Nitrogen guidelines for cereal forages

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Cereal grains such as wheat and barley are viable alternative hay crops and can provide valuable grazing opportunities. Due to drought resistance, good yields and ability to break pest cycles of perennial crops, annual forages can be a good fit in northern Great Plains production systems. An ongoing study provides preliminary nitrogen guidelines for some annual forage crops in Montana.

"In the most recent year with collected data (2008), approximately 200,000 acres of cereal forages were grown in Montana, making it the fourth largest acreage crop," said Andy Lenssen, research ecologist with the USDA Agriculture Research Service in Sidney, Montana.

However, there are no Montana fertilizer nitrogen guidelines for these crops. Insufficient nitrogen availability can decrease forage yield, increase producer costs and decrease potential profit. On the other hand, excess nitrogen combined with inadequate available soil water can cause the forage to contain nitrates at levels toxic to livestock.

A multi-year study funded by the Montana Fertilizer Advisory Committee is underway to develop fertilizer nitrogen guidelines for forage barley and winter wheat. Field trials are being conducted with Hays barley planted in April, and Willow Creek winter wheat planted in September at a farm near Froid and at the Southern Agricultural Research Center in Huntley.

"Dryland forage yields over the past two years have been good, ranging from one to four tons per acre for Hays barley and as much as five tons

per acre for Willow Creek winter wheat," said Lenssen. At Froid, the available nitrogen, meaning fertilizer nitrogen plus soil nitrate-nitrogen, needed to maximize yields ranged from about 27 pounds of nitrogen per ton of Willow Creek winter wheat when based on soil sampling to a depth of two feet, to 37 pounds of nitrogen per ton when soil was sampled to three feet. Hays barley required an average of 60 pounds of nitrogen per ton in a two-foot soil depth sample.

"The apparent higher nitrogen requirement of barley could be misleading," cautioned Clain Jones, Extension soil fertility specialist in the Department of Land Resources and Environmental Sciences at Montana State University. "Given Froid's relatively coarse soils and that much of the rainfall comes in the spring, it is likely some soil nitrate leached, overestimating the barley's actual nitrogen need," explained Jones.

Barley grown at Huntley required only 31 pounds of available nitrogen per ton of forage. The soils at Huntley are higher in clay and have lower leaching potential than at Froid. Warmer temperatures at Huntley also encouraged more plant growth early in the season. These factors would allow more of the soil available nitrogen to be captured by the barley crop at Huntley.

"Winter wheat's apparent nitrogen requirement was less than barley's, likely in part because it is better at scavenging nitrate at deeper depths," said Jones. Winter wheat would have a larger root system than barley by late April, when barley is just emerging, allowing winter wheat to take up more available nitrogen. It can also root deeper to capture the soil nitrogen that was leached by spring rains below barley's rooting depth. At Froid, the average soil nitrogen in the two to four foot soil depth in fall was similar to what was available in the top two feet. By spring, the two to four foot soil depth contained twice the available soil nitrogen as the top two feet, which is a substantial amount of nitrogen for deep

rooting winter wheat to tap into. This implies substantial amounts of leaching. Jones suggests soil be sampled to at least three feet where possible to best calculate nitrogen rates for winter wheat.

Fertilizer placement affected some yields. Barley yields were higher both years at Froid with banding versus broadcast applications. Spring fertilizer applications can have higher volatilization losses of ammonia to the atmosphere, due to moister soil surface conditions than often found in early fall. Banding protects nitrogen fertilizer from volatilization losses. Banding did not increase yields of barley at Huntley or winter wheat at either site.

The other concern with nitrogen fertilization of cereal forages is the risk of high forage nitrate concentration. Forage nitrate levels were never greater than 0.2 percent, well below the 0.5 percent level toxic to pregnant animals. Banding rather than broadcast fertilizing did not significantly increase the risk of high nitrate in feed.

"Since yields are a function of rainfall, basing nitrogen rates on a conservative yield potential and then topdressing if it's a wet year would be the best idea," concluded Jones.

This would reduce the potential for nitrate leaching and avoid nitrate accumulation, especially in hot, dry years. A third year of testing should help in developing more solid fertilizer nitrogen guidelines for barley and winter wheat as annual forages. Further validation of guidelines will improve cereal forage productivity and nutrient utilization, and improve economic sustainability of Montana producers.

More information: For a variety of information on annual forages see MSU's Extension Forage Specialist Dennis Cash's website at animalrangeextension.montana.e … rage/main-annual.htm . For more information on nitrogen cycling and fertilization, go to nutrient

management module three at landresources.montana.edu/nm .

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