

Effect of Nitrogen Rate and Placement on Barley Productivity and Wild Oat

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Background

- Seed-placed nitrogen (N) in the form of urea can be a popular option for barley producers in western Canada since it allows seeding and fertilizer application to be accomplished simultaneously with minimal soil disturbance.
- The practice is most appealing to zero tillage producers since surface application of fertilizer followed by soil incorporation is not an option.
- However, seedling damage can occur from excess seed-placed urea, and the main negative effects are on crop plant density and maturity.
- Thus, agronomic factors such as crop seeding rate may influence the amount of N that can be placed safely with the seed.
- The presence of weeds may also influence how crops respond to N placement and rate.
- There is little or no information available on the effects of seed-row compared to side-banded N on crop-weed interactions.

Objective

- The objective was to compare the effects of seed-placed and side-banded N applied at different rates, and to investigate if increasing the barley seeding rate would improve its ability to overcome urea-induced injury, compete better with wild oat and improve barley productivity.

Methods

- A field experiment was conducted at three locations (Lacombe and Beaverlodge, Alberta, and Brandon, Manitoba) in western Canada over three years.
- N was applied as urea at five rates (0, 30, 60, 90 and 120 kg ha⁻¹ actual N) either directly with the seed or as a side-band, at three barley (*AC Rosser*) seeding rates (200, 300 and 400 seeds m⁻²).
- The PROC MIXED model of SAS was used to analyze the data with reps and environments (location-years) as random effects and N rate and placement, and barley seeding rate as fixed effects.
- Linear regression analysis was used to describe the effects of N rate and placement on barley plant density, maturity and yield, and wild oat fecundity (seed m⁻²).
- Differences were deemed significant at a < 0.05.

Results

- The most consistent interaction occurred between N rate and N placement and the interaction was highly significant (p < 0.01) for all variables.
- The regression analysis indicated that the response of the variables to increasing N rate was strongly influenced by N placement method (Fig. 1).
- When N was placed in the seed-row, barley plant density decreased, while time to maturity and wild oat fecundity increased with increasing N rate (Fig. 1).
- Barley yield increased at seed-row N rates up to 60 kg ha⁻¹ and then decreased (Fig 1).
- When N was applied as a side-band, yield increased up to 120 kg ha⁻¹ N, delay in maturity was minimal and barley density and wild oat fecundity were unaffected (Fig. 1).
- Seeding rate significantly interacted with N placement method for all variables except barley seed maturity.
- With both N placement methods, increasing the seeding rate had positive effects on barley density and yield while reducing wild oat fecundity (Table 1).
- Increasing the seeding rate partially compensated for the negative effects of N seed-row placement on these variables (Table 1).
- However, barley densities and yields were still lower, and wild oat fecundity greater compared to when N was applied as a side-band (Table 1).

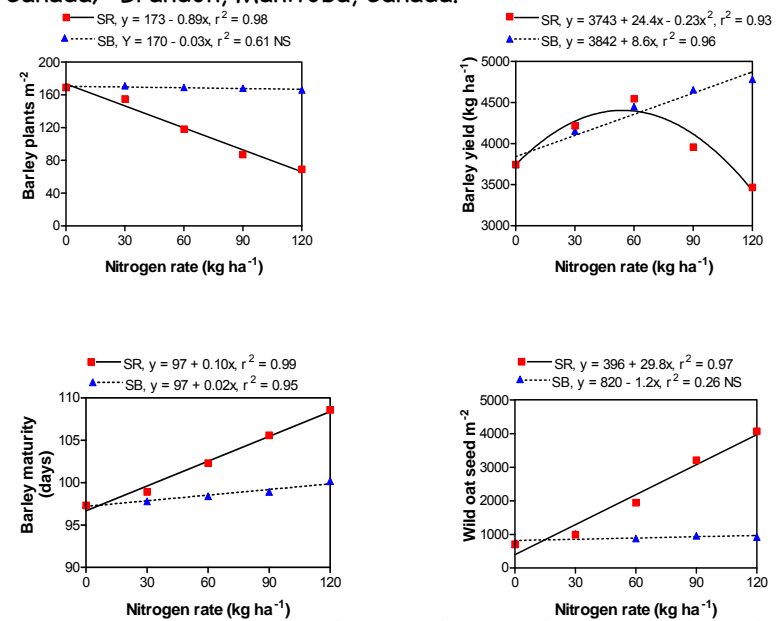


Fig. 1. Interaction between N placement (SR = seed row, SB = side band) and rate on barley plant density, yield and maturity, and wild oat fecundity.

Table 1. Interaction (p < 0.05) between barley seeding rate and N placement on barley plant density, barley seed yield and wild oat fecundity.

Barley seeds m ⁻²	N placement	Barley plants m ⁻²	Barley yield (kg/ha)	Wild oat seed m ⁻²
200	Seed row	94	3810	2586
200	Side band	131	4386	1220
300	Seed row	125	3956	2266
300	Side band	170	4276	838
400	Seed row	141	4193	1694
400	Side band	204	4409	632

Summary and Conclusions

- Barley density, maturity and yield were negatively impacted and wild oat fecundity increased with increasing N (urea) rate when N was applied in the seed-row but not when N was applied as a side-band.
- Increasing the barley seeding rate partially overcame the negative effects of seed-row placed N, but barley densities and yields were still lower, and wild oat fecundity greater compared to when N was applied as a side-band.
- The results suggest that, where possible, N should be side-banded away from the seed rather than placed directly in the seed-row since the risk of seedling damage and associated negative effects is considerably less.

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