BANDED PHOSPHORUS APPLICATIONS TO WINTER WHEAT - 1985-86.

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While many producers recognize the importance of a sound P fertilization program for profitable wheat production, there are many potentially responsive wheat acres not receiving any fertilizer P - resulting in reduced grain yields and farmer profitability. Over the years there have been many research studies conducted by land grant Universities throughout the Great Plains indicating the importance of fertilizer P applications for wheat production on low P testing soils.

In the mid to late 1970's Kansas State University conducted research on a method of N and P application which simultaneously placed both N and P fertilizers 4-6 inches deep on 18 inch centers. These "dual" or "deep band" applications were shown to be equal to drill row P applications for wheat - and that both of these methods were often superior to broadcast P applications. Research conducted throughout the Great Plains region has given in similar results.

During the past several years, Farmland Industries has conducted a series of studies in the western Kansas and eastern Colorado area designed to further evaluate the profitability of various rates of fertilizer P and anhydrous ammonia deep band applied with an undercutter. The results of the 1985 and 1986 harvested studies are presented in Table 1 and strongly support the conclusions of previous research.

Profitable yield responses to fertilizer P applications occurred in four of the six 1985 studies located on low soil test P soils, with the optimum P rate of these responsive sites being in the range of 30-45 lbs P_2O_5/A. Even with the very dry growing conditions across the western plains, similar results were obtained for the 1986 wheat crop. Of the six harvestable sites, all three of the low soil test P sites gave positive yield increases to fertilizer P with the optimum P application rate being 45 lbs P_2O_5/A. During the two years of these studies, profitable grain yield increases resulted in seven of nine studies conducted on low P soils - with the most profitable P application rate of 45 lbs P_2O_5/A resulting in an average $12.00 marginal return to fertilizer, at typical ammonia and 10-34-0 prices. In addition, two 1986 sites testing in the medium range of soil test P resulted in highly profitable yield increases at the 15 lbs P_2O_5/A rate.

After examining available research results, it is apparent that :

* Phosphorus fertilization of wheat in the Great Plains is profitable on low P testing soils.
* Phosphorus rates of 10-20 lbs P2O5/A for wheat on low testing soils are not adequate to maximize profits - regardless of application method.
* Profitable responses to fertilizer N may not be realized on low P testing soils unless fertilizer P needs are also met.

The superiorority of drill-row and dual deep band P applications over broadcast P applications is especially true under conditions of limited rainfall and/or shallow tillage operations. Dryland broadcast P applications in much of the high plains region (especially the western areas) frequently do not get incorporated deeply enough to prevent positional unavailability of fertilizer P, since the surface few inches of soil are typically dry during much of the year and plant roots are not active in the dry soil. Late summer broadcast P applications with the only incorporation being a pass or two with a field cultivator, undercutter or rodweeder often gives little or no benefit because of shallow incorporation.

We also hear that since dual deep band and drill-row P applications are more efficient, only 1/2 to 2/3 of the recommended broadcast rate needs to be applied on low P testing soils. However, recent Nebraska research indicated that the optimum economic application rates for band applications may be higher than broadcast P rates, and that these higher band applied P rates were much more profitable than lower broadcast P rates. These higher profits are the result of potentially higher grain yields associated with band P applications. For low P testing soils, Great Plains research has generally indicated that most profitable band applied P rate is in the neighborhood of 30-45 lbs P_2O_5/A, while higher rates may be needed on very low P soils.

Both fluid and dry fertilizer P sources will give equal results when applied at similar nutrient rates - but the equipment needed for proper placement differs. In areas where dry deep band equipment and/or dry fertilizer boxes on grain drills are present, producers are able to efficiently use lower cost dry fertilizer materials. Unfortunatly, this type of equipment is not common or available in all areas.

Liquid 10-34-0, while costing slightly more per pound of P_2O_5, offers an attractive alternative to dry materials where equipment to properly place dry phosphates is not already in place. It is relatively simple and inexpensive to rig equipment to properly place fluid materials as compared to dry materials - especially if the producer already has some of the needed equipment on hand. Squeeze pumps, piston pumps, centrifugal pumps and several other systems have all been sucessfully used. Keep in mind that it is the applied cost and net dollar return that is important - not the initial purchase price of a particular product.

How are potentially P responsive fields identified? Phosphorus deficient wheat will generally be stunted, thin, poorly tillered and often gray-green to light green in appearance. These areas can often be identified by walking the field in the spring or from the combine at harvest. Another symptom of a possible P deficiency might be that the field isn't producing as well as expected or doesn't seem to respond to nitrogen as well as it used to.

Many of the slightly-moderatly eroded slopes throughout the Great Plains are likely candidates and offer a high probability of obtaining profitable yield increases. These slopes may involve all of the field or only portions of a field. However, many non-eroded, nearly level fields may test low in soil test P and would likely be economically responsive as well. A sound soil testing program is essential for identifying and confirming P deficient fields.

Table 1. Farmland Industries Wheat N-P Research Results

Rate		1985 Study Location (County)								1985 Average of
N	P_2O_5	Ford	Wallace	Trego	Trego	Greeley	Kit Carson	Sherman	Gray	Low P Sites
-- lb/A --		---------- Grain Yield (bu/A) ----------								
0	0	27.3	49.4	32.2	41.4	57.7	22.4	74.4	25.0	38.8
80	0	29.6	47.3	59.5	48.1	52.0	25.4	82.2	20.2	43.6
80	15	30.6	58.4	56.0	49.6	56.2	33.6	76.7	21.1	47.4
80	30	35.4	61.4	57.3	52.7	57.3	33.6	75.9	22.5	49.6
80	45	39.1	59.8	54.2	52.8	53.1	38.1	81.7	24.6	49.5
80	60	38.2	62.4	53.0	53.6	57.1	37.0	64.3	22.4	50.2
80	75	41.1	63.4	54.5	55.0	57.6	37.6	66.0	22.9	51.5
Sig. P Response?		Yes	Yes	No	Yes	No	Yes	No	No	—
P Soil Test (lb/A)		20	23	18	17	22	14	36	42	—
Soil Test Range		Low	Low	Low	Low	Low	Low	Med.	Med.	Low

Rate		1986 Study Location (County)							1985
N	P_2O_5	Trego	Ellis	Sherman	Greeley	Gray	Grant	Average of Low P Sites	Average of Low P Sites
-- lb/A --		---------- Grain Yield (bu/A) ----------							
0	0	20.8	22.7	24.9	29.9	42.6	52.3	22.8	32.8
80	0	19.8	21.3	24.0	30.4	45.5	52.5	21.7	35.4
80	15	24.5	34.0	30.1	39.0	50.9	53.2	29.5	40.7
80	30	26.3	36.6	33.9	38.0	45.7	56.4	32.3	43.1
80	45	28.0	37.9	35.2	41.1	42.7	55.6	33.7	43.6
80	60	25.3	33.7	36.4	39.8	45.8	54.8	31.8	43.3
80	75	28.1	36.8	34.7	40.4	42.6	52.3	33.2	44.6
Sig. P Response?		Yes	Yes	Yes	Yes	Yes	No	—	—
P Soil Test (lb/A)		8	5	10	36	60	46	—	—
Soil Test Range		Low	Low	Low	Med	High	Med	Low	Low

Notes:

1. N supplied as anhydrous ammonia, P_2O_5 as 10-34-0.
2. All applications dual applied approximately July 1, 1984 and 1985 with undercutter.
3. Kit Carson county in Colorado, all others in Kansas.
4. 1985 Sherman county location severely lodged.
5. Soil P values are Bray P-1 and/or Mehlich II, except 1986 Trego, Ellis and Sherman counties are Olsen.

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