

Manitoba Soil Fertility Facts

Prepared by: **John Heard**, Crop Nutrition Specialist, Crops Knowledge Centre,
Manitoba Agriculture, Food & Rural Initiatives,
John.Heard@gov.mb.ca Phone: (204) 745-8093; Fax: (204) 745-5690

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Fall nitrogen application and dry soils

Fall nitrogen application continues to be important and practical application timing for many crops in Manitoba. The risk and success of such operations are dependent upon soil characteristics, weather conditions and machinery operation.

Dry soil conditions this fall offer both some opportunities and challenges for fall N application.

Opportunities

Usually growers are advised to delay application as long as possible in the fall so soils are cool, in order to prevent or delay conversion of ammonia-form N (NH_3) to nitrate (NO_3^-), which is vulnerable to loss by leaching or denitrification. On poorly drained soils or highly leachable soils, growers may be advised to completely avoid fall application. But, leaching and denitrification losses occur only under WET soil conditions. The very dry soil profiles this fall mean soils will behave as well drained sites, reducing the risk of losses from fall N applications.

With the reduced risk of “wet weather losses”, growers may reconsider making applications on poorly drained soils, and may make “earlier-than-normal” applications on well-drained soils. This is illustrated in Figure 1, where early fall applications of banded N on well-drained soils have full yield potential compared to spring applications. (Having N in place in the fall can reduce seed-bed disruption and moisture loss from N applications next spring and may also speed up spring seeding operations.)

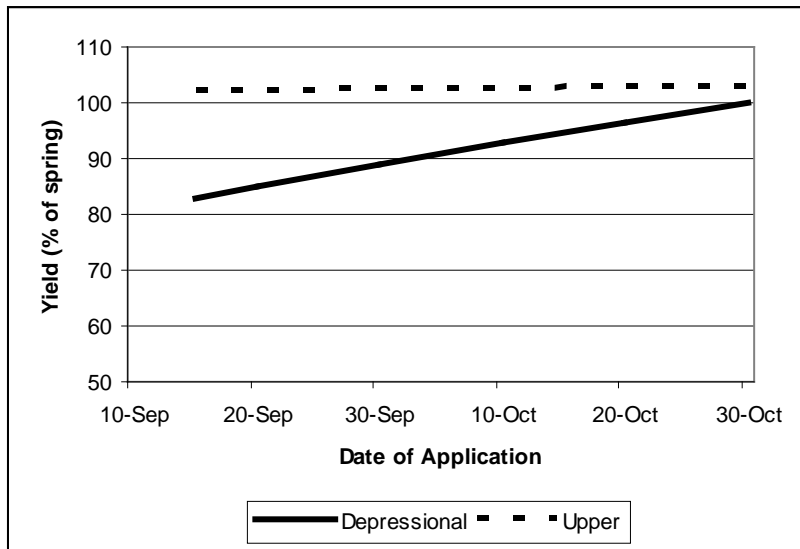


Figure 1. Effect of date of fall N application on wheat yield from fall banded urea relative to spring banded urea at depressionnal (poorly drained) and upper slope (well drained) slope positions.

Soils also appear to be cooling off, with many already dropping below 10°C in the evenings. The Manitoba Agriculture weather network of 35 stations measures soil temperature at a 2" depth under sod (posted at <http://tgs.gov.mb.ca/climate/SoilMoisture.aspx>). This data may provide guidance in when to start applications. Applications are at low risk if they commence at 7-10°C while soils are cooling. At 5°C there is very slow conversion of ammonia-N to nitrate.

Remember – all fertilizer operations in Manitoba are to be completed by November 10 according to the Water Protection Act.

Challenges

Dry soils are a challenge to in-soil banded nitrogen application, especially anhydrous ammonia. When anhydrous ammonia is injected into soil the ammonia (NH₃) is dissolved in water and reacts to convert to ammonium (NH₄⁺), which is positively charged and held by the cation exchange on the soil particles.

Soil moisture is needed to allow the ammonia to convert and be retained in the soil, however even in dry soils there is usually enough moisture present for this to occur. The major problem with dry soils is the clods or lumps that form can prevent a good seal, allowing the ammonia to be lost through large voids between clods before dissolution in moisture occurs. Indeed, nitrogen losses on low moisture soils are caused more by poor physical soil structure (soil tilth) than by a lack of moisture to chemically react with ammonia.

Clay soils that are very dry will be cloddy or lumpy and may permit too much gaseous ammonia to escape (Figure 1). The zone of ammonia dissipation from the injection point is larger in dry soil, so although the soil may be difficult to work, deeper injection may actually be required. However, deep tillage of dry clay soils may simply produce larger clods. Lighter textured soils will have better tilth than dry clay soils and will be more likely to produce a good seal to retain the ammonia.

Slot closure may be better on previously worked than on uncultivated soils if the soil flows and seals better. Such is not the case if soils were cloddy. Some cereal crops were harvested almost 2 months ago and the moisture that has been received may be sufficient to provide good tilth. Soil moisture and texture varies across the province, as does farm equipment. The only way to assess your soil conditions is a test run with your applicator. An application pass without N will indicate whether soils are too cloddy and injection slot closure is inadequate. If after making a round with N, you can still smell ammonia from the previous application, make adjustments in depth or closure modifications. Or wait for rainfall to improve soil structure.

Prepared by John Heard (MAFRI), C. Grant (AAFC-Brandon) and D. Flaten (University of Manitoba)



Figure 1. Typically “lumpy soil” resulting from tillage of dry, clay soils in fall 2012.