

Volatilization of Surface Applied Urea/UAN



Surface broadcasting of nitrogen (N) fertilizers has become popular to increase operational efficiency – increasing the speed of seeding and reducing risk of seed injury. According to recent grower surveys, 30% of corn, 4% of canola and 3% of prairie wheat acres are fertilized with preplant broadcast, and usually tillage-incorporated nitrogen. But, in a dry spring with limited rain prospects, growers may choose not to till and avoid further drying out seedbeds. Then growers must consider the risks of nitrogen volatilization loss and take precautions when risk is high.

Volatilization of ammonia (NH_3) from urea or the urea portion of UAN (28-0-0) affected by several factors.

Table 1. Volatilization risk factors (and why)

Volatilization Risk Factor	Reason
High soils temperatures	Speeds urea hydrolysis, diffusion of NH_3
Moist soil conditions followed by rapid drying	Granular pellet dissolves, followed by hydrolysis, then NH_3 is lost with evaporating water
Windy conditions	Reduces boundary layer between soil surface and atmosphere which increases losses of water and NH_3
High soil pH (>7.5)	Increases ratio of $\text{NH}_3:\text{NH}_4^+$ (positively charged ammonium NH_4^+ can be held on the CEC)
High lime (carbonate) content in surface soil	Increases ratio of $\text{NH}_3:\text{NH}_4^+$
Coarse soil texture (sandy)	Less CEC to hold ammonium NH_4^+ and to buffer pH increase
Low organic matter content	Less CEC to hold NH_4^+
High amounts of surface residue	-more urease enzyme present -may decrease volatilization if soil temperature and wind speed is reduced and soil moisture is preserved
Nitrogen source	Urea > UAN solution > ammonium nitrate

Often we experience such conditions in Manitoba. Research has shown losses to be as follows in Table 2.

Table 2. Loss of applied urea in 7 days as influenced by temperature and source (Grant et al, AAFC, Brandon)

Weather Conditions	Check	Urea	Urea & Agrotain	UAN	UAN & Agrotain
% of applied N volatilized					
May (warm 20-25°C)	0	40	2	7	1
July (hot 30°C)	0.6	88	12	50	16

Ways to minimize losses:

- Treat urea with a urease inhibitor NBPT like Agrotain Ultra. Several Agrotain formulations are available and some other NBPT products are now available. NDSU staff indicates to expect similar performance as long as the active ingredient NBPT rate per tonne urea is the same.
- Wait for rain.
- Surface banded or dribbled UAN is much less subject to volatilization than broadcast sprayed.
- The addition of other fertilizers has been inconsistent in their impact on volatilization (i.e. Ammonium thiosulphate).
- Choose to incorporate the broadcast fertilizer (at the risk of drying the seedbed).
- Select an in-crop option for nitrogen application.