

Campaign 13 (lower disturbance)



Campaign 14 (higher disturbance)



Figure 1. Disturbance created by the air-drill differed considerably at the two sites where a similar narrow style opener was used at Campaigns 13 (15-September 2010) and 14 (27-September 2010).



Figure 2. Seeding into dry soil conditions at a field site near Kremlin, Montana. 16-September 2011. Campaign 17. Soil disturbance at this site was insufficient to cover urea prills and protect against volatility losses. A narrow style opener was used at this field site. Photographs above show prills on surface before (left) and after (top) seeding from the same microsite in the field.

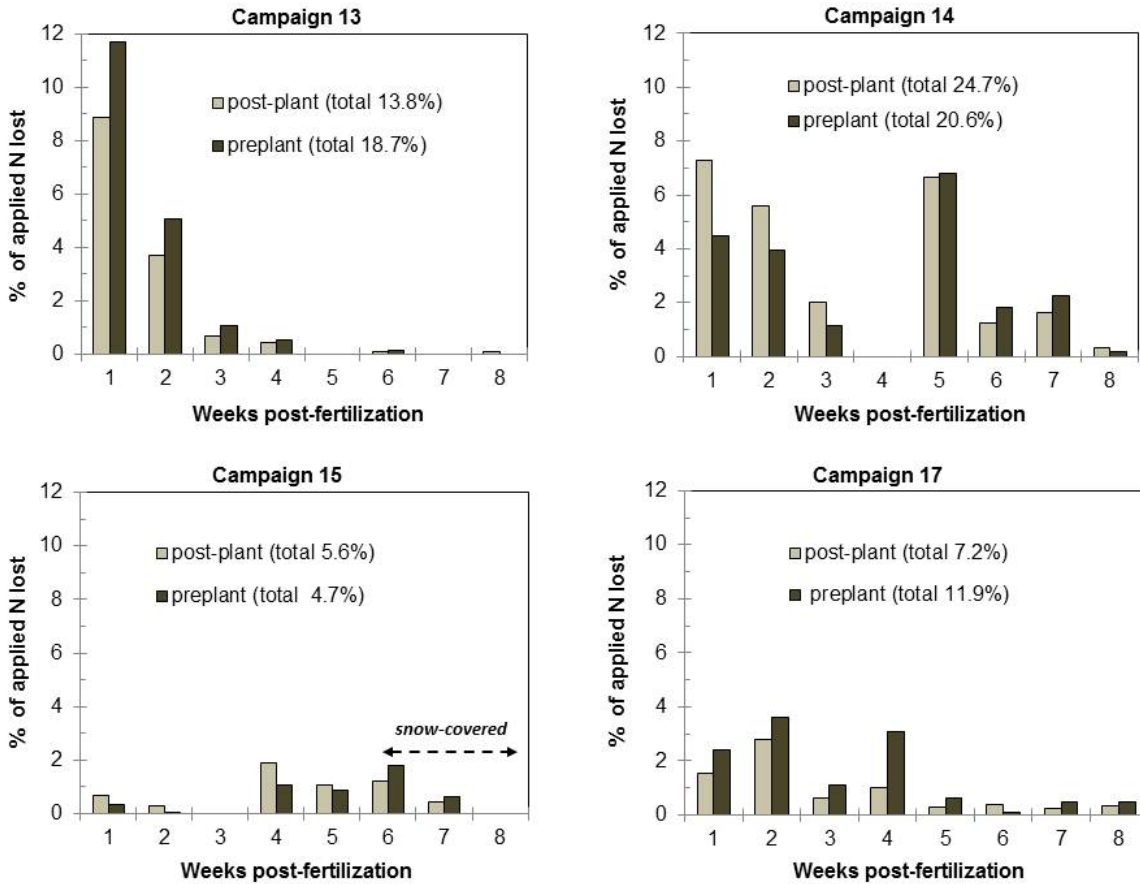


Figure 3. Weekly NH_3 losses from urea applied pre-plant and post-plant at north Havre (Campaign 13), Kremlin (Campaign 14), northwest Havre (Campaign 15), and Kremlin (Campaign 17) following fertilization on 15-September 2011, 27-September 2011, 07-October 2011, and 16-September 2012, respectively.

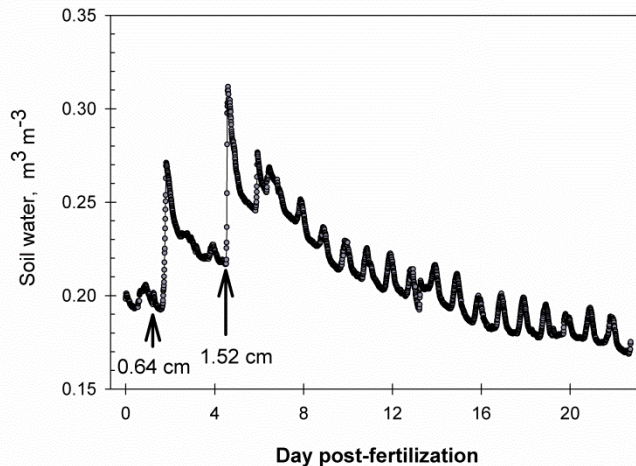


Figure 4. Soil water content (2.5 cm depth) vs. d post-fertilization during Campaign 13. Precipitation events and magnitude indicated by arrows.



Figure 4. Urea was applied to this field site with patches of snow near Denton Montana on 12-Dec 2012. Campaign 22.

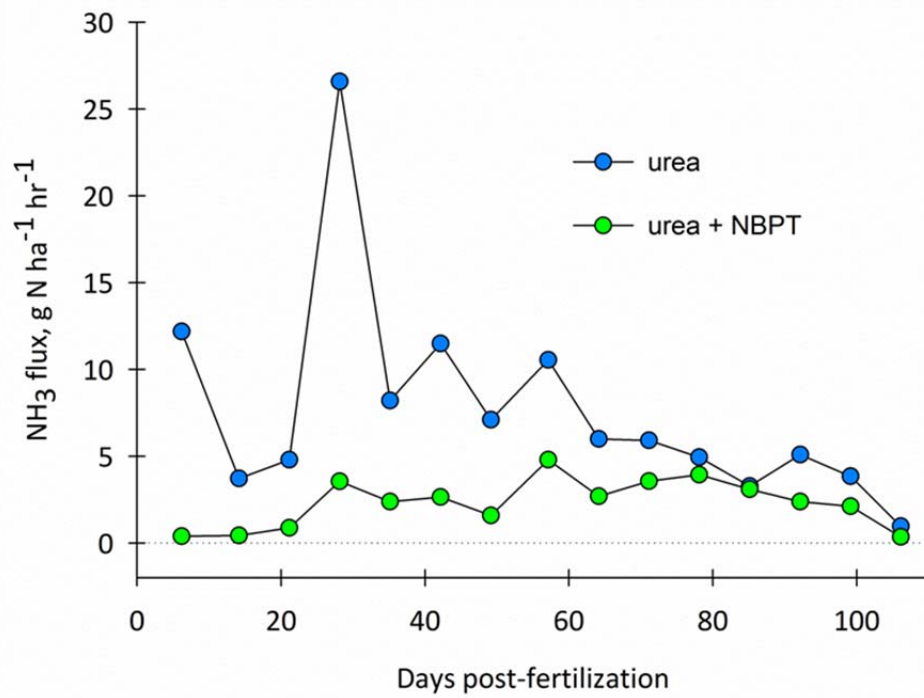


Figure 5. Nitrogen losses from urea for Campaign 22 were of modest intensity following a 12-Dec 2012 fertilizer application (100 kg N ha⁻¹) of urea and urea + NBPT.

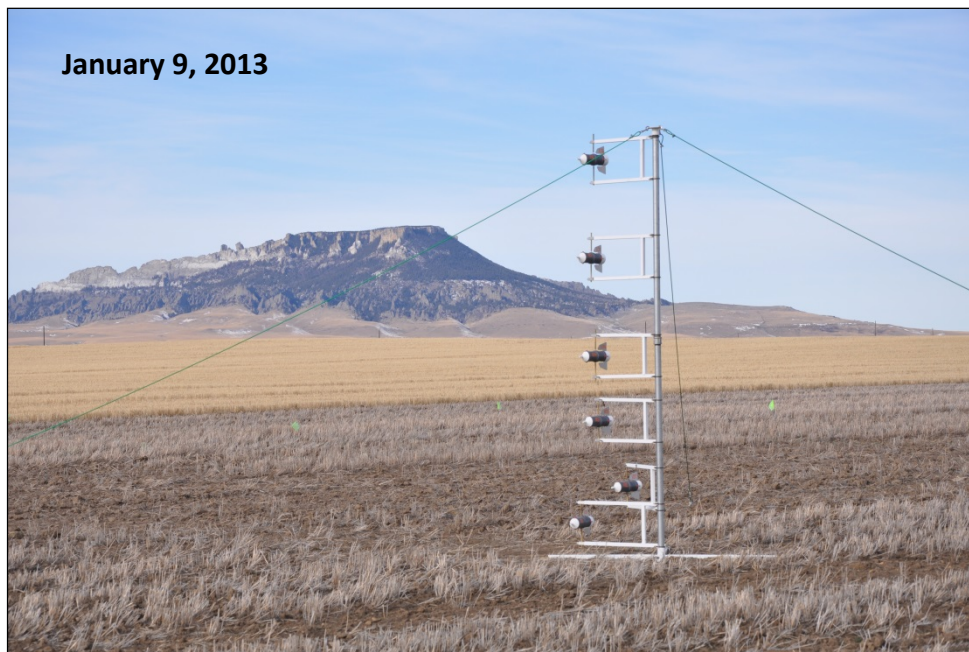


Figure 6. These photographs illustrate the change in field conditions during Campaign 22 over a 1-wk period in January 2013. Highest ammonia losses from fertilizer are typically associated with wet to dry cycles. During this period 4.5 kg N ha^{-1} (4.5% of applied N) was lost to the atmosphere as ammonia (see emission peak at 28 in Figure 4).



Figure 7. Field peas were terminated at the early-pod stage in 2011 (top) and flowering in 2012 (bottom) at field sites near Havre, Montana. A mast with Leuning samplers was erected inside of the circular plots to trap NH_3 loss according to the integrated horizontal flux method.

Table 1. Cumulative ammonia loss (% of applied N) from urea as affected by NBPT from surface-applied urea following late-fall, winter, and early-spring applications to winter wheat fields.

Campaign	Season	Fertilizer application		Length	NH ₃ loss		NBPT mitigation
		timing	date		Urea	Urea+NBPT	
				d	---- % applied N † ----		%
16	2010-2011	winter	Mar 02	56	20.7	10.1	51
18	2011-2012	late-fall	Nov 29	87	13.4	5.9	55
20		winter	Feb 28	49	13.0	4.1	68
21		early-spr	April 24	21	1.2	0.0	-
22	2012-2013	late-fall	Dec 12	106	19.3	5.3	73
23		winter	Feb 08	48	10.6	3.6	66
24		early-spr	April 12	55	4.2	1.4	67

† N application rate = 100 kg N ha⁻¹; NBPT added as Agrotain® at 0.1%

Table 2. Oral presentations given from July 2010-present on urea volatilization.

Meeting	Location	Date
International Agricultural Forum	Yangling, China	02-Nov-2010
American Society of Agronomy National Meeting	Long Beach, CA	03-Nov-2010
Grower Meeting	Glasgow, MT	16-Nov-2010
Montana Grain Growers Conv.	Great Falls, MT	02-Dec-2010
Nitrogen Conference	Havre, MT	12-Dec-2010
Grower Meetings (3)	Choteau, Shelby, Ft. Benton, MT	3-4 Jan-2011
Crop Pest Management School	Bozeman, MT	06-Jan-2011
Montana Agri-Business Convention	Great Falls, MT	26-Jan-2011
Grower Meeting	Malta, MT (via web)	07-Feb-2011
Alberta Soil Science Workshop	Calgary, AB	16-Feb-2011
Grower Meeting	Denton, MT	02-Mar-2011
Agriculture Extension Agent Update	Bozeman, MT	13-Apr-2011
Northern Ag Res Center Field Day	Havre, MT	28-June-2011
Central Ag Res Center Field Day	Moccasin, MT	07-July-2011
Grower Farm Tour	Poplar, MT	24-July-2011
Grower Meeting	Glasgow, MT	25-July-2011
Willow Creek Crops School	Willow Creek, MT	22-Feb-2012
Northern Ag Research Center field day	Havre, MT	July 2012
MSU Post Farm field day	Bozeman, MT	July 2012
Crop Pest Management School	Bozeman MT	02-Jan 2013
Sugarbeet and Barley Symposium	Billings, MT	09-Jan 2013
Golden Triangle Workshops	Denton, Ft Benton, Chester, Shelby	14, 15 Jan 2013
Montana Agri-business Association	Great Falls, MT	01-Feb 2013
Grower Meeting	Denton, MT	05-March 2013
American Society of Agronomy National Meeting-Symposium – Practices that Improve Fertilizer N use Efficiency	Tampa, FL	05-November 2013
<i>Upcoming meetings (below)</i>		
Great Plains Soil Fertility Conference	Denver, CO	05-March 2014
Grower Meeting	Denton, MT	?? – March 2014