MINNESOTA
FEED SERVICE

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1964 Crop Variety Recommendations

Harley J. Otto

Consistently high yields of good quality farm crops do not "just happen," they result from careful planning and attention to scientifically proven crop production practices. Such practices as (1) preparing a good seed bed, (2) planting high quality seed of proven varieties, (3) planting at the optimum time, (4) applying fertilizer of the kind and amount recommended according to the results of soil tests, (5) controlling weeds, insects, and diseases, (6) harvesting at the proper time with good machinery, and (7) storing properly to preserve high quality, are all needed to insure high yields and good income from crop production.

Selection of superior varieties is one of the important aspects of good crop production. Such factors as maturity, yielding ability, plant height, lodging resistance, disease resistance, winter hardiness and market quality distinguish one variety from another. A given variety seldom possesses all the desirable factors, the grower must consider all factors and choose varieties which most nearly meet his needs.

University of Minnesota scientists recently reviewed research data from crop variety trials and revised the list of recommended varieties. This list is based on several years of extensive tests conducted at experiment stations, in farmers' trials, in greenhouses, and in laboratories. A variety must be tested at least 3 years before it is recommended.

For 1964, Dodge oats, Mingren sunflowers, Crim wheat, and Summit flax have been added to the recommended list; Arny and Marine 62 flax have been removed.

Dodge oats was developed at the Wisconsin Agricultural Experiment Station and released in 1961. It is medium-early in maturity, has good lodging resistance, and produces yellow kernels with good test weight. Except for Portage, this variety has the highest degree of resistance to leaf rust of any of the recommended varieties. It also is resistant to the prevalent races of stem rust and to smut. Its yield is as good as other recommended varieties of comparable maturity. Ample quantities of certified seed are available.

The sunflower variety **Mingren** was released by the University of Minnesota Agricultural Experiment Station in spring 1963. It is a large-seeded variety selected from the variety Mennonite. Mingren has produced slightly lower yields than Arrowhead, the other recommended variety. It is slightly taller and somewhat later than Arrowhead and does not stand as well. In University tests conducted over a 6-year period, about 30 to 35 percent of the Mingren seeds were large compared with 12 to 14 precent for Mennonite and 1 percent for Arrowhead. Thus, it is recommended for situations where there is a good market for large sunflower seeds.

Crim wheat was released by the Minnesota Agricultural Experiment Station in the spring of 1963. It is a bearded, hard red spring wheat named for the late professor Ralph F. Crim, long-time Minnesota extension agronomist. Crim's good stem rust resistance is derived from a different source than other spring wheat varieties, which should help minimize the risk of devastating stem rust attacks. It is a high yielding variety with moderate resistance to

(Continued on next page)

These Varieties Are Recommended for Planting in 1964:

Barley	Larker, Kindred (L), Parkland, Traill, Trophy
Oats	Early: Minhafer, Andrew
	Medium Early: Burnett, Dodge, Goodfield
	Medium Late: Ajax, Portage, Garry
	Late: Rodney
Rye	Adams, Caribou, Elk
Wheat	Hard Red Spring: Crim, Justin, Pembina, Selkirk
	Durum: Lakota, Langdon, Wells
	Hard Red Winter: Minter
Flax	B5128, Bolley, Redwood, Summit, Windom
Soybeans	Acme, Chippewa, Comet, Flambeau, Grant, Harosoy, Lindarin, Merit, Norchief, Ottawa Mandarin
Sunflowers	Arrowhead, Mingren
Field Peas	Chancellor, Stråal
Millet	Proso: Turghai
	Foxtail: Empire, White Wonder
Alfalfa	Ranger, Vernal
Birdsfoot Trefoil	Empire
Red Clover	Dollard, Lakeland
Sweet Clover	Evergreen, Goldtop, Madrid
Kentucky Bluegrass	Park
Bromegrass	Achenbach, Fischer, Lincoln
Sudangrass	Piper
Timothy	Climax, Itasca, Lorain

For complete information on "recommended," "not adequately tested," and "other" varieties, see Miscellaneous Report 24, "Varietal Trials of Farm Crops."

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lodging, and is moderately susceptible to leaf rust and loose smut. Crim is considered of acceptable quality for milling and baking. About 900 bushels of foundation seed were distributed in 1963 and a fair supply of registered seed should be available for 1964 planting. Certified seed is expected to be available for planting in 1965.

Summit flax was developed and released by the South Dakota Experiment Station. The variety is early in maturity, has high seed yield potential, particularly when sown early, is medium in height, and has fair lodging resistance. Its pasmo tolerance is better than Windom and Redwood, but poorer than Arny and Marine. It is low in oil content, but oil quality is fair. Summit has excellent wilt resistance and is immune to all known North American races of rust, including race 300.

Foundation seed of this variety will be distributed in 1964.

New Race of Flax Rust Affects Flax Recommendations

A new race of flax rust, Number 300, has been discovered in flax fields in Canada and North Dakota. The varieties Arny, Marine, Marine 62, Cree, Raja, and Sheyenne are susceptible to this race. Since flax rust can overwinter and reproduce on flax straw, it is feared that if these susceptible varieties are planted on large acreages the rust will increase and, possibly, new races develop. If this happens, a race may develop which will attack other varieties now immune to the disease. There would then be no source of resistance to this devastating disease in adapted varieties. *It is, therefore, highly recommended that susceptible varieties not be planted in 1964.* Arny and Marine 62 have been removed from the recommended list because of their susceptibility; Bolley, B5128, Redwood, Summit, and Windom are immune to rust and can safely be planted.

Removal of Arny and Marine 62 from the recommended list eliminates the varieties with the best pasmo resistance. However, plant pathologists consider rust to be much more serious than pasmo as a potential flax production hazard.

Certified Seed Assures Varietal Purity and Seed Quality

Recommended varieties have demonstrated superior performance compared to other varieties tested. If a grower is to obtain the benefits incorporated into these varieties he must plant seed of known varietal purity. This assurance is best obtained by planting certified seed.

Certified seed is no more than three generations removed from foundation seed maintained by the University of Minnesota and known to be pure for variety. Production and processing of certified seed are supervised by the Minnesota Crop Improvement Association through field and laboratory inspections.

In addition to varietal purity, certified seed must meet high standards for freedom from weeds, other crop seeds, and inert material, and must be high in germination. Within certified seed a tolerance for these factors is allowed. For example, the minimum germination allowed in small grains is 85 percent. Individual lots may have considerably higher germination. Thus some certified seed is better than others. It is, therefore, wise to study the analysis tag.

Seed cost represents only a small fraction of the total cost of producing an acre of a given crop. A crop producer cannot afford to take a chance on planting poor seed. It is wise policy to plant certified seed purchased from a reliable seedsman.

How the United States Exports Grain

Harold C. Pederson

At the beginning of 1964 Many U. S. wheat exporters are gearing up in the expectation that they will be called upon to move record quantities of grain. This turns the spotlight on grain export programs and procedures.

Export Role of U. S. Government

Most wheat exports from the United States are handled by the private grain trade. An important supporting role is performed by the U. S. Government. Exports of wheat for the year ending June 30, 1963, actually exceeded domestic uses and totaled 638 million bushels, of which 433 million bushels were hard red winter; 40 million bushels, soft red winter; 39 million bushels, hard red spring; 4 million bushels, durum; and 122 million bushels, white wheat.

Exports of feed grains in recent years have been about one-tenth of the domestic use, or 17 million tons. However, the U. S. Government has assumed a much weaker supporting role in feed grain exports.

Since the early 1930's, the U. S. Government has operated various agricultural price support programs. Among these was the Commodity Credit Corporation, created by executive order in 1933, with Congress passing on the CCC Charter in 1948. The CCC supports domestic commodity prices by nonrecourse loans to farmers which have the effect of removing excess grain from the market and placing it in Government storage. Through this price support program, U. S. wheat growers have been able to receive an average of $1.80 to $2 a bushel for wheat in the past several years, even though world market prices were about one-third lower.

Obviously U. S. wheat, at domestic prices higher than the world market, will not be attracted into the world market except through some compensating device. This compensating device takes the form of an export payment, made "in kind" (wheat) to the exporter ("in cash" in the case of flour) enabling him to offer U. S. wheat to foreign buyers at competitive world prices.

The exporter does not pocket this export payment in the form of profit. Actually, the payment merely compensates him for the loss he otherwise would suffer by buying high and selling low. *The U. S. farmer actually receives the utimate benefit, as the payment maintains his domestic wheat prices at levels higher than world prices.* The export payment also makes it possible to move substantial amounts of U. S. wheat production out of storage and thereby helps to reduce the cost of maintaining excessive inventories.

How the Export Payment Program Operates

Each business day USDA specialists observe world wheat prices and wheat prices in the United States. At 3:30 each afternoon, USDA announces export payment rates for key classes of wheat on all coasts of export.

On September 24, for example, the export payment to the exporter which made U. S. No. 2 hard red wheat competitive in the world market from Gulf ports was 56 cents a bushel; on the West Coast the rate for hard red winter was 62 cents, while the soft white wheat rate was 47 cents.

These rates vary because of market factors in the United States and differences in the location of wheat-producing areas relative to ports. Although

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this payment in the first instance went to the exporter it actually ended up in the pocket of the wheat producer in the form of an above-the-world-price.

Announcement of these export payment rates constitutes an offer by the Government to make a payment in the stated amount per bushel for any wheat or flour sold for export during the 24-hour period between daily subsidy announcements. Wheat exporters can look at U. S. market prices and the export payment announced and *bid for business* in the competitive world market. Public Law 480 authorizes barter of wheat for strategic materials and a CCC credit program, but these involve only a small volume.

U. S. wheat exports are either considered sales for dollars (involving the export subsidy described above) or disposals under Government programs, including credit transactions, exchange for nonconvertible foreign currency, and grants to foreign governments. The services of a private trade may be used in Government disposals.

Role of International Wheat Agreement

World wheat prices—like domestic prices—have been stabilized to some extent since 1949. The International Wheat Agreement (IWA), last renewed in 1962, provides the means for doing this. The IWA is an agreement among exporting and importing countries to conduct most of the world's commercial wheat trade within a certain price range.

The range of prices in the 1962 agreement is $1.62½ to $2.02½ per bushel in terms of a basic wheat, No. 1 Manitoba Northern, stored in a warehouse at Fort William or Port Arthur, Canada, on Lake Superior. This range of prices is roughly equal to $1.15 to $1.55 per bushel for average quality hard wheats on the farm in the central United States, taking into account prevailing differentials for quality and location.

Exporting countries agree under the IWA to supply a specific portion of importers' needs for wheat and flour at the maximum price, even if world prices are higher as a result of a wheat shortage.

Importing countries agree to buy a specified percentage of their total commercial wheat and flour purchases from member exporters so long as prices remain below the maximum price. Prices may not go below the minmum of the agreement range.

During the last marketing year, wheat moved from exporting countries to importing countries at prices approximately midway in the IWA range. These prices, less freight from farms to export terminals, can be translated into a farm price of $1.30 to $1.35 a bushel at a central U. S. farm.

The U. S. Government is not unique in its wheat program. Governments throughout the world are heavily involved in a supporting role in grain production, pricing, and trade matters. This is true for both wheat exporting and importing countries. Canada, for example, requires that most wheat produced by farmers be marketed through the Canadian Wheat Board. Prices paid to farmers for deliveries scheduled by the Board are roughly world market prices, although there are certain advantages to farmers through favorable transportation rates.

The United Kingdom, on the other hand, maintains a comparatively low market price for grains, but makes substantial government payments to farmers, which bring total returns for a bushel of wheat to about the same level received by U. S. producers.

The Common Market Countries, made up of wheat exporting and importing countries, support internal wheat and grain prices by means of levies of various amounts applied to grain imports. Typical hard wheats shipped to Germany from North America can be landed at Hamburg for about $2. But levies placed on the wheat before it enters Germany have the effect of supporting wheat prices to German farmers at more than $3 per bushel, the sum of the import price plus the levy.

Countries normally active in the world's wheat export markets are the United States, Canada, Australia, Russia, and France.

DHIA Electronic Processing Now Done on St. Paul Campus

Ralph W. Wayne

An electronic computer on the University of Minnesota's St. Paul Campus is gradually taking over record calculating for the state's Dairy Herd Improvement Associations.

The first use of this computer for central processing of DHIA records was in October 1963; already records on more than 1,000 of Minnesota's 3,236 dairy herds using the electronic record system are being computed on the St. Paul Campus. Since 1958, when the program started, the processing has been handled by a computing center at Iowa State University. By June 1964 all Minnesota cows on central processing will have their records processed here.

The computer, installed by the University's Agricultural Experiment Station, is used in the DHIA program to give dairymen rapid and complete reports on dairy production efficiency.

Central processed DHIA records provide the most complete records available to dairymen as guides for culling, feeding, breeding, and management since the first Minnesota DHIA was founded in Freeborn County in 1910. Largely because of enthusiasm for the new recordkeeping system, the number of new cows on test has tripled in the past 10 years.

Past experience shows that when a dairyman uses the information supplied in his DHIA records he can figure from $5 to $8 in increased net returns for each dollar he invests in the program. For the complete DHIA service, a farmer pays from $4 to $6.50 per cow annually.

In the DHIA central processing system, a local DHIA supervisor weighs and samples the milk from each cow 1 day a month, and checks feed and feed quality. He then tests the milk and makes out a report with test and feed data, other costs, and management figures.

The report goes by mail to the dairy husbandry extension office on the St. Paul Campus where it gets a thorough audit. The data are transferred to cards; the computer makes the computations and prints a complete report which is mailed back to the herd owner. From the time the data is put on cards there are no further hand calculations or entries.

Here are some of the special features of the DHIA central processing record.

1. The most accurate system ever available, as factors of human error are reduced to a minimum.
2. Monthly printed reports are easily read and studied, with all records on one sheet for ready comparisons.
3. Feed value of all feeds fed is evaluated.
4. Shows on a month-to-month basis the amount of grain to feed each cow.
5. Determines the percentage of nutrients coming from each feed constituent.
6. Calculates the percentage of the Morrison feeding standard fed.

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(DHIA electronic processing . . . from page three)

7. Determines value of milk produced, cost of concentrates, total feed cost, returns over feed cost, feed cost to produce 100 pounds milk, and pounds of milk per man taking care of the herd.
8. Factors are calculated monthly for both the current month and the past 12 months, thus giving the dairyman constant information on trends in his herd.
9. Records are flagged when cows should be bred and dried off.
10. Complete records of breeding services and calvings are maintained.
11. Summary and lactation record information is machine-punched on cards to use in proving sires.
12. All punch cards are readily available for extensive research study of various management factors by University dairy scientists.

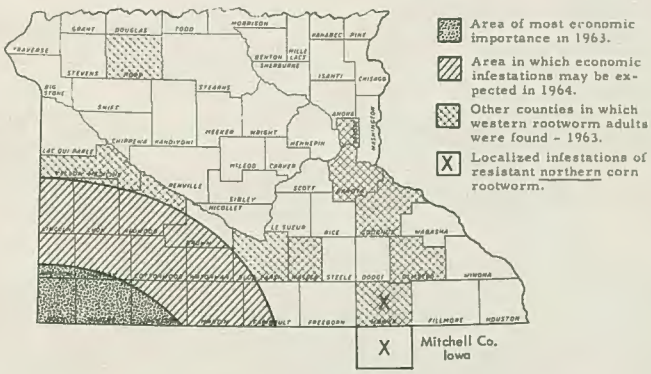
The stimulus this program has given will result in over 200,000 cows in 6,500 herds being enrolled in the Minnesota DHIA central processing system within the next 3 years. Encourage your dairymen customers to take advantage of the benefits available to them through DHIA testing and central processing records.

MINNESOTA DHIA SUMMARY, 1962-63

Herds on test (std. DHIA)	4,040
Average pounds milk per cow	11,163
Average pounds fat per cow	418
Average feed consumption per cow:	
Pounds concentrates	3,800
Pounds succulents	7,400
Pounds dry roughage	5,200
Days on pasture	116
Total feed cost per cow	$150
Income over feed cost per cow	$245
Feed cost per cwt. milk	$1.36

The Western Corn Rootworm in Minnesota

J. A. Lofgren



The western corn rootworm is present throughout most of southern Minnesota and is firmly established in the southwest corner of the state (see map). It is expected to continue to spread and increase and eventually become a pest of high economic importance in the corn-producing counties. This insect is related to the common northern corn rootworm and has a similar life cycle: eggs are laid in the fall, larvae hatch in June, and adults emerge in July and August.

Concern over the western corn rootworm is because crop rotations are less effective in preventing infestations than they are for the northern corn rootworm, and the insect readily becomes resistant to aldrin and heptachlor, the commonly used soil insecticides. Furthermore, when the western species becomes established in a field or a locality it becomes dominant and the northern rootworms become less abundant. The western rootworm apparently is more vigorous and damaging than the northern.

For fields in which western rootworms have become damaging, or for the few localized areas in which the northern species has become resistant to aldrin or heptachlor, the following suggestions may help minimize losses:

1. Wherever practicable rotate the badly infested fields to crops other than corn in the following year.
2. With other factors equal, late planted corn generally is more severely damaged than early planted corn. Avoid late planting dates for fields which probably are infested.
3. When corn is planted in fields likely to be economically infested with western or resistant northern rootworms, the use of certain phosphate insecticides may reduce the severity of the losses if the chemical chosen is properly applied. Chemicals which have label approval for the control of resistant rootworms are granular diazinon, phorate (Thimet), stabilized parathion, and compound 4072.
   Aldrin or heptachlor is still recommended for the control of nonresistant populations of rootworms. (See Entomology Fact Sheet No. 14, available from your county extension office.)

Application Rate of Organic Phosphates

Apply 1 pound of actual chemical per acre. The commercially available form of diazinon, phorate, parathion, and compound 4072 to use for rootworms is the 10-percent granular formulation applied at 10 pounds per acre, concentrated over the rows.

Placement of Insecticides

It is extremely important to apply the right amount of chemical in the right place. Properly calibrated and adjusted planter-mounted granular applicators should be used. The granules should be in 4- to 6-inch band over the seed and just covered by ½ to 1½ inches of soil. This can be done by using spreaders on the ends of the applicator tubes and adjusting the tubes to deliver the insecticides well behind the planter shoes, just ahead of the press wheels. **Granules should not be placed deep in the furrow with the seed.**

Postemergence Treatments

Experimental work in some north-central states shows that applications of these phosphate insecticides at 1 pound of actual chemical per acre in the row about the middle of June may give satisfactory control. The granules should be applied with an applicator mounted on the cultivator, directed at the bases of the plants, and covered with 2 to 3 inches of soil. This may be done with disk hillers on the cultivator. Good results probably will not be obtained if the treatment is made during droughty periods.

Caution!

Some of the organic phosphate insecticides are highly toxic and must be used with extreme care. Avoid exposure to the skin, lungs, and mouth. Wear protective clothing when directed to do so on the label, do not breathe the dust or vapors, and do not eat or smoke while handling the chemicals or until after washing thoroughly. When finished for the day, bathe thoroughly and change clothes. Follow these and other precautions given on the container labels for your protection.

The Varied Effects of Fertilizer on the Corn Plant

Based on a paper presented at the Soils and Fertilizer Short Course by J. T. Murdock

For many years crop yield has been the major factor determining fertilizer usage. If good responses are obtained to applications of only one nutrient, minimal quantities of other nutrients are applied without considering the effect on crop quality or on the depletion of soil fertility. Such practices have often created new and sometimes severe problems.

Although crop yield continues to be a factor of major importance, farmers, fertilizer dealers, and professional agronomists can well afford to keep a close eye on the crop through the growing season and learn to watch for signs of future problems.

The data in this article are taken from two experiments. The first series of treatments included broadcast applications of 0, 80, and 160 pounds per acre of N; 0, 35, and 70 pounds per acre of P (0-80-160 pounds per acre P_2O_5) and 0, 66, and 132 pounds per acre of K (0-80-160 pounds per acre K_2O) in all possible combinations. The second series included the above broadcast treatments plus a row application of 200 pounds per acre of 5-20-20 and an additional 30 pounds per acre of N plowed down.

Effects of Fertilization on General Growth and Vigor

Early vigor may well be the most critical stage of growth for the plant. Weak plants often succumb to weeds, disease, insects, or the farmer's cultivator. The primordia which later develop into the various plant parts are laid down very early in the plant's life. Consequently, a program of fertilization which provides adequate nutrition for the crop during this stage of growth is essential to normal development of the plant.

The data in table 1 illustrate the influence of various fertility treatments on the early growth of corn. Row fertilizer resulted in higher dry matter yields during the first 30 days of growth than did broadcast treatments in which much greater quantities of fertilizer were applied. Examination of the nutrient uptake data indicates that the reason for this increase in yield was due to more efficient utilization of the applied nutrients.

Early growth, of course, does not tell the whole story; this merely covers the stage in which the capacity of the root system is limited. Adequate amounts of plant nutrients must also be provided to take the plant through the rapid stage of vegetative growth and finally through the reproductive stage.

Although little nutrient uptake and dry matter production occurs during the first period of growth, the relative differences between treatments may be quite great (table 1).

During the second period of growth (12 inches high to 80 percent silk) the "factory" is built and the greatest amount of nutrient uptake occurs (table 2). With either N, P, or K in short supply, nutrient uptake during this period was limited, crop growth was hindered, and nutrient deficiency symptoms became quite pronounced.

Nutrient uptake decreased in all cases during the last stage of growth (80 percent silk to full dent), although maximum dry matter production occurred during this time. The data in table 2 indicate that substantial quantities of N and P were taken up during this period, especially when adequate levels of these nutrients were applied. On the other hand, relatively little K was taken up during this time, even when adequate quantities were in the soil.

Table 1. The effect of row fertilizer on early growth (first 30 days) and nutrient uptake by corn, average of 4 replications, 1961

Fertilizer application			Dry matter	Nutrient uptake		
N	P	K	yield	N	P	K
pounds per acre						
0	0	0	60	2	0.2	1
160	0	130	80	3	0.3	3
160	70	0	155	6	0.5	3
0	70	130	119	5	0.7	8
160	70	132	207	8	0.7	8
40	17	33*	226	8	0.8	8

* Row application of 200 pounds per acre of 5-20-20 + 30 pounds per acre of N plow down.

The final yields of grain appear to be closely related to total uptake in the case of N and P. But yields were only slightly reduced on the —K treatments, even though K uptake was less than half of that occurring with the complete N-P-K treatment. Observations indicate that the plant made severe adjustments to provide potassium for ear formation in the —K treatment (65 percent of the plants lodged on these plots before the harvest date). As a result of the observations an intensive study was made of the effects of the various fertility treatments on the development of the corn plant.

Influence of Fertilizer Treatment on Crop Maturity

Treatments which result in rapid maturity of corn may be very helpful in areas where there is danger of early frost. Many farmers believe that fertilizer applications, especially of nitrogen, delay the maturity of their corn.

Table 3. The influence of fertility treatment on the percent of corn plants in silk on August 5, average 4 replications, 1961

Fertilizer applied			Plants in silk
N	P	K	
	lb./acre		%
40	17	35*	87
120	17	35*	87
200	17	35*	86
160	70	130	86
160	70	0	81
0	0	0	26
0	70	130	22
160	0	130	17
160	0	0	5

* Row treatment used.

Data from a study in which silking dates were used as a measure of crop maturity do not support such a conclusion, except in cases where inadequate levels of P and/or K were supplied (table 3).

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Table 2. Nutrient uptake and dry matter yield of corn during 3 periods of growth with various fertility treatment, average of 4 replications, 1961

Uptake period	Nutrient uptake, lb./acre						Average dry matter yield, lb./acre
	Nitrogen		Phosphorus		Potassium		
	-N	N-P-K	-P	N-P-K	-K	N-P-K	
May 26-June 30	5	8	0.3	0.8	3	8	155
June 30-Aug. 4	41	96	8	12	30	105	4,060
Aug. 4-Sept. 12	24	82	3	11	29	28	7,020
Total	70	186	11.3	23.8	62	141	11,235
Yield, bu./acre	43	115	83	115	102*	115	

* 65 percent of the stalks on these plots were lodged.

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Deficiencies of P appeared to have a much more marked effect on delayed maturity than did deficiencies of K. It is also interesting to note that in any case where row fertilizer was applied the undesirable effects of delayed maturity were completely masked.

Influence of Fertility Treatment on Corn Morphology

Varying fertility levels have a marked influence on the form and structure of the plant. Some of these commonly noted differences find their way into descriptions of nutrient deficiency symptoms which generally relate to things such as color, chlorosis, necrosis, "burning," or "firing."

The data in table 4 indicate other plant characteristics which are influenced. These measurements are primarily related to stalk growth. Both plant height and height of ear set are related to internode length and deficiencies of either P or K resulted in shortened plants and lower ear set. Potassium deficiency had the most marked influence in this respect. Deficiency of either of the three major nutrients resulted in decreased stalk diameter.

Various fertility treatments also had an appreciable influence on the corn plants' root system.

The least lodging occurred on plots receiving the 0-0-0 treatment and was primarily root lodging which occurred relatively early in the season. Although the brace root system on these plants was small, 53 percent of the plants had brace roots above ground and the average number of brace roots per plant was fairly high (table 5). Also, the plants were short and had little ear weight to support, which may account for the high standability of the plants on this treatment.

Lodging on the 160-0-130 treatment was also very slight and was entirely due to root lodging. These plants had a substantial brace root system and the ear weight was higher than that of the check plot.

Moderate lodging occurred on the 160-70-130 treatment and again this was primarily root lodging. These plants had an excellent brace root system, but the plants were tall and had substantially more ear weight support than did any of the other treatments.

Severe lodging occurred on the plots receiving the 160-0-0 treatment. Almost two-thirds of the lodging on these plots was root lodging; the rest was stalk breakage. This lodging occurred although ear weights were low. The crop on these plots had a very poor root system; only 42 percent of the plants had aboveground brace roots. The brace root system anchored the plants in only 7 square inches of surface area as opposed to 46 square inches of surface area covered by brace roots of plants on the 160-70-130 treatment.

The most severe lodging occurred on plots receiving the 160-70-0 treatment. About two-thirds of the lodging occurring on this plot was due to root lodging and as in the 160-0-0 treatment, only 42 percent of the plants had a brace root system developed above ground. The smallest number of brace roots occurred on these plants and the soil area in which they were anchored was relatively small.

Influence of Fertility Treatment on Internal Plant Morphology

Further studies examined more thoroughly the factors involved in stalk breakage. Since earlier observations indicated that the breakage was in some way related to the breakdown of the tissue of the lower portion of the stalk, portions of the plant were sampled for histological studies. From July 12 through harvest in October 1962, samples were collected every week from the treatments listed above and were processed for sectioning.

Photomicrographs of these sections revealed a definite pattern in the breakdown of the parenchyma tissue in the lower portion of the plants grown on plots receiving low levels of potassium. Although the mechanical tissue did not appear to be appreciably affected, the breakdown of the pith left little stalk strength and stalk breakage occurred.

Tissue breakdown appeared as early as August 15 and then become progressively worse. Undoubtedly, this breakdown is related to the extremely low levels of potassium in this portion of the plant (0.2 to 0.5 percent as opposed to normal levels of 1.5 to 2.0 percent). Apparently the potassium reached a lethal deficiency level in these cells resulting in decomposition. No stalk rot or other disease was found in the tissue until a considerable degree of breakdown had occurred. Thus, any infection which took place was thought to be secondary in nature.

Conclusion

Many of the problems related to the production of corn result from insufficient planning in determining the fertilization practices to be used. Frequent soil tests should be taken in order to determine the nutrient status of the soil, and fertilizer applications should be made on the basis of these tests. However, frequent observation of the crop during the growing season may be helpful in determining nutritional status of the crop and in avoiding future problems.

Table 4. The influence of fertilizer treatment on plant height, height of ear set, and stalk diameter, average of 4 replications, 1961

Fertilizer applied			Plant height	Height of ear set	Stalk diameter
N	P	K			
	lb./acre			in.	mm.
160	70	130	97	44	24
0	70	130	94	42	20
160	0	130	90	41	21
160	70	0	88	36	21
160	0	0	80	36	21

Table 5. The influence of fertility treatment on the brace root development and lodging of corn, average of 4 replications, 1962

Fertilizer applied			Brace root (B.R.) characteristics				
N	P	K	Plants with B.R.	Area covered by B.R.	Root lodging	Broken stalks	Total lodging
	lb./acre		%	sq. in.		%	
0	0	0	53	5.2	1.5	0.5	2.0
160	0	130	79	21.2	3.3	0.0	3.3
160	70	130	85	46.4	9.8	0.4	10.2
160	0	0	42	6.7	24.0	14.3	38.3
160	70	0	42	9.9	49.5	28.3	77.8

MINNESOTA FEED SERVICE

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RECENT PUBLICATIONS

Listed below are selected recent publications of the University of Minnesota's Agricultural Extension Service and Agricultural Experiment Station which may interest you. Single copies are free upon request; you can either pick them up at your county extension office or send your request to the Bulletin Room, Institute of Agriculture, St. Paul, Minnesota 55101. Be sure to list the number and title of each publication you want.

Quantities of most publications are available at cost; quantity prices are listed in the *Publications List,* also available free from your county agent cr from the Bulletin Room.

Extension Folder 210. *Liming Minnesota Soils.* Revised last fall to give up-to-date recommendations on liming in Minnesota.

Extension Folder 211. *The Dutch Elm Disease.* Just revised to give latest information and recommendations for control of this serious disease now present in Minnesota.

Extension Folder 212. *Chemical and Cultural Weed Control in Field Crops.* Just revised with recommendations for 1964.

Extension Pamphlet 194. *Crop Production Guide for Minnesota.* Recommendations on variety, seeding rate, date of seeding, weed control, and fertilizer needs. 1964 revision is just off the press.

Special Report 10. *Agricultural Bargaining Power: Some Factors to Consider.* Reviews some of the issues that bear on farmers' bargaining power.

Special Report 12. *Minnesota Retail Dealers Conference 1964.* Prepared by extension specialists in soils, agronomy, plant pathology, entomology, and civil defense. 48 pages.

Miscellaneous Report 24. *Varietal Trials of Farm Crops.* Just revised for 1964.

FDA Food Additive Orders Pertaining to Animal Feeds as Published in the Federal Register for the Period July 6, 1963, to December 1, 1963

Compiled by R. E. Bergman

July 6, page 6915. A combination of 100 grams per ton of *chlortetracycline* as chlortetracycline hydrochloride plus 50 grams per ton of *penicillin* as procaine penicillin plus 0.011 percent *sulfamethazine* in feeds for swine not over 75 pounds in body weight for the reduction of the incidence of cervical abscesses; treatment of bacterial swine enteritis including enteritis caused by Salmonella choleraesuis, prevention of these diseases during periods of stress, and maintenance of weight gain in the presence of atrophic rhinitis. Medicated label format is required with warnings to be fed to swine under 75 pounds of weight and withdrawal 5 days before slaughter (121.208).

July 20, page 7425. *Novobiocin* for chickens and turkeys at 200 grams per ton for aid in the treatment of breast blisters associated with staphylococcic infections, and 350 grams per ton for treatment of staphylococcic infections and staphylococcic synovitis (infectious arthritis). Medicated label format is required with warnings not for laying birds, feed 5 to 7 days, and withdrawal 4 days prior to slaughter (121.212).

July 25, page 7559. *Calcium silicate,* including synthetic calcium silicate, may be safely used as an anticaking agent in animal feed, provided that the amount does not exceed 2 percent (121.250).

August 6, page 7971. *Choline xanthate* may be safely used as a source of choline in feeds for ruminants (121.231). It had previously been cleared for use in feeds for poultry and swine.

August 14, page 8309. Food Additive Regulation 121.241 amended to provide for the use of *diethylstilbestrol in feed for sheep* for fattening purposes to be fed at the rate of 2 milligrams per head per day from feeds containing the following percentage levels and bearing the following feeding directions:

Percent in feed	Feeding rate pounds/animal/day
0.00009	free choice
0.00011	4.0
0.00018	2.5
0.00022	2.0
0.00033	1.3
0.00044	1.0

Hormone-type labeling required with warnings not to be fed to breeding animals and withdraw 48 hours before slaughter.

August 14, page 8311. A new food additive amendment 121.251 providing for the use of *oxytetracycline in chicken and turkey feed* at specific levels for specific infections, organisms, and diseases; also when in combination with amprolium or zoalene as coccidiostats. Medicated label format required with adequate directions and warnings for use.

August 20, page 9148. An amendment to Food Additive Regulation 121.225 providing for a combination of *procaine penicillin plus tylosin phosphate* in chicken feed for growth promotion and feed efficiency in an amount not less than 1.2 grams of penicillin and not less than 2 grams of tylosin and not more than 50 grams of the combination per ton of complete feed. A medicated label format is not required but quantitative guarantees for tylosin and penicillin in grams per ton must be stated on the label.

August 21, page 9207. An amendment to Food Additive Regulation 121.225 providing for *chlortetracycline in horse feed* for growth promotion and feed efficiency in feed for horses up to 1 year of age in the amount of 85 milligrams per head per day where such horses are not to be slaughtered for food purposes. A medicated label format is not to be used.

September 10, page 9838. A new food additive amendment 121.252 for the use of *bacitracin methylene disalicylate* in poultry feeds at specific levels for specific purposes; also when in combination with penicillin, amprolium, amprolium plus ethopabate, with or without hygromycin B. A medicated label format is required with adequate directions and warnings for use.

(Continued on next page)

R. E. Bergman is director, feed control section, Minnesota Department of Agriculture.

Emphasis Changing in Soil Science Research

New approaches in soil science research, designed to cope with changing agricultural conditions, were reviewed in December at the Soils and Fertilizer Short Course on the University's St. Paul Campus.

Sherwood O. Berg, dean of the Institute of Agriculture, said the Institute has research projects in soil science ranging from determination of fertilizer effects on different soil types to studies of how tiny soil organisms produce chemical compounds and affect plant growth.

These projects, Berg said, reflect shifts in emphasis to keep pace with changes in agriculture and the rest of society.

He said that among the Institute's soil science research projects, one in four has been developed within the past 5 years.

As one example, he noted the increased study of minor elements, such as copper, sulphur, boron, molybdenum, zinc, and iron, as contrasted with traditional studies of nitrogen, potassium, and phosphorus.

He pointed to the seeking of knowledge about soils for new crops, such as soybeans. He said the use of pesticides as a routine procedure in weed and soil parasite control has created a new series of studies.

Conventional soil tillage practices may be in for some refinement, as a result of studies by the Institute on minimum tillage, soil compaction, movement of nutrients through different kinds of soils, and soil erosion.

Exen the weather is subjected to intensive basic research, through studies in soil climatology mentioned by Berg. Conventional weather observations are too gross. They do not, for example, describe conditions near the ground to provide data needed to find out how different conditions promote or restrict fungal and bacterial diseases.

Such research is carried on around the state, at the central experiment stations at St. Paul and Rosemount, at the outlying experiment stations, and on scores of private farms.

Last year, in one project alone, the Institute had soil studies in 400 fields involving 92 different soil types.

Similarly, Berg continued, much soils research is in cooperation with industry. As examples, he mentioned projects on coated slow-release fertilizers, movements and transformation of nitrogen, efficiency and possible losses of nitrogen fertilizer, and studies on sulfur in soils and plants.

The Institute of Agriculture, Berg said, has an obligation "to provide an appropriate balance between immediate problem solving and keeping the 'storehouse' replenished with basic knowledge."

(FDA food additive orders . . . from page seven)

September 17, page 10150. Amending Food Additive Regulation 121.241 and 121.251 to provide for the addition of *oxytetracycline to beef cattle feed containing diethylstilbestrol* for reduction of the incidence and severity of liver abscesses. Hormone type medicated labeling required with warnings not to be fed to dairy or breeding cattle and withdrawal 48 hours before slaughter.

September 20, page 10291. Amending Food Additive Regulation 121.208 and 121.241 to prescribe conditions of use for *chlortetracycline and diethylstilbestrol in beef cattle feed* at certain levels for various infections and diseases. Hormone type medicated labeling required with warnings for use for beef cattle and withdrawal 48 hours before slaughter.

September 28, page 10488. Amending food additive regulations providing for the addition of *bacitracin* or *zinc bacitracin* at therapeutic levels to poultry feeds containing *reserpine* at 0.0001 percent and 0.00002 percent levels. A medicated label format is required with adequate directions and warning for use.

October 10, page 10869 and 10870. New Food Additive Regulations 121.253 and 121.254 provide for 0.01 percent levels of *arsanilic acid* or *sodium arsanilate* with 0.004 percent to 0.025 amprolium, or 0.004 percent to 0.01875 percent *zoalene* for growth promotion, feed efficiency, improving pigmentation, and prevention and control of coccidiosis. A medicated label format is required with warnings not to be fed to laying birds and 5-day withdrawal before slaughter.

November 27, page 12618. Amending Food Additive Regulation 121.220 for *nystatin* permitting addition of low level amounts of antibiotics to chicken, turkey, and swine feeds for growth promotion and feed efficiency purposes. *Penicillin, bacitracin, chlortetracycline,* and *streptomycin* are antibiotics indicated including combinations of *penicillin plus bacitracin* and *penicillin plus streptomycin.* Specific minimum and maximum levels of the antibiotics are specified for chicken and turkey feeds but not specified for swine feeds. A medicated label format is required including quantitative guarantees in grams per ton for the additives, except that the labels for the complete final feed need not guarantee quantities of the antibiotics added solely for growth promotion. Adequate directions and warnings for use are also required.

November 28, page 12665. A new food additive amendment 121.255 providing safe use of *furazolidone* in swine feeds with specific levels for prevention and treatment of bacterial scours, enteritis, and dysentery. A medicated label format is required with adequate directions and warning for use.

Special announcement from FDA, November 1:
"The addition of *nickel sulfate* or *sodium borate* to trace minerals or finished feeds is not permissible under present regulations. Use of the compounds would require the filing of a food additive petition and the establishment of a regulation providing for their safe and efficacious use in animal feeds."

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ROLAND ABRAHAM, acting director
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