

Ammonia volatilization and urea fertilizer

Summary

We have completed ten field investigations (i.e. gas sampling campaigns) since this projects conception and which are summarized in Table 1. The magnitude of N losses due to ammonia volatilization are quite variable and very much dependent on the soil moisture conditions, rainfall, and climatic conditions that are experienced following dissolution of the fertilizer prills. The best example of this is provided by the contrast in results from Campaigns 2 and 5.

Investigations were carried out at the identical field site, yet the N losses from urea differed by more than 10x (i.e. 3.1 vs. 39.9%) for the fall and spring applications, respectively. Surface soil moisture conditions at time of fertilization were dry and fertilizer prills remained undissolved and visible for 24 days during Campaign #2 (see photo below). Beginning on November 2, 0.98" of rain fell over a 67 hour period which was sufficient to dissolve the fertilizer prills and transport the urea to a depth in the soil profile where it was protected from volatilization losses.

In contrast, the spring fertilizer was applied to the soil surface with a trace of snow (Campaign #5). Although the surface temperatures were at 31 F, the fertilizer prills began to dissolve almost immediately (see photo below). Ammonia volatilization losses during this campaign were extremely large, because only light precipitation was received over the first month (e.g. 0.3"), and fertilizer N remained exposed near the surface.

Table 1. Percentage of applied N (100 kg N/ha or 90 lbs N/a) lost as ammonia-N following broadcast applications of urea and Agrotain* coated urea.

Campaign	Location	Fertilization date	Urea	Agrotain
			-----% -----	
1	west Havre	27-Mar, 2008	8.4	4.4
2	west Havre	9-Oct, 2008	3.1	1.4
3	north Havre	14-Nov, 2008	31.5	4.0
4	north Havre	25-Mar, 2009	35.6	18.0
5	west Havre	26-Mar, 2009	39.9	18.1
6	Kremlin	6-Oct, 2009	10.4	4.4
7	west Havre	13-Oct, 2009	10.5	5.0
8	north Havre	19-Oct, 2009	15.7	3.4
9	Willow Creek	27-Jan, 2010	24.3	9.3
10	Willow Creek	26-Feb, 2010	44.1	11.9
Average			22.4	8.0

*Agrotain rate = 4 quarts/2000 lbs urea for Campaigns 2-10, 3 quarts/2000 lbs urea for Campaign 1



Campaign #2. Dry surface soil conditions showing intact urea fertilizer prills 1 wk following fertilization.



Campaign #5. Surface soil conditions immediately following fertilization with trace of snow and fertilizer prills beginning to dissolve.