EFFECT OF PLANT POPULATION AND PLANTING DATE ON SUGAR PRODUCTION

Joseph F. Giles and Norman R. Cattanach

Associate Professor and Research Specialist
Department of Soil Science, North Dakota State University

Introduction

Plant populations of 150 to 175 plants per 100 ft of 22 inch row are recommended at the six leaf growth stage for early seeded sugarbeet to maximize sugar production in the Red River Valley of Minnesota and North Dakota. Most of the research on which this recommendation is based was conducted during the late 1970's and early 1980's and is reported in the Sugarbeet Research and Extension Reports. Some of the studies evaluated the effect date of planting and plant population had on sugarbeet yield and quality. Limited data evaluating the date of planting has been collected in recent years. The lateness of planting in the spring of 2001provided an opportunity to evaluate the effect of plant population effects on late seeded sugarbeet. This study was expanded in 2004 to include two planting dates using two varieties of sugarbeet, a low sugar variety, HH 2469 which is also resistant to rhizomania and a low sugar variety, Beta 3820 a rhizomania susceptible variety.

Materials and Methods

Field experiment was established on Glyndon loam (Coarse-silty, mixed, superactive, frigid Aeric Calciaquoll) at the Rhizomania Research site near Glyndon, MN. Each planting date was arranged in a randomized complete block design with three replications. Individual treatment plots measured 11 feet wide and 30 feet long. Soil N levels were adjusted with fertilizer to approximately 130 lbs/acre of available residual soil test plus added fertilizer N.

Sugarbeet, rhizomania resistant Hilleshog 2469 and rhizomania susceptible Beta 3820, was planted on April 28 and May 27 with a John Deere MaxEmerge 2. Sugarbeet was placed 1.25 inches deep with 3-inch in-row spacing. A 22-inch row spacing was used. Counter was surfaced band applied at 11.9 lbs/a and incorporated with chain at planting. Post emergence herbicides, cultivation and hand labor was used as needed for weed control. Three applications of fungicide, Eminent, Headline, and Eminent were applied for Cercospora leafspot control.

Sugarbeet populations of 75, 100, 125, 150, 175, and 200 plants per 100 feet of row were established with hand thinning at the four-leaf stage on the early planting date. As a result of poor germination on the late planting date, populations of 75, 100, 125, and 150 beets per 100 feet of row were established.

Sugarbeet were harvested October 6. 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 yield data indicate a population of at least 100 plants per 100 feet of row, except Beta 3820,75 plants, early planting date, is needed to maximize sugar production (Table 1- 4). The significant increases in recoverable sugar per acre occurred with plant populations of 100 and 200 in the April 28 planting and 125 plant population when compared to plant population of 75 in the May 27 planting date with HH 2469. Plant populations of 150 and 175 produced the most recoverable sugar in the April 28 planting of Beta 3820 and 150 plants per 100 feet of row produced the most recoverable sugar in the May 27 planting. A plant population of 75 plants per 100 feet of row in the April 28 planting of both Beta 3820 or HH 2469 produced more recoverable sugar than any May 27 planting plant population. A non-significant decrease in root yield, recoverable sugar per acre resulted as plant population reached 200 with the Beta 3820 early planting date and HH 2469 late planting date. This decrease may be due to the large decrease in harvestable roots as a percentage of the established plant population, especially with the HH 2469.

The April 28 planting significantly increased the root yield and recoverable sugar per acre, and gross revenue per acre, as compared to the May 27 planting (Table 5). The differences are mostly the result of a cool, wet spring, high percentage of surface straw residue, and poor emergence of the late planted varieties resulting in slow plant growth.

With environmental conditions which are conducive to the development of rhizomania, the rhizomania resistant variety HH 2469 produced higher root yield and recoverable sugar per acre, and more gross revenue per acre than the rhizomania susceptible variety Beta 3820 (Table 6).

Table 1. Effect of planting date (April 28) and population of Beta 3820 on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Rhizomania site, Glyndon, MN, 2004.

POPULATION (plants /A)		ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
17820	(75)	19.5	14.0	5454	279	93	28.5	556
23760	(100)	17.8	14.6	5192	292	108	31.3	557
29700	(125)	18.6	14.8	5525	297	125	32.4	604
35640	(150)	19.2	14.5	5586	291	130	31.0	596
41580	(175)	19.4	14.8	5729	295	140	32.0	621
47520	(200)	17.1	14.9	5090	298	164	32.7	558
LSD (.05)		ns	0.4	ns	8	13	1.7	81

Table 2. Effect of planting date (May 27) and population of Beta 3820 on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Glyndon, MN, 2004.

POPULATION (plants /A)		ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
17820	(75)	12.6	14.4	3614	287	76	30.2	381
23760	(100)	13.4	14.7	3947	295	100	32.0	429
29700	(125)	13.9	14.8	4104	296	112	32.3	446
35640	(150)	15.2	14.6	4455	293	131	31.5	480
LSD (.05)		ns	ns	ns	ns	13	ns	ns

Table 3. Effect of planting date (April 28) and population of Hilleshog 2469 on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Glyndon, MN, 2004.

POPULATION (plants /A)		ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
17820	(75)	20.6	14.5	5968	290	86	31.0	636
23760	(100)	26.2	14.1	7375	282	122	29.1	760
29700	(125)	22.6	14.5	6579	290	142	31.0	703
35640	(150)	22.4	15.1	6729	301	148	33.3	744
41580	(175)	23.2	14.4	6685	289	169	30.6	707
47520	(200)	24.7	14.3	7067	286	194	29.9	742
LSD (.05)		ns	0.4	887	7.6	13	1.8	ns

Table 4. Effect of planting date (May 27) and population of Hilleshog 2469 on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Glyndon, MN, 2004.

POPULATION (plants /A)		ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
17820	(75)	13.0	14.5	3759	290	77	30.8	400
23760	(100)	14.8	14.1	4169	283	96	29.3	431
29700	(125)	15.9	14.4	4573	288	103	30.4	482
35640	(150)	14.8	14.8	4389	296	119	32.2	477
LSD (.05)		2.9	0.7	813	13	10	3	83

Table 5. Effect of planting date over population and variety on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Glyndon, MN, 2004.

PLANTING DATE	ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
April 28	21.0	14.5	6082	291	135	31.1	649
May 27	14.0	14.5	4080	291	100	31.1	436
LSD (0.5)	ns	ns	177	ns	16	ns	57

Table 6. Effect of variety over population and planting date on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population, Glyndon, MN, 2004.

VARIETY	ROOT YIELD Tons/A	NET SUCROSE Percent	REC SUGAR Lbs/Acre	REC SUGAR Lbs/T	HARVEST BEETS /100 FT	GROSS RETURN $/T	GROSS RETURN $/A
Beta3820	16.1	14.7	4709	293	116	31.6	507
Hilleshog 2469	18.9	14.4	5452	289	119	30.6	578
LSD (0.5)	2.3	0.2	651	3	ns	0.7	69