More nitrogen

Nitrogen dynamics

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Published: Blackshaw, R. E., X. Hao, R. N. Brandt, G.W. Clayton, K. N. Harker, J. T. O'Donovan, E. N. Johnson. and C. L. Vera. 2011. "Canola Response to ESN and Urea in a Four-Year No-Till Cropping System." Agronomy Journal. 103:92-99.

Li, C., X. Hao, R. E. Blackshaw, J. T. O'Donovan, K. N. Harker, and G. W. Clayton. 2012. "Nitrous oxide emissions in response to ESN and urea, herbicide management, and canola cultivar in a no-till cropping system." Soil and Tillage Research 118:97-106.

Both hybrid and open-pollinated canola responded positively to higher nitrogen fertilizer rates in about 50 percent of the cases. The study also looked at the relationship between nitrogen and weeds, finding that weed tissue nitrogen concentration was often lower with ESN than with urea, indicating that crop-weed competition for soil N might be reduced if ESN were utilized.

Robert Blackshaw with Agriculture and Agri-Food Canada (AAFC) led a multi-year study to determine the merits of polymer-coated urea (specifically Environmentally Smart Nitrogen (ESN) from Agrium) compared with standard urea on weed management and yield of hybrid and open-pollinated (OP) canola. Information from the study will be used to develop improved fertilization strategies for canola production on the semiarid Prairies.

The study started at three Alberta sites in 2005 – Lethbridge, Lacombe and Beaverlodge. Two Saskatchewan sites were added in 2006 – Scott and Melfort. Trials included two varieties of glufosinate-resistant canola (hybrid 5020 and OP LBD2393 LL) and two varieties of barley (hulled AC Lacombe and semi-dwarf hulled Vivar).

Fertilizer treatments consisted of urea or polymer-coated urea (ESN) at rates of 100 percent or 150 percent of recommended levels to reach target yields. In-crop herbicides were applied at 50 percent or 100 percent of recommended rates. Canola was grown in rotation with barley in a no-till system and both crops of the rotation were grown each year. Canola was seeded at 150 seeds/m^2 on nine-inch rows.

Data collected included: crop and weed emergence dates, crop and weed density, crop and weed nitrogen concentration at four and eight weeks after emergence, weed biomass shortly before harvest, crop maturity date, crop yield, and crop quality parameters such as oil and protein concentration.

NITROGEN RESULTS

Hybrid and open-pollinated canola responded positively to the 150 percent fertilizer rate versus the recommended 100 percent rate in about half of the cases. Overall yields were higher for hybrids most of the time.

ESN provided a canola yield increase over urea in 25 percent of the cases. Otherwise yields were the same for both treatments.

Canola seed oil concentration was unaffected by ESN versus urea.

Nitrous oxide emissions were measured at the three Alberta sites. Overall, nitrous oxide emissions averaged 20 percent less with ESN than with urea, indicating

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Table 1. Mean yield increase of hybrid compared with OP canola when significant (P<0.05) differences occurred (15 of 20 site-years).

	kg/ha	bu/ac
Lethbridge	260	5
Lacombe	670	12
Beaverlodge	430	7
Melfort	290	5
Scott	340	6
Mean	400	7

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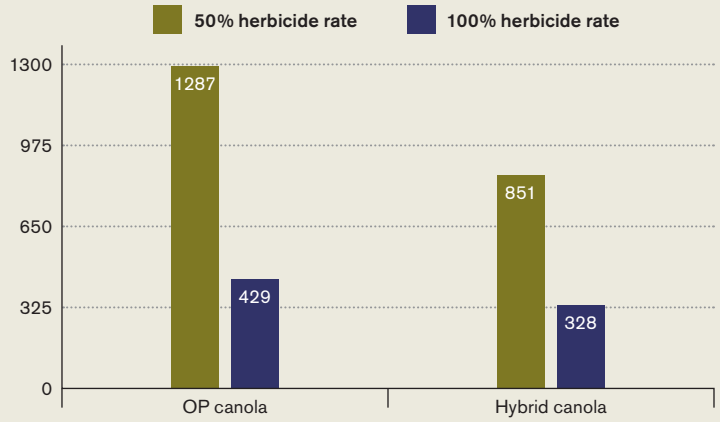
the merits of ESN use, especially in wet environments. However, cumulative nitrous oxide emissions over the three growing seasons were low (0.15 to 2.97 kg N/year) for all treatments and sites. This study confirms that nitrous oxide emissions are not a major concern on the Canadian Prairies. This attribute can be used as a marketing advantage when selling Prairie crops domestically and in the export market.

WEED MANAGEMENT RESULTS

Study results confirmed that hybrid canola cultivars are more competitive with weeds than open-pollinated (OP) canola. Weed tissue nitrogen concentration and weed biomass were often lower with hybrid canola.

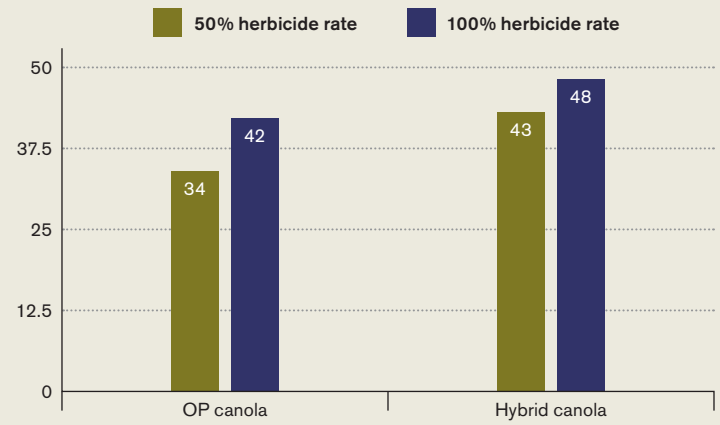
Weed tissue N concentration was often lower with ESN than with urea, indicating that crop-weed competition for soil nitrogen might be reduced if ESN were utilized. ●

Figure 1. Weed biomass (kg/ha) based on herbicide rate



Source: Bob Blackshaw, Agriculture and Agri-Food Canada, 2010.
Notes: Figures based on a mean of 18 site years. Here are the numbers with standard error of the mean in brackets: 1,287 (239); 429 (61); 851 (132); 328 (36).

Figure 2. Canola yield (bu./ac.) based on herbicide rate



Source: Bob Blackshaw, Agriculture and Agri-Food Canada, 2010.
Notes: Figures based on a mean of 18 site years. Here are the numbers with standard error of the mean in brackets: Yields for OP canola: 34 (1.6) and 42 (1.8). Yields for hybrid canola: 43 (2.0); 48 (1.8).

The enhanced efficiency phosphorus fertilizers evaluated in this study provided little economic benefit compared to traditional monoammonium phosphate (MAP) or ammonium polyphosphate (APP) fertilizers. The polymer coated controlled-release MAP (CRP) product may reduce the risk of seedling toxicity if it is necessary to exceed safe levels of seed-placed phosphorus (P) fertilizer to optimize crop yield.

Cynthia Grant with Agriculture and Agri-Food Canada (AAFC) led field studies from 2008 to 2010 to evaluate the effect of various enhanced efficiency P fertilizers on seedling toxicity, yield and quality of canola.

Field studies were conducted at two locations in Western Manitoba, one on a fine sandy loam (FSL) soil and the other on a clay loam (CL). Soil analysis was conducted to select sites low in P to increase the likelihood of seeing a P response. At each location, nitrogen (N) and sulphur (S) were applied before seeding to ensure an adequate nutrient supply for optimum yield, based on soil test results. Pre-plant banding was used to avoid any risk of seedling damage from the N. Plots were seeded using a Seed-Hawk type plot seeder equipped with narrow hoe openers. Seeding rate for the canola was 5 kg/ha.

Polymer coated P

Impact of Traditional and Enhanced Efficiency Phosphorus Fertilizers on Canola Emergence, Yield, Maturity and Quality

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Collaborators: Jo-Anne Relf-Eckstein, Rong Zhou

The trial compared seven treatments: (1) control with no P application; (2) standard MAP; (3) CRP formulated for broad-acre agriculture; (4) Avail-treated MAP, with treatment to sequester antagonistic ions and reduce soil P reactions; (5) ammonium polyphosphate, a liquid product; (6) Avail-treated APP; and (7) Polyon, a polymer coated MAP product formulated for horticulture.

Each source was applied at four application rates (10, 20, 40 and 80 kg P2O5/ha) with a single control, for a total of 25 treatments per site. Each treatment was replicated four times per site.

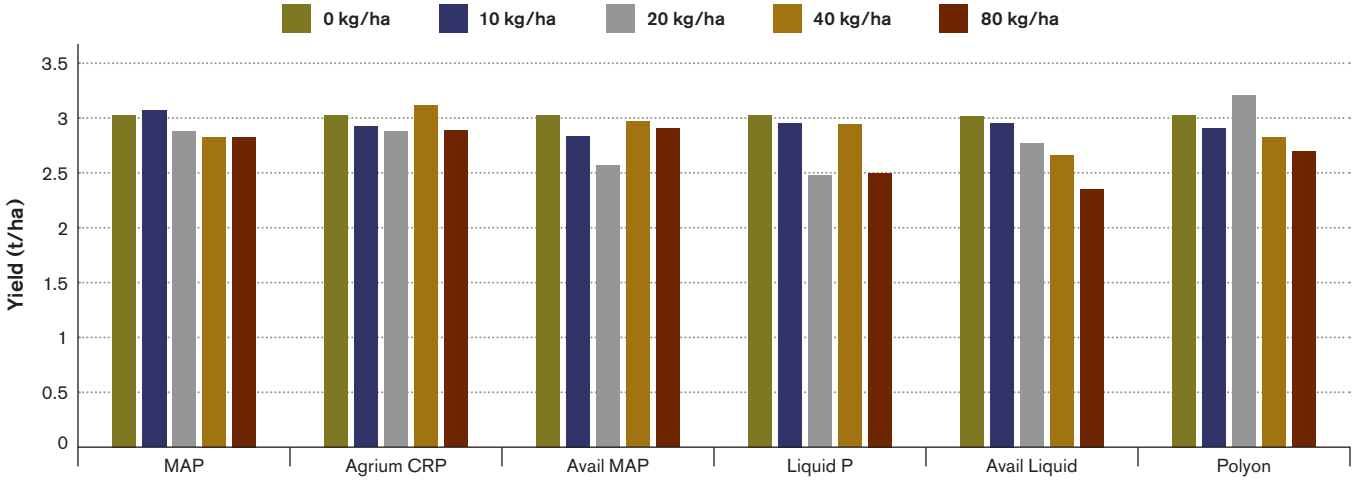
Canola yield generally increased with moderate rates of P application, but there was little difference among P sources in their effects on canola seed yield. Where seedling damage occurred, use of polymer coated MAP reduced the risk.

Seedling damage occurred with high rates of applied P unless soil conditions were very wet, with damage being particularly evident with liquid P. Damage occurred with P rates of 40 and 80 kg P2O5/ha. Yields tended to increase to between 20 and 40 kg P2O5/ha and then decline, reflecting the seedling damage at higher application rates.

The study found that canola could compensate for seedling damage if stands were not reduced below critical levels. Where stand density was low, seed yields declined and maturity was delayed due to seedling toxicity.

An additional part of this study compared yellow- and black-seeded canola cultivars, following the methodology described for the previous study. The yellow-seeded canola displayed extremely poor emergence and vigour. Yields were low in relation to the black-seeded cultivars, and assessing P responsiveness was difficult due to the poor crop performance. ●

Figure 1. Seed yield as affected by source and rate of phosphorous fertilizer at two locations in 2010.



Source: Grant, AAFC 2012