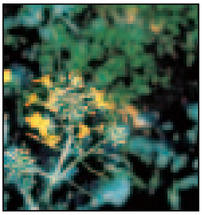

Management of High Yielding Canola Cultivars

By S. Brandt, D. Ulrich, G. Lafond, R. Kutcher, S. Malhi, and A. Johnston

To maximize seed yield, high yielding canola cultivars should be receiving more fertilizer than is currently being applied on the northern Great Plains.

Registered open pollinated and hybrid canola currently grown on the northern Great Plains provide higher yield potential than conventional varieties for farmers. However, the management strategies necessary to achieve optimum yield are not well understood. Nutrients frequently restrict the yield of canola and it is reasonable to expect that higher fertilizer application rates would be required to support higher yields possible with newer cultivars.

Seed of hybrid canola cultivars is several times more expensive than open pollinated types, and therefore reduced seeding rates is seen as a possible area for cutting input costs. Research trials were conducted over a three-year period to evaluate whether combinations of fungicides, seed rates and fertility levels needed to be altered, and whether increased rates of fertilizer nitrogen (N) would be required to optimize the yield of newer high yielding canola cultivars.

Field trials were conducted in Saskatchewan at Melfort (clay), Indian Head (heavy clay), and Scott (loam), between 1999 and 2001. Canola was direct seeded into wheat stubble using low disturbance openers with on row packers. At seeding, N was applied as banded urea, along with a phosphorus (P), potassium (K), and sulfur (S) fertilizer blend. Treatments in the experiment were two cultivars (hybrid and open pollinated), three fertility levels that supplied 2/3, 1.0, and 1 1/3 times a target level of soil test recommendation for N, P, K, and S, and three seeding rates: 2.5, 5.0, and 7.5 lb/A. A fungicide treatment included an application of Ronilan EG (vinclozolin) to control sclerotinia stem rot. At Melfort only, there was an additional application of Quadris (azoxystobin) for blackleg. Background levels of N and S to 24 in. depth, and P and K to 6 in., were measured each year to establish residual soil fertility. Residual soil N varied from 18 to 52 lb/A depending on location and year.

In a second experiment, six N rates were applied (0, 27, 54, 80, 107, and 134 lb/A) as urea using the same open pollinated and hybrid cultivars as above. Residual soil N varied from 22 to 67 lb/A. A single rate of P-K-S blend was applied, with a seed rate of 6.2 lb/A. Growing season moisture conditions were above normal in 1999, near normal in 2000, and below normal in 2001.

The two cultivars responded consistently to seeding rate, nutrient level, and fungicide across all location and years, despite the hybrid producing greater seed yield than open pollinated cultivar. Because the same weight of seed was sown for both cultivars, and the seed size for the hybrid was greater than that of the open pollinated cultivar by an average of 40%, the number of hybrid seeds sown was lower. This was the major factor affecting cultivar differences in plant density (**Table 1**).

Generally, the hybrid had lower densities than the open pollinated cultivar, while the reverse occurred for percent establishment (% of seeds sown that emerged).

Table 1. Plant densities, plant establishment, biomass production, and seed yield of hybrid and open pollinated canola at Scott, Melfort, and Indian Head during 1999-2001. (Data are the mean of three seed rates and three fertility levels).		
Factor[1]	Hybrid	Open Pollinated
Plant density, no./sq yd	67b	79a
Percent establishment, % of seed planted	53	47
Biomass yield, tons/A	3.32a	2.95b
Grain yield, bu/A	32.6a	29.0b

[1]Values in rows followed by a different letter are significantly different at p=0.05.

Biomass and grain yield with the hybrid was similar or higher than the open pollinated cultivar at all locations and years, and averaged 12% higher. With above normal moisture during 1999 grain yield differences between cultivars were relatively small (0.9 bu/A), while in the dry year 2001 grain yield differences between cultivars were quite large (5.5 bu/A). These results provide good evidence that canola hybrids do not require more available moisture to express a yield advantage, and possibly are more drought tolerant.

Both increased seed rate and fertility level generally increased yield (**Table 2**). However, for the low fertility treatment, yield increased when seed rate was increased from 2.5 to 5.0 lb/A, with no further increase at 7.5 lb/A. Similarly, at 2.5 lb/A seed rate, yield was higher for the mid than low fertility level, but further increases in yield were not detected for the high fertility treatment. At the 5.0 and 7.5 lb/A seed rates yield continued to increase with each increase in fertility. This provides strong evidence that higher plant densities are required to take advantage of higher fertility, and vice versa. The lack of an interaction of cultivar with seed rate or fertility level suggests that both canola cultivars require similar seed rates and fertility to optimize yield.

In the N rate trial, the interaction of cultivar with location-year and N rate was significant. The general trend was for the yield of the hybrid to be equal to, or greater than, the yield of the open pollinated cultivar at all N rates. Under dry conditions in 2001, seed yield of both cultivars was maximized with 105 lb/A of applied N (**Figure 1**). But yield was not maximized even with the highest N rate under near normal moisture conditions in 2000. Averaged over all location-years, the seed yield of the hybrid canola was maximized at 40 bu/A with 119 lb/A of fertilizer N/A, while the yield of the open pollinated was maximized at 34 bu/A with 132 lb N/A. The hybrid outyielded the open pollinated cultivar at all levels of applied N indicating that it used N more efficiently. The relative difference in seed yield between the two cultivars increased as N supply increased, yielding 10% more without N application and 17% more when 98 lb N/A was applied.

Table 2. Seed yield (bu/A) with three fertility rates and three seed rates averaged across 7 location-years. (Means for two cultivars and two fungicide treatments).

Fertility level	Seed rate, lb/A [1] 2.5	5.0	7.5
Low	26.8e	30.1d	29.8d
Mid	29.1d	31.9c	33.6b
High	29.9d	33.7b	35.4a

[1]Values in rows followed by a different letter are significantly different at p=0.05.

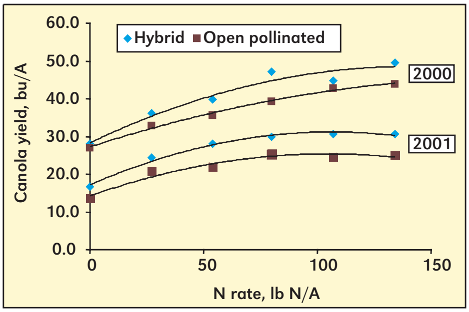

Figure 1. Seed yield of hybrid and open pollinated canola as a function of applied N under normal to above normal moisture conditions in 2000 and below normal moisture conditions in 2001.

In this study, despite an average yield advantage of 3.6 bu/A for the hybrid over the open pollinated cultivar and greater advantage under dry conditions, both cultivars were consistent in their response to seed rate, nutrient level, and fungicide. Fungicide generally failed to increase yield in our trials since disease levels were insignificant. While yields generally increased with increasing fertility and increased seed rate, the seed yield response to high fertility occurred only with high seed rates.

The N response results indicate that target N levels for canola grown on wheat stubble in moisture-limited environments should be the same for a higher yielding hybrid as they are for a high yielding open pollinated cultivar. The results also suggest that high yielding cultivars should be receiving more fertilizer to maximize seed yield than is currently being applied by many farmers. When adequately fertilized with N, greater N use efficiency of hybrid canola results in greater seed yields than the open pollinated cultivar at all location-years, despite a higher seed cost.

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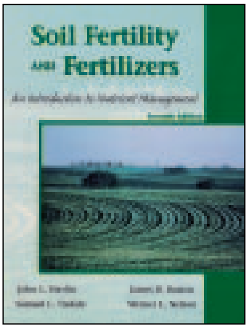

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