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PLANT POPULATION AND DATE OF PLANTING EFFECTS WITH RHIZOMANIA RESISTANCE AND SUSCEPTIBLE VARIETIES ON SUGARBEET YIELD AND QUALITY

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Sugarbeet yield and quality with some rhizomania resistant varieties is lower than that of comparable susceptible varieties making growers reluctant to use them. This trial was designed to determine if increasing the plant population of a rhizomania resistant variety would increase overall quality as well as yield compared to a susceptible check under a non-rhizomania environment. A similar trial at a known rhizomania location was conducted by Dr. Joseph Giles, North Dakota State University.

Procedure: Beta 4811 (resistant) and Crystal 999 (susceptible) sugarbeet seed were planted in 22-inch rows at a 1.25 inch spacing to insure adequate thinning populations on April 25 and May 27, 2003. The varieties were chosen for their similarity in yield, but wide differences in net sucrose % and recoverable sugar per ton (RST) and acre (RSA).

Both planting dates were thinned to uniform populations of 17820, 23760, 29700, 35640, 41580, 47520, and 53460 seedlings per acre at the six-leaf stage. These populations correspond to plant populations of 75, 100, 125, 150, 175, 200, and 225 plants per 100 ft of 22-inch row. Recommended fertility, herbicide, insecticide and fungicide practices were followed. The trial was harvested on September 23 and quality determined at the ACSC Quality Laboratory in East Grand Forks, MN.

Results and Discussion: Planting date (PD), population (P) and variety (V) effects were statistically significant for the variables net sucrose %, RSA, and RST (Table 1). Varieties were not statistically different for yield, but were for PD and P. There were no significant interactions.

Analysis of the individual varieties at each planting date is shown in Tables 2 - 5. The April 25 planting for Crystal 999 showed no statistical differences in RSA, RST, yield, % sucrose, gross return/T or acre between plant populations of 29700-43460. These populations were significantly higher in these variables as compared to the two lowest populations. The rhizomania resistant variety, Beta 4811, had the highest RSA and yield at populations 35640-47520. The 29700 plant/A population was not statistically different than the 47520 population for these traits. At the highest population (53460) there was a significant reduction is RSA and yield as compared to the populations of 35640-47520.

Populations of 35640 and 41580 with Crystal 999 at the May 27 planting had higher RSA than the three lowest plant populations. For the other variables measured, considerable variation occurred. However, in all cases the highest population (53460) had significantly higher RSA and yield than the two lowest populations. The rhizomania resistant variety had the highest RSA and yield at populations of 29700-53400. There was no statistical differences in RST, % sucrose, and % LTM between the different populations.

The main effects of PD, V and P are shown in Tables 6-8. Plant populations of 35640-41580 produced significantly higher RSA and yield as compared to the other populations. There was no difference between the populations of 29700, 47520 and 53460 in these variables.

Summary: While overall quality was improved by increasing plant population, both varieties performed in a similar fashion. The hoped for improvement in quality of the rhizomania resistant variety as compared to the susceptible check failed to occur.

Table 1. ANOVA

	RSA	RST	Yield	Net Sucrose	LTM

Source	(lb/A)	(lb/T)	(T/A)	(%)	(%)
Planting Date (PD)	((	((	((	((	((
Variety (V)	((	((	NS	((	NS
V x PD	NS	NS	NS	NS	NS
Population (P)	((	((	((	((	NS
P x V	NS	NS	NS	NS	NS
P x Pd	NS	NS	NS	NS	NS
P x V x Pd	NS	NS	NS	NS	NS

**, *, Statistically significant at the 1 and 5% levels respectively

Table 2. Effect of planting date (April 25) and population on Beta 4811

Population (plants /A)	RSA (lb)	RST (lb)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return[1] $/T	Gross Return[1] $/A
17820 (75)	4634	268.0	17.3	14.70	1.30	26.00	449
23760 (100)	4970	276.0	18.0	15.05	1.25	27.79	500
29700 (125)	5764	287.5	20.0	15.50	1.13	30.38	609
35640 (150)	6326	294.0	21.5	15.80	1.10	31.84	685
41580 (175)	6423	295.0	21.8	15.90	1.15	32.07	699
47520 (200)	6166	292.0	21.1	15.75	1.15	31.39	663
53460 (225)	5615	285.5	19.6	15.50	1.23	29.93	589
Statistical Sign.	**	**	**	**	NS	**	**
LSD_{05}	508	12.3	1.4	0.56	----	2.77	75

1. Basis - ACSC November 15, 2003 payment

Table 3. Effect of planting date (May 27) and population on Beta 4811

Population (plants /A)	RSA (lb)	RST (lb)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return[1] $/T	Gross Return[1] $/A
17820 (75)	4068	253.5	16.0	14.00	1.33	22.73	365
23760 (100)	4321	255.0	17.0	14.05	1.30	23.09	390
29700 (125)	4942	266.0	18.6	14.58	1.28	25.54	474
35640 (150)	5189	264.5	19.6	14.53	1.30	25.20	495
41580 (175)	5268	268.5	19.6	14.68	1.25	26.10	513
47520 (200)	4923	265.5	18.6	14.58	1.30	25.43	471
53460 (225)	4973	268.0	18.6	14.68	1.28	25.99	482
Statistical Sign.	**	NS	**	NS	NS	NS	**
LSD_{05}	444	----	1.4	----	----	-----	71

Table 4. Effect of planting date (April 25) and population on Crystal 999

Population (plants /A)	RSA (lb)	RST (lb)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return $/T	Gross Return $/A
17820 (75)	5995	290.5	17.9	15.68	1.15	31.05	556
23760 (100)	6009	298.0	202	15.95	1.05	32.74	660
29700 (125)	6618	316.5	20.9	16.92	1.10	36.90	772
35640 (150)	6695	316.5	21.2	17.00	1.18	36.90	781
41580 (175)	6699	319.0	21.0	16.98	1.03	37.47	787
47520 (200)	6676	324.5	20.6	17.23	1.00	38.70	796
53460 (225)	6729	324.0	20.8	17.35	1.15	38.59	801
Statistical Sign.	**	**	**	**	NS	**	**
LSD_{05}	565	14.8	1.6	0.65	----	3.33	84

Table 5. Effect of planting date (May 27) and population on Crystal 999

Population	RSA	RST	Yield	Sucrose	LTM	Gross Return

(plants /A)	(lb)	(lb)	(T/A)	(%)	(%)	$/T	$/A
17280 (75)	4030	273.5	14.7	15.03	1.35	27.33	401
23760 (100)	4646	2825	16.4	15.45	1.33	29.25	483
29700 (125)	5160	289.5	17.8	15.78	1.30	30.83	549
35640 (150)	5646	292.5	19.3	15.93	1.30	31.50	607
41580 (175)	5630	296.5	19.0	16.13	1.33	32.29	615
47520 (200)	4947	287.5	17.2	15.68	1.30	30.38	522
53460 (225)	5325	295.0	18.07	16.00	1.25	32.07	578
Statistical Sign.	**	*	**	*	NS	*	**
LSD_{05}	400	13.3	1.4	0.59		2.99	56

Table 6. Main effects of planting dates (averaged over variety & population) on yield & quality

Planting Date	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Net Sucrose[1] (%)	LTM (%)
April 25	6039	299.1	20.1	14.95	1.14
May 27	4935	275.5	17.9	13.78	1.30
LSD_{05}	95	3.9	0.5	0.20	0.04

1. Net sucrose = % sucrose - % LTM

Table 7. Main effect of variety (averaged over planting date and population) on yield and quality

Variety	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Net Sucrose (%)	LTM (%)
Beta 4811	5257	274.2	19.1	15.02	1.24
Crystal 999	5716	300.4	18.9	13.71	1.20
LSD_{05}	238	3.9	NS	0.19NS	

Table 8. Main effect of population (averaged over planting date and population) on yield and quality.

Population (Plants/A)	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Net Sucrose* (%)	LTM (%)
17820	4483	271.4	16.5	13.57	1.28
23760	4988	277.9	17.9	13.89	1.23
29700	5622	289.9	19.3	14.49	1.20
35640	5965	291.9	20.4	14.59	1.22
41580	6007	294.6	20.3	14.73	1.19
47520	5680	292.4	19.4	14.62	1.19
53460	5662	293.1	19.3	14.66	1.22
LSD_{05}	229	6.7	0.7	0.33	NS