
Comparision of agronomic performance of N fertilizer placement and formulation on wheat, canola and flax at four sites in Saskatchewan

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BACKGROUND

- Increasing the efficiency of plant use of N from fertilizer improves the agronomic, economic and environmental value of fertilizer N.
- Under- and over-application of N fertilizer is uneconomical and fertilizer N applied in excess of crop needs has the potential for environmental damage.
- If N is applied when and where plants need it the most, N-use efficiency should increase, leaving less N free in the soil for shorter periods of time and loss to the environment should be minimized.
- One way to increase fertilizer-use efficiency is to place the fertilizer in bands.
- The availability of fertilizer N to the plants can be affected by the position of fertilizer N in relation to plant roots.

OBJECTIVE

- To compare the efficiency of placement methods (broadcast, side band and mid-row band) and application times (autumn and spring) of urea and anhydrous ammonia for production of wheat, canola and flax, and the impact on the emission of greenhouse gases (N₂O).

MATERIALS AND METHODS

- Field experiments were conducted in 2000, 2001 and 2002 at four sites in Saskatchewan in different soil-climatic zones, using wheat, canola and flax.
- Experimental sites included Swift Current (Brown), Scott (Dark Brown), Indian Head (Black) and Star City (Dark Gray).
- Crops were direct seeded into standing stubble using a 3 m, 4 tank PAMI pneumatic plot seeder Seedrow openers were located at 25 cm spacing.
- In side banded treatments, seed was placed with Flexicoil Stealth opener.
- In mid-row banded treatments, seed was placed with Bourgault 2 cm knives.
- In mid-row banded treatments, Bourgault mid-row banders were attached between every second seed row.
- In mid-row banded treatments, urea or anhydrous ammonia was mid-row banded and P fertilizer was seed-placed.
- In side banded urea treatments, P fertilizer was side banded with the Stealth openers (except for treatment 17, where urea was side banded and P fertilizer was seed placed).

- In side banded anhydrous ammonia treatments, P fertilizer was seed placed.
- All plots received a blanket application of potassium sulphate.
- On row packing with V-shaped packers was done in all the treatments.
- Fertilizer N rates were 0,40,80,120 kg N ha⁻¹ at Melfort and Indian Head and 0,30,60,90 kg N ha⁻¹ at Scott and Swift Current
- Data collected included soil nutrient measurements (N, P, K and S in the 0-15 cm; N and S in the 15-60 cm), plant counts, head counts, 1000 seed weight, seed yield, straw yield, seed N, straw N and soil characteristics (pH, EC, CEC, texture, OM, etc.)
- N₂O emissions were measured, but results on seed yields only are reported in this poster.

SUMMARY OF RESULTS

- Of the total 12 site-years for each crop, significant seed yield response to N fertilizer was observed in 5 site-years for wheat, 6 site-years for canola and 4 site-years for flax. The N rate for maximum seed yield varied with crop, year, site and soil-climate conditions.
- Anhydrous ammonia (NH₃) gave similar seed yields compared to urea with both mid-row and side band fertilizer application systems. This research confirms other research results that NH₃ can be safely side banded.
- On average, there was no significant difference in seed yield (or seed protein content) between mid-row and side band systems 75% of the time. Whenever there was a significant difference in seed yield, the mid-row band system had higher seed yield 12.5% of the time, and the side band system had higher seed yield 12.5% of the time.
- Seed yields were lower with broadcast compared to banded urea in 3 site-years for wheat; 2 site-years for canola; and 2 site-years for flax.
- Autumn-banded N produced lower seed yield than spring banded N in 1 site-year for wheat; 2 site-years for canola; and 3 site-years for flax. For canola, seed yield was greater with autumn than spring banded N in 2 site-years.
- Seed-placed P fertilizer produced more seed yield in canola in 3 site-years compared to side banded P fertilizer.
- Other observations: Side band openers were found more difficult to adjust for optimum seed depth compared to knife openers due to soil disturbance with the side band openers.

CONCLUSIONS

- Overall, there was no difference in seed yield between the two N sources (urea and NH₃).
- There was no seed yield difference between the two fertilizer application systems (mid-row and side band) in 75% of the site/crop years, and seed yield differences were exactly equally split between the two systems for the remaining 25% of the site/crop years.
- Autumn band N and broadcast urea were less effective in increasing seed yields than their spring banded counterparts.
- Other observations suggest that side band systems increase the potential for problems with seed-bed quality under both dry and wetter soil conditions in heavy clay soils.
- If soil conditions are dry, there is a possibility of limited availability of N to crop plants in the early growing season from mid-row banded N fertilizer.

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