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NBPT Reduces Seedling Damage In UAN Trials

Canadian no-till canola studies find NBPT helps maintain stand density when increasing rates of side-banded UAN in certain soils.

Summary: NBPT reduced seedling toxicity and canola stand reduction when increasing rates of UAN were applied to clay loam soils. Without NBPT, significant stand reduction occurred. On fine sandy loam soils, no significant stand reduction occurred with increasing rates of UAN. Apparent cause may have been high rainfall after seeding that reduced N toxicity. Biomass yield at flowering increased linearly with N fertilizer application on clay loam soils. On fine sandy loam soils, N management did not influence biomass. Seed yield on both soils increased with increasing N rates.

Reduced tillage systems are being adopted by more and more producers in Canada who list canola as one of their major crops. Canola is grown on more than 13 million acres and represents nearly a $3 billion market.

Reducing the number and intensity of tillage operations allows producers to improve water-use efficiency, lower costs of crop production, decrease time required for field operations, and reduce the risk of soil erosion and degradation. More and more producers are also moving toward seeders that are equipped to side-band fertilizer near the seed. A problem for these producers, however, is that canola is more sensitive to seed damage than cereal grains when side-banding N near the seed. It is a crop requiring high nutrient levels, but characteristically also one deficient in nitrogen (N), which limits canola yields.

Along with the trend toward side-banding fertilizer near the seed is the increasing use of wider row spacing. The practice reduces draft requirement, price of equipment, soil disturbance, and problems with trash clearance. In the past, many held to the opinion that separation of the seed and fertilizer by one to two inches was sufficient to ensure crop safety under most soil conditions. However, when row spacing increased to 12 inches, concentration of fertilizer near the seed increased when compared to traditional 6- to 9-inch row spacings. This could reduce the amount of fertilizer that can safely be applied as a side-band.

Recent studies have shown reduced performance of canola with 12-inch spacings and side-banded, although fertilizer rates used were approximately two-thirds of recommended levels. The reduced performance might have been due to seedling toxicity from fertilizer, since canola is very prone to seedling damage. A more recent study has examined more closely the impact of side-banded fertilizer on canola growth at 9- and 12-inch row spacings. Damage from high fertilizer rates was apparent at the wide row spacing at some locations.

In most crops, urea is considered to be more damaging to seedling emergence than nitrate sources of N. This is because urea converts to ammonia that is directly toxic to germinating seedling. It also creates a desiccating "salt effect." In contrast, nitrate only causes damage through salt effect. Therefore, toxicity is believed to increase in the order of ammonium nitrate<UAN<urea. However, other studies have shown urea was no more harmful to canola than was ammonium nitrate, under specified conditions, suggesting that canola might be more sensitive to salt effects than ammonia toxicity.

Other recent studies have shown that urea toxicity can be reduced in barley and wheat by applying NBPT *(Agrotain)*. This may or may not be effective in canola, depending on the importance of ammonia toxicity and the effect of slow ammonia release from urea on salt effect near the seed. To search out the effects of NBPT, we designed a study in 1999 to evaluate the effects of increasing side-banded UAN rates on canola seedling, with the following objectives:

• Determine the effectiveness of

- NBPT in increasing UAN rate levels that can be side-banded with canola
- Compare seedling damage and yield response to side-banded UAN at varying rates, with and without NBPT
- Determine optimal UAN rates, with and without NBPT, that can be applied on contrasting soil textures.

Mother nature strikes

The spring of 1999 was extremely challenging. Excess rainfall throughout May and early June made seeding difficult. Our fine sandy loam site was seeded in May and the clay loam site in June. High spring rainfall caused sulfate to leach from the soil, creating a sulfur deficiency during early stages of canola growth. We broadcast 15 lbs/A of S as calcium sulfate to correct the deficiency. A July 5 hailstorm caused plant damage during early stage growth on the clay loam site. They recovered reasonably well. Harvest was also delayed due to wet, cold conditions.

Seedling emergence

Clay loam w/o NBPT. Significant stand reduction occurred with increasing UAN rates (Figures 1 and 2). Patterns of response were similar at two to four weeks after seeding. Stand reduction was evident at 80 lbs/A of N and increased with increasing fertilizer rate.

Clay loam with NBPT. Application of NBPT reduced damage and maintained stand density at levels similar to the control, although there was a tendency to reducing stand density by increasing UAN rates at the four-week stage (Figures 1 and 2). This may reflect toxicity occurring in older seedlings as the inhibitor broke down over time.

Fine sandy loam. There was no significant decrease in stand density when UAN was applied at increasing rates, with or without NBPT (Figures 3 and 4). High rainfall after seeding apparently reduced the toxicity of the N fertilizer, eliminating seedling damage.

Biomass yield

Clay loam. Biomass yield at flowering increased linearly with UAN applications to approximately 120-160 lbs/A of N on the clay loam soil.

Fine sandy loam. N management did

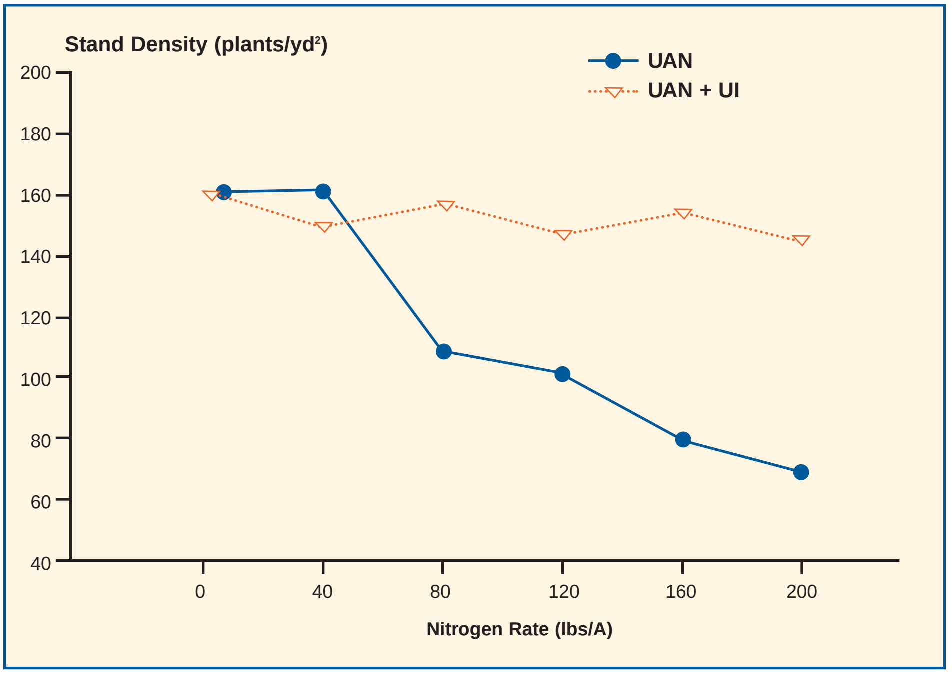

Figure 1. Effect of N rate and NBPT on stand density at two weeks in a clay loam soil, Grant, et al., Manitoba, 1999.

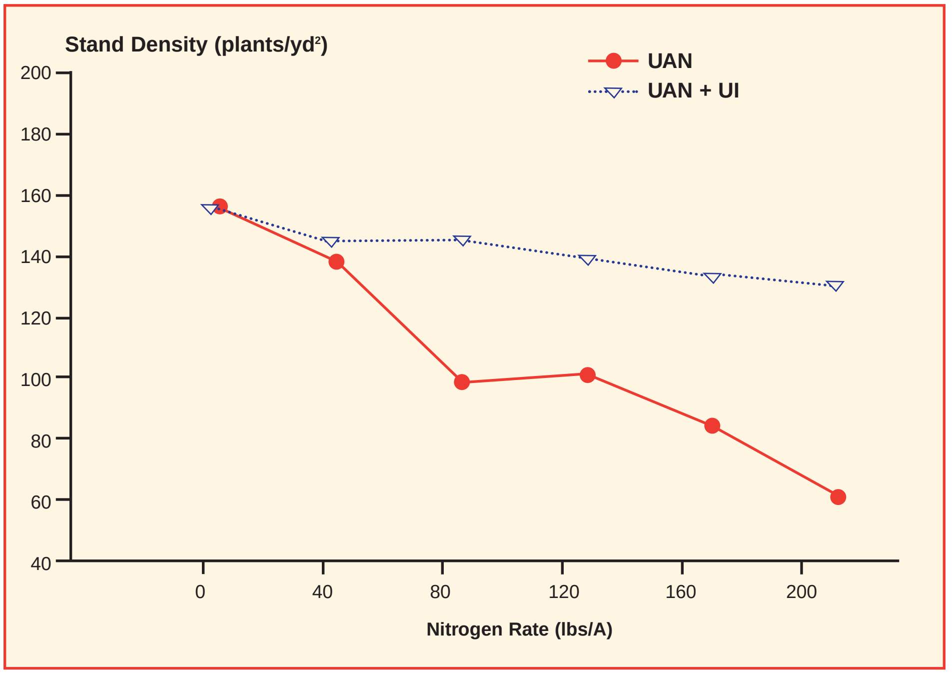

Figure 2. Effect of N rate and NBPT on stand density at four weeks in a clay loam soil, Grant, et al., Manitoba, 1999.

not influence biomass yield, but biomass yield was reduced by herbicide application. A distinct delay in flowering was also noted with herbicide application.

Seed yield

Seed yield on both soils increased with increasing N rates, with the relationship on the clay loam soil being linear and on the fine sandy loam soil cubic. Yield potential was higher on the clay loam soil. There was a greater degree of N deficiency, so the yield response persisted to a higher N level.

It appeared that decreasing stand density actually benefited seed yield at the clay loam site. This may have been due to: 1) late seeding, 2) wet, cold growing conditions, or 3) the presence of early-season S deficiencies, which were corrected at bolting by application of $CaSO_4$ fertilizer.

On the fine sandy loam soil, application of *Roundup* decreased canola seed yield. This appeared to be related to damage from the herbicide, since the herbicide also led to a reduction in biomass yield and delayed flowering at this location. Therefore, the cultivar was not completely resistant to the herbicide but did show some damage.

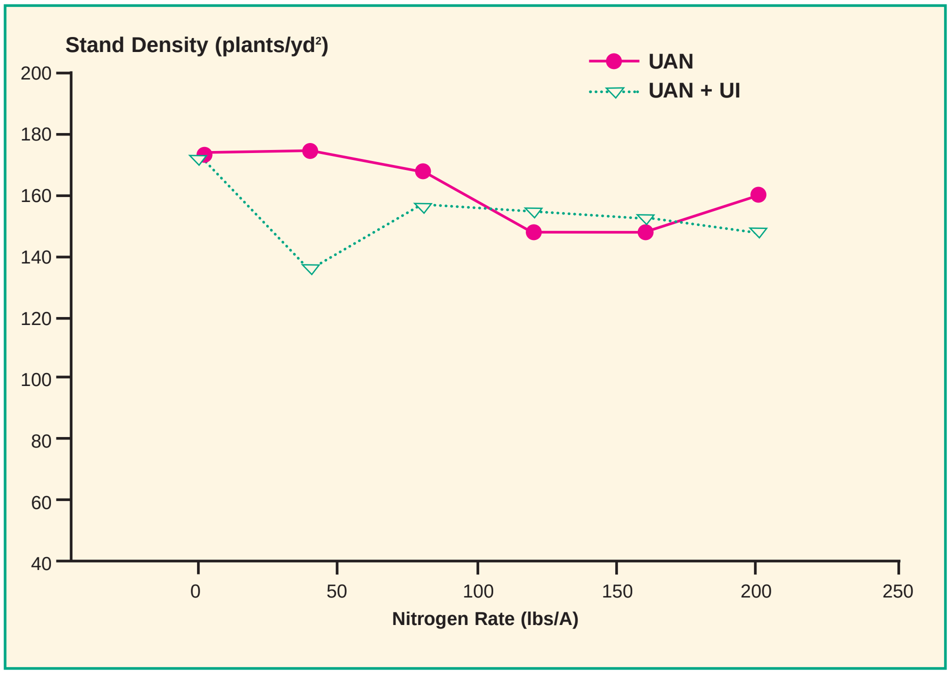

Figure 3. Effect of N rate and NBPT on stand density at two weeks in a fine sandy loam soil, Grant, et al., Manitoba, 1999.

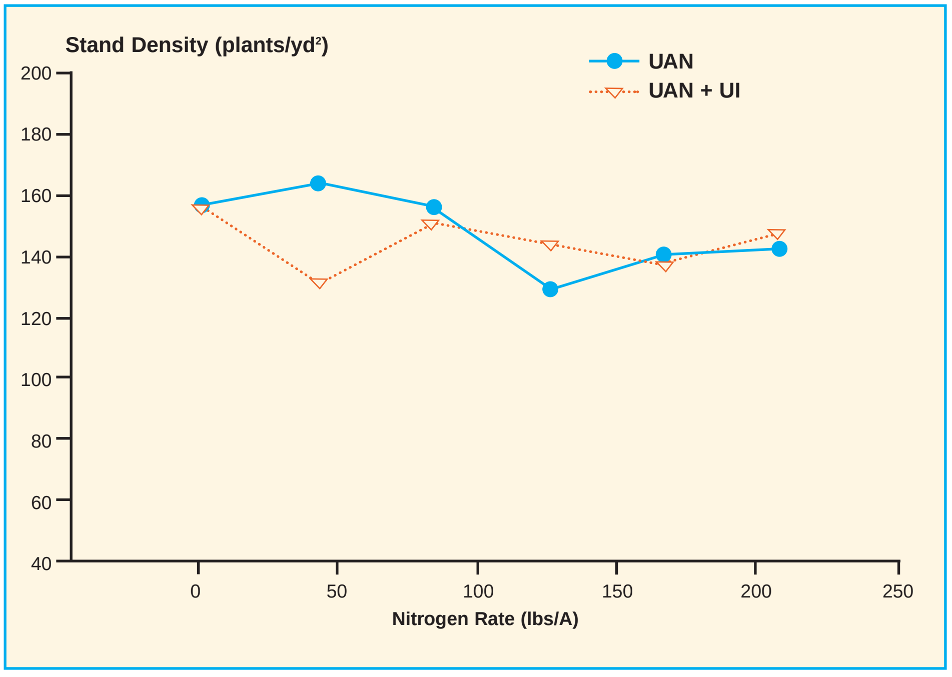

Figure 4. Effect of N rate and NBPT on stand density at four weeks in a fine sandy loam soil, Grant, et al., Manitoba, 1999.

Procedure

Replicates: 4

Treatments: 21 x 2 (high and low competition)

Seeding rate: 9.0 lbs/A

Seeding depth: 1.0 inch or less

Total plots: 336

Seeding equipment: SeedHawk (8-inch spacing)

Locations: 2

Plot size: 2 yds. x 5 yds.

Measurements: Soil nutrient status
- Spring moisture
- Stand emergence
- Biomass yield at flowering
- Weed populations
- Seed yield
- Seed quality

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