Field observations of ESN release rates and mechanical damage during application

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Background

Growers and crop advisors are investigating opportunities for the use of ESN (Environmentally Smart Nitrogen 44-0-0) polymer coated urea to increase nitrogen use efficiency when loss potential is high.

Two questions frequently arise:

1. Whether the rate of release of spring applied ESN is sufficiently rapid for crop uptake
2. Whether there is excessive damage to the polymer coating during handling and application as reported by others[1,2].

- Simple methods to estimate N release from polymer coatings and to evaluate damage from handling have been proposed and we decided to field test them in 2010

Method A– Estimating N Release in the Field

The following method was proposed by Wilson et al, 2009[3].

1. 3.00 g of ESN was placed in a mesh bag and bags were sewn shut.
2. Bags were placed 2 inches deep in soil at the Crop Diagnostic School in Carman (June 16) and in a commercial potato field (May 22). These timings are much later than normal.
3. Bags were marked with flags and retrieved at intervals through the growing season (Figure 1)
4. Bags were air-dried, opened and prills separated from soil and weighed.
5. N release was assumed to be due to prill weight (wt) loss. Calculations were done to see the effect of accounting for ESN coating.

a) Simple wt loss = Wt loss % = $\frac{(3.0 - wt)}{3.0} \times 100$

b) Accounting for coating, Wt loss % = $\frac{(1-(wt - 0.13)}{(3.0-0.13)} \times 100$

where wt is retrieved wt and 0.13 g is coating wt of ESN (44-0-0)

Sample bag below with 3.00 g ESN.

Figure 1. Retrieving mesh bags containing ESN.

N Release rates.

Observed data is shown in Tables 1 and Figures 4-5. To contrast the N release with crop uptake, typical N uptake patterns are shown for corn and potatoes.

Table 1. N release based on a) ESN weight loss alone and b) ESN weight loss accounting for coating weight (Crop Diagnostic School).

Date	ESN wt g	N Release rate% a	N Release rate% b
July 17	3.00	-	-
July 1	1.00	67%	70%
July 16	0.64	79%	82%
August 6	0.44	85%	89%
August 31	0.29	90%	94%

Note: the more detailed calculation using the ESN coating produced slightly greater values

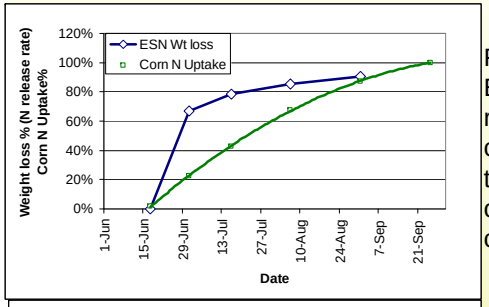

Figure 2. Estimated N release compared to the typical rate of N uptake by corn.

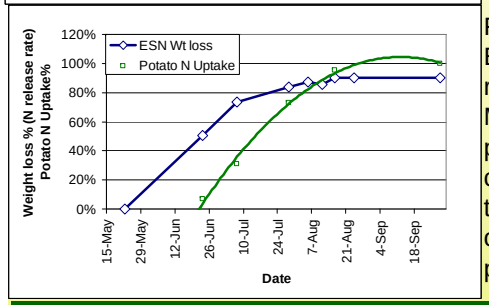

Figure 3. Estimated N release in a Manitoba potato field compared to the typical rate of N uptake by potatoes.

Handling damage of ESN during application

Researchers have reported ESN damage during fertilizer mixing and loading. In air-flow spreaders, average damage rates of 24% and 13% have been reported in Minnesota[1] and Alberta[2] respectively.

Greater prill damage was observed at the end of booms and at higher airflow speeds. Despite prill damage, no reduced performance of the crop occurred their studies.

Method 2: Estimating damage of ESN by application

We used the technique of Rosen et al, 2010[1] to evaluate a Manitoba fertilizer applicator.

1. ESN was collected from a semi-trailer unhandled by the dealer
2. Following was blended with potash and ammonium sulphate and collected from a Terra Gator air flow applicator at 2 points and 2 air flow rates:

- Mid boom at medium and high air flow rates
- End of the boom at medium and high air flow rates

Method:

1. 3.00 g of ESN was put into a beaker of water, gently stirred and stored at room temperature
2. After 24 hrs prills were sieved out and air-dried
3. Weight loss was assumed to be due to N release.
4. Results are shown in Figure 4 below

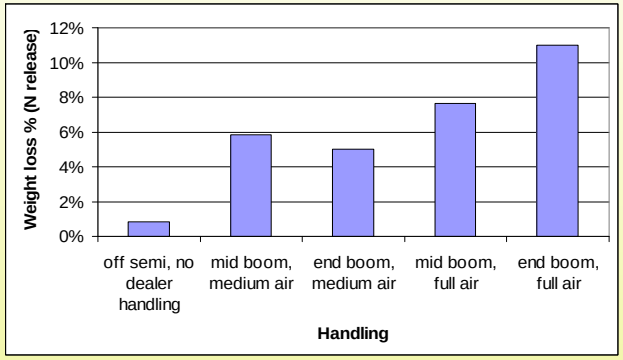

Figure 4. N release from ESN after application.

Discussion

These simple techniques can easily be used by crop advisors wishing to document these factors. The only requirement is access to electronic balances.

- N release from ESN was delayed but would be available to meet N needs of these long season crops (even with our delayed placement of bags)
- Damage to ESN granules through air-flow applicators occurred but was less than observed in other studies and would not reduce the performance of the product.

References

1 Rosen,C. M. McNearney, and A. Garg 2010. Evaluation of Damage to Polymer Coated Urea Prills During Handling. ASA Meetings 2010.

2 Beres, B., R. McKenzie, R. Dowbenko, and D. Spanner. 2009. Does handling physically alter the efficiency of polymer-coated urea fertilizer? In press.

3 Wilson, M.L., C.J. Rosen, and J.F. Moncrief. 2009. A comparison of techniques for determining nitrogen release from polymer-coated urea in the field. HortScience 44:492-494.