Soil Testing Is Key To Profitable Phosphorus Use

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Proper phosphorus (P) nutrition is critical for producing maximum rice grain yields. Phosphorus promotes strong early plant growth and development of a strong root system. Maximum tillering is also dependent on P. Often times P deficiency in rice is referred to as a "hidden hunger" because the symptoms are not apparent unless deficient plants are directly compared to sufficient plants. When compared to healthy rice of the same age P deficient rice is caricaturized by an abnormal bluish green color of the foliage with poor tillering, slow to canopy, and is slow to mature. When such plant comparisons are not available plant tissue testing is the best tool for diagnosis P deficiency.

Phosphorus bonds easily to soil minerals forming compounds which are insoluble. It's availability to plants is largely controlled by soil pH. At a pH 5.0 or less it binds to iron minerals, while at a pH above 7.4 it readily binds to calcium minerals. Phosphorus bound to iron or calcium is not available to plants. Generally only 10 percent of the total phosphorus in the soil is available to plants at any one time. The other 90 percent, while not available now, will gradually become available as soil bacteria breaks it down. Your soil test will reveal only the plant available phosphorus but your fertilizer recommendation also reflects the other 90 percent.

Soil testing is the key to profitable phosphorus fertilizer use. Our research has shown that when your soil contains more than 30 lb Bray-1 P/acre of phosphorus adding more will probably not increase rice yields. However, rice will remove 0.30 lb phosphorus per bushel of grain. This will need to be replaced, so soil test recommendations often include a maintenance addition reflecting anticipated yield goal. There is a point that maintenance additions do not make economic sense. In the University of Missouri system, at a yield goal of 160 bushels, soils testing above 55 lb P/acre do not have a phosphorus fertilizer recommendation. We do recommend annually retesting to make sure the phosphorus levels remain above 30 lb P/acre. Some labs recommend maintenance phosphorus regardless of what is found. This could be a good place to save fertilizer dollars. Take a hard look at the amount of phosphorus found, not just the amount of fertilizer recommended.

The soil chemistry following flooding may also limit soil phosphorus availably. Many Southeast Missouri irrigation wells, used for flooding rice fields, contain water with large amounts of dissolved calcium. This calcium can bond with soil phosphorus after flooding to limit phosphorus availability. This effect sometimes continues for several months after the flood is removed. Studies of rice soil showed that immediately after the flood was removed phosphorus availability was low and progressively increased during the fall and winter.

In the drill-seeded rice production system commonly employed in the Southeast Missouri, Northeast Arkansas region rice is grown to the growth stage first tiller, nitrogen fertilizer is applied to dry soil, and a permanent flood is established. Additional supplemental nitrogen may be applied later in-season as needed. As the pre-flood urea is applied with ground based equipment a piggy back of P fertilizers represents an added material cost only.

Subsequent applications must by supplied via air and represent an additional $5-10 cost above materials. This combines to make a pre-flood P application the most cost effective in-season timing. There are two methods of evaluating plant P status (soil & tissue sampling) at pre-flood. Of the two, tissue testing provides a better prediction of yield than soil testing. In field tests, tissue P levels greater than 0.18 percent consistently correlated with maximum rice yields (relative yields greater than 95 percent). Soil testing at pre-flood was much less successful at yield prediction. Tissue testing would be the preferred method for P status.

To properly collect a tissue sample at pre-flood, rice producers should select areas within each field that are uniform in caricature (crop history, soil texture, fertilization history……). These areas should represent areas which may be fertilized as a unit. The above ground tissue from one foot of drill row at 4 or 5 randomly selected locations within each unit should be collected. Care should be taken that the sample is not contaminated with soil as this will influence the results. The basal portion of the sample may be washed with distilled water if contamination is suspected. Samples should be placed in paper containers (not plastic) to allow drying during subsequent handling. Proper labeling of samples insures consistent identification later. The samples may now be transported to a qualified tissue testing lab for analysis. When selecting a lab, close attention should be paid to turn around time. Results not returned to producers in a timely manner may cause delays in flood establishment or missing the pre-flood application timing window.

Producers have the opportunity to correct P deficiency in rice as late as pre-flood and still obtain maximum yield benefit. Tissue testing for P at pre-flood could have indicated a possible P deficiency. Producers should consider tissue testing rice fields at pre-flood and apply P fertilizers if the tissue P level is 0.18 percent or below. Δ

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