

SEED BANDED NITROGEN FOR WINTER WHEAT

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ABSTRACT

Field studies were conducted in two years at the University of Idaho, Parma R&E Center to compare a polymer coated urea (ESN[®]) to conventional urea for seed-banding with optimal early (mid October) or late planted (mid November) winter wheat. Treatments included an untreated control, and both fertilizers at four nitrogen (N) rates (20, 40, 60, and 80 lb N/A) seed-banded through double disk openers and balanced with pre-plant broadcast urea to provide a total of 80 lb of applied N/A. ESN[®] was considerably safer than urea when seed-banded. Stands were reduced with as little as 20 lb seed-banded urea N/A. Emergence was invariably delayed with urea but final stands at the lower N rates were not always reduced. Delayed emergence with seed-banded urea reduced yield even when final stands did not differ from the control. Yield with seed-banded ESN[®] was not affected even with the highest N rate of 80 lb N/A.

INTRODUCTION

Due to security concerns, fewer major suppliers will manufacture ammonium nitrate (AN) fertilizer. Ammonium nitrate, with only half the ammoniac N content of ammonium sulfate or urea, was historically a favored seed banded N source for wheat due to its reduced potential for seed damage or phytotoxicity. Higher N rates could be seed-banded using AN so it facilitated single pass seeding and fertilization, especially in dryland systems where the amount of N needed was relatively low anyway. Seed-banded N at seeding effectively reduced field traffic in wetter soils and fuel expenses. In addition, preplant incorporated N helped distribute the workload in addition to minimizing volatile N losses from the soil surface.

There is need for N fertilizer that can be applied with the seed without the limitations of conventional dry N sources (immobilization; rapid nitrification and subsequent leaching or denitrification; phytotoxicity). Older slow release N sources were shown to reduce phytotoxicity on germinating wheat and barley (1, 2) but were considerably more expensive. More recently developed and less expensive controlled release nitrogen products such as polymer coated urea may also have potential for significantly delaying N release and reducing immobilization, nitrification, and phytotoxicity.

METHODS

To compare a polymer coated urea, ESN[®] (Agrium), with conventional urea when seed-banded with winter wheat, Idaho Wheat Commission sponsored field studies were conducted at the Parma R & E Center in 2008 and 2009. Treatments included an untreated control, and both fertilizers at four N rates (20, 40, 60, and 80 lb N/A) seed-banded through double disk openers in 7" spaced rows. All seed banded N rates were balanced with preplant broadcast urea N to provide a total of 80 lb N/A. Treatments were evaluated in both October (October 10, 2007 and October 21, 2008) and late (November 5, 2007 and November 21, 2008) plantings of Stephens soft white winter wheat in separate trials. Plots were seven rows wide on five foot beds, 25 feet long, and irrigated with furrows spaced between plots. Irrigation sets were of sufficient duration to wet to the centers of the five foot beds.

Stand counts were collected from 2 meters of row twice weekly during fall or winter emergence. Plant heights were measured at dough stage in the outside and middle row of each plot to assess N availability after several irrigations. Chlorophyll meter readings (SPAD values) were also collected from the same rows but at heading. Yield was determined with a small plot combine. Test weight of the harvested grain was determined. There was no lodging.

RESULTS AND DISCUSSION

The resulting stands from the treatments in the early and late wheat plantings are shown in Figure 1 for 2008 and Figure 2 for 2009. There was no early planted wheat emergence for seed-banded urea at the highest N rate in 2008. There was virtually no improvement in the early planted wheat stand with late winter emergence in 2008. Likewise, in 2009, October planted wheat emerged by December 1 and there was no late winter emergence. Seed-banded conventional urea reduced stand counts or significantly delayed emergence of early planted wheat as compared to seed-banded ESN[®].

The emergence results were similar for late planted wheat, except that there was very little fall emergence of late planted wheat in fall 2007 with the higher seed-banded urea N rates, but there was appreciable late winter emergence. In 2009 there was no emergence of any late planted wheat until late winter, and emergence was delayed for seed banded urea. Slow release polymer coated ESN[®] was considerably safer than conventional urea when seed-banded.

Late planted wheat emergence was more tolerant of seed-banded urea N than early planted wheat. Cooler soil temperatures or higher soil moisture apparently reduced urea's impact on wheat germination and emergence.

Yield was reduced in both early and later plantings as the seed banded urea N rate increased to the highest rate. In contrast, yield with seed banded ESN[®] was unaffected by the highest N rate and was consistently as good as urea broadcast preplant. Delays in emergence may be as detrimental to yield as reduced stands. Any delay in emergence can reduce tillering or delay maturity. Delaying maturity can reduce yield by shortening the grain filling period. Test weight was not affected with higher N rates of ESN[®] in any trial but test weight decreased from 58.6 to 57.4 lb/bu with higher urea N seed-banded in the October 2008 planting.

Plant height in the outside row next to the irrigation furrow differed for the two seed-banded N sources (Table 1) in two of the four plantings (November 2007 and October 2008). Outer row height for these plantings were unaffected with ESN[®] N rates but height decreased with increasing N rates of seed-banded urea. Reduced plant height reflects the stunting effects of seed-banded urea and possibly the greater movement away from the furrow to bed centers with urea. Height in the bed center row was not affected by N source.

Chlorophyll meter readings (SPAD) at heading in 2009 were higher with urea than with ESN[®] in outer rows in the early planting (52.8 vs 50.5) and late planting (55.6 vs 53.8) and also higher in the middle rows for the late November 2007 planting (49.4 vs 47.1) and early planting for 2009 (56.6 vs 51.9). The higher values for urea reflect the slower release of N from ESN[®] prior to heading in outside rows and the greater movement of N to middle rows.

Using the same seed-banded fertilizer N rates per acre with wider row spacings (10" or 14") would concentrate the fertilizer in fewer rows, and increase the phytotoxicity of seed-banded N. Consequently, with wider row spacings, lower seed-banded N rates will be required to avoid affects on germinating wheat. Other slow release N sources may also reduce the impact of seed banded N on wheat, but were not evaluated in these trials.

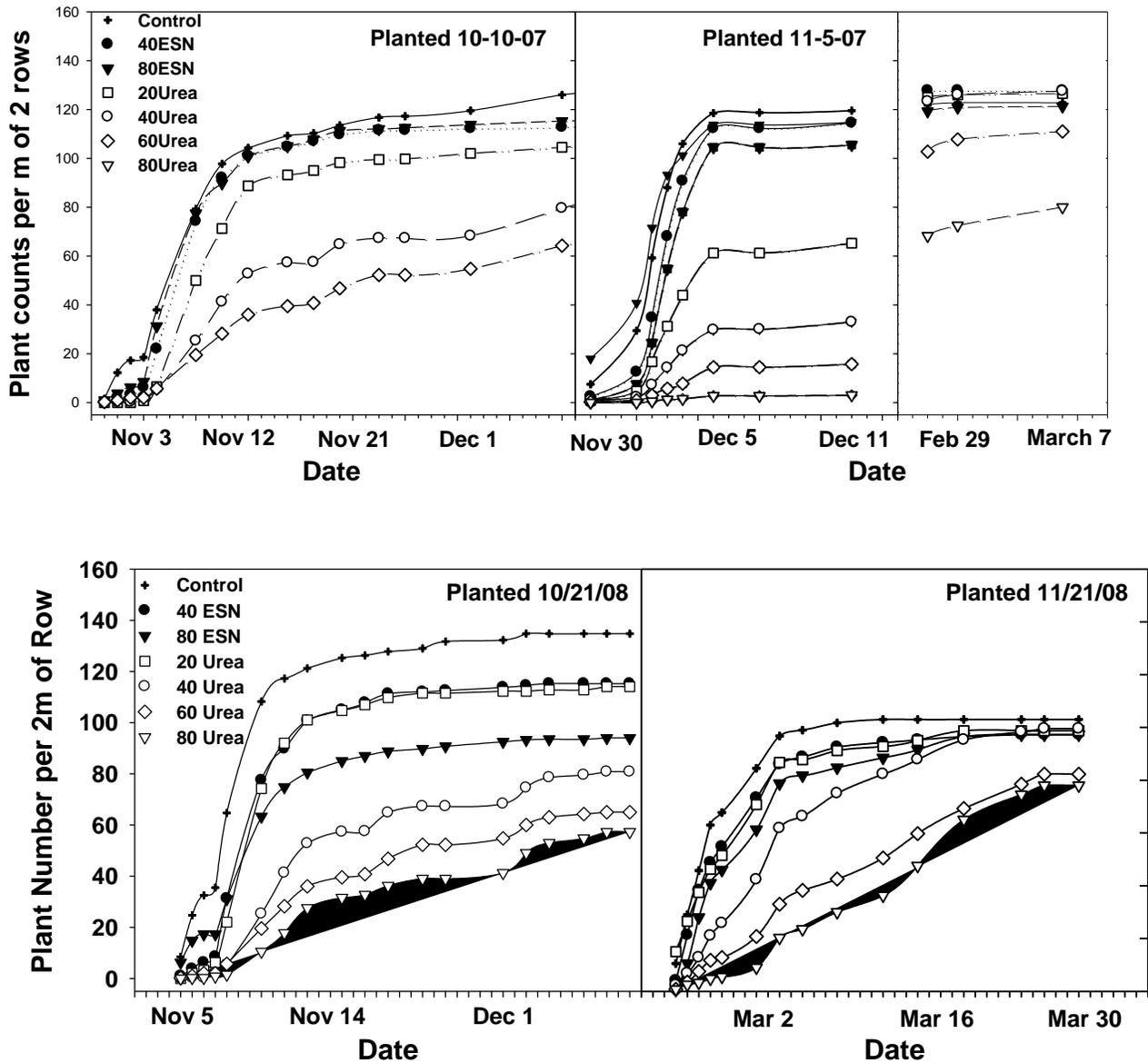


Figure 2. Early and late planted winter wheat plant counts as affected by seed banded N at Parma in fall 2008 and late winter 2009.

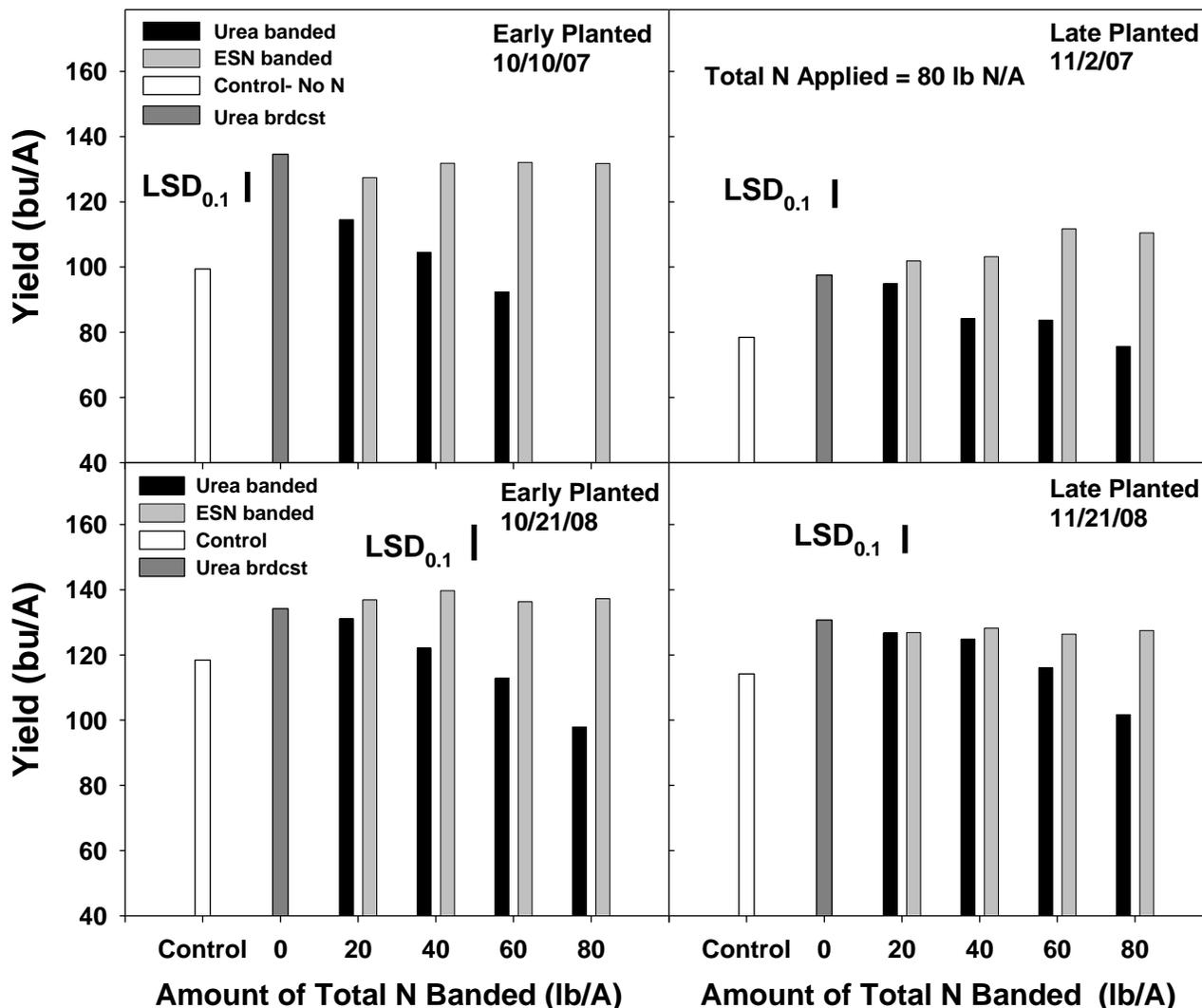


Figure 3. Early and late planted winter wheat yield as affected by N rates of seed banded conventional urea or slow release ESN N in the 2008 and 2009 seasons. There was no yield with the 80 lb urea N seed banded for the earlier planted wheat in 2008.

REFERENCES

- Mahler, R. L., L. K. Lutcher, and D. O. Everson. 1989. Evaluation of factors affecting emergence of winter wheat planted with seed-banded nitrogen fertilizers.
- Severson, G. R., and R. L. Mahler. 1988. Influence of soil water potential and seed-banded sulfur-coated urea on spring barley emergence. *Soil Sci. Soc. Amer. J.* 52:529-534.

Table 1. Plant height of winter wheat in the outer row, next to the furrow, as affected by N source and rate.

| Planting Date | N Source | Seed-banded N Rate (lb N/A) | | | |
|---------------|----------|-----------------------------|------|------|------|
| | | 20 | 40 | 60 | 80 |
| Nov 2007 | ESN | 34.9 | 35.0 | 34.9 | 35.1 |
| | Urea | 33.5 | 32.8 | 32.3 | 30.6 |
| | | LSD _{.05} =0.9 | | | |
| Oct 2008 | ESN | 36.7 | 37.1 | 36.9 | 36.7 |
| | Urea | 36.4 | 36.0 | 35.6 | 33.9 |
| | | LSD _{.05} =2.1 | | | |