No-Till Could Need a Nitrogen Boost in Spring

Summary: Crops grown on no-till wheat stubble may need more nitrogen compared to those produced under conventional or minimum tillage.

May 1, 2014. Contact: Clain Jones (406) 994-6076 or clainj@montana.edu
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 – No-till crop production provides benefits through reduced soil erosion and soil moisture loss, which potentially increases yield. However, no-till fields with wheat stubble may need a nitrogen boost in the spring above that required under conventional or minimum tillage.

Tillage breaks up plant residue and increases the rate of residue decomposition, which increases the rate at which nitrogen becomes available. A study by Chengi Chen, research scientist at the Central Agricultural Research Station in Moccasin, Montana, found soil nitrate increased more in sweep-till treatments from late summer to mid-spring than in no-till fields.

As tillage decreases, the build-up of plant residue increases. This helps improve soil conditions that may improve yield. However, the soil microbes that break down residue require nitrogen to do their work. According to Clain Jones, Extension soil fertility specialist in the Department of Land Resources and Environmental Sciences (LRES) at Montana State University, it takes about 1,000 pounds nitrogen per acre to gain one percent soil organic matter in the soil's top 6 inches, meaning to raise soil organic matter from say 2.5 to 3.5 percent.

“Clearly this can't happen in one season, but rather over many years,” said Jones.

A Canadian government study by Agriculture and Agri-food Canada scientist Brian McConkey and associates in the semi-arid region of Saskatchewan found even after adding 5 pounds nitrogen more to no-till fields for 8-12 years after conversion from conventional till, no-till still had lower soil nitrogen availability than conventional till. These researchers concluded more nitrogen needs to be applied to no-till for up to 15 years after conversion from conventional till to get similar grain yields and protein.

Jones cautioned there is no one-size-fits-all recommendation for how much more nitrogen a no-till or minimal till system requires. It varies with soil texture, climate, degree of tillage, prior crop and time since conversion from conventional till.

As a general rule of thumb, no-till requires 10 pounds nitrogen per acre more per 1,000 pounds stubble, than conventional till, up to a total of 40 pounds of nitrogen per acre annually for at least a few years. Each 10 bushels of winter wheat, 12 bushels of spring wheat and 20 bushels of barley leaves about 1,000 pounds stubble. Fine- to medium-textured soils are more likely to need a boost of nitrogen under no-till than coarse-textured soils.

Growing legumes in place of fallow can help offset this increased nitrogen demand.

In Chen's study, there was no change in soil nitrate from late summer to the following spring after spring wheat, while nitrate increased by about 15 pounds nitrogen per acre after spring pea or winter pea grown for forage and fallow. Pea crops provided more nitrogen than needed by the microbes to break down the pea residue. Winter wheat grain yield after winter pea was equal to that following fallow.

Weather influences spring soil nitrogen availability. In the year with the wettest fall in the Moccasin study, there was little nitrate gain over winter and some treatments lost nitrate. It is best to test soil nitrate levels in the spring.

Ideally nitrogen fertilizer is placed at least two inches below the surface; however, Jones acknowledged that spring applications on no-till are generally broadcast applications. If possible, incorporate fertilizer with at least a half-inch of water or time the application before a substantial rainfall event. If nitrogen is limiting, application by mid- to late-tillering is most likely to improve yield. Later applications will likely mainly increase protein.

The MSU Extension bulletin, “Nutrient Management in No-till and Minimum-Till Systems,” provides more information about nutrient adjustments to consider when opting for no-till. This and other related bulletins are available as printed copy from MSU Extension Publications (www.msuextension.org/store; 406-994-3273) and online at Jones' webpage at http://landresources.montana.edu/soilfertility/publications.html. “Soil Nitrogen Cycling Affected by Tillage and Crop Rotations” (Fertilizer Fact No. 67) presents details on Chen's study and is available at http://landresources.montana.edu/fertilizerfacts/.

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