

Start Ahead. Stay Ahead.

APPLY NITROGEN FERTILIZER IN THE FALL

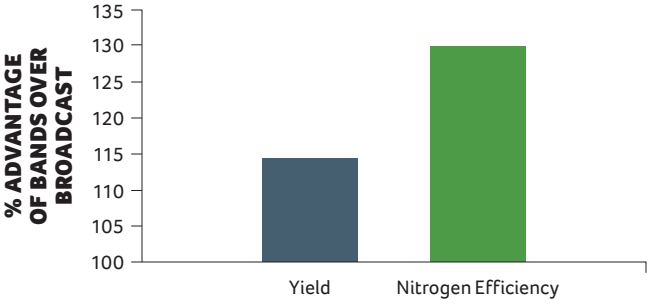
Save time, money and reduce stress during a busy spring planting season. Ammonia applied in the fall can also reduce spring loss of seedbed moisture, reduce soil compaction and of course, remove the need to store nitrogen fertilizer.

- Often lower fertilizer prices in the fall
- Low-cost storage in the soil
- One spring job already completed, improving seeding logistics and helping avoid occasional NH_3 delays
- Guaranteed nitrogen supply because it's already in your soil when you're ready to seed

One benefit of using ammonia is that it must be applied in a band. Research data in western Canada has proven the efficiency of nitrogen fertilizer placed in a band. Nitrogen fertilizer in a band can prevent rapid loss of ammonia (a problem that can occur for both ammonia and urea), reduce the risk of nitrogen gas loss due to denitrification and leaching in wet soil and minimize the risk of nitrogen fertilizer being tied up during crop residue decomposition in the process called immobilization.

Is there a risk of significant loss of fall banded nitrogen fertilizer? This is an important question as the loss of nitrogen fertilizer impacts farm yield, economy and the environment.

ALWAYS PLACE N BELOW THE SOIL SURFACE! IT IS THE RIGHT PLACE.



106 site years of data in western Canada.

Source: Rennie, Doyle and Cowell, 1993: Summary of western Canadian research.

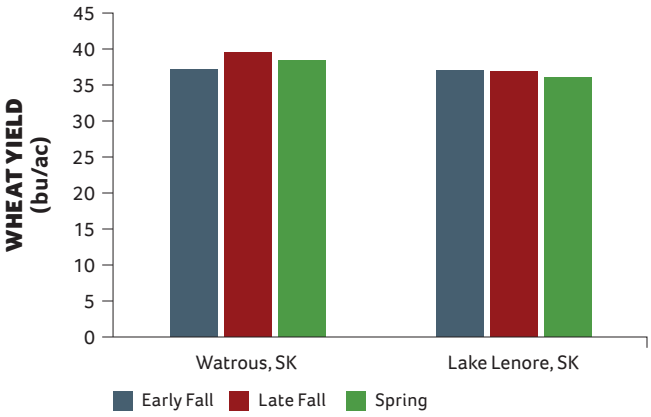
Research indicates that the loss of nitrogen applied in fall can be minimal. The key is to apply the nitrogen in cool soil, in a proper band and avoid soils that will be flooded in the spring.



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THE BUSINESS OF CROP NUTRITION

IMPACT OF TIME OF APPLICATION OF NH_3.



KEY FINDINGS

1. There was very little impact of time of N fertilizer application.
2. There was very little difference between NH_3 and urea as an N fertilizer.
3. There was very little benefit to adding Denitrification Inhibitor at any time of application.

Source: Karamanos, Hanson and Stevenson, 2014.

1. THE COOLER THE SOIL, THE BETTER

Soil temperature is critical to effective anhydrous ammonia applications. When anhydrous ammonia applications occur, the ammonia quickly dissolves in soil water to form ammonium. The ammonium can then be oxidized by certain bacteria into nitrate in a process known as nitrification. While both ammonium and nitrate can be used by growing crops, nitrates have a higher risk of loss through leaching and denitrification—which makes it beneficial to slow down its conversion in the soil.

When soils are cooler, microorganisms will convert ammonia into nitrate—nitrogen at a much slower rate—reducing the likelihood of nitrogen loss and protecting your nitrogen investment.[1] Best practices suggest beginning anhydrous ammonia applications once soil temperature is below 50° F (10° C). Cooler soil temperatures will help slow down the process of nitrification and reduce the potential for nitrogen loss. Soil temperatures should be based on a soil depth of three to four inches (the depth of fertilizer application) and the soil should be on a cooling trend before application.[2]



2. CONSIDER SOIL MOISTURE AND RECENT WEATHER CONDITIONS

Soil moisture is one of the most important factors to consider when it comes to effective anhydrous ammonia applications. While anhydrous ammonia does dissolve readily in water, it is held in the soil by clay and organic matter. Before this hold occurs, the ammonia must dissolve in soil water to form ammonium. Ammonium (NH_4^+), which has a positive charge, will bind with the negative charge of surface clay and organic matter.

Extremely dry soils may not be ideal for ammonia applications for two important reasons. First, it takes very little soil water to dissolve applied ammonia. But, when soils are extremely dry, the rate at which ammonium binds to the soil exchange sites will be slower because of low moisture.[2] This can lead to lower levels of plant-available nitrogen in the soil. Second, and perhaps most important, extremely dry soils may not be capable in creating an effective seal over the top of a band of ammonia. This allows the direct loss of ammonia from the furrow, which can lead to significant nitrogen loss and additional time, money and effort. Ensuring that the soil has available moisture and good structure to flow over and seal the fertilizer band will help reduce the potential for loss and make a more effective anhydrous ammonia application this season. Even a small amount of rainfall or conserved soil moisture can improve soil conditions enough to create a more effective application.[2]

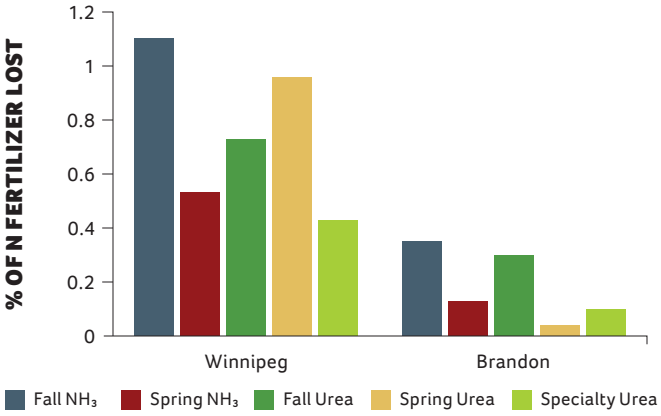
Pro tip: *Check to make sure you are leaving a well-sealed band behind your applicator or you may incur large losses at the time of application.*

3. USE A NITRIFICATION INHIBITOR

When added to nitrogen-based fertilizers, nitrification inhibitors slow down the conversion of ammonium to nitrate soon after application.[1] Slowing down this process is important if you want to start applying ammonia before the soil has cooled below 10°C in the fall. Nitrification inhibitors are important tools that protect nitrogen investments, reduce nitrate leaching, decrease nitrogen gas emissions and improve nitrogen use efficiency, regardless of whether you apply it in the spring or fall. However, it should be noted that the loss of ammonia from a band due to denitrification tends to be small–less than 2% and often close to zero. It is also important to know that inhibitors that slow formation of nitrates will only work in the fall. By spring, the inhibitors will have degraded and will not further prevent nitrates. Research in wet heavy clay soils in Manitoba showed that the total nitrogen loss of a nitrous oxide gas was very small and would not likely

contribute to yield loss. Overall, the best use of nitrification inhibitors will be for ammonia application in early fall and if soils are likely to be very wet or flooded in spring. This can be countered by avoiding these soil types in early fall ammonia application.

% LOSS OF N AS N_2O.



Note: Specialty urea = NBPT at Brandon and ESN at Winnipeg.

KEY FINDINGS

1. The amount of N lost as nitrous oxide was related more to soil mineralization potential and soil water than fertilizer management.
2. Total loss of N as N_2O gas average 0.8% at Winnipeg and 0.2% at Brandon.

Source: Burton et al., 2007.

Pro tip: *If you anticipate a field may be wet in the spring (low lying areas or heavy textured soils), a nitrification inhibitor can help reduce the formation of nitrates that are at risk of loss by denitrification or leaching in the spring.*

4. PERFECT THE APPLICATION SEAL

With the right soil and environmental conditions in place to apply anhydrous ammonia, it is time to perfect the seal. When applying anhydrous ammonia to the field, you want to do everything you can to avoid loss. Achieving a perfect seal on the application slot supports this and allows you to avoid the direct loss of ammonia through volatilization (loss to the air).[1]

Pro tip: *A good soil seal over a band requires good soil structure and surface moisture. Avoid topsoil compaction and unneeded tillage to improve ammonia application.*

5. CHOOSE THE RIGHT APPLICATION EQUIPMENT

Good ammonia applications require an applicator capable of creating a well-sealed band at an appropriate depth. Applicators and machines that are not level or contain various banding depths may create a poor band, even in good soil conditions.

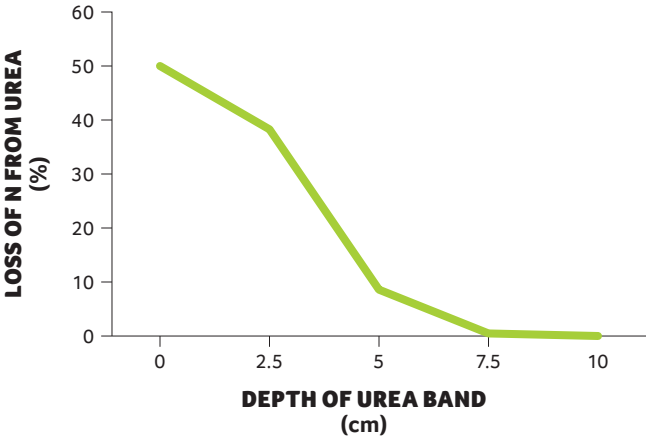
Pro tip: *Some application equipment and machines will have harrows or row packers to help seal a band. Be sure that these are positively impacting the condition of your field.*

6. USE THE RIGHT BAND DEPTH

Ammonia is a gas that is capable of expanding beyond its point of application. If it is poorly sealed during application, it will continue to move to the soil surface and risk loss. Thus, the depth of your band is extremely important for effective anhydrous ammonia applications. In good soil conditions, the band should be eight to 10 cm deep before sealing.

LOSS OF N RAPIDLY DECREASES WITH BAND DEPTH.

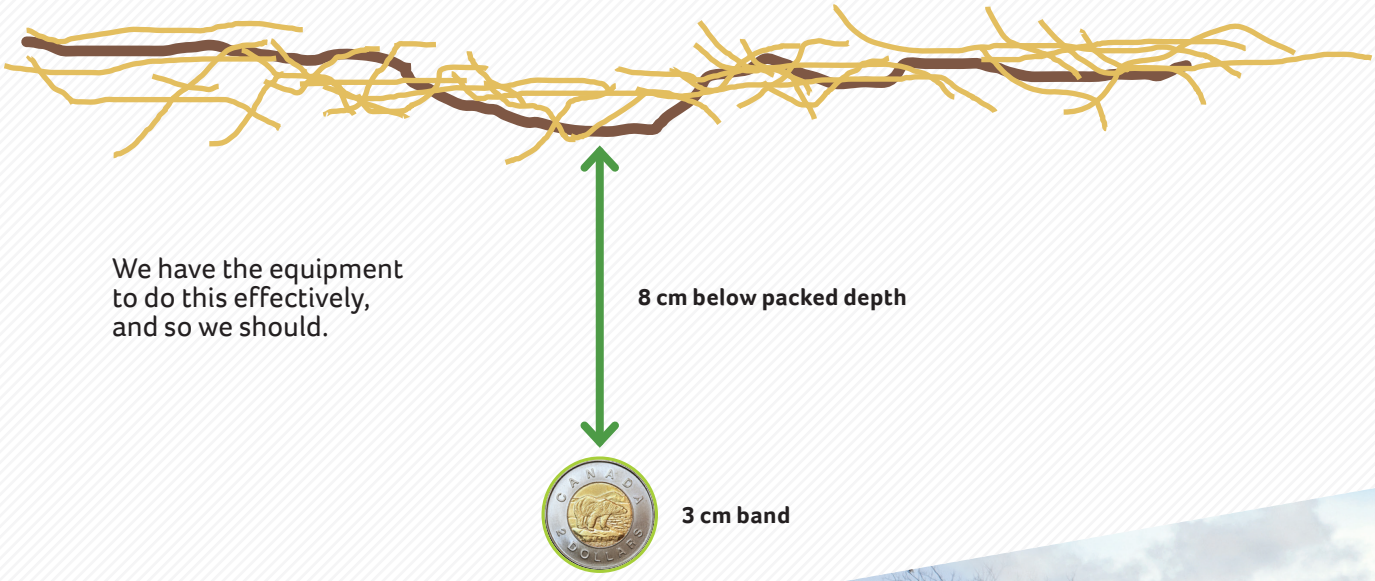
Total % loss of N as ammonia from urea over 25 days with increasing band depth.



- N applied at 145 lb. as urea
- 30 inch row spacing
- Bare soil, in wind tunnel
- Silt loam, CEC 18
- pH 5.5
- 5 mm water applied at 7, 14 and 21 days

Source: Rochette et al., 2013. J. Env Quality
High N rate, Bare Soil. Wide Row Space.

TARGET 8 CM TO EDGE OF BAND, DEPENDING ON CLOSURE.



We have the equipment to do this effectively, and so we should.

8 cm below packed depth

3 cm band



IT'S TIME TO MINIMIZE LOSS

Following these tips will help reduce nitrogen loss, increase plant uptake and make more effective annual anhydrous ammonia applications—helping to create a more productive and profitable nutrient management plan.

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