Multiple Crops: Pinto Bean, Blue Corn, Hybrid Corn, Peanut

Language: English

Location: USA

Date: 1990-1992

Title of Study: “Field Testing of MicroSoil® Formula”

FIELD TESTING OF MICROSOIL FORMULA

INTRODUCTION

The MicroSoil formula is a concentrated liquid microbiological soil inoculate, containing various free living soil microbes and their food reservoir. The biomass which it provides enhances metabolic activity, facilitating a more complete and balanced nutrient assimilation by the plant. The apparent ability of the MicroSoil formula to fix atmospheric nitrogen and make it available on an "as needed" basis is unprecedented.

Crop nutrition and soil fertility represent complex chemical and biological systems. They are dynamic, constantly changing as the crop passes through various maturity stages. The MicroSoil formula appears to have overcome the limitations of single nutrient approaches that producers (and researchers) have primarily relied on to achieve stable crop yields. The microbes appear to be working in a synergistic manner with the plant to provide, for the first time, a method of dealing with the complex problems of crop nutrition in a natural manner. The "on demand" aspect of nitrogen availability, as well as other metabolic and enzymatic activities associated with the microbes appear to minimize antagonistic relationships between nutrients. Luxuriant assimilation of one nutrient at the expense of others is reduced. Yields are maximized while inputs are minimized.

This paper is intended to present field research conducted in an accepted scientific method. If the authors are permitted to speculate on the future, the MicroSoil formula will obsolesce most existing fertilizer recommendations. The bottom line -- this product is agronomically significant. It will radically change the way we perceive soil fertility and crop nutrition. But most important of all is that this product will benefit the farmers and producers.

MATERIALS AND METHODS

The soil type of the experimental area was classified as a Canez fine sandy loam (a fine-loamy mixed, thermic Ustollic Haplargid). The field was prepared by mold board plowing, disking, leveling and listing rows. The rows were spaced 3 feet apart. Pre-plant treatments were applied per manufacturer's instructions. The MicroSoil formula was applied 3 weeks before planting with a ground spray rig. CSA Liquid pre-plant fertilizer (treatment N P)was applied via a 2 row spoked wheel injector system (Cady Systems, Inc., Ankeny, Iowa) 4 inches deep in the center of the beds.

Seed was planted with John Deere Flex 70 planter units, at a depth of approximately 2 inches for all crops. Planting occurred on 28 May. Seeding rates were calculated to achieve the following populations: 27,500 plants per acre for blue corn and 102,000 plants per acre for pinto beans. Peanuts were planted at 60 pounds per acre. Soil moisture was adequate for germination. Precipitation was favorable for early growth and the first irrigation was not applied until 19 June (furrow irrigation through gated pipe) with the second irrigation occurring 10 July. Approximately 4 acre inches were applied at each irrigation. Precipitation during growing season was 11.4 inches (May -- September). Herbicides and pesticides were not used throughout the experiment. Weeds were hand hoed and/or tractor cultivated.

An open pollinated strain of blue corn was grown. Grain yield, grain moisture, test weight (bushel weight), total plant count and the number of ears were measured. Ears were harvested by hand and shelled with a single ear sheller to determine yield. Grain moisture was recorded using a Burrows Digital Moisture Computer, Model 700. Test weight was taken using a Fairbanks 1 quart standard volume container (Seedburo Equipment Company, Chicago, Illinois). Yield and test weight were adjusted to 15.5% moisture.

Pinto beans, cultivar *Flint*, were grown. Clean seed yield was determined by hand harvesting the entire plant and placing it in a nylon mesh bag. Bags were hung in an open air barn until dry enough to thresh. The entire plants were threshed, seed obtained and weighed.

Peanuts, cultivar *Valencia C.*, were grown. Peanuts were dug using a single row potato digger. The peanuts were picked in the field by hand, placed in nylon mesh bags, and hung to dry. Two weeks later the peanuts were cleaned by hand and weighed to determine yield.

Soil samples were taken at time 0 (after the rows were made but before treatments were applied), at early tassel (blue corn) and at harvest (all crops). Sampling was accomplished using a standard soil probe at a depth of 0-15 cm. Treatments x crops in all blocks were sampled, air dried for 3 days, sub-sampled, then sent to A&L Plains Agricultural Laboratories, Lubbock, Texas, for analysis. Statistical analysis was conducted using SAS PC, version 6.03 (SAS Institute, Inc., Cary, North Carolina).

DESIGN

The experimental design (Fig. 1) was a split plot, with four replications. The main plots consisted of the fertility treatments (six) and the sub-plots were the crops (three). The main plots and sub-plots were randomized within each of the replications (blocks). The experimental units were 40 feet long by four rows wide (12 feet). Each experimental unit was bordered by a row of red clover and separated from the other experimental unit by a 10 foot fallow alley.

The treatments (main plots) were (1) AgriGrow (Doniphan, Missouri), a claimed microbiological enhancing liquid material; (2) CSA, Inc. *Foliar* (Williamsburg, Iowa), a proven foliar nutritional system; (3) MicroSoil formula, a microbiological fertility product, one application plus 35 pounds/acre nitrogen on peanuts and pinto beans, 50 pounds/acre N on blue corn. The added N is used as an energy source (food source) which is required in soils initially testing low in soil nitrogen; (4) MicroSoil formula plus foliar: the combined treatments of foliar and MSF less the foliar pre-plant; (5) N P standard liquid fertilizer (10-34-0 and 32-0-0): 50 pounds N, 40 pounds P_2O_5 per acre pre-plant and 100 pounds N/acre side-dressed at the 6 leaf stage on blue corn, otherwise the entire treatment per crop applied pre-plant; (6) Control: no fertilizer.

The crops (sub-plots) were (1) blue corn, (2) pinto beans, and (3) peanuts. Chile was planted but the weather conditions were too adverse (crusting of the soil due to winds and evaporation of the top 6 cm of soil moisture) for the emerging seedlings and the crop was determined as a loss for any type of reliable data.

RESULTS

The results will also present two years data on hybrid corn using MicroSoil formula. The soil type was the same and the proximity to the 3 crop trial was approximately 30 meters.

HYBRID CORN

A summary of three years of commercial hybrid corn trials is presented in Table 1. Yield is adjusted to 15.5% moisture. The estimated pounds of nitrogen required to obtain a bushel of corn, 1.3 pounds N/bushel, is derived from Olson and Sander[1]. MicroSoil formula was used in 1991 with 3 cultivars in a separate trial. These three cultivars were also included in the 13 cultivar trial of 1991, grown with standard fertility methods. A statistical analysis of variance (ANOVA) showed that the yield of the three cultivars grown with the formula was not significantly different than those same three cultivars grown with standard commercial fertility methods. Those results (1991) were so encouraging that in 1992 the MicroSoil formula was applied pre-plant to the entire trial. In 1990, before the MicroSoil formula was used, 182 pounds N/acre was required to obtain a respectable yield. The fertilizer inputs of 1990 are typical in this soil type to obtain marketable yields.

BLUE CORN

Blue corn is an open pollinated, non-hybrid, indigenous land race of maize (corn). It was selected for this trial due to the increasing demand for organically grown blue corn. Since it is not a hybridized cultivar, its response to a natural system of nutrient supply was also under investigation. Yield and other measurements are presented in Table 2. Yield and test weights are adjusted to 15.5% moister. Net profit was calculated from the increase in yield over the control treatment, multiplied by 17 cents per pound, subtracting the cost of the fertility treatments, on a per acre basis. Soil nitrogen status at mid-season (early tassel) and harvest is presented in Fig. 2. Soil nitrate nitrogen and phosphorus levels at harvest are presented in Fig. 3.

The MicroSoil formula was the highest yielding treatment, averaging 2,925.2 pounds/acre (52.2 bushels/acre). Production yields of blue corn range from 1,000 pounds/acre to 2,500 pounds/acre with the lower to mid-range occurring more often than the higher range. Test weights for the formula were highest of all treatments. Net profit per acre with MSF was the highest of all treatments tested. This is a direct reflection of lower initial inputs when using the product. Soil nitrogen status at harvest

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1 Olsen, R.A. and Sander, D.H., 1988. Corn production pg 639-686. In Sprague, C.F. and Dudley, J.W. (ed). Corn and Corn Improvement, third ed., Amer. Soc. of Agronomy, Madison, Wisconsin.

when the MicroSoil formula was used, was 50.5 ppm NO_3, or approximately 100 pounds/acre nitrate nitrogen remaining in the soil. Fig. 3 graphically demonstrates, by treatments, the N and P status of the soil at harvest. The formula significantly increased the soil nitrogen reserve. Treatment N P did have nitrogen levels higher than time "0" levels, but this is probably due to poor utilization of applied fertilizer. This trend for nitrogen also exists at mid-season for the N P treatment. Phosphorus levels at harvest (Fig. 3) were lower for the MicroSoil formula compared to the other treatments.

PEANUTS

Peanut yield and other measurements are presented in Table 3. Net profit per acre is calculated similarly to the net profit for blue corn, except the price per pound was calculated at 34 cents. The average yield of the MicroSoil formula treatment was 2,652.2 pounds/acre. A substantial yield of Valencia peanuts, in this area, is 2,500 pounds/acre. The yield of the MicroSoil formula + foliar was significantly lower than the formula used separately, due to the higher cost of the combined treatments. The net profit per acre of MicroSoil formula was $219.82. This represents the largest difference of the net profit among treatments for all three crops. Soil nitrogen and phosphorus levels at harvest are presented in Fig. 4. Nitrogen levels are significantly higher in the MSF treatments (Table 3). Phosphorus levels in all treatments are lower than the time "0" phosphorus levels.

PINTO BEANS

Yield is presented in Table 4. The yield among treatments was not significantly different. This is primarily due to the large variation in yield data (R^2=0.26). There was a significant difference in net profit per acre. This would indicate that in an adverse year or poor market demographics, MicroSoil could significantly maintain profits. Soil nitrogen and phosphorus levels at harvest are presented in Fig. 5. As with the previous crops, the formula left a significant amount of nitrate nitrogen remaining in the soil (14 ppm, approximately equal to 28 pounds/acre). Nitrogen levels are significantly higher for MSF and MSF + foliar than the other treatments (Table 4 and Fig. 5). Soil phosphorous levels are reduced from time "0" for all treatments (Fig. 5).

DISCUSSION

SOIL NITROGEN, PHOSPHORUS AND pH LEVELS

The MicroSoil formula, across all three crops, left the soil nitrogen levels at a higher state than when the cropping season was started. This phenomenon is unprecedented in an agricultural fertility product, short of over fertilizing. The nitrogen was tested using a nitrogen ion specific probe (personal communication with A&L Labs). Previous experience using nitrogen probes has alluded that any source of nitrogen (organic or inorganic) will be registered by the probe. The mid-season (early tassel) blue corn levels (Fig. 2) show low levels of soil N. However, the harvest levels of the MicroSoil formula dramatically rise. This is an example (supported by this data and data from the Ministry of Agriculture, People's Republic of China) of the biofeedback mechanism at work with the formula. When crop growth is rapid and demand for nitrogen is high, the N fixing microbes are producing nitrogen as fast at the plant can absorb it. Soil nitrogen levels test low at this time. When the crop is matured and root exudates are reduced, there appears to be a lag time or buffer period with the microbes continue to fix nitrogen until environmental conditions reduce the demand and the microbes go dormant.

PHOSPHORUS

The phosphorus cycle is complex, continual and highly mediated by phospho-bacteria[2, 3]. Estimates from 25 to 90 (approximately) of the total soil phosphorus is organic phosphorus. This organic phosphorus is slower to be released (made available) for plant absorption than inorganic phosphorus forms [2, 3]. With low levels of soil microbial activity, responses to applied inorganic phosphorus would be pronounced, even in soils that test high in organic matter or organic phosphorus content.

Figure 6 shows weak bray and strong bray levels of phosphorus, at mid-season and at harvest, in blue corn for the three treatments. Weak bray phosphorus and strong bray phosphorus time "0" lines are also shown. Weak bray P is considered readily available, whereas strong bray P is considered to represent the readily available plus a portion of the active reserve P[4]. Active reserve P should be considered immobilized P (slightly available or slowly available to the plant) until mineralized and solubilized. Both of these processes are mediated primarily by phospho-bacteria[2, 3].

At mid-season and harvest (Fig. 6), the MicroSoil formula and the N P treatment show equivalent levels of available P (weak bray) and active reserve P (strong bray). The amount of active reserve P lost (or cycled into available P) at mid-season, from time 0, is 11 ppm for the MicroSoil formula and 14 ppm for N P. At harvest, the N P treatment shows an elevated level of strong bray and weak bray (above time 0), where the MicroSoil formula treatment shows depressed levels of strong bray and weak bray. The difference between the weak and strong bray of N P and the formula at harvest (14 ppm for each) still holds the same magnitude as at mid-season. Since the N P treatment had 40 pounds P_2O_5 added in the treatment, elevated levels at harvest are due to the added P. Mid-season levels for the N P treatment are below time 0, which would indicated active absorption of P by the crop.

The 0 fertilizer treatment (control) shows no immobilization or mineralization of phosphorus at mid-season or harvest. This indicates that although P levels test adequate for a crop, the native microbe populations are not active enough to stimulate an adequate phosphorus response. Furthermore, nitrogen is not available at levels high enough for blue corn production, revealing the necessary interactions of N plus P for stimulating plant metabolism.

The harvest levels for the MicroSoil formula are lower than time 0 at both weak and strong bray. These are native P levels in the soil. The formula reacts with the native phosphorus levels, as does an added fertilizer. It is making this P available during peak plant requirements (mid-season), at the same levels and reaction time, as a soluble commercial fertilizer. It maintains this cycle up to harvest, continually making available adequate amounts of P, by solubilizing P from the active reserve.

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2 Finkl, C.W. Jr. and Simonson, R.W., 1980. Phosphorus Cycle, pg. 370-377. In Fairbridge, R.W. and Finkl, C.W. Jr. (ed.). The Encyclopedia of Soil Science, Part 1, Dowden, Hutchinson and Ross, Inc., Pennsylvania

3 Follet, R.H., Murphy, L.S. and Donahue, R.L., 1981. Fertilizers and Soil Amendments, pg. 88-101. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

4 Explanation of soil analysis report, 1989. A&L Plains Agricultural Laboratories, Inc., Lubbock, Texas

The MicroSoil formula apparently improves or maintains the uptake and availability of phosphorus, when compared to a soluble commercial fertilizer. The significant increase in yield of blue corn and peanuts cannot be attributed to nitrogen alone. Bahn[5] noted an interactive effect of adequate N + P on dry matter production in peanuts and a synergistic effect of adequate available nitrogen and phosphorus has also been recognized with corn. This is further evidence to the reduction of nutrient antagonism by the MicroSoil formula.

SOIL pH

Soil pH for each crop by treatments is shown in Figure 7. The difference between the time 0 pH and the harvest pH, by treatment for each crop, was significant (alpha=0.01, R=0.99 for blue corn, R=0.92 for peanuts and R=0.68 for pinto beans). The presentation of this data is considered best suited to a graph. The MicroSoil formula is the only treatment that lowered the pH in all three crops. The other treatments exhibited a large spread, at times being lower than time 0, other times higher. The AgriGrow treatment experienced significant drops in pH, as did 0 fertilizer and N P. AgriGrow had an additional application of 100 pounds of ammonium sulfate (21-0-0-21). This introduced 21 pounds of sulfur per acre which reacts with water to form sulfuric acid, although it did not lower the pH in the blue corn. Application of liquid 32-0-0 and 10-34-0 (N P treatment) produces an acidic soil condition due to bacteria nitrification (free H^+ ions are liberated), consequently a drop in pH should not be unusual, although there was little change in the blue corn. The extreme drop in pH in the 0 fertilizer (control) treatment with peanuts could be explained by the high amount of calcium required by this crop. The requirement is higher than the other two crops and removal of calcium would have an effect in lowering the pH. The peanut line is much lower for all treatments, suggesting a partial explanation for this phenomenon.

The MicroSoil formula lowered the pH in all three crops (significantly in blue corn and peanuts). Maximum microbial activity occurs around pH 7.2 (personal communication) and will, through their life processes, attempt to mediate their environment for optimum growth. This is evident upon observation of the pH spread by treatment (Fig. 7). MSF had the smallest spread, 0.3 pH units. This indicates a significant buffering capacity. The formula will raise an acidic pH more rapidly than it will lower a basic pH (supported by soil test data from Florida and Ecuador), reducing the liming requirement significantly. This is demonstrative evidence that adjustment of pH for optimum crop growth is best accomplished by enhanced microbial activity.

HYBRID CORN

The use of the MicroSoil formula, with a 65% reduction of nitrogen in 1992 and a 78% reduction of nitrogen in 1991, produced equivalent yields when compared to the three year average. Initial fertilizing costs were reduced, yields were maintained or increased and insect pressure was reduced by the tremendous proliferation of beneficials, that application of pesticides was not necessary. Subtraction of the actual N applied to 3 cultivar in 1991 and 1992 from the estimated N required to obtain yield (Table 1), leaves 143 and 123 pounds N/acre unaccounted for. Clearly, this nitrogen had to be supplied

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5 Bahn, S, 1977. Nutrient Uptake by Groundnut (*Arachis hypogaea L.*) As influenced by Variety, Spacing and Soil Fertility on Desert Indian Soil. Indian Journal of Agronomy, 16 (3):309-312.

from somewhere. The only logical conclusion capable is from the MicroSoil formula microbes. This is definitive evidence of the atmospheric nitrogen fixing capabilities contained in the product.

BLUE CORN

The blue corn crop growth with the MicroSoil formula exhibited normal growth throughout the season. However, there was a period of growth that was quite exceptional. At green silk, the plant is setting and filling the grain. All the other treatments were of the same stage growth at this time, except the 0 fertilizer control. The control was a bit ahead of the rest due to seriously stressful nutrient conditions. This is a period of rapid nutrient translocation in the corn plant. Filling grain is the dominant sink for nutrient deposits. If the plant cannot supply this rapid requirement, it removes stored nutrients from the leaves and translocates them to the ears. This causes what is commonly referred to as "drying down". The lower leaves in the canopy turn brown as the nutrient levels are moved into the filling grain. This phenomenon was observed in all plots except those treated with the MicroSoil formula. These treatments were apparently capable of supplying this massive demand through the soil system via the roots. The lower canopy remained green with its photosynthetic machinery intact and functioning. This is a significant observation.

No less significant was the reduction in corn ear worm damage and early army worm defoliation. This was due to the abundance of beneficial insects in the MicroSoil treatments. Nowhere was it more obvious than in the hybrid commercial corn. The populations were diverse and abundant, completely removing the necessity to apply insecticides. This can amount to a significant savings in material and labor. The abundance and durability of the beneficials is somewhat unexplainable. Assuming that the plants are healthy and are receiving a well balanced nutrient supply, the development of natural defensive mechanisms are probably more enhanced under this condition than under a stressed condition. Applying pesticides would remove the insect but lower the natural defenses, thereby subjecting the plant to an immediate attack by insect predators. Spraying will also kill the beneficials, further rendering the field susceptible.

PEANUTS AND PINTO BEANS

The most striking observation in the peanuts occurred at harvest. Throughout the season the MicroSoil formula treated plots were healthy and in good condition. While harvesting, it was observed that, with the exception of the MicroSoil formula plots, there was occurrences of "black hull". This is caused by a soil fungus which blemishes the outside of the peanut hull, turning the hull black and resulting in a lower quality yield. This is a predominant disease in continual peanut culture. Partially decomposed previous crop residue is the main problem. Where black hull occurred in this trial was in the vicinity of partially decomposed plant residue. The MicroSoil formula plots did not exhibit this problem. Crop stubble in these plots was completely decomposed. It must be assumed that the microbe populations, within months, thoroughly used any organic material remaining in the soil for a food source. This could solve major obstacles in sanitizing fields, increasing decomposition in limited tillage situations, and controlling soil borne diseases.

The MicroSoil formula pinto beans, in general, had a larger spread of canopy across the rows of the experimental units than did the other treatments. A non-significant yield was a surprising result given the more massive amount of canopy area. However, like the blue corn, commercial corn and peanuts, the pinto beans showed lower insect and disease damage compared to the other treatments. The fact that both the peanuts and pinto beans are legumes would account for the lower soil nitrogen at harvest. The demand for massive quantities of nitrogen from the soil system was buffered due to the symbiotic association on their roots.

INTERPRETIVE SUMMARY

Microorganisms are the dominate factor in the metabolic activity of the soil. Their activities profoundly affect the cycles of carbon, nitrogen, and phosphorus, as well as the transformations of other basic elements which form a necessary part of the system of soil fertility and crop nutrition.

In the opinion of this researcher, the MicroSoil formula will alter the way in which successful farms operate in the future. The idealized biomass provided by this product offers significant benefits in soil chemistry and plant nutrition. It has the demonstrated ability to achieve equal or improved yields with lower imputs. Quicker and more pronounced fertilizer responses should be expected. The proven ability to fix atmospheric nitrogen and provide it to the growing crop offers an available solution to the problem of nitrate contamination of water supplies. Long term improvement of soil physical parameters (structure, bulk density, and infiltration) due to the enhanced microbial activity of the formula should reduce the erosion potential under any given soil type.

The results of this study may be considered premature or circumstantial. However, it should be pointed out that in addition to the results of the 1992 trial, the MicroSoil formula maintained or increased hybrid corn yields for two consecutive years under significantly different weather patterns. This was accomplished with reduced inputs of fertilizers and insecticides to the point that many traditional farmers and researchers refuse to believe the results. This product represents a significant step toward the long sought goal of sustainable agriculture.

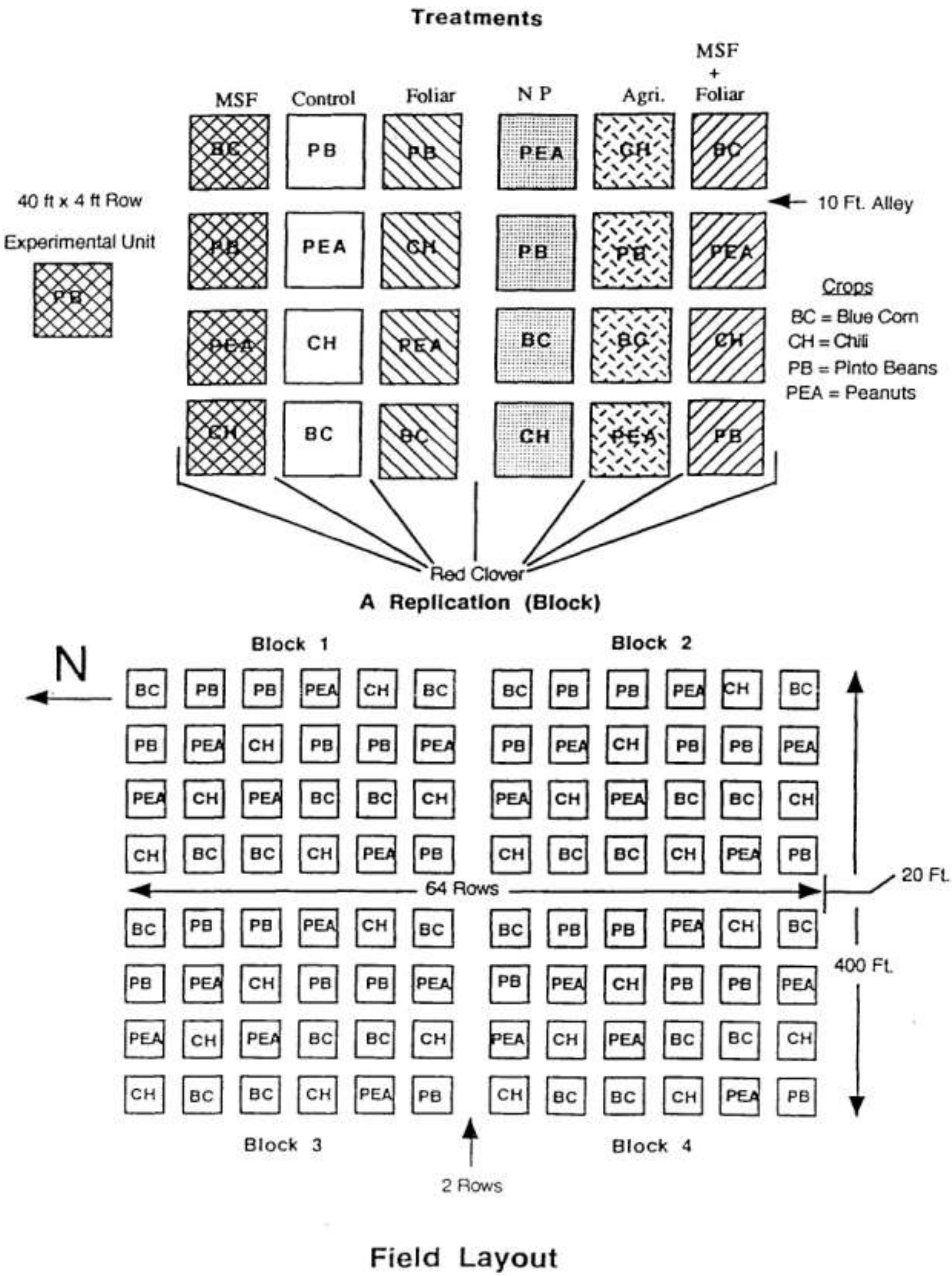

Figure 1: Experimental Design and Field Layout

Year	Yield Average of Test		Fertility Elemental lbs/acre			Estimated N Required to Obtain Yield[3]		Cost Per Acre Fertilizer Material	Pesticides[1]	Net Profit[2] per acre
	bu/acre	Kg/ha	N	P	K	lbs/acre	Kg/ha	Dollars	Dollars	Dollars
1992 7 cultivars	141	8851	60 + 1 treatment of MSF	31	104	183	205	60.48	-0-	313.17
1991 13 cultivars	124	7784	160 Normal fertilizer	27	0	161	180	61.86	19.46	247.28
3 cultivars	137	8600	35 + 1 treatment of MSF	0	0	178	200	21.30	-0-	341.75
1990 12 cultivars	154	9668	182 45 Mg 55S Base Year	27	55	200	224	88.45	47.22	272.43
3 Year Average	139	8726								

Table 1: Comparison of Three Years of Variety Testing of Commercial Hybrid Corn Grown on a Fine Sandy Loam - Yield, Fertilizer Applied and Cost and Return of Chemical Inputs, 1990-1992

[1] Pesticide costs include the cost of chemicals + $6.00/acre application costs for an agricultural airplane (crop duster).

[2] Net profit calculated at $2.65 per bushel minus the cost of fertilizers and pesticides.

[3] = 1.3 lbs N/bu (Olson and Sander, 1988. In Corn and Corn Improvements, pg. 666, American Society of Agronomy).

Product	Fertilizer Treatments Amount Applied	Yield[1] lbs/acre	Test Weight lbs/bu	Net Profit[2] Per Acre Dollars	Soil N Reserve at Harvest[3] ppm NO_3	Ears Per Plant
MSF	1 treatment MSF + 50 lbs N/A	a2952.2	a 58.1	a 328.08	a 50.5	1.02
Foliar	Preplant + 4 foliars	bc2183.7	ab 56.6	bc158.91	d 5.5	0.88
MSF + foliar	Combined Treatments less foliar preplant	ab2728.6	ab 57.2	ab236.53	c 7.5	0.98
AgriGrow	Preplant (1 qt/A) + 1 foliar (AGrow) + 100 lbs 21-0-0-21S	c1614.0	b 55.1	cd 89.19	d 5.5	0.97
Control	No fertilizer	d 857.8	ab 56.6	—	cd6.5	0.52
NP	150 lbs N.A 40 lbs P_2O_5/A	ab2384.0	ab 57.1	b208.50	b19.3	0.92
AVERAGE		2115.6	56.8	169.53	15.8	0.89
LSD (0.05)		675.3	2.5	114.81	1.6	0.13
LSD (0.01)		933.6	3.4	158.72	2.3	0.18
R^2		0.80	0.42	0.75	0.99	0.86

Table 2: Blue Corn (Open Pollinated) - Yield, Test Weight, New Profit Per Acre, Soil N Reserve and Ears per Plant, 1990-1992.

Note: Means within columns preceded by the same letter are not significantly different, at Alpha = 0.05.

[1] Yield is adjusted to 15.5% moisture.

[2] Calculated from the increase in yield over control at 17 cents per pound - the cost of the fertility material.

[3] Samples taken from 0-15 cm.

Brand Name or Company Name	Fertilizer Treatments Amount Applied	*Yield* **Lbs/acre**	*Net Profit*[1] per Acre **Dollars**	Soil Nitrogen *Reserve* at Harvest[2] **ppm NO_3**
			*	
MSF	1 treatment MSF plus 35 lbs/A N	a 2652.2	a 219.82	a 11.0
Foliar	Preplant + 2 foliars	ab 2266.0	bc 69.20	c 5.0
MSF plus foliar	Combined treatments less foliar preplant	a 2573.7	ab158.97	c 5.0
AgriGrow	Preplant (1 qt/A) + 1 foliar (Agrigrow) + 100 lbs 21-0-0-21S	b 2118.8	c 11.53	bc 6.0
Control	No fertilizer	b 1962.0	-----	c 5.3
NP	50 lbs/A NA 40 lbs/A P_2O_5	b 2087.7	bc 15.67	b 7.0
AVERAGE		2115.6	169.53	15.8
LSD (0.05)		675.3	114.81	1.6
LSD (0.01)		ns	ns	1.3
R^2		0.65	0.63	0.95

Table 3: Peanuts (Valencia C.) - Yield, Net Profit Per Acre and Soil Reserve at Harvest, 1990-1992.

* Means within columns preceded by the same letter are not significantly different, at Alpha = 0.05

[1] Calculated from the increase in yield over control at 34 cents per pound - the cost of the fertility material.

[2] Samples taken from 0-15 cm.

Brand Name or Company Name	Fertilizer Treatments Amount Applied	Yield Lbs/acre	Net Profit[1] per Acre Dollars	Soil Nitrogen Reserve at Harvest[2] ppm NO_3
MSF	1 treatment MSF plus 35 lbs/A N	1442.2	39.11	a 14.0
Foliar	Preplant + 2 foliars	1355.2	1.97	e 3.2
MSF plus foliar	Combined treatments less foliar preplant	1234.4	-37.01	b 9.2
AgriGrow	Preplant (1 qt/A) + 1 foliar (Agrigrow) + 100 lbs 21-0-0-21S	1242.5	-25.78	c 5.2
Control	No fertilizer	1174.8	—	c 5.3
NP	50 lbs/A NA 40 lbs/A P_2O_5	1156.2	-30.72	d 4.2
AVERAGE		1267.9	- 8.73	6.8
LSD (0.05)		ns[5]	ns	0.4
LSD (0.01)		ns	ns	0.6
R^2		0.26	0.34	0.99

Table 4: Pinto Beans (Flint) - Yield, Net Profit Per Acre and Soil Reserve at Harvest, 1990-1992

1 Calculated from the increase in yield over control at 20 cents per pound - the cost of the fertility material.

2 Samples taken from 0-15 cm.

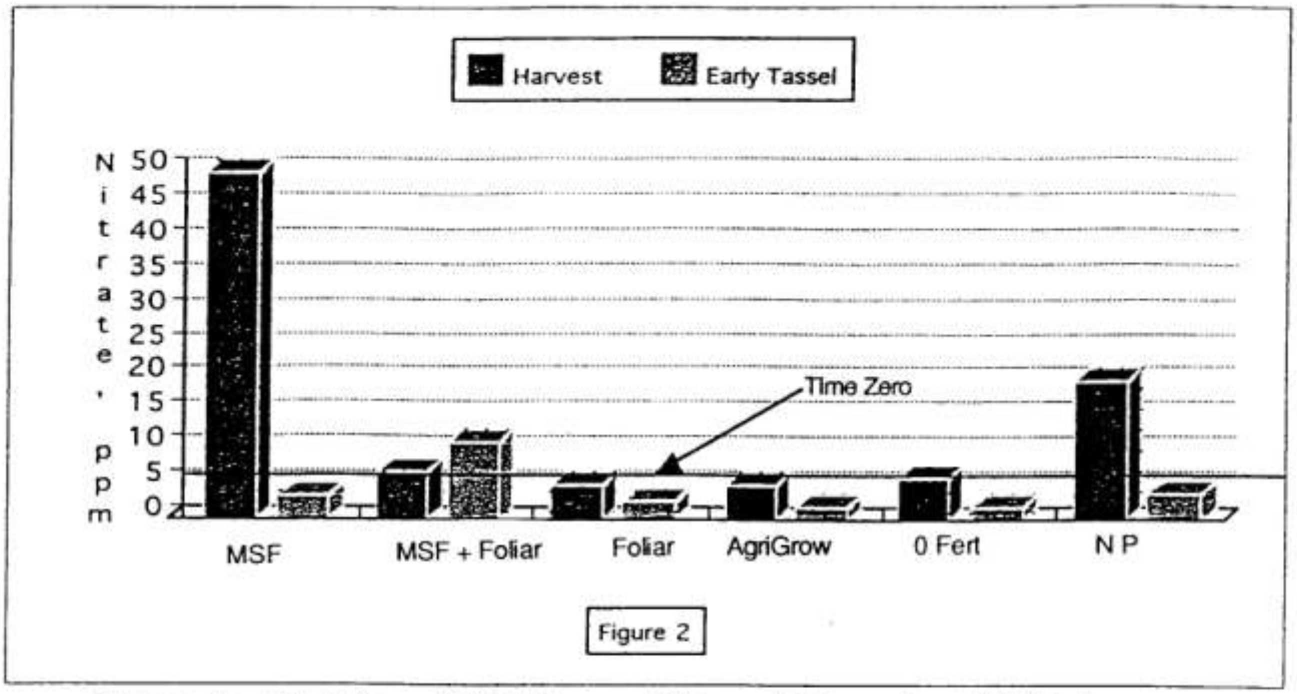

Figure 2: Blue Corn Soil Nitrogen Status at Harvest and Mid-Season (Early Tassel)

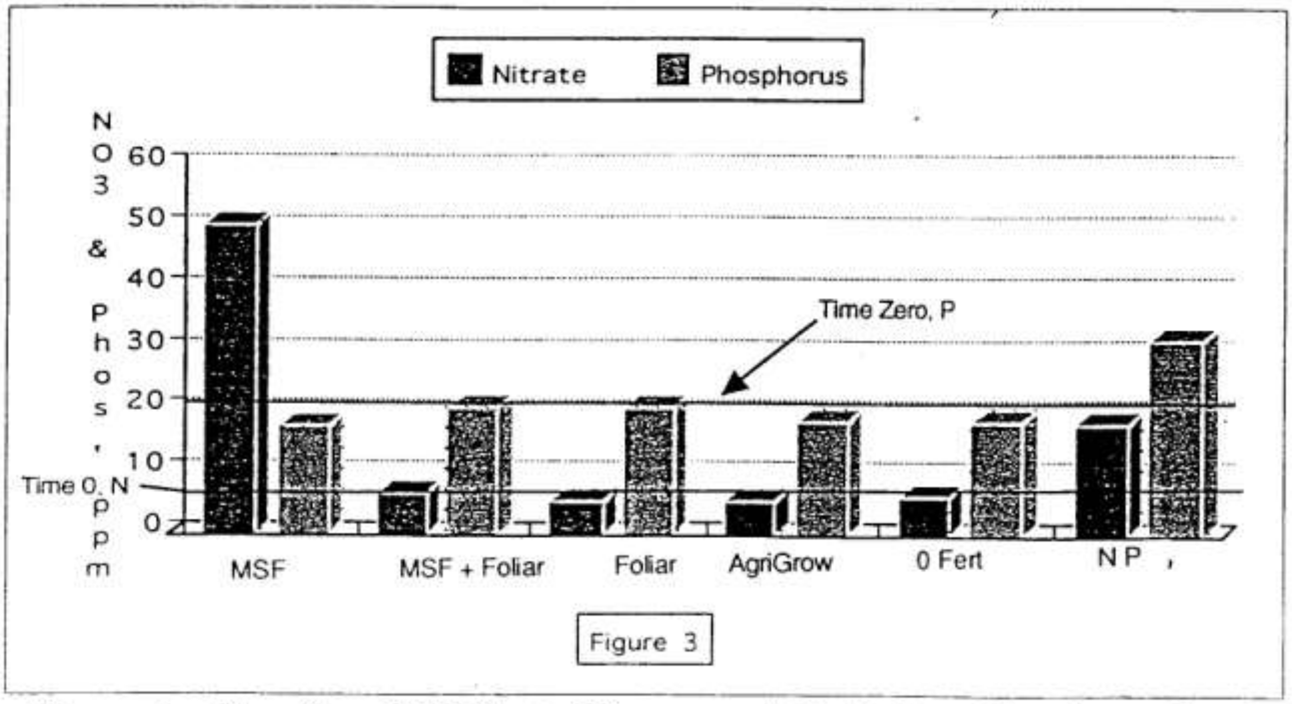

Figure 3: Blue Corn Soil Nitrate Nitrogen and Weak Bray Phosphorus Levels at Harvest

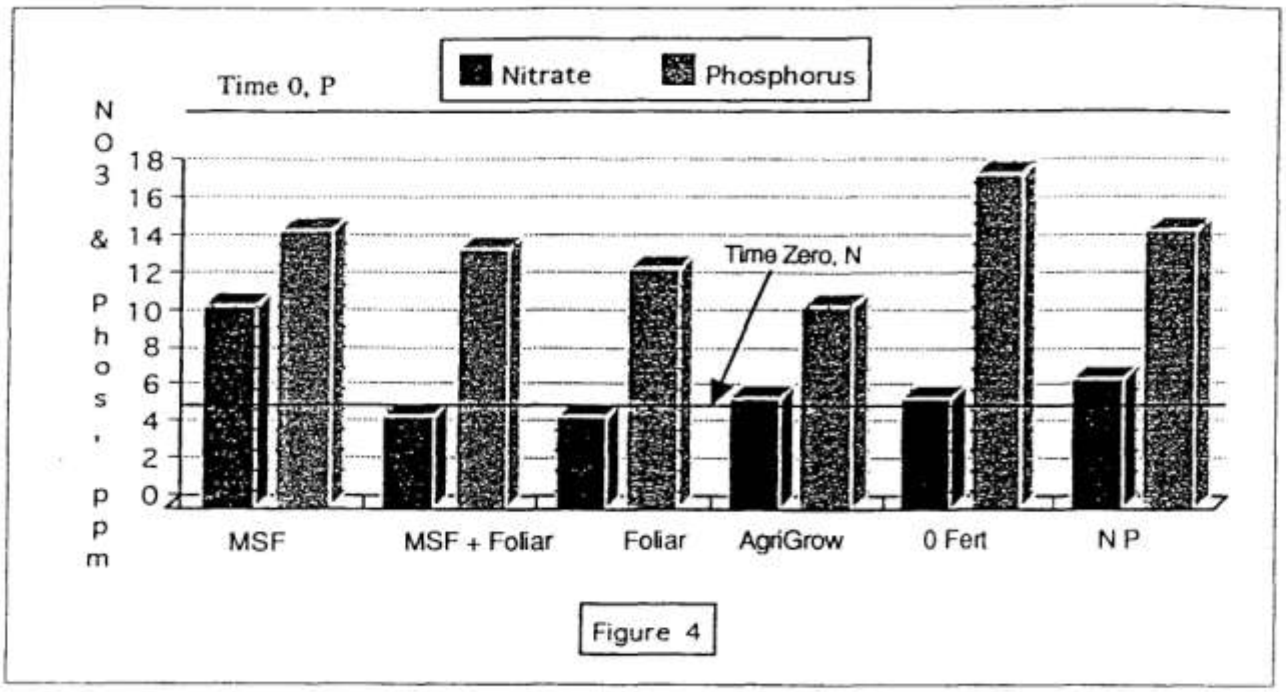

Figure 4: Peanut Soil Nitrogen and Weak Bray Phosphorus Levels at Harvest

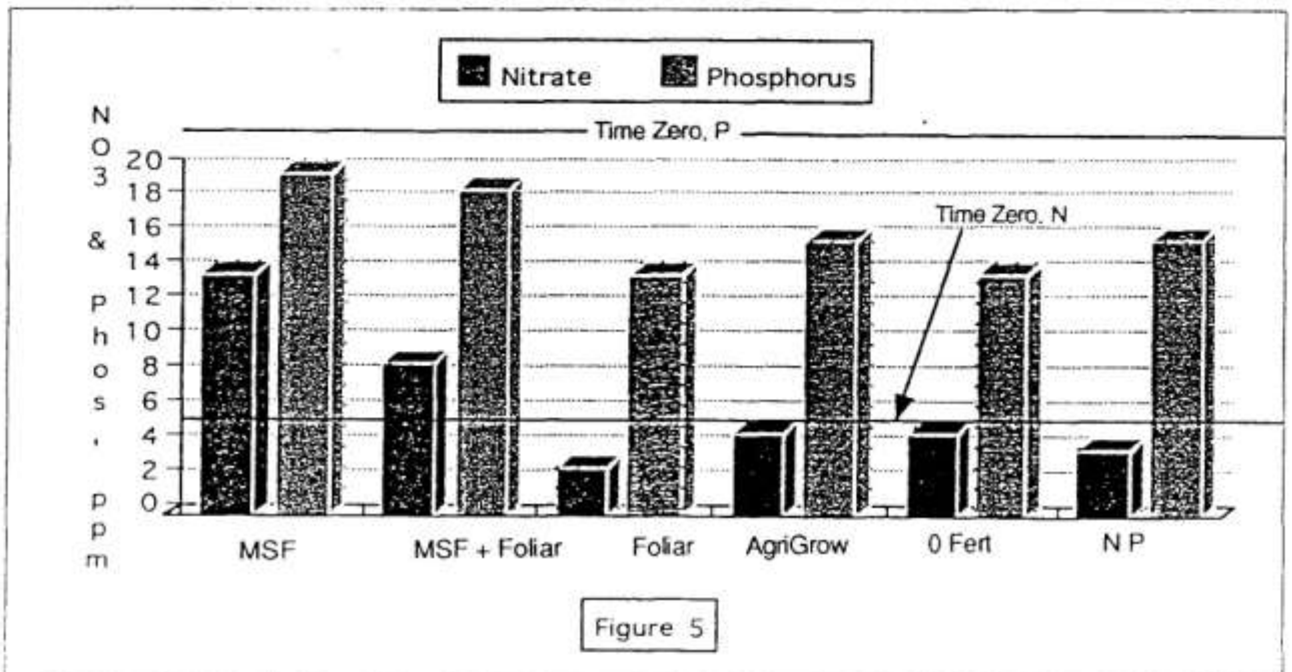

Figure 5: Pinto Beans Soil Nitrogen and Weak Bray Phosphorus Levels at Harvest

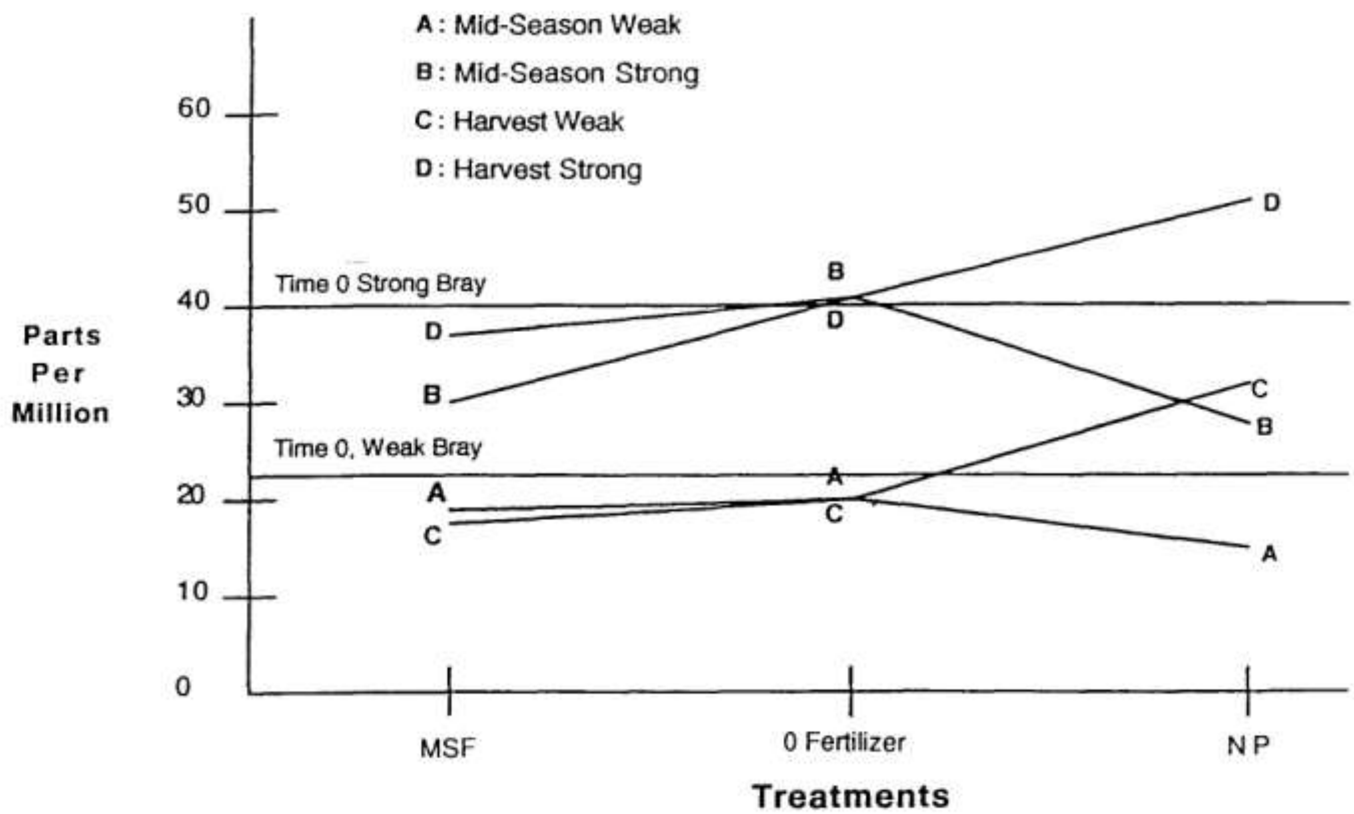

Figure 6: Weak Bray and Strong Bray Phosphorus Levels at Mid-Season and Harvest in Blue Corn, for Three Treatments

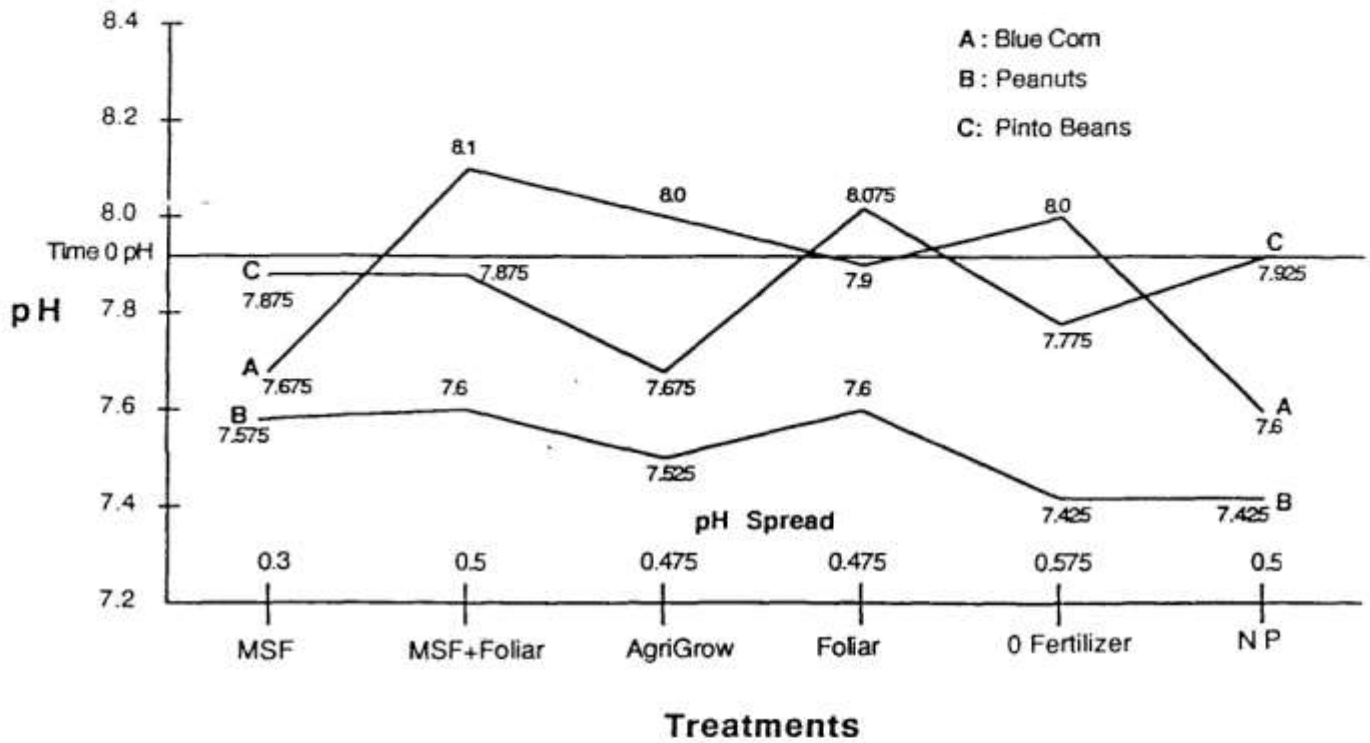

Figure 7: **Soil pH at Harvest for Three Crops by Treatments, Grown in a Fine Sandy Loam**

MICROSOIL FORMULA (MSF)

PEANUT TEST

Brand Name or Company Name	Fertilizer Treatments Amount Applied	Yield Lbs/acre	Net Profit[1] per Acre Dollars	Soil Nitrogen Reserve at Harvest[2] ppm NO_3
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MSF	1 treatment MSF plus 35 lbs/A N	a 2652.2	a 219.82	a 11.0
Foliar	Preplant + 2 foliars	ab 2266.0	bc 69.20	c 5.0
MSF plus foliar	Combined treatments less foliar preplant	a 2573.7	ab158.97	c 5.0
AgriGrow	Preplant (1 qt/A) + 1 foliar (Agrigrow) + 100 lbs 21-0-0-21S	b 2118.8	c 11.53	bc 6.0
Control	No fertilizer	b 1962.0	----	c 5.3
NP	50 lbs/A NA 40 lbs/A P_2O_5	b 2087.7	bc 15.67	b 7.0
AVERAGE		2115.6	169.53	15.8
LSD (0.05)		675.3	114.81	1.6
LSD (0.01)		ns	ns	1.3
R^2		0.65	0.63	0.95

Table 3: Peanuts (Valencia C.) - Yield, Net Profit Per Acre and Soil Reserve at Harvest,

PEANUTS

Peanut yield and other measurements are presented in Table 3. Net profit per acre is calculated similarly to the net profit for blue corn, except the price per pound was calculated at 34 cents. The average yield of the MicroSoil Formula treatment was 2,652.2 pounds/acre. A substantial yield of Valencia peanuts, in this area, is 2,500 pounds/acre. The yield of the MicroSoil Formula + foliar was significantly lower than the formula used separately, due to the higher cost of the combined treatments. The net profit per acre of MicroSoil Formula was $219.82. This represents the largest difference of the net profit among treatments for all three crops. Soil nitrogen and phosphorus levels at harvest are presented in Fig. 4. Nitrogen levels are significantly higher in the MSF treatments (Table 3). Phosphorus levels in all treatments are lower than the time "0" phosphorus levels.

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