NEWS & VIEWS

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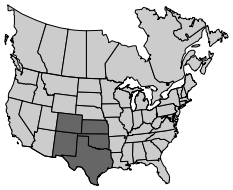

Dr. W.M. Stewart, Great Plains Director
October 1999

Fertilization and Low Crop Prices…What to Do?

THE CURRENT low crop price situation has generated many questions about the economics of fertilization. A question that may be asked in this atmosphere is: "Can I afford to cut back on fertilizer to save on variable costs, or will that decrease profits"? A detailed answer for a specific situation will depend on several factors, but a review of the basics will give us a foundation for addressing such questions.

Once a decision has been made to plant a certain crop, then it becomes a matter of making the most of the opportunity. This requires planning a program designed to maximize efficiency and to produce maximum returns per acre...in other words, to maximize profit. The maximum economic yield (MEY) concept was popular several years ago and is still as valid and legitimate today as then. There are four primary factors that affect profit…crop price, yield level, production costs, and crop quality (as it affects price). The question now must be asked, which of these factors does the grower have significant control over?

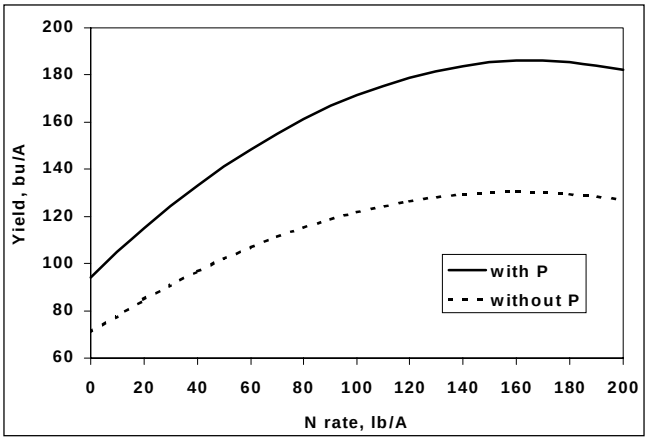

Figure 1. Effect of N and P fertilizer on average corn yields over 30 years.

Typically, producers are price takers and thus have little control over prices. However, they do have control over variable costs, which can directly impact yields and quality. In this sense, yield level is a controllable factor determining profit. Greater profits come from higher yields since costs are spread over more units (bushels, bales, pounds, etc.) resulting in lower cost per unit of production. Efficient and profitable production involves lowering unit cost to a point of maximum net return.

Long-Term Kansas Research

A long-term western Kansas study has evaluated irrigated corn response to nitrogen (N) and phosphorus (P) fertilizer. The research site, established in 1961, has been in continuous irrigated corn with treatments receiving six N rates (0, 40, 80, 120, 160, 200 lb N/A) and two P rates (0 and 40 lb P_2O_5/A). Long-term studies such as this one are especially valuable because they enable us to effectively evaluate yield response to fertilization over time and to analyze the economics of fertilization and crop production.

Grain yield over 30 years (from 1961 to 1991) was significantly increased by N and P fertilization (**Figure 1**). Average yield increase due to P fertilizer across all N rates was about 45 bu/A. While fertilizer P increased yields at all N rates, the yield increase was greatest at high levels of N, indicating the benefit of a balanced fertilizer program. Where P was applied, the profit-maximizing N rate, or economic optimum N rate, was approximately 160 lb N/A (assumes $0.15/lb N and $2.30/bu corn). This is illustrated in **Figure 2**, where the effect of N and P fertilization on net revenue (profit) is shown. The point of maximum profit occurred at approximately 10 lb less N than was required to maximize yield (i.e., 160 lb/A vs 170 lb/A). At

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the optimum N rate, P fertilizer increased profit by almost $120/A.

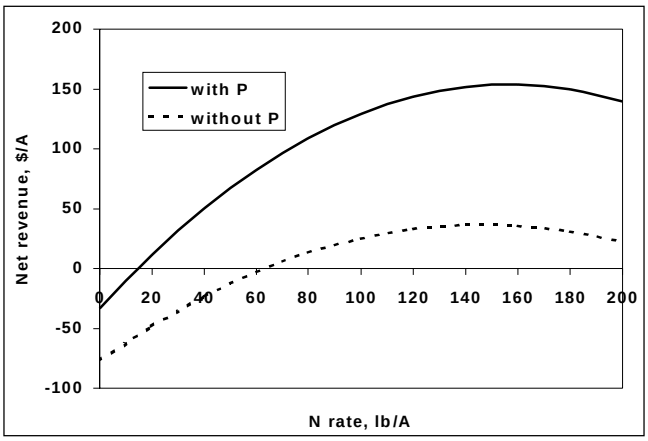


Figure 2. Effect of N and P on net revenue from corn production over 30 years (assumes corn price of $2.30/bu, $0.15/lb N, $0.24/lb P_2O_5, and $240/A in other costs).

In maximizing profit and efficiency of production, an important consideration is cost per unit of production. With increasing yield, cost per unit of production decreases, to a point, and profit is increased. **Figure 3** shows the effect N and P fertilizer had on reducing production costs in this study. Fertilizer P reduced production cost at the optimum N rate by $0.55/bu.

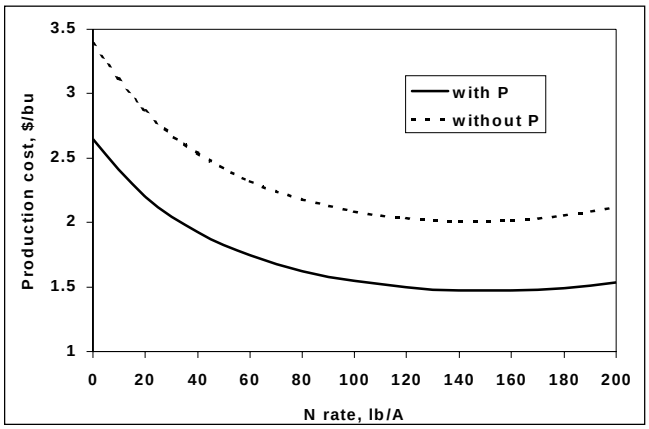


Figure 3. Effect of N and P fertilizer on cost per unit of production (assumes $0.15/lb N, $0.24/lb P_2O_5, and $240/A in other costs).

An especially meaningful observation made in this study involved the influence of crop price on economic optimum N rate. An analysis of the long-term data revealed that the optimum N rate varies little with corn price. If we assume that N is priced at $0.15/lb, the economic optimum N rate varies less than 10 lb/A between a corn price of $1.50 and $3.50/bu (**Figure 4**). Similarly, the economic optimum N rate is relatively insensitive to the price of N. For example, the optimum N rate decreases only about 5 lb/A when the price of N increases from $0.15/lb to $0.25/lb at $2.50/bu corn (**Figure 4**). Another interesting observation was the effect of type of year on the economic optimum N rate. Nitrogen rate varied by only 6 lb N/A (with P) from the highest to the lowest yielding years (data not shown).

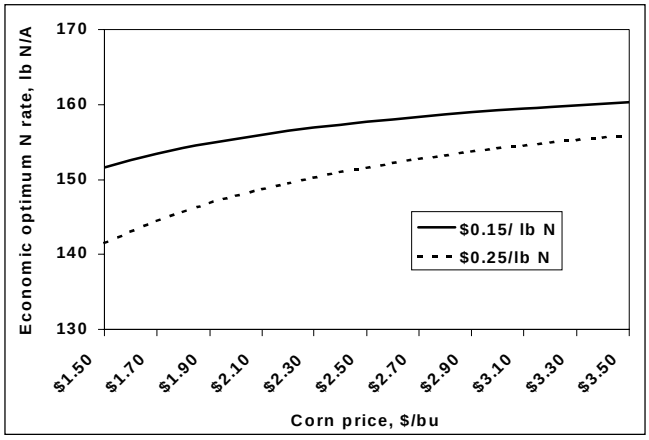


Figure 4. Economic optimum N rate (with P) as influenced by corn price and cost of N.

"Hidden" Benefits of P Fertilizer

Phosphorus fertilizer substantially increased N use efficiency in this study. In evaluating maximum yield with and without P fertilizer, P increased N fertilizer demand by about 10 lb N/A while increasing corn yield by almost 60 bu/A (**Figure 1**). This indicates that fertilizer P allows the plant to use available N more efficiently, rather than substantially increasing N fertilizer demand. Phosphorus increased fertilizer N use efficiency at the optimum N rate by about 42 percent and, when averaged over all N rates, by 40 percent.

Increased N use efficiency observed with P fertilization has environmental benefits too. **Figure 5** shows the effect P fertilizer had on reducing nitrate-N (NO_3-N) in the upper 10 ft. of soil after 30 years of production. At the optimum N rate, P fertilizer reduced NO_3-N levels by 66 percent. The increased N use efficiency due to P fertilizer results in a significantly reduced risk of NO_3–N leaching into groundwater.

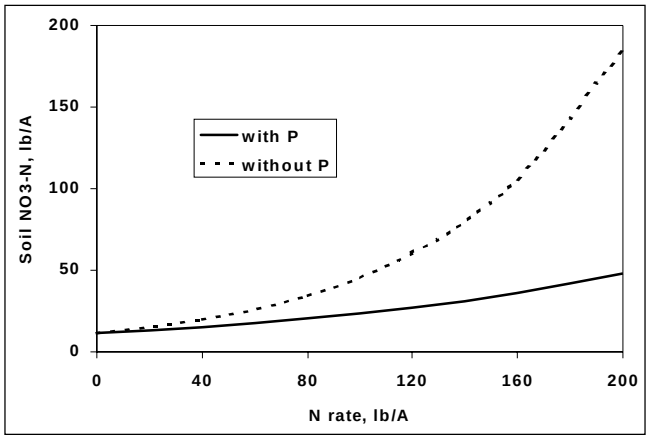
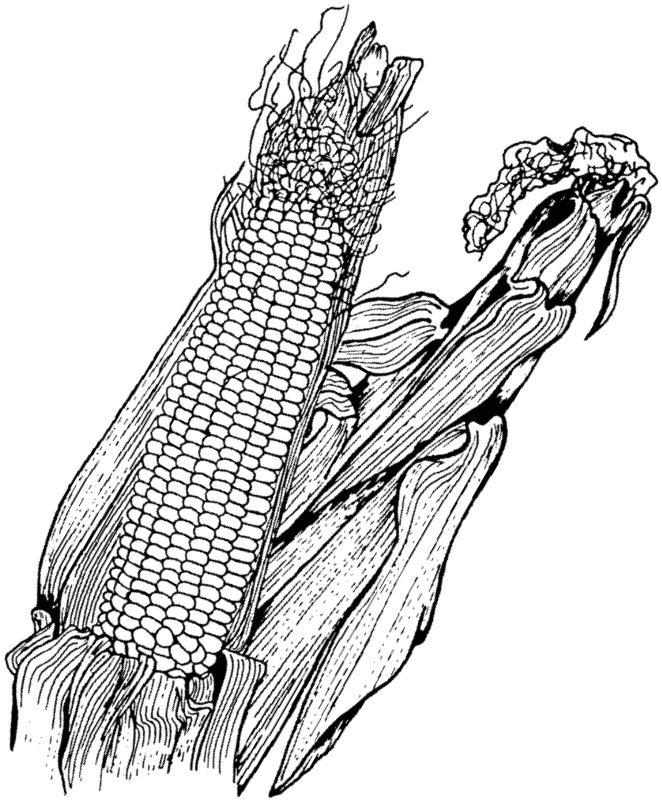


Figure 5. Effect of N and P fertilization on nitrate-N in the upper 10 ft. of soil after 30 years.

Another non-yield benefit of P fertilizer is its effect on maturity and grain moisture at harvest. Application of P fertilizer in this study significantly reduced grain moisture. At the optimum N rate, grain moisture was reduced from 27 percent without P to 22 percent with P. Artificial drying of corn can be expensive. Based on drying costs of $0.02/bu for each percent of moisture above 15.5, P fertilizer reduced drying costs by an average of $0.10/bu. Other benefits of P that are related to faster maturity include timeliness of field operations, reduced lodging, and increased marketing flexibility.



Summary

So, what are some of the conclusions we can make from the preceding discussion?

- **greater profits come from higher yields**
- **adequate and balanced fertility is essential to achieving higher yields and greater profits**
- **crop and fertilizer price has little influence on optimum fertility levels**
- **phosphorus, and other fertilizer nutrients, may have "hidden", or non-yield, profit benefits**
- **fertility requirements are best determined by soil testing and other considerations such as crop removal and experience**
- **and finally, needed fertility is not fat to be cut in lean times.** ■

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