EFFECT OF PHOSPHORUS ON GRAIN MOISTURE AND PROFITABILITY

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Summary

Phosphorus (P) fertilization increases grain yields and hastens crop maturity. Crops that physiologically mature faster have lower grain drying cost and/or can be harvested quicker. The economic returns to P are the results of increased yields and decreased drying costs. Increased yields account for the majority of the economic benefit of P fertilization. In addition to lower drying costs, corn maturing faster provides intangible benefits such as timeliness of field operations, reduced crop lodging, and increased marketing flexibility. These positive effects of P should not be overlooked.

Introduction

Phosphorus fertilization is essential for optimum production and profitability from irrigated corn in western Kansas. Corn plants deficient in P yield less and mature later than plants receiving adequate P. The role of P in crop maturity often is overlooked when analyzing the economic benefits from P. A long-term N and P study is being conducted for irrigated corn to determine the effects fertilizer have on grain yield and moisture content at harvest.

The objectives of this study are to determine the effect P fertilizer has on grain yield and moisture content at harvest at various N rates; determine the grain drying costs with and without P; and compare the economic benefits of P with regard to grain yield and drying cost.

Procedure

Nitrogen and P fertilizers have been applied annually to irrigated corn grown on a Ulysses silt loam. Fertilizer treatments included N rates ranging from 0 to 200 lb N/a in 40 lb increments with and without P at 40 lb P$_2$O$_5$/a. Corn was not allowed to dry completely in the field. Grain moisture content was recorded at harvest and used to determine drying cost. Grain yields were adjusted to 15.5% moisture to reflect shrinkage.

Economic benefit of P was calculated for each level of N. Only costs that varied between treatments were considered when determining the economic benefit. Drying costs were calculated using a drying charge of $0.02/bushel for each point of moisture above 15.5%. Fertilizer costs were based on $0.15/lb for N and $0.25/lb for P. Gross income was calculated using moisture-adjusted yields and corn prices of $1.75, $2.25, and $2.75/bu.

Results

A long-term N and P study has shown that the optimal N rate for irrigated corn is about 160 lb N/a (Figure 5). Over the past 6 years (1988-1993), application of P (40 lb P$_2$O$_5$/a) has increased grain yields by about 80 bu/a. With less than 80 lb N/a, the increase in yield from P fertilizer was much less than at the higher rates of N. This interaction between N and P indicates the need for a balanced fertility program to achieve maximum economic yields.

Phosphorus is essential for seed development and hastens crop maturity. In this study, the corn was harvested at relatively high moisture levels. Earlier harvest reduces the potential for crop losses from lodging and adverse weather conditions. Earlier harvest also will increase marketing flexibility and crop rotation alternatives. Application of P significantly reduced grain moisture by an average of 5% (Figure 6). At the optimal N rate, grain moisture was reduced from 27% moisture without fertilizer P to 22% with P.

Artificial drying of corn consumes scarce natural resources and is expensive. The addition of P reduced drying costs by an average of $0.10/bu (Figure 7). The biggest savings in drying cost occurred at N rates of 80 and 120 lb/a, but these N rates do not
represent the most economical levels because of lower yields. At the optimal N rate, the drying cost was $0.24/bu without fertilizer P compared to $0.14/bu with fertilizer P.

The economic benefit from fertilizer P was calculated as the difference in net revenue at each N rate with and without P. Net revenue was calculated as gross revenue less drying and fertilizer costs. The economic benefit from P varied with corn prices and ranged from approximately $125/a with a corn price of $1.75/bu to over $200/a with a corn price of $2.75/bu (Figure 8). This indicates that, regardless of corn prices, returns on irrigated corn can be improved greatly with P when N also is applied at optimal rates.

Figure 5. Phosphorus increases grain yield

Figure 6. Phosphorus reduces grain moisture

Figure 7. Phosphorus reduces grain drying cost

Figure 8. Phosphorus increases economic returns
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