

NEWS & VIEWS

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P and K Build Crop Profits— High Yields Mean High Profits

IT'S NO SECRET that high yields and high profits go hand-in-hand as long as those high yields are grown efficiently. High yields are often more important than other management factors—such as cost-cutting or marketing, even though these management tools are also critical to increased profitability.

In a three-year Iowa survey, soybean growers were asked to keep track of several of their production costs, including tillage, planting, herbicides, nutrients, harvesting, land, and marketing. The growers were divided into groups, based upon overall profitability. Production practices of the most profitable 20 percent were compared to those of the least profitable 20 percent. See **Table 1**. Three-year averages showed that:

- Nearly three-fourths of increased income came from higher yields,
- About 20 percent came from cost reductions,
- Less than 7 percent came from marketing.

Because high yields are such a vital component of crop profitability, understanding how phosphorus (P) and potassium (K) fertilizers affect yield is critical to the grower's success.

Table 1. Increased yields were the primary factor in increased profits in a survey of top soybean producers (Iowa).

Year	Percent of difference in profitability for the more profitable growers compared to the less profitable growers		
	Increased income from:		
	Higher yields	Better marketing	Cost reduction
1995	68	7	25
1996	77	10	13
1997	73	3	24

Source: Iowa Soybean Association Producer Profitability Program

Soil Tests Help Predict Yield Responses

Soil tests are good indicators of likely yield responses to P and K fertilization. **Figure 1** shows the relationship between soil test P or K and yield. At lower soil test levels, yields are low—with little potential for grower profits. As P or K fertility increases, yields approach their maximum. An important feature of **Figure 1** is the critical level. The critical level is the soil test level below which yield responses to fertilizer are expected. Above this level, significant yield responses are usually not expected.

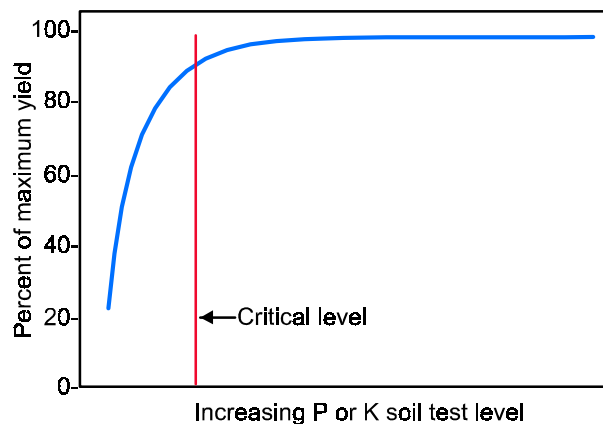
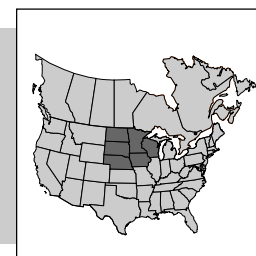


Figure 1. Relationship between soil fertility and crop yield.

Using technology now available, yield responses and returns to fertilizer investments can be predicted for different areas within a field. Relationships such as those in **Figure 1** can be used to approximate yield responses to P or K applications.



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Using soil test levels from an intensively sampled field and assuming that nutrients applied in accordance with proven fertilizer recommendations produce yields approaching yield goals, maps of yield response can be calculated (**Figure 2**). This map shows that responses to fertilizer applications can be dramatic where either P or K is too low.

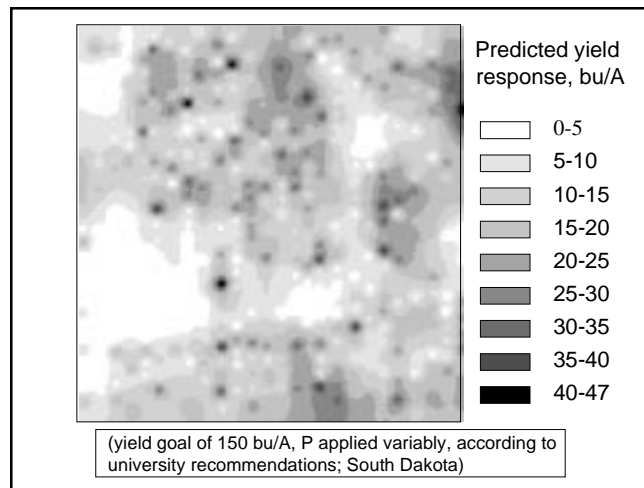


Figure 2. Predicted yield response to P fertilizer in an actual corn field.

Combining estimates of yield response with crop prices and fertilizer input costs allows net returns to be estimated. **Figure 3** shows predicted returns to phosphate for the same corn field shown in **Figure 2**. Areas where higher returns are predicted (darker shades) are associated with lower soil test levels.

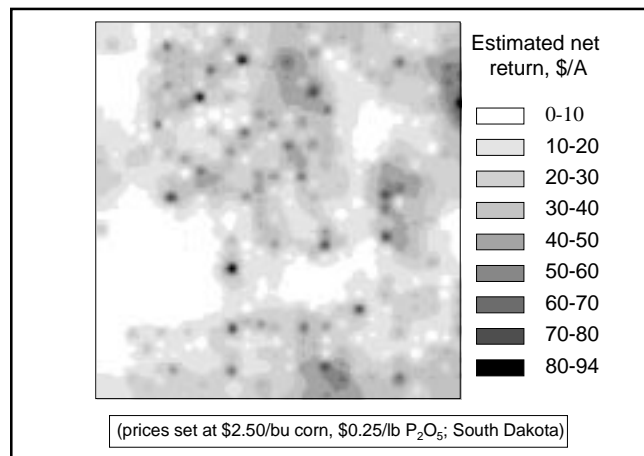


Figure 3. Returns to P fertilizer investment vary within an actual corn field.

P and K Interact with Other Nutrients to Boost Yields

Yield responses to P and K depend upon many factors, including the supply of other nutrients. Nutrient balance is critical to high yield, high profit crop production. An

example of this is shown in **Figure 4**. This graph demonstrates the importance of soil test K to the efficient use of fertilizer nitrogen (N). At the higher soil test K level, 100 lb/A less N was required to optimize yields than at the lower K level. Increasing the supply of both N and K increased the maximum yields possible. Higher soil K increased returns to the optimum N rate by \$140/A.

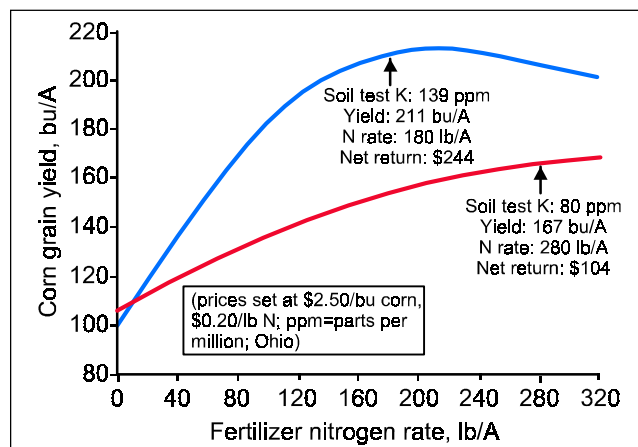


Figure 4. Higher soil test K levels increase N use efficiency and net returns to N fertilization.

P and K Help in Problem Situations

Growers can't always get things done on time for one reason or another. Weather often delays operations or causes some tasks to be rushed. When such things happen, factors other than fertility can limit yields the most. Delayed planting and compaction are two common examples. Good fertility can help minimize the impact of these adverse conditions.

Compaction occurs when soils are worked too wet or too often. It breaks down soil structure and inhibits the growth of roots. Potassium deficiencies have been observed when compaction is severe, and K fertilization has been shown to be helpful in achieving more profitable yields under these conditions. **Table 2** shows that the addition of K on low K soils was more profitable than on high K soils. High K soils had a greater ability to prevent yield losses from compaction. Potassium fertilization on low K soils produced yield increases that helped offset yield losses from compaction.

Table 2. Corn grown on compacted soils testing low in K responded profitably to additional K (Wisconsin).

Soil test K, ppm	Net return to 45 lb/A K ₂ O, \$/A		
	Axle weight, tons		
	<5	9	19
102	38.70	51.20	81.20
131	-17.55	29.95	7.45
234	-6.30	6.20	-0.05

Prices set at \$2.50/bu corn and \$0.14/lb K₂O.

If planting is delayed, yield losses can occur. Starter fertilizer applications containing P and K often help reduce the amount of lost yield. Data in **Figure 5** show that P and K applied as starter produced more profitable responses as planting was delayed in no-till systems. However, in moldboard tillage systems, P and K starters proved profitable at most of the planting dates investigated. In other studies, starter responses have also been shown to be important for longer season hybrids planted late.

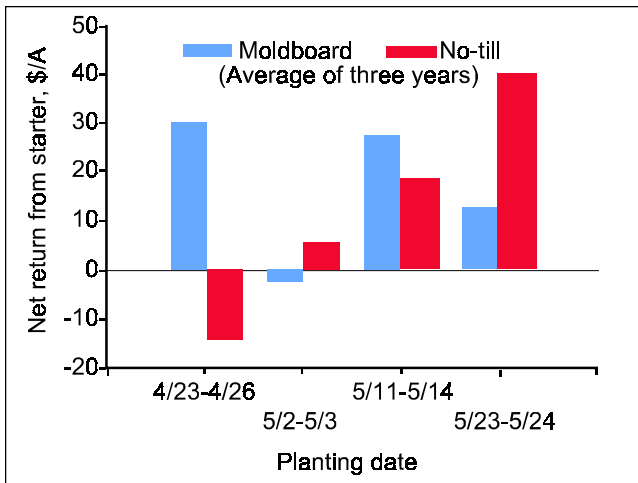


Figure 5. P and K applied as starter fertilizer can be profitable (Wisconsin).

P and K Affect More Than Just Yield

Both P and K provide many benefits to crops that are difficult to relate directly to yield increases, but they can increase profitability. Some of these other benefits are listed below.

Phosphorus

- Increased nodulation of legumes
- Better water use efficiency
- Improved disease resistance
- Higher crop quality
- Faster maturity
- Increased root growth

Potassium

- Increased nodulation and development of legumes
- Increased ability to withstand stress
- Improved disease resistance
- Higher crop quality
- Increased grain development
- Better N use efficiency



Not all of these benefits can be easily assigned a dollar return for a fertilizer investment. However, all of them can be necessary for maximizing profitability. As an example, faster maturity with adequate P nutrition can lead to reduced grain moisture. If grain is dried commercially, substantial drying costs can be avoided by lower moisture. **Figure 6** shows how much the savings from drying costs can add to the overall return on an investment in P at various N rates.

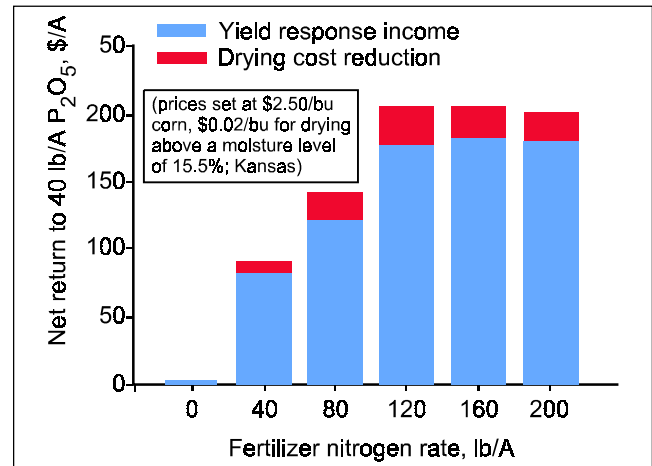


Figure 6. Net return to P fertilizer considering both corn grain yield income and savings from commercial drying costs.

Summary

In this age of advanced technology and sophisticated production systems, it is possible to overlook the fundamentals. In sports, complex plays will fail if the fundamentals of the game are not remembered. The same principle applies in crop production: P and K are basic to all the other management inputs required for building profits. ■

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