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COOLER THAN NORMAL SPRING SOIL TEMPERATURES ALONG WITH DRY SOILS MAY RESULT IN SHORT-TERM NUTRIENT DEFICIENCIES

Weather conditions, especially temperature and moisture, greatly affect nutrient availability and movement in a soil. This is especially true for nutrients such as P and K that move relatively slowly in the soil by chemical diffusion. Plant available P exists in soils primarily as low solubility compounds, such as calcium phosphate under neutral to alkaline pH conditions and iron and aluminum phosphates under acidic pH conditions. Only a small amount of dissolved P is ever present in a soil as the $H_2PO_4^-$ (acidic soil pH) and HPO_4^{-2} (neutral to alkaline soil pH) ions. Plant-available K is present in soils primarily as the K^+ ion that is strongly attracted to the negatively-charged clay particles in the soil. Thus, for both P and K, the soil solution concentrations are low and as plant roots take up these plant nutrients, there is slow dissolution or dissolving of the low solubility P-compounds, or slow movement of the K^+ ions off clay particles into soil solution.

Soils that have normally adequate P and K availability may show P and K deficiencies in a cooler and drier than normal spring. This was common in much of the area of the Northern Great Plains region early in the growing season of 2009. Below normal temperatures and low soil moisture combined to have numerous reports of slowly emerging and stunted crops. If it was P deficiency, the plants were usually just stunted and slow growing with some purpling of older leaves for small grain cereal crops, while with K deficiency there may have been a yellow discoloration along the edges and tips of lower leaves.

If a grower notices slower than normal growth and stunting early in the growing season, they can become quite alarmed. It is common for a retail agronomist, or crop consultant to be called out to look at affected fields displaying P or K deficiencies. This can happen on both fields that have been managed quite well for P and K nutrition, as well as fields that have not received much attention to P or K availability.

The important question is whether the crop will come out of the deficiency, or should some remedial nutrient applications be tried to prevent a potential crop failure. The challenge is that P and K deficiencies are not easily corrected in-season like N or S deficiencies. Deficiencies of N or S can be corrected through top-dressed N or S fertilizers early in the growing season. For example, before stem elongation in cereal crops or before bolting in an oilseed crop like canola. For P and K, there is not much that can be done after planting and it is usually most effective to put plans in place to correct deficiencies for subsequent crops. Some of the most effective ways to apply P and K fertilizers for field crops are to place the P and K fertilizers in seed-row blends, or precision placed bands near the seed-row, or broadcast and incorporate P or K fertilizers if inversion tillage is used.

Fortunately, on most fields where P and K have been managed well, these cool-dry spring P and K deficiencies are short-term. As the later spring temperatures increase and moisture is received, the crops will usually improve in appearance and growth. It is a test in patience for a grower-customer to be content that there is no real problem and that their crop will be fine. This is a situation where the best way to proceed is to do nothing and rely on the normally adequate P and K availability to improve.

The most effective way to determine whether or not a true P or K deficiency exists is to take soil samples and have the soils analyzed for P and K availability. If soil-test levels are lower than optimum, P and K fertilizer applications can be beneficial for subsequent crops. Growers should contact their local crop adviser or agronomist to review the P and K soil test levels on recent soil samples (e.g. sampling done within the last couple of years). Arrange for soil samples to be taken and analyzed if no samples have been previously done, or it is newly acquired or rented land where the history of soil-test results are not known.

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Abbreviations: N = nitrogen; P = phosphorus; K = potassium.

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