IMPACT OF NITROGEN, VARIETY, AND FUNGICIDE ON SUGARBEET YIELD AND QUALITY

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Nitrogen (N) is the most important nutrient element applied as fertilizer for sugarbeet since few soils have adequate amounts of nitrogen in an available form for optimum sugarbeet yield. Nitrogen improves color and vigor of the canopy which resulted in over-use of this type of fertilizer. In the United Kingdom, nitrogen usage was reduced from about 13 pounds per ton of roots in the 1970s to about 3.7 pounds per ton of roots in 2000 (Draycott and Martindale, 2000). In North Dakota, 8.5 pounds of nitrogen per ton of roots was recommended in the 1970s (Wagner et al., 1976). The N rate was reduced to 6.6 pounds per ton of roots in the 1990s and is currently about 5.2 pounds per ton of roots. Prior to the mid-2000s, most of the sugarbeet varieties were of the larger, triploid type. With the advent of Rhizomania in all sugarbeet production areas, diploid varieties, typically smaller than triploid varieties, became more widely used. In the late 1990s and early to mid-2000s, an average yield of 20 tons per acre was considered a good yield. Over the past five years, average yield in North Dakota and Minnesota increased to about 25 tons per acre. The nitrogen recommendation of 130 lb N per acre was not changed even when yield increased by 25%. Leaf architecture of diploid varieties may be characterized as either erect or somewhat prostrate and close to the ground. Fungicides are typically used for controlling Cercospora leaf spot but are sometimes used in the absence of disease in an attempt to increase yield. It will be useful to know whether N rates should be adjusted for optimum yield and quality of newer diploid varieties, and whether fungicides increase sugarbeet yield.

The objective of this research was to determine the best N rate for sugarbeet varieties with different leaf architecture and whether fungicides increase sugarbeet yield and quality.

MATERIALS AND METHODS

Research was conducted at Foxhome, MN in 2010. The experimental design was a split-split plot arrangement of a randomized complete block design with four replicates. There were four levels of the whole plot factor, nitrogen rate (70, 100, 130 and 160 lb per acre); two levels of the subplot factor, variety (A and B; proprietary material of Syngenta seeds and Crystal Beet Seeds, respectively); and five levels of the sub-subplot factor, fungicide (non-treated check, Inspire XT applied at 7 fl oz/A, Headline at 9 fl oz/A, Eminent at 13 fl oz/A, and Proline+NIS at 5 fl oz/A + 0.125% v/v, respectively). Individual plots comprised of six 30-feet long rows spaced 22 inches apart. The site was fertilized with urea on 19 May, and incorporated immediately, just prior to planting. Seeds were treated with Tachigaren (45 g/kg seed) and Poncho beta, and Counter 15G insecticide was applied at planting. The center two-rows of plots were thinned manually on 18 and 28 June to 41,580 plants per acre. Weeds were controlled with two applications of glyphosate.

Fungicide spray treatments were applied with a CO_2 pressurized 4-nozzle boom sprayer with 11002 TT TwinJet nozzles calibrated to deliver 17 gpa of solution at 60 p.s.i pressure to the middle four rows of plots on 20 August.

Plots were defoliated mechanically and harvested using a mechanical harvester on 29 September. Stand counts were taken after defoliation and before harvest. The middle two rows of each plot were harvested and weighed for root yield. Twelve to 15 representative roots from each plot, not including roots on the ends of the plot, were analyzed for quality at the American Crystal Sugar Company Quality Tare Laboratory, Moorhead, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8 software package (Gylling Data Management Inc., Brookings, South Dakota, 2010).

RESULTS AND DISCUSSIONS

Warm and wet conditions resulted in good germination, emergence, and plant stand in early June. Variety A was greener compared to Variety B. Both varieties took longer to close canopy at the 70 lb per acre N rate compared to the higher N rates. There were some Rhizoctonia infected plants by mid-July, and Cercospora leaf spot was present before fungicide treatments were applied.

There were no significant interactions among the N rates, varieties, and fungicides. The main effects were significant for some of the parameters evaluated. Nitrogen resulted in significantly greater tonnage and recoverable sucrose at the 100 to 160 lb per acre rate compared to the 70 lb per acre rate. However, sucrose concentration was significantly lower at the 160 lb per acre N rate compared to the 70 to 130 lb per acre N rate. Variety A produced significantly greater tonnage, sucrose concentration, and recoverable sucrose than Variety B. Variety A had better Cercospora leaf spot and Rhizoctonia tolerance than Variety B. Since both diseases were present at Foxhome, the more disease susceptible variety B suffered yield and quality losses. Cercospora leaf spot impacted the plants later in the season. Fungicides provided leaf spot protection and resulted in significantly higher sucrose concentration and recoverable sucrose than the non-treated check. There were no significant differences in sugarbeet yield and quality among fungicides.

Table 1. Effect of Nitrogen rate, variety, and fungicide on sugarbeet yield and quality at Foxhome, MN in 2010.

Total soil Nitrogen (lbs/A)	**Yield (tons/A)**	**Sucrose concentration (%)**	**Recoverable sucrose (lbs/A)**
70	22.7	16.6	7068
100	28.6	16.6	8870
130	29.9	16.7	9307
160	30.6	16.3	9238
N Rate LSD (P=0.05)	2.4	0.2	719
Variety			
A	29.5	16.8	9199
B	26.4	16.3	8043
Variety LSD (P=0.05)	0.5	0.2	240
Fungicide			
Nontreated check	27.4	16.2	8229
Inspire XT at 7 fl oz/A	28.4	16.7	8849
Headline at 9 fl oz/A	28	16.6	8639
Eminent at 13 fl oz/A	27.8	16.6	8618
Proline + NIS at 5 fl oz/A + 0.125% v/v	28.3	16.6	8771
Fungicide LSD (P=0.05)	NS	0.2	289

References

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