Phosphorus And Potassium Fertilization

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High fertilizer prices for a few years were followed by a wet fall and a late harvest last year. All this resulted in many fields' not receiving all the phosphorus and potassium needed to maintain optimum test levels. This fall looks promising for P and K applications; many fields have already been harvested, and soil conditions are ideal for tillage or driving equipment over the field. Every year around this time, questions about P and K applications start to come my way. I'll try to answer some of these common questions from an agronomic perspective. Additional aspects, including pricing, labor allocation, and other operation constraints, do need to be considered; I'll leave it to you to evaluate the information here against your particular situation to determine the best course of action.

Placement. Should P and K be incorporated in the soil with tillage, left on the surface, banded on the surface, or banded deep (4-8 inches) below the surface? All the research I and others have done in the Corn Belt indicates that, for the most part, how you apply P and K does not matter; what is important is that you do apply it, or that you confirm that test levels are adequate for crop production. Deep banding is sometimes suggested because "it makes the nutrient more available," but we have not seen evidence for that being the case. The only time researchers have seen an advantage to deep placement is when soil test levels are low. Concentrating the fertilizer in a band could allow the plant to take P and K from a "hot spot," and the fertilizer has less chance to be fixed in the soil.

However, with adequate test levels, and due to the characteristics of most soils in Illinois, nutrient fixation is not a big problem in the state. Sometimes matching the fertilizer band with the planter provides a crop effect similar to starter fertilizer. Of course, two factors are important to keep in mind: starter effects are not always seen (they normally occur with early planting or when soil conditions are cool and/or wet), and a starter fertilizer effect is more often aesthetic – the crop "looks good" early on, but often that doesn't translate to greater yield.

The use of strip-tillage is increasing in many parts of Illinois. While it is very easy to apply P and K during the strip-till operation, it is not a "requirement" to deep-band the fertilizer then. Some people find it faster and more convenient to broadcast the fertilizer beforehand. One advantage we have seen with deep placement of P is being able to, over time, lower P test levels in the surface layer of the soil without reducing overall fertility of the field.

This reduction can help in minimizing potential P runoff from fields and possibly reducing the negative impact of P loading into bodies of water. Something to keep in mind, though, is that with deep placement of fertilizer, traditional sampling approaches to determine soil fertility might not work as well. I would say that while we have not seen yield advantages to deep placement of fertilizer with strip-till, we have seen a yield advantage compared to a strict no-till system due to the tillage effect. One final point is that if you plan to strip-till this fall, it is better to wait until at least mid-October. Normally by then the heavy rains have passed, and there is less chance for the berm created during the tillage operation to become too mellow by spring.

Annual vs. biennial applications. Is an annual application better than a biennial one? Just as with placement, our research indicates that as long as you apply the needed fertilizer to make sure soil test levels are adequate to supply what the crops will need, no yield benefit hinges on whether the application is done every year or every other year. All that said, we have seen that for biennial applications it is better to apply fertilizer before the corn crop and to have soybean as a residual feeder. Research has shown that planting corn in the second year after fertilization can cause yield reductions, especially in no-till systems. Conversely, soybean yields were not affected in response to the time of fertilization. Even if a biennial application results in saving time and making one less pass over the field, if your experience tells you that your soil does not build up, I would suggest always applying annually.

Fall vs. spring applications. Is it better to apply P and K in fall or spring? Many studies over the years have indicated that both are effective in providing nutrients to the crop, and neither timing is better at increasing nutrient availability. Fall is normally the preferred timing, since typically more time and equipment are available than in the spring planting season. Also, soil compaction is less of a concern in the fall when driving heavy equipment loaded with fertilizer, soils are typically drier than in the spring, and P and K applications combined with tillage operations are more feasible in the fall. One potential drawback for fall application is the fact that the nitrogen accompanying P in MAP and DAP is more susceptible to loss even if applied late in the fall. However, the amount of N present in these applications is not very high (typically no more than 30-35 lb N/acre), and the benefits of a fall application typically outweigh the potential for any small N losses.

Phosphorus and potassium for continuous corn. Do I need to manage P and K differently in a corn-corn than a corn-soybean cropping system? Recently there has been interest in increasing corn acres. In Illinois that most often means putting soybean acres that have been in rotation with corn into a continuous-corn or a corn-corn-soybean rotation. If P and K are at adequate levels, there is no need for significant change in the short term when going into a rotation with more corn. If soil test levels are below recommendations, it is always advisable to establish a fertilization program that will bring them up to sufficiency ranges. In situations of short tenure of the land – where a build-up approach might not be possible – band application at maintenance levels will provide the best management approach.

If you are planning to make a long-term commitment to more corn, note that, overall, corn can remove more P and less K than soybean. Your fertilization plans should be adjusted accordingly. As an example, a corn crop of 180 bushels an acre removes about 77 pounds of P_2O_5 and 50 pounds of K_2O per acre, while a soybean crop of 50 bushels an acre removes about 42 pounds of P_2O_5 and 65 pounds of K_2O per acre. Assuming constant yields, over two years a corn-corn rotation will remove 35 pounds of P_2O_5 per acre more than a corn-soybean rotation but 15 pounds of K_2O per acre less. (This of course assumes nutrient removal only in grain. If stover is removed as well, additional nutrients will be removed. For details on nutrient removal in stover see "Removing Crop Residue Removes Nutrients from the Field.") Δ

The single most important thing to know before deciding placement method and when and how much phosphorus and potassium to apply is the test levels of the soil. To find these out, there is no substitute for a regular (every four years) soil sampling program.

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