

Warm Soil Temperatures Increase the Need for Inhibited Nitrogen Products

Typically 40-50% of Manitoba farmers apply fall nitrogen (N) to canola and wheat fields. In 2019 the excessive September rainfall thwarted these applications and so many had to modify a plan for spring applications. So now many farmers are anxious to get fall fertilization underway to avoid another “shutout” due to poor fall weather. But there are also risks to applying N too early.

The principles that enables the Prairie success of fall N application is COLD soil temperatures and in soil-banded placement. Our cold, frozen conditions essentially halt the microbial process that converts ammonium (NH_4^+) for nitrogen to nitrate (NO_3^-), called nitrification. It is this nitrate form of N that is vulnerable to loss under wet conditions – leaching on sandy soils and denitrification on soils that become waterlogged. Additionally, the concentrated band placement of ammonium-N (ie as urea or anhydrous ammonia) deters this nitrification process.

Classic Manitoba research done some 20 years ago showed the impact of applying ammonium-form N (as banded urea) to soils of varying temperature and wetness regimes (Figure 1). Where soils were well-drained (upper slope areas), there was little N loss and yields were comparable to springtime N. But in wetter soil conditions in depressional areas, there was up to a 20% yield penalty for earlier fall applications to warm soils. The data indicated that this conversion of banded urea to nitrate was temperature dependent and Table 1 shows the rate by which conversion may occur.

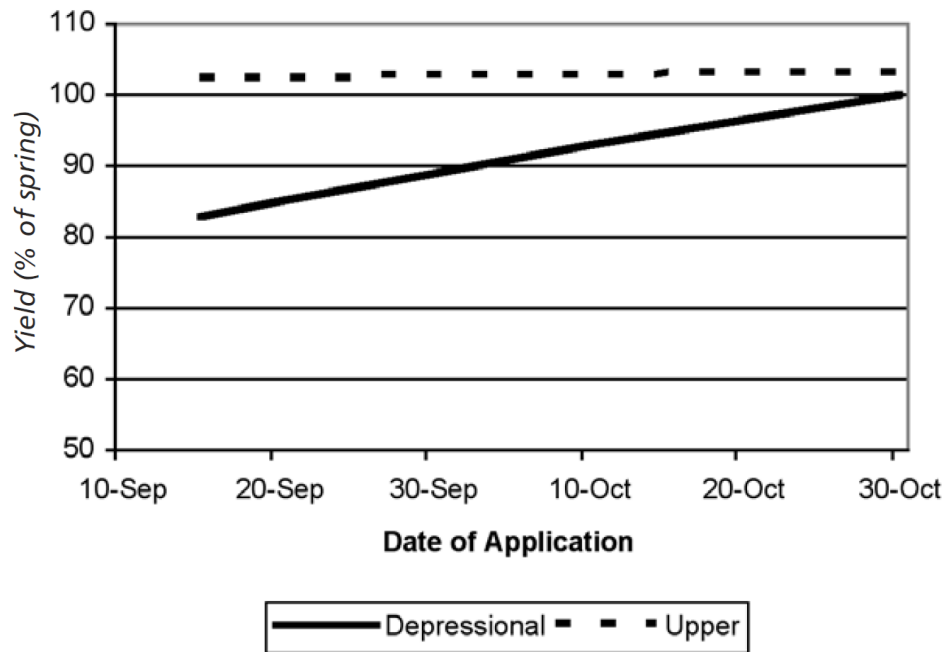


Figure 1. Effect of date of fall N application on wheat grain yields from fall-banded urea relative to spring-banded urea at depressional and upper slope positions.

Table 1. Nitrification rates of ammonia to nitrate N for banded urea (adapted from Tiessen et al, 2008)

Ave Soil Temp at band depth	50% conversion to nitrate Days	100% conversion to nitrate Days
1°C	190	380
5°C	38	76
10°C	19	38
15°C	13	26
20°C	10	20

Accessing our Manitoba Ag Weather network shows that soil temperatures are still very warm - in the 12-15° C range (<https://www.gov.mb.ca/agriculture/weather/soil-temperature.html>), so N applied now could be at risk of loss should conditions later this fall or spring become wet.

Fortunately growers now have access to several nitrification inhibitors formulated to slow this mineralization process. Such examples are nitrapyrin (N-Serve for anhydrous ammonia or eNtrench for urea), pronitridine (Centuro for anhydrous ammonia) and DCD (a component in SuperU). Some of these active ingredients may be available from other suppliers. Physically slowing of N release can be provided through a controlled release product such as ESN.

So if one is applying fertilizer to warm soils, strongly consider the use of such products, particularly on poorer drained soils. Or one can delay banding N applications until mid to late October, when soil temperatures have generally cooled to minimize conversion rates.

Fall banding N is also an excellent opportunity to co-band phosphorus (P) and ammonium-sulphate sulphur (S) for next year crops, especially canola. The co-band with N reduces the fixation of P and increases availability, although some starter P is generally still warranted at seeding. And such fall placement eliminates the concerns over high rates of P and S needing to be placed into the seedrow.

References: Tiessen et al. 2008. Interactive Effects of Landscape Position and Time of Application on the Response of Spring Wheat to Fall-Banded Urea, *Agronomy Journal* 100:557–563