
EFFECT OF SUGARBEET PLANT SPACING UNIFORMITY ON SUGAR PRODUCTION IN THE RED RIVER VALLEY OF THE NORTH

J.F. GILES AND N.R. CATTANACH

*Department of Soil Science, North Dakota State University,
Fargo, North Dakota, USA*

ABSTRACT

Increasing ground speed of a MaxEmerge 2 planter results in non-uniform plant spacing. Field studies were conducted in 2001 and 2002 to evaluate the effect of sugarbeet within-row space uniformity on sugar production in the soils of the Red River Valley. Minimum build-up and pellet seed types planted at ground speeds of 1.8, 2.2, 2.7 and 3.1 ms^{-1} were used to establish non-uniform plant spacing in these studies. Plant space distribution was determined at the 2 to 4 leaf stage and root yield and extractable sucrose were measured at harvest. Uniformity of plant spacing decreased with increasing ground speed, regardless of seed type. Recoverable sugar production was reduced with increasing ground speed.

INTRODUCTION

Uniform spacing of sugarbeet (*Beta vulgaris* L.) plants is recommended to maximize light interception and reduce weed competition in order to maximize production of sugar. With the rapid changes in soil moisture conditions and a very short time period for planting in during the early spring, there is a desire among sugarbeet growers to increase planter ground speed. Results from planter test stand grease belts have shown decrease in uniformity of seed spacing with increasing ground speeds. The objectives of this study were to determine (1) the effect of increasing planter ground speed on sugarbeet plant spacing in the field and (2) the effect of plant spacing on sugar production.

MATERIALS AND METHODS

Field experiments were established on Bearden silty clay loam (Fine-silty, mixed, super active, frigid, Aeric Calciaquoll) near Glyndon, MN in 2001 and 2002. The experiment was arranged in a randomized complete block design with six replications. Individual treatment plots measured 3.3 m wide and 9.1 m long. Soil nitrogen levels were adjusted with fertilizer to approximately 145 kg ha^{-1} of available residual soil test plus added fertilizer N.

Sugarbeet, Crystal 9581, was planted May 25, 2001 and May 1, 2002 with a 6-row John Deere MaxEmerge 2 at ground speeds of 1.8, 2.2, 2.7, and 3.1 m s^{-1} . Small minimum buildup and MiniPellet (2M) seed were used both years at each

of the ground speeds. Sugarbeet was placed 3.2 cm deep with a 14 cm in-row spacing in 2001 and a 13.3 cm spacing in 2002. A 56 cm row spacing was used. Counter was surfaced band applied at 13.3 kg ha⁻¹ and incorporated with chain at planting. The distance between sugarbeet plants was determined to the nearest 1.2 cm at the two to four leaf stage of growth. Post emergence herbicides, cultivation and hand labor was used as needed for weed control. Two applications each of Eminent and Super Tin were applied for Cercospora leafspot control.

Sugarbeet were harvested the last week of September each year. Plant top material was removed with an Alloway 3-drum flail at a ground speed of 3.1 m s⁻¹. The middle two rows of each 6 row plot were harvested. Yield determinations were made and quality analysis performed at American Crystal Sugar Quality Tare Lab, East Grand Forks, MN.

RESULTS AND DISCUSSION

The uniformity of sugarbeet plant spacing was decreased with increasing planter ground speed (Fig. 1-4). Percent of total number of plants at the target seed spacing was reduced more with increasing ground speed in 2001 with MiniPellet seed and in 2002 with both seed types. Occurrence of plants with in 2.4 or 4.8 cm of each other is more common with the minimum build-up seed.

The recoverable sugar production was higher in 2001 (Table 1) than that of 2002 (Table 2), even though planting occurred earlier in 2002. Below normal temperatures experienced in May 2002 delayed emergence and growth of sugarbeet in to early June. Differences between seed types were not statistically significant in either year, thus speed means are shown in the tables. Although statistical analyses do not show significant differences in the harvest parameters, a decrease in net sucrose percentage, root yield, extractable sugar, and harvest population with increasing ground speed is shown in both years. Some of this decrease is due to the inability to completely remove top growth material from the crown of sugarbeet that is in close proximity to other sugarbeet, causing a lower net sucrose. The competition between these close sugarbeet plants also reduces the number of harvestable roots, thus decreasing root yield. The reduction in gross return per ton of \$.98 and \$1.25, and \$30.76 and \$35.20 ha⁻¹, as planter speed increases from 1.8 to 3.1 m s⁻¹, in 2001 and 2002 respectively, can have a great impact on the cash flow of an individual grower.

CONCLUSION

Increasing planter ground speed caused non-uniformity in sugarbeet plant spacing. As a result of this irregular plant spacing, sugar production decreased due petioles remaining on the crown following flailing and the competition of close sugarbeet plants to obtain size sufficient for harvest. Using lower ground speed during planting is recommended.

Figure 1. Effect of planter ground speed on sugarbeet plant spacing with minimum buildup seed at target spacing of 14 cm, 2001.

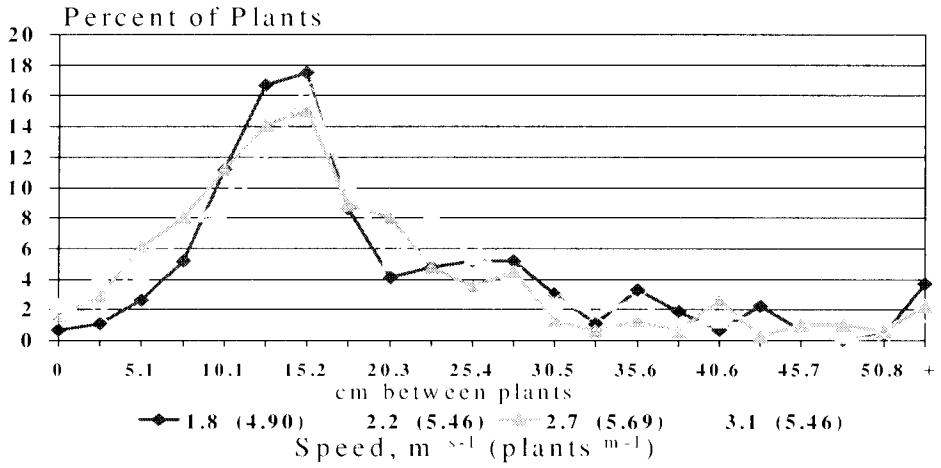


Figure 2. Effect of planter ground speed on sugarbeet plant spacing with MiniPellet seed at target spacing of 14 cm, 2001.

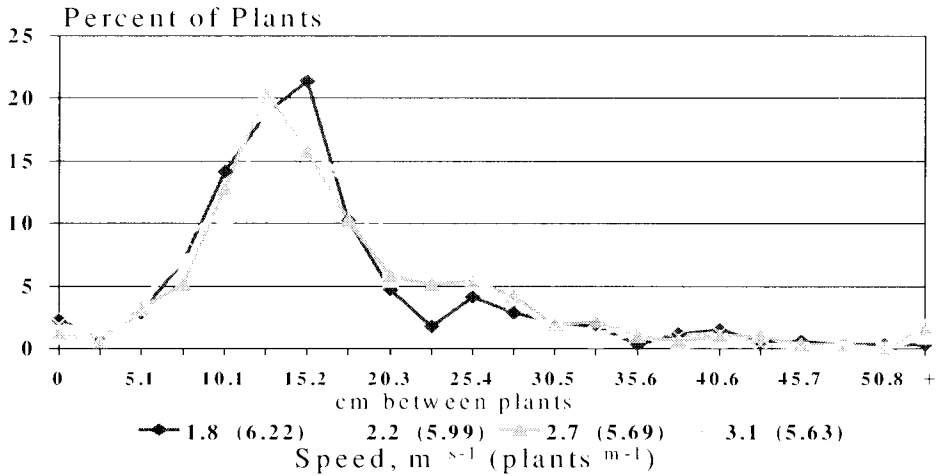


Figure 3. Effect of planter ground speed on sugarbeet plant spacing with minimum buildup seed at target spacing of 13.3 cm, 2002.

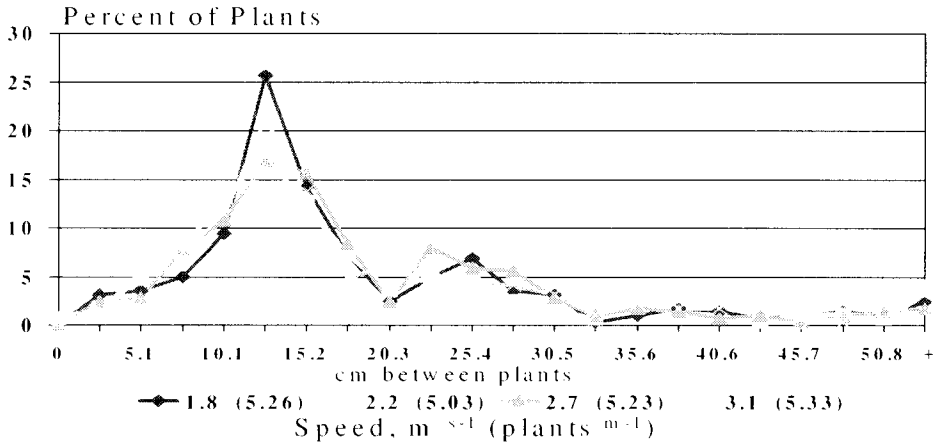


Figure 4. Effect of planter ground speed on sugarbeet plant spacing with MiniPellet seed at target spacing of 13.3 cm, 2002.

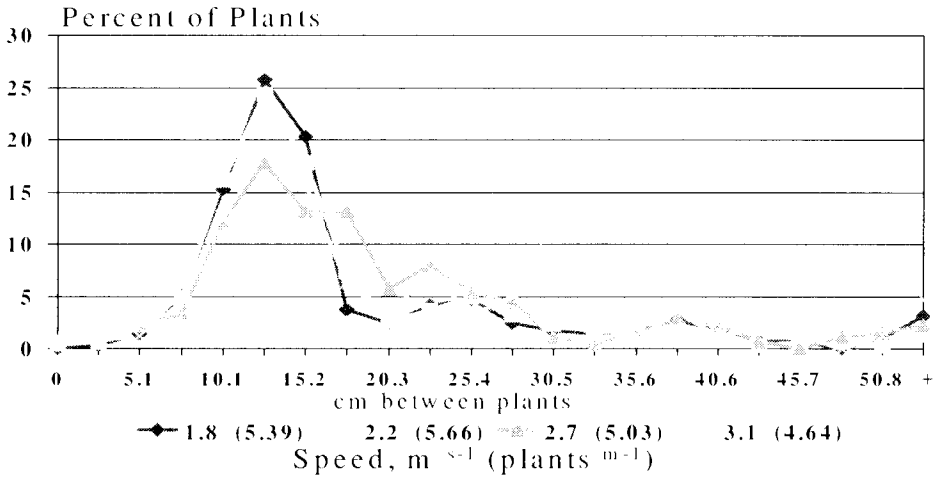


Table 1. Effect of planter ground speed on net sucrose percentage, root yields, recoverable sugar production, harvest population and gross return, 2001.

PLANTER SPEED (m s ⁻¹)	Net Sucrose (%)	Root Yield (t/ha)	Ext. Sugar yield (t/ha)	Harvest Population (beets/30.4m)	Gross Return (\$/t)	Gross Return (\$/ha)
1.8	14.95	53.1	7.94	153	34.47	331
2.2	14.81	52.6	7.80	148	33.85	322
2.7	14.96	51.1	7.63	148	34.51	322
3.1	14.42	51.2	7.44	144	32.04	300
LSD (.05)	ns	ns	ns	ns	ns	ns

Table 2. Effect of planter ground speed on net sucrose percentage, root yields, recoverable sugar production, harvest population and gross return, 2002.

PLANTER SPEED (m s ⁻¹)	Net Sucrose (%)	Root Yield (t/ha)	Ext. Sugar yield (t/ha)	Harvest Population (beets/30.4m)	Gross Return (\$/t)	Gross Return (\$/ha)
1.8	14.15	45.3	6.40	151	30.80	252
2.2	14.13	45.5	6.44	157	30.72	254
2.7	13.77	44.8	6.19	145	29.02	237
3.1	13.47	43.0	5.81	129	27.70	217
LSD (.05)	.64	ns	ns	14	2.94	ns