Boosting Grain Protein

Summary: A new Montana State University Extension publication will describe nutrient management practices available to boost wheat protein.

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To: News-dailies, News-weeklies, AgMedia, News-local, News-tv, News-radio, MSU-All-News, News-internal, NatResourcesNonmedia, Producers, Web. From Sara Adlington, 406-994-4602.
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BOZEMAN – Any year would be a nice one to get a grain protein premium, or at least avoid the discount, but especially in a wet year when wheat yields should be good. To produce high grain protein there must first be enough nitrogen to meet the wheat's growth requirements. Once yield potential is met or weather factors become limiting to yield, excess nitrogen is used to make protein. With high moisture producing high yields, yet causing potentially high nitrogen leaching losses, grain may need an early in-season nitrogen application to meet yield requirements and a late-season nitrogen application to achieve high protein.

Crop management practices such as selecting varieties with high protein potentials and using legume cover crops, green manure or livestock manure as sources of long term, late-season nitrogen can improve the chance of getting high protein. However, because these choices no longer play into this year's harvest, "providing additional nitrogen is the most important management factor to produce high protein this year," said Clain Jones, Extension Soil Fertility specialist in the Department of Land Resources and Environmental Sciences at Montana State University.

Nitrogen provided before heading will most likely improve yield, while nitrogen taken up during and after heading may increase protein. Nitrogen concentration in the flag-leaf (uppermost leaf of the stem) at heading can be measured to determine whether a late-season nitrogen application will boost protein. According to regional research, grain protein is likely to increase with late-season nitrogen if the flag-leaf nitrogen concentration is less than 4.2 percent. The lower the flag-leaf nitrogen, the greater the potential response to late season nitrogen, but the more nitrogen that will be required to reach high protein. Jones did comment that "flag-leaf analysis can tell you whether the crop is likely to increase protein content with late-season nitrogen, but not how much nitrogen to add, or the final protein level."

Late-season nitrogen is best applied right around flowering. The amount to apply is a little less clear. "The higher the yield, the more late-season nitrogen is required to increase protein by a point," said Jones. For example, on dryland winter wheat with 60 pounds nitrogen per acre preplant, a 30 pounds nitrogen per acre top-dress increased grain protein by 1.4, 0.5 and 0.1 percent for 53, 76, and 89 bushels per acre respectively. Irrigated spring wheat required 40 pounds nitrogen per acre applied at heading to increase protein by 0.5 to 2 percent, when initial nitrogen was optimal for yield.

"There may be a limit to how much late-season nitrogen can be applied to boost protein," cautioned Jones. An Idaho study found 75 pounds per acre late-season nitrogen on irrigated wheat increased lodging and reduced yield. Also, it is important to use application methods that maximize the amount of nitrogen that gets taken up by the crop.

Foliar applications are the best late-season application option to limit stand damage as long as rates are low enough to prevent leaf burn. No more than 30 pounds nitrogen per acre of urea ammonium nitrate solutions and 45 pounds nitrogen per acre of liquid urea should be applied to minimize burn and yield loss. Research has found that little nitrogen is actually taken up through the leaf surface. Foliar nitrogen needs to be washed off the leaf and moved into the soil by rainfall or sprinkler irrigation. Jones suggested adding a surfactant or urease inhibitor (such as Agrotain®) may improve foliar applied urea recovery and protein response, if at least ½ inch of irrigation or rainfall doesn't move the fertilizer from the leaf into the soil.

Late-season nitrogen is not guaranteed to increase protein. Studies in South Dakota with winter and spring wheat found foliar nitrogen at flowering increased grain protein 70 percent of the time if the yield goal was exceeded, yet only 23 percent of the time when yield goal was not met. If a grower adds late-season nitrogen exceeding the requirements for yield and does not get a protein response, there may be a sulfur deficiency. Sulfur deficiency shows up as yellowing upper leaves, whereas nitrogen deficiency shows up as yellowing lower leaves. A foliar application of three to five pounds sulfur per acre as ammonium thiosulfate should correct the problem if there's sufficient rain or irrigation water applied after application to wash the sulfate into the root zone.

While nitrogen for boosting protein should be addressed now, there will soon be a new MontGuide available through Montana State University Extension with information on management practices to improve grain protein. For this and other extension publications visit the Web at http://msuextension.org/publications.asp, or call Extension Publications at (406) 994-3273 for more information. For other soil fertility information, please go to http://landresources.montana.edu/soilfertility.