Nitrogen Fertilizer for Canola

Nitrogen Fertilizer for Canola:
The Ideal Placement

Although farmers have been direct seeding for years, the question is still asked: "How much nitrogen can you safely put with or near the seed?"

Farmers want to use seed-placed nitrogen (N) for several good reasons. Placing N near the seed in a single pass operation means faster seeding, less fuel used and better soil moisture conservation. However, placed too close, the fertilizer can injure the seed or seedling.

The Canola Council of Canada agronomists conducted trials at Canola Production Centres (CPC) comparing different rates of N fertilizer with canola seed.

The treatments included:

- narrow, medium and wide spread patterns of the seed in bands using a fixed row width; and
- low, medium and high rates of N within bands.

The goal of the trials was to find how to maximize the amount of N that could be safely applied with the seed.

Row width utilization (RWU) is the amount of seedbed over which N has been spread relative to the space between rows, expressed as a percentage (spread of seed in inches divided by distance between rows times 100). By changing RWU it is possible to manage the relative risk of emergence damage and yield reduction due to early season fertilizer damage to seedlings.

CPC agronomists examined three spread patterns. Each was applied to farm-scale plots through machinery set to 8" row spacings.

The spread patterns were:

- A knife opener with a narrow spread pattern (9% RWU) where N (urea) was applied in a 3/4" band with the seed. The three rates of urea put with the seed were 35, 70 and 105 lb of actual N/ac.
- A spoon opener with an intermediate spread pattern (25% RWU) where the fertilizer was applied in a 2" band with the seed. The same three rates of actual N/ac were applied.
- A 'Froc' opener attached to an 11" sweep with a wider spread pattern (75% RWU), where the fertilizer was applied in a full 7" pattern with the seed. The same three rates of actual N/ac were applied.
- A 'Swede' sideband treatment where the seed was applied with a 1" separation between the seed and the fertilizer band. The same three rates of actual N/ac were applied.
- All combinations were measured against a check treatment where 70 lb actual N/ac was broadcast.
- At all sites, canola emergence, plant development, yield and oil content for the various treatments were measured.

The Results

Seed-placed N had a significant effect on the canola in some treatments. The effect grew more pronounced as N rate increased and as the spread width narrowed.

Table 1 shows that plant emergence suffers even at the lowest rates of N when a narrow opener is used to apply fertilizer and canola seed in the same band. For 3/4"- and 2"-spread widths, emergence was lower by 19% and 16%, respectively, even when the applied N was limited to 35 lb/ac. Emergence fell by 50% when the narrow opener was used with 70 lb N/ac, and fell by 49% when the 2" opener was used with 105 lb N/ac.

Separating the seed from the row by an inch using the swede sidebander was not sufficient to prevent reduced emergence in this treatment. Some reductions in emergence occurred even at the lower N rates with the Swede sidebander, leading the agronomists to speculate that lateral movement of the ammonia from urea in contact with the seed may have occurred when moisture conditions at time of seeding were below field capacity. Moisture was likely being pulled away from the seed resulting in low plant counts.

TABLE 1 **Summary of Canola Emergence Following Seeding with Varying N Rates**

Opener type	RWU	Actual N with seed lb/ac	Mortality rate[1] %
Knife *(3/4" on 8" rows)*	9%	35 70 105	19 50 67
Spoon *(2" on 8" rows)*	25%	35 70 105	16 30 49
Sweep ~ Froc opener *(7" spread on 8" rows)*	87%	35 70 105	5 19 28
Swede *(side banded 1" away on 8" rows)*		35 70 105	14 31 42

[1]Mortality of emerged seedlings versus the broadcast check at 70 lb

Time and again canola has shown itself to be a crop where early season damage appears to be overcome by compensating growth and these trials were no different. Final season yields did not fall as dramatically as the early season injury might have indicated. In some cases, even the highest N rates did not impact yield in the narrower spreads.

An examination of all the data shows that the odds of getting a yield reduction appear to increase as more N is placed with the seed in a narrow band.

A two-year study conducted at sites near Naicam, Unity and Foam Lake found that initial injury caused significant decreases in yield. The injury was due to too much nitrogen near the seed in a narrow band.

Figure 2 shows the yield of canola as N levels were increased. Yield is expressed as a percentage of a plot where the N was broadcast. Any yields below the 100 percent line had lower yield than the broadcast treatments at the same N rates.

Yield should go up with increasing N provided no injury occurs. The narrow openers do not show this expected N response. Note that there is a substantial yield decrease as N rate goes from 70 lb up to 105 lb in the knife (3/4") treatment. There is a slight decrease in the spoon (2") where an increase due to the extra fertilizer would be expected. The greatest increase in yield occurred when N was side banded away from the seed. In those treatments, the crop benefited the most from the additional fertilizer.

Oil content suffered (Figure 1) with high N rates for all three of the spread patterns. Oil content fell between 0.05 and 0.7 percentage points when comparing the 70-lb N/ac rate broadcast versus applied with the seed, regardless of spread width. Oil content fell 1.4 to 2.5 percentage points at the 105-lb N/ac rate compared to the 70-lb N/ac broadcast rate.

FIGURE 1 **Canola oil content with rates of N banded with seed**

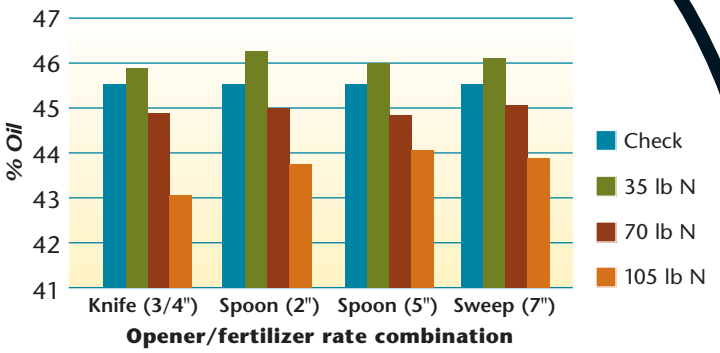
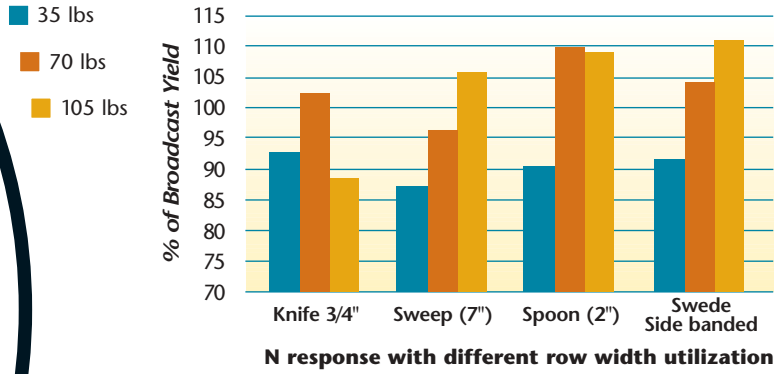


FIGURE 2 **Canola Response to Fertilizer Rates with Various Openers**



The agronomists also made qualitative observations on the effects of seed-placed fertilizer.

The pattern observed with most of the trials conducted at the CPCs was:

- Higher N rates in combination with narrower openers led to decreased emergence, increased weed pressure, and increased days to maturity.
- Reduced quality (green seed and oil content)
- Less dramatic effects on yield due to additional branching on the canola.

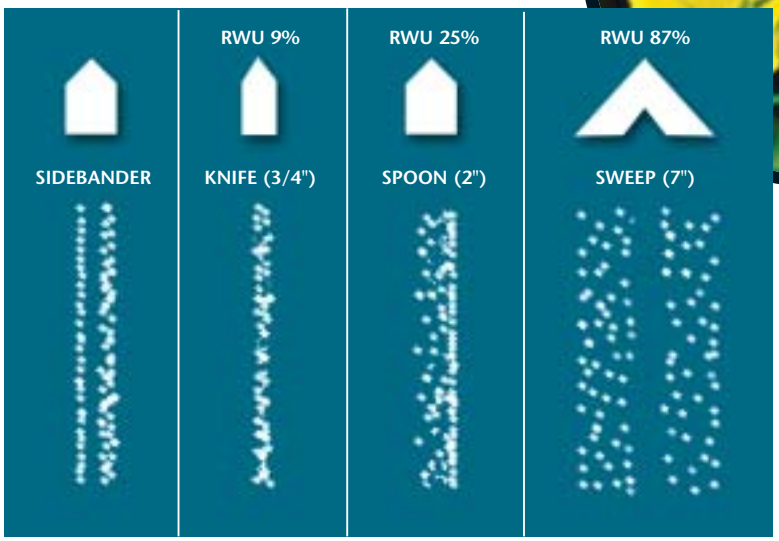
Factors Affecting Fertilizer Placement Decisions

The results must be taken in context with a larger body of work done on seed-placed fertilizer and canola.

The work conducted shows the need to separate canola seed from banded urea to minimize damage to the seedling as it germinates and emerges. Some management techniques can be used to minimize the risk of injury. All involve 'softening' the initial shock of the seed hitting a high concentration of urea early in the growth process.

The primary technique for minimizing early season injury with seed-placed fertilizer is through manipulating row width utilization (Figure 3).

FIGURE 3 **Effect of Opener Types on Row Width Utilization (RWU)**



*** Results achieved using eight inch row spacing.**

RWU is a risk analysis tool to help determine the potential for emergence damage and crop reduction. The higher the RWU, the lower the risk of seed damage and crop loss. This represents the single most important technique to manage seed/fertilizer placement in canola.

Some factors cannot be controlled. Soil characteristics and seedbed moisture all play a part.

TABLE 2 **Factors affecting fertilizer injury and emergence**

FACTOR	RELATIONSHIP
Soil texture	The lighter the soil texture, the higher the risk to emergence damage and yield loss. Sandier soils are more risky than clays. Damage is caused by free ammonia (NH_3). Clay soils hold more ammonium (NH_4), so injury is reduced.
Seedbed moisture conditions at seeding	The lower the seedbed moisture, the higher the risk to emergence damage and yield loss.
Fertilizer source	For canola, the risk is identical for both ammonium nitrate (34-0-0) and urea (46-0-0).
Row space	The wider the row spacing, the higher the risk to emergence damage and yield loss.
Application rate	The higher the N rate, the higher the risk to emergence damage and yield loss.
Crop type	Generally, smaller seeded crops are more sensitive to emergence damage and yield loss to a given rate of N. Be cautious with high N rates placed with canola.
Soil pH	At higher pH more of the N from urea is in the free ammonia form (NH_3) vs. ammonium (NH_4). NH_3 is more damaging. This is one reason why guidelines are more conservative in areas with high pH soils (Manitoba).

A Summary

TABLE 3

Guidelines for fertilizer placement with canola

SOIL TEXTURE	1" spread* (Disc or Knife)** ROW SPACING 6" RWU***	9" RWU***	12" RWU***	2" spread* (Spoon or Hoe) ROW SPACING 6" RWU***	9" RWU***	12" RWU***	3" spread* (Sweep) ROW SPACING 6" RWU***	9" RWU***	12" RWU***
	17%	11%	8%	33%	22%	17%	50%	33%	25%
Light *(sandy loam)*	10 (0)	5 (0)	0 (0)	20 (10)	15 (0)	10 (0)	30 (20)	20 (10)	15 (0)
Medium *(loam to clay loam)*	15 (0)	10 (0)	5 (0)	30 (20)	20 (10)	15 (0)	40 (30)	30 (20)	20 (10)
Heavy *(clay to heavy clay)*	20 (10)	15 (0)	10 (0)	40 (30)	30 (20)	20 (10)	50 (40)	40 (30)	30 (20)

Numbers in brackets ( ) are for Manitoba from Manitoba Agriculture & Food

* Width of spread varies with air flow, soil type, moisture level, amount of trash and other soil conditions, so it must be checked under field conditions.

** Some openers give less than 1" spread.

*** RWU = Row Width Utilization

Based on research from several organizations, these guidelines are approximate safe rates of N (urea) applications with the seed, if **seedbed soil moisture is good to excellent (soil moisture at or near field capacity).**

All rates are in pounds actual N per ac (for example, divide by 0.46 to get lb of 46-0-0 per ac).

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