Crop Nutrient Management Following Drought

Summary: The extremely dry conditions in much of Montana may affect how producers manage nutrients for crop production next year.

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BOZEMAN -- The extremely dry conditions in much of Montana may affect how producers manage nutrients for crop production next year. There are a few recommended differences between nutrient management during drought conditions and normal conditions. "The nutrients available for the next season's crops may be either higher or lower than normal because the amount removed by the drought-stressed crop may be different than in a normal year and soil nutrient cycles are altered," said Clain Jones, Extension Soil Fertility specialist in the Department of Land Resources and Environmental Sciences at Montana State University.

There is an assumption that fewer nutrients are removed by the lower yields from drought stressed crops. However, some crops may have been harvested as forage rather than as grain. Harvest of the whole plant may remove more nutrients from the field than a grain harvest. Alternatively, if a crop is considered a total loss and not harvested at all, no nutrients are removed from the field. The amounts of nutrients removed are more a function of the size of the harvest than of possible changes in grain or straw nutrient concentrations caused by drought.

Nitrogen removal by harvest is only one factor affecting next year's available nitrogen supply. Decreased downward nitrogen movement out of the rooting zone also contributes to potentially higher than normal fall nitrate-nitrogen levels. If there is substantial fall to mid spring rainfall, this residual nitrogen is susceptible to over-winter leaching loss, especially in coarse soil or soil with cracks. "No-till slows decomposition of the plant residue, making less residual nitrogen available for leaching and therefore helps retain the nitrogen on the site," Jones said. "A volunteer grain crop or winter weeds can help capture and hold some of the residual nitrogen."

Phosphorus and potassium levels are largely influenced by: Reduced plant uptake, the harvest timing, the harvest amount, and which part of the plant is removed. Harvesting wheat grain removes about 80 percent of the phosphorus taken up by the crop, with the remainder staying on the field if straw is not removed. Harvesting the wheat as forage at early heading removes only half as much phosphorus. In contrast, most of the potassium taken up by wheat is in the leaves and stems and very little is removed in the grain. If wheat is harvested for forage at mid-heading then more potassium is removed than when wheat is harvested for grain. The recycling of potassium from plant residue generally recharges soil potassium levels. However, lack of rain reduces release of potassium from plant material, causing reduced potassium soil test levels. Jones advised producers to not overreact to low soil test potassium. "The potassium is temporarily tied up in plant residue but most will become available to the next crop," said Jones.

Soil sampling is the best tool available to help make fertilizer rate decisions, especially since nutrient removal estimates are not available for all crops at all stages of harvest. Jones strongly suggests using spring soil tests because available nutrients change from fall to spring, therefore

spring tests better reflect what is actually available for the next crop. If possible, sample to a two to three foot depth to determine residual nitrogen. Sampling at six-inch increments can help determine where the nitrogen is located in the soil profile to evaluate risk and magnitude of leaching loss from the root zone. Jones noted that plant nutrient uptake tends to be more variable across a field under drought than normal conditions, so consider taking more samples than normal. "Even if soil samples are available from the prior year, samples taken after drought provide a better basis for next year's fertilizer needs because drought can change nutrient availability," said Jones. Also, analyzing soil samples in a drought year and comparing the results and yield records with 'normal' years can help interpret tests in future dry years.

Fertilizer rates should be based on available nutrients as indicated by soil tests and reasonable yield predictions, which are difficult under normal moisture conditions, let alone during drought cycles. Nitrogen credit from a legume crop grown for grain is not largely influenced by drought during the legume rotation. It can vary from zero to about 20 pounds nitrogen per acre, being at the upper end of this range when legumes have been grown several times in rotation. Nitrogen credit should be at the low end when the spring following the legume crop is dry, which makes water, rather than nitrogen, the limiting factor for grain growth and delays the release of nitrogen from the legume residue.

Nitrogen is best applied near planting to avoid overwinter loss and adjust for overwinter changes. Nitrogen levels can be adjusted with top-dressing if moisture conditions improve after planting. This will minimize over- or under-fertilizing, which is costly to producers in drought as well as normal years. Phosphorus and potassium can be applied in the fall.

The International Plant Nutrition Institute has a few articles on nutrient management following drought (http://www.ipni.net/article/IPNI-3277). Contact your local MSU Extension agent (http://www.msuextension.org/localoffices.cfm) or crop adviser for help with specific fertilizer decisions. To find a certified crop adviser, click on "Find a CCA" at https://www.certifiedcropadviser.org/. For other soil fertility information, please go to http://landresources.montana.edu/soilfertility.