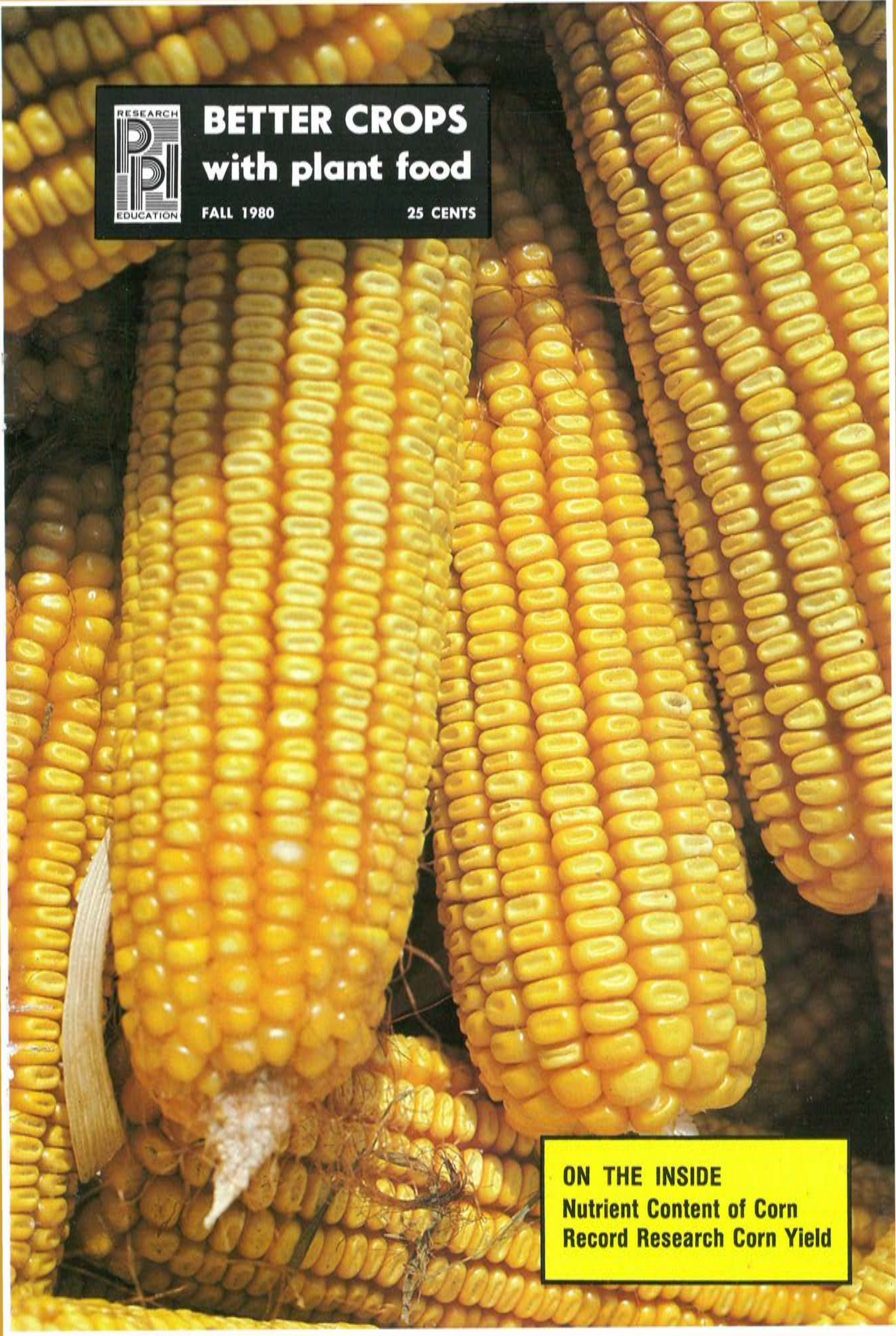
BETTER CROPS with plant food
FALL 1980 25 CENTS



ON THE INSIDE
Nutrient Content of Corn
Record Research Corn Yield

BETTER CROPS with plant food

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On the Cover

Dr. Roy Flannery, soils specialist at Rutgers University in New Jersey produced this high yielding corn on irrigated research plots. Dr. Flannery's work is partially funded through a PPI research grant (see page 7).

Nutrient Content of Corn Plants Increases Faster Than Grain Yields

W. M. WALKER and T. R. PECK
University of Illinois

STUDY OF THE concentrations of nutrients in corn plants and their relationship to subsequent yield has been the objective of considerable research.

As a result, nutrient concentration of various elements is frequently used to diagnose the nutritional status of plants during the growing season. Some agriculturalists have suggested that total uptake of nutrients might also be a helpful tool for diagnosing mineral nutrition problems in plants.

As part of some soil fertility research conducted in Illinois we determined the total uptake of plant nutrients in young corn plants and uptake in different parts of the corn plant at early tassel at high and low levels of soil fertility.

FERTILITY LEVELS. Plant samples were obtained from a fertilizer rate experiment at the Kewanee Research Field in northwestern Illinois. A soil test from the high fertility plot showed a soil pH of 6.1, 49 lb/A of available phophorus, and 545 lb/A of exchangeable potassium.

In early May 320 lb/A of N, 90 lb/A P_2O_5 and 80 lb/A K_2O were broadcast and disked into the soil. A soil test of the low fertility plot showed a pH of 5.4, 11 lb/A available phosphorus, and 187 lb/A exchangeable potassium. No fertilizer was applied on the low fertility plot. Yield from the high fertility plot was 157 bu/A and yield from the low fertility plot was 68 bu/A.

PLANT SAMPLES. Whole plant samples were obtained from low and high fertility plots when corn plants were about 10 and 30 inches in height, respectively, on the high fertility plots and again when plants were in early tassel.

At early tassel the corn plants were separated into six parts for subsequent chemical analysis: (1) Lower leaves, (2) mid leaves, (3) upper leaves, (4) lower stalk, (5) upper stalk, and (6) a composite consisting of mid stalk, silk and tassel.

After being dried, weighed, and ground, plant samples were analyzed in the Agronomy Department Plant Analysis Laboratory. Chemical analysis of each sample was made for 10 elements: Nitrogen, phosphorus, potassium, calcium, magnesium, boron, copper, iron, manganese, and zinc.

RESULTS. Table 1 shows the nutrient content of corn plants grown at low and high levels of soil fertility at each sample period and the distribution of nutrients in different plant parts.

Although plants continue to absorb and translocate nutrients throughout the growing season, the nutritional status of the plant at early tassel is considered critical since grain formation is initiated at this time.

Figure 1 shows the relative nutrient content of the plants between the high and low fertility plots.

Table 1. Nutrient content of corn plants grown at high and low levels of soil fertility.

Stage of Development	Pounds per 20,000 plants										
	N	P	K	Ca	Mg	Mn	Fe	Zn	B	Cu	Dry Wt.
					High Fertility						
10 inches in height	8.1	0.7	8.7	1.2	0.5	0.014	0.061	0.012	0.003	0.002	193
30 inches in height	39.3	3.2	50.4	5.8	2.5	0.058	0.201	0.057	0.030	0.014	1283
Early Tassel											
Lower Leaves	13.1	1.1	12.5	3.3	1.1	0.025	0.071	0.017	0.005	0.006	444
Mid Leaves	17.1	1.4	14.8	3.5	1.2	0.025	0.087	0.018	0.007	0.007	559
Upper Leaves	15.8	1.4	12.4	2.6	0.8	0.020	0.080	0.018	0.009	0.007	489
Lower Stalk	13.8	1.1	37.8	3.8	2.8	0.047	0.080	0.016	0.009	0.005	1324
Upper Stalk	5.7	1.0	11.3	1.7	1.0	0.026	0.022	0.015	0.030	0.025	552
Mid Stalk, Tassel & Silk	42.5	4.2	75.3	8.8	6.3	0.095	0.213	0.064	0.021	0.014	2971
Total	**108.0**	**10.2**	**164.1**	**23.7**	**13.2**	**0.238**	**0.553**	**0.148**	**0.081**	**0.064**	**6339**
					Low Fertility						
10 inches in height	2.1	0.2	1.8	0.3	0.2	0.006	0.033	0.003	0.001	0.001	52
30 inches in height	11.1	0.8	9.8	1.6	1.2	0.032	0.094	0.019	0.007	0.005	373
Early Tassel											
Lower Leaves	4.9	0.3	5.9	2.1	1.0	0.024	0.059	0.007	0.004	0.002	312
Mid Leaves	8.4	0.5	7.4	2.2	1.0	0.025	0.068	0.008	0.007	0.004	376
Upper Leaves	5.9	0.4	5.1	1.0	0.4	0.011	0.036	0.007	0.007	0.003	260
Lower Stalk	3.0	0.2	4.9	1.8	1.6	0.050	0.070	0.013	0.004	0.002	533
Upper Stalk	2.7	0.2	4.9	0.8	0.6	0.015	0.033	0.008	0.002	0.011	241
Mid Stalk, Tassel & Silk	11.8	0.5	13.4	4.4	3.5	0.082	0.106	0.037	0.011	0.005	1196
Total	**36.7**	**2.1**	**41.6**	**12.3**	**8.1**	**0.207**	**0.372**	**0.080**	**0.035**	**0.027**	**2918**

When plants were only 10 inches high, those plants growing on the well-fertilized plots had absorbed about **four to five times** as much nitrogen, phosphorus, potassium, zinc and calcium and about **two to three times** as much magnesium, manganese, iron, boron, and copper as plants growing on low fertility plots.

Dry matter accumulation at this stage of development was about 3½ times as great on the high fertility as on the low fertility plot. Similar differences in nutrient content were observed when plants were 30 inches in height, and at early tassel. Grain yield on the high fertility plot was 2.3 times that on the low fertility plot.

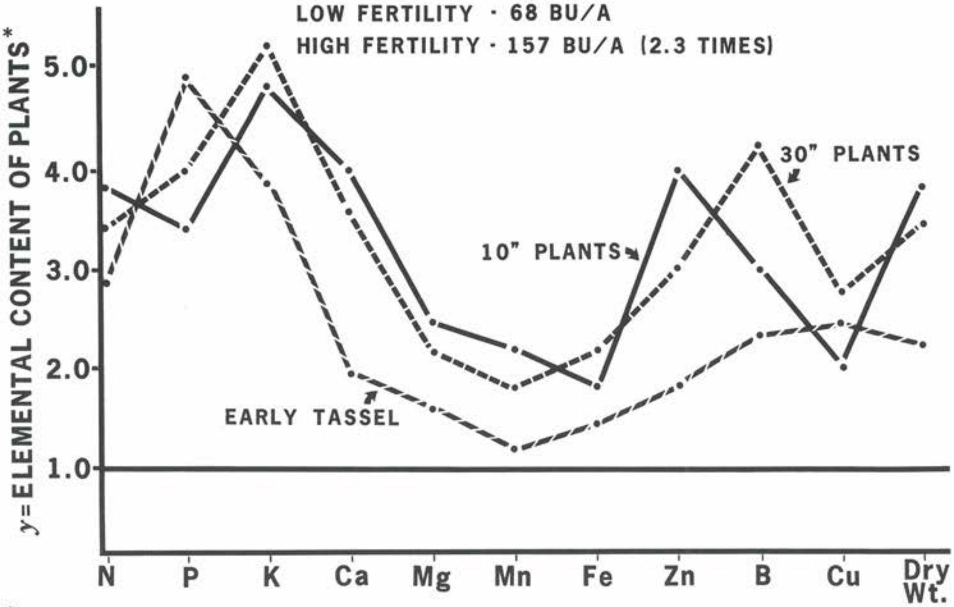
Distribution of nutrient content in different parts of the corn plant at early tassel is shown in the table. Almost all parts of well-fertilized plants were higher in nutrient content than plants from low fertility plots.

The considerable difference in the nitrogen, phosphorus, potassium, and calcium content of the mid stalk, silk and tassel portion of the corn plants is noteworthy.

This part of corn plant from high fertility plots contained about **eight times** as much phosphorus and potassium as those from low fertility plots and **3½ times** as much nitrogen. If nutrition of the corn plant is poor at early tassel, fewer grains of corn will be initiated along with poor fill of those that are formed and low yields result.

Even though only a part of the plant at early tassel is used for diagnostic purposes, adequate nutrition of the entire

NUTRIENT P-K REQUIREMENT OF CORN INCREASES FASTER THAN YIELD



****y=Relative elemental content of plants at various growth stages--determined by dividing nutrient content of plants from the high fertility plots by nutrient content of plants from the low fertility plots.***

FIGURE 1

plant will be required for high yields.

SUMMARY. Plants at tassel on high fertility plots contained about **three times** as much nitrogen, **five times** as much phosphorus, and **four times** as much potassium as those growing on low fertility plots. This was a considerably larger increase than the doubling of dry matter accumulation of high over low fertility plots. Grain yields were **2.3 times higher** with an adequate supply of plant food.

The plant content of manganese, iron, zinc, boron, and copper on high fertility plots, though small compared to nitrogen, phosphorus, and potassium, increased with the higher fertility and the higher yields.

Though the total plant content of micronutrients may be small compared to the major plant nutrients, micronutrients are just as essential as nitrogen, phosphorus, and potassium.

It is obvious that plant content of **all** of the plant nutrients was considerably higher on the plot yielding 157 bushels per acre than on the plot yielding 68 bushels per acre. **As corn yields and plant populations increase, it is likely that an even greater acceleration of nutrient uptake will be observed.**

This study supports quantitatively what has often been observed qualitatively—plants grown under high levels of soil fertility resulting in higher yields, contain considerably more nutrients than those grown under low levels of fertility with the resulting lower yields.

Although climatic conditions and different varieties may influence total nutrient uptake, high yields of grain at harvest reflect high levels of plant nutrition during the entire growing season. **The End**

The Potash & Phosphate Institute awarded $2,000 Fellowships to five outstanding graduate students pursuing advanced degrees in soil and plant sciences. The winners were (top left to right) Daniel Dyer, University of Arkansas; Irvin Widders, University of California at Davis receiving his check from Dr. Albert Ludwick, PPI Western director; (bottom left to right) John Lyle, University of Tennessee; William Inskeep, Oregon State University; and James Amonette, Iowa State University.

Five Fellowships Awarded by Potash & Phosphate Institute

THE POTASH & PHOSPHATE INSTITUTE named five outstanding graduate students as PPI Fellows. Each received a $2,000 Fellowship from the Institute to pursue advanced degrees in plant and soil sciences.

The Institute initiated the fellowship program this year as another phase of its support and emphasis on agricultural research. The fellowships provide financial support for outstanding graduate students training to become key researchers for tomorrow's world agriculture.

The recipients were James E. Amonette, Daniel J. Dyer, William P. Inskeep, John H. Lyle and Irvin E. Widders.

Mr. Amonette is a graduate research assistant at Iowa State University where he is pursuing the M.S. degree in soil chemistry. He received the B.S. degree in soil science from New Mexico State University in 1979. He is a native of Albuquerque, New Mexico.

Double majors in agronomy and chemical science were conferred on Mr. Dyer in 1978 by Kansas State University. He is now working towards the M.S. degree in soil science at the University of Arkansas and plans to continue his studies for a Ph.D. degree. He was born in Kansas City, Missouri.

Mr. Inskeep graduated in 1979 from the University of Idaho *summa cum laude* with a B.S. in soil science. The Berkeley, California, native immediately started working toward the M.S. degree in soil science at Oregon State University.

Clarksville, Tennessee, native Mr. Lyle, graduated with highest honors from the University of Tennessee. His 1978 degree was in plant and soil science. He is currently a graduate assistant in teaching and is pursuing the M.S. degree in soil fertility.

Mr. Widders was born in Ephrata, Pennsylvania, and received his B.S. degree from Penn State University in 1975. He will be pursuing the Ph.D. degree in plant physiology at the University of California at Davis.

Each Fellow listed numerous honors, societies and activities to complete impressive applications for the fellowships.

The selection committee included Chairman Dr. J. F. Reed, retired president of PPI; Dr. W. R. Thompson, Jr., PPI Midsouth director; Dr. John Pesek, agronomy department head at Iowa State University; and Dr. Roy Flannery, specialist in soils at Cook College, Rutgers University. Pesek and Flannery are members of PPI's Advisory Council. They chose the Fellows from over 50 applicants representing 29 states and 2 Canadian provinces. **The End**

FLANNERY GETS WORLD RECORD RESEARCH CORN YIELD

Dr. Roy Flannery harvested a record 312 bu/A of corn from his New Jersey maximum yield research study. "We believe this is a world record," said Dr. Bill Griffith, regional director for the Potash & Phosphate Institute.

A sound management system paid big dividends for Dr. Flannery, specialist in soils for the New Jersey Cooperative Extension Service. The project, partially funded by PPI, included a study of fertilization rates for NPK and micronutrients, of irrigation, of two hybrids and of two population rates.

The above ground portion of the plants were harvested from the research plots and comparable silage yields were recorded. The record yielding 312 bushel hybrid (Agway 849X) yielded 45.1 tons/A of 32 percent dry matter silage. These treatments included irrigation, micronutrients, 40,700 plants per acre and 500-300-300, N, P_2O_5, and K_2O.

Yields dropped to 218 bu/A where fertilizer was applied at the lower rate of 250-125-125. Silage yields also dropped to 35.2 tons/A. This fertilization rate would be considered "good fertility" by many but not adequate for Dr. Flannery's precision management maximum yield study.

Yields totaled 303 bu/A in grain and 44.3 tons of silage when the higher fertilizer rate was applied on the lower population treatments of 32,000 plants per acre.

The top yield on the second hybrid was 227 bu/A in grain and 36.3 tons of silage. These treatments were at the high rates that produced the 312 bushel yield with the Agway hybrid. When fertilizer was at the lower rate, grain yields were cut to 199 bu/A and silage to 32.8 tons.

And Dr. Flannery expects record yields on his soybeans with over 90 bu/A. The soybeans are grown in rotation with the corn. *Better Crops* will report more fully on these PPI supported studies.

The Potash & Phosphate Institute emphasizes maximum yield research and awards many of its research grants for such projects.

Crop Response to Potassium in Western Canada

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Federated Cooperatives Limited
Saskatoon

POTASSIUM, even though classified as a major plant nutrient, is frequently overlooked in fertility research and in crop production.

It is difficult to conceive that one would be mining potash at depth in Saskatchewan and be required to apply it on the soil surface to increase, and in some cases, even insure crop production.

The main thrust in soil fertility research in western Canada has been to determine yield response curves to nitrogen and phosphorus with potassium considered only occasionally.

Various methods have been used over the years to determine the nutrient requirement of crops on soils, ranging from field fertilizer strip trials to soil test correlation experiments and replicated field research plots. In many instances, the fertilizer treatments were based primarily on soil tests for available levels of a specific nutrient.

This technique has worked quite well over the years. The present increased costs involved in crop production results in a very fine line between profit and loss, necessitating a review of the method of determining potassium requirements for crop production.

REPLICATED FIELD RESEARCH PLOTS to determine nitrogen and phosphorus requirements were conducted by Sherritt Gordon across the prairies in the 1968 to 1973 period. In many instances, a potash treatment was included to determine response to potassium when high rates of nitrogen and phosphorus were applied.

Many of these soils according to a soil test indicated a high level of available (exchangeable) potassium. The potassium level in the soils was determined by the respective provincial soil testing laboratories on the 0-6-inch soil depth using the ammonium acetate extraction method, which determines the level of exchangeable potassium.

The 200 lb/A level of available potassium has generally been considered the level at which there was adequate potassium for cereal crop production on the prairies.

Yield response to potassium in **Alberta** is indicated in **Table 1.** The Vega site, which had an available K level of 123 lb/A resulted in a 3.8 bu/A yield increase in barley with the broadcast application of 60 lb/A K_2O.

It was also noted that the soil at this site had a high level of organic matter (peaty) which tended to give an additional yield response (3.1 bu/A) when the K_2O was applied with the seed or as a band even at lower rates of application (30 lb/A). There were 14 sites with K levels over the 200 lb/A level. Yield responses to the broadcast application of 60 lb/A K_2O occurred at five of these sites. Some of these yield increases, such as at Coronation and Worsley, were quite substantial (11.2 bu/A).

Table 1. Barley Response to K in Alberta 1968-1973.

Location	Soil Zone	Available K lb/A	Yield NPS bu/A	Yield Increase NPKS bu/A	Increase %
Vega	Gr. Wood (SL)	123(L+)	77.4	3.8	4.9
Morecambe	Dk. Gr. Wood (SL)	216(M)	42.8	—	—
Olds	Black (C)	233(M)	60.5	—	—
Bluesky	Dk. Grey (CL)	266(M+)	51.8	5.1	9.8
Calmar	Black (CL)	270(M+)	60.4	8.0	13.2
Ponoka	Black (SiL)	295(M+)	39.9	—	—
Fort Saskatchewan	Black (SCL)	366(H−)	71.1	—	—
Provost	Dk. Brown (SICL)	443(H)	29.8	—	—
Coronation	Dk. Brown (SCL)	452(H)	32.7	11.2	34.3
Fairview	Dk. Grey (C)	476(H)	63.3	—	—
Nampa	Dk. Grey (C)	525(H)	98.0	—	—
Delia	Dk. Brown (CL)	632(H+)	20.4	—	—
Worsley	Dk. Grey (CL)	658(H+)	78.9	11.2	14.2
Eureka River	Gr. Wood (CL)	800+(H+)	57.9	5.6	9.7
Three Hills	Thin Black (C)	1,000+(H+)	66.5	—	—

N at 90—240 lb/A P_2O_5 at 45—60 lb/A
K_2O at 60 lb/A Broadcast
Available K determined by Provincial Soil Test Laboratory using ammonium acetate extraction.
Data from research plots conducted with Sherritt Gordon.

Table 2. Barley Response to K in Saskatchewan 1969-1973.

Location	Soil Zone	Available K lb/A	Yield NPS bu/A	Yield Increase NPKS bu/A	Increase %
Nipawin	Gr. Black (FSL)	69(L)	50.9	6.5	12.8
Burgis	Thin Black (L)	99(L)	27.0	6.8	25.2
Mackwa	Gr. Black (FSL)	190(H)	59.0	10.2	17.3
Stornoway	Deg. Black (L)	220(H)	66.2	—	—
Kinistino	Black (SiCL)	445(VH)	49.0	6.4	13.1
Gorlitz	Black (L)	520(VH)	25.0	—	—
Rosetown	Dk. Brown (C)	1,130(VH)	35.3	—	—

N at 90 lb/A P_2O_5 at 45-60 lb/A
K_2O at 60 lb/A Broadcast
Available K determined by Provincial Soil Testing Laboratory using ammonium acetate extraction. Data from research plots conducted with Sherritt Gordon.

Yield response to potassium in **Saskatchewan** is given in **Table 2.** All the sites with an available K level below 200 lb/A resulted in a response to the broadcast application of 60 lb/A K_2O. Of the four sites with a K level above the 200 lb/A level, only one gave a response to K_2O at a 13.1 percent yield increase over the NPS treatment.

YIELD RESPONSE TO POTASSIUM in **Manitoba** is given in **Table 3.** The soil with an available K level below 200 lb/A (126 lb/A) resulted in a 15.7 percent yield increase with the broadcast application of 60 lb/A of K_2O.

Overall yield on this site was extremely low with the no fertilizer treatment yielding only 10.1 bu/A. There were nine soils with available K levels above 200 lb/A with five of these giving varying responses to broadcast K_2O.

Table 3. Barley Response to K in Manitoba 1968-1969.

Location	Soil Zone	Available K lb/A	Yield NPS bu/A	Yield Increase NPKS bu/A	Increase %
Carman	Black (SL)	126(L)	22.3	3.5	15.7
Winkler	Black (FSL)	244(M+)	77.7	—	—
Newdale	Black (CL)	290(H)	78.9	—	—
Osterwick	Black (VFSL)	326(H+)	62.0	0.3	0.5
Miami	Black (SCL)	344(VH−)	68.7	5.4	7.9
Newdale	Black (C)	414(VH+)	50.0	—	—
Neepawa	Black (SCL)	430(VH+)	76.3	—	—
Miami	Black (SCL)	620(VH+)	71.8	1.1	1.5
Minnedosa	Black (CL)	670(VH+)	61.7	11.4	18.5
Letellier	Black (SiC)	756(VH+)	56.4	5.8	10.3

N at 90-240 lb/A P_2O_5 at 60 lb/A
K_2O at 60 lb/A Broadcast
Available K determined by Provincial Soil Testing Laboratory using ammonium acetate extraction. Data from research plots conducted with Sherritt Gordon.

THE CONSENSUS HAS GENERALLY BEEN that the coarse and sandy soils with low clay contents require additional potassium. This concept does not completely hold true as many of the above soils on which K_2O response occurred were of a finer texture and with a higher clay content.

It is being considered that on some of these soils the imbalance of calcium and magnesium to potassium may be creating potassium deficiencies even though the soil test indicates a high exchangeable K level.

There are also indications that the clay mineralogy differs in many of these soils which could offset the exchangeable K recovery ability of the soils after and during crop production. Climatic factors may also be affecting the extent of response to K_2O. Production at higher yield levels than those used in calibrations for the K test might also be a factor.

The data tends to point out that the soil test methods for potassium should be reviewed and refined to more clearly delineate the responsive from the non-responsive soils. It could be advantageous for growers to evaluate the reliability of the K test for their farms by trying some K fertilizer strips. **The End**

Managing Coastal Bermudagrass for Maximum Beef and Hay Production

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Red River Valley Agricultural Experiment Station
Bossier City, Louisiana

COASTAL BERMUDAGRASS continues to be an excellent grazing and hay crop in Louisiana. If adequately fertilized and properly managed, heavy stocking rates must be employed. Under high stocking rates internal parasites may become a problem.

By proper management, rotational grazing, and harvesting the surplus grass as hay, many of these problems can be minimized. Good management improves the quality of forage and the hay harvested supplies an excellent source of winter feed.

A pasture management study was initiated 22 years ago at the Red River Valley Agricultural Experiment Station **to determine whether Coastal bermudagrass would maintain a beef cow herd on a yearly basis by providing adequate grass through the grazing season and hay for the winter months.**

The study was also undertaken **to determine the maximum stocking rate for efficient utilization of Coastal bermudagrass and to note the problems, if any, caused by a heavy stocking rate.**

MANAGEMENT PROCEDURE. A 16-acre Coastal bermudagrass pasture was established in 1955 and cross fenced into two pastures of equal size. The pastures were overseeded each fall with ryegrass and Louisiana S-1 white clover.

Sixteen Hereford cows with calves at their sides were placed on the pastures in May 1958. Four cows with their calves were added in March 1959 in an effort to increase the total beef production. These same cows were confined to the pastures continuously for 3 years.

The cow herd was regrouped in December 1961, and 24 cows with calves at their sides were placed on the pastures. A stocking rate of 24 cows with calves was maintained continuously on the 16 acres.

Death losses, disease, and failure to produce a calf were used as criteria for replacement of cows. Replacement cows with calves were placed on the pastures each year on December 1 to maintain 24 cows and 24 calves on the 16 acres.

The brood cows were bred to calve from September 15 to December 1. A 75-day breeding season was employed. All calves were vaccinated with a 7-way blackleg vaccine.

All brood cows were vaccinated annually for vibriosis and 5-way leptospirosis. They were also injected with vitamin A prior to the breeding season. The cows were wormed twice in the fall and twice in the spring to control internal parasites. External parasites were controlled by spraying or dusting, as needed.

PASTURES WERE FERTILIZED each year with three applications of nitrogen. Nitrogen was applied in early spring, midsummer, and late summer to provide a sufficient supply of high quality forage throughout the grazing season. The pastures were clipped and sprayed to control weeds. Accumulated manure was spread with a harrow, as needed.

Table 1. Performance of cows and calves on 16 acres of Coastal bermudagrass, 1958-79.

Year	Cows per acre	Cow weight loss Dec. 1 to Apr. 1	Calf weaning weight	Creep per calf[a]	Beef per acre	Value per calf	Calf value per acre	Calf crop	Nitrogen per acre	Hay harvested per acre[b]	Hay fed per cow Dec. 1 to Apr. 1
		lb	lb	lb	lb	$	$	%	lb	ton	ton
1958	1.00	—	433	—	433	110.98	110.98	—	150	3.63	0.88
1959	1.25	43	451	—	564	127.08	158.85	—	190	3.52	1.36
1960	1.25	96	443	—	554	108.80	136.00	85	220	3.19	1.06
1961	1.25	68	433	—	541	104.66	130.82	95	234	5.08	1.21
1962	1.50	34	403	—	604	102.32	153.48	88	251	2.82	1.63
1963	1.50	50	385	—	578	100.79	151.18	92	251	1.52	1.79
1964	1.50	120	398	—	597	86.42	129.63	96	251	1.55	1.55
1965	1.50	78	403	—	604	95.59	143.38	92	251	1.04	1.27
1966	1.50	87	390	—	585	100.30	150.45	83	251	1.54	1.24
1967	1.50	118	488	651	732	135.73	203.60	96	251	2.55	1.00
1968	1.50	108	451	542	676	134.43	201.64	100	251	1.57	1.10
1969	1.50	143	456	645	684	150.09	225.14	75	251	0	1.19
1970	1.50	49	475	524	712	155.19	232.78	88	251	2.01	1.16
1971	1.50	108	487	572	730	159.84	239.76	88	251	1.79	1.04
1972	1.50	56	521	—	782	219.28	328.92	83	251	1.89	1.03
1973	1.50	117	491	—	737	283.71	425.57	91	251	3.12	1.09
1974	1.50	136	469	—	704	144.33	216.50	75	251	1.70	1.35
1975	1.50	93	477	—	716	125.57	188.36	92	251	1.45	1.25
1976	1.50	48	520	—	779	187.64	281.46	79	251	1.55	1.47
1977	1.50	92	544	—	816	185.32	277.98	83	251	1.64	1.37
1978	1.50	95	533	—	800	280.36	420.54	92	251	2.13	1.79
1979	1.50	152	491	—	737	394.00	591.00	92	251	1.54	—
22-yr average	1.44	90	461	—	667	158.75	231.73	88	241	2.13	1.28

a Calves were creep fed an average of 587 pounds 1967-71. Calves creep grazed ryegrass pasture 1972-79.
b No hay was harvested during the 1969 season due to extremely low rainfall.

All weights on the cows and calves were taken following a 14-hour period off feed and water. Cow weights were taken December 1, April 1, and again when the calves were weaned, generally in mid-July at an average age of approximately 9 months.

Calves received a grain creep ration from 1967 to 1971 and consumed an average of 587 lbs per calf from December 1 to July 15, when weaned. The calves were allowed to creep graze a 4-acre ryegrass pasture adjoining the Coastal bermudagrass during 1972-79 from December 1 to July 15 in each of the 8 years. All calves were graded and priced at weaning time.

Hay was harvested during midsummer by cutting the surplus forage from both 8-acre pastures. The two pastures were alternately grazed and harvested to provide continuous grazing for the cattle. The Coastal bermudagrass was allowed to grow as much as possible in the late fall for stubble grazing.

Hay was fed in the open pastures from December 1 to April 1 at a rate of approximately 20 lbs per cow per day. No protein supplements were fed during the winter months. Salt and minerals were supplied free-choice.

Due to an extremely small amount of rainfall, no hay was harvested during the 1969 season. However, excess hay from previous years was used during the 1969-70 winter feeding period.

RESULTS. The data obtained on the performance of cows and calves on Coastal bermudagrass are presented in **Table 1**

for the 22-year period.

Weight losses by brood cows during the winter months had no apparent detrimental effect on their future performance as they regained weight as soon as spring grasses and clovers began to grow.

This loss in weight was caused by stress on cows nursing calves while being maintained on a medium level of nutrition during the winter period.

Under average conditions where brood cows are provided supplement with hay during the winter, they are likely to lose less weight. But in this study, cows with calves at their side were safely maintained on hay alone with no protein supplements during the winter period.

Hereford cows bred to Hereford, Brahman, and Exotic bulls were used in this pasture management study for 19 years (1958-76). In a further effort to increase total beef production, Hereford cows were replaced with 24 crossbred cows with calves on this pasture study beginning December 1, 1976.

The crossbred cows consisted of six Brahman-cross, six Limousin-cross, six Maine-Anjou-cross, and six Simmental-cross cows. All crossbred cows were bred to the same Angus bull.

Brahman-cross cows weaned the heaviest calves during the 1977 and 1978 seasons (596 lbs), followed by Simmental-cross (535 lbs), Limousin-cross (520 lbs), and Maine-Anjou-cross (504 lbs).

The calves had an average weaning weight of 533 lbs and produced 800 lbs of beef per acre, valued at $420.54 per acre during the 1978 season.

In a continuing effort to further increase total beef production, 24 Brahman-Hereford crossbred cows with calves were placed on this pasture study beginning December 1, 1978. All the crossbred cows were bred to the same Angus bull.

The winter and early spring of 1978-79 was extremely cold and wet. Therefore, very little ryegrass grazing was available for the cows and calves.

The calves weaned at a considerably lighter weight than average for Brahman cross-bred cows. The calves had an average weaning weight of 491 lbs and produced 737 lbs of beef per acre, valued at $591.00 per acre during the 1979 season.

SUMMARY. This pasture management study demonstrates that a beef cow herd with a stocking rate of one and one-half cows per acre can be maintained on Coastal bermudagrass pastures on a yearly basis. The total nitrogen applied averaged 241 lbs per acre per year. Coastal bermudagrass forage was harvested during midsummer and fed to the cows and calves from December 1 to April 1 at the rate of 1.28 tons of hay per cow per winter.

All hay fed to the cows and calves was harvested from the 16 acres. The total hay produced averaged 2.13 tons/A. No protein supplements were fed during the winter months. The cows rebred at 88 percent during the winter while nursing a fall dropped calf.

The total beef produced from the calves during the 22 years averaged 667 lb/A, valued at $231.73/A. However, during the last 13 years the total beef produced from the calves averaged 739 lb/A, valued at $294.87/A. **The End**

Fababeans Require K For Growth And Nitrogen Fixation In Manitoba

K. W. CLARK
University of Manitoba

FABABEANS have the potential of yielding 4,000 to 7,500 kg/ha of grain having 28-32 percent crude protein, if all the required agronomic and climatic inputs are timely and adequate.

Research in Manitoba indicates this grain legume could play an essential and highly profitable role in the maintenance of the nitrogen status in cropping rotations which may include small grains and special crops.

With the continued increase in the cost of nitrogen fertilizer, any contribution that can use annual legumes through symbiotic nitrogen fixation is an economic saving to the grower.

Intensification of crop production in Manitoba has led to increased requirements of all nutrients and in particular those required on the coarse textured soils where NPK are recommended.

NITROGEN FIXATION by fababeans grown under optimum conditions is significantly greater than that found in field peas, soybeans, or field beans. The fact that some farmers do not recognize the value of N fixation indicates that agronomic practices to insure high rates of N fixation are not met.

This is due to some lack of knowledge of the correct method for applying inoculum or due to an incorrect use of an applied fertilizer or some fungicide seed treatment.

Rhizobium strains used in fababean inoculum are able to supply the plant with its total N need over an extended season of plant growth, as shown in **Figure 1.** Note this is quite a different pattern from that of the soybean or field pea which incidentally hosts the same Rhizobium leguminosarum as the fababean.

The soybean and field pea essentially shut down their N-fixation system during the flowering-pod fill period. The fababean, though capable of sustained N fixation if adequate moisture is available, still shows a reduced rate during grain filling.

This is due to the competition for energy requirement. And since the pod fill component has first call on such energy, it therefore deprives the nodulation system of sufficient energy.

AFTER THE PLANT is mature and especially where it may be used as a silage crop, the stubble fababean will with adequate moisture again attain a very high rate of nitrogen fixation during regrowth, shown in **Figure 1.**

This regenerated second growth has attained a height of 75 centimeters at flowering in Manitoba and continued to fix N until late November-December when the soil temperature has dropped below 10°C.

The opportunity to late fall plow this high N-containing growth certainly enhances the role of the fababean in our crop rotations. In a rotation where fababeans are sown every fourth year, wheat or barley following fababeans may have little yield response to applications of 56 kg/ha N.

What kind of response can we expect from K applied to fababeans in terms of growth and crude protein yield?. **Figure 2**

EFFECT OF 20 kg/ha N APPLIED WITH SEED, ON ACETYLENE REDUCTION IN FABABEANS, PEAS AND SOYBEANS IN 1978

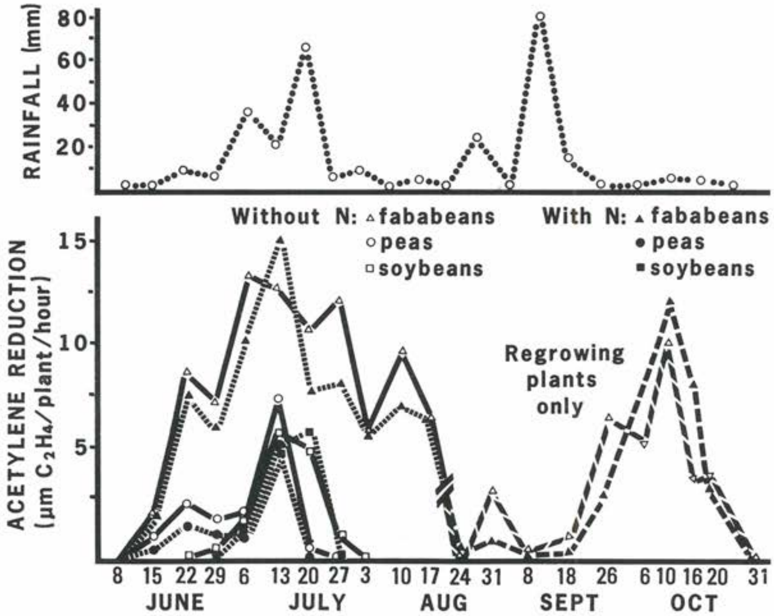

FIGURE 1

EFFECT OF K AND STAGE OF GROWTH ON N FIXATION RATE

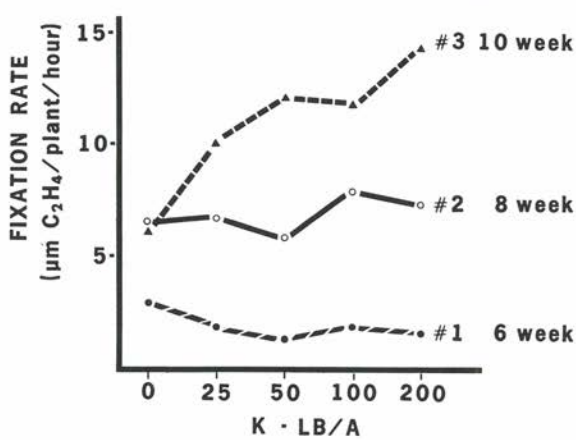

FIGURE 2

shows a response to K in terms of N-fixation rates as measured by use of the acetylene reduction technique.

NODULATION CAN generally be recorded in the field by 6 weeks. And by 10 weeks, we expect fababean plants to be actively fixing N and enhanced by adequate K. As the plant matures, the percent K in the total dry matter of the fababean declines from an initial 5 percent to approximately 1 percent at seed maturing, shown in **Figure 3.**

In Manitoba, K levels available in the soil can be directly related to levels of N fixation. Earlier and higher fixation rates occur with adequate available K (higher soil test levels), shown in **Figure 4.** There was a very striking drawdown in available soil K during growth of the crop.

The change in potassium levels recorded at five samplings throughout the growing season, in **Figure 5,** shows that only with an applied rate of 200 lb/A K was there enough K at 14 weeks of growth on this Almasippi fine sandy loam soil.

This suggests that high K rates must be applied to this high yielding grain legume. Crude protein level with 100 and 200 lb K rate exceeded 30 percent.

Earlier high N-fixation rates with higher K rates is a most valuable attribute to this plant's nutrition even if something over 50 lb/A K may seem to satisfy the N-fixation component of the plant's growth.

IF THE FABABEAN is grown for silage, then the high K rates certainly insure the dry matter will exceed the cattle diet requirement of 0.8 percent (NAS-NRC, 1978).

With the possibility of growing 7.0-10.0 metric ton/ha of this high protein silage (17 percent dry matter), the fababean is a valuable crop with much lower input costs than corn.

It is evident from our preliminary studies that both K and P enhance N fixation in fababeans. While the reason for this may still be obscure, S. H. Duke et al (1980) suggests that K increases N fixation by increasing available photosynthate for ammonia assimilation and energy production in root nodules.

Their findings support the concept that the primary effect of K fertilization on N fixation is on increased nodulation and not necessarily on efficiency of nodule tissue.

Such studies clearly show more detailed research on the role of K in N fixation is required for the benefit of both perennial and annual legumes. **The End**

EFFECT OF ADDED KCl AND AGE OF CROP ON LEVEL OF K IN DRY MATTER

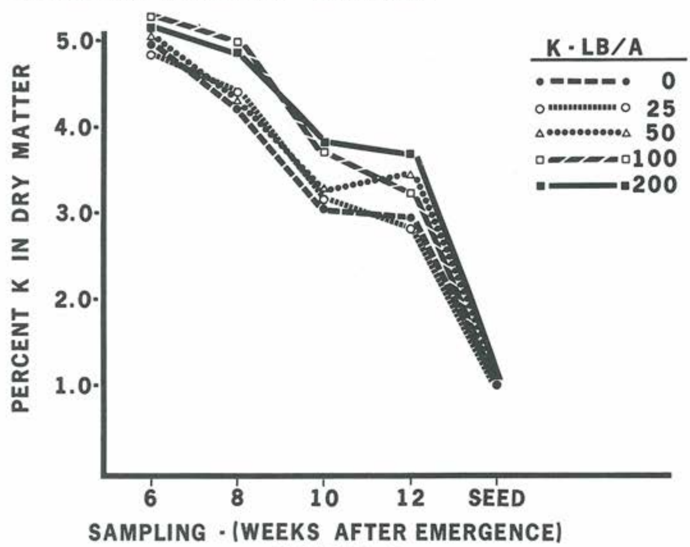

FIGURE 3

SOIL K LEVELS AND N FIXATION RATES AT DIFFERENT RATES OF K

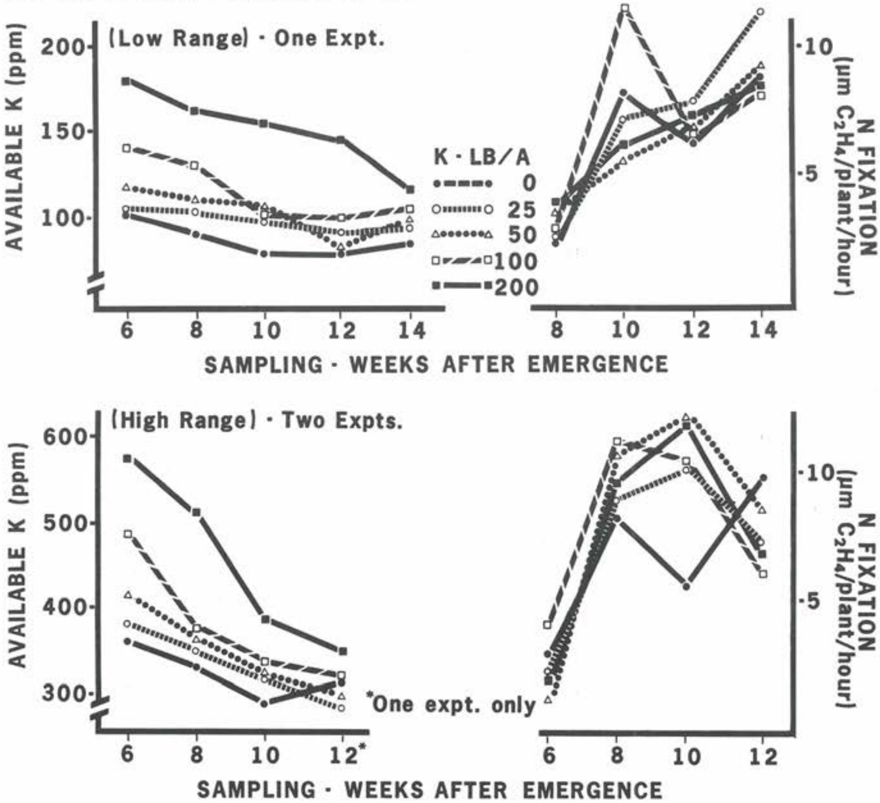

FIGURE 4

CHANGE IN K LEVELS OVER FIVE SAMPLINGS AT FIVE RATES OF ADDED K

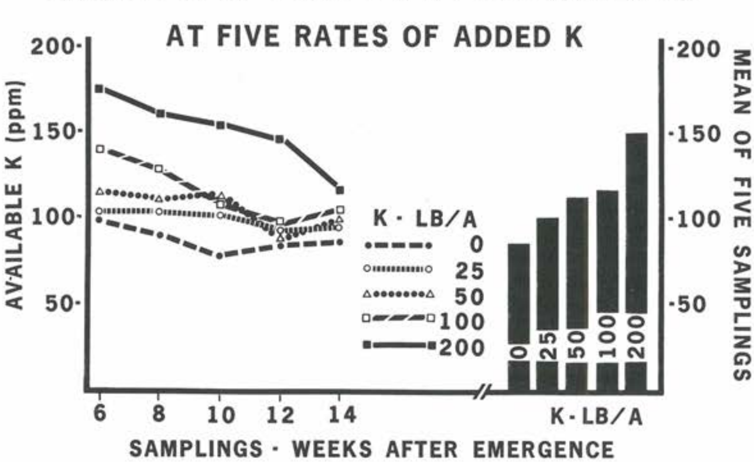

FIGURE 5

Placement of Phosphate Fertilizer in Southwestern Saskatchewan

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THE CONVENTIONAL METHOD of applying phosphate fertilizer in western Canada has been to place it with the seed. With some crops such as flax and rape it has been found that with seed placement causes some reduction in germination.

To overcome this, sidebanding of the fertilizer 2 cm to the side and 2 cm below the seed has been recommended. This involves a special machine and both methods are done at seeding time when the farmers are short of required labor.

Results from previous studies have shown that on many soil types large applications of phosphate broadcast and incorporated into the soil last for several years and can eliminate the need for phosphate placed with the seed.

Another recently developed method of application is placing the N and P 6 to 10 cm deep in the soil in bands 30 cm apart using a heavy duty cultivator. This is applied in one of the fall or spring cultivation operations or, in some cases, as part of the seeding operation.

Broadcasting low rates of P, similar to rates used with seed application, in either the fall or spring and incorporation during one of the normal cultivation operations has also been used.

These are the most common of many methods of application of phosphate fertilizers. The current thinking is changing more toward building up soil P, then using maintenance levels of application rather than considering only the current crop requirements.

THERE ARE THREE ASPECTS that should be considered in fertilizer application: (1) The efficiency of the use of the fertilizer, (2) the cost of application in dollars and labor, (3) the residual effects.

The efficiency is a comparison of the yield increase obtained in the first year from the different methods. With seed application or banding below the seed probably gives the best response per unit of fertilizer in the year of application, but are costly to apply in both labor and equipment.

Broadcasting and incorporation with one of the tillage operations may give less response in the year of application than the same amount of P applied with the seed. The application costs are low and it can be applied any time when labor is more available that at seeding time.

Banding below the seed is efficient but requires special equipment and added energy to get it down into the soil.

ON ALMOST ALL SOILS in southwestern Saskatchewan the applied P that is not used by the plant will remain in the soil in a form that is available for future crops.

At Swift Current, rates of 0, 112, 224, 448 kg/ha of P were broadcast and incorporated in the soil in 1966. This land has been in a wheat fallow rotation ever since. The plots were sampled in the fall of 1979, 13 years after application, and there were distinct differences in the amount of $NaHCO_3$ extractable P in the soil from the different treatments **(Table 1).**

There was a consistent increase in available P with the increased application. In spite of the fact that P does not move readily in the soil these differences could be measured at all depths in the soil, including the 90-120 cm depth.

Table 1. Residual $NaHCO_3$ extractable P remaining in the soil 13 years after initial application—kg/ha

Depth cm	Initial application rates—kg/ha of P			
	0	112	224	448
0- 15	32	50	65	148
15- 30	16	22	22	38
30- 60	22	24	26	27
60- 90	18	18	20	27
90-120	17	22	20	28
0-120	105	136	153	268

A possible explanation for this downward movement is by "bio-cycling." The plants grown on soils with the high rates of fertilizer contained more P in their tissues. When the roots with this higher P content decomposed the P was released at the depth to which they had grown.

A STUDY TO COMPARE the yield response of wheat to phosphate broadcast and incorporated into the soil before seeding with the response from seed application shows that in the year of application the broadcast method was slightly less efficient.

Rates of 0, 40 and 80 kg/ha of 11-48-0 were broadcast and rototilled into the soil two weeks before seeding and 40 kg/ha of 11-48-0 was applied with the seed on adjacent plots. All plots were seeded at the same time.

Table 2. Yield of wheat from rates of broadcast 11-48-0 and from seed application (average of 13 tests)

11-48-0 applied kg/ha	Placement of fertilizer	Yield of wheat kg/ha
0		1887
40	Broadcast	2020
80	Broadcast	2076
40	With seed	2081

This test was conducted on several soil types over 3 years, a total of 13 test sites. The 40 kg rate broadcast yielded 3% less than the same rate of application with the seed. The 80 kg rate broadcast yielded the same as the 40 kg rate with the seed and the unused portion would **build up the level of soil P.**

WHEN THE SOILS were separated into the six tests that had less than 20 kg/ha of $NaHCO_3$-P in the top 15 cm of soil at seeding time and the seven tests that had more than 20 kg/ha, the results are slightly different.

On soils low in available P the seed placement gave slightly better yields than either the 40 or 80 kg rate broadcast. On the soil that had more than 20 kg/ha of available P the 40 and 80 kg broadcast rates gave slightly higher yields than the P with seed application.

Table 3. Yield of wheat from rates of broadcast 11-48-0 and from seed application on soils with different levels of available P

11-48-0 applied kg/ha	Placement of fertilizer	$NaHCO_3$-P content of soil 0-15 cm-kg/ha	
		Less than 20	More than 20
0		1872	1900
40	Broadcast	1964	2068
80	Broadcast	2088	2068
40	With seed	2112	2056

Phosphate fertilizer can be applied in several different ways. All have some advantages and some disadvantages. The correct method will depend on the individual farmer.

Before deciding which method to use he should consider the efficiency, costs of each method, as well as the residual effect, then use the method best suited to his conditions. **The End**

K Fertilization Increases Yield and Quality of Peaches

GEORGE A. CUMMINGS
North Carolina State University

THE CORRELATION between soil test values and foliar elemental levels found in fruit crops is often low.

Many studies indicate K levels of the soil below the plow sole often has a higher correlation with foliar levels than the plow sole.

In most of the highly leached soils of the Southeast, where peaches are grown, the reserves of K are low throughout the soil profile. Several studies indicate a widespread response of peach trees to K fertilization.

But fertilizer application, especially K, is often not reflected in a rapid increase in K foliar levels. Research work with peaches in N.C. indicate that **fruit quality is often improved when K is supplied at rates above the level required for maximum yield.**

Yields shown in **Table 1** are six-year average while the quality measurements were made in the final year. Although yields for the top 2 rates of K were similar, every measure of quality appeared to increase with the final increment of K.

High compared to low K fertilization was responsible for producing larger, firmer, better colored fruit with a longer shelf life.

A large portion of the peaches produced in N.C. is sold on the fresh market in N.C. as well as in the mid-Atlantic and Northeastern states. From the data listed in **Table 1,** it is apparent that **adequate K is required in the maintenance of peach quality for the ultimate consumer.**

K influences not only the physical factors listed in **Table 1,** but also influences internal chemical characteristics important to quality.

Table 1. Influence of K fertilization upon Elberta peach yield, shelf life, firmness, color and size.

K Applied lb/A/year	Yield lb/tree	Shelf Life days	Firmness (a)	% Surface Red Color	No. Peaches/Tree Over 2 1/4" Dia.
20	127	3.0	8.7	11	307
66	144	3.6	10.1	18	386
132	142	3.8	11.3	20	416

(a) Measured with a Baulauf pressure tester using a 5/16" blunt plunger.

Table 2. Influence of K fertilization upon K concentration and internal quality of peaches.

K Applied lb/A/year	K Concentration % Foliage	Fruit	Fruit Browning (a) Resistance	Titratable Acidity As % Citric
20	1.05	0.74	12.8	0.39
66	1.79	0.95	13.0	0.42
132	2.15	1.31	13.7	0.44

(a) Measure of yellow color after macerated fruit are stored at room temperature. Higher readings indicate greater browning resistance.

A concerted effort has been made in the field of peach genetics in N.C. to develop peach varieties that would resist discoloration upon injury or after preparation of the fresh fruit.

The browning resistance shown in **Table 2** indicates that increasing K fertilization will also increase the browning resistance of freshly prepared fruit. The figures reported are objective readings from a Hunter color and color difference meter after maceration of the fruit and color change after 1 hour exposure to air.

But sliced fruit from the trees supplied with high K maintained a fresh appearance when stored overnight under refrigeration while sliced peaches from low K treatments were discolored and of poor appearance.

The acid content also increased as K fertilization was increased. Increased acidity in most fruit is a good indication of keeping quality. In this study, the acid content was highly correlated with increased shelf life.

Finally, K concentration was higher in peach foliage than in the fruit. With increases in K fertilization, foliar K increased to a greater extent than K in the fruit. This indicates that fruit does not serve as a sink for K, but as often noted for other crops, changes in increased uptake of K resulting from K fertilization is reflected primarily by changes in K levels in the foliage.

The response of peaches to applied K is not as visibly evident as with nitrogen.

Yet, in North Carolina, production of top yields with good quality require annual rates of K equal to or in excess of the nitrogen rates needed for optimum yield.

DO NOT be misled by what appears to be optimum yields with low K fertilization. With perennial crops, such as peaches, it may be too late to apply remedial K after losses in yield and quality become evident. **The End**

John F. Marten
Staff Economist
FARM JOURNAL

"A strong fertility program is the cornerstone for building tomorrow's high yields."

1980 IS HISTORY... PLAN NOW... TO MAKE TOP YIELDS IN 1981

WEST LAFAYETTE, IN—The 1980 drouth areas proved once again a strong fertility program is the best drouth insurance you can buy, Dr. John Marten, Staff Economist of **Farm Journal,** emphasizes.

Dr. Marten believes strong crop prices and all-out production in 1981 should create a record demand for fertilizer, despite some softness in areas hit hard by drouth.

The economics certainly justify higher rates, he says. He expects average U. S. farm prices of over $3.00 for corn, $7.50 for soybeans, $4.00 for wheat, and 80¢ for cotton in the 1980-81 marketing year.

Dr. Marten discusses some issues farmers face in 1981 with Dr. Werner Nelson, Senior Vice President of the Potash & Phosphate Institute.

1. Some top USDA officials question our ability to maintain the yield increases of the past several years. What are the prospects?

USDA thinks we have hit a yield plateau. I take the opposite view. History teaches us not to bet against the ingenuity and productive potential of U. S. farmers. Give them the tools and a good market price and they'll produce. My trend yield for corn is 104 bu/A in 1981. Don't bet against it! U.S. farmers are good agronomists and economists. They'll work wonders if the market payoff is there.

2. Will we be able to sell the bigger crop in years ahead?

Yes, definitely. Food-shortage strikes in some nations are typical of the hidden hunger around the world. China is now our biggest cotton importer. Huge sales of wheat, feed-grains, and soybeans will follow—unless politics interferes. An aggressive export sales program would enable us to sell bigger crops—and most important—at profitable prices to U.S. producers.

3. Will higher yields give higher net profit?

In the range most farmers are operating, higher yields increase net profit because over 80% of the costs are about the same regardless of the yield. Notice how higher yields decrease cost of production/bu and increase net return (adapted from University of Illinois data, 1980). Note how the higher yields pay even with $2.75 corn and $7.00 beans.

Yield	Production Cost		Net Return
bu/A	$/A	$/bu	$/A
	Corn $2.75/bu		
100	$331	$3.31	—$56.00
125	343	2.74	0.75
150	359	2.39	53.50
175	383	2.18	98.25
	Soybeans $7.00/bu		
30	$267	$8.90	—$57.00
40	275	6.88	5.00
50	284	5.68	66.00
60	294	4.90	126.00

4. What does this look like on a total farm basis?

Dr. Bill Griffith of PPI stresses the farmer, his banker, and his suppliers are all interested in dollars spent, net return, and the cash flow for the whole farm. Using the above facts:

CORN			SOYBEANS		
A farmer with 300 acres must			A farmer with 300 acres must		
Yield-bu/A	Spend	To Make	Yield-bu/A	Spend	To Make
125	$102,900	$ 225	40	$82,500	$ 1,500
150	107,700	16,050	50	85,200	19,800
175	114,900	29,475	60	88,200	37,800

An extra $12,000 spent for corn gave an extra $29,250. An extra $5,700 spent for soybeans gave an extra $36,300.

5. What about production costs in the years ahead?

Dr. David Dibb of PPI examined trend yields and projected production costs for 1989 in Illinois.

	CORN		SOYBEANS	
	1979	1989	1979	1989
Production cost $/A	$353	$637	$288	$517
Yield bu/A	119	152	36	43
Breakeven yield bu/A	134	169	40	47

The breakeven yields of 169 bu corn and 47 bu soybeans in 1989 underline the urgency to start increasing yields now.

6. Are there some changes that will cost little or nothing?

Here is where to start. Timeliness is perhaps the most important whether it is tillage, planting on or ahead of time, having everything ready at the appointed time, controlling pests, or making field observations. Selection of adapted hybrids or varieties and the right corn population are other key ones. An extra 4,000 corn kernels costs about \$3.00/A. Putting all this together is called good management.

7. Is there a key practice to consider changing on corn?

Yes. More adequate fertility. Corn yields tend to be more closely related to N use than other inputs. Nitrogen is the high energy cost nutrient. And adequate P and K are a must to increase efficiency of return from N. "Down costs" could lead to "down corn" and "down profit." Keep an NK balance and harvest what you grow. If "down corn" was a problem in 1980, it may be worse in 1981.

A higher plant population will help get more out of the N. The average U.S. corn population in 1979 was only about 19,000 plants per acre.

8. How about soybeans and wheat?

They, too, need more adequate fertility. This means more P and K on beans. P and especially K uses have increased the past few years along with yield.

Dr. Jay Johnson, Ohio State agronomist, says soybeans respond to a higher K level than corn. On a low-to-medium K soil the highest rate, 200 lb K_2O, gave the highest yield. The average K_2O rate on soybeans in U.S. in 1979 was only 26 lb/A!

K_2O	Bean Yield	Prod. Cost	Net Return	Prod. Cost
lb/A	bu/A	\$/A	\$/A	\$/bu
0	42	280	16	6.66
50	46	288	34	6.26
100	49	295	48	6.02
150	50	302	48	6.04
200	52	309	55	5.94

Decreasing soybean row width is a key practice to consider. It is not a question of whether 7 to 10 inch rows are superior to 30 to 36 inch rows but whether management capability can handle the narrow rows. The answer is yes for more and more farmers, giving a potential 5 to 10 bu/A higher yield.

Like corn, wheat responds to increasing N levels with careful attention to adequate P and K in many instances.

9. Are soil tests still important in increasing yields?

Definitely. Be sure to sample by soil types or color to monitor pH, P, K, and other nutrient levels. Low pH, particularly on high ground, is causing real crop problems. Build P and K in the soil to high levels over a period of time, as a first step in the route to higher yields. Then be sure the maintenance recommendations reflect the higher yield goals.

10. Does this need and possibility for higher yields apply only to large farmers?

No! It applies to small, average, and large farmers alike. But a survey in Michigan shows the smaller farmers are investing less per acre in chemicals and fertilizer—and unfortunately are producing 15 to 30% less.

11. Is it better to overshoot or to undershoot in fertilizer rate?

It is better to overshoot. Drs. S. A. Barber at Purdue and M. L.

Vitosh at Michigan State agree. Dr. Barber's ideas expressed in bushels of corn look like this. Applying ¼ over compared to ¼ under optimum netted 2.6 bu/A more corn.

Fertilization	Corn Yield	Net Bushels Minus Fertilizer Cost
	bu/A	bu/A
Optimum	151	55.2
¼ less	142	50.4
¼ more	153	53.0
Check	79	—

University of Wisconsin economist, Richard Schoney, says: "Figure the year will be slightly better than average and fertilize accordingly. The cost of being wrong in overestimating optimum fertilizer rate is less than the cost of underestimating rates."

12. How does the farmer view fertilization?

Let's assume 300 acres of corn using N response information from a longtime Ohio experiment on N:

N	Corn Yield	Prod. Cost	Net Return
lb/A	bu/A	$/A	
120	135	$106,500	$4,800
240	167	114,300	23,400

Spending an extra $7,800 with good management he increased his return $18,600—over $2 net return for each $1 invested. In 1979, the average use of N on corn in U.S. was only 130 lb/A.

13. What about the weather factor?

Farmers hit hard by drouth or high temperatures in 1980 may find it hard to hold a positive long-term attitude toward fertilizer and other inputs. Soil test to see where you are. 1980 is over. You couldn't help the weather. The job is to grow the highest profit crop possible in 1981.

Look how soybean yields are going up the three best years and the three worst years in each decade. The three worst years in the 1970's were almost as good as the three best years in the 60's. Climate hasn't changed. But technology has.

14. What about a strong fertility program as drouth insurance?

No doubt 1980 proved a strong fertility program is the best drouth insurance you can buy. Look at the corn yield advantages for adequate P and in **both good and bad years** in Virginia:

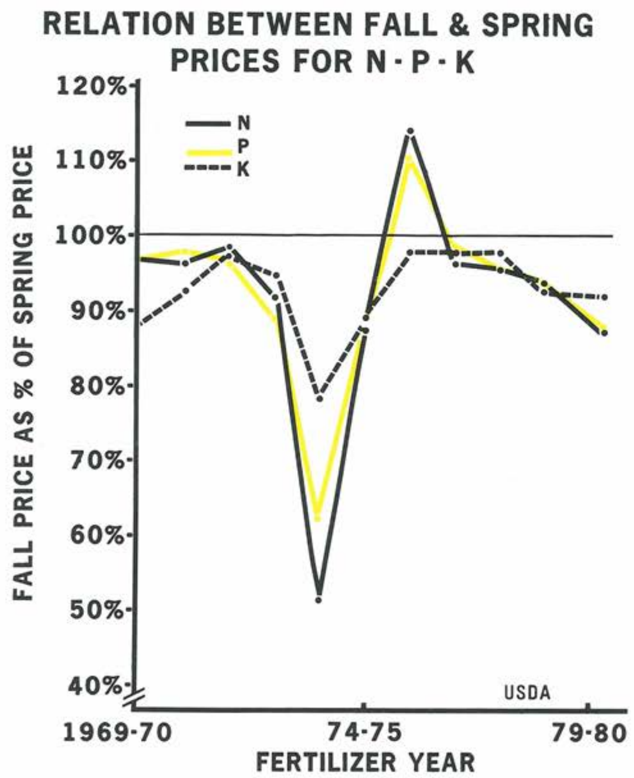
P_2O_5	Good Years	Bad Years
lb/A	Corn Yield Advantage — bu/A	
25	36	19
50	45	29
100	40	37

In Iowa, P response on corn was highest in low rainfall years.

15. Set higher yield goals for yourself.

The potential is there. A strong fertilizer program is a key to higher yields and profits in your farm business.

What should you shoot for? National yields for several crops are trending up about 2% annually. Even if you are getting high yields if you plan to survive and prosper, you need to set your goals for 2 to 4% increase per year. Some who have let things slip the past few years may even wish to try 10% annual increases for three or four years to move up faster. A strong fertility program is one of the cornerstones. **The End**



Sound Economics Says Get P and K On In Fall & Winter

BECAUSE it is economically sound. USDA data show fall application of NPK has been a good decision economically. This graph shows the relation between fall and spring prices for NPK for each fertilizer year since 1969.

BECAUSE the fall price of NPK has generally been lower than the spring price. The price of N or P has been higher only one year and price of K has been lower every year in the fall than in the spring.

BECAUSE it is agronomically sound, except on very sandy soils for K or where winter erosion is a major problem.

BECAUSE fall weather is usually more predictable for getting on fertilizer.

BECAUSE it has some special advantages. Applying before fall plowing gives greater assurance of getting the P and K into the zone where moisture is likely to be most favorable and roots most active during the next growing season.

BECAUSE time is still money, especially in farming.

BECAUSE it clears the way for planting on time. Research has shown planting after the optimum planting date for your area can cost valuable yields. In the central Corn Belt, at least one bushel of corn per acre is lost for each day planting is delayed past the optimum date.

BECAUSE this means a 400-acre corn farmer could lose $2,400 with $3/bu corn if his failure to put on P and K in fall delayed his spring planting just 2 days.

IF YOU MISS in the fall or winter, then get it on in spring—it pays.

• The lost opportunity of applying P and K in fall and winter should set the wheels in motion for spring applications.

• A farmer may wonder out loud: "Weather was so bad last fall I couldn't apply P and K. I'm already late this spring. Should I risk being 2 days later in planting in order to apply my P and K?"

• The successful farmer will answer that question with a loud YES. He has already lost the opportunity to apply in fall and winter. He should not lose the advantage of adequate fertility by skipping his spring application.

• Economics is again the reason. A University of Illinois study tells the point:

$N - P_2O_5 - K_2O$ lb/A	CORN YIELD bu/A
180 - 60 - 0	96
180 - 0 - 90	111
180 - 60 - 90	143

• Failure to put either P or K on this soil low in P and medium in K would have cost the farmer at least 30 bushels per acre.

• That is much more loss than the 2 or 3 bushel/acre potential loss from the delay in optimum planting date.

• Farming is an investment instrument. Many farmers have considerable cash tied up. Proper fertilization helps give high returns on the investment.

1980 IS HISTORY

•

PLAN NOW

•

TO GET TOP YIELDS IN 1981

•

THE PAYOFF COMES FROM HIGHER YIELDS

ORDER FOLDERS ON BACK COVER

The payoff comes from HIGHER YIELDS

BEATING THE AVERAGE

"The high yield, higher profit farmer . . .

Planted 6,000 more plants per acre.

Applied 115 lb more N, 48 lb more P_2O_5, and 114 lb more K_2O per acre.

And harvested 102 more bushels of corn per acre.

. . . than the average Iowa farmer."

THE 1980's WILL BE the decade of inflation and energy concerns, economists say. This will have a great impact on your operation.

How are you going to overcome the squeeze? We know you are thinking about this as you plan ahead.

The questions and answers below may help your plans. We use corn, but the principles can apply to any crop.

What happens to my breakeven yield if the price of corn drops?

Answer: The breakeven yield increases.

In southcentral Minnesota, economists figured it cost $292/A to grow a 120 bushel crop of corn in 1980. A breakeven price would be $2.44/bu.

Your costs may be higher or lower. Let's see what happens to breakeven yields as the selling price of corn changes:

Selling Price Of Corn	Breakeven Corn Yield*
$/bu	bu/A
3.00	97.3
2.50	116.6
2.00	146.0

*Yield needed before you make a profit.

Your strategy to store grain, use the futures market, or timing of your sales can be helpful in boosting profitability.

What has happened to production costs in the past decade?

Answer: Costs have more than doubled.

An example can be seen in the corn production costs of farmers involved in central Illinois Farm Business Records, shown in **Figure 1.**

CORN PRODUCTION COSTS IN THE 70'S

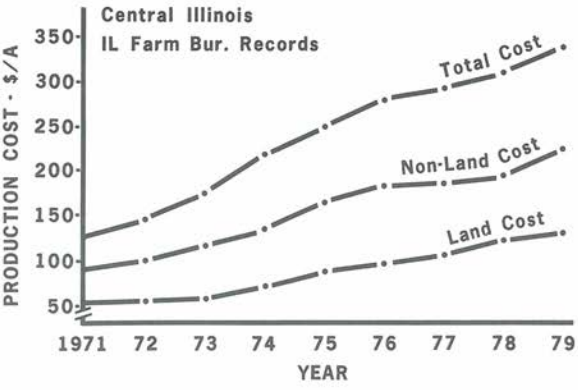


FIGURE 1

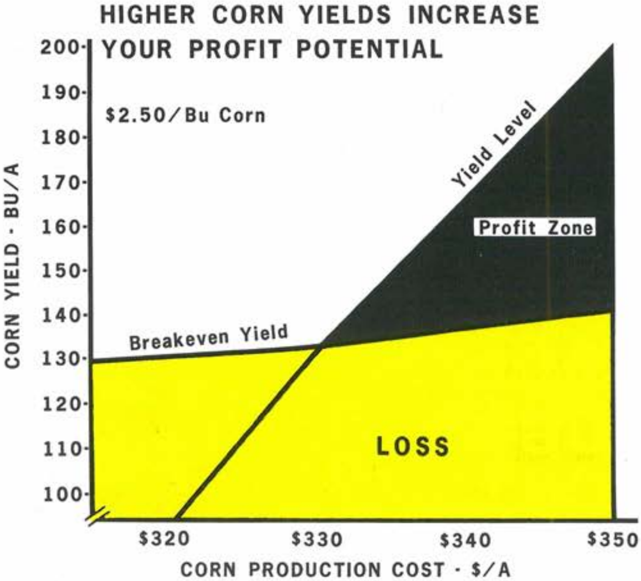


FIGURE 2

Using this information, if we assume inflation and production costs are about the same during the 1980's, what will it cost to produce an acre of corn in 1989?

Answer: $637/A

USDA projects per acre production costs in 1980 will increase 24 percent for corn, 23 percent for wheat, and 21 percent for soybeans—in just one year.

If corn were $3.77/bu, what would be the breakeven yield to meet a $637/A production cost?

Answer: 169 bu/A

From this, higher yields and, hopefully, higher prices MUST be part of future planning.

Are higher yields profitable?

Answer: Yes?

Look at Iowa. **Table 1** uses their state average yield of 127 bu/A and Iowa State University's estimated corn production costs to compare returns with those a top farmer obtained on his test area:

Table 1	Average Iowa Farmer	High Yield Test Area
Corn yield	127 bu/A	229 bu/A
Production cost—$/A	$306.37	$369.58
Profit or loss with $2.35/bu* corn—$/A	$ 7.92 (loss)	$168.57 (profit)

*Average price received by Iowa farmers in 1979.

Farmers have different land charges. Some farmers own their land and it's all paid for. Others rent or have just bought their land. So land charges can make a big difference in figuring costs.

But indications are that the "average" farmer who sold his grain didn't make much. Of course, income can often be increased if the grain is used for livestock.

What are the major differences between average farmers and high yield, high profit farmers?

Answer: Better management

We have looked closely at high yield, high profit farmers' programs. Several things stand out:

1. **Top farmers do things on time, such as planting early.**

Table 2. Estimated nutrient contents for a 200-bushel corn crop—lb/A

Corn	N	P_2O_5	K_2O	Mg	S	B	Mn	Zn
Grain	144	80	59	14	11	.19	.12	.30
Stover	112	34	207	24	22	.10	.38	.78
Total	256	114	266	38	33	.29	.50	1.08

2. Their weed control and pest management are tops.

3. They try several hybrids or varieties.

4. They use higher plant populations than average farmers.

5. They use more plant nutrients from fertilizer and/or manure and they harvest more bushels.

6. They use tillage and practices that conserve moisture and soil.

In Table 1, the high yield, higher profit farmer planted about 6,000 more plants per acre, applied 115 lb more N, 48 lb more P_2O_5, and 114 lb more K_2O per acre and harvested 102 more bushels of corn than the average Iowa farmer.

His costs were $63.21/A greater than average, but his profits were $176.49/A greater.

With good management, higher yields do increase profits, although production costs increase. With the higher yield goals, the associated improved management provides a larger buffer to absorb effects of adverse growing conditions and to help stay in the profit zone, shown in **Figure 2.**

IS IT TIME to sit down with your fertilizer dealer and make plans to help you increase your yields and profits in the 1980's? You be the judge.

What plant nutrients would a 200 bushel corn crop require? **Table 2** gives the estimates.

Fertilizer and adequate plant nutrients will play a key role as you increase soil productivity, crop yields, and profits during the 1980's. To hit a target, you often have to aim high. **The End**

FALL-WINTER FERTILIZER PROMOTION MATERIALS...

	Quantity	Amount
FOLDERS: 15¢ ea. (MC 10¢)*		
Fall-Winter Fertilization Pays	________	$________
Plant Food Your Soybeans Take Up	________	$________
Plant Food Your Corn Takes Up	________	$________
Alfalfa Absorbs Much Plant Food	________	$________
Stepping Up The Yield Ladder Increases Plant Food Needs	________	$________
Wheat Takes Up Much Plant Food	________	$________
Sorghum Takes Up Much Plant Food	________	$________
BOOKLETS: 20¢ ea. (MC 15¢)*		
Phosphorus for Agriculture (40 pages, 4-color)	________	$________
Potassium for Agriculture (40 pages, 4-color)	________	$________
Stepping Up The Yield Ladder (32 pages, 2-color)	________	$________
WALL CHARTS: 20¢ ea. (MC 15¢)*		
Plant Food Utilization (3 yield levels)	________	$________
Soybeans Get Hungry, TOO!	________	$________
Every-Season Fertilization	________	$________
Crops Take Up Nutrients ALL Season	________	$________
PLACE MATS: $3/pkg. of 50 (MC $2)*		
Year-Round Fertilization Starts Today	________	$________
Crops TAKE UP Nutrients All Season	________	$________
POST CARD: $3/pkg. of 50 (MC $2)*		
Year-Round Fertilization PAYS	________	$________
SLIDE SET: 39 slides $15/set (MC $10)*		
Facts Point to Fall-Winter Fertilization	________	$________

*MC Indicates member cost. This price is extended to member companies of the Institute, to colleges, universities, and government agencies.

$________ Payment enclosed (no shipping charges)

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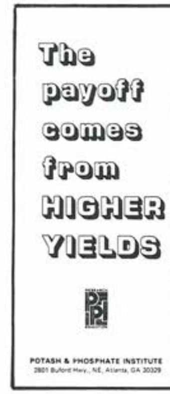

FOLDERS: 15¢ ea. (MC10¢)*	**Quantity**	**Amount**
NOW . . . Sound Economics Says Get P & K On In Fall & Winter	______	$______
1980 Is History . . . Plan Now . . . To Get Top Yields in 1981	______	$______
The Payoff Comes From Higher Yields	______	$______

*MC indicates member cost. This price is extended to member companies of the Institute, to colleges, universities, and government agencies.

____Payment Enclosed (No shipping charges)

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