Ammonia losses of NBPT-treated urea under Brazilian soil conditions

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OBJECTIVES:

Evaluate the efficiency of the urease inhibitor NBPT to decrease NH_3 volatilization losses of surface-applied urea (UR) to no-till or other mulched soils.

MATERIAL & METHODS:

12 field experiments
Urease inhibitor: NBPT(1)
- Added during urea granulation (NBPT-gr):
  - Hydro (Netherlands) or Ultrafertil (Brazil), 375 mg NBPT/kg UR
- Covering urea prior to fertilizer application (NBPT):
  - (1)Agrotain®, 1325 or 530 mg NBPT/kg UR

Design: factorial 4 sources X 4 N rates (4 replications)
- N sources: UR, UR-NBPT, UR-NBPT-gr, AN (ammonium nitrate as non volatile control)
- N rates: 0, 40, 80, and 120 kg/ha N

Fertilizers surface applied
Volatilization measurement: PVC volatilization chambers (Nommik, 1973; Cantarella 2003)

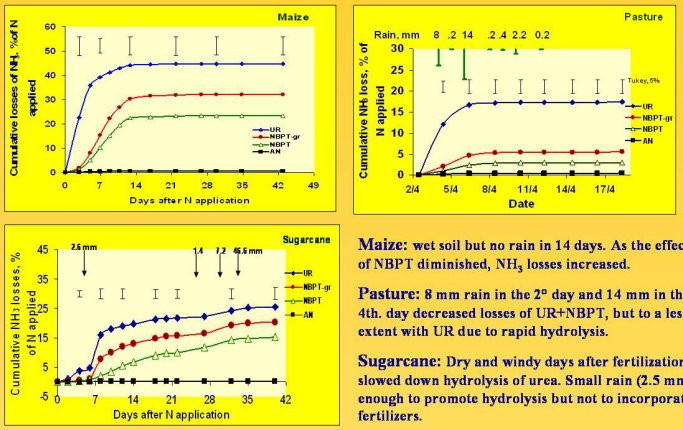
RESULTS:

- In hot and moist soils urea hydrolysis and NH_3 volatilization peak 2 days after fertilization. NBPT delays peak by 2-6 days.
- Climate and soil moist conditions determine the amount of NH_3 lost and the extent of the volatilization process.
- Dry soil conditions seem to decrease volatilization more than temperature in Brazil since at daytime soil tends to be worm even during the winter.
- The effectiveness of NBPT added during urea granulation decreased with time of storage.
- The time window for rain to incorporate N into the soil is short for untreated urea but is a little longer for NBPT-treated urea. NBPT reduced NH_3 losses by 89% when rain occurred 2 to 3 days after fertilization, but by only 29% when it did not rain in 10 to 15 days.

Volatilization chambers in place in a corn field under no-till

N Source	Maize grain yield	NH_3 volatilization
	kg/ha	% of applied N
UR	6960 a	44.7
UR+NBPT-gr	7440 ab	32.1
UR+NBPT	7860 b	23.5
AN	8164 b	0.6

Table 1. Grain yield of maize as affected by sources of N surface-applied to a no-till field. Mococa. 2001.



Maize: wet soil but no rain in 14 days. As the effect of NBPT diminished, NH_3 losses increased.

Pasture: 8 mm rain in the 2° day and 14 mm in the 4th. day decreased losses of UR+NBPT, but to a lesser extent with UR due to rapid hydrolysis.

Sugarcane: Dry and windy days after fertilization slowed down hydrolysis of urea. Small rain (2.5 mm) enough to promote hydrolysis but not to incorporate fertilizers.

Figure 1. Ammonia volatilization losses in 3 locations: amounts and patterns of NH_3 losses depend on soil moisture and climate

Crop/Location	NH_3 losses (Percent reduction compared to urea)		
	UR	UR-NBPT	UR-NBPT-gr
	---------- % of applied N ----------		
Maize Mococa	45	24 (47)	32 (28)
Maize Rib. Preto	37	5 (85)	24 (36)
Maize Mococa	64	22 (65)	40 (37)
Maize Pindor.	48	34 (29)	44 (8)
Sugarcane 1	11	7 (38)	7 (65)
Sugarcane 2	25	15 (39)	20 (19)
Pasture 1	18	6 (69)	7 (65)
Pasture 2	51	22 (56)	34 (32)
Pasture 3	18	3 (83)	5 (70)
Pasture 4	18	2 (89)	4 (78)
Mean	*34*	*14 (60)*	*22 (41)*

Table 2. Ammonia volatilization losses due to surface application of urea, and percentage of reduction of NH_3 losses due to addition of NBPT. Summary of 10 field experiments on soils covered with plant residues

CONCLUSIONS:

- NBPT can contribute to increase the efficiency of surface-applied urea. In the average of 10 field experiments in Brazil NH_3 losses were decreased by 40 to 60% compared to untreated urea.

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