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Timing of N application affects winter cereal production

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Timing of N Application Affects Winter Cereal Production

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Objective

To evaluate if mid row banding fertilizer N in fall at seeding is as effective as spring surface broadcast application in meeting N requirements of winter cereals.

Introduction

Fertilizer N is typically surface broadcast (as ammonium nitrate) in early spring for winter cereals (winter wheat and fall rye)(Gusta et al 1999). Fertilizer N applied with or near the seed at seeding has been shown to reduce winter survival of winter wheat (Grant et al. 1984).

Precipitation is required to move surface applied N into the rooting zone where the crop can utilize it. In West - Central Saskatchewan, winter cereals fertilized in this manner often show severe N deficiency symptoms, that persist as late as early tillering of the crop. Symptoms are most noticeable in dry springs, a frequent occurrence in the area.

Seeding equipment that can mid row band fertilizer while seeding has recently been developed. Such placement may make N available to the crop earlier in the growing season than is possible than with spring surface broadcasting.

To evaluate whether this method of N application is advantageous, we conducted research comparing fall mid row banded N with spring broadcast N during 1998 to 2000 at the Scott Research Farm.

Materials and Methods

Winter cereals (Prima fall rye in all years, CDC Claire winter wheat in 2000) were direct seeded, at recommended seeding rates into standing wheat stubble between Aug 29 and Sept 1 of each year. A high clearance hoe drill (20 cm row spacing) that placed fertilizer phosphate near the seed was used for all seeding operations.

For the fall mid row banded treatments, fertilizer nitrogen as urea (46-0-0) was placed using double disc openers placed between every second pair of hoes on the drill. For the spring broadcast treatments, ammonium nitrate (34-0-0) was used. During the first 2 years, N rates of 0,30,60 and 90 kg ha^{-1} were used and in 1999-2000, rates were 0,20,40,80,160 kg ha^{-1}.

For winter annual weed control, MCPA amine 500 was applied at 0.84 L ha-1 in late October of each year.

Results and Discussion

During the 1998 growing season, precipitation was much below normal for all months except June, which was near normal (Table 1). As a result, fall rye grain yield was low for all treatments, although there was a small N response noted. At late tillering, the mid row band treatments showed little evidence of N deficiency, while spring broadcast treatments appeared deficient (visibly pale green and less vigorous), particularly at rates of 30 and 60 kg ha^{-1}. Despite visual differences earlier, the response to N was similar for fall mid row banded urea as for spring broadcast ammonium nitrate (Fig.1).

Precipitation was well above normal for April, May and July of 1999. Under these conditions, large responses to N were noted. Ample spring rainfall likely moved spring broadcast nitrogen into the soil shortly after application. However, mid row banded N consistently provided yields that were 12-15 % higher than for spring broadcast N (Fig.2).

Table 1. Precipitation (mm) conditions at Scott during the 1998, 1999 and 2000 growing seasons.

	1998	1999	2000	Long Term
April	12	52	39	23
May	5	46	24	36
June	64	46	38	60
July	16	76	76	59
August	14	54	60	45

April and July precipitation were well above normal in 2000, but below normal for May and June. Fall rye and winter wheat again showed large yield increases in response to fertilizer N, and mid row banding was higher yielding than spring broadcast for both crops(Fig. 3 and 4).

At the outset of the study it was expected that mid row banding would work best in dry springs. However, the positive response to this treatment in 1999 suggests that even when spring moisture conditions are favorable, mid row banding may be beneficial. Not surprisingly, in drought years, the benefits of N and of mid row banding appear to be reduced. This response is likely because water and not N is more limiting to crop production.

With surface broadcasting, it is possible that more N was lost or temporarily tied up in surface residues. If this were the case, adding more N should compensate for such losses. The range of N rates used in 1998 and 1999 may not have been high enough to address this issue. However the rates used in 2000 were much higher, but even at the highest rates, mid row banding maintained an advantage over spring broadcasting. This supports the theory that earlier availability of N and not reduced N losses were contributing to higher yield.

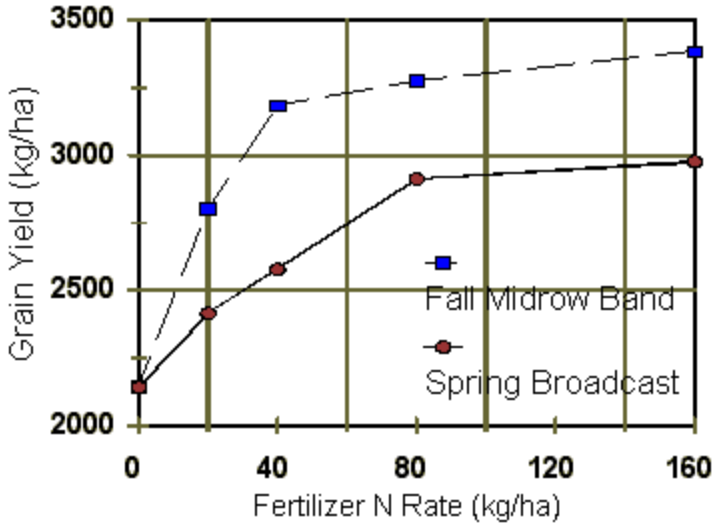

Figure 1. Fall rye yield response fall midrow banded and spring broadcast N at 4 rates in 1998.

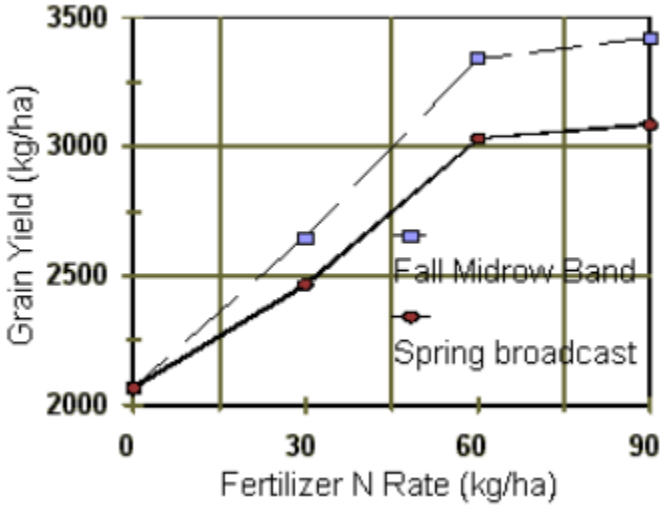

Figure 2. Fall rye yield response fall midrow banded and spring broadcast N at 4 rates in 1999.

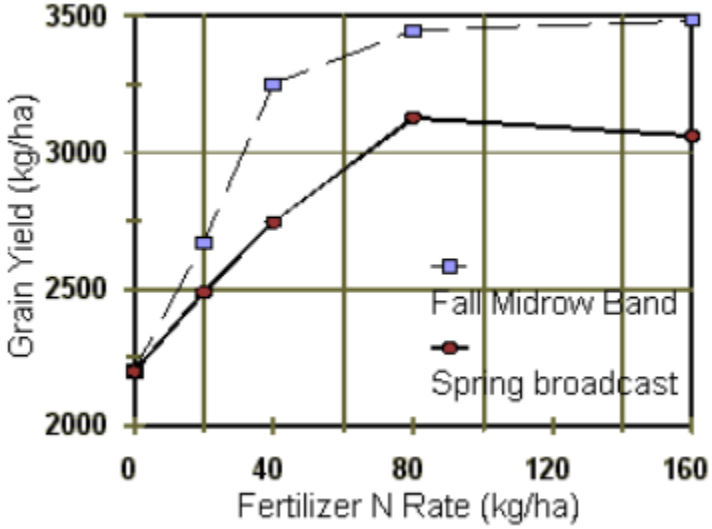

Figure 3. Fall rye yield response to fall midrow banded and spring broadcast N at 5 rates in 2000.

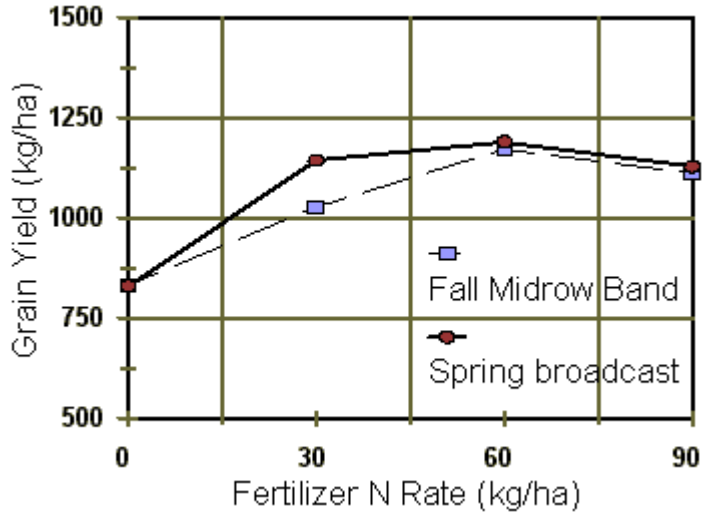

Figure 4. Winter wheat yield response to fall midrow banded and spring broadcast N at 5 rates in 2000.

Conclusion

While this research is still preliminary, it does indicate that mid row banding of fertilizer N in fall does have potential to enhance yield of winter cereals. This practice would allow growers to seed and fertilize in a single operation, as well as to use the more readily available and lower cost urea N formulation as opposed to ammonium nitrate.

References

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