MSU Extension offers information on selecting fertilizer nitrogen rates

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BOZEMAN – A Montana State University soil fertility specialist with MSU Extension is sharing information on selecting nitrogen fertilizer rates.

Selecting fertilizer rates for yield and quality will depend in part on this past summer's rains and the amount of this year's residue, according to Clain Jones, MSU Extension soil fertility specialist in the MSU College of Agriculture's Department of Land Resources and Environmental Sciences. According to the National Weather Service, some parts of Montana received well-above average rainfall this year, leading to high yields with higher than average plant residue and good soil water for the coming growing season. However, other regions had lower than average rainfall, with lower production. Both nitrogen and sulfur needs for next year's crops should be considered, Jones said, especially in areas that received well-above or well-below normal rainfall.

"There are several things that influence the next crop's nitrogen requirements," Jones said. "These include yield potential, residual nitrogen in the soil, and this year's crop residue."

Jones encourages producers to use guidelines published in MSU's Extension bulletin *Fertilizer Guidelines for Montana Crops* along with a reasonable yield potential to provide a starting point for calculating nitrogen fertilizer rates. If all factors line up for a high yielding season next year, then there is the option to add more nitrogen during the growing season. Otherwise, if yields are lower than expected, unused nitrogen can be lost to groundwater, which he said can be detrimental both financially and environmentally.

Jones stated the amount of nitrogen provided by the soil is highly variable, depending on how much is gained through the decomposition of plant residue and how much is lost to leaching or as nitrogen gas, adding that a combination of moist soils and warm temperatures leads to relatively rapid decomposition.

"Ideally, a crop is in place to capture the nitrogen that becomes available," Jones said. "Otherwise, especially shallow (less than two feet deep) or sandy soils with greater than 60 pounds nitrogen per acre tend to lose nitrogen to leaching between late summer and spring. Soils that stay ponded tend to lose nitrogen as gas."

Generally spring soil tests better reflect nitrogen available to the crop than late summer or fall soil tests, according to Jones.

"If soil tests have already been taken, then a few spring samples would be useful to determine whether, or in which fields, nitrogen may have been lost or gained over winter," he said.

The quantity and quality of residue is also important, Jones noted.

"Small grain residue tends to be high in carbon. This feeds high populations of soil microbes, but they in turn need nitrogen. Ten pounds of nitrogen are needed per 1,000 pounds of residue per acre, up to a total of 40 pounds nitrogen per acre to feed the microbial population."

However, this is a good investment in building up soil organic matter, Jones noted, which provides nutrients in the long term and helps store soil moisture.

Nitrogen fixation that occurs on legume (e.g., pea, lentil, chickpea) root nodules helps make above and below ground pulse residue higher in nitrogen than small grain residue. MSU research trials have found pulse crops generally increase protein in the following wheat crop, compared to fallow. The potential drawback is water use by a pulse crop. However, now might be a good time to consider using a pulse crop to replace fallow, Jones said. Over the long term (at least four small grain/legume cycles), wheat grain yield and protein can be greater after legume cover crops, than after fallow with less or no fertilizer nitrogen.

"This has exciting potential," said Perry Miller, professor of cropping systems in LRES at MSU. "Replacing fallow with field pea provides similar or higher economic returns with greater stability, partly by reducing the reliance on fertilizer nitrogen."

Wheat producers can evaluate the effectiveness of their nitrogen fertilization practice by looking at their past grain protein levels, Jones said. If winter wheat protein is under 12.5 percent or spring wheat grain protein is under 13.2 percent, then yield and protein have been compromised by under-fertilization. However, this assessment should be done over several years, Jones added, as low protein in a high-yielding year is not indicative of overall practices.

"If high protein discounts and low prices continue, it is best to put your nitrogen into protein by delaying fertilizer application or doing a second application," Jones said. “The MSU bulletin *Practices to Increase Wheat Grain Protein* provides information to make these decisions. The MSU Small Grains Nitrogen Economic Calculator is another resource to help calculate economically optimum nitrogen rates.”

Insufficient sulfur can also contribute to low yields, and low wheat protein levels. Without adequate sulfur, nitrogen cannot be used, and like nitrogen, sulfur can be lost to leaching. Unfortunately soil testing and guidelines for sulfur are not nearly as clear as for nitrogen, Jones noted. Visual symptoms along with soil type and location in the landscape can help determine plant sulfur deficiency. Sulfur deficiency causes uniform yellowing on upper, younger leaves first, in contrast to nitrogen deficiency, which shows up on lower leaves first. Loam or more coarse-textured soils, especially on eroded ridgetops, are more susceptible to sulfur deficiency, particularly after high rainfall.

If sulfur deficiency has been observed, then applying seven to 10 pounds sulfur per acre with the seed can prevent a sulfur deficiency. Up to 20 pounds of sulfur per acre may be needed for oilseeds such as canola. An in-season rescue treatment for sulfur is to apply three to five pounds sulfur per acre as granular ammonium sulfate (21-0-0-24) or as a liquid sulfur formulation.

In areas with lower than average precipitation, like in much of western and southwest Montana, there may be above average amounts of nitrogen left in the soil, so it may be a year to save on fertilizer, Jones said.

"Soil tests are the best way to confirm this, and are always a good idea," he said.

The Economic Nitrogen calculator is available at http://www.msuextension.org/econtools/nitrogen/. For *Fertilizer Guidelines for Montana Crops* and *Practices to Increase Wheat Grain Protein* visit the Web at http://msuextension.org/publications.asp, or call Extension Publications at (406) 994-3273. Also see the soil fertility website at http://landresources.montana.edu/soilfertility. Jones can be reached at clainj@montana.edu or 994-6076.

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