KOCH
AGRONOMIC SERVICES

The Role of Enhanced Efficiency Fertilizers in Fall and Spring Nitrogen Placement

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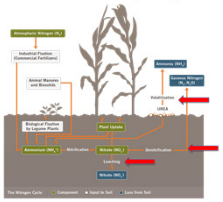
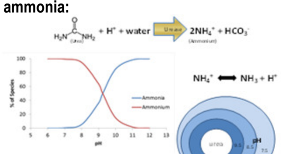
Introduction

There are three mechanisms of nitrogen (N) losses depicted below:



Ammonia volatilization occurs due to hydrolysis causing a rapid rise in pH around unprotected urea granule. The high pH results in more ammonia:

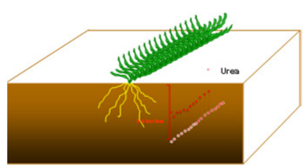


There are a number of recommended practices to reduce volatilization

- Use of urease inhibitors (Watson,1990)[1]
- Slow-release forms (Rao, 1987)[2], and,
- Irrigation shortly after application (Holcomb et al., 2011)[3]
- Most common - incorporation of the fertilizer into the soil (Harapiak et al. 1986)[4].

Benefit of deep banding

Ammoniacal N from urea is retained in the soil because of a resistance in upward diffusion (Sommer et al., 2004)[5].



What is new?

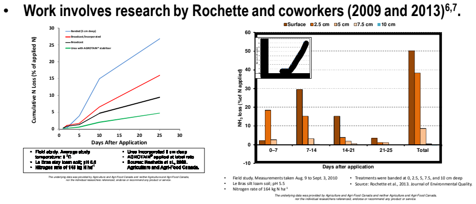
- Zero till urea or UAN bands in one-pass systems are seldom more than 1 1/2" - 2" deep.
- Shallow placement of nitrogen may cause higher losses.
- The belief that if "it's in the soil it's safe" may be misguided.
- New research is indicating that shallow banded urea and UAN are susceptible to volatilization losses.

Background on shallow banding

- Some of the pioneer work on shallow banding was carried out by Nyborg (1986) as quoted by Harapiak et al. (1986)[4].

Method of placement	Yield increase (kg ha^{-1}) 4 Trials	8 Trials
Shallow mix	915	1614
Deep mix	130	1776
Shallow band	1130	
Deep band	1400	

- Work involves research by Rochette and coworkers (2009 and 2013)[6,7].



- Also, demonstrations in Ontario and Manitoba
  - http://www.ontariosoilcrop.org/cropadvances.htm
  - https://www.umanitoba.ca/faculties/afs/agronomists_conf/media/2013_Heard_measuring_ammonia_lossesDec_4.pdf

Why the interest now?

- Fluctuating prices of nitrogen fertilizer and crops
- Efforts to reduce NH_3 and N_2O emissions, and nutrient leaching and run-off
- Long periods from application to crop demand
- Susceptible to loss
- Enhanced Efficiency Fertilizers

Enhanced Efficiency Fertilizers (EEF)

Enhanced Efficiency [Fertilizer] describes fertilizer products with characteristics that allow increased [nutrient availability] and reduce potential of nutrient losses to the environment e.g., gaseous losses, leaching or runoff when compared to an appropriate reference product. (Tentative 2015, Association of American Plant Food Control Officials)

Types of EEF

- Uncoated slowly available fertilizers containing N, e.g., urea-aldehyde condensation products (e.g., urea-formaldehyde reaction products, IBDU), triazines, etc.
- Physical coating or barrier around soluble N fertilizer, e.g., SCU, PCU, combination products
- Stabilizers, e.g., nitrification and urease inhibitors

Field research program

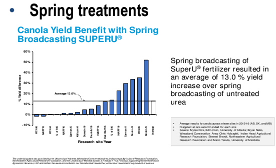
- Five sites in 2014, seven in 2015 and seven in 2016
- Three products (Urea, Urea + AGROTAIN® stabilizer, SUPERU® fertilizer)
- Three placements (broadcast, two depths of banding)
- Twp placement times in 2015 and 2016 (fall and spring)
- Two rates, recommended and 70% of recommended
- Replicated four times

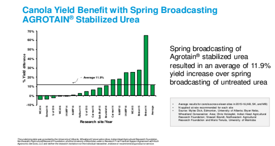
Key Results and Discussion

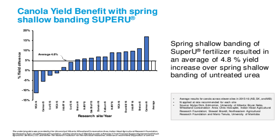
Overall statistical effects

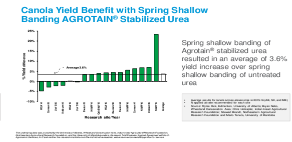
Effects	All	+ fall
site	0.002	0.018
site*placetime	0.011	0.004
site*treatment	0.000	0.000
site*placetime*trt	0.146	0.001

- Spring treatments

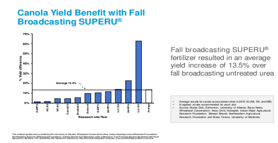


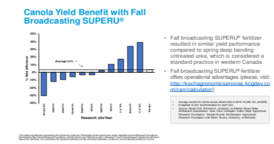


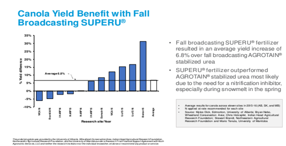


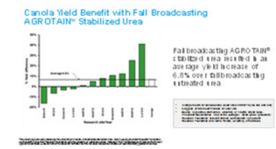


- Fall treatments









Deep banding remains the standard placement method of urea-based fertilizers. However, as the farm size increases, farm operators are seeking operational efficiencies, often at the expense of agronomic efficiencies. The results of this project support the use of nitrogen stabilizers to minimize the risk of nitrogen losses when deep banding placement is replaced with either shallow banding or broadcast.

References

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