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2011
2010
2009
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Is Tissue Testing Useful in Identifying Corn and Soybean Fields Responsive to Phosphorus and Potassium Fertilizers?

By Antonio P. Mallarino, Professor, Department of Agronomy

Producers often ask questions about tissue testing to decide "emergency" in-season phosphorus (P) and potassium (K) fertilization for corn and soybean. Previous articles(June 2010 and July 2008) have discussed the viability of post-emergence application of P and K fertilizers. A large application of granulated P or K fertilizer to soil during the very early crop growth stages may result in some grain yield increase although an economic benefit for the current crop is not likely. The probability of an economic response to foliar fertilization is likely with insufficient preplant fertilization or when soil and climate factors (other than drought) limit nutrient uptake. Traditionally, farmers and crop consultants have used soil sampling and testing of visually affected and seemingly unaffected field areas to determine if there is a nutrient deficiency. This is an effective practice when crop growth is limited by low soil nutrient supply, but will not be effective when soil or climatic factors other than low soil nutrient levels limit early nutrient uptake.

Is tissue testing helpful for identifying fields responsive to foliar fertilization?

No simple and reliable tissue test exists to identify the conditions that increase the chance of corn or soybean response to P and K fertilization. In spite of many field trials in Iowa, we have not been able to identify a useful critical or optimal P or K concentration in plant tissue. Figures 1 and 2 show a very poor relationship between the nutrient concentration in young plants or leaves and the yield response to fertilization across several fields and years. The reason is that many factors other than nutrient supply affect plant growth and influence the tissue nutrient concentrations due to nutrient uptake and also dilution and concentration of nutrients in the dry matter. Relationships (not shown) are acceptable for different fertilizer treatments or soil nutrient levels in a specific field and year, but a diagnostic tool should work reliably across fields and years. Attempts to overcome this problem by using nutrient ratios have not been successful and often suggest higher fertilizer rates than needed.

Some universities suggest as a general guideline a high tissue test level at which there seldom is yield response to fertilization. The problem of using a "safe" but too high critical nutrient concentration is that such a level encourages farmers to apply fertilizers when the probability of an economic yield increase is very small or inexistent.

Recommendation

Use of soil testing and fertilization before planting is the most effective way of assuring adequate P and K supply for corn and soybean. A practical and useful way of using tissue testing is to use test results in conjunction with in-season soil testing, comparing field areas with apparent deficiency symptoms or poor growth with nearby seemingly unaffected areas. This strategy may not solve the problem for this years' crop, but will provide clues to improve

fertilizer or soil management for next year.

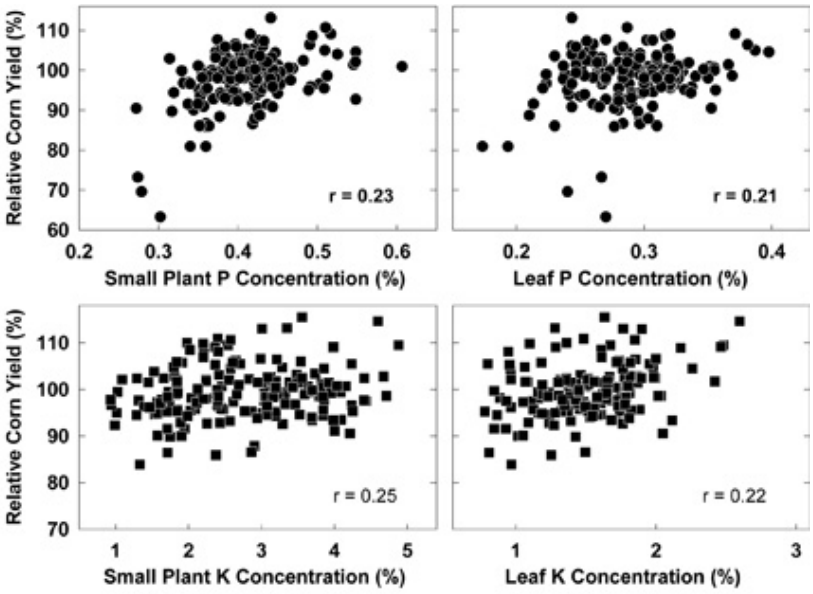

Figure 1. Relationships between relative corn yield response to P and K fertilization and the nutrient concentration of small plants or leaves (at V5-V6 or silking) across several Iowa field trials. Relative yield represents the yield without fertilization expressed as the percentage of the maximum yield achieved with fertilization.

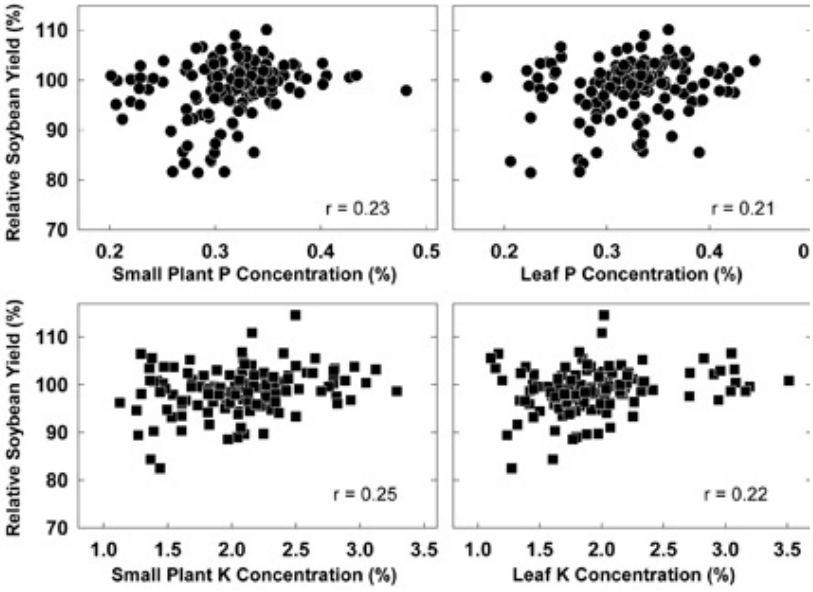

Figure 2. Relationships between relative soybean yield response to P and K fertilization and the nutrient concentration of small plants or leaves (at V5-V6 or R2-R3 stages) across several Iowa field trials.

Antonio P. Mallarino is a professor of agronomy with research and extension responsibilities in soil fertility and nutrient management.