MINNESOTA FEED SERVICE

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CROP VARIETIES RECOMMENDED FOR 1963

Harley J. Otto

Revisions in the list of recommended crop varieties for 1963 were made at a recent University of Minnesota variety recommendation conference attended by representatives of the Minnesota Agricultural Experiment Station, Agricultural Extension Service, and Crop Improvement Association. Extension Agronomist Harley J. Otto here explains how varieties are selected for the recommended list, and reports changes in the list for 1963.

More complete information is found in Miscellaneous Report 24, "Varietal Trials of Farm Crops," available from your county agent.

Decisions regarding recommendation of specific crop varieties for Minnesota are made after carefully reviewing research results from field, laboratory, and greenhouse studies.

Factors such as maturity, yield, disease resistance, standability, plant height, winter hardiness, and feeding and market qualities are all important in varietal performance. A given variety is seldom superior for all traits. Varieties which are superior for one or more factors and not significantly inferior for others are added to the recommended list. As new varieties are developed which prove better than those on the recommended list, older varieties are removed from the list.

Varieties sometimes perform differently with respect to each other from one year to the next. Therefore, a minimum of 3 years of testing is usually required before recommendation is considered.

In the past, varieties have been classified in three categories, "recommended," "not adequately tested," and "not recommended." Action was taken at the conference to change the "not recommended" category to "other varieties."

Changes in the List

Varieties added to the recommended list are Larker and Trophy barley; Portage oats; Climax timothy; and Turghai, Empire, and White Wonder millet.

Three varieties were previously approved for recommendation, but approval was given too late for inclusion in regular publications. The three varieties are Justin hard spring wheat and Marine 62 and Windom flax.

Three varieties, Lee wheat, Minton oats, and Marine flax were removed from the recommended list.

Lee wheat is susceptible to race 15B of stem rust and has not yielded as well as other recommended varieties.

Minton oats has lower test weight and does not stand as well as other varieties of similar maturity.

Marine flax has been replaced with Marine 62, a similar variety with higher oil content.

Finally, the varieties, Warrior, Rodco, and Omaha winter wheat and Glen and Clintland 60 oats were moved from "not adequately tested" to "other varieties" category.

Warrior, Rodco, and Omaha winter wheat are not as winter hardy as Minter and are susceptible to leaf and stem rusts. Glen and Clintland 60 oats have not performed as well as other varieties in their respective maturity groups.

Newly-Recommended Varieties

Larker and **Trophy** barley were developed at the North Dakota Agricultural Experiment Station. They resulted from a cross of Traill and a white kerneled selection of U.M. 570. The awns of Trophy are rough while those of Larker are semismooth. Both are superior to Kindred in standing ability. Larker is superior to Trophy in kernel plumpness and both are superior to Kindred and Traill in this respect. In 4 years of tests conducted by the Minnesota Agricultural Experiment Station, Larker has tended to yield slightly more than Traill while Trophy has yielded slightly less.

Larker and Trophy have been classified as acceptable to the malting and brewing industries based on tests conducted so far. Because of possible differences in malting procedures, these varieties must be marketed separately. They must not be mixed with Kindred and Traill.

Justin is an awnless, hard red spring wheat variety developed by the North Dakota Agricultural Experiment Station. It is superior to Selkirk in resistance to leaf rust, certain races of stem rust, and in some milling and baking characteristics. It is about 2 days later in maturity than Selkirk and is of medium height with stiff straw.

In 3 years of Minnesota tests, Justin has yielded slightly less than Selkirk.

Portage oats was developed by the Wisconsin Experiment Station and released in 1960. It is medium in maturiy, has good test weight, is resistant to smut and to most prevalent races of stem rust, and has good field tolerance to leaf rust. Portage is a rather tall oat and does not have as good resistance to lodging as the shorter varieties such as Minhafer and Goodfield. This variety has given good yield performance compared to varieties of similar maturity.

Marine 62 and **Windom** flax varieties were released by the Minnesota Agricultural Experiment Station and the U.S. Department of Agriculture in 1962.

Marine 62 is similar to Marine in most respects except for oil content, which has been about 0.6 percent higher in Minnesota tests. This variety is early in maturity, is moderately resistant to wilt and pasmo, and is immune to rust. The plants produce blue flowers and

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brown seeds. Marine 62 has equaled Marine in yield in Minnesota tests.

Windom is an early maturing variety which has produced high seed yield whether sown early or late. Usually, early maturing varieties will not produce as well at late maturing varieties if planted early. Thus, the variety Windom is the exception to the rule.

This variety is immune to rust, resistant to wilt, and moderately susceptible to pasmo. The oil content is less than that of other recommended varieties, but is considered satisfactory. Oil quality is excellent. Windom produces blue flowers and small brown seeds.

Climax timothy was selected and released by Experimental Farms Service, Ottawa, Ontario. A tall, fine stemmed, leafy variety, it is 7 to 10 days later in maturity than common timothy and may be better adapted in alfalfa-grass mixtures than common timothy. Climax has produced the highest forage yields of any timothy variety in Minnesota tests and is an excellent seed producer.

Turghai is a red-seeded variety of proso millet, used mainly for bird and livestock feed. For livestock, its feeding value is approximately equal to oats.

Of three sources of certified seed tested in Minnesota the Nebraska source has given best performance. This source will be increased under the Minnesota Seed Certification program. Only certified seed is available from this superior source.

Empire and **White Wonder** are foxtail millet varieties. Foxtail millet is usually grown for hay or silage, but some seed is used in bird feeds. Empire and White Wonder are later maturity, taller, and produce more forage than other varieties tested in Minnesota.

Certified Seed Assures Varietal Purity and Seed Quality

Recommended varieties have clearly demonstrated superior performance compared to other varieties tested. If a farmer 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 for this information.

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.

These varieties are recommended for planting in 1963:

Barley	Larker, Kindred (L), Parkland, Traill, Trophy
Oats	Ajax, Andrew, Burnett, Garry, Goodfield, Minhafer, Portage, Rodney
Rye	Adams, Caribou, Elk
Wheat	Hard Red Spring: Justin, Pembina, Selkirk Durum: Lakota, Langdon, Wells Hard Red Winter: Minter
Flax	Arny, B5128, Bolley, Marine 62, Redwood, Windom
Soybeans	Acme, Chippewa, Comet, Flambeau, Grant, Harosoy, Lindarin, Merit, Norchief, Ottawa Mandarin
Sunflowers	Arrowhead
Field Peas	Chancellor, Strål
Navy Beans	Michelite, Sanilac
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

Field Crop Insect Control Recommendations for 1963

J. A. Lofgren*

Corn rootworm control is still one of the most popular uses of insecticides. Aldrin and heptachlor are still the recommended chemicals. At this time there is not enough evidence of rootworm resistance to these materials to warrant the use of alternate, more costly ones. Proper application is important in order to obtain satisfactory control and also to head off the development of insecticide resistance.

Both broadcast and row treatments may be made with sprays or with granules. If granules are used applications may be made to level, fall plowed fields during the winter, even on snow, when the temperature is below 45° F.

Use of granules in a planter attachment has become the most widely accepted method of chemical rootworm control. When using a granule applicator on the planter it is important to place granules properly and have the equipment calibrated. Granules should be placed over the seed and just beneath the surface of the soil but firmly covered. It is not advisable to bury the insecticide deep in the furrow with the seed.

Whether the insecticide is broadcast or banded it must be covered or mixed into the soil; the chemicals volatilize rapidly when the temperature is above 45° F. Soil incorporation may be done by disking the broadcast application or by checking the planter attachment to be sure soil covers the band of granules just ahead of the packer wheels.

Cutworms become destructive, especially to corn and other row crops, in some fields every year. Best answer to the problem is to check fields carefully in the spring for the early feeding by these pests, and spray before severe damage is done. Dieldrin, endrin, and toxaphene are three effective insecticides. Use drop nozzles on the sprayer and direct spray to the base of the plants or over the row. Cutworm control is quite slow and may take several days.

Soil treament with aldrin or heptachlor, using the higher recommended rates as a broadcast application, will give fair cutworm control in most cases.

The European corn borer is still a highly economic pest in Minnesota but

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insecticide control has not become popular. Damaging borer infestations can be anticipated in individual fields in western Minnesota, especially in west-central counties. DDT is still the most effective and economical material for control in field corn. If the field is to be grazed or if the plants are to be fed or ensiled alternate materials such as sevin or endrin should be used.

Major grasshopper trouble spots in western Minnesota took a beating from the wet weather during the past season but there will still be some isolated or localized areas in which 'hoppers will need control. The best and most economical control materials, such as aldrin and dieldrin, are severly limited by label restrictions because of chemical residues. These chemicals can still be used for field margins, roadsides, and idle land. Forage crops and pastures must be treated only with insecticides approved for that use. These include diazinon, malathion, and sevin.

Spraying for aphid control on field crops is seldom justified. On small grains the fact that barley yellow dwarf virus is spread by aphids complicates the picture, and usually spraying is done too late to stop the virus transmission or the sprayed fields rapidly become reinfested.

Materials effective against aphids in small grain and also for pea aphids in alfalfa are malathion, parathion, and Phosdrin. Phosdrin and parathion are highly toxic and should be applied only by qualified aerial spray operators.

Sweet clover weevils increased during 1962; every new seeding of sweet clover made this spring should be protected from these pests. If new seedings are fairly well isolated from old stands adequate protection may be expected by applying dieldrin granules with the seed, if the seeding is shallow. Plantings adjacent to old, heavily infested fields should be sprayed with aldrin, dieldrin, or toxaphene when circular notches appear in leaf edges, first sign of weevil feeding.

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New Herbicides for '63

Richard Behrens*

Here's a summary of possible new uses of herbicides on field crops for 1963. For more detailed information see the 1963 revision of Extension Folder 212; it's now available from your county agent or from the Bulletin Room, Institute of Agriculture, St. Paul 1.

Corn—Preemergence applications of linuron (Lorox) at 3 pounds per acre appear promising although some corn injury has been noted. Directed postemergence applications of linuron at 1½ pounds per acre plus a wetting agent applied when corn is 12 to 18 inches tall have shown promise also. **Caution:** Cleared for use only on corn grown for grain.

Directed-sprays of dalapon plus 2,4-D have given good control of weeds in the corn row if the weeds are not to large in relation to the size of the corn. **Caution:** Label clearance has not yet been received for this use.

Soybeans—Preemergence applications of linuron at 2 pounds per acre have been somewhat erratic. Instances of poor weed control and stunting of soybeans have been noted. **Caution:** This herbicide can be used only on soybeans grown for seed.

Prebloom and bloom applications of 4-(2,4-DB) to soybeans has given good initial dieback of cocklebur, but some cocklebur regrowth and some bur production has been observed. At 0.2 pounds per acre of 4-(2,4-DB) soybeans are slightly stunted but yield reductions are not apparent.

Sugar beets—Preplant incorporation of EPTC at 2 pounds per acre plus TCA at 6 pounds per acre has given excellent control of annual grasses, and some broad leaved weed control in sugar beets. This treatment will be used on a limited experimental basis during 1963.

PEBC (Tillan) in a preplant soil incorporated application has given satisfactory control of grasses and some broad-leaved weeds in several years of trials. Sugar beet growers used PEBC to a limited extent in 1962 with variable results.

Legumes—Use of 4-(2,4-DB) at ½ to 2 pounds per acre to control most broad-leaved weeds in legumes has received label clearance. Treated legumes cannot be grazed or harvested for 30 days after treatment.

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Soil Test Correlation with

John Grava and L. D. Hanson*

MOST farmers who get their soils tested are beyond the stage where the question whether or not to use fertilizer is being asked. Today's fertilizer recommendation must tell what grade, how much, and how to apply it; rather complicated field experiments are needed to provide such information. With these questions in mind an NPK-rate and placement study with corn was initiated on Fayette and related soils in southeastern Minnesota in 1961. The study was continued on three corn fields in Goodhue and Wabasha counties in 1962.

Field 1—Nygren Brothers, Red Wing, Goodhue County. Soil Type: Fayette-Seaton silt loam

Year	Crop	Fertilizer pounds/acre	Manure tons/acre
1961	Corn	100 5-20-20, row	......
1960	Alfalfa	......	10 in fall
1959	Oats and alfalfa	......	......

Limed: 1957 2 tons/acre

Plowed: Spring 1962

Weed control: Cultivated once, weeds not eliminated

Field 2.—Dale Flueger, Red Wing, Goodhue County. Soil Type: Fayette silt loam

Year	Crop	Fertilizer pounds/acre	Manure tons/acre
1961	Corn	125 5-20-20 row	8
1960	Corn	125 5-20-20 row	8
1959	Pasture (bromegrass and alfalfa)	......	......

Plowed: Spring 1962

Weed control: Atrazine (postemergence); weeds not eliminated

Field 3.—Edwin Freeze, Kellogg, Wabasha County. Soil Type: Fayette silt loam

Year	Crop	Fertilizer pounds/acre	Manure tons/acre
1961	Sweet Corn	275 4-12-36 and 80 N	......
1960	Sweet Corn	200 6-24-24	......
1959	Sweet Corn	200 6-24-24	......

Limed: 1957 or 1958, 3 tons/acre

Plowed: Fall 1961

Weed control: Atrazine (postemergence), cultivated once, weeds eliminated

The 1961 experiments were conducted on soils testing medium to high in phosphorus and low to medium in potassium. The three fields used for experiments in 1962 showed much higher P and K fertility levels, as shown in Table 1.

Surface and subsoil samples were collected during the first week of May for moisture determinations and routine chemical analyses. Each field experiment consisted of 15 treatments replicated five times, a total of 75 plots. Individual plots were 25 feet long and 13.3 feet wide. Part of the fertilizer was broadcast, plowed down on fields 1 and 2, and disked-in on field 3.

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Studies in Southeast Minnesota

Table 1. Soil test results

Location	County	pH	Organic matter	Extract-able phsophorus	Exchange-able potassium	Soil texture	Check yield
			percent	lbs./acre	lbs./acre		bu./acre
Nygren Brothers	Goodhue	6.7	2.8 L	58 VH	220 M	Silt loam	129
Flueger	Goodhue	7.4	2.8 L	18 M	225 H	Silt loam	99
Freeze	Wabasha	7.1	2.6 L	64 VH	185 M	silt loam	121

A 108-112 day corn variety was planted (May 16, 17, and 18) at all locations. Corn was thinned to a uniform stand of 20,000 plants per acre (two plants per hill, 15 inches apart in 40-inch rows).

Farmer cooperators were provided with rain gauges and asked to keep rainfall records. Corn leaf samples were collected at tasselling time for N, P, and K determinations. Finally, corn yields were determined by harvesting and weighing ears from 20 two-stalk hills from each plot. Moisture content was determined on five representative ears from each treatment.

Subsoil moisture was sufficient at planting time. All locations received about 18.5 inches of rainfall from May 15 to September 30. Corn development was delayed, particularly in the early stages of growth.

Corn yield response to **nitrogen** fertilization is shown in table 2.

All treatments received 0+0+80 broadcast and 10+40+40 row treatment.

The 60-pound rate of nitrogen was sufficient in producing profitable yield increases on two fields. At one location the highest yield was realized with the application of 120 pounds of nitrogen. However, one of the most significant conclusions that can be derived from this study is the ability of the Fayette soils to release nitrogen to corn. An average corn yield of 132 bushels per acre was produced with only 10 pounds per acre of row-placed nitrogen (average 110 bushels per acre at four locations in 1961).

Table 2. Corn yield response to nitrogen fertilization, bushels per acre of shelled corn, 15.5 percent moisture.

Rate of nitrogen pounds/acre	Location: Nygren Brothers	Flueger	Freeze
10	140	134	133
60	**164**(24)	146(12)	**140**(7)
120	164(24)	**155**(21)	136(3)

Bracketed figures show yield increase over base rate; bold figures show most profitable yield.

A comparison of three **phosphorus** rates and two types of placement is given in table 3. All treatments received 110+0+80 broadcast and 10+0+40 row treatment.

In 1961 phosphorus applications on similar soils resulted in decreased yields at three out of four locations. Furthermore, broadcast application of 40 pounds P_2O_5 per acre resulted in lower yields (average of 14 bushels per acre) than the same amount of phosphorus applied in a row.

Corn responses to phosphorus applications were observed on all fields in 1962. On Flueger's field with a medium P test, row placement was more effective than broadcast. Both types of placement were equally effective on a soil with very high P test (Nygren Brothers).

Corn yield responses to five potassium rates and two types of placement are given in Table 4. All treatments received 110+0+0 broadcast and 10+40+0 row treatment.

The potassium test values on these fields are approaching the high level, generally higher than most Fayette soils. On two fields the 80 pounds of K_2O per acre rate was most efficient, resulting in 6 to 12 more bushels of dorn than the O K treatment. At one location the 120-pound rate of K_2O increased the yield by 25 bushels per acre. While corn leaves collected from row-placed potassium treatments showed higher K content than those from broadcast treatments, no such clear cut differences due to placement were observed in corn yields.

Recommended rates and placement of N, P, and K, based on the reported experimental data, are indicated in table 5.

Table 3. Corn yield response to phosphorus fertilization, bushels per acre of shelled corn, 15.5 percent moisture.

Rate of phosphorus P_2O_5 pounds/acre	Location: Nygren Brothers Soil test = 58	Flueger Soil test = 18	Freeze Soil test = 64
0	151	139	135
40 broadcast	156(5)	140(1)	**143**(8)
40 row	157(6)	**156**(17)	136(1)
80 (40 broadcast + 40 row)	**170**(19)	155(16)	144(9)

Bracketed figures show yield increase over base rate, bold figures show most profitable yield.

Table 4. Corn yield response to potassium fertilization, bushels per acre of shelled corn, 15.5 percent moisture.

Total K_2O	Broadcast K_2O	Row K_2O	Location: Nygren Brothers soil test: 220	Flueger soil test: 225	Freeze soil test: 185
	pounds/acre				
0	.. .	......	146	145	141
40	40	......	166(20)	150(5)	131-10
40	......	40	161(15)	148(3)	132-9
80	80	......	156(10)	**157**(12)	137-4
80	......	80	160(14)	154(9)	133-8
80	40	40	154(8)	152(7)	**147**(6)
120	80	40	**171**(25)	153(8)	136-5
120	40	80	157(13)	159(14)	145(4)
160	80	80	162(16)	156(11)	147(6)

Bracketed figures show yield increase over base rate, minus sign indicates yield decrease. Bold figures show most profitable yield.

Table 5. Most efficient fertilizer treatments—1962

Location	N		P_2O_5		K_2O
Nygren Brothers	60	+	80*	+	120†
Flueger	120	+	40‡	+	80§
Freeze	60	+	40§	+	80¶

* P_2O_5, 40 pounds per acre broadcast + 40 pounds per acre/row.

† K_2O, 80 pounds per acre broadcast + 40 pounds per acre/row.

‡ Row

§ Broadcast

¶ K_2O, 40 pounds per acre broadcast + 40 pounds per acre/row.

FIELD EXPERIMENTS WITH ZINC ON CORN

Orville Gunderson and John MacGregor*

Minnesota soils, considered about average in zinc content in comparison with other soils of the United States, may not supply enough zinc for some crops. As the natural lime content of the soil increases, crop plants generally find it increasingly difficult to take up sufficient zinc for normal growth. This problem is naturally more serious in the relatively short-lived, high production plants such as corn.

Zinc deficiencies of corn have been observed for some years on the high lime soils of many western states, especially under irrigation. Irrigation indirectly tends to induce such microelement deficiencies since high crop yield removes more nutrient elements.

Zinc deficiency is especially noticeable under irrigation agriculture because of the associated land forming that exposes subsoil layers—and perhaps because of the use of high analysis fertilizers in greater quantity, although nitrogen fertilizer placed near the seed has frequently resulted in normal plant growth.

This indirect effect of fertilizer nitrogen has two possible explanations. When nitrogen is placed with zinc or alongside seed in the soil, the supply of native available zinc is increased due to the acidic residue of the nitrogen fertilizer. Ammonium sulfate is especially effective in this way. The increased effectiveness of band applied zinc sulfate (ZnSO4) when mixed with a small amount of nitrogen could be due to the above mechanism, or to some other mechanism that diminishes toxicity produced by high zinc concentrations of the bands.

Zinc deficiency of corn was first reported from central Minnesota during the 1961 growing season, and limited field studies were made at that time. The deficiency on corn is characterized by initial stunting, followed by the later development of a longitudinal striping of the leaves. The veins remain green and interveinal tissue yellows and, in serious cases, dies. The younger leaves may be almost white. Corn grown on high lime peat or on mineral soil may be affected, especially on low lying, recently drained areas.

Field experiments in 1962 consisted of trials on (1) a recently pumped calcareious clay loam on the Litch farm north and west of Lake Lillian (Kandiyohi County), (2) a slightly higher lying clay loam on the Larson farm 2 to 3 miles farther north, and (3) a pumped area of peat soil a mile south of Lake Koronis, on the Behr farm in western Meeker County.

Each field was spring plowed shortly after the plowdown zinc sulfate treatments were broadcast. A two-row tractor attached corn planter with fertilizer band placement equipment especially built by the Morris ARS Station, was used to plant corn and to apply the banded zinc and nitrogen about an inch to the side and below the seed.

A third type of treatment consisted of coating corn seed with a zinc chelate (Na_2Zn chelate) at the rate of 8 ounces per bushel. Phosphorus and potassium fertilizers were broadcast before plowing to supply 100 pounds of phosphate per acre and 50 pounds of potash. Urea nitrogen at 100 pounds of nitrogen per acre was broadcast in early June.

The two mineral soil fields were seeded in mid-May; planting on the colder peat soil was delayed until June 5. Herbicides were used to control weed growth. Plant populations approximated 18,000 plants per acre.

The no-zinc corn plants on the Litch field and on the Behr peat were more seriously affected by zinc deficiency whereas the Larson field showed little vegetative deficiency during the growing season. The Litch corn showed some stunting, but no distinct leaf symptoms until July 10, 11, and 12, when severe leaf striping developed rapidly. Since the peat soil of the Behr field was planted late, leaf striping commenced relatively late in July.

An early frost the morning of September 5 killed corn leaves on the low lying peat field, but ears filled to some degree after this damage and all three fields were harvested and sampled in mid-October.

Results

Broadcasing fertilizer at the rate of 100-100-50 over the three entire experimental areas should have insured an ample supply of the three major nutrients. Plant populations of 18,000 per acre, with ample rainfall, should have allowed for maximum zinc effect.

Wet corn on the early frosted peat field lowered yield averages substantially, the no-zinc treatments of the three fields averaging only 47 bushels ear corn per acre. Where zinc as zinc sulfate (about 30 percent zinc) was plowed under at rates of 5, 10, 20, or 40 pounds per acre, average yield increases varied from 13 to 15 bushels per acre, with the 10-pound zinc treatment increasing yields very well.

Banding ammonium nitrate at the rate of 20 pounds of nitrogen per acre (no zinc) about 1 inch to the side and below the seed showed an average yield increase of some 10 bushels per acre. This effect has usually been observed by other investigators and the increase has been attributed to nitrogen stimulation of the plants and to a greater extraction of native zinc from the soil.

Banding both nitrogen and the zinc as the sulfate at the rate of 10 pounds of zinc per acre increased average corn yields only about 8 bushels per acre.

Banding both 20 pounds of nitrogen (as NH_4NO_3) and zinc sulfate at rates of 5, 10, or 20 pounds of zinc per acre increased yields an average of 8 to 13 bushels per acre.

Zinc chelate treated seed was only slightly effective for increasing corn yield, possibly because of the limited amount of zinc chelate adhering to the seed. Since only 1 year's results are available, no definite conclusions can be made as to optimum rate and placement of the zinc. However, it appears that heavier rates were not beneficial and may have been somewhat detrimental.

Conclusions

Although much more research is essential before definite recommendations can be made, it appears that plowing down zinc sulfate at a cost of $2 or $3 per acre may be practically effective. Further research may show that (1) granulation of either zinc sulfate or of an effective low cost zinc chelate in the fertilizer manufacturing process, and (2) either plowing such materials under or banding near the seed may be done at relatively low cost, and may supply sufficient zinc for maximum corn production.

Application of zinc to soil is not recommended unless there is a known need for including this element with the fertilizer treatment.

* The authors are respectively, area soils agent and instructor, and professor of soil science. The active cooperation of Dr. Raymond Allmaras and the use of specialized equipment from the Soil and Water Conservation Research Station, ARS, Morris, is hereby acknowledged.

Nitrogen and Phosphorus Together in Starter Fertilizer for Corn

A. C. Caldwell and R. Blanchar*

Reasons for large effects from starter fertilizer last spring are not well established. Observations indicate that starter fertilizer effects are more pronounced in a cold, wet spring. Also, some experiments indicate that plant nutrient interactions within a fertilizer were important also.

In experiments near Lamberton, Waseca, and Red Wing (the first two on Nicollet soils, the third on Fayette), starter fertilizers containing only nitrogen and potassium, phosphorus and potassium, or all three, were applied to corn. The nitrogen source was ammonium nitrate, the phosphorus source concentrated superphosphate, the potassuim source muriate of potash.

Whole plant samples when plants were 12 to 18 inches high, and sixth-leaf samples at tasselling time were gathered and analyzed for phosphorus and potassium. Yields were taken.

We drew the following conclusions:

1. Adding phosphorus usually increased phosphorus content of the plant.

2. At two locations the combination of nitrogen and phosphorus increased the phosphorus content of tissues substantially above that from phosphorus alone. At Lamberton when nitrogen and phosphorus were applied together, the amount of phosphorus per 10 plants was five times greater than when phosphorus was used alone.

3. The combination of nitrogen and phosphorus usually gave the best yields also; at Lamberton, for example, the nitrogen-phosphorus treatment outyielded treatment with phosphorus alone by 50 bushels per acre.

4. The phosphorus content of the young plant is a better indication of the nutrient status and final yield than that of the sixth leaf at tasselling time.

5. Potassium in the fertilizer increased potassium content of corn plants, but had no significant effect on phosphorus content.

6. Starter fertilizer for corn in Minnesota should contain both nitrogen and phosphorus and they should be closely associated. The ammonium form of nitrogen source affects phosphorus absorption. It can be part of a fertilizer salt (such as diammonium phospate) or can be present as in ammonium nitrate or ammonium sulfate.

The nitrogen to phosphorus ratio should be 1 to 4 or less.

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The 1963 Feed Grain Program

Paul R. Hasbargen*

Principal points of the 1963 Feed Grain Program are:

1. **Voluntary participation.** Each producer decides whether to participate.

2. **Acreage diversion.** A minimum of 20 percent and a maximum of 40 percent of the total base acreage of corn, grain sorghum, and barley (1959-1960 average) can be signed up. However, up to 25 acres may be diverted on any farm if the allotment is large enough.

3. **Payments.** The 1963 program provides for two types of compensation to participating farmers—direct diversion payments and payment-in-kind certificates.

• Diversion payments: On the first 20 percent of acreage retired the per acre diversion rate is determined by multiplying the county support price by 20 percent of normal yield.

For example, given a normal yield in corn of 60 bushels and a support rate of \$1.10, the diversion payment would be (.2) × (60) × (\$1.10) = \$13.20 per acre. For additional acres retired the rate will be based on 50 percent of normal yield. In this example it would be (.5) × (60) × (\$1.10) = \$33. **Note:** If all acres are diverted on farms with base acreage of 25 acres or less, the 50-percent rate will be paid on **all** acres.

• Payment-in-kind: Those who divert at least 20 percent of their feed grain base acres become eligible for support rates based on a national rate of \$1.25 per bushel for corn. However, part of the total support rate will be paid to all cooperators in payment-in-kind certificates regardless of how they dispose of their crops. These certificates can be redeemed in cash. Such payments will be based on the assigned yield on **acres planted for harvest** in 1963. Rates of payments per bushel will be 18 cents for corn, 14 cents for barley, and 16 cents for grain sorghum.

The minimum diverson cooperator will receive such payments on 4 acres of production for every acre he diverts. Where only corn acreage is involved, this amounts to 72 cents (4 × 18 = 72) per bushel on the normal yield for each acre retired. Using the 60-bushel normal yield example, the cooperator would get 72 cents × 60 = \$43.20 for each retired acre if he did not go beyond the 20 percent required diversion. Should he go beyond the minimum, his receipts from this phase of the program would decrease since fewer acres would be planted.

4. **Joint tenure arrangements.** The feed grain base on each additional farm in which the producer shares in the crops must not be exceeded, even though these farms are not included in the program.

5. **Advance payments.** Up to about one-half of the diversion payments will be paid in advance at signup time.

6. **Price support** on corn, grain sorghum, and barley will be available to cooperators only.

7. **Signup dates** for both the Feed Grain Program and the Wheat Program will be February 1 to March 22.

The Wheat Program

The 1963 Wheat Program is similar to the Feed Grain Program. Participation will be on a voluntary basis and two types of payments are made to participants. Nonparticipants must abide by the old marketing quota program.

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