both leaves and roots in soils high in P For soils low in available P, root weight was not affected by method of application Topdressing promoted root production in the upper 7 cm of the soil for soils high in P, other treatments had negligible effects on root distribution in the upper 20 cm of soil Method of application generally had little effect on the P content of roots or leaves moderate to high in available P except topdressing did increase the P content of leaves about 25% for both soils For soils low in available P, P fertilization increased the P content of both roots and leaves about 50% regardless of method of application P fertilization increased P uptake 25 30% in soils moderate to high in available P and over 100% in soils low in P The author recommends a split P application for wheat, one part buried more or less superficially with the seed, the other applied on the surface at tillering (FA 2 1115)

313 Lefort, G , Sebillotte, M 1968 *Action of Frost on Winter Wheat as a Function of Microrelief and Fertilization* Ann Agron 19(6) 685 97 (Fr) (Inst Nat Agron , Paris)

On two plots of winter wheat (varieties Cappelle and Etoile de Choisy), the effects of a long frost period (winter 1962 63) caused a decrease in the number of the wheat plants, this decrease was higher on the mounds of the microrelief than in the hollows An application of fertilizers, at the end of this frost period, allowed wheat plants growing in the hollows to be saved, but not those on the mounds The fertilizing joined to a low density (about 100 plants/m^2) caused high increase in weeds, the ratio of each species depending on the wheat variety The protection of the rows of wheat in the hollows resulted in an average production of 60 q of dry grain It is therefore desirable in the cold, windy areas to use sowing techniques which produce the same type of protection (FA 2 911)

314 Moulinier, H , Mazoyer, R 1968 *Contribution to the Study of the Effect of Cr on Plant Growth* Ann Agron 19(5) 553 67 (Fr) (Sta Agron Physiol Veg INRA, Antibes)

Wheat cv Florence Aurore was sown in pots containing acid or alkaline soils in January 1967 and harvested 3 5 months later Cr was applied to the soil as sulfate or oxide at different rates Results showed that yield and chemical composition of the grain and other above ground parts were not affected by applied Cr Chromium oxide had little effect on root growth on either soil, but chromium sulfate reduced root growth on the acid soil and caused a small reduction only on the alkaline soil (FCA 22 1682)

315 Moulinier, H , Mazoyer, R , Aguis, I 1968 *Effect of Chromium on Plant Growth* Ann Agron 19(5) 553 67 (Fr) (Centre Rech Agron Provence, Antibes)

The toxicity of Cr^{3+} to wheat and tomato plants was studied with a view to using chrome tanning waste as a fertilizer Cr_2O_3, which is insoluble, had no toxic effects $Cr_2(SO_4)_3$ had no toxic effects in calcareous soil in long term growth tests In the Stanford test, root growth was nearly normal in the presence of $Cr_2(SO_4)_3$ in calcareous soil In acid soil $Cr_2(SO_4)_3$ was toxic to plants, but this toxicity was counteracted by the addition of $CaCO_3$ Plants grown in acid soil to which $Cr_2(SO_4)_3$ had been added showed P deficiency, which was counteracted by addition of 0 5 g P_2O_5/kg soil Similarly, the soil itself showed a deficiency in available P In the Stanford test the toxic effect of 300 mg Cr^{3+} was counteracted by 630 mg $CaHPO_4$ In the long term growth test the toxic level was about 1,000 mg Cr/kg soil, while in the Stanford test it was only 200 300 mg Cr/kg soil (CA 71 2597q)

316 Raverdy, M 1967 *Interaction Between Herbicide Treatment and Time and Rate of Nitrogen Applications to Winter Wheat* C R Hebd Seances Acad Agr Fr 53 709 21 (Fr)

The interaction between each of five rates of N applied to winter wheat at each of four stages of growth with and without herbicide treatment is analyzed statistically 120 kg/ha N applied at heading after herbicide treatment at tillering increased yields by 120% (SF 31 540)

EAST GERMANY

317 Ansorge, H , Schnee, M , Jauert, R 1967 *Correlations Between Preceding Crop and Fertilization of Cereals* Albrecht Thaer Arch 11(2) 163 69 (Ger) (Inst Mineraldueng , Leipzig)

Winter wheat and spring barley were grown with 0, 40, and 80 kg N/ha following sugar beet, potatoes, or oats N increased grain yields by 10 hkg/ha Yields were higher after potatoes than after oats, the differences were 6 6 hkg/ha without N and 1 8 hkg with high N for spring barley, 5 1 hkg without N and 2 2 hkg with high N for winter wheat Response to N was least after potatoes Barley yielded more than wheat and gave a higher yield response to 40 kg N/ha (FCA 20 2143)

318 Goerlitz, H , Ansorge, H , Specht, G , Jauert, R , Ebert, K 1970 *Use of High Nitrogen Doses With Winter Wheat and Winter Rye Under Different Site Conditions* Albrecht Thaer Arch 14(4) 321 30 (Ger) (Inst Mineraldueng , Leipzig)

The effect of heavy N fertilization on winter wheat and rye was investigated on several types of soils The effect depends strongly on water supply, mineralization of N in the soil, and the lodging resistance of the cereal The effect is therefore highest on loamy sands and sandy loams On loam and clay soils and on chernozems the productive value of mineral N fertilization is lower and the maximum of N fertilization is reached sooner, because of the greater N supply from the soil and the lower lodging resistance (CA 73 130234x)

319 Rinno, G , Ansorge H , Koriath, H , Ebert K , Jauert, R 1970 *Effect of Nitrogen Fertilization on the Crude Protein Content of Wheat in Relation to Site, Weather Conditions, and Variety* Albrecht Thaer Arch 14(4) 305 14 (Ger) (Inst Mineraldueng , Leipzig)

The baking quality of wheat flour is improved by a high crude protein content in the flour Field experiments proved that it is raised by a high N fertilization The deviations in protein as related to site and weather conditions decreased as N fertilization increased To get the highest and most stable protein content, the N should be given in two or three portions during the growing period Addition of (2 chloro ethyl)trimethylammonium chloride had no effect on protein level (CA 73 130233w)

WEST GERMANY

320 Bachthaler, G 1967 *Effect of Foliar Spraying With CCC on Winter Wheat and Spring Wheat Grown at a High Rainfall Site* Z Acker u PflBau 126(4) 357 82 (Ger) (Bayer Landesanst Bodenkultur, PflBau und PflSchutz, Munchen)

Winter wheat and spring wheat grown for 4 yr at rates of N up to 160 kg/ha on loess soil with 850 mm rain/yr were given 3 to 7 l 46% CCC at the four to six leaf stage Applying CCC increased the number of ears per unit area and the number of grains per ear but decreased the 1 000 grain weight The amount of straw shortening obtained depended more on variety in spring wheat than in winter wheat CCC usually increased grain yields of spring wheat, but in some varieties of winter wheat he yields were decreased and positive responses were obtained only when control plots lodged severely There was no clear relationship between rate of N and response to CCC either in terms of grain yield or of straw shortening In some years, CCC encouraged infection by *Septoria nodorum.* (FCA 21 2340)

321 Belger, U 1965 *Investigations into the Effect of Late N Manuring on Grain Yield, Grain Characteristics, and Baking Quality of Some Winter and Spring Wheat Varieties* Bayer Landwirt Jahr 42(6) 667 701 (Ger) (Inst PflBau u PflZucht, Weihenstephan)

In different localities in West Germany over 2 yr the effect of N application at two levels at shoot emergence and at the appearance of the ears was tested on wheat Late N application increased the yield at either time of application and increased the grain size Wheats of poor baking quality did not benefit from late N application as much as the better quality ones (FCA 19 1957)

322 Brandt, J, Wolter, K 1965 *The Capability for Baking and the Supply of Wheat With Phosphorus* Phosphorsaeure 25 238-49 (Ger)

Six wheat varieties from NK and NPK plots were tested for baking properties A good P supply caused an increase of yield The content of raw protein (quantity of gluten) and the sedimentation value (quality of gluten) increased considerably The output of flour proved greater and in baking tests a greater volume output was obtained (CA 64 16571b)

323 Braun, H 1969 *The Effect of Different Forms and Times of Application of N on Yield and Quality of Winter Wheat* Bayer Landwirt Jahr 46 302 9 (Ger) (Tech Hochsch Munchen, Weihenstephan)

In 5 yr field trials at different locations, highest grain yields were produced by split application of "60 $CaCN_2$ + 20 $Ca(NO_3)_2$" and lowest yields by "60 calcium ammonium nitrate + 20 $Ca(NO_3)_2$" (or 80 calcium ammonium nitrate singly) Treatments had practically no effect on grain quality (crude protein content and sedimentation value) (SF 33 4804)

324 Breitschneider Hermann, B 1968 *Long Term Nitrogen Balances in a Complex Experiment With Organic Manuring and Mineral Nitrogen Fertilizing* Stikstof, No 12, 111 17 (Ger) (Univ Giessen)

Total yields of 3 yr rotations (sugar beet, spring wheat, oats), receiving different organic manures (straw, dung, sheep manure) without or with 20 150 kg mineral N, are compared with N balances calculated from N uptake and supply Yields successively decreased on organic matter plots without mineral N, moderate and high amounts of mineral N moderated the negative nature of N balances or made them positive, respectively, with simultaneous maintenance of, or increase in yields Decrease in yield [illegible] ssociated with negative N balances and/or wide [illegible] of some organic manures (i e straw, fresh dung), and also with omission of organic manuring (SF 32 1396)

325 Diercks, R Amberger, A, Wick, H 1968 *Preliminary Trials to Control Eyespot, Weeds, and Weed Grasses in Winter Wheat by Combined Application of Calcium Cyanamide and Various Chemicals* Bayer Landwirt Jahr 45(1) 37 45 (Ger) (Bayer Landesanst Bodenkultur, PflBau und PflSchutz, Munchen)

In trials in 1966, increased grain yields were obtained at one site by applying 60 kg N as calcium cyanamide in mixture with either 0 4 kg simazine or 0 6 kg monolinuron, compared with 60 kg N as ammonium nitrate limestone plus double the above herbicide rates Lodging was also reduced, and good control of *Apera spica venti* obtained At another site with less eyespot (*Cercosporella herpotrichoides*) infection, *Alopecurus myosuroides* was well controlled by the above treatments, but there was no increase in grain yield Good control of lodging and reduced attack by eyespot were obtained with 80 kg N as calcium cyanamide + 1 or 2 l CCC/ha At equivalent rates of N, calcium cyanamide enhanced the straw shortening effect of CCC compared with ammonium nitrate limestone (FCA 22 35)

326 Ewald, E 1965 *Effect of Various N Levels on Spring Wheat With Special Reference to Grain Protein and Baking Quality* Z Pflanzenernaehr Bodenk 108(3) 218 32 (Ger) (Inst PflErnahrungslehre u Bodenbiol, Hohenheim)

Applying N early (up to shooting) to five spring wheat varieties differing in baking quality increased yields, mainly by improving stand density, but partly by improved grain formation on individual ears Additional application at flowering improved grain formation, increased 1,000 grain weight, and more than doubled the N content of the grain Varietal differences were slight Increased prolamine and glutelin accounted for most of the increased grain protein content N increments increased the gluten content N had a variable effect on baking quality, but late application improved it No relationship was found between protein content and baking tests or gluten quality (FCA 19 7)

327 Ewald, E, Wenzel, G 1967 *Influence of Nitrogen Fertilizers on Protein Composition and Amino Acid Content of Wheat Grain* Qual Plant Mater Veg 14(1 2) 98 104 (Ger) (Landw Hochsch, Hohenheim)

In a field experiment, a summer wheat (Opal) was grown with applications of 0 75 kg of N [as $Co(NO_3)_2$ NH_4NO_3]/ha The crude protein of the grain, extracted by the Michael Blume technique was fractionated into soluble N, albumin, globulin, prolamine, and glutelin Hydrolysis of these fractions with 6*N* HCl yielded up to 16 amino acids Although the effect of N fertilization was

relatively smaller in the field than in earlier pot experiments, the data confirmed that the primary effect of N was on the reserve proteins, prolamine, and glutelin Changes in the amino acid contents of the whole grain with increase in N fertilization were probably caused by modifications in the protein fractions, e g, by increasing the prolamine portion Differences in the protein fractions shown in the field experiment were so small that they alone could not explain observed changes in biological values found in animal experiments (CA 66 94353e)

328 Fruchtenicht, K 1967 *Estimation of the Late Nitrogen Requirements of Cereals* Z Acker u PflBau 125 219 31 (Ger) (Inst PflBau PflZucht, Univ Kiel)

Oats, spring barley, and spring wheat, receiving N at 4 5 different rates in a field experiment, were examined at the heading stage for morphological characters possibly related to late N requirements Leaf color and length of leaf, but not crop density or length of the lower internodes, were closely correlated with N requirement at heading Morphological characteristics are not, however, reliable guides by themselves and need to be used in conjunction with local experience in manuring, taking soil, previous crop, and weather into account (SF 30 3779)

329 Fuchs, W, Rauhe, K, Wicke, H J 1970 *Effect of Organic, Mineral, and Combined Organic + Mineral Fertilization on the Development and Yield of Some Cereals* Albrecht Thaer Arch 14(4) 359 66 (Ger) (Sekt Pflanzenprod, Martin Luther Univ Halle Wittenberg, Halle/Saale)

The effect of organic and combined organic and mineral fertilization on the development and the yield of winter rye, winter wheat, and spring barley was investigated Since the nutrients mineralized from organic matter are plant available usually later than the nutrients from mineral fertilizers, organic fertilization promotes those yield components that develop later (number of grains per ear and the grain weight) With high temperatures in the early spring mineralization begins earlier than normal and there is less difference between mineral and organic fertilizers (CA 73 130235y)

330 Gunzel, G 1968 *Effect of Extremely High and Late Applications of Nitrogen on the Quality of Selected Varieties of Winter and Spring Wheat* Z Acker u PflBau 128 93 116 (Ger) (Tech Hochsch Munchen, Weihenstephan)

The field experiments involved base fertilizing with 20 + 40 kg/ha N and 160 kg each of P_2O_5 and K_2O, and application of $Ca(NO_3)_2$ at a total rate of 100 kg N given in 25 kg doses at 3 to 4 day intervals after ear formation The beneficial effects of late applied heavy N dressings on yields, crude protein, and quality characteristics (milling and baking quality, water uptake of flour, etc) are discussed (SF 31 4358)

331 Helal, M, Mengel, K 1968 *The Effect of a Varied N and K Supply on Soluble Amino Compounds and on the Yield of Spring Wheat* Z Pflanzenernaehr Bodenk 120(2) 89 98 (Ger) (Landw ForschAnst Buntehof, Hannover Kirchrode)

Spring wheat cv Grano grown with 0 5, 1, or 1 5 g N with or without 2 g K_2O/pot was harvested at tillering, elongation, and ear emergence Total content of soluble amino compounds increased with increasing N supply At tillering, N increased glutamic acid content only, while at later stages it also increased contents of alanine, aspartic acid, serine and γ aminobutyric acid K had no effect on glutamic acid content, but decreased those of glutamine, asparagine, aspartic acid, and glycine, particularly at tillering This was not a dilution effect, since the decreases were much greater than were accounted for by the 30% increase in yield with high K (FCA 22 884)

332 Jahn Deesbach, W, Weipert, D 1965 *Investigations on the Effect of Nitrogen Fertilizing on Yield and Baking Quality of Wheat* Landwirt Forsch 18(2) 132-45 (Ger) (Inst PflBau u PflZucht, Giessen)

The results from trials conducted in 1964 are examined, particularly in relation to baking quality The first application of N at the time of spring growth significantly increased stand density The second application at shoot emergence increased the yield where the first application was too low The last application at ear formation significantly affected the baking quality There was a close correlation between crude protein and gluten content, so that determination of the former may be substituted for gluten determination (FCA 19 1958)

333 Jahn Deesbach, W, Weipert D 1967 *Some Changes Induced in Cereal Grains by Late Manuring* Z Acker u PflBau 125 211 18 (Ger) (Inst PflBau PflZucht Justus Liebig Univ, Giessen)

Baking quality and protein (especially alcohol soluble protein) of the grain of spring and winter wheat varieties, including Opal and Wika, were increased by late and split applications of N, of which three applications of 40 kg were generally optimal Amylase activity measured in terms of the viscosity of wheat starch was lowered by high single doses of N in spring but remained relatively unaltered or increased slightly by late N manuring depending on cereal variety Late N manuring frequently raised the P and Mg content of wheat, barley, and oats Late manuring with P and K did not generally increase P and K in the grain nor except occasionally, did it improve baking quality (SF 30 3780)

334 Kuhn, H, Linser, H Schuster W 1966 *Experiments With CCC Combined With Increased N Manuring on Some Varieties of Spring and Winter Wheat* Z Acker u PflBau 123(4) 356 73 (Ger) (Inst PflBau u PflZucht, Justus Liebig Univ, Giessen)

In field experiments in 1963 using four levels of N and various amounts of CCC, 12 kg CCC/ha with N had an unfavorable effect on the grain yield of both spring and winter wheat, but 6 kg had no effect CCC treatment decreased the sedimentation value in winter wheat cv Werla and high levels decreased the moist gluten content of spring wheat, but no effect on baking quality was shown In the dry year 1964, application of CCC either to the soil or as a foliar spray increased the grain yield, probably by improving rooting and hence moisture supply Not all cv responded to CCC in the same way (FCA 20 69)

335 Linser, H Farrahi Aschtiani, S 1965 *Effect of Light and Darkness on Nutrient Uptake by Etiolated and Green Plants* Z Pflanzenernaehr Bodenk 110(1) 26 35 (Ger)

(Inst PflFrnahr, Univ Giessen)

In pot trials with young seedlings of wheat and rice, green plants absorbed slightly more cations and less phosphate through the roots than etiolated ones Illumination of the shoots during nutrient uptake increased the total phosphate uptake and the transport in the shoot of P, K, and Ca Illumination of the roots during their development reduced the uptake of P, but during nutrient uptake, it increased the P translocation to the shoot (FCA 19 1387)

336 Lorenz, H 1969 *The Amino Acid Pool During the Growth and Development of Some Wheat Varieties III Effect of Differential Nitrogen Fertilizing in Combination With Cycocel, and of the Preceding Crop, on the Amino Acid Pool in the Foliage of Some Local Varieties as Compared to an Intensive Variety* Landwirt Forsch 22 1 9 (Ger) (Univ Gottingen)

Different N supply has only minor influence on the pool size in winter wheat varieties during shooting There is no difference between normal plants and plants treated with cycocel In spring wheat free amino acids are higher in concentration when grown after alfalfa as proceeding crop, than after corn, although N supply was higher in the last case Generally, asparagine, serine, alanine, and γ aminobutyric acid are higher in concentration Native wheat varieties contain small amounts of asparagine as compared to the improved variety Opal Arginine, histidine, and lysine are also different in concentration in some native varieties from that in Opal (SF 32 3987)

337 Mengel, K, Helal, M 1969 *Effect of Short Time Nutrition With Inorganic Nitrogen on the Content of Soluble Amino Acids in Roots and Shoots of Wheat Seedlings* Z Pflanzenernaehr Bodenk 123(3) 196 204 (Ger) (Landwirt Forschungsanst Buentehof, Hannover)

The effect of short time inorganic N nutrition (NH_4NO_3) (1 hr) on the content of soluble amino acids was studied on wheat seedlings Samples of fresh root and shoot material, taken before N addition and at different stages after N supply (immediately, 1 hr, 4 hr), were analyzed for their EtOH soluble amino acid content by using two dimensional paper chromatography Detected were glutamine, glutamic acid, asparagine, aspartic acid, alanine, glycine, serine, and threonine Of the total soluble amino acids in the roots, 67% was accounted for by asparagine, alanine and glutamic acid Of the soluble amino acids in the shoots, 75% was alanine, asparagine, and serine Short time inorganic N application increased the total soluble amino acid content to 150% in the roots and to 125% in the shoots, 4 hr after N application, these contents decreased to 112% and 74% in roots and shoots, respectively Glutamine, glutamic acid, asparagine, and aspartic acid contents increased mainly in the roots During the first hour after N application, all amino acid contents increased, with the exception of asparagine, the content of which decreased remarkably, and aspartic acid In the shoots, asparagine content increased during N application, after N application this content decreased considerably and the proportion of alanine increased (CA 72 78077m)

338 Saalbach, E 1969 *The Optimum Rates of Nitrogen Fertilizing for Bread Cereals* Ber Getreidechem Tag Detmold, 9 pp (Ger)

A discussion of N uptake by wheat, application of N fertilizers for maximum yields and crude protein production, and factors affecting the efficiency of N fertilizing of wheat and rye (such as weather conditions, green manuring, or CCC) (SF 33 1489)

339 Sauerbeck, D 1967 *The Carbon Metabolism of Wheat Seedlings in Relation to Mineral Nutrition and Illumination* Z Pflanzenernaehr Bodenk 115(1) 10 16 (Ger) (Univ Bonn)

Wheat grains labeled with ^{14}C were used as seeds with an activity of 18 μc/g CO_2 Fertilizers used were KH_2SO_4 and K_2SO_4 also NH_4NO_3 From 60 to 70% of the grain C was found in the young seedlings after 17 days The distribution of seed reserves in shoots and roots did not depend on the illumination intensity Seedlings fertilized with N had less seed N in the roots, than those poor in N, a result of an early effect of mineral nutrition on the composition of seedlings, starting in the heterotrophic stage (CA 66 114958m)

340 Scheffer, F, Przemeck, E, Saolapurkar, V K 1968 *Mineral Nutrition and Metabolic Processes in Young Plants II Effects of Manganese Nutrition on the Levels of Free Amino Acids in Oats ("Avena sativa") and Wheat ("Triticum sativum")* J Indian Soc Soil Sci 16(2) 135-41 (Eng) (Univ Gottingen)

Free amino acids were extracted from oats and wheat plants grown in liquid culture with different levels of Mn In oats, the contents of aspartic acid and leucine were reduced in Mn deficient plants, while those of methionine, glycine, valine, lysine, threonine, and glutamic acid were increased Methionine and glycine contents were increased greatly, up to sevenfold, while that of threonine and glutamic acid changed little Contents of methionine aspartic acid, and glycine were reduced in plants suffering from Mn toxicity Similarly, in Mn deficient wheat plants, the contents of aspartic acid, threonine, serine, glutamic acid, glycine, alanine, and arginine were increased over that in normal plants Contents of glutamic acid, proline, glycine, and valine in wheat suffering from Mn toxicity were likewise higher (CA 70 56799e)

341 Schuphan, W, Kling, M, Overbeck, G 1968 *Effect of Genetic and Environmental Factors on Contents of Vitamin B_1, Vitamin B_2, and Niacin in Winter and Spring Wheats* Qual Plant Mater Veg 15(3) 177 214 (Ger) (Bundesanst Qualitatsforschung Pfl Erzeugnisse, Geisenheim)

Data are reported on contents of vitamins B_1, B_2, and niacin in 29 wheat cv grown at three sites and in nine cv grown at three levels of NPK at one site Niacin content was unaffected by weather, that of B_1 was higher in wet seasons Grain of winter wheat cv Firlbecks I was high in B_1, while cv Authari contained high amounts of all three vitamins (0 468 mg B_1, 0 164 mg B_2, and 6 6 mg niacin/100 g fresh weight) Of five spring wheats grown at two sites, cv Opal tended to have a high vitamin content, cv NOS Nordgau a low one Increasing rates of NPK increased the contents of B_2 and niacin in grain of winter wheat but not that of B_1, whereas in spring wheat NPK increased the contents of B vitamins but not of niacin Vitamin B contents did not appear to be related to baking quality There was an inverse correlation between 1,000 grain weight and content of B_1 and niacin (FCA 21 2346)

342 Schuster, W 1968 *The Variability Within Wheat and Rye Crops of Individual Plant Characteristics Under Different Growth Conditions* Z Acker u PflBau 127(2) 131-48 (Ger) (Inst PflBau PflZucht, Justus Liebig Univ, Giessen)

In field trials during 3 yr at two sites, N was applied to winter wheat and winter rye at 0, 70, and 100 kg/ha Data are given on grain yield, culm and ear length, and number per ear There was marked variability for all the characteristics, especially in wheat, within the crop, and between years, sites, and N treatments Environment influenced variability of most characteristics, but no clear conclusions were possible because of the interactions between th three factors studied Variability was generally greater in unfavorable conditions than in those favorable for plant growth (FCA 22 46)

343 Sotiriou, N 1969 *Effects of Sulfur, Zinc, Copper, and Boron on Wheat Quality, in Relation to Late Application of Nitrogen* Forsch Berat No 18A, 42-4 (Ger) (Inst PflBau, Bonn)

Application of S or Zn increased, and that of B or Cu decreased, yields, combined application of all these elements markedly depressed yields The quality of wheat (sedimentation value) was markedly improved by S but not by the other three elements, high rates of all the four elements did not appreciably affect the contents and composition of proteins in the grain (SF 33 1493)

344 Trolldenier, G 1969 *Cereal Disease and Plant Nutrition* Potash Review, Subject 23, Suite 34, 16 pp (Eng) (Landwirt Forschung Buntehof, Hannover Kirchrode)

This paper reviews the published information concerning the effects of N, P, and K on disease and insect infestations of cereals The earliest experimental work on nutrition disease relationships was reported in 1898, over 75% of the 85 papers cited in the bibliography, however, are dated in the 1950's and 1960 s Cereal crops discussed are wheat, barley, rye, oats, maize, and rice The mechanism of resistance has received some attention but much remains to be investigated The nature of the compounds formed within plant cells as a result of mineral nutrition variations seems to be one of the controlling factors In general K excess and N deficiency increase resistance to disease (FA 2 1161)

345 Vetter, H, Teuteberg, W 1967 *Is the Optimum Nitrogen Rate for Winter Wheat Near to the Limit of Lodging?* Z Acker u PflBau 126 157 63 (Ger) (Inst PflBau, Kiel)

During 9 yr experiments, involving increasing applications of N at up to 160 210 kg/ha, yield increases in winter wheat were limited only 3 times by lodging, and 11 times by other factors The fact that very high N rates result in lower yields without lodging calls for further investigations and efforts in plant breeding (SF 31 599)

346 Wiemann, H 1969 *Effects of Manganese, Boron, and Magnesium on Wheat, With Special Reference to the Proteins in Grain and Late Application of Nitrogen* Forsch Berat, No 18A, 44 5 (Ger) (Inst PflBau, Bonn)

In sand culture trials, responses to Mn and Mg were due to more grains per ear and to increased 1,000 grain weight, respectively Spring wheat was more tolerant of high B rates than winter wheat was Application of Mn tended to increase the proportions of globulin in winter wheat, and Mn, B, and Mg (in this order of importance) increased utilization of late applied N (SF 33 1492)

HUNGARY

347 Cseh, E 1967 *Calcium Uptake and Translocation by Intact Wheat Seedlings* Acta Bot 13(1 2) 11 20 (Eng) (L Eotvos Univ, Budapest)

Although Ca affects root absorption of other ions, little is known of its own behavior Wheat seedlings were grown on 2 X 10^{-4} *M* $CaSO_4$ or Hoagland solution for 7 days in the dark Excised roots were then observed after 1 and 2 hr on $^{45}CaCl_2$ at concentrations of 0 01 10m*M* intact plants after 1, 2, 3, and 6 hr The most rapid uptake of ^{45}Ca by excised roots was in the first hour Intact plants showed that after 2 hr a slow constant rate takes over that is independent of external concentration in the range 0 3 3m*M* and is apparently metabolically regulated the amount so absorbed is however <10% of the total taken up The concentration dependence curves resemble those of ions on a dual absorption system The greatest increments were between 0 03 and 0 3m*M* and especially 3 and 10m*M* Ca transport into shoots did not occur when plants were grown on dilute $CaSO_4$ even after 6 hr whereas for Hoagland solution the maximum transport reached 40% of the total Ca absorbed with external concentrations of 3 10m*M* for 6 hr Lower concentrations (0 03 0 3m*M*) showed a 1 3 transport increase in the first hour and only a slow rise thereafter But between 1 and 10m*M* a sharp rise occurred regardless of time K^+ supplied by addition of 5m*M* KCl to the Ca concentration series strongly inhibited root uptake of Ca^{++} (CA 68 10248e)

348 Horvath, L, Kiss, B, Pozsar, B I 1969 *Stimulating Effect of Ammonium Nitrate and Urea Fertilization on Photosynthetic Carbon Dioxide Fixation by Wheat Variety Bezostaia 1* Bot Kozlem 56(4) 237 39 (Hung) (Isotop Inst, Hung Acad Sci, Budapest)

Fertilization with urea was more effective than fertilization with NH_4NO_3 in increasing the chlorophyll content of wheat leaves Compared to controls photosynthetic $^{14}CO_2$ fixation was increased 22% using NH_4NO_3 as fertilizer, 35% when urea was used The fertilizers also increased protein synthesis These results are explained on the basis of the formation of chlorophyll protein complexes which have a stimulating effect on photosynthetic CO_2 fixation (CA 73 3063r)

349 Koltay, A 1965 *Winter Wheat Manuring Experiment* Acta Agron (Budapest) 14(1 2) 107 15 (Hung) (Agr Res Inst Hungarian Acad Sci, Martonvasar)

The effect of P and K fertilizer application was examined in 1961 63 at different N levels Application of N was very effective while P caused a moderate yield increase where the high rate of N was given only No K effect was demonstrated (FCA 19 1960)

350 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 yr period Better results with N fertilizer 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)

351 Latkovics, I 1965 *Fertilization of Acid Brown Forest Soils* Magy Tud Akad Agrartud Oszt Kozlemeny 24(3 4) 387 93 (Hung) (Magy Tud Akad Talajtani Agrokem Kutato Int, Budapest)

The effect of various fertilizers on the yield of barley, corn, and wheat, as well as on the uptake of nutrients by these plants, was investigated in pot cultures using acid brown forest soils Basic fertilizers, such as NH_4CaPO_4 or NH_4NO_3, were more efficient than acid fertilizers (CA 64 13346g)

352 Latkovics I, Kramer, M 1968 *Examinatio of the Effect of Fertilization on Winter Wheat and Maize in a Long Term Experiment (1960 67) I Grain Yield* Agrokem Talajt 17(3) 189 200 (Hung) (Res Inst Soil Sci Agr Chem, Budapest)

In field trials in 1960 67 on soil of low nutrient status, a crop sequence of 1 yr spring barley/1 yr winter wheat/4 yr maize/2 yr winter wheat was used Various combinations of 60 and 120 kg N/ha, 13, 16 and 26 kg P/ha and 37, 42, and 50 kg K/ha were applied N increased the grain yields of maize, winter wheat, and spring barley by 2 4 1 8, and 1 0 tons/ha, respectively P had no effect on maize yield but increased that of wheat and barley when applied both with and without N, 26 kg P/ha was no more effective than 16 1 g K had no effect except on winter wheat and even then only at the highest rate of N + K (FCA 22 1629)

353 Matus L, Opauszky, L, Horvath, L, Pozsar, B I 1970 *Comparative Mass Spectrometric Evaluation of the Incorporation of Stable Nitrogen into Leaf Proteins of Bezostaia 1 Wheat Variety from Labeled Ammonium Nitrate and Urea* Agrochimica 14(5 6) 437 40 (Eng) (Cent Phys Res Inst Hungarian Acad Sci, Budapest)

Bezostaia 1 wheat utilized urea N more efficiently than N from NH_4NO_3 Based on 100% utilization of $CO(^{15}NH_2)_2$, ammoniacal N ($^{15}NH_4NO_3$) was utilized 76%, and NO_3 ($NH_4{}^{15}NO_3$) was utilized 60% (CA 74 41456z)

354 O'Svath, J 1965 *Examination of Yield Components by Path Analysis, in a Fertilizer Experiment With Winter Wheat* Acta Agron (Budapest) 14(1 2) 139 47 (Eng) (Agr Res Inst, Hungarian Acad Sci, Martonvasar)

Though sampling error was great (51%), it could be demonstrated that number of ears was hardly affected by fertilizing Weight of grains per ear was influenced by up to 37% by N application (FCA 19 1959)

355 Pekary, K 1968 *Autumn Fertilizing of Winter Wheat in a Single Operation* Agrokem Talajt 17 91 100 (Hung) (Mezog Kiserl Inst, Kempolt)

Single applications of calcium ammonium nitrate (Pet salt) at 120 240 kg/ha (52 104 kg N) together with superphosphate and potash produced as high grain yields on heavy brown forest soils as N fertilizer applied in several installments, as basal fertilizer, and as topdressing did (SF 31 3650)

356 Pollhamer, Z 1968 *Effect of Fertilizers on the Quality of Wheat* Acta Agron (Budapest) 17 271 74 (Eng) (Agr Res Inst, Martonvasar)

Treatments comprised 139 kg/ha each of N and/or P, combination of NPK at 139 kg each or at half these amounts, and untreated controls Changes in quality characteristics (crude protein, wet gluten, water absorption, etc), grain yields, and complex qualitative indices are given in tables (SF 31 2841)

357 Pozsar, B I, Horvath, L, Kiss, A S 1968 *Uptake and Leaf Level Distribution of Urea ^{14}C in Wheat* Bot Kozlem 55(4) 251 52 (Hung) (Forschungsinst Pflanzenschutz, Budapest)

The specific activity of urea ^{14}N is greatest in growing young leaves There is a tenfold greater amount of urea ^{14}C in the youngest leaf than in the oldest one The main reason is the more intensive metabolism of the younger leaves, and only partially leaf transpiration The labeled urea remained undecomposed after 18 hr exposure (CA 71 21^52q)

358 Pozsar, B I, Kiss, B 1965 *Effect of Mineral Fertilizers on the Alteration of Amino Acid Ratios in the Proteins of the Wheat Variety, Besostaia 1* Naturwissenschaften 52(12) 350 (Ger) (Forschungsinst Pflanzenschutz, Budapest)

Paper chromatography was used to determine changes in the amino acid ratios of Besostaia 1 wheat grown on a layered brown loess loam soil after fertilization Three treatments were 159 kg N/ha and 159 kg N/ha + 37 2 kg P_2O_5/ha in the soil, and 9 4 kg N/ha on the leaves in the form of a urea solution The content of lysine, phenylalanine, arginine, and histidine increased, tyrosine glutamic acid + threonine, and leucine + isoleucine decreased, the others were unchanged The NP treatment had the greatest effect (CA 63 10618g)

359 Sarkadi, J 1966 *Some Major Factors Affecting the Nutrient Content of Wheat* Tagungsber, Deut Akad Landwirtschaftswiss Berlin 85 67 75 (Ger) (Forsch Inst Bodenk Agrichem Akad Sci, Budapest)

Yield of wheat grain, straw, and content of N, P, and K in straw and chaff were determined for samples from 314 sites in Hungary Variation in nutrient content and nutrient uptake from soil were correlated for variety, year, location, and manuring Grain yields and N uptake were primarily affected by fertilizing, then by variety and to some extent only tended to diminish (whereas N content increased) from east to west K uptake and grain yields were not correlated at the flowering stage probably on account of the high K content of these soils, but a significant correlation was observed between yield and the N content at flowering (SF 30 3785)

360 Szabolcs, I, Latkovics, I 1967 *The Effect of Various Nitrogen Fertilizers on the Mineral Nutrition of Winter Wheat Studied on Two Different Types of Salt Affected Soils* Isotop Plant Nutr Physiol, Proc Symp Vienna, pp 3 11 (Eng) (Hungarian Acad Sci, Budapest)

Greenhouse experiments were conducted on two different

types of salt affected soils (solodized solonetz soil and calcareous, salinized solonetz soil) by applying three kinds of N fertilizers [$Ca(NO_3)_2$, NH_4NO_3 + $CaCO_3$, and pure NH_4NO_3] Each fertilizer used in the experiments was labeled with ^{15}N The effect of the various fertilizers, both on the mineral nutrition and on the yield of young winter wheat plants, was examined The N, P_2O_5, K_2O, and CaO contents of winter wheat plants were studied in each case Considerable differences could be detected in the N contents of plants growing on the two different types of salt affected soils The ratio of the plant N uptake from the original N content of the soil to the N uptake from the applied fertilizers was also studied Significant differences were found depending on both the type of salt affected soil and the kind of mineral fertilizer applied In the solonetz soil, which had comparatively better properties, the uptake of N, P, K, and Ca was considerably higher than in the other salt affected soil Results obtained with the isotope dilution method showed that the young winter wheat plant took up N compounds to a great extent from the applied N fertilizers as early as the first 3 weeks of its development (CA 67 72896c)

IRELAND

361 Cunningham, P C 1966 *Effects of Plowing and Sowing Dates on Behavior of Soil Borne Pathogens of Spring Wheat* Irish J Agr Res 5(2) 215 36 (Eng) (An Foras Taluntais, Plant Path Dep, Oakpark, Carlow)

The incidence of eyespot (*Cercosporella herpotrichoides*) was much less when crops were sown in late April than in early April and mid March Late plowing increased eyespot incidence, except where a close succession of plowing and sowing resulted in an unthrifty crop N application increased eyespot except in late April sowings in 1 yr The incidence of take all (*Ophiobolus graminis*) decreased with earliness of plowing and lateness of sowing and was increased by a short interval between plowing and sowing N decreased its incidence Grain yields were greatly influenced by N availability and take all It was concluded that where N supply was adequate, the adverse effect of late sowing on wheat yields was greater than the advantageous effect of controlling disease (FCA 20 1505)

362 Gallagher, E J 1968 *A Preliminary Study of the Utilization of (2 Chloroethyl) Trimethylammonium Chloride Under Irish Conditions I The Effect of (2 Chloroethyl) Trimethylammonium Chloride and Nitrogen on the Yield of Spring Wheat* Ireland Dep Agr J 65 70 81 (Eng) (Univ Coll Dublin)

In a factorial experiment testing two rates of CCC at different stages of growth and four rates of N, wheat yields were unaffected by rates but not by time of application of CCC Yields were higher when CCC was applied at the five leaf instead of the seven leaf stage $(NH_4)_2SO_4$ at 2 and 4 cwt/acre significantly increased yields, a small but nonsignificant increase was also obtained with 6 cwt/acre (SF 32 1547)

363 Gallagher, E J 1968 *A Preliminary Study of the Utilization of (2 Chloroethyl) Trimethylammonium Chloride Under Irish Conditions II The Effect of (2 Chloroethyl) Trimethylammonium Chloride and Nitrogen on the Quality of Spring Wheat* Ireland Dep Agr J 65 82 90 (Eng) (Univ Coll, Dublin)

Neither CCC nor N treatments had any effect on flour extraction, flour color, or enzyme activity Protein content was unaffected by rate or time of CCC applications but increased with increasing rates of N The later and heavier of two applications of CCC and the N treatments appeared to improve baking characteristics, but the effects were not significant N topdressings improved dough strength, CCC had no effect (SF 32 1548)

ITALY

364 Antoniani, C 1965 *Response of Different Wheat Varieties (in Italy) to N Fertilizer* Sementi Elette 11(6) 426 39 (Ital) (Inst Agron, Univ Bologna) (FCA 19 1352)

365 Cantele, A, Giardini, L 1967 *N and CCC for Wheat and Oats* Progresso Agricolo 13(2) 187 202 (Ital) (Inst Agron, Univ Padova)

In trials in 1965 66, CCC was applied to wheat cv Argelato at 2 and 3 kg active ingredient/ha in combination with four rates of N, in 1966, CCC was also applied to oats cv Sole II at 5 kg/ha with three rates of N The CCC treatments reduced plant height in wheat by about 12% and were concluded to be of greater potential value for wheat than for oats Lodging during the trials was only slight and the effect of CCC under conditions of lodging could not therefore be assessed (FCA 20 2149)

366 Cervato, A 1964 *Nitrogen Fertilization of Wheat* Ann Fac Agrar, Univ Cattolica Sacro Cuore 4(1) 5 52 (Ital) (Univ Cattolica Sacro Cuore, Piacenza)

A series of tests was run between 1959 and 1963 to determine the effect of time of application of topdressings of NH_4NO_3 on the yield of wheat In low N soils application of N as well as of K and P was required before seeding In high N soils, N should be applied entirely as NH_4^+ For a given amount of N, efficiency of fertilization is increased by increasing the number of split applications Late fertilization increased the N content of the grain and straw but not the yields (CA 62 4565a)

367 Ghini, G, Vercellino, G 1966 *Effect of Trivalent and Hexavalent Chromium on the Growth of Wheat* Ann Idrol 4(1) 17 24 (Ital) (Univ Pavia)

Trivalent or hexavalent Cr salts, even at 1 ppm, strongly inhibit the growth of wheat The average height of the plants was measured after 12 days of growth For 10 ppm of $Cr_2(SO_4)_3$, growth was inhibited 50%, for 20 and 50 ppm, the growth inhibitions were 66 and >90%, respectively Control tests in which Na_2SO_4 was applied showed that the sulfate ion is not inhibitory when compared with distilled water (CA 66 45871p)

368 Pacucci, G 1967 *Investigations of the Effect of CCC on Durum Wheat First Experimental Results* Agrochimica 12(1) 5 20 (Ital) (Inst Agron, Univ Bari)

In a factorial field experiment, durum wheat cv Cappelli was given four levels of N (0 120 kg/ha), and three levels of CCC (0-4 kg/ha) applied at tillering and elongation Lodging did not occur even in the control plots, and CCC did not increase grain or straw yield The main effects of CCC were reduction in length of basal internodes (except the first), delay of developmental stages, interaction of N level with application stage, and CCC level in terms of certain agronomic characteristics (FCA 21 2341)

369 Paris, P, Manenti, G 1968 *Fertilization of Durum Wheat in Northern Italy Relation Between Nitrate Fertilization and Whiteness* Ann Fac Agrar, Univ Cattolica Sacro Cuore 8(1) 45 65 (Ital)

In the presence of adequate fertilization with K_2O and P_2O_5, applications of $(NH_4)_2SO_4$ and NH_4NO_3 equivalent to 0, 75, and 100 kg N/ha to the durum wheat varieties Mahani 1, Mahani 3B, and Mahani 18 had no effect on grain yield, plant density, or 1,000 grain weights Yield of straw and N content of the grain were increased significantly Indices of occurrence of "yellow berry" (bianconatura) at the three levels of N were for Mahani 1, 38 70, 19 15, and 21 35, for Mahani 3B, 38 20, 32 10, and 30 85, and for Mahani 18, 8 05, 3 65, and 2 85 The additional 25 kg N/ha applied as a late topdressing of NH_4NO_3 had little effect on the occurrence of yellow berry Occurrence of yellow berry is inversely correlated with the N content of the seed (CA 71 37950b)

370 Picciarro, G, Ferrandi, L, Bonifoti, R, Bracciocurti, G 1967 *Uptake of ^{15}N labeled NH_4^+ in Excised Roots of "Durum" and Bread Wheat* Isotop Plant Nutr Physiol Proc Symp, Vienna, pp 511 26 (Eng) (Cent Stud Nucleari, Rome)

Uptake of NH_4 in wheat roots was found to be an active uptake process, mediated by two simultaneous, and independent carrier systems, one of which was active at concentrations between 1 10 ^{2} and 1 10 ^{4}M NH_4 and the other at concentrations of 1 10 ^{4} 1 10 ^{5}M Certain differences occurred between the two *Triticum durum* varieties (Cappelli and the mutant Cp C 148) (SF 32 1544)

371 Silva, S, Fontana, P 1967 *Use of ^{15}N in N Nutritional Studies in Wheat* Agrochimica 10(4) 331 43 (Ital) (Univ Cattolica)

Wheat fertilization was studied using ^{15}N-containing fertilizers Two presowing treatments were tested, the first one was based on simple fertilizers, the second one was based on 6 12 9 NPK fertilizer in the same amount The fertilizer was split into four doses between the third and fifth leaf and flowering, the last dose being given either as $Ca(NO_3)_2$ or as $(NH_4)_2SO_4$ enriched with ^{15}N in order to determine the N translocated into the grain $Ca(NO_3)_2$ was generally more efficient than $(NH_4)_2SO_4$ More N was accumulated in the grain of plants fertilized with the 6 12 9 fertilizer, although less labeled N was absorbed This was probably due to the fact that the complete fertilizer was more slowly leached off, can satisfy at least partially the initial plant needs and, therefore, the labeled N was taken up in smaller amounts (CA 66 94295n)

372 Venturi, G 1967 *Care of Wheat Up to the Springtime* Raccolto 8(11) 263 66 (Ital)

373 Venturi, G 1967 *N Manuring of Wheat Following Sorghum* Progresso Agricolo 13(11) 1099 108 (Ital) (Inst Agron, Univ Bologna)

A trial was carried out in 1966 67 to study the effect on wheat of the residual fertility after growing sorghum to which N had been applied at 50, 100, and 150 kg/ha, and the effect of N applied to the wheat at 0, 60, and 120 kg/ha Results showed that N applied to sorghum at the two higher rates did not increase significantly grain yield of sorghum compared with the lower rate, but increased the yield of grain and straw of the succeeding wheat crop However, the increase in grain yield of wheat was higher when N was applied to it directly (FCA 21 1508)

NETHERLANDS

374 Arnold, G H 1969 *Nitrogen Fertilizing of Cereals 19 Effect of Chlormequat (CCC) and the Distribution of Nitrogen Application on Wheat Quality* Stikstof 6 109 13 (Neth) (Inst Bodemvruchtbhd, Groningen)

On old marine silt soil, 120 kg/ha N applied as a split application or as a single application in conjunction with CCC increased the crude protein content and improved the baking quality as compared with 60 kg/ha N (SF 33 4049)

375 Arnold, G H, Dilz, K 1967 *Late Topdressing of Winter Wheat by Means of Aerial Spraying With Urea* Neth Nitrogen Tech Bull No 5, 1 19 (Eng)

Trials were conducted with winter wheat in 3 consecutive yr to investigate the effect of a late topdressing of N applied by aircraft as a spray of urea just prior to or at ear emergence Fertilizing with calcium nitrate applied by centrifugal spreader served as comparison In 1963 and 1965 an aerial spray of 11 kg N/ha was found to give as great an increase (200 300 kg/ha) in grain yield as was obtained with 30 kg N as calcium nitrate applied by conventional means Wheel tracks formed in the crop had no adverse effect on yield No increase in yield was obtained from late topdressing in 1964 Spraying with urea at ear emergence appeared to be more effective than spraying before ear emergence Reasons for the observed results are discussed (FA 1 578)

376 Arnold, G H, Dilz, K, Kersten, M C 1967 *Nitrogen Fertilization of Cereals 13 Aerial Spraying With Urea 1965 Trial and Final Conclusions* Stikstof 5(53) 275 79 (Neth) (Inst Bodemvruchtbhd, Groningen)

Felix winter wheat was given 45, 76, and 97 kg N/ha in spring and (a) topdressed with 11 or 31 kg N/ha as calcium nitrate at flag leaf appearance, (b) aerial sprayed with 11 kg N as urea/ha at flag leaf appearance or at emergence of the first ears Crop analysis showed that the nitrate N content of the plants was inadequate at the time of late topdressing Lodging was severe later in the season, even on plots receiving no late topdressing Treatment with 31 kg N as calcium nitrate and with urea at ear emergence gave the greatest increases in yield at all levels of spring N, the former treatment was the more expensive The lowest rate of spring N gave the highest average grain yields Driving a tractor through the crop at flag leaf emergence had no effect on crop yield, it decreased the number of ears but increased the 1,000 grain weight Spraying

with urea was thought to have increased the number of grains per ear (FCA 20 2147)

377 Belderok, B 1967 *Effect of Nitrogen Manuring and Spraying With Cycocel on the Shooting Tendency of Wheat* Stikstof 5 263 67 (Neth)

Shooting tendency indicated by the duration of the "rest" period preceding germination, was not affected by increasing N application or by spraying with chlorcholinechloride (Cycocel) (SF 30 3784)

378 Dilz, K 1966 *Nitrogen Fertilization of Cereals 12 Effect of Time of Spraying With CCC on Lodging Resistance and Yield of Winter Wheat at Increasing Rates of Nitrogen* Stikstof 5(51) 174 87 (Neth) (Inst Bodemvruchtbhd, Groningen)

Ibis winter wheat was grown on farms at (a) Emmeloord, (b) Spijk, and (c) Dinteloord in 1965 At site (a) there was severe lodging due to eyespot and at (b) the crop was attacked by *Septoria (nodorum)* CCC at 2 kg active ingredient/ha was most effective when applied at growth stages 5 7 (between end of tillering and beginning of elongation) Straw was shortened most by treatment at stage 7 CCC considerably increased grain yields and enabled the crops to benefit from more N than was commercially used on the farms (80 kg/ha), ceiling yields were obtained with 120 kg N/ha, and the yield increase obtained compared with normal farm practice was (a) 900, (b) 400 500, (c) 1,000 1,200 kg grain/ha In (b) and (c), similar yield levels were obtained without CCC by using split N dressings, but the crops were less resistant to lodging CCC increased ear number by 5 10% and had little effect on 1,000 grain weight In (c), high rates of N without CCC considerably increased ear numbers but decreased 1,000 grain weight, at this site CCC increased yields of nonlodging crops, probably because of better utilization of light by the treated crop In (b), CCC and high N favored disease development, and the infection led to low 1,000 grain weights (FCA 20 1486)

379 Dilz, K 1968 *The Nitrogen Manuring of Cereals 8 Split Applications of Nitrogen on Winter and Summer Wheat* Stikstof, No 59, 471 81 (Neth)

On reclaimed peat soils, splitting the N application was not beneficial at moderate N rates except in a very wet year, but with rates of 90 120 kg/ha, splitting reduced the risk of lodging and sometimes increased yields Applying CCC with a single N application gives sufficient safeguard against lodging (SF 32 1546)

380 Hellings, A 1967 *Effect of Sprinkler Irrigation and Nitrogen on Spring Wheat Yields on a Sandy Soil* Versl Landbouwk Onderz 700, 27 pp (Neth) (Inst Cultuurtechn Waterhuishouding, Wageningen)

In 1961 64, on poor sandy reclaimed heath soils containing 6 5% organic matter, the mean yield increase per mm irrigation water was 11 9 kg/ha Increasing the irrigation frequency decreased the effect per mm The grain straw ratio was increased by irrigating when 50% of available moisture in the main root zone had been used More intensive irrigation resulted particularly in greater straw production Economically, the best results were obtained by irrigating after 75 80% of available soil water had been used With this irrigation schedule, the optimum N rate for highest grain yields was 110 kg/ha, provided the soil itself supplied about 50 kg of available N With more intensive irrigation a lower N rate (about 70 kg/ha) was necessary to avoid lodging (SF 31 4476)

381 Jonker, J J , de Jong, G J 1966 *Effect of Split Nitrogen Applications and of CCC on the Yield of Cereals in Eastern Flevoland* Stikstof 5(51) 160 73 (Neth)

For wheat, oats, and barley on heavy loam soil dividing the N between an early application and another at the start of stalk elongation increased grain and lowered straw yields of partially lodged and unlodged (CCC treated) crops Treatment with CCC increased the grain yields of winter and spring wheat (SF 30 1356)

382 Meppelink, E K 1969 *Can the Baking Quality of Dutch Wheat be Improved by Nitrogenous Fertilizers?* TNO Nieuws 24(2) 41 7 (Neth) (Inst Graan, Meel, Brood, T N O)

The baking quality of flour in terms of loaf volume and crust color depends mainly on the protein content of the wheat This can be increased by application of N fertilizers in the generative stage of plant life, when excessive vegetative response with risk of lodging is excluded Addition of $KBrO_3$ or ascorbic acid is necessary for full development of the baking qualities in this protein rich flour (CA 71 2628a)

383 Smilde K W Henkens, C H 1967 *Sensitivity to Copper Deficiency of Different Cereals and Strains of Cereals* Neth J Agr Sci 15 249 58 (Lng) (Hallstraat 3 Groningen Bovenweg 7, Bennekom)

In pot experiments on a Cu deficient sandy soil sensitivity to Cu as indicated by grain yield responses decreased in the order wheat, oats, rye Barley was intermediate between wheat and oats Rye was fairly insensitive to Cu deficiency There were significant differences in sensitivity between strains in wheat, oats and barley In sensitive strains of oats and barley, a reduction in grain yield under conditions of Cu deficiency was accompanied by an increase in straw yield caused by profuse tillering, this did not occur in wheat Reduction in grain yield resulted from a decrease in the number of fully developed grains It may be accompanied by a decrease in average grain weight depending on the presence of empty grains The effect of Cu application on the Cu content of oat and wheat foliage generally decreased with plant age Sensitivity to Cu deficiency was not related to Cu content of foliage and straw (SF 31 2105)

384 Toussaint, C G 1965 *Effect of Water and Nitrogen on Winter Wheat Sprayed or Unsprayed With Chlorocholine Chloride* Stikstof 4(45 46) 391 95 (Neth) (ICW, Wageningen)

The effects of sprinkler irrigation to field capacity whenever 50% of available soil moisture had been consumed, and of 7 1 40% CCC/ha applied just before stem elongation, were investigated in winter wheat grown on poor sandy soil with a basal dressing of 72 kg N/ha with or without a further topdressing of 28 and 68 kg N/ha Increasing the rate of applied N to a total of 100 kg/ha increased yields only on irrigated plots given CCC In all other treatments, topdressing with N induced lodging and decreased yields CCC increased the grain yield of both irrigated and unirrigated wheat and

decreased the amount of moisture consumed by the crop, it tended, however, to reduce total dry matter output (FCA 19 1379)

385 van Burg, P F J 1968 *Ammon' 'njection as a Method of Nitrogen Manuring 8 Injection in the Spring for a Winter Wheat Crop* Stikstof, No 59, 482 83 (Neth)

On reclaimed peat soils, NH_3 injection gave wheat yields equal to or above yields with Ca ammonium nitrate on two good crop stands, but not on a poor stand on puddled soil (SF 32 1551)

386 van Burg, P F J 1965 *The Nitrogen Manuring of Cereals 8 Effect of Late Topdressing With Nitrogen on the Yield, Seed Quality, and Baking Quality of Two Varieties of Spring Wheat* Stikstof, No 45-46, 354 62 (Neth)

On reclaimed peat soil (pH KCl 5 1, humus 12 2%) a late topdressing of 40 kg/ha N as $Ca(NO_3)_2$ on two varieties of summer wheat increased the yield only when spring applications (Ca ammonium nitrate) were insufficient (less than 120 kg/ha N), otherwise it was better to apply all the N at an early date Grain quality is generally unfavorably affected by a late topdressing Baking quality may be improved by late topdressing (SF 30 622)

387 van Burg, P F J , van Brakel, G D , Schepers, J H 1966 *Ammonia Injection as a Nitrogen Fertilizing Method 2 The Effect of Date of Injection in Autumn and Early Spring on Yields of Spring Crops* Stikstof 5(52) 223 30 (Neth) (Inst Bodemvruchtbhd, Groningen)

Anhydrous NH_3 injected 15 cm deep in lines 30 cm apart in early November 1963 or mid March 1964 was compared with conventional applications of nitrochalk at 0, 70, 140, and 210 kg N/ha for oats and spring wheat and at 0, 140, 210, and 280 kg N/ha for potatoes and sugar beet, grown on three soil types Yields from autumn injection were equal to or slightly higher than from spring injection, and higher than from conventional fertilizing In trials in 1964 65 in which NH_3 was injected at a single rate of N on various dates between mid October and mid February, yields improved with delay in injection and were always lower than those from conventional fertilizing The 1964 65 winter was warmer and wetter than that of 1963-64, and soil analyses showed that much of the N had been leached into the deeper soil horizons and had thus become unavailable to the crops Autumn injection was therefore not recommended (FCA 20 2145)

388 van Burg, P F J , Schepers, J H , van Brakel, G D 1966 *Ammonia Injection as a Method of Nitrogen Fertilizing 4 Results of Experiments With Winter Wheat* Stikstof 5(52) 234 36 (Neth)

Injection of NH_3 during early growth gave much lower yields than normal fertilizing with Ca ammonium nitrate Injection in August before sowing resulted in poor yield responses in a year in which heavy leaching occurred during the subsequent winter (SF 30 2908)

389 van Dobben, W H 1965 *Higher Grain Yields With Cereals by Delaying Nitrogen Manuring* Stikstof, No 45 46, 363 68 (Neth)

Delaying the N supply to winter wheat and winter rye increased yields in the field, the effect was less evident in pot experiments (SF 30 608)

390 Van Luit, B 1966, *Testing of Copper Slag and Copper Sulfate as Copper Fertilizers on Arable Land* Landbouwvoorlichting 23(2 3) 81-4 (Neth) (Inst Bodemvruchtbhd, Groningen)

In trials with spring wheat grown in 1958 on Cu deficient soil there were no differences in the effectiveness of Cu applied at two rates in autumn 1957 compared with in spring 1958 Cu slag at 500 kg/ha was just adequate to give maximum grain yields The residual effect of 300 kg Cu slag/ha was adequate for oats grown in 1959, but the higher rate was needed to give optimum yields of spring wheat in 1962 At equivalent rates of Cu, both fertilizers were equally effective (FCA 20 62)

POLAND

391 Blaim, K , Szynal, J 1968 *Influence of (2 Chloroethyl) Trimethylammonium Chloride (CCC) and Calcium Ions on Wheat Seedling Growth* Bull Acad Pol Sci Ser Sci Biol 16(12) 735 38 (Eng) (Inst Soil Sci Plant Cult , Pulawy)

Wheat seedlings were treated with aqueous solutions of chlormequat, $CaCl_2$, and KCl Chlormequat and Ca influenced seedling growth, but K did not Chlormequat influenced both the uptake and the form of Ca It also influenced the content and appearance of pectic substances in wheat seedlings Wheat treated with chlormequat was more resistant to lodging than untreated wheat (FCA 23 86)

392 Burczyk, H 1968 *Effect of Increasing Nitrogen Doses on the Yield, Phosphorus Pentoxide, Potassium Oxide, and Protein Content in Winter Wheat Grain, Depending on the Method and Level of Phosphorus and Potassium Fertilization* Pamiet Pulawski 32 169 70 (Pol) (Inst Uprawy, Nawoznia Glebozn , Baborowko)

Investigation on the effect of increasing doses of N on the yield of wheat was carried out in 1963 66 on field plots of light brown soil with an average content of P_2O_5 and K_2O As fertilizers 33% NH_4NO_3 in doses varying from 0 (control plots) to 200 kg/ha N, 40% K salt in doses from 80 to 240 kg/ha K, and 17% superphosphate in doses from 70 to 240 kg/ha P_2O_5 were used Winter wheat responds to increasing doses of N by higher yields of grain, straw, and protein, but no correlation was ascertained between the method of application or the dose of P and K fertilization on the content of P_2O_5 and K_2O in the grain (CA 70 114265r)

393 Burczyk, H , Klupczynski, Z 1967 *Effect of High Rates of Nitrogen Application in Relation to Sowing Density and Row Spacing of Winter Wheat and Rye* Pamiet Pulawski 24 251 66 (Pol) (Pracownia Nawozenia IUNG Z D Baborowko)

During 1962 65 on light podzolic soil, yields of wheat or rye receiving up to 160 kg/ha N did not depend on sowing density at sowing rates of 80 160 kg/ha or on row spacing at distances of 15 25 cm (SF 31 541)

394 Czuba, R 1969 *Uptake of Nutrients by Winter Wheat* Rocz Nauk Roln, Ser A 96(1) 5 28 (Pol) (Cent Osrodek Metodyczno Nauk, Stacji Chem Roln, IUNG, Wroclaw)

During the vegetative period, differences in the uptake of N, P_2O_5, K_2O, CaO, and Mg were negligible The uptake of B, Cu, Mn, and Mo was similar to that of macroelements and was seasonally conditioned In the initial period of growth in the spring, plants took up K and CaO, followed by uptake of N, P and Mg uptake remained constant during the entire growth period Wheat grain contained less B, Cu, and Mo, but more Mn than straw Increase in the NPK dosages had only a small effect on the amount of these elements in the plants (CA 73 87061z)

395 Fulara, K, Jaworska, K, Ruszkowska, B, Ruszkowski, M, Ulinska, M 1968 *Investigations on the Influence of Mineral Fertilizing on the Yields of Winter Wheat Varieties Adapted to Different Regions* Pamiet Pulawski 35 173 90 (Pol)

In 3 yr field experiments in the various regions of Poland, 21 wheat varieties were fertilized with $N_{45}P_{27}K_{40}$ and $N_{90}P_{54}K_{80}$ There were no significant differences between the varieties in their response to N but there were interactions between the varieties and the regions and between the regions and fertilizing (SF 32 3976)

396 Gawda, J, Sobczynska, J 1966 *Effect of Nitrogen Fertilization and Application of Chlorocholine Chloride on Wheat* Biul Inform Central Lab Technol Przetworstwa Przechowalnjctwa Zboz Warszawie 10(3) 64 6 (Pol)

Previous to sowing Olza variety of winter wheat, plots were fertilized with N 120, P 54, and K 80 kg/ha After sprouting, chlorocholine chloride (CCC) [4, 8, or 12 kg/ha with aqueous $(NH_4)_2SO_4$] was applied Wheat grain was analyzed for protein (*I*) and the flour was analyzed for gluten (*II*) The elasticity and stability of *II* were also determined Bread was made and the ash and Cl were determined *I* and *II* contents were unchanged from controls, but the physical qualities of *II* were less desirable The size of the bread and its porosity were less, especially with the addition of 8 or 12 kg CCC/ha, the amount of ash and Cl were higher (CA 65 20789c)

397 Glebowski, H 1969 *Reaction of Spring Varieties of Wheat and Oats to Magnesium Sulfate Fertilization of Soils With Long Partial Application of Fertilizers* Zesz Nauk Szk Gl Gospod Wiejsk Warszawie, Roln, No 12, 7 18 (Pol) (Szk Gl Gospod Wiejsk, Warsaw)

Pot experiments were carried out with soil fertilized since 1923 with $(NH_4)_2SO_4$ and NH_4NO_3, on soil not fertilized since 1923, and with soil from productive fields with varying fertilization The following fertilizers were applied NPK, NPK + 0 2 g MgO/100 g, and NPK + 0 4 g MgO/100 g Soils in which $(NH_4)_2SO_4$ fertilizing had been applied contained <0 5 mg Mg/100 g and had pH values in KCl solution of 3 9-4 1 With these soils a distinct reaction of oats and wheat to Mg fertilizing was found Soils fertilized with $NaNO_3$ contained 1 2 2 4 mg Mg/100 g and had pH 4 4-4 6 In all experiments with these soils, oats were unaffected by Mg fertilizing, and wheat was affected only in cases where the Mg content in the soil was ~1 2 mg/100 g (CA 73 87077j)

398 Goralski, J, Mercik, S 1967 *Effect of Increasing Doses of Urea as Topdressing to Cereals (5 Year Field Experiments)* Rocz Nauk Roln, Ser A, 93 263 83 (Pol)

Urea or NH_4NO_3 was applied at the four leaf stage to cereals growing on a slightly acid podzolic soil containing 10 17% clay 45, 60, and 75 kg/ha N were applied to rye and winter wheat, and 30, 60, and 90 kg N to barley and oats Adequate superphosphate and KCl were supplied before sowing The effects of urea resembled those of NH_4NO_3 Winter cereals utilized 34-40% of applied N and 50 53% was used by the spring cereals Yield variations in 5 yr were less when 60 kg N were applied than when no N was given (SF 31 2832)

399 Jaworska, K, Krol, M, Ruszkowska, B, Ruszkowski, M 1967 *Influence of the Amount of Seed per Hectare Upon the Yield of Winter Wheat With Different Levels of Mineral Fertilizing* Pamiet Pulawski, No 26, 21 30 (Pol) (Zaklad Roslin Zbozowych IUNG, Pulawy)

In trials in 1962 65 at 12 locations in Poland, winter wheat was sown at 100, 150, and 200 kg/ha and given either 45 or 75 kg N/ha plus 54 kg P and 80 kg K Grain yields were little affected by sowing rate where the lower N rate was used With reduction in sowing rate, tillering was increased, as also were grain number and weight per ear, the length of the various developmental phases was unaffected, but lodging was increased slightly (FCA 21 2301)

400 Klupczynski, Z 1967 *Influence of Nitrogen Fertilizing on the Yield of Rye and Winter Wheat and on the Content and Composition of Protein in the Grain* Pamiet Pulawski, No 24 229 50 (Pol)

Application of up to 90 kg N/ha increased grain yields of rye and winter wheat Split applications at the beginning of growth and at heading gave the best results Increasing the rate of N or applying it as split dressings increased percentage N in the grain In rye this was mainly due to an increase in prolamines and in wheat to an increase in glutelins (FA 1 1344)

401 Mazurek, J 1967 *The Variability in Number of Plants and Analysis of Yield Components of Two Spring Wheat Varieties Depending on the Seeding Rate and Nitrogen Fertilization* Pamiet Pulawski, No 26, 31-40 (Pol) (Zaklad Roslin Zbozowych IUNG, Pulawy)

In two trials during 1961 63, two spring wheat cv were sown at rates of 100, 150, 200, and 250 kg/ha At emergence, the proportion of emerged plants to seed sown declined by about 4% as sowing rates increased from 100 to 250 kg/ha, at harvest, plant numbers as a percentage of seed sown declined as sowing rates increased, from 55 0 to 33 6 in one trial and from 51 2 to 37 8 in the other Differences in N treatments (30 120 kg N/ha) had little effect on seasonal trends in plant numbers (FCA 21 2300)

402 Mazurek, J, Mazurek, J 1968 *Influence of Seeding Rate on the Yields of Spring Wheat Varieties at Different Levels of Mineral Fertilizing* Pamiet Pulawski 35 193 202 (Pol)

Two spring wheat varieties, Ostka Chlopicka and Opolska, were sown at rates of 100, 150, 200, and 250 kg seed/ha and

fertilized with 30, 60, 90, and 120 kg/ha N N and seeding rate did not affect the rate of plant development but the higher N rates produced taller plants Rates of up to 90 kg/ha N increased grain yields as did increasing the seeding rate, but increasing the seeding rate above 150 kg/ha seed did not give significant yield increases The seeding rate did not affect the protein content of the grain but N fertilizing did (SF 32 3985)

403 Michniewicz, M , Chrominski, A , Belt H 1967 *Effect of (2 Chloroethyl) Trimethylammonium Chloride (CCC) on Grain and Straw Yield of Winter Wheat and on Some Physiological and Biochemical Properties of Grain* Rocz Nauk Roln , Ser A 93(1) 131 52 (Pol) (Lab Plant Physiol , Cent Appl Biol , Copernicus Univ , Torun)

Winter wheat cv Leszczynska Wczesna received NPK in autumn and topdressings of N on April 9 and May 29, bringing the total amounts of N applied to 80, 120, and 160 kg/ha On May 29, 4, 8, or 12 kg CCC/ha were applied, alone or mixed with ammonium nitrate Treatment with CCC reduced plant height, and increased lodging resistance, ear length and weight, and grain yield Joint CCC and N applications in spring increased grain yield by 42 63% and straw yield by 34-41% compared with plots which received N in spring only CCC treatment decreased grain protein content, but increased total protein yield Germination 4 months after harvest and the content of auxins and gibberellic acid like substances in germinating grains were not affected (FCA 21 2339)

404 Sienkiewicz, J 1968 *Effect of Mineral Fertilizing and Irrigation on the Baking Quality of Winter and Spring Wheat* Zesz Probl Postepow Nauk Roln 77B 15 21 (Pol) (SF 32 3977)

405 Slabonski, A , Piech, M , Malcherek, M 1968 *Effect of Nitrogen Fertilization on the Baking Quality of Winter Wheat* Zesz Nauk Wyzsz Szk Roln Szczecinie Roln 4(28) 175 94 (Pol) (Wyzsz Szk Roln , Szczecin)

Fertilization with 30, 60, and 90 kg N/ha increased the total protein content in winter wheat kernels to 10 8, 11 4, and 12 0%, respectively, gluten content to 18 0, 19 7, and 22 0%, respectively, and sedimentation index to 23 1, 24 8, and 27 2, respectively The sowing rate (150, 180, and 210 kg/ha) had no effect on the baking quality of the grain (CA 71 21291b)

406 Szukalski, H , Zembaczynska, A 1967 *Effect of Magnesium Fertilization on the Yield of Barley, Wheat, and Ryegrass as Affected by the Form of Applied Nitrogen* Pamiet Pulawski, No 24, 161 70 (Pol) (Pracownia Nawozenia IUNG, Gorzow)

Investigations were carried out on a laboratory scale, using wheat, barley and ryegrass Pots, filled with a light loamy sand (pH 4 9), were fertilized with K, Mg, and N, the latter either as ammonium or nitrate Results showed that without Mg fertilization the yields were somewhat lower when $(NH_4)_2SO_4$ was used as compared with $Ca(NO_3)_2$ Plants fertilized with $(NH_4)_2SO_4$ reacted positively to Mg treatment, but with either form of N, the yields were equal $(NH_4)_2SO_4$ inhibited to some extent the absorption of Mg by barley and ryegrass The ryegrass requirement for Mg was considerably higher than that of the other plants The ratio of N, P, K, and Ca to Mg in plants was markedly higher in barley and wheat than in the ryegrass (FA 1 461)

PORTUGAL

407 Almeida, L A V , dos Santos, J Q 1966 *Nitrogen Fertilizers for Wheat Results of Three Year Field Experiments* An Inst Super Agron Univ Tec Lisboa 29 271 77 (Port)

The effect of applying one third of the total rate of N as $(NH_4)_2SO_4$ at sowing, and broadcasting the rest as various other forms of fertilizer N at the shooting stage, was tested on wheat yield, 100 grain weight, and protein content in 10 field experiments in south Portugal Highest yields were obtained when either urea or NH_4NO_3 (20 5% N) was used for broadcasting, $(NH_4)_2SO_4$ NH_4NO_3 gave intermediate results Broadcasting two thirds of the total rate of N as $Ca(NO_3)_2$ or $(NH_4)_2SO_4$ gave similar yields to those obtained when the total rate was applied at sowing as $(NH_4)_2SO_4$ No effect on quality was observed (SF 32 1545)

408 dos Santos, J Q 1966 *Soil Acidity and Calcium Deficiency* An Inst Super Agron Univ Tec Lisboa 29 263 69 (Port)

Limestone and Ca acetate markedly increased yields of wheat and berseem on three acid soils Gypsum had no effect This is attributed to the higher increase in soil pH with limestone and Ca acetate It is suggested that low yields on very acid soils are not due to Ca deficiency but to decreased availability of P and to toxic levels of Al and Mn (SF 32 1538)

ROMANIA

409 Adler, T 1965 *The Yield of Wheat as Affected by CCC in Connection with N Fertilizer Application* Novenytermeles 14(3) 223 32 (Hung) (Sta Exp , Lugos)

CCC (5 and 8 kg/ha) and/or ammonium nitrate were applied to plants of 15 wheat varieties When applied when plants were 10 20 cm high, the width of the leaf blade was increased, the leaves were darkened and the stem shortened CCC alone at the lower rate increased yields by 0-60%, depending on variety (FCA 19 759)

410 Borlan, Z , Bordeiasu, C , Pop, C , Boieriu, I , Buzdugan, I , Dornescu, D 1967 *Relative Effect of Potassium Fertilizers in Wheat and Corn on Soils With Various Agrochemical Features* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr , Ser B 35 207 24 (Rom)

K soluble in conventional reagents (0 4*N* NH_4Cl, ammonium lactate, ammonium acetate, and 2*N* HCl) determines a variance in the relative effect of K fertilizers containing N and P base of up to 42% in wheat and to 75% in corn the H K pH pK exponent illustrates that true K^+ accessibility for plants depends on soil reaction (CA 72 99577q)

411 Bratu, I , Saulescu, N N 1967 *Effect of High Rates of*

Chemical Fertilization on Yield of Wheat Grown After Peas and Some Considerations on its Interpretation An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 281 90 (Rom)

Wheat yield after peas increased more under P additions, it was affected by N fertilizers only when wheat emerged late in autumn and was followed by a dry spring In order to spare fertilizers when wheat is grown after peas, it is suggested to apply N in 70 kg/ha rates, only in spring when the crop requires this P fertilizer requirements could be satisfactorily estimated on the basis of the yield response curve obtained by a second degree polynomial (CA 72 99581m)

412 Bretan, I, Simionescu, I, Salajan, G, Luca, A 1966 *The Effect of Fertilizers on Yields of Winter Wheat and Other Crops on a Moderately Podzolized Brown Forest Soil* Probl Agr, No 8, 31 6 (Rom)

High yields are obtained from application of $N_{60}P_{45}$ in conjunction with 10 tons/ha dung In absence of organic manure, rates of mineral fertilizers should be increased to $N_{60}P_{95}$, effects of hyperphosphate at high rates are comparable to those of superphosphate (SF 30 1360)

413 Bulinaru, V, Danaila, E, Maricica, L, Lungu, A S 1967 *Effect of Fertilizers on the Chemical Composition of Winter Wheat* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 355 65 (Rom)

N applied alone, or with P, or P and K, increased N content in the plant and protein content in the grain, and decreased starch content, to a lesser extent P applied alone did not affect N content in the plant or protein content in the grain Nutrient consumption was affected by the applied fertilizers due to the increase of nutrients in the plant, but most particularly to yield increase Highest consumption was obtained when fertilizers were applied in mixtures Utilization rate of the active ingredient from fertilizers was higher for N whether applied alone or with P Both N and P were best used when N fertilizers were applied together with P, or with P and K Most of the consumed nutrients were used for the formation of grain (CA 72 99586s)

414 Bunescu, O, Coronea, C 1967 *Effect of Fertilizers and of Different, Previous Plants on Some Chemical Wheat Components* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 345 54 (Rom)

Protein content in the grains was affected by fertilizers and previous plants (continuous wheat crop, corn, and peas) N and P fertilizers in continuous crops caused protein to increase by 12 25% over the protein levels of the nonfertilized crop Starch in grains varied within smaller limits and was inversely proportional to protein content (CA 72 99585r)

415 Buzdugan, I, Moga, E, Nitu, S 1966 *Effectiveness of Fertilizers Applied to Wheat and the Utilization of Fertilizer Nutrients Under Conditions Prevailing in the Suceava Meadow Chernozem Soil* Stiinta Solului 4(4) 26 31 (Rom)

With wheat in three crop rotations the best N P_2O_5 fertilizer ratio was 1 0 66 The utilization coefficient of fertilizers by plants decreased with increasing rate of fertilizing N applied alone or with P increased the protein content of wheat but P applied alone decreased it (SF 30 2995)

416 Caluianu, C, Pasa, V 1966 *Effect of Fertilizers in a Wheat-Corn Rotation on a Brown, Moderately Podzolized Produlesti Soil* An Inst Cercet Pentru Cereale Plante Teh Fundulea, Ser B 34 229 39 (Rom)

The effect of N (NH_4NO_3), P (superphosphate), and K (K salt, not specified) on wheat and corn in rotation was examined in an experiment carried out on a brown, moderately podzolized soil, at Produlesti (Titu district) in 1963 66 The soil was acidic (pH in water 5 63, pH in salt solution 4 57, hydrolytic acidity 3 87 meq/100 g soil, cation exchange capacity 6 10 meq/100 g soil, and saturation percent 61 49), poorly supplied with N (total N 0 120%) and P (P_2O_5 total 0 13%, and available P_2O_5 1 10 mg/100 g soil), moderately supplied with K (K_2O in 0 4*N* NH_4Cl 13 58 mg/100 g soil), and poor in humus, 2 20% N and P fertilizers proved most efficient when applied together, maximum wheat yield increase of 71% and corn yield increase of 27% were reached with N 96 and P_2O_5 128 kg/ha K had no consistently beneficial effect on yields Yearly application of the N fertilizer depressed the soil pH 0 4 0 5 units, but this did not affect the wheat and corn yields The available P level in the soil rose due to the superphosphate applications Application of 1 kg of P_2O_5 raised the available P_2O_5 in the soil by 0 051 mg/100 g soil The available K_2O content of the soil did not increase significantly due to the K fertilization The total NPK content of the plants and grains correlated with the level of fertilization The total N in wheat grains and straw increased linearly with the rate of N fertilization, and the total P in wheat straw increased linearly with the rate of P application, but no significant correlation was found between the total P in the wheat grains and the rate of P application Linear correlations were also found between the total N in corn grains and stalks and rate of N fertilization P accumulation in corn followed the same pattern in grains and stalks K application rates correlated with the amount of K in stalks and stems of corn and wheat, respectively, but not in the grain of either crop (CA 71 80302d)

417 Caluianu, C, Pasa, V 1967 *Effect of Mineral Fertilizers and Liming on Wheat and Corn in a Brown, Slightly Podzolized, Forest Soil of the Northwest Romanian Plain* An Inst Cercet Cereale Plante Teh Fundulea Inst Cent Cercet Agr, Ser B 35 245 56 (Rom)

Experiments with chemical fertilizers and liming carried out during 5 yr on brown forest soils proved that yields up to 3,000 kg/ha wheat and 5,000 kg/ha corn kernels could be obtained even in these soils Highest yield gains are due to N fertilizers, or to N administered together with moderate P rates Liming and K fertilizers did not produce significant yields Fertilizers and liming strongly affected soil reaction and soil levels of P and available K, as well as NPK content in plants (CA 72 99578r)

418 Caluianu, C, Pasa, V 1967 *Results of Wheat and Corn (Fertilization) on Two Soils Typical for Wallachia* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 257 68 (Rom)

A rocky, poor soil imperatively needs fertilizers, the increases obtained with N and P were 300 kg/ha of wheat and 900 kg/ha of corn kernels, while on a meadow chernozem of Sahatemi the increases were only 360 kg/ha wheat grain and

430 kg/ha corn kernels Soil reaction and content of nutrients were changed under the effect of fertilizers Thus N in high rates leads to a gradual soil acidification while P and K raise soil available K and P contents The fertilizers affected total NPK content in plants P and N increased P and N content in grains and straw, and K fertilizers raised total K content, especially in the straw of wheat and in the stalks of corn (CA 72 99579s)

419 Caramete, C , Popescu, S , Bartok, R , Stan, S , Vines, I , Hera, C , Isfan, D , Cremenescu, G 1969 *Effect of Chemical Fertilizers on Wheat Quality* Probl Agr 21(3) 49 64 (Rom)

The effects of rate, kind, and time of application of N and P fertilizers to Bezostaia wheat on yield and quality of the grain, were examined in field experiments in 1967 68, on a podzolized brown forest soil at Albota and on a levigated chernozem at Fundulea A strong positive interaction w. found between N and P, on grain yields In 1967, the highest yield on the podzol was achieved with N 200 and P_2O_5 120 kg/ha (N 200 P 120), and on the levigated chernozem with N120 P200 In all the treatments, the yields were lower in 1968 than in 1967 due to drought conditions The N content of the wheat grains was linearly correlated with the rate of N applied, but the P content of the grains increased with rate of P application to a lesser extent and less systematically Fertilization with N stimulated P uptake by the plants, there was an NP interaction and an equilibrium N/P ratio at which nutrition and yield quality were optimum The protein content increased with increasing rates of N application, and at the same time the starch content decreased Starch accumulation was stimulated by P fertilization, accompanied by a d crease in protein The effect of rate and kind of N fertilizer on the different protein fractions in the Bezostaia wheat grain was examined in an experiment on the levigated chernozem, 80 or 180 kg of N/ha as NH_4NO_3 or urea was applied on a constant base of P50 K40, with zero N on the PK base as control Total N, protein N, and the different protein fractions varied with the treatments In all N treatments, the gliadin content exceeded that of the control, and was higher in the urea treatments than with NH_4NO_3 Albumin and globulin contents varied within tighter limits, being lower with urea than with NH_4NO_3 The variation of the glutelin content was erratic The distribution of the protein N among the different fractions, as affected by time of N application, was examined in an experiment on the same soil A constant amount of P50 was applied in the fall, and N40 was applied in four doses in the fall, in the spring, before heading, and during grain formation, zero N on the P base was the control The protein N content increased as the N application was delayed, the maximum value being obtained when the N was applied during grain formation, the gliadin content was also highest in this case The absolute and relative amounts of amino acids varied with rates of N and P fertilization (CA 71 69780n)

420 Catanescu, V 1967 *Dynamics of Nutrient Accumulation (NPK) in the Ponca Wheat Variety, Grown on a Podzolic Soil of Albota* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr , Ser B 35 379 90 (Rom)

Decrease of nitric N in the soil, from straw formation up to anthesis, was noticed and also a tendency to increase at harvesting time N utilization degree increased especially in the first growth stages and decreased together with increase of N rates N applied alone for several years successively worsened soil reaction and considerably reduced available phosphates in the soil and P_2O_5 in the plants Combined N 64, P 64, and K 80 kg/ha fertilizers favored the accumulation of protein substances, high N rates favored nonprotein N increase to the detriment of protein N Available phosphate content and utilization degree was highest at anthesis stage Highest K consumption was at anthesis and ripening stages (CA 72 99583p)

421 Coculescu, G , Pop, L , Boeriu, I , Segarceanu, A P , Isfan, D , Sirbu, M Triboi, E 1967 *Effect of Time of Application of Nitrogen Fertilizers on Wheat Yield* Probl Agr 19(2) 72 80 (Rom)

Single or split applications of N at various times between plowing and early spring had no effect on wheat under dry or wet conditions, but yields were reduced when applications were delayed until heading There was no difference between $(NH_4)_2SO_4$ and urea (SF 30 3000)

422 Costache, I , Petrovici, P , Dumitrescu, N , Stoian, G , Popa, A , Popa, G 1969 *Contributions to the Determination of Management Practices on Sloping Ground* Probl Agr 21(9) 21 32 (Rom) (Agr Exp Sta Podu Iloaie, Iasi)

On a chernozem type soil with a slope of 10 30% and different degrees of erosion, best results were obtained with a rotation consisting of a 2 yr ley followed by wheat, peas, a 1 yr ley, beans, sunflower, and maize On moderately eroded soils, winter wheat yields were increased by 165% by $N_{64}P_{24}$ + 20 tons farmyard manure/ha On a strongly eroded soil, wheat yields were increased by 235% when $N_{96}P_{96}K_{60}$ + 20 tons farmyard manure/ha were applied (SF 33 2346)

423 Cremenescu, G , Pop, C 1968 *Investigations on the Time of Application of Fertilizers to Winter Wheat* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr , Ser B 34 311 18 (Rom)

On a brown podzolic soil with a very low P content, NH_4NO_3 had most effect on wheat yield and quality when applied in early spring (on the frozen soil) at the rate of 200 kg/ha or when applied in equal amounts in autumn and early spring at the same overall rate (SF 32 3160)

424 Dinca, D , Tabaranu, T 1966 *New Agrotechnical and Agrochemical Aspects of Short Rotations With Different Proportions of Wheat and Maize on Reddish Brown Forest Soils* Probl Agr , No 8, 7 19 (Rom)

Application of $N_{48}P_{32}$ + 10 tons/ha dung increased yields, more so in 4 yr rotations than in monoculture Yields were higher in 4 yr rotations than in monoculture both with or without application of fertilizers Fertilizers and dung increased mobile P reserves and slightly decreased pH in the soil, and dung had a slight positive effect on the mobile K reserves (SF 30 1353)

425 Hera, C Segarceanu, O , Apostol, V , Sirbu, M , Tabaranu, T , Nicolae, A 1967 *Investigations on the Use of Various Nitrogen Fertilizers in Winter Wheat Crops* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet. Agr ,

Ser B 35 171 82 (Rom)

The results prove that the four N fertilizers investigated anhydrous ammonia (NH_3), aqua ammonia (NH_4OH), carboammoniates (NH_4OH in which NH_4NO_3 or urea are dissolved and saturated with CO_2) and NH_4NO_3, lead to practically equal yield gains Best results were obtained by introducing the N liquid fertilizers in the soil in autumn before sowing the wheat With respect to economic efficiency liquid fertilizers proved superior to NH_4NO_3 An increase of plant N content was detected (CA 72 99574m)

426 Isfan, D, Cproiu, E 1967 *Effect of Progressive Urea Doses on Wheat Yield and Quality* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 269 79 (Rom)

Performance of urea in comparison with NH_4NO_3 plowed under in progressively larger doses, ranging 0 220 kg N/ha with 50 and 100 kg P/ha on a moderately leached South Romanian forest steppe chernozem, was investigated during 3 yr Urea behaved practically similarly to NH_4NO_3 with no significant differences in 2 yr and significant positive differences in 1 yr During the 3 experiment yr the yields obtained were 4,320, 2,570, and 3,850 kg/ha for urea and 4,290, 2,490, and 3,870 kg/ha for NH_4NO_3, and year means were 3,570 kg/ha in the first case and 3,550 kg/ha in the second case Concerning the effect on quality characters, a double dose of P did not significantly affect any of the investigated indices as compared with the single dose Increasing N doses gave a significant increase in protein and gluten content, and also improved baking qualities (CA 72 99580k)

427 Lixandru, G 1967 *Effect of Mineral Fertilizers on Winter Wheat in Podzolized Gray Forest Soils* Lucr Stiint Inst Agron Iasi 1966, pp 129-44 (Rom)

Tillering increased with N fertilizer or N in combination with P and K Concentration of N in the plant increased with N treatments, and more so with N + P + K P_2O_5 in the plant increased with P fertilizer but decreased when high rates of N were also applied K concentration was not greatly affected by treatments with P or K but increased when N was included P and K fertilizers decreased, and N fertilizer increased Ca concentration N and P_2O_5 content of the grains increased when > 64 kg/ha N and >32 kg/ha P_2O_5 were applied, respectively (SF 31 655)

428 Maricica, L, Bulinaru, V, Danaila, E 1967 *Effect of Fertilizers on Winter Wheat Yield on a Brown Chernozem Soil* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 183 90 (Rom)

Experiments were carried out during 5 yr on a brown chernozem with 16 treatments of Bezostaia 1 and No 301 wheat varieties, grown in a corn wheat rotation The Bezostaia 1 wheat variety appeared to have exceeded average yields of the No 301 variety by 390 kg/ha, and N 32 and P 32 kg/ha developed a gain of 14 kg for 1 kg fertilizer active ingredient in the Bezostaia 1 variety and 11 7 kg in the No 301 variety (CA 72 99575n)

429 Mihailescu, I G, Pop, L, Nedelcu, P, Popescu, F 1968 *Variation of Dry Matter, Water, and Certain Mineral Matter in Wheat ("Triticum vulgare") at Different Stages of Growth Under the Influence of Fertilizers With Ammoniacal Water* Rev Roum Biol, Ser Bot 13(1 2) 73 83 (Eng) (Univ Craiova)

Cultivated wheat was treated with ammoniacal water alone or in conjunction with superphosphate Maximum dry weight was obtained in stems of wheat treated with N and P The increase in weight was more in leaves of plants treated with N alone (CA 70 28071t)

430 Milica, C I, Juncu, A M, Pirjol, L 1969 *Results Concerning the Application of Chlorcholine Chloride as Related to Winter Wheat Fertilization* Probl Agr 11(11) 22 34 (Rom) (ICCPT Fundulea, Ilfov)

CCC increased resistance to lodging and gave yield increases of up to 500 kg/ha, especially at high rates of application of fertilizer (SF 33 3166)

431 Moga, I, Vines, G, Stefan, O, Moga, R 1966 *Experimental Results on the Effect of Fertilizers on Yield and Quality of Winter Wheat on Chestnut Chernozem Soils at Marculesti* Probl Agr, No 10, 4 13 (Rom) (Agr Exp Sta, Marculesti)

In a 3 yr field experiment, P fertilizers were applied to winter wheat at plowing and N fertilizers in early spring Low available soil moisture in early spring increased response to P and decreased N requirements (SF 30 2993)

432 Nagy, M, Avram, P, Jeger, A, Paris, I 1967 *Content and Consumption of Nutrients in Winter Wheat* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 333-44 (Rom)

Following N fertilization, consumption of N, as well as that of P and K by plants, increased N and K consumption differ from one year to the other, while P consumption remains relatively constant N consumption, calculated for 100 kg grain, presented a considerable increase only at a 100 kg N/ha rate P consumption for 100 grains decreases together with yield gain Of the total consumption of nutrients, 67 73% in the case of N, 64 92% in the case of P, and 19 36% in the case of K was represented by incorporation into the grains (CA 72 99582n)

433 Nicolae, C 1966 *The Effect of Plowing Depth and Fertilizing on Yields of Winter Wheat on a Podzolized Brown Soil* Probl Agr, No 8, 20 30 (Rom)

With moderate annual applications of $N_{64}P_{64}$ kg/ha, economical returns were obtained with normal plowing depth of 18 20 cm, with $N_{96}P_{96}$, normal tillage was economical during the first 2 yr and deep plowing to 30 cm in the third year Dung applied alone at 30 tons/ha at the start of the trial produced only a small increase in yields (SF 30 1359)

434 Oproiu, E, Cernescu, L 1970 *Effect of Chemical Fertilizers on Wheat Quality* Probl Agr 22(9) 55 64 (Rom) (ICCPT, Fundulea)

N applied alone, or with P and K increased wheat gluten content P fertilizers applied alone decreased the gluten concentration (CA 74 52559m)

435 Segarceanu, O, Toma, I, Chiriac, S, Teaciuc, N 1966 *Some Technical and Economical Aspects of Fertilizer*

Application to Winter Wheat in the Banat Region Probl Agr, No 7, 4 15 (Rom)

The increase in wheat yields averaged 668 892 kg/ha from $N_{32}P_{32}$ and 704 1,200 kg from $N_{64}P_{64}$, both on a fertile chernozem and on slightly podzolized brown soil (pH 5 84) Application of P alone was not effective, and additional K did not increase yields further Dung gave economic returns in the first year of application when given at 20 tons alone or at 10 tons together with NP (SI 30 615)

436 Simota, H 1966 *Establishment of a Fertilizing System for Winter Wheat After Various Preceding Crops Grown in Calcareous Chestnut Chernozem in the Dobrogea* Probl Agr No 7, 16 29 (Rom)

Applications of N did not significantly increase yields, P fertilizers increased yields when wheat was grown after maize and bean, and K fertilizers had no effect Dung increased yields of wheat after all the preceding crops tested Yields of >4 tons/ha are obtained when wheat is grown after pea and bean, or grown after wheat and given high doses of $N_{64}P_{64}$ or dung (SF 30 1362)

437 Sipos, G 1966 *Adjustment of Preceding Crop Effects on Winter Wheat by Agrotechnical Management* Tagungsber, Deut Akad Landwirtschaftswiss Berlin 72 275 80 (Ger) (Sta Exp, Oradea)

Trials on meadow chernozem showed that on unmanured plots, peas, as compared with maize, increased wheat yields by 470 kg/ha (22%), on plots receiving 48 kg/ha N and 32 kg/ha P the difference fell to about 4% Yields of over 4,000 kg/ha were obtained by doubling the NP application (SF 31 2111)

438 Stratula, V, Pop, L, Ionescu, F 1969 *New Aspects of Wheat Management on Sloping Ground Situated in the Central Zone of Oltenia* Probl Agr 11(9) 41 8 (Rom) (Agr Exp Sta, Simnic, Craiova)

On a brown forest soil of pH 5 3 5 7, 1 5 2% organic matter content and a slope of 11 15°, depth of plowing had no effect on wheat yield in a maize pea wheat rotation Best results were obtained with $N_{84}P_{24}$, $N_{64}P_{48}$, $N_{96}P_{64}$, and $N_{64}P_{64}$ + 20 tons farmyard manure/ha every second year (SF 33 2344)

439 Timpeanu, I, Ciorlaus, A, Bredt, H, Margineau, T 1966 *Experiments With Mineral Fertilizers Applied to Wheat and Maize in a Two Year Rotation* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 32 39 50 (Rom)

Wheat and maize growing in a leached chernozem responded to N and P but not to K, optimum fertilizer rates were 64 kg/ha each of N and P for winter wheat and 96 kg each of N and P for maize Superphosphate gave 50% higher yield increases than hyperphosphate did During 4 yr treatment, the soil P rose to an extent proportional to the rate of P applied (SF 30 2210)

440 Timpeanu, I, Bilaus, I, Bucur, C, Gheorghiu, O, Nagy, C 1967 *Effect of Nitrogen and Phosphorus Interaction in Wheat and Corn on a Moderately Leached Chernozem of the Transylvanian Plain* An Inst Cercet Cereale Plante Teh Fundulea, Inst Cent Cercet Agr, Ser B 35 191 205 (Rom)

An analysis of N and P interaction emphasizes changes in the latter according to P supply in the soil An accumulation of available P was present after systematic superphosphate fertilization After 3 yr the P supply level changed by 3-4 mg P_2O_5/100 g soil for 100 kg P_2O_5 applied A N P K ratio of 1 0 4 0 6 was established for winter wheat At high P storage levels, the N utilization coefficient remained high up to the 100 kg/ha N rate (CA 72 99576p)

RUSSIA

441 Abasheeva, N E, Senichkina, M G, Gershevich, E G, Khadykova, R M 1967 *Use of Tungsten Molybdenum Wastes as Fertilizer for Wheat in the Buryat ASSR* Mikroelem Sib, No 5, 71 3 (Russ)

W Mo wastes contain other trace elements Mn, Zn, Cu, Co, Ni, and V By applying these wastes (100 kg/ha) together with regular NPK (60 60 60) fertilizers, wheat yields increase ~40% Applying the wastes separately increases yields 32%, applying the fertilizer separately increases the wheat yield by 8% (CA 70 105496q)

442 Abazyan, S P 1969 *Influence of Trace Element Fertilizers on the Yield of Winter Wheat in the Artashat, Abovyan, and Razdan Regions* Izv Sel'skokhoz Nauk 12(11 12) 59 64 (Arm)

The seeds were either powdered with fertilizer before sowing or the plants were sprayed twice with a solution containing 0 03% borax or 0 05% Mn and Zn sulfate during the growth of the stem and at the flowering time The powdering method increased the yield 3 16% and the spraying method 1 6 11 9% (CA 73 87037w)

443 Abutalybov, M G, Samedova, M D 1966 *Influence of Trace Elements on the Content of the Amino Acids in Leaves of Wheat and Beans* Izv Akad Nauk Azerb SSR, Ser Biol Nauk, No 2, 16 22 (Russ)

During shoot growth, the content of total amino acids increased after fertilization with Co, Mo, Mn, or B, but during reproductive growth no difference in total amino acids content was found between control plants and plants grown with fertilization In experiments with Mo there was an increase of glycine, alanine, aspartic acid, and glutamic acid, whereas in experiments with Mn there was an increase of glycine, alanine, and glutamic acid With B fertilization, there was an increase of tyrosine and histidine (CA 66 1920g)

444 Agaev, N A 1968 *Effect of the Reaction of Boron With Other Mineral Elements on the Yield of Winter Wheat and Corn* Izv Akad Nauk Azerb SSR, Ser Biol Nauk, No 6, 38-43 (Russ)

In field experiments, the effects of B, Mn, and Cu were studied on yields of corn and wheat The trace elements were applied in three ways by soaking seeds in trace element solutions for 4 or 8 hr, by adding trace elements to the soil, and by spraying 0 05 or 0 1% solutions on plant leaves All ways of fertilization resulted in increases of corn foliage and corn and wheat grain yields Best results were attained by spraying the plants with 0 1% $MnSO_4$, $CuSO_4$, or 0 05% HBO_3 solutions (CA 71 29661t)

445 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 In 1958, the sequence of applying fertilizers under winter wheat was superphosphate (simple and with Mg), then (*7*), (*2*), (*3*), and (*6*) The first three treatments yielded 23 6 24 0 q of straw, and the remaining ones, 13 4 19 2 q/ha Treatment (*2*) gave the greatest grain yield (36 4, as compared with 28 8 q/ha for the control) These results were obtained during a very favorable farming year Treatment (*6*) was less effective than readily soluble fertilizers, and during some years provided only a yield of 0 7 q of winter wheat grain, as compared with 5 2 6 3 q/ha obtained with readily soluble fertilizers 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 q/ha (CA 65 14374c)

446 Arzybov, N A 1966 *Uptake of Phosphoric Acid from Different Fertilizers by Young Winter Wheat Seedlings* Khim Sel' Khoz 4(3) 185 87 (Russ)

Winter wheat grown in sand culture in vegetative pots (3 kg of sand) was fertilized using different phosphate fertilizers having equal amounts of P_2O_5 Plants were harvested 15 days after emergence Plots were newly sown with selected first class seeds, this procedure being repeated four times with all vegetative pots In this short time the plants were able to absorb only soluble P_2O_5 from the fertilizers The following combinations were tested (*1*) without Prianishnikoff's nutritive mixture (PM), (*2*) PM without dicalcium phosphate, (*3*) PM with dicalcium phosphate, (*4*) PM with monocalcium phosphate, (*5*) PM with tricalcium phosphate, (*6*) PM with fluorine free phosphate, (*7*) PM with Ca metaphosphate, (*8*) PM with K metaphosphate, (*9*) PM with phosphate slag, and (*10*) PM with phosphate flour The weights of plant dry matter, P_2O_5 contents in plants, P_2O_5 removed from soil, and resulting pH of soil were determined The availability of P_2O_5 to young seedlings was highest with *3*, thereafter followed *6*, *8*, *4*, *9*, *5*, *7*, and *10* The highest neutralizing effects were produced with *9* and *6* Na neutralizing effects were found with *7* and *8* (CA 65 4596a)

447 Asmaeva, A P, Aslanyan, V E, Astvatsatryan, B N, Avundzhyan, E S 1966 *Effect of the Extended Use of Fertilizers on the Biochemical Composition of Winter Wheat Seeds* Sb Nauch Tr, Nauch Issled Inst Zemled, Arm SSR, pp 225 32 (Russ)

Winter wheat was treated with N, P, K, and/or manure at various levels and combinations Sugar, N, protein free N in flour extracts, protein, starch, and moisture were determined NPK plus manure resulted in an increased grain protein content N induced protein accumulation, during the first experimental years, but protein decreased later Protein content was adversely influenced by P NPK contributed to sucrose accumulation in seeds and stimulated starch synthesis, mainly due to the K Ash content decreased as a consequence of N doses, but remained constant when N was omitted (CA 68 68062f)

448 Avdonin, N S, Lakalina, O I 1969 *Effect of the Properties of Sod Podzol Soils and Long Term Application of Mineral Fertilizers on the Quality of Winter Wheat Grain* Agrokhimiya, No 2, 36-45 (Russ) (Moskow Gos Univ)

While a single application of ammonium N to winter wheat improved the yields of grain and increased the protein content, long term application of these N fertilizers either alone or especially in mixtures with KCl significantly worsened the properties of acid heavy loamy sod podzol soils and decreased grain yields and quality to levels below those in nonfertilized controls Liming these soils did not increase the proteins in the grain but significantly increased yields, percentage of starch, and the albumin/globulin ratio, and improved gluten quality (CA 71 2587m)

449 Avundzhyan, E S, Asmaeva, A P 1968 *Amino Acid Composition of Protein Fractions of Wheat Grain During Prolonged Use of Fertilizers* Sel' Khoz Biol 3 437 39 (Russ) (Nauchno Issled Inst Zeml MSKh Arm SSR, Echmiadzin)

Annual application of various combinations of mineral N, P, and K, dung, or dung + mineral fertilizers for 10 yr did not affect the qualitative and quantitative amino acid composition of the fundamental protein fractions (SF 31 4466)

450 Avundzhyan, E S, Asmaeva, A P, Gukasyan, L L 1966 *Amino Acids of Wheat Gain and Endosperm in Long Term Fertilization* Dokl Akad Nauk Arm SSR 43(3) 154 59 (Russ)

The results of experiments conducted in the Armenian S S R in long term fertilization showed that the qualitative composition of amino acids was the same in the wheat grain, but the level was several times greater in embryo than in endosperm This difference was due to higher contents of starch and other nutrients in the latter The contents of different amino acids differed more sharply quantitative in endosperm than in embryo as a result of long term fertilization The quantitative contents of different amino acids fluctuated, depending on the fertilizer regime and on the meteorological conditions In long term fertilization there was a greater accumulation of useful amino acids in endosperm under favorable meteorological conditions (CA 66 94308u)

451 Badalyan, V S, Grigoryan, A M 1967 *The Effect of Fertilizers on Some Anatomical and Physiological Features of Winter Wheat* Biol Zh Armenii 20(6) 80 8 (Arm)

Presowing application of NP fertilizers to winter wheat decreased the amount of total water in plants, reduced their water retaining capacity and intensity of transpiration, and reduced the number of stomata per unit leaf surface area

Presowing application of PK produced the opposite results, spring dressing with N did not change the PK effect (FA 1 1394)

452 Belonozhko, M A, Alimov, D M 1969 *Efficiency of Trace Elements During Growth of Winter Wheat* Nauk Pr, Ukr Akad Sil's'kogospod Nauk 7 53 6 (Ukr)

Winter wheat was grown in chernozem soil with the following properties humus 4 5 5 5%, total N 0 22 0 27%, available forms of P and K 7 5 8 5 and 5 5 7 5 mg/100 g soil respectively, degree of saturation with alkali 85 90%, and pH 7 3 7 4 The soil was fertilized with NH_4NO_3, granulated superphosphate, 40% KCl, $MnSO_4$, and borax The application of Mn and B in conjunction with the mineral fertilizers increased the crop by 2 2 and 3 3 cwt/ha, respectively Spraying of the plants with Mn and/or B salt solutions increased the content of ascorbic acid in the plant leaves, and increased the final yield of grain by 3 0-4 6 cwt/ha (CA 73 13619r)

453 Belonozhko, M A, Gorovii, V G 1969 *Effect of the Form of Nitrogen Fertilizer on the Quality and Quantity of Winter Wheat* Nauk Pr, Ukr Akad Sil's'kogospod Nauk 7 46 9 (Ukr)

Winter wheat was grown in chernozem soil of low humus content (4 38 4 53%), total N 0 19 0 27%, and available P and K 7 5 8 5 and 5 5 7 5 mg/100 g soil, respectively Additionally, the soil was fertilized with separate or combined NPK fertilizers in the form NH_4NO_3, $(NH_4)_2SO_4$, KNO_3, $NaNO_3$, urea, and granulated superphospate The most effective was fertilization with $(NH_4)_2SO_4$, which increased the crop by 6 2 cwt/ha The N fertilizers considerably increased the chlorophyll content in the plants during all phases of their growth and development The bread baking properties of the flour from the cropped grains also improved considerably (CA 73 13618q)

454 Berlyand Kozhevnikov, V M, Peisakhov, U I, Surganova, L D 1968 *Effect of Fertilizers on Growth and Yield of Winter Wheat cv Bezostaia 1 Under Different Irrigation Regimes* Agrokhimiya, No 4, 151 55 (Russ) (Vses Inst Udobr Agropoch, Moscow)

In trials in Dagestan, grain yields depended as much on the fertilizer rate as upon the soil moisture content, highest yields 56 2 hkg/ha, were obtained from applying 120 kg each of N and P/ha and by maintaining soil moisture content at 80% of field capacity Any further increase in fertilizer rate increased lodging and decreased yields Root anchorage forces decreased with increase in fertilizer rate and in soil moisture content from 60 to 80% Increase in soil moisture content did not increase yields on the unfertilized plots (FCA 21 2308)

455 Bezuglaya, Y M 1968 *Effect of Forms of Phosphorus Fertilizers in a Long Term Experiment* Agrokhimiya, No 8, 50 8 (Russ) (Ramensk Agrokhim Opyt Sta NIUIF)

The effectiveness of basal applications of eight P fertilizers to winter wheat and potatoes receiving NK and grown in a five course rotation was studied on derno podzolic soil with and without liming and with and without application of granular superphosphate in the rows For wheat on acid soil, 15 kg/ha P_2O_5 as granular superphosphate + 45 kg of basal P_2O_5 applied in autumn was better than 60 kg P_2O_5 as basal fertilizer In the combined treatment, the different forms of basal P were equally effective The superiority of the combined treatment over basal application alone was greater on unlimed than on limed soil For late potatoes, 20 kg P_2O_5 in the row + 70 kg P_2O_5 applied basally in spring was not better than 90 kg P_2O_5 applied basally On average, for the rotation as a whole, combined application was better than basal application alone, but this superiority was less with water soluble basal P than with citric acid soluble basal P or particularly with phosphorite Utilization of broadcast P was not increased by combined application (SF 32 638)

456 Bogdan, I K, Korchemaya, M G 1968 *Effect of Spray Nutrition of Trace Elements on the Photosynthetic Productivity and Crop of Winter Wheat* Nauk Pr, Ukr Akad Sil's'kogospod Nauk 8 28 30 (Ukr) (Ukr Sil's'kogospod Akad, Kiev)

Winter wheat plants was sprayed in April with $CuSO_4$, borax, or $ZnSO_4$ solutions Total plant solids correlated with the assimilation area, and was highest after spraying with $ZnSO_4$ The photosynthetic productivity correlated with the assimilation area and the organic compounds formed, its value was 8 1 8 9 g/m^2/day at the end of June after spraying with the trace elements Spraying did not affect the respiratory intensity in regard to CO_2 High O assimilation, and low respiration coefficients were observed after spraying plants with $CuSO_4$ and $ZnSO_4$, while spraying with borax had the opposite effect Spraying with $CuSO_4$ increased the content of chlorophyll a and decreased that of chlorophyll b in the plants No significant effect on the final grain crop was observed (CA 73 44373k)

457 Boronina, I I 1970 *Effect of Forms of Phosphorus Fertilizers and Nutrition Levels on the Metabolism of Phosphorus Compounds in Plants* Agrokhimiya, No 7, 38 41 (Russ)

Field experiments were carried out with ammophos and superphosphate as alternative P fertilizers for winter wheat and sugar beet for 3 yr The nutrient content of the soils tested was adjusted to three different levels (low, medium, and high) by applying varying amounts of fertilizers The following forms of P were determined in selected plant parts taken at different growth stages phosphatides, inorganic P, organic acid soluble P, nucleoproteins, and total P Application of ammophos on soils at medium and low nutrient levels resulted in accumulation of nucleoproteins in wheat at the tillering stage, while superphosphate brought about an increase in organic acid soluble P With sugar beet no similar phenomena were observed The degree of conversion of inorganic phosphates to organic forms was higher on soils with a relatively low nutrient level (CA 74 12189j)

458 Brushkivs'ka, N A, Kalinichenko, V O, Navol's'ka, I I 1967 *Quality of Winter Wheat Grain Depending on Conditions of Nitrate Nutrition* Visn Sil's'kogospod Nauki 10(4) 27 31 (Ukr)

The effect of N fertilizers on the yield of winter wheat and its content of protein, gluten, and hyaloid grain was studied under field conditions at the Chortoriyskiy Experimental Station (Ukraine) The field was divided into sections to which

the basic mineral fertilizers consisting of NH_4NO_3 (N 34%), superphosphate (P_2O_5 20%), and a K salt (K_2O 40%) were added at different times The grain harvested from each of the sections was separately studied N 20 and N 60 kg/ha added to the soil at cultivation time on a background of P 40 and K 40 kg/ha increase the yield and improve the quality of the grain, addition of N 20 to P 40 K 40 kg/ha during the spring season increased the wheat protein content by 0 59 and gluten by 1 8%, the quality indices of the grain were further improved by supplementing P 40 K 40 N 20 with additional N 20 kg/ha during the spring season, P 40 K 40 N 20 applied at the time of soil cultivation + N 20 during the spring season + additional N 20 kg/ha during ear formation increased the wheat content of proteins by 1 98, gluten by 8 42, and the quantity of hyaloid grains by 26% $NaNO_3$ added to the basic mineral fertilizers produced best results in dry years, in years with adequate precipitation, NH_4NO_3 and $NaNO_3$ were of equal value (CA 67 53144q)

459 Bugakov, P S, Lubite, Y I 1968 *Effect of Mineral Fertilizers on the Nitrogen Status of the Leached Chernozem of Krasnoyarsk Forest Steppe and on Wheat Yield* Agrokhimiya, No 6, 19 25 (Russ)

460 Bulatkin, G A 1969 *Nutrient Content of Leached Chernozems of the Tambov Region and Effect of Mineral Fertilizers on Yield and Quality of Winter Wheat* Agrokhimiya, No, 11, 100 6 (Russ) (Tambov Zonal' Agrokhimlab)

The percentage protein content of the grain was increased by P, but decreased by high rates of K (SF 33 3167)

461 Buzinov, P A, Agarkova, N T 1968 *Effect of Nitrogen Fertilizers on Grain Quality of Winter Wheat* Vestn Sel'skokhoz Nauki (Moscow), No 3, 99 101 (Russ) (Vses Inst Maslich Kul'tur)

On leached thick heavy loamy chernozems, low in humus, topdressing with N increased 1,000 grain weight, the crude gluten content, the protein content, and the vitreousness of the grain $(NH_4)_2SO_4$ was more effective than NH_4NO_3 as an autumn topdressing, but NH_4NO_3 was better as a spring topdressing (SF 31 3648)

462 Chesalin, G A, Shirshikov, A P 1969 *Combined Application of 2,4 D and Ammonium Sulfate to Winter Cereals* Vestn Sel'skokhoz Nauki, (Moscow), No 4, 42 6 (Russ) (Vses Inst Udobr Agropochv, Moscow)

In a farm trial in Moscow province, winter wheat plots containing 684 weed plants/m² (95% being *Matricaria inodora*) were treated in spring with granular 2,4 D butyl ester and ammonium nitrate Ammonium nitrate at 200 kg/ha increased grain yields from 17 2 hkg/ha in the control plots to 18 8 hkg 2,4-D at 1 2 kg/ha reduced the fresh weight of weeds from 833 g/m² in the control plots to 84 g and increased grain yields to 20 9 hkg/ha Combined applications of both resulted in grain yields of 25 2 hkg/ha, similar, but slightly lower, yield increases were obtained in a trial on another farm In both trials, 2,4 D amine applied alone was less effective than 2,4 D butyl ester in controlling weeds and wheat yields were increased by 1 2 hkg grain/ha (FCA 23 29)

463 Chesalin, G A, Terent'eva, M I, Gorbunova, S P, Aliev, A M 1968 *Application of Granular 2,4 D Ester in Combination With Ammonium Nitrate to Winter Wheat as a Topdressing in Spring* Khim Sel' Khoz 6(8) 37 40 (Russ) (Vses Inst Udob Agropoch, Moscow)

In field trials with winter wheat grown on different soils in the USSR, 0 9 kg granules of 2,4 D butyl ester + 2 hkg ammonium nitrate/ha applied from the air in spring gave excellent weed control, particularly of annuals, and higher grain yield increases (7 3 8 5 hkg/ha) than when either was applied alone (2 6 4 6 hkg/ha) (FCA 22 38)

464 Darkanbaev, T B, Zairov, S Z 1970 *Effect of Nitrogen Fertilizers on the Protein Content and Baking Qualities of Wheat Grain* Sel' Khoz Biol 5(3) 331 36 (Russ) (Kaz Gos Univ im Kirova, Alma Ata)

For optimum conditions of N fertilization of wheat in southern Kazakhstan, the best results were obtained with preemergent application of 45 kg/ha urea (following previous applications of $P_{45}K_{30}$) followed by spraying with 0 05% $CuSO_4$ (600 l/ha) at the tillering stage This treatment increased the yields of grain from 20 2 to 31 6 q/ha, the content of total protein from 12 0 to 16 2%, and the content of gluten in total proteins from 20 1 to 37 98% The grain also had significantly better baking qualities due to the higher content of gluten and its better physicochemical properties (CA 74 22229m)

465 Davidovskii, G M 1968 *Sowing Rates for Cereals* Vestn Sel'skokhoz Nauki, (Moscow), No 4, 18 25 (Russ) (Lenkoran Selek Stan, Azerbaidzhan)

In field trials in southeast Caucasus, yields of spring wheat (a) cv Norkondik and winter wheat, (b) cv Novoukrainka 83, and (c) Bezostaia 1 were studied in crops sown at 2 5 15 million seeds/ha, unfertilized or given N, P_2O_5, and K_2O each at 60 or 150 kg/ha The maximum yields obtained were 27 6 hkg grain/ha for (a), 33 9 hkg for (b), and 44 3 hkg for (c) High sowing rates considerably increased grain yields without fertilizers, whereas only slight yield increases were obtained with fertilizers When the amount of seed used for sowing was taken into account, grain production in fertilized crops was about equal for all sowing rates except in (c) which responded to fertilizers and sowing rates better than the other two cv Irrigation [applied to (a)] only increased the yields of grain when fertilizers were applied (FCA 21 2302)

466 Demidyuk, M G, Stetsko, L I 1966 *Yield and Grain Quality of Winter Wheat With Regard to Various Methods of Fertilizer Application* Agrokhimiya, No 6, 39-43 (Russ)

Increase of the effectiveness of mineral fertilizers applied scattered (at random) and in the rows was experimentally tested in the conditions prevailing in the western regions of the Ukraine, characterized by an increased and stable moisture level The experiment was carried out in 1963 65 on winter wheat on a soddy podzolic, surface gleyed soil Mineral fertilizers (NH_4NO_3 and K superphosphate) were applied at random (scattered) under the first cultivation which was carried out every year after the August plowing to the depth of 20 22 cm The appearance of shoots was noted on the 12th day after planting, with a variation of 1 2 days, depending on the fertilizer application method Where fertilizer was applied

in the rows, the shoots appeared 1 2 days later, but later on, no differences in the development stages of the plants were observed The fertilization conducted in the fall and the spring showed an increased winter hardness of the plants The highest effectiveness of mineral fertilizer and the best economical return on a fertilizer unit was obtained when the fertilizer was applied in a small quantity in the rows during the planting A single application of fertilizer (at random under cultivation) in all tested dosages (N_{40} P_{40} K_{40}, $N_{50}P_{50}K_{50}$, $N_{60}P_{60}K_{60}$) was not in any way inferior to twofold application (at random under cultivation and in the rows of planting) The application method of fertilizer did not show any substantial effect on the quality of the winter wheat with respect to gluten, crude protein, albumen and starch Increase in fertilizer application decreased the quantity of starch and increased the quantity of protein and albumen (CA 65 11283c)

467 Didychenko, A P 1968 *Effect of Fertilizers Applied in the Row and as a Topdressing on Yield and Protein Content of Grain of Winter Wheat in the Wooded Steppe of the Ukrainian SSR* Agrokhimiya, No 7, 27 39 (Russ) (Ukrain Nauchno Issled Inst Zeml Kiev)

NPK applied in the row without basal fertilizing after peas for seed or maize for silage increased wheat yield, but was less effective with basal fertilizing and even decreased yield when it supplied high rates of N under dry conditions Autumn topdressing with N was ineffective Spring topdressing with or without basal fertilizing with PK increased yield on the right bank of the steppe and in the northeast of the left bank, but not in the central Dnieper Supplementary topdressing at earing increased the protein content of the grain (FCA 21 710)

468 Dmitrenko, P A 1968 *Time Periods for Applying Nitrogen Fertilizers and the Grain Quality of Winter Wheat* Agrokhimiya, No 3, 3 13 (Russ) (Ukrainian Sci Res Inst Agr, Kiev)

N fertilizers increased the protein and gluten content in the kernel and had positive effects on characterizing kernel quality of wheat The influence of N fertilizers depends upon their application time The protein and gluten content of the kernel increased in proportion to the increase in the N rate up to 60 kg/ha under sufficient moisture conditions The application of N fertilizer as a spring topdressing provided a higher yield increase and a larger increase of grain quality The topdressing of wheat with N fertilizers in the heading period increases the content of the protein in the kernel by 0 3 0 6% and increased gluten by 3 0 3 5%, not increasing the yield of kernels substantially The degree of influence summer toodressing has on these indicators depends upon the moisture conditions in the vegetative stage (FA 1 880)

469 Dorokhov B L, Baranina, I I, Makharinets, S N 1966 *Variation of the Photosynthetic Intensity of Winter Wheat With Mineral Nutrition* Agrokhimiya, No 8, 109 16 (Russ)

Photosynthesis was studied during the fall and winter months in Moldavia, where the fall is comparatively warm, the winter sets in gradually, and the wheat is not always covered with snow The wheat was grown in sand cultures in open containers The nutritional variants of the experiment were (1) control 1N, 2P, 1K, (2) 2N, 1P, 1K, (3) 1N, 2P, 1K, (4) 2N, 2P, 1K, and (5) 2N, 2P, 2K The greatest increase in dry matter occurred in November and December The chlorophyll content of the leaves reached a maximum in November and early December, the highest chlorophyll contents were obtained with (4) and (5) The second peak of chlorophyll formation was in May, but it was not as high as the November maximum The intensity of photosynthesis decreased as the growth season progressed, however, in the variants where larger amounts of N and P were used, this decrease was slower The intensity of CO_2 absorption and respiration was measured by covering the wheat plants with transparent plastic At low positive temperatures the CO_2 exchange was above the compensation point, resulting in productive synthesis At negative temperatures the level was below the compensation point, resulting in loss of CO_2, particularly during high light intensities More P in the soil resulted in a more favorable CO_2 balance (CA 65 17647b)

470 Durynina, E P 1970 *Effect of Nutrient Conditions on the Quality of the Grain of Spring Wheat* Vest Mosk Univ Biol Pochvoved, No 6, 101 6 (Russ)

In a 2 yr pot experiment with derno podzolic soil of pH 4 8, the percentage contents of protein and gluten in the grain were greatest when only N was applied, but P and lime increased grain yield Grain and protein yields were highest with NPK (SF 33 3169)

471 Evgrafova, N P, Yarkova, P F 1970 *Phosphorus Compounds in the Germ and Endosperm of Spring Wheat Grain at Various Levels of Nutrition* Agrokhimiya, No 7, 42 9 (Russ) (Ural Nauch Issled Inst Sel Khoz, Sverdlovsk)

Pot experiments were carried out with wheat on sod podzolic clay and dark gray loamy soils N, P, and K were applied in quantities up to 0 1 g/kg of soil The concentration of all P fractions (protein, nucleic acid, phosphatide, acid soluble, and total) in germ was greater than in endosperm When N content increased, the concentration of total P decreased The ratios between different forms of P in the germ were not dependent on the P/N ratio in fertilizers, whereas the content of acid soluble P in the endosperm was dependent on this ratio The best P/N ratio for sod podzolic clay soil is 1 3 1, whereas for dark gray loamy soils it is 0 33 1 1 (CA 73 97954g)

472 Fedorova, N A, Lysenko, N V 1968 *Effect of Nitrogen Fertilization on the Nitrogen Fractions of Leaves of Winter Wheat in Connection With Its Frost Resistance* Rost Ustoichivost Rast, Akad Nauk Ukr SSR, No 4, 189 95 (Russ) (Ukr Nauch Issled Inst Zemled)

The N content (20 90 kg/ha) in the fertilizer (40 kg/ha P_2O_5 and K_2O) markedly influenced the composition of N fractions in the leaves, the crop yield, and the cold resistance of winter wheat Increasing amounts of N enhanced the yield, but decreased the water soluble protein fraction and thereby the cold resistance (CA 69 95521g)

473 Fedorova, N A, Lysenko, N V 1967 *Some Features of Nitrogen and Carbohydrate Metabolism, Frost Resistance, and Productivity of Winter Wheat Versus Nitrogen Fertilization*

Rost Ustoichivost Rast, Akad Nauk Ukr SSR, No 3, 177 87 (Russ)

Catalase activity, mono and disaccharides, and total and protein N were determined in the leaves of a winter wheat grown in 2 yr experiments on 100 m^2 plots of the semipodzol and grassy podzol soil of the Kiev region, with additions of 20, 40, 60, or 90 kg/ha doses of N as NH_4NO_3, and 40 kg/ha doses of both P_2O_5 and K_2O as superphosphate and K salt in all experiments A significant stimulating effect of N fertilizers on all these characteristics as well as on the development and weight of the overground parts and on crop yields was obtained when the moisture content of the soil was adequate The N at 40 kg/ha was considered optimum since higher doses reduced frost resistance (FA 1 447)

474 Filip'ev, I D 1967 *Effect of Nitrogen on Yield and Grain Quality of Maternal Plants of Winter Wheat and on Their Progeny* Agrokhimiya, No 9, 22 7 (Russ) (Izmail Opyt Sta Vses Nauchno Issled Kukuruzy)

On south Ukrainian chernozem, topdressing the maternal plants with N may decrease the yield and quality of the grain produced by their progeny (SF 31 545)

475 Filip'ev, I D, Zhemela, G P, Mel'nichenko, V F 1970 *Effect of Fertilizers on Yield and Quality of Winter Wheat* Agrokhimiya, No 1, 39-43 (Russ) (Izmail Opyt Sta, Vses Nauchno Issled Inst Kukuruzy, Mirnopol'e, Odess Obl)

In a 2 yr experiment on heavy loamy ordinary chernozem, P and PK decreased the contents of protein and crude gluten in the grain and decreased loaf volume A high rate of N increased the protein and gluten contents NP increased grain yield (SF 33 3170)

476 Filonov, V B 1968 *The Effect of Fertilizer NP on the Crop Structure of Some Wheat Cultivars* Vest Sel' Khoz Nauki, Alma Ata, No 10, 31 5 (Russ) (Kazakh Sel'skokhoz Inst, Alma Ata)

In trials in Kazakhstan, winter wheat yield responses to fertilizer NP (30 kg N + 40 kg P_2O_5/ha) varied from 32 to 82% depending on cv and those of spring wheat from 22 to 27% Yield increases per ha were positively correlated with grain weight per ear and with the number of grains per ear (FCA 22 1625)

477 Ganyushina, E V 1969 *Effect of Fertilizers on the Peroxidase Activity of the Winter Wheat at Low Temperatures* Vest Mosk Univ, Biol, Pochvoved 24(1) 92-4 (Russ) (Mosk Gos Univ, Moscow)

Peroxidase activity of wheat, regulating the optimum redox level of plant processes in winter, was studied with soil samples supplemented with four types of fertilizers N, N + P, N + P + K, and N + P + K + Ca_2CO_3 The peroxidase activity was determined in the tiller nodes of winter wheat, before and after freezing the plants at 10°, 20°, 22°, and 25° At the temperatures indicated, peroxidase activity was heightened during the whole investigation period Addition of N fertilizer considerably enhances activity, the effect decreasing in the order given (CA 71 21289g)

478 Ganyushina, E V 1967 *Effects of Soil and Fertilizers on the Utilization of N and Sugars by Wheat Plants During Wintering* Vest Mosk Univ Biol Pochvoved No 4, 105 8 (Russ)

On soil (a) fertilized with NPK or NPKCa all winter wheat plants in the trial survived the winter, 80 90% of plants grown (b) without P fertilizer survived, and (c) when liable Al was added to the substrate, plant survival was 27% Sugar content in tillering nodes in autumn was higher under (b) or (c) than under (a) but was less efficiently used by the plants during the winter (FCA 22 1636)

479 Glukhovskii, A B, Belous, L G, Kononov, N P 1968 *Effect of Fertilizers on the Quality of Winter Wheat Grain* Agrokhimiya, No 9, 39-47 (Russ) (Sel'skokhoz Inst, Krasnodar)

In a field trial on leached chernozem in northwest Caucasus, highest yields and best quality grain were obtained by the application of 60 kg N, 60 kg P_2O_5, and 45 kg K_2O/ha + two dressings each of 30 kg N/ha the first in spring and the second at the early flowering stage This treatment resulted in a mean yield of 40 7 hkg grain/ha during 2 yr compared with 29 6 hkg for the unfertilized control, respective yields of crude protein were 5 7 and 3 7 hkg The content of gluten in the grain was increased from 23 7 to 28 3% (FCA 22 842)

480 Glukhovskii, A B, Polyakova, G D 1968 *Effect of Fertilizers on Winter Wheat Yield and Uptake of Mineral Nutrients on Leached Chernozem in Krasnodar Province* Agrokhimiya, No 11, 26 33 (Russ) (Kuban Sel'skokhoz Inst, Krasnodar)

Winter wheat received different combinations of 90 kg N, 60 kg P_2O_5, and 60 kg K_2O/ha, the P_2O_5, K_2O, and 50% of the N was incorporated into the soil with plowing in autumn and remainder of the N with the presowing cultivations The order of effectiveness of the fertilizers in increasing uptake and contents of various nutrients in different plant parts at the different growth stages, grain yields, and grain protein content was NPK, NP > NK > PK (FCA 22 847)

481 Glukhovskii, A B, Polyakova, G D 1969 *Quality of Winter Wheat Protein and Its Accumulation in Relation to Mineral Fertilizers* Agrokhimiya, No 6, 15 22 (Russ) (Kuban Sel'skokhoz Inst, Krasnodar)

In field and greenhouse trials the dynamics were studied of the fractional composition of protein in relation to plant growth and the effect of N, P, and K on its accumulation In the younger plants albumins prevailed, presenting 70 78% of all N compounds, declining to 13 34% with ripening of the grain The globulin fraction (7 10%) was the most stable one Gliadin content rose from traces in young plants to 4 6% during grain formation Glutelin increased from an initial 6 to 25% during the ripening stage N fertilization promoted higher yields, and increased protein in the grains, especially gliadin and glutelin P fertilization increased yields but lowered the protein content For K fertilization no definite relation was established (CA 71 69750c)

482 Glyan'ko, A K, Kamenkova, L D 1966 *Phosphorus Metabolism in Wheat During Ammonia and Nitrate Fertilization Under Low Soil Temperature Conditions* Ustoich Rast Nizk Polozhitel'nym Temp Zamorozkam Puti Ee Povysh, Mater Simp, pp 166 71 (Russ) (Sib Inst

Fiziol Biokhim Rast, Irkutsk)

Low temperatures in the root zone inhibited the metabolism of P compounds in wheat the contents of total, organic, and inorganic acid soluble phosphates decreased in roots and leaves Unlike nitrates, NH_3 containing fertilizers caused a marked absorption of P and its accumulation in leaves Both roots and leaves of wheat grown at 5 6° contained a great concentration of organic acid soluble phosphates (CA 74 12246a)

483 Golovatyi, V G 1967 *The Effect of Root Temperature on the Uptake of Different Forms of N by Wheat Plants* Izv Akad Nauk Kazakh SSR, Ser Biol, No 5, 38 41 (Russ)

The uptake of ammonium N by wheat plants was greater at 15° C than at 30° n solution culture, whereas the reverse was observed for nitrate N The proportion of ammonium N in relation to the total amount of N absorbed by the plant decreased with plant age (FA 1 1481)

484 Gorodnii, N M, Peterfalvi, A 1969 *Effect of the Systematic Application of Mineral Fertilizers to Dark Gray Podzol Soils on Trace Element Levels in the Soils and Plants* Mikroelem Sel Khoz Med, No 5, 120 24 (Russ) (Ukr Sel'skokhoz Akad, Kiev)

Systematic application of mineral fertilizer for several years plus crop rotation on dark gray podzolized soils increased total and available Mn and Cu Application of double fertilizer doses after liming increased the total Mo, content, while that of available B decreased After mineral fertilization, the Mn and Mo contents in the straw were higher The Mn and Mo content in winter wheat grains increased after double mineral fertilizer dosages, but decreased after fertilization with lime (CA 73 44371h)

485 Gurevich, S M, Boronin, N K 1969 *Effect of Forms of Phosphorus and Nitrogen Fertilizers on Yield and Quality of Winter Wheat Grain on Thick Chernozem Supplying Different Amounts of Moisture* Agrokhimiya, No 5, 3 8 (Russ) (Grakov Opyt Pole NIUIF, Kharkov Obl)

In 2 yr experiments in the Grakov region, basal application of P and particularly of ammophos greatly increased grain yield from wheat grown with and without irrigation on the upturned furrow slice after lucerne, but N had little effect Only N increased the percentage contents of protein and gluten NPK increased the effectiveness of irrigation 1 5 2 0 times (SF 32 3980)

486 Gurevich, S M, Boronina, I I 1968 *Effect of Level of Nutrition on Uptake of Nutrients by Winter Wheat Plants and Nutrient Removal by the Crop* Agrokhimiya, No 8, 40 3 (Russ) (Grakov Opyt Pole NIUIF, Kharkov Obl)

In 1962 66, NK increased the percentage N and K contents of the dry matter of plants on thick chernozem only slightly P, particularly at high rates, increased the P content of the plants, but not in proportion to the amount of P applied The average amounts of N and P_2O_5 removed annually by the harvest were 100 117 and 20 22 kg/ha respectively P removal was greatest when Ca or NH_4 monophosphate was applied, less with $CaHPO_4$ or basic slag, and least with phosphorite The fertilizers had little effect on yield (SF 32 3005)

487 Guseinov, A A 1969 *Effect of N Fertilization on Yield of Winter Wheat in the Azerbaidzhan SSR* Khim Sel' Khoz 7(2) 70 (Russ)

In trials with winter wheat cv Bezostaia 1 on meadow soil during 2 yr, incorporating 30 kg each of P_2O_5 and K_2O/ha with autumn plowing and topdressing with 60 kg N/ha at the tillering stage in spring, increased grain yields to 25 4 30 8 hkg/ha and 1,000 grain weight to 40 1 51 5 g, compared with 19 7 21 7 hkg and 33 5 46 g, respectively, for unfertilized controls, N applied at lower rates was less effective (FCA 22 2441)

488 Gvozdenko, D V 1969 *Fertilization of Winter Wheat Cv Bezostaia 1 in the Karabakh Steppe Zone of Azerbaidzhan SSR* Khim Sel' Khoz 7(2) 27 8 (Russ)

In trials with winter wheat cv Bezostaia 1 on chestnut soil during 4 yr, incorporation of 60 kg N + 60 kg P_2O_5/ha with presowing cultivation increased average grain yields by 9 7 hkg (32 1% increase)/ha, compared with an increase of 12 6 hkg (41 7%) where 30 kg N + 60 kg P_2O_5/ha was incorporated before sowing and 30 kg N/ha was applied as a topdressing (FCA 22 2433)

489 Ioselev, L G 1967 *Effect of N Fertilizers on The Quality of Grain of Winter Wheat PPG 186* Agrokhimiya, No 7, 8 11 (Russ) (N I Inst Sel' Khoz Tsentral' Raion Nechernozem Polocy, Moscow)

In field trials during 3 yr with winter wheat cv PPG 186, N, P, and K were given at various rates and times Maximum grain yields resulted from 80 kg N/ha, but the increases were inconsistent, the grain yields increased by 8 10 hkg/ha in 1 yr and by 2 2 2 9 hkg/ha in another The content of protein in grain and of gluten in flour was highest when the increases in grain yields were lowest The quality of grain decreased when N and P were applied alone (FCA 21 19)

490 Ivanov, P K, Gruzneva, N I 1968 *Effect of Previous Crops and of Fertilizers on Yield, Grain Quality, and Baking Quality of Spring Wheat* Dokl Vses Akad Sel' Khoz Nauk, No 11, 8 10 (Russ) (Saratov Sel Khoz Inst)

Wheat with and without autumn application of NPK was grown after wheat, peas, maize, or millet Wheat as the previous crop decreased yield and impaired grain quality and baking quality Quality was affected more by NPK than by the previous crop (SF 32 3172)

491 Kalmykov, A G, Nedbailo, E P 1965 *Effect of Fertilizer on the Yields in Corn–Winter Wheat Crop Rotation* Sov Soil Sci, pp 681 85 (Eng)

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 e carbonate chernozem soil, corn was very responsive to P and NP 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)

492 Kalyazin, I A, Kaminskii N V 1969 *Effectiveness of Fertilizers on Chernozem Solonetz Soil* Khim Sel' Khoz 7(8) 10 13 (Russ) (Sel'skokhoz Inst, Stravropol)

In trials with wheat on chernozem solonetz soil during 3 yr, yields were increased by 3 4 hkg where 60 kg P_2O_5/ha was applied, by 1 9 hkg with 20 tons farmyard manure/ha and by 4 1 hkg with P_2O_5 + farmyard manure, the average grain yield on unfertilized plots was 15 2 hkg/ha In the subsequent years, yields from the residual effect of P_2O_5, farmyard manure, and P_2O_5 + farmyard manure were increased by 2 8, 3 2, and 4 5 hkg/ha, respectively, yields on unfertilized plots being 19 3 hkg/ha Crops showed no yield response to NK (FCA 23 25)

493 Karandashov, I G 1966 *Effect of Times and Means of Application of Urea and NH_4NO_3 on Yield and Quality of Winter Wheat Grain* Agrokhimiya, No 5, 10 16 (Russ)

The addition of N fertilizers during the early stages of wheat growth (even in higher rates) does not always result in a higher quality grain NH_4NO_3 and urea show the same effect in this respect A good harvest and high quality grain was obtained by combining early spring fertilizer additions with subsequent feeding at the end of the growth phase For optimum results, NH_4NO_3 (60 kg N/ha) is introduced in early spring, followed by plant spraying with urea (30 kg N/ha) at the blooming stage (CA 65 4592g)

494 Karasyuk, I M 1967 *Influence of Topdressing of Winter Wheat "Mironovskaya 808" With Nitrogen Fertilizers on Its Yield and Biochemical Indices* Visn Sil's'kogospod Nauki 10(6) 55 9 (Ukr) (Umans'k Sil's'kogosp Inst, Uman)

Topdressing of wheat was done with NH_4NO_3 or NH_4Cl using 30 kg N/ha in spring or in autumn, on the fields with or without background fertilizing with $P_{30}K_{30}$ The effects of NH_4NO_3 and NH_4Cl on yield were similar Background fertilizing only retarded the development of plants Additional topdressing with NH_4NO_3 or NH_4Cl increased the amount of chlorophyll and sugars 1 5 2 0 fold Topdressing in spring facilitated the development of plants The addition of P and K fertilizers increased the accumulation of chlorophyll and carotene The topdressing with NH_4NO_3 increased the formation of phytochrome more than with NH_4Cl The amounts of total N, gluten, proteins, P, and K increased considerably with topdressing with NH_4NO_3 or NH_4Cl (FA 1 120)

495 Kardinalovskaya, R I 1968 *Effect of Fertilizers on Content of Humus and Basal Nutrients in Gray Podzolized Soil* Sov Soil Sci, pp 1556 561 (Eng) (Ukrain Nauchno Issled Inst Zeml MSKh Ukrain)

Application of dung and NPK to winter wheat, sugar beet, and maize for grain grown in the first part of a rotation prevented impoverishment of the soil and, at appropriate rates, even increased its effective and potential fertility (SF 32 1359)

496 Kartseva, L N 1966 *Changes in the Phosphorus Content in Winter Wheat and Rye Plants as Affected by Fertilizers* Khim Sel' Khoz 4(4) 252 59 (Russ)

Phosphate fertilizer and manure considerably change the content of P compounds (total, inorganic P, and nucleoproteins) in leaves and, to a lesser degree, in the stems of young plants During growth, the P content decreased gradually in the growing organs In the growing organs of winter rye, inorganic P, phosphatides, organic acid soluble P, and nucleoproteins gradually decreased until the end of growth In wheat during flowering, P increased somewhat in the growing organs Fertilization did not change the amount of P in the grain of the plant, but increased the amount of phosphatides and nucleoproteins The P content of leaves, stems, and ears increased In the ear, P is present mostly in organic compounds (CA 65 12817c)

497 Kartseva, L N 1967 *Reutilization of Phosphorus and Nitrogen in Plants of Winter and Spring Wheat* Agrokhimiya, No 2, 21 8 (Russ) (Nauch Inst Udobr Insektofung Samoilova, Moskva)

Uptake of N and P from soil after flowering is considerable by spring wheat and small by winter wheat During ripening, the larger part of the P absorbed during the vegetative period is used to form the phosphates in the grain, this reutilization involves all forms of P Protein and nonprotein N in the leaves, stems, and ears are likewise reutilized in grain formation (SF 30 2070)

498 Kazakov, V E, Gutsal, A I 1968 *Effect of Soil Fertility on Development of Root System of Spring Wheat* Agrokhimiya, No 1, 143-47 (Russ) (Odess Sel' Khoz Inst)

On southern chernozems in the Odessa region, the number and length of roots developing from the coleoptile and the nodes increased as soil fertility was increased by combinations of deep plowing and fertilizer application (SF 31 2112)

499 Khalid, G M 1966 *Bread Baking Qualities of Wheat as a Function of Plant Nutrition* Izv Timiryazevsk Sel'khoz Akad, No 3, 93 7 (Russ)

Russian and an Egyptian soft winter wheat varieties were tested A fertilizer containing N, P, K, and Ca was applied to the Russian wheat plants, while a NP fertilizer was applied to the Egyptian wheat In each instance, application of fertilizer caused a significant increase in the protein in the grain, and with the Russian variety, there was an improvement in the physical properties of the gluten The amounts of individual sugars decreased somewhat on fertilizer application (CA 65 12817b)

500 Khalid, G M 1965 *Effect of the Nutrition on the*

Amino Acid Composition of Proteins and Content of Protein and Nonprotein Nitrogen in Wheat Grain Dokl TSKHA, No 109, Pt 1, 121 27 (Russ)

A significant correlation was found between amounts of fertilizers applied (NPKCa fertilizers and manure in various rations) and yield and N content of grain in two wheat varieties grown under field conditions Resulting increase of yields and N content of grain depends mainly on N fertilization, while relatively smaller amounts of P and K are needed Under optimal fertilizer application (1 1 NPKCa manure) the content of total, protein, and nonprotein N of grain significantly increased in both varieties The amino acid composition of isolated proteins of grain determined by paper chromatography of acid hydrolyzates was about the same in all groups tested, and no changes in relation to fertilizer applications could be observed (CA 65 9676g)

501 Khalid, G M, Safonov, V I, Pleshkov B P 1967 *Composition and Properties of the Protein Complex of Wheat Grain as Affected by Growing Conditions.* Sel'khoz Biol 2(1) 68 72 (Russ) (K A Timiryazev Moscow Agr Acad, Moscow)

The combined application of mineral fertilizers (N, P, K, and Ca) results in the considerable increase of protein content in wheat grain The amino acid composition of the total protein changes little These changes are conditioned mainly by the increase of the content of proteins soluble in 0 05*N* solution of acidic acid and of insoluble proteins Polyacrylamide gel electrophoresis revealed that the composition of soluble fractions of proteins is not the same in different varieties Fertilizers do not qualitatively affect the composition of each fraction The number and the mobility of components of protein fractions remained stable and specific for each variety in all cases (FA 1 931)

502 Khot'ko, A E 1969 *Some Questions of the Topdressing of Winter Wheat on Chernozem Soils* Agrokhimiya, No 3, 25 8 (Russ)

Fertilizer P applied to the surface of the topdressing of winter wheat on chernozem soils is as effective as N fertilizers Autumn application of superphosphate provides more increase in yield than spring application N fertilizers provide their greatest increases in yield when applied before seeding When P and N fertilizers are applied separately, they yield more grain than when applied together The optimal dose of fertilization for winter wheat is 30 kg of P_2O_5/ha K fertilizers have no substantial effect on wheat grain yield on chernozem soils

503 Kiyak, G S, Izdrik V M, Kogut, P M 1969 *Effectiveness of Using Trace Element Enriched Superphosphate on Winter Wheat, Spring Wheat, and Buckwheat* Mikroelem Sel Khoz Med, No 5, 112 17 (Russ) (L'vov Sel'skokhoz Inst, Lvov)

Fertilization with N P_2O_5 K_2O (30 30 30) plus 1 52% Mn, 0 24% B, or 1 1% Zn increased the yield (2 5%) and quality of winter wheat grain, and grain weight per ear is increased With buckwheat, yield increases upon addition of 8 7% Zn, 16 5% B, or 13 9% Mn to the fertilizer were higher than with application of NPK alone Trace elements also increased the grain weight significantly (CA 73 44370g)

504 Kodanev, I M, Shibaev, P N, Maslovskii, V V 1968 *Effect of Split Application of N on Yields and Grain Quality of Spring Wheat* Agrokhimiya, No 3, 20 3 (Russ)

In field trials near Gor'kii, split application of N (30 kg before sowing and 30 kg at the beginning of stem elongation) increased grain yields of wheat from 1,900 kg/ha (60 kg N/ha at sowing) to 2,110 kg/ha Delaying the second application until the ear-emergence stage did not increase yields, but raised the grain protein content from 15 8 to 17 1% (FA 1 1639)

505 Kondrat'ev, I G, Mel'nik, L V 1967 *Effect of Diammophos on the Yield of Crops* Agrokhimiya, No 4, 22 6 (Russ)

The experiments with diammophos (DAP) as a combined NP highly effective fertilizer confirmed its advantage on certain soils and for certain cultures over regular low percentage mineral fertilizers On peat podzol soil for summer wheat and potatoes, DAP increased the yield more than granulated superphosphate (SP) On leached black soil DAP gave higher corn yields On *Asov* (Ukraine) carbonate sandy loam chernozem for summer wheat, on chestnut and soils for corn, sugar beets, and on peat podzol for winter wheat, barley, peas, and oats, an increase of yield is visible The same results were found on chernozem for vegetables and rice and on gray soils for cotton (FA 1 167)

506 Kondrat'ev, I G, Podkolzina, G V 1967 *Effect of Granulated Urea Containing Various Amounts of Biuret on Crop Yields in Field Experiments* Agrokhimiya, No 1, 55 64 (Russ)

Granulated urea with various proportions of biuret was used as a N fertilizer for barley, spring wheat, and corn, and its effect compared with that of NH_4NO_3 Both granulated urea and NH_4NO_3 (60 100 kg/ha) increased the crop yields The presence of biuret in urea up to 2 03% did not inhibit the potential effect of N fertilizer (CA 66 104393j)

507 Kondratyuk, I V 1968 *Effectiveness of Fertilizers Applied to Winter Wheat on Eroded Soils of Cherkassk Province* Agrokhimiya, No 2, 72 5 (Russ) (Sel'skokhoz Opytn Stan, Smela, Cherkass Obl)

The application of 20 kg each of N, P, and K/ha to eroded grey podzolic soil increased the grain yield of winter wheat to 28 5 hkg/ha and grain protein content to 12 64%, compared with 24 5 hkg and 11 61%, respectively, for the unfertilized control, doubling the fertilizer rate raised yield to 31 3 hkg with no effect on protein content The increases in yield and protein content were attributed mainly to N Application of N before plowing or splitting it between plowing/topdressing had a similar effect on yield (FCA 21 1512)

508 Koritskaya, I A 1968 *Transformation of Nitrogen Fertilizers in Soil and the Coefficient of Their Utilization by Spring Wheat in a Field Experiment Using Fertilizers Labelled with N^{15}* Agrokhimiya No 2, 52 61 (Russ) (Inst Fertilizers and Insectofungicides, Moscow)

Coefficients of utilization were $Ca(NO_3)_2$ 37 8%, $(NH_4)_2SO_4$ 30 9%, $CO(NH_2)_2$ 30 3% Use of $(NH_4)_2SO_4$ at tillering did not reduce the coefficient, but when used at flowering the coefficient fell to 20 9% In the year after application, 2 2 7 0% of the N applied was utilized (by oats),

in the plot where $(NH_4)_2SO_4$ had been given at flowering, the recovery was 12 4% After 2 yr the proportions of the original fertilizer N remaining were urea 19%, $Ca(NO_3)_2$ 32 5%, $(NH_4)_2SO_4$ 34 6%, $(NH_4)_2SO_4$ + nitrate inhibitor 40 8% (SF 31 2764)

509 Koritskaya, I A 1969 *Utilization by Spring Wheat of $Ca(^{15}NO_3)_2$ and $(^{15}NH_4)_2SO_4$ Applied at Different Stages of Growth* Agrokhimiya, No 9, 3 7 (Russ) (Nauchno Issled Inst Udobr Insektofung , Moscow)

On derno podzolic loamy soil limed to neutralize the hydrolytic acidity and dressed with PK, wheat utilized 46, 49, and 13% respectively of the N applied at shooting, earing or the milky stage Applications at shooting gave the highest yield In the following year, oats utilized 3 14% of the N applied initially (SF 33 1491)

510 Kudyarov, V N , Rynks, I N 1967 *Diagnosis of Nitrogen Nutrition of Spring Wheat Under Conditions in the Irkutsk Region* Agrokhimiya, No 4, 13 21 (Russ) (E Siberian Biol Inst , Irkutsk)

Maximum unfertilized wheat yields (31 2 q/ha) were obtained on meadow chernozem soil, minimum (10 5 q/ha) on light gray forest soil PK had no effect on growth or yield on either soil, N (30 90 kg/ha) PK affected growth positively, but only on the gray forest soil had it any effect on yield (from 17 23 q/ha with 60 kg/ha N) Nitrification was active in chernozem, especially at midsummer, and a negative correlation was found between N response and nitrate content of the topsoil and subsoil in spring (SF 30 3786)

511 Kuraev, V N 1966 *Effect of Various Concentrations of Fe^{2+} in Water Cultures on Growth and Development of Agricultural Plants* Agrokhimiya, No 12, 110 17 (Russ) (Pochv Inst Dokuchaeva)

In dilute nutrient solution, increasing the Fe^{2+} concentration impaired growth of seedlings of oats and spring wheat, with 9 5 mg/l N, 12 5 mg K_2O, and 7 0 9 3 mgP_2O_5, 4-5 mg FeO was harmful and 10 mg stopped growth Spraying the seedlings with P_2O_5 did not decrease the toxicity of high concentrations of Fe^{+} Th first toxic effect of high concentrations of Fe^{2+} was to stop root development, Fe^{2+} absorbed by the plants decreased development of roots not directly in contact with excess Fe^{2+} (SF 30 2094)

512 Lakalina, O I 1970 *Effect of Soils and Fertilizers on the Yield and Quality of Winter Wheat* Agrokhimiya, No 12, 96 7 (Russ) (Mosk Univ)

Greenhouse trials were carried out on well cultivated and poorly cultivated turf podzolic soils The relationship was studied between NPK fertilization and the quality of grain with regard to protein and starch content Liming and addition of Mn and Al sulfates were tested Application of NPK fertilizers improved plant growth on both soils and increased grain protein content The grain on well cultivated soil contained more albumin and globulin than on poorly cultivated s s (CA 74 63517x)

513 Lakalina, O I 1969 *Various Nitrogen Topdressing of Winter Wheat and Its Effect on the Quality of the Seeds* Vest Mosk Univ , Biol , Pochvoved 24(3) 92 6 (Russ)

In 2 yr experiments winter wheat was grown on two kinds of turf podzol with a base saturation of 91 and 67 3%, respectively, and P_2O_5 (soluble in 0 5*N* HOAc) of 17 9 and 9 3 mg/g soil (detailed data given), with a direct spraying, at the beginning of flowering, of 30 kg N/ha as a 2% solution of NH_4NO_3 and urea, respectively For the daily doses the N supply of the soil was considered There was no corresponding increase in the crop yield with either NH_4NO_3 or urea, but both resulted in an increase of 1 17 1 42% of the total protein of the grain, the grain from the poorer soil profited more by the treatment In the first year the NH_4NO_3 treatment was more effective than urea Both N forms resulted in a decrease of the grain starch by ~ 1% The ratio, gliadin/glutenin in the case of NH_4NO_3 was 1 39, with urea 1 23 The total gluten was raised by NH_4NO_3 to 28 8 and 30% in 2 yr, and by urea to 26 and 29 1%, respectively The flour strength for baking was raised by NH_4NO_3 to 480, by urea to 509 joules (control 349) Other baking criteria showed no change (CA 71 80346w)

514 Lamanov, A A 1968 *Application of Zn, Cu and Mn Fertilizers to Spring Wheat on Forest Steppe Lands of the Perm' Province* Agrokhimiya, No 2, 76 9 (Russ) (Sel'skokhoz Inst , Perm')

The yield increases resulting from the presowing application of different microelements with 60 kg each of N and P, plus 45 kg K/ha to spring wheat ranged from 2 2 to 6 hkg grain/ha, Zn gave the highest increases and Cu the lowest Zn raised the grain Zn content to 23 8 30 1 ppm, compared with 17 1 ppm for the unfertilized control The other microelements had little effect on Zn content (FCA 21 1517)

515 Lazurskii, A V , Lebedinskaya, V N 1969 *Methods and Dates of Application of Mineral Fertilizers for Winter Wheat in the Ukrainian Wooded Steppe* Agrokhimiya, No 10, 21 31 (Russ) (Ukrain Nauchno Issled Inst Zeml , Kiev)

Results reported in the literature and experiments in the Ukraine in 1957 68 show that on most soils split application does not improve the yield and quality of the grain more than basal application does (SF 33 2351)

516 Lebedev, S I , Khlyastikov, G P 1968 *Carbon Metabolism in Winter Wheat Plants and Frost Resistance* Nauk Pr , Ukr Akad Sil's'kogospod Nauk No 4, 24 30 (Ukr)

The $^{14}CO_2$ uptake and distribution into soluble and insoluble carbohydrates, free amino acids, and proteins was determined with winter wheat plants in pots of soddy podzol soil with added P_2O_5 (as KH_2PO_4) 0 15, K_2O (KCl) 0 15, and N (NH_4NO_3) 0 20 g/kg Plants were kept at 1, 2, or 13 14°, at various levels of illumination, and with or without added N Decreasing the temperature increased the ratio of ^{14}C activity in free amino acids to that in protein, and also the ratio of soluble sugars to starch, a similar situation occurred in shaded plants compared with unshaded, both at 13 14° Frost resistance in wheat may result from the accumulation of amino acids and soluble sugars in the plant sap, thus lowering the freezing point (CA 71 88489r)

517 Levenets, P P , Yurko, E P 1970 *Determination of the Nutrient Requirements of Plants Grown in Chernozems of the*

Ukrainian Forest-Steppe Zone Diagn Potrebnosti Rast Udobr 284 88 (Russ) (Ukr Nauchno Issied, Inst Pochvoved Agrokhim im Sokolovskogo Kharkov)

With corn and winter wheat grown on the title soils it was established that the Tserling method of sap analysis in he earlier phases of plant development provides a practically exact evaluation of the degree of provision of the plant with N, P, and K A more complete insight is gained for the whole growth period by combining the leaf analysis with that of the soil Introducing small fertilizer doses in the earlier growth phases facilitates the uptake of nutritional elements by winter wheat In the later periods the nutritive contents of the plants on soil with and without a fertilizer basis approach each other (CA 74 31111u)

518 Lipkind, I M 1967 *Efficiency of Fertilizers in Tadzhikistan Soils* Agrokhim Kharakter Pochv SSSR, pp 259 87 (Russ)

A survey of available data on the effects of fertilizers on cotton and wheat crops grown on various types of Tadzhikistan soils In boghara areas the average wheat yield of 10 12 centners/ha was doubled by P, N, and K fertilizers, and on moderately eroded soils it was increased by 2-4 centners/ha with N and P fertilizers A great diversity of effects of fertilizers on cotton is noted n various types of soil Mineral fertilizers are especially effective (CA 68 2318n)

519 Lomnitskii, Y E , Roiko, A V 1970 *Effect of the Forms of Nitrogen Fertilizers on the Yield and Quality of Winter Wheat Grain* Agrokhimiya, No 4, 24 8 (Russ) (Nauch Issled Inst Zemled Zhivotnovod Zapad Raionov Obroshino)

Winter wheat grown in podzolic soils was fertilized with P and K (45 kg/ha each) and N (30 or 60 kg/ha) of various forms [NH_4NO_3, $NaNO_3$, $Ca(NO_3)_2$, NH_4Cl, $(NH_4)_2SO_4$, or urea] in autumn The addition of N to basic fertilizers increased the yield of wheat by 18 22% A better effect was obtained by addition of 30 kg N/ha at the time of ear formation N fertilization increased the content of proteins and gluten in grain by 10 20 and 20-40%, respectively, and also the content of chlorophyll in the leaves No substantial differences in the effectiveness of various N fertilizers were noted (CA 73 44337b)

520 Mikhalev, N I , Volleidt, J P 1969 *Effect of Mineral Fertilizers on Yield and Quality of Grain of Different Varieties of Winter Wheat* Agrokhimiya, No 12, 30 6 (Russ) (Tsentral' Oypt Sta , VIUA Barybino Moskov Obl)

When NPK was applied to derno podzolic soil in the Moscow region in 1966 68, only high rates of mineral N increased the percentage contents of protein and crude gluten in the dry matter of the grain Improved NP nutrition increased the percentage contents of gliadin and glutenin in the grain (SF 33 2347)

521 Mineev, V G , Kalyazin, I A 1966 *Significance of N in the Fertilization of Winter Wheat on Chernozem.* Agrokhimiya, No 4, 21 5 (Russ) (Agrochem Inst , Voronezh)

Tests on plots of 250 500 m^2 were made with winter wheat N, sugar, protein, and gluten were determined in wheat planted after peas or corn and with or without fertilizers The best results were obtained after corn, along with NPK (30 45 30), the wheat sown after peas had less N, indicating that peas do not provide sufficient amounts of N for wheat The yield of wheat after peas was 23 1 q/ha, after corn 19 8 q/ha (without fertilizing) PK (45 30) increased the yield of wheat after peas by 6 q/ha, as well as the protein and gluten in the grain Fertilizing with NPK (60 45 30) after corn increased the yield of wheat by 8 4 q/ha, and the increased yield of protein and gluten was greater than before It was necessary to use complete NPK fertilization with wheat to obtain good yields (CA 65 2953c)

522 Mishin, P Y 1967 *Dynamics of Copper and Zinc in Summer Wheat in the Stages of Development* Agrokhimiya, No 2, 62 6 (Russ) (Sel'skokhoz Inst , Orenburg)

Dynamics of Cu and Zn in summer wheats Albidum 43 and Kharkovskaya 46, under field conditions, on Southern chernozem soil, of medium deep profile, clay loam texture on yellow brown, calcareous, loamy clay deluvium deposit, was studied The content of N in the soil was medium, of P low, and of K very high Cu and Zn were extracted from the soil and plants with 1*N* HCl and 1*N* NH_4OAc, respectively, and determined with dithizone The content of the trace elements, in all parts of plants, increased continually during growth The highest content of the trace elements was observed during germination The uptake of the trace elements was better in Kharkovskaya 46 than in Albidum 43 During growth the content of the trace elements in the root was always higher than in the aerial parts of plants (CA 67 2420u)

523 Mosolov, I V , Semikhov, V F 1967 *Effect of Mineral Fertilizers on Winter Wheat Under Conditions of Irrigation* Khim Sel' Khoz 5(4) 245-48 (Russ)

Field experiments were done in calcareous chernozem of northern Caucasus With irrigation and using beans as the preceding crop, the best fertilizers were phosphate ones Under these conditions, the N fertilizer may have a positive influence if it is added during wheat earing The phosphate fertilizers must be applied (at once) up to 90 kg of P_2O_5/ha (CA 67 32023j)

524 Mosolova, L V 1970 *Effect of the Nitrogen Nutrition Level on the Formation and Quality of the Grain Yield of Winter Wheat* Agrokhimiya, No 4, 18 23 (Russ) (Vses Nauch Issled Inst Udobr Agropochvoved , Moscow)

The yield of winter wheat with an increased content of N in grain depended on the supply of N, especially during grain formation Experiments with ^{15}N showed that N of the late fertilization was incorporated mainly into gliadins and that ammonia N was better utilized than nitrate N The N content of wheat leaves and stems reached maximum values at the end of their growth, in grain, it was maximum at the time of harvest At shooting, wheat sap contained 31 8 34 0 mg amino acids/100 ml, mainly arginine and asparagine (23 1 25 4 mg/100 ml) (CA 73 44336a)

525 Muterko, N I 1966 *The Effect of Mineral Fertilizers on Spring Wheat Yield in the Zone of Sufficient Moisture of the Northern Kazakhstan Territory* Khim Sel' Khoz 4(11) 815 16 (Russ) (Soil Inst , Tselinograd)

NH_4NO_3, superphosphate, and 40% K salt were applied in various combinations P (60 kg/ha) or NPK (45, 60, and 45 kg/ha, respectively) were effective in increasing wheat yield When P was not present in the mixture, plants suffered from P deficiency (CA 66 45858q)

526 Nazarov, Y I 1967 *Application of Fertilizers to Spring Wheat in Kokchetav Province* Khim Sel' Khoz 5(12) 58 60 (Russ)

The soils of Kokchetav province in Kazakh SSR are highly deficient in P Application of 40 kg P/ha to spring wheat increased the grain yield by 3 5 hkg/ha N was effective when applied to the third wheat crop after fallow (FCA 21 1513)

527 Nazirov, N N, Musaev, K 1970 *Uptake and Metabolism of Radioactive Phosphorus in Spring Wheat Plants With Various Water Requirements* Dokl Akad Nauk Uzb SSR 27(4) 53 5 (Russ)

Pot experiments were carried out at two soil moisture levels (40 and 60%) on a typical serozem fertilized with P_2O_5, K_2O, and N at levels 5 g each/8 kg soil Radioactive P was added as $Na_2H^{32}PO_4$ The content of ^{32}P in leaves, stems, and roots was determined at the stage of 1 2 leaves, tillering, shooting, and milky ripeness The most intensive ^{32}P uptake by plants was found in the initial phase of development With plant growth, the rate of ^{32}P uptake by various organs gradually decreased, reaching a minimum at blooming ^{32}P uptake and metabolism, in the initial growth stage were much more rapid at 40% than at 60% soil moisture In later growth stages almost no differences were found between the soil moisture variants, the uptake and metabolism of ^{32}P in the final phases were often more intensive at 60% than at 40% soil moisture (CA 74 75661c)

528 Neugodova, O V 1967 *Effectiveness of Vermiculite as Magnesium Fertilizer* Agrokhimiya, No 1, 117 22 (Russ)

The effectiveness of various Mg fertilizers was compared in laboratory experiments Mg of vermiculite can be utilized by various plants but its availability is substantially lower than that of easily and difficultly soluble Mg fertilizers ($MgSO_4$, schoenite, Mg phosphate, and serpentine) In spite of the enhanced dose of vermiculite (calculated on a MgO basis) the content of Mg in watercress and winter wheat, and the yields of watercress, rye, sunflower, and millet was lower than that of plants fertilized with other Mg fertilizers, although higher than that of controls (without Mg fertilization) (CA 66 104396n)

529 Novikov, M N 1968 *Effect of Mineral Fertilizers on Yields of Spring Wheat Grown on Meadow-Brown Soils in Khabarovsk Province* Agrokhimiya, No 10, 129 30 (Russ) (Zon Agrokhim Lab, Khabarovsk)

In field trials in Khabarovsk province, Russian Far East, N at 30 kg/ha gave grain yield increases of 1 2 and 2 0 hkg/ha in 1965 and 1966, respectively, P_2O_5 at 60 kg/ha gave increases of 6 3 and 2 9 hkg, and NP increases of 6 8 and 10 0 hkg/ha (FCA 22 846)

530 Okhrimenko, M F 1966 *Effect of Trace Elements on Nitrogen Changes in Plants* Mikroelem Sel Khoz Med, Akad Nauk Ukr SSR, pp 117 19 (Russ) (Inst Plant Physiol, Kiev)

Peas and winter wheat were grown on a chernozem meadow podzol and fertilized with NPK (control) or NPK plus B or Zn The total N content of the leaves was determined at intervals during the growing season Total N was highest early in the growing season and, in peas, decreased toward the end of the season In winter wheat, the total N content sometimes increased again near the end of the season Fertilization with B or Zn increased the total N content of peas in comparison with the control In winter wheat, total N was higher at the beginning and end of the season, but decreased to a value less than that of the control during the middle of the growing season The total N content varied from 2 12% to 2 90% in winter wheat and from 1 50% to 3 05% in pea leaves Weather conditions probably caused large variations in the total N content (CA 66 10270h)

531 Pavlov, A N, Kolesnik, T I, Lobanova, N V 1966 *Effect of Late Top and Root Dressing With Nitrogen on the Accumulation of Protein in Wheat and Oat Grain* Agrokhimiya, No 11, 33 8 (Russ)

Pot tests (5 kg of soil) were made on summer wheat by spraying it three times with a 5% urea solution with addition of 0 1% OP 7 wetting agent during three stages of growth earing, blooming, and milky ripeness The later N was applied, the more the protein content increased (in the third stage 34% greater than in the control) Increase of the protein content was the greatest in proteins soluble in alcohol, less in protein soluble in alkalies, and the least in water soluble protein Oats were investigated by spraying three times with a 5% urea solution in the blooming grain forming stage or by applying 750 mg N/pot to the soil In both cases the wt of 1,000 grains increased only slightly, the leaves were dark green Root dressing gave a higher content of protein than topdressing (CA 66 28043c)

532 Pavlov, A N, Kolesnik, T I, Safonov, V I 1968 *Study of the Effect of Nitrogen Fertilizers on the Gliadin Component of Wheat, Using Electrophoresis* Agrokhimiya, No 4, 144-46 (Russ)

Gliadin was determined by vertical electrophoresis in a polyacrylamide gel The increase in protein content of the grain after late N fertilizing was not accompanied by any change in the numbers or proportions of gliadin components (SF 31 3649)

533 Pchelkin, V U, Smirnova, R S 1970 *Comparative Effectiveness and Balance of Potassium in Field and Fodder Crop Rotations on Sod Podzolic Soils of the Moscow Region* Agrokhimiya, No 4, 43 9 (Russ) (Vses Inst Udobr Agropochvoved, Moscow)

The titled study was made on rotating field and forage crops during 1962 67 The field crops were cultivated in the order winter wheat, potatoes, winter wheat, spring wheat and clover, and finally clover alone The fodder crops were corn, beet, and feed grade beans The agrochemical features of the soil, climate of the region, and details of treatment of the soil with limestone and NPK fertilizers for each crop are mentioned The material balances of NPK nutrients for each crop is given Use of K fertilizer greatly increased the yields for both types of crops When cattle manure was used, the

effectiveness of K on the yield decreased sizaoly Percent utilization of K ranged 32-44% for the field crops, and was 50% in the absence of limestone, for the fodder crops it was ~50% For the types of crops, the soil fertility increased progressively with further cultivation Stoppage of K fertilizers in feed doses immediately reduced the yield of the next crop in both cases, and also reduced the content of available K in the soil in all cases The plants did not remove all K fed to the soil, and this led to mobilization and consequent accumulation of K in certain soil layers An experimental procedure is described to determine such accumulation of K in these soils (CA 73 35085u)

534 Peisakhov, U I 1968 *Effect of Phosphorus on the Yield of Bezostaia 1 Wheat Under Various Irrigation Regimes* Agrokhimiya, No 5, 110 12 (Russ) (Vses Inst Udobr Agropochvoved, Moscow)

In trials with wheat during 2 yr, soil with different moisture contents and a P_2O_5 content of 7 8 mg/kg soil, received different rates of N and P Grain yields were increased by 85 96% from applying 120 kg N plus 120 kg P_2O_5/ha where moisture content was 80% of field capacity, by 102 105% at 70% moisture content and by 59 59% at 60% moisture content Decreasing the P_2O_5 rate to 60 kg/ha increased yields at the above three moisture levels by 72 83%, 63 95%, and 35 52%, respectively There were no differences in yield at different moisture levels from applying 60 kg N/ha Yield was not increased from applying different rates of N and P where soil P_2O_5 content was >40 mg/kg soil (FCA 21 2309)

535 Pershak, I T, Burlyai, L I, Velikii, A A 1969 *Effectiveness of Fertilizers Applied to Winter Wheat in the Cherkassy Province* Khim Sel' Khoz 7(2) 23-4 (Russ) (Cherkass Sel'skokhoz Opytn Stan, Khristinovka)

In trials on chernozem soil, winter wheat cv Mironovskaya 808 receiving 60 kg N + 45 kg P_2O_5 + 45 kg K_2O/ha yielded 47 3 hkg grain/ha, 12 4% protein and 30 6% gluten, compared with 41 9 hkg, 11 6%, and 26 6%, respectively, for unfertilized controls (FCA 22 2436)

536 Petukhov, M P, Piskunov, A S 1969 *The Time of Application and Depth of Placing Mineral Fertilizers Under Spring Wheat in the Middle Urals* Agrokhimiya, No 1, 17 22, (Russ) (Sel'skokhoz Inst Perm)

The effect of 60 kg P_2O_5 + 45 kg K_2O/ha, alone or plus 60 kg N/ha incorporated either during autumn plowing, or presowing cultivations in spring, on grain yields of spring wheat on two soils was compared in field trials in 1965 67 On dernovo podzolic soil, application in autumn and spring gave similar increases in yield, but on gray forest soil spring applications showed greatest effectiveness (FCA 22 1630)

537 Pokrovskaya, N F, Morozova, G I 1969 *Amino Acid Composition of Wheat Gluten* Agrokhimiya, No 12, 17 22 (Russ) (Vses Inst Rast, Leningrad)

N, P, and K in various combinations affected the amino acid composition of the gluten of eight varieties of wheat (SF 33 2348)

538 Poltavskaya, I A, Kovalenko, V D 1968 *Effect of Diammophos on the Yield of Summer Wheat Growing on Chernozem Soil of Northern Azov Area* Agrokhimiya, No 11, 3 7 (Russ)

539 Polyakova, G D, Glukhovskii, A B 1970 *Effect of Foliar Spraying on Accumulation of Nitrogenous Substances by Winter Wheat* Agrokhimiya, No 1, 26 32 (Russ) (Kuban Sel' Khoz Inst, Krasnodar)

In a field experiment in which wheat on leached chernozem in the Krasnodar region received a basal application of NPK, spraying with urea during flowering increased the protein content of the grain without altering the relative proportions of the various protein fractions or of protein N and nonprotein N In sand cultures with complete nutrient medium, foliar spraying and particularly topdressing, increased the protein content of the grain and increased the percentage of gluten in the protein The percentage content of non nitrogenous substances in the dry matter of the sub aerial mass increased shortly after spraying, whereas the content of nitrogenous compounds of P increased (SF 33 3173)

540 Porshnev, G A, Lesogorova, A I, Muzychkin, E T 1968 *Effect of Mineral Fertilizers on Yield and Quality of Spring Wheat* Agrokhimiya, No 7, 11 16 (Russ) (Kursk Sel' Khoz Sta, Pochv Inst Dokuchaeva)

In 2 yr experiments on typical chernozem, NP, NK, and NPK increased the protein and gluten contents of the grain The protein content was higher in a dry than in a wet year The amounts of N, P_2O_5, and K_2O removed by the grain were 3 22-4 19 kg/q, 0 78-0 88 kg, and 1 58 2 09 kg respectively (SF 31 711)

541 Presnyakov, N A 1969 *The Effectiveness of N Fertilizers on Winter Wheat Grown After Different Catch Crops on Chernozem Soil* Khim Sel' Khoz 7(2) 9 13 (Russ) (Sel'shokhoz Inst, Voronezh)

From the residual effects of 45 kg P_2O_5 + 30 kg K_2O/ha applied to catch-crops of peas or vetch/oat mixture and 60 kg each of N + P_2O_5 + K_2O/ha applied to maize for silage or potatoes, the 3 yr average grain yields of wheat cv Belotserkovskaya 198 were increased by 8 9, 2 8, 3 7, and 2 3 hkg/ha, respectively, compared with yields of 28 2, 24, 23, and 30 3 hkg/ha where wheat followed preceding crops receiving no fertilizer Wheat receiving 30 kg N + 45 kg P_2O_5 + 30 kg K_2O/ha gave yields of 43 1, 39 6, 38 3, and 42 3 hkg/ha after fertilized preceding crops compared with 36 7, 35 9, 31 8, and 36 7 hkg/ha after unfertilized preceding crops N was more effective when applied as liquid ammonia rather than ammonium nitrate (FCA 22 2442)

542 Prokoshev, V N, Nassonova, K P 1968 *Phosphorus Fertilizers in a Long Term Field Test* Vliyanie Dlitel'nogo Primen Udobr Plodorodie Pochvy Prod Sevooborotov, No 3, 91 114 (Russ) (Solikamsk Sel'skokhoz Opyt Sta, Solikamsk)

Winter rye, potatoes, spring wheat, clover with grass, flax or wheat, oats, and clean fallow were regularly rotated in an 8 yr cycle for 24 yr The fields were fertilized with NH_4NO_3, KCl, and one of the following P fertilizers superphosphate (60 or 30 kg/ha), precipitate ($CaHPO_4$), Thomas slag, ground phosphorite, ammophos [$(NH_4)_2HPO_4$] (60 kg/ha each), or their combinations Control fields were left without any

mineral fertilization or were treated by lime or lime + manure Without any fertilization, or in fields fertilized by N and K only, the yields of all crops gradually decreased and in the third cycle they dropped to 50 60% of the original value Manuring the fields once in a cycle partially prevented the decrease P fertilizers were more effective the decrease in the third cycle was only 8 10% Thomas slag and precipitate $CaHPO_4$ produced better response in crop yields than acidic P fertilizers, especially in clover and wheat Liming caused stable increases in yields of all crops A simultaneous application of manure substantially decreased the effectiveness of P fertilizers The long term fertilization increased soil pH in limed fields and soil P in all cases (CA 71 80348y)

543 Prutskov, F M 1966 *Effect of Fertilizers on Winter Wheat Frost Hardiness* Agrokhimiya, No 7, 37-41 (Russ) (Fruit Inst, Michurinsk)

Winter wheat was fertilized with N, P (as superphosphate), and K (20, 60, and 45 kg/ha) or with powdered phosphorite (60 kg/ha), control fields were not fertilized Fertilization decreased wheat mortality in the winter period and increased total sugar content Plants growing in fertilized fields were also more frost resistant (tested at 23°) Fertilization with powdered phosphorite was more effective than the full NPK fertilization (CA 65 12815g)

544 Prutskov, F M 1967 *Winter Hardiness of Winter Wheat on Fallow as Dependent on Fertilizers* Agrokhimiya, No 1, 78 80 (Russ) (I V Michurin Plodoovoshch Inst, Michurinsk)

Winter wheat was sown on August 15th or 25th or September 5th and fertilized with NP fertilizers, either with or without manure (control field without any fertilization) Independent of fertilization, the dry matter weight of aerial parts and roots, the number of primary and secondary roots, and their length were highest in wheat sown out on August 15th and lowest September 5th The addition of manure to mineral fertilizers increased all the values, the viability of plants in winter, and yields, regardless of the time of sowing (CA 66 104394k)

545 Rabets, V S 1969 *Effect of Fertilizers on Protein Production by Different Varieties of Winter Wheat* Agrokhimiya, No 11, 54-60 (Russ) (Univ Donets)

In a 3 yr experiment on leached chernozem in the Voronezh region, accumulation of protein and gluten in the grain of wheat preceded by peas or vetch oats was greatest when mineral fertilizers were applied by a combination of application under the plow, row application, and autumn topdressing N was the important fertilizer (SF 33 3168)

546 Razdymalin, I F, Rabets, V S 1967 *Use of Fertilizers for Various Varieties of Winter Wheat* Khim Sel' Khoz 5(3) 9 10 (Russ)

Field experiments arranged on leached chernozem were carried out to determine the effect of fertilizers on four different varieties of winter wheat All combinations of the NPK nutrients used in the experiments increased the yield of winter wheat regardless of the time of application, however, the effect varied according to the variety of wheat Chemical analysis of the grain produced from the experimental plots showed a considerable increase of the content of protein and gluten when N fertilizer was applied (CA 67 53126k)

547 Revenskii, V A 1969 *The Sources of Nitrogen Fertilizers Under Spring Wheat on the Chestnut Soils of Buryatiya* Agrokhimiya, No 7, 29 33 (Russ) (Inst Estestv Nauk, Ulan Ude, Buryatsk Obl)

In trials in southeast Siberia with spring wheat on chestnut soil during 3 yr, applying four forms of N at 60 kg N/ha with autumn plowing or spring cultivation increased average grain yields by 4 9 7 2 and 4 7 3 hkg/ha, respectively, yields on unfertilized plots were 14 5 and 12 5 hkg/ha Higher increases in yield resulted from applying N as ammonium sulfate than as ammonium nitrate, urea or liquid ammonia with autumn plowing, and as ammonium nitrate with spring cultivation N increased yields by increasing tillering and number of grains/ear, when applied with autumn plowing, it also increased 1,000 grain weight Straw grain ratio was higher on the plots receiving N with autumn plowing than on unfertilized plots, but the reverse held when N was applied with the spring cultivation (FCA 23 26)

548 Salcheva, G, Vaklinova, S, Gramatikova, K 1966 *Some Features of Phosphorus Metabolism of Winter Wheat During Low Temperature Hardening* Sov Plant Physiol 13 880 86 (Eng)

The changes in P fractions which occur during hardening were studied During the first and especially during the second phase of hardening, the incorporation of ^{32}P increased in the Ba soluble fraction and abruptly decreased in the phosphoprotein fraction of winter wheat plants Short time low temperature treatment (7°) decreased the rate of accumulation of ^{32}P in the insoluble nucleotide containing fraction from the leaves and roots of winter wheat (CA 66 44293q)

549 Sdobnikova, O V 1966 *Efficiency of Fertilizers and Their Application in North Kazakhstan* Vestn Sel'khoz Nauki (Moscow) 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)

550 Sechnyak, L K 1969 *Effect of Fertilizers on Chemical Composition of Grain of Different Varieties of Winter Wheat* Agrokhimiya, No 2, 46 53 (Russ) (Krym Sel' Khoz Opyt Sta, Klepinino)

In a 3 yr experiment with nine varieties on Crimean southern chernozems, N always increased the percentage content of protein in the grain, but different varieties reacted differently to different combinations of N, P, and K (SF 32 3159)

551 Semenenko, G I, Krasil'nikova, L A 1966 *Effect of Mineral Nutrients on RNA and Protein Metabolism in the Cytoplasmic Structures of Plant Cells* Sov Plant Physiol 13 577 80 (Eng) (State Univ, Kharkov)

The rate of glycine ^{14}C incorporation into RNA and

proteins, and the amount of these compounds in the chloroplast, mitochondrial, and microsomal fraction, from wheat, potato, and sugar beet plants, increased when the fertilizer NPK (60 45 45) was added to the soil prior to sowing or during the vegetative period The amount of RNA and the incorporation of glycine ^{14}C into proteins varied in a parallel manner and the largest effect of NPK on RNA and protein metabolism was in the chloroplast fraction (CA 65 17648d)

552 Shaposhnikova, I M , Makarova, L I , Tikhii, I K 1967 *Effect of N Top Dressings on Winter Wheat Grown on Chernozem in the Rostov Province* Agrokhimiya, No 7, 3 7 (Russ) (Donsk Zonal N I Inst Sel' Khoz , Rassvet)

Winter wheat cv Bezostaia 1 received 0, 20, 40, and 80 kg N/ha at different times The application of 40 kg N/ha in spring (April) gave the highest increase (3 2 hkg/ha) in grain yields, splitting the application between spring and the ear forming stage (May June) gave similar increases Forty kg N/ha, applied as a single or a split dose, raised the contents of crude protein by 0 4-0 6% and 0 8 1 1%, respectively (FCA 21 15)

553 Shemetov, V E , Drogalin, P S 1968 *Preceding Crops and the Root System of Winter Wheat* Vest Sel' khoz Nauki, (Moscow), No 8, 120 21 (Russ)

In three rotations on heavy leached Kuban chernozem with and without application of fertilizers to the crops preceding the main winter wheat crop, $N_{135}P_{90}K_{45}$ was applied to this winter wheat except when it was preceded by lucerne or peas Wheat yield was related to root weight in in the top 40 cm In the unfertilized rotation, root formation was best after legumes, and in the fertilized rotation it was best after row crops (SF 32 721)

554 Shilova, E I , Bronnikov, V I 1969 *Influence of Potassium on the Use of Fixed Ammonium by Oats and Wheat* Dokl TSKHA, No 154, 177 81 (Russ)

Oats and wheat were grown in pots filled with 2 6 kg dry soil Soil was fertilized with 0 4 g N in the form of $(^{15}NH_4)_2SO_4$, 0 5 g P_2O_5 as $Ca(H_2PO_4)_2 H_2O$, and 0 6, 1 2, or 1 8 g K_2O as K_2SO_4 The labeled NH_3 and K contents were determined in the soil at the beginning and at the end of plant growth, and also in the plants Maximum crops of both cultures were obtained after the addition of a single dose of K_2SO_4 (0 6 g) The N uptake coefficient from the fertilizers was ~51% Application of double K_2SO_4 doses considerably decreased the crop and the N uptake from the fertilizers by the plants, especially by wheat Following application of triple K_2SO_4 doses, uptake of labeled N by the wheat plants did not occur The contents of labeled NH_3 in the soil changed insignificantly in all variants (CA 73 87025r)

555 Sidorina, L V 1968 *Local Application of Ammonium Phosphates and the Effectiveness of Their Nitrogen* Agrokhimiya, No 8, 13 18 (Russ)

556 Spivak, K , Grabovskii, N , and Mel'nik, K 1968 *Mineral Fertilizers and the Yield of Winter Wheat on Different Soils (According to the Findings of Field Tests Performed at Regional Agrochemical Laboratories in the Ukraine)* Zernovye Maslich Kul't 8 22 3 (Russ)

557 Stepanov, N S 1965 *The Action and Effect of Urea on the Yield and Quality of Wheat* Agrobiologiya, No 3, 425 30 (Russ) (Agr Inst , Ul yanovsk)

Foliar application of urea was tested on five wheat varieties The maximum amount of urea that could be applied before the appearance of leaf burn was 25 kg/ha Application of 5% urea along with NPK in the soil during tillering produced the highest yield and increased the protein in the grain and the amount of protein/ha for most varieties Application of urea at the rate of 12 kg/ha by airplane increased the grain yield and the protein content by about 5% Foliar application of urea increased the grain yield 50 90 kg/ha and the protein content 37 54 kg/ha (CA 63 13989c)

558 Sukhinina, L A 1970 *Leaf Diagnostics of Wheat Nutrition in Gray Forest Soils of the Ob River Plateau* Diagn Potrebnosti Rast Udobr , pp 267 71 (Russ) (Lab Plodorodiya Pochv, Biol Inst , Novosibirsk)

The forest soils were adequately fertilized with P (20 50 mg P_2O_5/100 g soil), insufficiently fertilized with N (traces to 1 mg as NO_3), and scanty fertilized with K (exchangeable K_2O 8 mg/100 g soil) For leaf analysis, the second leaf from the top was used The fertilizer experiments together with soil and plant analysis led to the conclusion that an increase in the K doses is only beneficial when an adequate supply of N is provided The K deficiency, especially at the end of the growth period, became critical and led to a decrease in the utilization of N, which accumulated in the mineral form in the leaves The correlation coefficient between the leaf composition and the grain was 0 52 ± 0 25 for N, 0 76 ± 0 15 for P_2O_5, and 0 8 ± 0 13 for K_2O The maximum increase in the grain crop was 25% when 70 kg N/ha and optimal doses of K and P were used (CA 74 31109z)

559 Sul'zhenko, G K 1966 *Application of Fertilizers to Winter Wheat Grown on Chernozem Meadow Soils in the Kiev Region* Khim Sel' Khoz 4(5) 8 (Russ)

During 1963 64, winter wheat variety Mironvskaya 264, sown in autumn was subjected to the following treatments (1) control no fertilizers, (2) dung 20 tons/ha, (3) dung 20 tons/ha plus superphosphate and 30 kg P_2O_5/ha, (4) dung, 20 tons/ha plus superphosphate K salt NH_4NO_3, respectively 30 P_2O_5, 30 K_2O, 20 N (kg/ha), and (5) treatment (4) without the dung K increased the yield by 4 0 q/ha The N and P increased yield by 1 3 q/ha and 1 q/ha, respectively With treatment (4) the protein content in the grain was higher than with treatments (3) and (5) P and K increased the grain starch content N fertilizers acted adversely Treatment (4) induced the optimal protein to starch ratio in grain (CA 65 9678a)

560 Sul'zhenko G K 1967 *Influence of Fertilizers on Yield and Protein Content in Grain of Winter Wheat* Visn Sil's'kogospod Nauki 10(3) 49 53 (Ukr)

The combined application of manure and mineral fertilizers considerably increased the yield and improved the quality of winter wheat The efficacy of mineral fertilizers separately applied on a background of manure depended on weather conditions, in a year of insufficient moisture, the K fertilizer was most effective Winter wheat reacted not only to the combined direct action of the manure and mineral fertilizers, but also to the action of fertilizers previously applied for the

growing of peas A single dose of P + K fertilizer previously applied for the peas had a positive effect on the yield and quality of winter wheat The same fertilizers applied in a double dose adversely affected the wheat content of proteins and gluten (CA 67 21156d)

561 Tsoi, A N, Efimova, A S 1969 *Application of Fertilizers to Winter Wheat Grown After a Catch Crop* Khim Sel' Khoz 7(2) 13 15 (Russ) (Vses Inst Udobr Agropoch, Moscow)

Winter wheat cv Moskovskaya 2453 receiving 30 tons lime + 20 kg N + 10 kg P_2O_5/ha gave yields of 27 7 hkg grain/na where it followed a catch crop of early manuring potato cv Priekul'skii given 60 kg each of P_2O_5 + K_2O/ha, compared with 23 5 hkg/ha where it followed unfertilized potatoes The same rates of P_2O_5 + K_2O were applied direct to the wheat, the tuber yields of potatoes receiving P_2O_5 + K_2O were also increased by 20 1 hkg/ha Twenty tons farmyard manure/ha applied to the catch crop or directly to the wheat had similar effects on grain yield (FCA 22 2434)

562 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)

563 Turuleva, V A 1969 *Effect of Mineral Fertilizers on Winter Wheat Under Irrigation* Agrokhimiya, No 7, 67 70 (Russ) (Rostov Opytn Melior Stan, Elkin, Bagaev Raion)

In trials during 3 yr, different rates of N, P, and K were applied to winter wheat grown on chernozem soil given (a) presowing irrigation and (b) as (a) plus 1 3 irrigations during the growth period whenever soil moisture content decreased to 75 80% of field capacity Average grain yields on (a) and (b) soils receiving no fertilizer were 36 2 and 39 2 hkg/ha, respectively Application of N or P_2O_5 each at 90 kg/ha, gave yields of 42 5 and 41 4 hkg/ha, respectively, on (a) and 50 5 and 43 6 hkg/ha on (b) Application of 120 kg N + 60 kg P_2O_5/ha gave the highest yields of 52 8 and 58 1 hkg/ha on (a) and (b), respectively N increased the translucency percentage in grain and gluten content of flour Yields were not appreciably affected by applying K (FCA 23 23)

564 Tyulin, V A, Beus, T B, Bogdanova, V B 1967 *Effect of Increasing Levels of Organic Fertilizers and Their Combinations With Mineral Fertilizers and Lime on Yield and Dernovo-Podzolic Soil Properties* Agrokhimiya, No 8, 86 93 (Russ) (Nauch Issled Inst Sel'sk Khoz Tsentr Raionov Nechernozem Zony, Nemchinovka)

The investigation was carried out during 1960 65 on a dernovo podzolic soil both limed and unlimed in a several course rotation experiment (spring wheat, corn and sugar beet, corn) testing organic fertilizers and their combinations with mineral fertilizers and lime effects on physicochemical and biological properties of the soil The average increase in yield on limed soils, as compared with unlimed soils, was 48 centners/ha Liming promoted an increase of the capillary moisture capacity and porosity and decreased the specific gravity of the soil A combination of lime and manure increased the capillary moisture capacity by 3 48% and porosity by 3 99%, and lowered the specific gravity by 0 121 g/cm^3 Lime, manure, and especially their combination, promoted the activity of cellulose decomposing and other microorganisms, the activity of sucrose, and the respiration intensity during the months of July and August Tables showing rates of fertilizers (manure, NPK) and their influence on yield of corn, changes in humus content of the plow layer, capillary moisture capacity, porosity, and specific gravity of the soil are presented (CA 68 2315j)

565 Usmanov, Y A, Ikhsanov, R G 1967 *Effect of Urea in the Bashkir cisUrals* Agrokhimiya, No 2, 15 20 (Russ) (Bashkir Sel' Khoz Inst, Ufa)

Ammonification and nitrification of urea proceed at different rates in different soils Ammonificat on is rapid in gray forest soils and nitrification is rapid in chernozems Differences in the rates of conversion are associated with differences in the qualitative and quantitative composition of the soil flora Topdressing winter wheat with urea in spring increases yield, but delaying this topdressing sharply decreases its effectiveness Basal application of urea is as effective as that of $(NH_4)_2SO_4$ and NH_4NO_3 for increasing grain yield of spring wheat, urea is best applied in autumn in the chernozem zone, but in the nonchernozem zone autumn and spring applications are equally effective Urea increases the percentage content of protein in wheat grain (SF 30 2114)

566 Vertii, S A, Malyuga, N G 1970 *Effect of Nitrogen Topdressing on Yield and Quality of Winter Wheat Receiving Different Fertilizer Treatments* Agrokhimiya, No 3, 3 13 (Russ) (Krasnodar Nauchno Issled Inst Sel' Khoz)

On leached chernozem, foliar spraying with urea at ear formation of winter wheat preceded by maize for silage and receiving $N_{60}P_{90}K_{45}$ improved gluten quality more than did foliar spraying with NH_4NO_3, but the two forms were equally effective in increasing accumulation of gluten, protein, tryptophane, and P, and in improving the fractional composition of the protein When topdressing was with dry fertilizer, NH_4NO_3 increased the contents of gluten and protein more than urea did Urea at 7 5 15 N in solutions of 20% concentration is recommended when high rates of basal fertilizer are applied, with low rates of basal fertilizer, urea at 30 60 N in solutions of 30% and 40% is recommended so as to improve both the content and quality of the gluten (SF 33 4045)

567 Vertii, S A, Malyuga, N G 1969 *Role of Early and Late Topdressings in Increasing the Yield and Quality of the Grain of Winter Wheat* Agrokhimiya, No 11, 44 53 (Russ) (Krasnodar Nauchno Issled Inst Sel' Khoz)

The average effects of early topdressing with N, P, NP, NK, or NPK, or with early NPK + N at earing are tabulated for a 3 yr experiment with and without basal application of NPK to wheat preceded by peas, winter wheat, or maize for grain The effectiveness of early topdressings including N was greater without basal NPK Both with and without basal NPK, N was

the important component in the topdressings With basal NPK, the percentage contents of protein and gluten were highest when NPK + N was topdressed to wheat preceded by peas, and the tryptophane content was highest with NPK + P after maize The viscosity of the gluten was highest after topdressing with N or P after maize Topdressing sometimes affected the fractional composition of the protein (SF 33 3172)

568 Vertii, S A, Shemetov, V E 1968 *Effect of Preceding Crops and Fertilizer Practice in Rotations on Leached Chernozems of the Kuban on the Grain Quality of Winter Wheat* Agrokhimiya, No 7, 17 26 (Russ)

When NPK was applied in the rotation, maize for seed was the best preceding crop The NPK increased the protein content of wheat grain, NPK and the preceding crop affected the gliadin and glutelin contents of the protein (SF 31 4468)

569 Vertii, S A, Vetrukova, A M, Volkova, V A 1970 *Role of the Base Fertilizer in Increasing the Yield and Improving the Technological Qualities, Fractional and Amino Acid Composition of the Protein of Winter Wheat* Agrokhimiya, No 10, 21 30 (Russ) (Krasnodar Nauchno Issled Inst Sel'sk Khoz)

Addition of P and K to N fertilizer on leached chernozem (a) led to a considerable improvement in wheat grain quality The best results in yield and quality were attained with NPK (90 90 45) and NPK (135 135 90) Yield was increased by 22 9 cwt/ha, gluten increased by 8 8%, protein by 2 78%, and amino acids in raw protein by 12 8% On (a) and carbonate chernozem, a decrease in P fertilizer led to a decreased yield but an increased amino acid content, while an increase of N enhanced the glassiness of the grain and the content and fractional quality of gluten and protein (CA 74 52534z)

570 Vigutova, A Y, Ivchenko, A S 1970 *Effect of Molybdenum on Soil Nutrients and on the Yield of Peas and Winter Wheat on Chernozems in the Northern Azov Sea Region* Agrokhimiya, No 7, 109 14 (Russ) (Rostov Univ)

In field experiments, application of Mo [1 kg/ha as $(NH_4)_2MoO_4$] had no effect on the content of N, P, K, and Mo in the title plants Conclusion the application of Mo to winter wheat and peas on these soils is not expedient (CA 73 97955h)

571 Vlasyuk, P A, Balabaiko, V F 1969 *Effect of Topdressing With Combined Fertilizers on the Yield and Quality of Winter Wheat* Agrokhimiya, No 3, 5 8 (Russ) (Ukr Sel'skokhoz Akad, Kiev)

Dressing with nitrophos and the NPK equivalent of single fertilizers was calculated on the basis of 25 kg N/ha The 3 yr average yield of two types of wheat increased by 4 0 5 7 and 4 1 6 6 cwt/ha, respectively The protein content of the grain increased during the trial period by 0 2 1 2% Protein harvest per ha increased for one type by 0 4 0 9 cwt/ha The sugar content was not affected, and essential amino acids increased (CA 70 114242f)

572 Vlasyuk, P A, Kozlov, N V 1968 *Urea Nitrogen as a Nutrient for Winter Wheat* Dokl Vses Akad Sel'-Khoz Nauk, No 7, 2 5 (Russ)

Investigations on the effect of N fertilizers on the yield and protein content of winter wheat showed that urea should be applied for summer topdressing during ear formation, whereas NH_4NO_3 is preferred for nutritional balance Urea is less suitable for the latter purpose due to the loss of carbamide N as NH_3, especially on calcareous soils The prolonged (5 8 days) hydrolysis of urea deprives the wheat of N at a critical initial period Besides, nitrification of NH_3 is slowed down at the low temperature of early spring Urea is taken up metabolically with less expenditure of energy than NH_4NO_3 and serves not only as a source of N, but also as a reserve for the formation of the ureide form of N compounds, favorably affecting the syntnesis of amino acids and proteins (CA 69 95488b)

573 Vlasyuk, P A, Shmat'ko, I G, Rubanyuk, E A 1968 *Role of the Trace Elements, Zinc, and Boron in Amino Acid Metabolism and Drought Resistance of Winter Wheat* Sov Plant Physiol 15 237-42 (Eng) (Inst Plant Physiol, Kiev)

Under drought conditions, winter wheat treated with Zn or B showed an increased proline content in the leaves, stems, and ears, and a decrease in the total amount of the other free amino acids The effect of Zn on increasing the drought resistance of plants of different ecological groups was similar and was connected with the disturbance of N metabolism during drought Zn depressed cytoplasm permeability, and increased the content of high molecular weight compounds and colloid bound water (FA 1 120b)

574 Vlasyuk, P A, Rubanyuk, E A, Shmat'ko, I G 1969 *Effect of Zinc and Boron on Nucleic Acid Metabolism in Varieties of Winter Wheat Under Drought Conditions* Sov Plant Physiol 16 872 76 (Eng) (Inst Plant Physiol, Kiev)

The effect of foliar application of Zn and B on the DNA and RNA content of winter wheat in drought conditions was investigated Treatments with Zn and, to a lesser extent, B reduced the loss of the nucleotides in both drought resistant and hydrophilic varieties and favored protein synthesis (CA 72 99616b)

575 Vlasyuk, P A, Rudenko, G S 1969 *Baking Technological Properties of Winter Wheat Grain as Dependent on Various Levels of Fertilization* Agrokhimiya, No 6, 73 7 (Russ) (Ukrain Sel'skokhoz Akad, Kiev)

In trials during 2 yr, winter wheat cv Mironovskaya 808 grown on two soils was given different combinations of 40 60 kg each of N, P_2O_5, and K_2O/ha As the nutrient rate increased from nil to 60 kg N + 60 kg P_2O_5 + 60 kg K_2O/ha, there was a linear increase in the grain protein content and gluten content of flour and a decrease in grain starch content This fertilizer treatment gave 11 3 12 2% protein, 26% gluten, and 54 1 54 8% starch (a) on podzolic chernozem soil and 11 1 11 3% protein, 22 9% gluten, and 55 7 56 7% starch (b) on derno podzolic soil, compared with 8 9 10 2%, 18 9%, and 57 57 9%, respectively, for unfertilized treatments on (a) and 8 7 8 8%, 20%, and 58 2 60 7% for unfertilized treatments on (b) Information is also given on the baking quality of flour from grain obtained from plots given different rates of fertilizers (FCA 23 112)

576 Volkov, E D 1969 *Leaf and Soil Nutrition Conditions of Spring Wheat in Northern Kazakhstan* Vestn Sel'khoz

Nauki Alma Ata 12(11) 16 21 (Russ) (VNII7Kh, Shortandy)

The nutrient requirements of spring wheat on ordinary chernozem were studied by soil and leaf analysis A high yield was obtained by fertilization with $P_{40}K_{40}$ and $N_{20}P_{40}K_{40}$ The increase in yield was due principally to P and not N Raising the amount of P from 20 to 60 kg/ha increased the yield, but further increases in P did not increase the yield Leaf analysis showed that wheat requires available P from the first days of growth Therefore, the principal element that wheat requires is P The recovery of P_2O_5 after fertilization with PK was 12 5% (CA 72 89364d)

577 Volod'ko, M M , Biglov, T T 1968 *Effect of Mn and Cu on Frost Hardening of Winter Wheat* Trudy Inst Biol Bashkir Univ 1 115 25 (Russ)

In field trials in the West Urals, Mn and Cu increased frost resistance and winterhardiness in winter wheat cv Ul'yanovka, independent of the method of application Mn and Cu also increased protein N and P contents in the plants and decreased that of nonprotein N, content of monosaccharides was also decreased The positive effects of Mn are attributed to the increase of protein and RNA contents in tillering nodes of young plants and to intensification of phosphorylation The positive effect of Cu was apparently associated with the adaptation of protein metabolism to low temperatures (FCA 23 73)

578 Voznyakovskaya, Y M , Avrova, N P 1968 *Effect of Fertilizers on Multiplication of Microorganisms Producing Vitamins in the Wheat Rhizosphere* Mikrobiologiya 37 110 14 (Eng)

Additions of fertilizer to turf podzolic soil increase the number of microorganisms in the wheat rhizosphere (with a background of manure and mixed fertilizers) by 4 5 times as compared with a 1 5 2 increase found when NPK is used A corresponding increase is found in the number of vitamin producers, this amounts to 30 50% of the total number of rhizosphere microorganisms when counted on a vitamin deficient medium The species composition of the auxoautrophic microorganisms with rhizosphere of wheat growing on the indicated soil includes 30 species which differ only slightly depending on the nature of the added fertilizer (FA 2 910)

579 Vyshinskii, A M , Artsukevich, S G 1968 *Effectiveness of Mineral Fertilizers in Relation to Method of Application* Agrokhimiya, No 9, 22 30 (Russ) (Ukrain Nauchno Issled Inst Zeml , Kiev)

With basal application of NPK to winter wheat, spring topdressing with N was effective on gray podzolized and derno podzolic soils and on podzolized chernozems (SF 32 1367)

580 Yablokova, M 1969 *Spring Wheat Irrigation* Zemledelie, No 3, 54 5 (Russ) (Altaisk Sel'skokhoz Inst , Barnaul)

In field trials in Altai province, South Siberia, spring wheat grown without irrigation or fertilizers yielded 15 and 22 hkg grain/ha in 1966 and 1967, respectively The application of 75 80 kg N, 55 75 kg P_2O_5, and 40 50 kg K_2O/ha or two irrigations (900 m^3 water/ha) resulted in similar increases in yields to 22 hkg in 1966 and 24 hkg in 1967 The highest yields, 31 35 hkg/ha, were obtained when both fertilizers and three irrigations (1440 m^3 water/ha) were applied Grain flintiness was increased by fertilizers but not by irrigation (FCA 22 1626)

581 Yarkovoi, A S 1969 *Effect of Topdressing With N on the Grain Yield and Quality of Wheat* Khim Sel' Khoz 7(2) 15 17 (Russ) (Chernigovsk Obl Sel'skokhoz Optyn Stan , Progress)

In trials during 3 yr with winter cv Mironovskaya 808 given a basal dressing of 60 kg each of P_2O_5 + K_2O/ha, topdressing with 30 kg N/ha at the tillering stage in spring increased the average grain yield by 4 9 hkg/ha and gluten content by 1 19%, with a further topdressing at the earing stage, there was an additional increase of 1 2 hkg/ha in grain yield and of 2 77% in gluten content (FCA 22 2449)

582 Zakharevskii, V I , Volynskov, V P 1970 *Effect of Fertilizers on Fractional Composition of Protein of Wheat Grain* Agrokhimiya, No 3, 23-4 (Russ) (Sel' Khoz Inst Volgograd)

In a field and pot experiment on pale chestnut soil, organic manures and particularly mineral N, P, and K had little effect on the percentage contents of albumins, globulins, and prolamines in the protein, but markedly increased the glutelin content (SF 33 4041)

583 Zhurbitskii, Z I , Shidlovskaya, I L 1967 *Effect of an Electric Field and Air Ions on the Absorption of Mineral Ions by Wheat Shoots* Elektron Obrab Mater , No 6, 70 3 (Russ)

Wheat seedlings were cultivated in an electric field under a charged metallic screen There were nonspecific effects of atmosphere electricity and light air ions on the utilization of minerals by the seedlings Depending on other conditions, the electric field affected ionic composition of the air close to the plants Ionization of the air (positive ions) stimulated the uptake of K by 44% and of P by 13% from a 3 X 10^{-4}*N* KH_2PO_4 solution (FA 1 1491)

584 Zmeev, I I , Zmeeva, F P 1966 *Effect of Fertilizing on Winter Wheat Yield* Agrokhimiya, No 7, 32 6 (Russ)

Winter wheat was grown in a field previously fertilized with $(NH_4NO)_2SO_4$ or urea (30 or 60 kg N/ha) or NP (30 and 20 kg/ha, respectively) or finally with NPK (30, 20, and 30 kg/ha, respectively) The fertilization increased the respective elements in the upper 20 cm of soil up to the period of grain maturation Urea was as effective a fertilizer as $(NH_4)_2SO_4$ The wheat yield was higher when the field was treated with NP than with N alone, full fertilization was most effective Addition of P or K had no effect on the protein content of the grain (CA 65 12815b)

585 Zrazhevskii, M N , Slukhai, S I , Khalif, V B 1966 *Metabolism of Nitrogenous Products on Ripening of Winter Wheat Seeds During Irrigation* Biol Osn Oroshaemogo Zemled , pp 474 78 (Russ) (Ukrain Nauch Issled Inst Fiziol , Rast , Kiev)

Nitrogenous nutrients influenced the growth, formation of seeds, and protein composition of winter wheat Bezostaia 1,

during irrigation The protein fractions, gliadin, and glutenin, increased The addition of P and Zn in N nutrients had no effect on ripening of seeds (CA 68 38572e)

586 Zuev, L A, Golubeva, P F 1967 *Effect of Soil on Phosphorus and Nitrogen Forms Content in Wheat Plants as Connected With Spike Development* Agrokhimiya, No 3, 23 7 (Russ)

N deficiency caused by PK and NK fertilization on low fertility soils and by PK fertilization on moderately fertile soils reduced the N content (especially protein N) and the amounts of nucleic acids in spring wheat by which spike development was interrupted Interfering with the N uptake, P deficiency caused by PK and NK fertilization on soils of low fertility and by NK fertilization on moderately fertile soils, had the same effect on N and nucleic acid contents and the spike development (CA 67 31986p)

SPAIN

587 Aguilar, A, Esteban, E, Salazar, J 1968 *Comparative Study of Nitrogen Fertilizers I Ammonium Sulfate and Ammonium Nitrate* An Edafol Agrobiol 27(11 12) 875 84 (Sp) (Estac Exp Zaidin)

Wheat was grown in Neubauer pots filled with a soil high in N and P with additions of 0 00, 0 02, 0 04, 0 06, and 0 08% N as $(NH_4)_2SO_4$ in one series and as NH_4NO_3 in the other The plants were grown 15 days at 21 2° in a greenhouse under a 14 hr light/10 hr dark cycle The yield of dry matter was progressively less with increasing N added in the $(NH_4)_2SO_4$ than in the NH_4NO_3 series The courses of the N contents per plant were roughly parallel, with the $(NH_4)_2SO_4$ series somewhat lower The amount of P/plant was unaffected, while the S was decidedly higher in the $(NH_4)_2SO_4$ series In that series the K/plant was somewhat higher and at > 0 04% N added the Ca fell progressively In both series Mg/plant varied little but was constantly lower by approximately the same amount in the $(NH_4)_2SO_4$ series A positive correlation was found between K and Mg, N and S, N and Ca, and S and Ca, and a negative correlation between N and P (CA 71 2596p)

588 Caravello, R V A, Giannetto, F 1964 *Fertilization Studies in Wheat and Calculation of Minimum Doses of N, P, and K* Rev Invest Agropecuar, Ser 2 1(2) 13 27 (Sp)

Plots of 2 X 6 m were used in a 3 X 3 X 3 factorial design with two replicates in order to determine the reaction of wheat to N, P, and K fertilization in various soils in the Argentine, and to calculate the minimum amount of each element required to produce good crops N was applied at 0, 50, and 100 kg/ha as $(NH_4)_2SO_4$ or NH_4NO_3 P was applied at 0, 40, and 80 kg/ha of P_2O_5 in the form of triple superphosphate K was applied at 0, 30, and 60 kg/ha of K_2O in the form of KCl Results were obtained of 14 trials at six experimental stations, but significant results were derived only from the Marcos Juarez and Pergamino experimental stations of the Cordoba and Buenos Aires provinces, respectively In these stations the yield of wheat was increased by N fertilization, which was best used at the 50 kg/ha rate, and, in one case only, the yield was significantly increased by P and K fertilization (CA 67 53132j)

589 Hernando, V, Lombardia, V 1966 *Phosphorus Absorption by Wheat Grown in Several Spanish Soils I Trials of Different Duration* An Edafol Agrobiol 25(5 6) 283 99 (Sp) (Inst Edafologia Biol Vegetal, Madrid)

Wheat was grown in several Spanish soils for 40 60, and 120 days Between 40 and 60 days of the growing season, the wheat absorbs >50% of its total P on an arable soil Plants cultivated in two calcareous soils, with an adequate level of available P, absorbed the highest amount of P Soils with low levels of available P provided the plants with more P when the organic matter content was higher The source of the P absorbed from the two calcareous soils was the fraction extracted with *N* NH_4Cl, while in the other soils, this P source was the fraction extracted with 0 1*N* NaOH (CA 65 19256c)

590 Salazar, J 1967 *Abonos Para el Trigo* In Diez Temas Sobre El Trigo, pp 127-46 (Sp) (Ministerio de Agriculture)

SWEDEN

591 Fajersson, F 1968 *Significance of the Time of Application of Nitrogen Fertilizers to Spring Wheat* Agri Hort Genet 26(1 2) 1 42 (Sw)

Total yield, straw yield, and grain yield were determined in pot experiments with spring wheat after application of 3 or 6 g commercial $Ca(NO_3)_2$ (15 5% N)/pot Plant height was usually reduced by N applied during the first weeks after emergence because of increased tillering Total yield and straw yield were largest when N was applied 50 60 days after emergence Optimal grain yield was reached with N application after 40 50 days In 2 yr, the 6 g application gave the highest grain yield, whereas in 1 yr, the split 3 + 3 g dose was the most favorable The number of spikes per pot was normally strongly increased by N fertilization, while the number of kernels per spike decreased A single application of the large dose had a negative influence on the kernel size The highest N content was obtained 70 90 days after emergence On comparing an early ripening and a late ripening variety, the former gave optimum grain yield on split application, and showed a higher α amylase activity and lower lodging number than the late variety (CA 72 78022q)

592 Fajersson, F 1965 *Urea and Calcium Nitrate Fertilization of "Ring" Spring Wheat Results From a 5 Year Series of Trials* Weibulls Arsbok 60 22-4 (Sw) (Weibullsholm, Landskrona)

In trials in which spring wheat was given 300 and 600 kg calcium nitrate/ha or equivalent rates of urea, higher yields were obtained by applying N when the crop was 10 15 cm tall than by applying it at sowing time (FCA 19 1954)

593 Jonsson, L 1969 *Interaction Between Nitrogen and Phosphorus Potassium Fertilization of Spring Wheat* Lantbrukshoegsk Medd, Ser A 118, 18 pp (Sw) (Inst Vaxtnaringslara Jordbearbetning, Uppsala)

In 127 1 yr field experiments, four levels of N were applied with and without PK fertilization The effects on yield were significant in all groups Crude protein seemed correlated with the P value of the soil It was not influenced by PK but by N fertilization (CA 72 54263t)

594 Jonsson, L, Bondesson, L 1966 *Field Trials With Split Nitrogen Dressings to Winter Cereals* Landbrukshoegsk Medd Ser A, No 57, 30 pp (Sw)

Numerous trials throughout southern and middle Sweden mainly on winter wheat showed that N applications were profitable up to 62 kg/ha N Increasing N applications increased the crude protein content of the grain Both delaying and splitting fe tilizer application also increased the crude protein content N fertilizing considerably reduced the standing power of the straw, but this effect was decreased by splitting the N dressing Applying the greater part of the N just before heading increased average grain weight (SF 30 623)

595 Nilsson, L G 1968 *Effect of Uneven Spreading of Nitrogen on Yield and Quality of Cereal Grains* Vaext Naerings Nytt, No 1, 23 8 (Sw)

Uneven spreading of N on wheat 2 weeks after emergence decreased grain yield by 100 200 kg/ha and N uptake by 2 3 kg/ha No negative effects were observed on volume weight or on the 1,000 grain weight Tests for baking quality were inconclusive (SF 31 3635)

596 Roland, M 1968 *Nitrogen Fertilizing and Ripening of Cereals* Vaext Naerings Nytt, No 1, 5 8 (Sw) (Weibullsholm, Landskrona)

N increased tillering in cereals Ripening of oats, wheats, and barley was advanced by presowing and delayed by post-emergence applications, but differences in time and uniformity of ripening were affected more by soil conditions, rainfall distribution, and seasonal variations than by N applications (SF 31 3636)

UNITED KINGDOM

597 Beveridge, J L, Jarvis, R H, Ridgman, W J 1965 *Studies on the Nitrogenous Manuring of Winter Wheat* J Agr Sci 65(Pt 3) 379 87 (Eng) (School Agr, Univ Cambridge)

It is concluded that field trials are never likely to determine an optimum time for N topdressing because of the unpredictable relationship between individual yield components and grain yield, and because of the variation in response to N due to seasonal and environmental factors (FCA 19 727)

598 Bremner, P M 1969 *Effects of Time and Rate of Nitrogen Application on Tillering, "Sharp Eyespot" ("Rhizoctonia solani") and Yield in Winter Wheat* J Agr Sci 72 273 80 (Eng) (Univ Nottingham School Agr, Sutton Bonington)

Various rates of N fertilizer were applied in early and late spring to two densities of winter wheat The disease level was higher where N was applied early and increased with increasing application of N up to 120 units, and was higher at the higher density Late N gave higher grain yield (SF 32 3162)

599 Bremner, P M 1969 *Growth and Yield of Three Varieties of Wheat, With Particular Reference to the Influence of Unproductive Tillers* J Agr Sci 72(2) 281 87 (Eng) (Univ Nottingham School Agr, Sutton Bonington)

In a trial in 1962, the wheat cv Jufy I, Capelle, and Yeoman, which have low, intermediate, and high tiller production, respectively, were grown at densities of 129 and 259 plants/m^2 and received a basal dressing of NPK applied to the seedbed On March 20, half the plots were topdressed with 40 units N/acre None of the varieties responded to the higher N level Data for Yeoman and Cappelle showed that competition from unproductive tillers was not serious, in Yeoman, after the death of unproductive tillers, the remaining shoots grew more rapidly and caught up with those of Cappelle The three varieties gave similar grain yields (FCA 22 1684)

600 Eagle, D J 1968 *Effect of Nitrogen Rates on Grain Size in Winter Wheat* Exp Husb, No 17, 45 6 (Eng) (NAAS, Cambridge)

Data from 25 trials with winter wheat (Cappelle) showed that the grain size was reduced significantly only when N rates were excessive or when yield was restricted by some factor other than N (SF 32 1549)

601 Garner, H V, Dyke, G V 1969 *The Broadbalk Wheat Experiment The Broadbalk Yields* Rep Rothamsted Exp Sta 1968(Pt 2) 26-46 (Eng) (Rothamsted Exp Sta, Harpenden)

Yield tables showing the effects of different fertilizer treatments are given for the main period of the experiment (1852 1967), the continuous wheat period (1852 1925), and the post 1925 period after introduction of fallowing Results show that (1) yields from PKNaMg + N were as good as yields from large dressings of farmyard manure, (2) N only was much more effective than minerals only N was ever more effective in the presence of minerals, (3) yields increased with increasing applications of NH_4 N up to 86 lb/acre N, (4) higher yields were obtained with NO_3 N than with NH_4 N, (5) spring applications of NH_4 N were better than autumn applications, particularly in wet seasons, (6) NH_4 N had no residual value for a second crop but PKNaMg had a residual effect when N was also applied, (7) yields from rape cake were higher than those from equivalent amounts of N as NH_4 N but lower than yields from N + PKNaMg, (8) fallowing had a large immediate action but a small residual effect (SF 33 1499)

602 Gasser, J K R 1965 *Effects of Urea on the Germination and Early Growth of Kale, Barley, and Wheat* Plant Soil 23(3) 351 70 (Eng) (Rothamsted Exp Sta, Harpenden)

On a soil containing much free $CaCO_3$ derived from chalk, urea either did not affect yield or depressed it below that of the unfertilized crop (CA 67 72907g)

603 Gasser, J K R, Hamlyn, F G 1968 *Effects on Winter Wheat of Ammonium Sulfate, With and Without A Nitrification Inhibitor, and of Calcium Nitrate* J Agr Sci 71(Pt 2) 243-49 (Eng) (Rothamsted Exp Sta, Harpenden)

Winter wheat grown on a sandy loam and on a clay loam soil was given $(NH_4)_2SO_4$ alone or treated with the nitrification inhibitor, 2 chloro 6-(trichloro methyl)pyridine, drilled with seed, in autumn In spring, dressings of treated or untreated $(NH_4)_2SO_4$ or of $Ca(NO_3)_2$ were broadcast, 75 or 150 lb of N/acre were given on the sandy loam and 50 or 100 lb on the clay loam Plants were sampled during growth and grain yield was measured Without fertilizer N, the wheat

yielded 17 cwt/acre on the sandy loam and 46 on the clay, and with the double dressings given in spring yields were 52 and 56 cwt/acre On the light soil, treated $(NH_4)_2SO_4$ given in autumn increased yield by 3 5 cwt/acre with the single dressing and by 5 4 with the double one On the heavy soil, the inhibitor had no effect on yield Dressings of 50 lb of N/acre in autumn or spring increased yields equally, but with 100 lb of N/acre, spring dressing increased yield slightly more than autumn dressings $Ca(NO_3)_2$ at 75 lb of N/acre was significantly better than $(NH_4)_2SO_4$ on the light soil The inhibitor did not affect the speed with which N was taken up, or the total uptake, from fertilizer given in spring (CA 70 19250y)

604 Gasser, J K R, Iordanou, I G 1967 *Effects of Ammonium Sulfate and Calcium Nitrate on the Growth, Yield, and Nitrogen Uptake of Barley, Wheat, and Oats* J Agr Sci 68 307 16 (Eng) (Rothamsted Exp Sta, Harpenden)

Fifty and 100 lb N/acre in the field and 100 and 200 lb N/acre in the glasshouse, as $(NH_4)_2SO_4$ and $Ca(NO_3)_2$, were applied to barley, wheat, and oats grown on clay loam soil (Clay with Flints) In the glasshouse, dry matter production and N uptake depended on the N available and increased with increasing N application, in the field, dry matter was increased by applying fertilizer N, N uptake depending on the amount applied All crops produced more dry matter with nitrate N, more N was taken up from nitrate than ammonium From flowering to maturity, N content of straw in all crops decreased, but of grain, increased Recovery of fertilizer N by barley and wheat fluctuated between 58 and 69% from 56 days to harvest, but recovery by oats was 98% and 59% from 80 days to harvest N fertilizer application increased number of ears/ft^2, dry matter/ear, and N uptake/ear for crops both in the field and glasshouse, but effects varied between the three crops (SF 30 3782)

605 Gupta, M B S, Cornfield, A H 1966 *Phosphorus Supplying Power of Some Organic and Inorganic Sources to Wheat in a Calcareous Soil* Sci Cult 32(6) 322 24 (Eng) (Imp Coll Sci Technol, London)

The general effectiveness of various organic and inorganic sources of P on wheat in greenhouse pot experiments with a calcareous soil was in the following order nucleic acid > $NH_4H_2PO_4$ > $CaH_4(PO_4)_2$ = phytin > $CaHPO_4$ > $Ca_3(PO_4)_2$ Nucleic acid was superior to the order materials in increasing the yield and P content of the plants and in total P uptake in the straw and grain The other materials varied in their effects on these criteria Nucleic acid increased P uptake 55% over the control compared with a 11% increase by $Ca_3(PO_4)_2$ (CA 66 1934z)

606 Hanley, F, Ridgman, W J, Beveridge, J L 1966 *A Comparison of the Effects of Liquid and Solid Nitrogenous Topdressings for Winter Wheat* Exp Husb 13 79 84 (Eng) (School Agr, Univ Cambridge)

In three experiments on successive wheat crops at different sites in a clay land field, $(NH_4)_2SO_4$, $NaNO_3$, and urea were applied as solids or as aqueous sprays at rates of 40 units/acre N in 100 gal water The solid fertilizers consistently produced higher grain yields than the corresponding sprays The efficiency with which plants could use nutrients applied in solution as a spray was determined partly by the extent of leaf cover at the time of treatment and partly by subsequent rainfall (SF 30 1371)

607 Holmes, M R J 1968 *Nitrogen and Quality in Winter Wheat* Fisons Agr Tech Inf, pp 28 36 (Eng) (Levington Res Sta)

In 10 experiments over 3 yr in Eastern England, N applied in May increased grain yield more than did N applied in March N applied at ear emergence did not increase yield much The protein content of the grain increased with increasing rates of N and was greater after May than after March application, application at ear emergence increased it The optimal rate of N for yield usually gave a protein content above 10% (SF 32 1550)

608 Hooper, L J, Davies, D B 1968 *Melanism and Associated Symptoms in Wheat Grown on Cooper Responsive Chalkland Soils* J Sci Food Agr 19(12) 733 39 (Eng) (NAAS, Coley Park, Reading)

An account is given of symptoms of blackening observed in the field in South England in spring wheat cv Atle and Atson One of the symptoms was formation of a dark pigment (melanism) Blackening usually occurs on shallow, chalk rendzina soils, and the symptoms are aggravated by N, by wet, warm summers, and by prior cropping with kale When Cu, Mg, Mn, Mo, and Zn were applied to spring wheat in pots, significant reductions in blackening were obtained only from Cu and Cu + Mo In field trials in 1961 and 1962 with wheat cv Atle, grain yields were significantly increased by spraying with 12 oz $CuSO_4$ in 100 gal water/acre, or copper oxychloride at 1 5 lb in 20 gal water/acre, in combination with 73 or 22 66 lb N/acre, respectively The interaction between Cu and N was significant Symptoms of blackening were intensified by N, but were reduced by both soil and spray applications of Cu Of the various symptoms of blackening, melanism was least affected by Cu Factors associated with the occurrence of blackening in wheat are discussed (FCA 22 1667)

609 Johnston, A E 1969 *The Broadbalk Wheat Experiment The Plant Nutrients in Crops Grown on Broadbalk* Rep Rothamsted Exp Sta 1968(Pt 2) 50 62 (Eng) (Rothamsted Exp Sta, Harpenden)

Tables show the uptake, percentage content, and apparent recovery of nutrients for 1966-67 in crops from the continuous wheat section and from the first year after fallow Results are discussed in relation to earlier figures More N, P, and K were removed per acre in the first crop after fallow than in continuous wheat Percent N but no percent P, in the dry matter was also higher after fallow Percent K in the grain, but not in the straw, was little affected by treatment or fallowing and was roughly the same in 1966 67 as in 1852 91 Where no PKNaMg was given, uptake and recovery of N were less in 1966 67 than in earlier periods because deficiencies of P and K limited growth Where NPK was given, total uptake of both N and P remained much the same over the whole period of the experiment More N was recovered from NO_4 N (applied in spring) than from NH_4 N (applied in autumn and spring) Na uptake was small and was 1/25 to 1/50th of the K uptake Ca uptake was between one third and one fourth of the K uptake,

and approximately one half as much Mg as Ca was taken up (SF 33 1501)

610 Lessells, W J , Webber, J 1965 *The Effect of Nitrogen on Winter Wheat* Exp Husb , No 12, 74 88 (Eng) (Rothamsted Exp Sta , Harpenden)

One hundred and fourteen experiments over 7 yr on winter wheat are summarized A yield increase of 6 cwt/acre could be obtained by applying 60 units N/acre The lower yielding the site, the greater was the response to N, and the earlier the fertilizer had to be applied Lodging occurred at high yielding centers to which N was applied early The recommendations were 40 60 units N/acre in May after plowed grass, 60 units in April after arable crops on heavy clay soil and 80 90 units on other soils, 40 units in May on peaty fen, wet soils, or after frequent farmyard manure applications (FCA 19 1347)

611 Mundy, E J , McClean, S P 1965 *Winter Wheat Trials at Experimental Husbandry Farms and the Norfolk Agricultural Station 1 Comparisons of Times of Sowing, Seed Rates, and Seed Bed Versus Spring Nitrogen (1957 61) 2 Comparisons of Rates and Times of Application of Spring Nitrogen (1953 61)* Exp Husb , No 12, 146 63, 164 72 (Eng) (High Mowthrope Exp Husb Farm)

1 In trials at seven experimental farms on a range of soil types over 4 yr with the stiff strawed cv Cappelle Desprez, it was concluded that time of drilling had no effect on yield until November when late drilling depressed yield, the optimum seed rate was 140 lb/acre (higher on heavy soils), spring N gave a bigger response than seedbed N, an economic response being obtained from 60 units N/acre 2 Trials on five farms showed that 60 units N/acre produced a yield increase of 9 8 14 3 cwt/acre on light chalky soils, and 5 7 7 7 cwt/acre on heavy clay soils with no response on a heavy silt (after potatoes and peas) The effect of time of N application varied with the farm, although split dressings consistently gave the best results (FCA 19 1346)

612 Rodger, J B A , Gill, W D 1966 *The Effect of N and PK Fertilizers on the Yield of Winter Wheat* Exp Husb 13 66 71 (Eng) (Edinburgh & East Scotland Coll Agr)

Trials were conducted for 7 yr in East Scotland on soils that were mainly loams and clay loams of satisfactory P and K status Winter wheat grown after potatoes did not respond to dressings of 48 units/acre of P_2O_5 and 48 units of K_2O applied either to the seedbed or in early spring (unit = 1 12 lb) Light dressings of N (usually 18 units/acre) applied to the seed bed or in early spring in addition to a N topdressing just before stem elongation, resulted in significant but subeconomic yield increases Spring and autumn applications of N were equally effective and N could therefore be applied as a single dressing in spring (SF 30 1369)

613 Spratt, E D , Gasser, J K R 1970 *The Effect of Ammonium Sulfate Treated With a Nitrification Inhibitor, and Calcium Nitrate, on Growth and N Uptake of Spring Wheat, Ryegrass, and Kale* J Agr Sci 74 111 17 (Eng) (Rothamsted Exp Sta , Harpenden)

Italian ryegrass (*Lolium multiflorum*), spring wheat (*Triticum aestivum*), and thousand headed kale (*Brassica oleracea*) were grown on a clay loam (pH 7 6, and 0 175% total N) developed from Clay with Flints $Ca(NO_3)_2$ and $(NH_4)_2SO_4$ (treated with a nitrification inhibitor) were each applied at 50 and 100 lb N/acre Wheat and ryegrass responded better to $(NH_4)_2SO_4$, until the milky stage of growth Dry matter production in kale was larger with $Ca(NO_3)_2$ Most wheat grain/lb of N was produced with 50 lb N/acre given as $Ca(NO_3)_2$ N uptake by wheat and ryegrass was faster from $(NH_4)_2SO_4$, and from $Ca(NO_3)_2$ by kale Fifty-eight percent of the fertilizer N was recovered from $Ca(NO_3)_2$ and 43% from $(NH_4)_2SO_4$ (SF 33 3175)

614 Spratt, E D , Gasser, J K R 1970 *Effects of Fertilizer Nitrogen and Water Supply on Distribution of Dry Matter and Nitrogen Between the Different Parts of Wheat* Can J Plant Sci 50(6) 613 25 (Eng) (Rothamsted Exp Sta , Harpenden)

Wheat in pots and in the field was subjected to different watering regimes and fertilizer N, either as ammonium N with a nitrification inhibitor or as nitrate N, was applied at sowing or during growth Greater leaf and stem weight was produced during early growth with ammonium N than with nitrate N, but the two forms gave similar yields of grain The grain straw ratio with ammonium N was smaller than with nitrate N, and more N was retained in the straw Both forms of N increased the weight/spike but not the number of spikes/unit area (tillering) Applied at the boot stage of growth, N increased dry matter much less than when applied at sowing, but increased the percent N in the grain Divided dressings, half at sowing and half during growth, increased yield and N uptake by the same amount as applying all the N at sowing Drought during spike formation or floret development led to smaller spikes and yields of grain, and also to a smaller grain straw ratio, up to three fourths of the extra N taken up from fertilizer N remained in the straw (CA 74 22185u)

YUGOSLAVIA

615 Andelic, M , Saric, M , Petrovic, M 1968 *Effect of Some Biogenic Elements on the Anatomic Structure of Wheat Plants* Arh Poljopr Nauke 21(75) 71 80 (Eng) (Inst Agr Res , Novi Sad)

The effect of the deficiency of some biogenic elements on the anatomic characteristics of the root, stalk, and leaf of wheat was studied N most frequently effected changes of the anatomic characteristics, then P, S, and Mg Plants grown without Mg had the thickest leaves with the largest vascular bundles, especially the trachea, without N there was the opposite effect (CA 73 130238b)

616 Andrascik, M 1966 *Influence of the Preceding Agrotechniques and Nutrition on the Yielding Ability and Some Properties of the Seed of Winter Wheat ("Triticum aestivum" L)* Sb Vys Sk Pol'nohosp Nitra 14 39 62 (Serbo)

In trials in 1962 64 at Beladice in the maize growing region, the effects of fertilizers and tillage practices on yield and grain properties of winter wheat cv Kosutska, Diana I, and Harrachweizen were investigated In 1962 63, highest yields were obtained from cv Kosutska with plowing 28 30 cm deep and subsoiling to (a further) 10 12 cm without applying

fertilizer, in the following year Harrachweizen yielded most grain with the same tillage treatment together with 40 kg N/ha plus P and K in the ratio 1N 1 2P 1 4K (FCA 20 2156)

617 Curic, R 1967 *Effect of Temperature on the Metabolism of Nitrogen in Wheat Depending on Its Source* Isotop Plant Nutr Physiol, Proc Symp Vienna, 1966 179 88 (Eng) (Inst Agr Res, Novi Sad)

The research was conducted with wheat of the Mara variety The plants were grown for 23 days in Knop's nutritive medium with different sources of N, the alternative sources being urea, $Ca(NO_3)_2$, and $(NH_4)_2SO_4$ The plants grown in such media were divided into three groups with growing temperatures, respectively, of 10, 20, and 30° for 72 hr To observe the possible assimilation of molecular urea, one series of plants (at all the three temperatures) was given urea ^{14}C in addition to the regular urea for nutrition purposes Plants grown in a solution with urea ^{14}C were kept for 3 hr at a corresponding temperature Afterwards, the radioactivity of the part of the plant above the ground was determined In the other plants, kept for 72 hr at the corresponding temperatures, determinations were made of the dry matter content of N in nitrates, of ammonium and amide N, of free amino acids, and of proteins The growing of wheat in nutritive media with different sources of N supply and at different temperatures brings about certain changes in the metabolism of this element in the plants and affects the general physiological condition Plants grown at lower temperatures had more hydrated tissues than those grown at higher temperatures The least changes in the water content of tissues at different temperatures were observed in plants grown on $Ca(NO_3)_2$ Plants grown on urea and those on $(NH_4)_2SO_4$ showed equal changes The wheat plant may assimilate not only NH_4^+ after the hydrolysis of urea, but also the molecules of this compound, which is indicated by the data on the assimilation of ^{14}C from urea ^{14}C The nitrate form in the plants examined showed no major changes There is some indication that the reduction of nitrates in plants takes a more rapid course at higher temperatures, 20° was best suited to the accumulation of ammonia, whereas $Ca(NO_3)_2$ led to a decrease in its content Amide N in the part of the wheat plant above the ground was found in approximately equal amounts at all temperatures When using $(NH_4)_2SO_4$ as a plant nutrient the amide content was perceptibly higher at 10° When using urea for wheat nutrition, the amide content showed a tendency to increase with rise in temperature Free amino acids showed a minimum content in plants grown at 10° when the nutrients applied were $Ca(NO_3)_2$ and $(NH_4)_2SO_4$, and a maximum at 20°, while the temperature of 30° already produced a tendency for their content to decrease Plant nutrition with urea caused an increase in the free amino acid content with rise in temperature Proteins were least subject to changes from differences in temperature or the source of N in plant nutrition This stability of proteins was particularly prominent when the nutrients applied were $Ca(NO_3)_2$ and urea On the basis of the above findings it would be impossible to assert that any one of the three N sources examined had a more powerful effect on plants than the others (FA 1 122)

618 Curic, R 1969 *A Study of the Significance of Nitrogen in the Nutrition of Wheat of Different Age. I The Effect of Nitrogen Deficiency at Different Plant Age on Some Morphologic Changes* Arh Poljopr Nauke 22(78) 50 65 (Croat) (Inst Agr Res, Novi Sad)

The effect of N deficiency on the growth and development of wheat plants in nutrient solutions varied considerably with the stage of plant development at which deficiency occurred and with the duration of the deficiency N deficiency in the early stages of development retarded both root and shoot growth but shoot growth was affected most The number of spikelets on the spike of the main stem depended largely on the N nutrition in the earlier stages of the development of the reproductive organs but was not affected by N deficiency during the later stages N deficiency decreased the number of ripe kernels, and the size of the kernels depended upon the length of the period of deficiency (SF 33 2357)

619 Djokic, A 1966 *Effect of Seed Rate and Different N Rates on the Productivity Potential of Some Wheat Varieties* Zborn Rad Poljopriv Fak Univ Beogr 14(416) 23 (Serbo)

In trials in 1957 60, five varieties of winter wheat were sown at 500, 600, and 700 seed/m² and given 65 160 kg N/ha On average, highest yields were obtained at the lowest seed rate The optimum rate of N in terms of grain yield was 80 kg N/ha for San Pastore, Autonomia, and Bankut 1205, and 110 kg N/ha for Hybrid 013 and Producttore Straw yields were highest at high N and high seed rates 1,000 grain weight increased with decreasing N and increasing seed rate Test weight was highest with 110 kg N/ha at the two highest seed rates Effects of treatments on straw length were variable Ear length was greatest at 110 kg N/ha and above, and it was greater at the two higher seed rates in San Pastore, Hybrid 013, and Bankut Number of spikelets per ear increased with increasing N and decreasing seed rate Number of grains per ear in Autonomia was highest at the lowest seed rate, in San Pastore and Bankut 1205 at the intermediate seed rate, and in Producttore and Hybrid 013 at the highest seed rate N at 110 kg/ha gave the highest number of grains per ear in all varieties except Bankut 1205 (FCA 22 72)

620 Eberhardt, S 1967 *Effect of Increasing Rates of P on Yield of Wheat Cv Leonardo* Agron Glas 17(6) 447 64 (Serbo) (Poljoprivred Fakult Sveucilista, Zagreb)

The fertilizers tested were P_2O_5 at 0, 60, 120, or 180 kg/ha, K_2O at 0, 50, 100, or 150 kg, and N at 0, 50, 100, or 150 kg Two thirds of the P and K was applied during plowing, and one third prior to rolling and harrowing before sowing wheat, N was applied as topdressing in 3-4 equal doses by hand The effect of increasing rates of P depended on soil type and the quantities of other fertilizers applied The best results (3 yr average) were obtained with 60 kg P_2O_5/ha on chernozem soil (in 1963 64 with 120 kg), and with 50 kg/ha each of N and K_2O (FCA 22 1642)

621 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 effect 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 yr 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 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)

622 Jelenic, D 1966 *Effect of Phosphorus on the Content of Protein Fractions in Wheat* Zeml Bil 15(3) 255 64 (Croat) (Inst Kukuruz, Zemun, Belgrade)

The effect of P on the content of protein fractions in wheat was studied in two varieties (San Pastore and Novosadska 1993) differing biologically in the fact that one is early and the other is late The following amount of nutrients was applied to the soil P_2O_5 0 252, N 100, and K_2O 80 kg/ha Each had a different effect on the synthesis of individual protein fractions in the grains of these two wheat varieties The amounts and the fraction rates of free amino acids, globulin, and albumin increased in the San Pastore variety and decreased in the Navosadska variety at all combinations of NPK fertilizers compared with the NK fertilizers The amounts of gliadin and glutenin fractions in the wheat grain decreased under the effect of P in both varieties The two varieties responded differently to the incorporation of P by alterations in the content of individual protein fractions, although the total protein content decreased in both varieties The decrease occurred during addition of 0 72 kg/ha P_2O_5 A further increase in P did not significantly affect the total protein content (CA 68 94949v)

623 Jelenic, D 1965 *Influence of Mineral Fertilizers on Some Technological Properties of Wheat Grain* Zeml Bil 14(2) 117 86 (Croat)

The effect of mineral fertilizers on some technological properties of wheat grain of the wheat varieties Bankut 1201, San Pastore, and Producttore, with special reference to the application of increasing amounts of fertilizers, was investigated The optimum levels of N, K, and P_2O_5 were 71 5, 80, and 128 kg/ha, respectively The mineral fertilizer affected favorably the volume weight and hardness of the grain, and it also enhanced the gluten content and the capacity of the wheat to absorb water in each of the three varieties (CA 65 16021f)

624 Jelenic, D B , Martinovic, B , Fridman, B 1966 *Influence of Mineral Nutrition on the Dynamics of Synthesis of Nucleic Acids and Proteins in Different Phases of Development of a Variety of Spring Wheat After Application of Radioactive Phosphorus 32* Zeml Bil 15(3) 293 309 (Croat) (Inst Primenu Nukl Energije Poljoprivredi, Belgrade)

The effect of variations in N, P, and K nutrition on the uptake of ^{32}P was measured during the growth of a spring wheat, to study the nutritional influence on RNA and protein synthesis Total P uptake was proportional to P concentration in the medium, and inversely proportional to the N concentration, at all growth phases The P uptake decreased with maturation Increase in RNA synthesis correlated with increased dosage of N, P, and K, and was proportional to the N concentration RNA and protein synthesis were greatest in the first phase of plant development, and RNA content was twofold greater than that in the third phase of maturity N application was most important since protein synthesis was in direct proportion to the N concentration P had a lesser effect but was necessary, as was K (CA 68 48611f)

625 Jelenic, D , Martinovic, B , Fridman, B 1965 *Influence of Nitrogen, Phosphorus, and Potassium on the Dynamics of Nucleic Acids Synthesis in Wheat* Zeml Bil 14(3) 289 310 (Croat)

The influence of various amounts of N, P, and K on the dynamics of nucleic acid synthesis in high productive wheat "Bezostaia 1" was investigated using ^{32}P The highest P absorption in the early stage of growth occurs in the presence of higher concentrations of P and is proportional to the amount of P in the nutrient medium The influence of N on P absorption is inversely proportional to its concentration, while K does not show any regularity of action In the acid soluble fraction the presence of the three elements is essential for P absorption The synthesis of RNA is in direct proportion to the concentrations of the N and P containing components of the nutrient medium The synthesis of RNA decreases with the age of the plant (CA 65 16019d)

626 Kastori, R , Saric, M 1965 *The Influence of Some Trace Elements on the Uptake of Phosphoric Acid by Wheat Plants* Phosphorsaeure 25 281 88 (Ger) (Univ Novi Sad)

In water cultures with wheat, Cu, B, Zn, and mainly Mn, in certain concentrations, affected plant P uptake At the highest applied concentration of Cu, Zn, B, and Mn, the P uptake was 3 89, 9 09, 9 78, and 10 34 mg P/100 g dry matter (CA 64 18035h)

627 Kastori, R , Tyupina, T 1967 *Coloring Matter Content of Chloroplast as Affected by Cu, B, Mn, and Zn in the Individual Phases of the Development of Wheat* Agrokem Talajt 16(1 2) 161 68 (Hung) (Fac Agr , Univ Novi Sad)

The contents of chlorophyll *a* and *b* in wheat plants grown in nutrient solutions increased from tillering to earing, and decreased again at the milk ripe stage The chlorophyll *a*/chlorophyll *b* ratio decreased as the plants matured The chlorophyll/carotenoids ratio was more variable, but also generally decreased Chlorophyll and carotenoid contents were increased by 0 01 0 1 mg Cu, 0 05 0 25 mg B, 0 2 1 0 mg Mn, or 0 05 0 5 mg Zn/l Further increase of these elements, or their absence, substantially reduced chlorophyll and carotenoid content The effects on chlorophyll *a* and *b* content were greatest at the earing stage, carotenoid content remained fairly constant (FCA 20 2211)

628 Madjaric, Z , Musac, I 1967 *Influence of Increasing*

Quantities of Phosphorus and Potassium and Their Residual Effects on the Yield of Winter Wheat in a Stationary Experiment Zeml Bil 16(1 3) 53 60 (Croat) (Poljoprivredni Inst , Osijek)

The effects of increasing quantities of P and K on the yield of wheat were examined in an experiment carried out on brown soil on a carbonate loess terrace The experiment was carried out in a fourfold crop rotation consisting of sugar beet, corn, soybeans, and wheat Chemical analysis of the soil showed a low content of physiological active P and a medium high content of K with poor to neutral pH value and a humus content of 2 0 2 3% The results of the experiment obtained during the first 3 yr showed that an increase in phosphoric acid (superphosphate) increased the yield of wheat, while in the case of K the positive effects were observed only when applying the lowest rates With higher rates no positive effect on the yield was noticed (CA 68 28854j)

629 Martinovic, B , Grujic Injac B , Jelenic, D 1968 *Effect of Nitrogen, Phosphorus, and Potassium on the Dynamics of Synthesis of Nucleic Acids and Proteins in the Different Phases of Wheat Development* Isotope Studies on the Nitrogen Chain, pp 119 31 (Lng) (IAEA, Vienna, Austria)

The influence of different N, P, and K levels on the dynamics of RNA synthesis and raw proteins, as well as the uptake of P in the different phases of wheat development, were studied by applying ^{32}P The rate of the uptake of P is proportional to its concentration in the nutrient supply in all phases of wheat development, in spite of the fact that the uptake of P during vegetation decreases with the plant's maturity The influence of N on the uptake of P is inversely proportional to the concentration of N in the nutrient, while the influence of K depends on the relation of the amounts of N and P The increased levels of N and P are directly proportional to the increase of RNA synthesis, and conversely the decrease of these levels decreases the RNA synthesis The RNA synthesis decreases with the wheat's maturity during vegetation and is considerably greater in the first phase than in the later phases of the plant's development N and P have the greatest influence on protein synthesis, K has far less influence These investigations show that the synthesis of nucleic acids and the building up of P in the RNA fraction is directly proportional to the concentration of N in the nutrient supply, even though the uptake of P by wheat is not proportional to the increased N levels Investigations now being carried out provide further explanations concerning the mutual relationship of some forms of RNA of the cells and the amino acids in the synthesis of certain protein fractions of wheat under the influence of different levels of N, P, and K (FA 2 914)

630 Miladinovic, N 1967 *A Study of the Complex Effect of Different Plowing Depth and the Dose of Fertilizers on the Yield of Winter Wheat* Arh Poljopr Nauke 20(70) 68 75 (Serbo) (Agr Inst , Zajecar)

Yields of winter wheat increased as the plowing depth was increased from 15 to 40 cm and as the rate of fertilizer applied increased up to 100 kg N, 120 kg P, and 100 kg K/ha, but without fertilizer or at low rates they were significantly below the overall average, even in the deep plowed plots Plowing and fertilizer treatments influenced yield mainly through the number of grains/ear, less by the number of ears/unit area and least by 1,000 grain weight (FCA 21 1510)

631 Perkovic, M , Kovacevic Tatic, R 1966 *Ratios and Quantities of N P K for Wheat on Different Soil Types* Zeml Bil 15(3) 311 23 (Croat) (Inst Proucavanje Zemljista, Belgrade)

Field experiments were made on parapodzol, chernozem, and forest soil to determine the optimum quantity and the most effective quality contents of N, P, and K nutrients for growing wheat The experiments were made with four N levels (N 60, N 90, N 120, and N 150 kg/ha) and three P levels (P_2O_5 60, P_2O_5 120, and P_2O_5 180 kg/ha), and three K levels (K_2O 100, K_2O 150, and K_2O 200 kg/ha) $N_{120}P_{120}K_{100}$ (~1 500 kg/ha total) had the best effect on chernozem and parapodzolic soils The best fertilizer for the forest soil was $N_{90}P_{120}K_{100}$ at 1,300 kg/ha total The relative amount of nutrients depended on the soil type and weather conditions For the 1,500 kg of mineral fertilizers, the best ratio was N P_2O_5 K_2O (1 1 0 8) and for 1,300 kg it was 1 1 3 0 8 The P effect was more prominent in soils fertilized by a smaller amount of N (CA 68 94950p)

632 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 soils, 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

633 Popovic, Z , Markovic, N , Teofilovic, K 1967 *Influence of Mineral Fertilizers Upon the Contents of Individual Fractions of Albumins in Wheat Grain* Zeml Bil 16(1 3) 79 87 (Serbo) (Inst Proucav Zemljista, Beograd Topcider)

Low doses of fertilizer N (60 kg/ha) increased protein yield of wheat, especially on chernozem soil, although the percent protein in the grain was reduced, higher rates (up to 150 kg) increased grain N content P and K had little effect on quality Grain N content was inversely related to rainfall N increased the albumin, globulin, glutenin, and gliadin fractions Glutenin content was affected more on chernozem soil and gliadin content more on parapodzol soil (FCA 21 1547)

634 Saric, M , Petrovic, M 1969 *The Effect of N, P, K, Ca, S, and Mg on Morphogenesis, Synthesis of Organic Matter, and*

Chemical Composition of Wheat Plants Arh Poljopr Nauke 22(76) 38 51 (Croat) (Inst Agr Res Novi Sad)

Wheat seedlings were grown in nutrient solutions lacking N, P, K, Ca, S, or Mg for periods of up to 75 days before being transferred to complete nutrient solution Plants grown without K did not survive for more than 20 days and those without Ca only lived for 40 45 days Lack of N and P had grater effects on plant growth than lack of Ca, S, and Mg Deficiency of Mg had most effect on the plant when the plant was passing from the vegetative to the generative stage The length of time a plant was deprived of a particular element not only affected the total dry matter weight but also its distribution per individual organ (SF 33 4800)

635 Saric, M , Kastori, R 1965 *Influence of the Variations in Concentration of Fertilizer and Variations in the Proportion of Nitrogen, Phosphorus, and Potassium on Wheat Resistance to Low Temperatures* Zeml Bil 14(1) 51 62 (Croat) (Univ , Novi Sad)

The resistance of young wheat plants to low temperatures was investigated using various concentrations of N, P, and K (as NH_4NO_3, $CaHPO_4$, and KCl) under controlled and partially natural conditions Variation in the proportion and concentration of these elements influences the synthesis and accumulation of organic matter, which imparts variable resistance to low temperatures By increasing the amount of N, the synthesis of reducing sugars decreased, that of raw protein increased, and accumulation of organic matter improved The percent of plants that survived was significantly reduced The opposite occurred by increasing the amounts of P and K The synthesis and accumulation of organic matter, as well as resistance to low temperatures, depends not only on the ratio of these elements but also on their concentration, if the ratio is 1 1 1 and the concentration is increased the resistance is decreased (CA 65 16019b)

636 Sestic, S , Vuksanovic, S 1966 *Effect of Reduced Number of Topdressings on Wheat Yields* Savr Poljopr 14(9) 703 11 (Serbo) (Soil Res Inst , Belgrade)

On brown forest soil at Sabac, wheat yields were almost the same when one third of the N was applied at sowing and two thirds in winter and spring, as when half the N was applied at sowing and half in spring Three topdressings in autumn, winter, and spring, respectively, gave the best results After normal applications of PK at sowing, subsequent topdressing with P and K gave no additional benefit (FCA 20 2144)

637 Silc, J 1967 *Nitrogen Fertilizers for Winter Wheat and Barley in Rather Cold and Wet Climatic Parameters* Soc Kmetijstvo Gozdarstvo 18(13) 292 95 (Serbo)

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638 Agency for International Development Spring Review of the New Cereal Varieties, May 13 15, 1969 *Major Physical Inputs–With Emphasis on Fertilizer and Water Management for Crop Production* (Eng)

639 Asian Agricultural Survey 1969 *Part II Production of Farm Crops* pp 197 264 (University of Washington Press, Seattle) (Eng)

640 deGeus, J G 1967 *Wheat* Fertilizer Guide for Tropical and Subtropical Farming, pp 88 102 (Zurich Centre d'Etude de l'Azote) (Eng)

641 Jacob, A , Uexkull, H V 1963 *Fertilizer Use (Nutrition and Manuring of Tropical Crops)* Verlagsgesellschaft fur Ackerbau mbH Hannover, pp 137-40 (Eng) (Translated by C L Whittles)

642 Janick, J , Schery, R W , Woods, F W , Ruttan, V W 1969 *Wheat* Plant Sci (An Introduction to World Crops), pp 355 59 (Eng) (San Francisco, W H Freeman and Co)

643 Matz, S A 1969 *Wheat* Cereal Sci , pp 1 39 (Eng) (Westport, Conn , The Avi Publ Co , Inc)

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Agr Nitrogen News (*Agricultural Nitrogen News*)
Agr Pak (*Agriculture Pakistan*)
Agr Tec Mex (*Agricultura Tecnica en Mexico*)
Agr Tec (Santiago de Chile) [*Agricultura Tecnica (Santiago de Chile)*]
Agrartud Kozlem (*Agrartudomanyi Kozlemenyei*)
Agri Hort Genet (*Agri Hortique Genetica*)
Agrobiologiya
Agrochimica
Agrokem Talajt (*Agrokemia es Talajtan*)
Agrokhim Kharakter Pochv SSSR (*Agrokhimicheskaya Kharakteristika Pochv SSSR*)
Agrokhimiya
Agron Glas (*Agronomski Glasnik*)
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Albrecht Thaer Arch (*Albrecht-Thaer-Archiv*)
Allahabad Farmer
Am Univ Beirut, Fac, Agr Sci, Publ (*American University of Beirut, Faculty of Agricultural Sciences, Publication*)
An Edafol Agrobiol (*Anales de Edafologia y Agrobiologia*)
An Esc Super Agr "Luiz de Queiroz," Univ Sao Paulo (*Anais da Escola Superior de Agricultura, Luiz de Queiroz," Universidade de Sao Paulo*)
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Aust J Biol Sci (*Australian Journal Biological Sciences*)
Aust J Exp Agr Anim Husb (*Australian Journal of Experimental Agriculture and Animal Husbandry*)
Aust J Soil Res (*Australian Journal of Soil Research*)

Bayer Landwirt Jahr (*Bayerisches Landwirtschaftliches Jahrbuch*)
Ber Getreidechem Tag, Detmold (*Bericht ueber die Getreidechemiker Tagung, Detmold*)
Biol Osn Oroshaemogo Zemled (*Biologicheskie Osnovy Oroshaemogo Zemledeliya*)
Biol Zh Armenii (*Biologicheskii Zhurnal Armenii*)
Biul Inform Central Lab Technol Przetworstwa Przechowalnictwa Zboz Warszawie (*Biuletyn Informacyjny Centralnego Laboratorium Technologii Przetworstwa i Przechowalnictwa Zboz*)
Boln Tec Cent Invest Agric "Alberto Boerger" (*Boletin Tecnico, Centro de Investigaciones Agricolas "Alberto Boerger"*)
Bot Kozlem (*Botanikai Kozlemenyek*)
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Bull Acad Pol Sci, Ser Sci Biol (*Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Biologiques*)

C R Hebd Seances Acad Agr Fr (*Comptes Rendus Hebdomadaires des Seances de l'Academie d'Agriculture de France*)
Can J Biochem (*Canadian Journal of Biochemistry*)
Can J Bot (*Canadian Journal of Botany*)
Can J Plant Sci (*Canadian Journal of Plant Science*)
Can J Soil Sci (*Canadian Journal of Soil Science*)
Colo Agr Exp Sta Prog Rep (*Colorado Agricultural Experiment Station Progress Report*)
Commer Fert (*Commercial Fertilizer*)
Conserv Res Rep, U S Agr Res Serv (*Conservation Research Report, U S Agricultural Research Service*)
Crop Sci (*Crop Science*)
Curr Sci (*Current Science*)

Dacca Univ Stud, Part B (*Dacca University Studies, Part B*)
Diagn Potrebnosti Rast Udobr (*Diagnostika Potrebnosti Rastenii v Udobreniyakh*)
Diss Abst (*Dissertation Abstracts*)
Diss Abst Int (*Dissertation Abstracts International*)
Dokl Akad Nauk Arm SSR (*Doklady Akademii Nauk Armyanskoi SSR*)
Dokl Akad Nauk Uzb, SSR (*Doklady Akademii Nauk Uzbekskoi, SSR*)
Dokl TSKHA [*Doklady TSKhA (Timiryazevskaya Sel'skokhozyaistvennaya Akademiya)*]
Dokl Vses Akad Sel khoz Nauk (*Doklady Vsesoyuznoi Akademii Sel'skokhozyaistvennykh Nauk*)

East Afr Agr Forest J (*East African Agricultural and Forestry Journal*)
Elektron Obrab Mater (*Elektronnaya Obrabotka Materialov*)
Exp Agr (*Experimental Agriculture*)
Expanded Tech Assis Prog, FAO Rep (*Expanded Technical Assitance Program, Food and Agricultural Organization of the United Nations Report*)
Exp Husb (*Experimental Husbandry*)

Farm Quarterly

Farming S Afr (*Farming in South Africa*)
Fertilizer News
Fisons Agr Tech Inf (*Fisons Agricultural Technical Information*)
Forsch Berat (*Forschung und Beratung*)

God Soffi Univ, Biol Fak (*Godishnik na Sofiiskiya Universitet, Biologicheski Fakultet*)

Idaho Agr Exp Sta Bull (*Idaho Agricultural Experiment Station Bulletin*)
Indian Agr (*Indian Agriculturist*)
Indian Agr Res Inst (*Indian Agricultural Research Institute*)
Indian Farming
Indian J Agr Econ (*Indian Journal Agricultural Economics*)
Indian J Agr Sci (*Indian Journal of Agricultural Science*)
Indian J Agron (*Indian Journal of Agronomy*)
Indian J Pl Physiol (*Indian Journal of Plant Physiology*)
Indian J Sci Ind [*Indian Journal of Science and Industry (Sec A)*]
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Irish J Agr Res (*Irish Journal of Agricultural Research*)
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Izv Akad Nauk Kazakh, SSR, Ser Biol (*Izvestiya Akademii Nauk Kazakhskoi, SSR, Seriya Biologicheskaya*)
Izv Inst Fiziol Rast "Metodii Popov," Bulg Akad Nauk (*Izvestiya na Instituta po Fiziologiya na Rastenyata, Bulgarska Akademiya na Naukite*)
Izv Sel'skokhoz Nauk (*Izvestiya Sel'skokhozyaistvennykh Nauk*)
Izv Timiryazevsk Sel'khoz Akad (*Izvestiya Timiryazevskoi Sel'skokhozyaistvennoi Akademii*)

J Agr (*Journal of Agriculture*)
J Agr Assn China [*Journal of the Agricultural Association of China (Taiwan)*]
J Agr Sci (*Journal of Agricultural Science*)
J Agr, W Aust (*Journal of Agriculture, Western Australia*)
J Aust Inst Agr Sci (*Journal of the Australian Institute of Agricultural Science*)
J Indian Soc Soil Sci (*Journal of the Indian Society of Soil 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 S Afr Bot (*Journal of South African Botany*)
J Sci Food Agr (*Journal of the Science of Food and Agriculture*)
J Soil Sci (*Journal of Soil Science*)

Kgl Vet Landbohoejsk, Arsskr (*Kongelige Veterinaer-og Landbohoejskole, Arsskrift*)
Khim Sel'Khoz (*Khimiya v Sel'skom Khozyaistve*)

Labdev
Landbouwvoorlichting
Landwirt Forsch (*Landwirtschaftliche Forschung*)
Landwirt Forsch Sonderh (*Landwirtschaftliche Forschung, Sonderheft*)
Lantbrukshoegsk Medd, Ser A (*Lantbrukshoegskolans Meddelanden, Serie A*)
Lucr Stiint Inst Agron Iasi (*Lucrari Stiintifice Institutul Agronomic "Ion Ionescu de la Brad," Iasi*)

Maatalous Koetoiminta (*Maatalous ja Koetoiminta*)
Maataloustieteellinen Aikak (*Maataloustieteellinen Aikakauskirja*)
Magy Tud Akad Agrartud Oszt Kozlemeny (*Magyar Tudomanyos Akademia Agratudomanyok Osztalyanak Kozlemenyei*)
Mikrobiologiya
Mikroelem Sel Khoz Med (*Mikroelementy v Sel'skom Khozyaistve i Meditsine*)
Mikroelem Sel Khoz Med, Akad Nauk Ukr SSR (*Microelementy Sel'skom Meditisine, Akademiya Nauk Ukrainskoi SSR*)
Mikroelem Sib (*Mikroelementy v Sibiri*)
Mysore J Agr Sci (*Mysore Journal of Agricultural Sciences*)

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Nauk Pr Ukr Akad Sil's'kogospod Nauk (*Naukovi Pratsi, Ukrains'ka Akademiya Sil's'kogospodars'kikh Nauk*)
Near East Wheat and Barley Improvement and Production Project Food and Agricultural Organization of the United Nations
Nebr Agr Exp Sta Outstate Test Circ (*Nebraska Agricultural Experiment Station Outstate Test Circular*)
Nebr Agr Res Bull (*Nebraska Agricultural Research Bulletin*)
Neth J Agr Sci (*Netherlands Journal of Agricultural Science*)
Neth Nitrogen Tech Bull (*Netherlands Nitrogen Technical Bulletin*)

Nippon Dojo Hiryogaku Zasshi (*Journal of the Science of Soil and Animal Fertilizers, Japan*)
Novenytermeles

Ore Agr Exp Sta Spec Rep (*Oregon Agricultural Experiment Station Special Report*)

Pak J Sci (*Pakistan Journal of Science*)
Pak J Soil Sci (*Pakistan Journal of Soil Science*)
Pamiet Pulawski (*Pamietnik Pulawski*)
Phosphorsaeure
Phosphorus Agr (*Phosphorus in Agriculture*)
Phytopathology
Plant Physiol (*Plant Physiology*)
Plant Soil (*Plant and Soil*)
Planta
Pochvozn Agrokhim (*Pochvoznanie i Agrokhimiya*)
Pol'nohospodarstvo
Potash News Letter (India)
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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)*]
Proc Nat Acad Sci, India, Sect A (*Proceedings of the National Academy of Science, India, Section A*)
Progressive Farming
Progresso Agricolo

Qd Agr J (*Queensland Agricultural Journal*)
Qd J Agr Anim Sci (*Queensland Journal of Agricultural and Animal Sciences*)
Qual Plant Mater Veg (*Qualitas Plantarum et Materiae Vegetabiles*)

Raccolto
Ranchi Univ J Agr Res (*Ranchi University Journal of Agricultural Research*)
Rastenievud Nauki (*Rastenievudni Nauki*)
Rep Crop Res Lesotho (*Report Crop Research, Lesotho*)
Rep Rothamsted Exp Sta (*Report of the Rothamsted Experimental Station*)
Rev Invest Agropecuar Ser 2 (*Revistas de Investigaciones Agropecuarias, Serie 2 Biologia y Produccion Vegetal*)
Rev Roum Biol Ser Bot (*Revue Roumaine de Biologie, Serie Botanique*)
Rhodesia Agr J (*Rhodesia Agricultural Journal*)
Rocz Nauk Roln Ser A (*Rocznika Nauk Rolniczych, Seria A*)
Rost Ustoich Rast (*Rost i Ustoichivost Rastenii*)
Rostl Vyroba (*Rostlinna Vyroba*)

S Afr Tydskr Landbouwetensk (*Suid Afrikaanse Tydskrif vir Landbouwetenskap*)
Savr Poljopr (*Savremena Poljoprivreda*)
Sb Nauch Tr, Nauch Issled Inst Zemled, Arm S S R (*Sbornik Nauchnykh Trudov, Nauchno Issledovatel'skii Institut Zemledeliya, Armenian SSR*)
Sb Vys Sk Pol'nohsp Nitra (*Sbornik Vysoka Skola Polnohospodarskej Nitra*)
Sb Vys Sk Zemed Brne, Rada A (*Sbornik Vyskoe Skoly Zemedelske v Brne, Rada A*)
Sci Cult (*Science and Culture*)
Sel' khoz Biol (*Sel'skokhozyaistvennaya Biologiya*)
Sementi Elette
Soc Kmetijstvo Gozdarstvo (*Socialisticno Kmetijstvo in Gozdarstvo*)
Soil Crop Sci Soc Florida, Proc (*Soil and Crop Science Society of Florida, Proceedings*)
Soil Sci (*Soil Science*)
Soil Sci Soc Amer Proc (*Soil Science Society of America, Proceedings*)
Soils Fert Taiwan (*Soils and Fertilizers in Taiwan*)
Sov Pl Physiol (*Soviet Plant Physiology*)
Stiinta Solului
Stikstof

TNO Nieuws
Tagungsber Deut Akad Landwirtschaftswiss Berlin (*Tagungsberichte, Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin*)
Tenn Agr Exp Sta Bull (*Tennessee Agricultural Experiment Station Bulletin*)
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku (*Bulletin of the Tokai Kinki National Agricultural Experiment Station*)
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USAID (*United States Agency for International Development*)
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Va Polytech Inst Res Div Bull (*Virginia Polytechnic Institute Research Division Bulletin*)
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Versl Landbouwk Onderz (*Verslagen van Landbouwkundige Onderzoekingen*)
Vest Mosk Univ, Biol Pochvoved (*Vestnik Moskovskogo Universiteta, Biologiya, Pochvovedenie*)
Vest Sel'khoz Nauki, Alma Ata (*Vestnik Sel'skokhozyaistvennoi Nauki, Alma Ata*)

Vestn Sel'skhoz Nauki (Moscow) [*Vestnik Sel'skokhozyaistvennoi Nauki (Moscow)*]

Visn Sil's'kogospod Nauki (*Visnik Sil's'kogospodars'koi Nauki*)

Vliyanie Dlitel'nogo Primen Udobr Plodorodie Pochvy Prod Sevooborotov (*Vliyanie Dlitel'nogo Primeneniya Udobrenii na Plodorodie Pochvy i Produktivnost Sevooborotov*)

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W Pak J Agr Res (*West Pakistan Journal of Agricultural Research*)

Wash State Univ Agr Exp Sta Circ (*Washington State University Agricultural Experiment Station Circular*)

Weibulls Arsbok

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Z Ausland Landwirt (*Zeitschrift fur Auslandische Landwirtschaft*)

Z Pflanzenernaehr Bodenk (*Zeitschrift fuer Pflanzenernaehrung und Bodenkunde*)

Zborn Rad Poljopriv Fak Ujriv Beogr (*Zbornik Radova Poljoprivrednog Fakuleta, Univerzetet u Beogradu*)

Zeml Bil (*Zemljiste i Biljka*)

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Zesz Nauk Wyzsz Szk Roln Szczecinie Roln (*Zeszyty Naukowe Wyzszej j Szkoly Rolniczejw Szczinie*)

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