

STAEI VON HOLSTEIN, CARL<sup>1\*</sup>, ROBERT WILSON<sup>2</sup>, CORY RANSOM<sup>3</sup>, COREY GUZA<sup>3</sup>, JOEY ISHIDA<sup>3</sup>, JOSEPH F. GILES<sup>4</sup> and ALLAN W. CATTANACH<sup>5</sup>, <sup>1</sup>Novartis Seeds, P. O. Box 7, Glyndon, MN 56547, <sup>2</sup>University of Nebraska, Panhandle Research & Experiment Center, 4502 Ave., Scottsbluff, NE 69361, <sup>3</sup>Oregon State University, Malheur Experiment Station, <sup>4</sup>North Dakota State University, 133 Walster Hall, Fargo ND 58105, and <sup>5</sup>American Crystal Sugar Company, 101 North Third St. Moorhead, MN 56560. **Row width and plant population study with transgenic Glyfosate resistant sugarbeets.**

This experiment was designed to take a look at the different plant populations per acre, using transgenic glyfosate resistant sugarbeets, to determine if the recoverable sugar per acre can be increased with this new growing technique. The trials were conducted at three different locations in the US. We have not yet received the results so they can't be submitted at this time.

PRELIMINARY RESULTS OF SUGAR BEET ROW SPACING AND PLANT POPULATION  
IN HERBICIDE RESISTANT SUGAR BEETS

Corey Ransom, Joey Ishida, and Corey Guza  
Malheur Experiment Station  
Oregon State University  
Ontario, Oregon, 1998

Purpose

Transgenic sugar beet varieties may provide potential for reducing cultivation for weed control in sugar beets. If cultivation was eliminated, row spacing and plant population could be modified to maximize sugar production. A trial was conducted to evaluate different row spacing and plant populations for sugar production in Roundup resistant sugar beets.

Procedures

Hilleshog Mono-Hy Pillar Roundup Ready (RR) sugar beets were planted with a tool bar planter in 22 inch and 11 inch rows. Within each row spacing, plant spacing was varied from 6 to 16 inches between plants. Final populations ranged from 23,760 to 71,280 plants per acre.

Varieties were planted in 4 or 7-row plots 23 feet long with 4-foot alleys between plots. Plots were 7.3 feet wide and were replicated 6 times in a randomized complete block design. After planting, the trial was corrugated and Counter 20 CR was applied in a 7-inch band over the row at 6 oz/1000 ft of row.

Roundup at 0.56 lb ai/ac was applied for weed control May 8, June 8, and June 22. On May 18, sugar beet stands were thinned to the respective plant populations. The study was fertilized by broadcasting with 189 lb/ac of N as urea in June. Weeds not controlled by herbicide treatments were removed by hand as needed throughout the season. A hail storm on July 4 caused severe injury to sugar beet foliage.

For powdery mildew control, Super Six liquid sulfur was applied July 29 at 1 gallon/ac. Sulfur dust at 60 lb/ac was applied to the study by air on July 31 and August 23. Bayleton was applied at 1 lb/ac on August 18.

Sugar beets were topped and harvested by hand October 15 and 16. Roots were harvested from the center two rows of plots with 22 inch row spacings and from the center 3 rows of plots with 11 inch row spacing. The combined weights of sugar beets were adjusted for the area they were harvested from and used to calculate root yield. Root yields were adjusted for a 5% tare. For quality analysis, approximately 20 pounds of beets were taken from each plot. The samples were coded and sent to Hilleshog Mono-Hy research station in Nyssa, Oregon, to determine sugar content and quality

parameters. The percent sugar extraction and recoverable sugar were estimated using empirical equations.

Data were analyzed using ANOVA, and variety means were separated using a protected least significant difference at the 5 percent level, LSD (0.05).

## Results

The results of this trial suggest that a combination of row spacing and spacing within the row have the greatest effect on sugar beet yield and quality. Root yields for sugar beets grown in 11 inch rows with a 16 inch spacing produced higher yields than sugar beets grown in 22 inch rows with 6 or 8 inch spacing within the row (Table 1). Yields were similar for the other configurations. Larger spacing both within and between rows produced larger beets than closer spacings. Sugar content of beets grown in 11 inch rows were higher than sugar content of sugar beets grown in 22 inch rows with the exception of beets grown in 22 inch rows with 6 inches between plants. Sugar extraction was also greater for beets grown on a 12 inch spacing in 11 inch rows than for sugar beets grown at 8 or 12 inch spacings in 22 inch rows. Estimated recoverable sugar per acre was highest with sugar beets grown on 12 or 16 inch spacings in 11 inch rows in comparison to sugar beets grown in 22 inch rows. Estimated recoverable sugar per ton of sugar beets was also greater for sugar beets grown in 11 inch rows compared to 22 inch rows, with the exception of the 6" plant spacing within the 22 inch rows. Depictions of the data in Figure 1 suggest that sugar beet sugar content may be less affected by beet spacing in the row when grown on 11 inch rows than when grown on 22 inch rows. Growing sugar beets on 11 inch rows may reduce the effects of in the row spacing on sugar content and has the potential to increase total sugar production.

## Effect of Row Spacing and Plant Population on Roundup-Ready Sugarbeet Growth and Development at Scottsbluff, NE During the 1998 Growing Season

Robert G. Wilson

A field study was initiated near Scottsbluff, NE to compare the growth and root yield of Roundup-Ready Sugarbeet planted in different row spacings and plant populations. The experimental design was a randomized complete block with six replications. Plots were six rows wide by 30 feet long and were located on a silt loam soil with a pH of 7.8 and organic matter content of 1.0%. The plot area was plowed and packed in preparation for planting. Sugarbeet 'HM 1605 RR' were planted on April 27 at a seed spacing of four seeds per foot. Half the sugarbeet were planted in rows spaced 11 inches apart and half in rows spaced 22 inches apart. Sugarbeet were irrigated on April 28 with 0.30 inch of water and again May 5 and May 28 with 1.0 inch of water to enhance seed germination and emergence. Sugarbeet were sprayed with Roundup Ultra at 0.75 lb/acre three times, once on May 18 when the crop was in the 2-true-leaf growth stage, on May 26 when the crop was in the 4-true-leaf stage, and again on June 10 when the crop was in the 6-true-leaf stage. Three applications of Roundup Ultra provided excellent weed control and the crop was not cultivated or handweeded. Herbicide was applied with a tractor mounted sprayer calibrated to deliver 19 gallons/acre with Spraying Systems 11002 nozzles at 36 psi pressure. Sugarbeet plants were removed by hand hoeing on June 12 to 15 to achieve five desired plant populations within each row spacing. Plant populations of 35,640, 41,580, 47,520 59,400 and 71,280 plants/acre were target plant populations for 11-inch rows and 23,760, 29,700, 35,640, 41,580, and 47,520 plants/acre were target plant populations in 22-inch rows.

Plant populations were measured on June 23 and actual plant populations averaged 3% of

target plant populations (Table 1). One of the benefits of narrow row spacing is the potential for crop leaves to cover the entire row space earlier in the growing season. At an actual plant

population of 38,491 plants/acre sugarbeet planted in 11-inch rows had a leaf area of 4.70 LAI/m<sup>2</sup> on July 23 while a similar population planted in 22-inch rows had a leaf area of 3.93 LAI/m<sup>2</sup>. The narrower row spacing allowed the crop to develop a larger leaf area earlier in the growing season. By mid August, leaf area was similar between row spacings and plant populations.

Plant population effected sugarbeet root yield more than row spacing (Table 1). In both 11 and 22-inch row spacing, root yield was greatest at an actual plant population of 40,947 (22-inch) to 43,085 (11-inch) plants/acre. The lowest root yield was achieved when sugarbeet were planted in a 22-inch row at a plant population of 23,998 plants/acre. There was a trend for percent sucrose to increase as plant population increased in both 11 and 22-inch rows. Sucrose yield of sugarbeet planted in 11-inch rows at a plant population of 43,085 plants/acre was greater than sugarbeet planted in 22-inch rows at plant populations of 23,998, 31,284, and 35,640 plants/acre. Sugar loss to molasses followed a trend similar to percent sucrose and declined as plant population increased.

Row Width Study Notes 1998 Fargo and Glyndon

Fargo row width study notes

Planted 4 -23 / JD MaxEmerge II Planter

HH Empire RR - large seed

3 inch spacing

4 mph planting speed

Worked up and replanted 1st 4 reps 5-23 / 2nd 4 reps 6-4

rated flood damage on plots 6-24

sprayed 1 ½ pts/A roundup 7-13

rated plots for water and root rot damage 7-29

sprayed 1 ½ pts/ A roundup 8-10

Harvested 10-1

Glyndon row width study notes

Planted 4 -23 / JD MaxEmerge II Planter

HH Empire RR - large seed

3 inch spacing

4 mph planting speed

Cooperator had aerial applicator spray micro rates on all plots 5-19

sprayed 1 ½ pts/A roundup 5-22

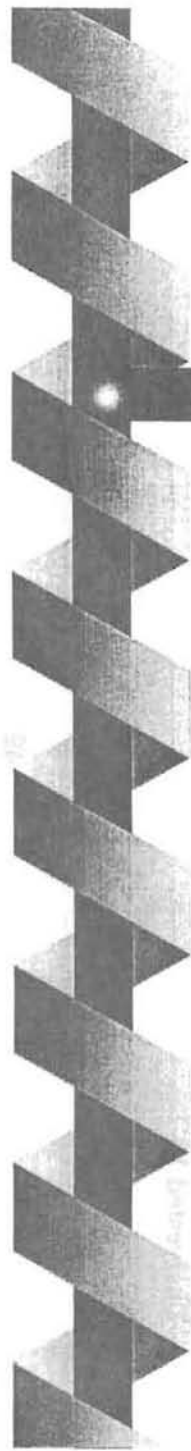
sprayed for cercospora aerial applicator 7-8

rated plots for water damage 7-13

sprayed 1 ½ pts/A roundup 8-10

sprayed supertin 5 oz 8-28

harvested 10-1



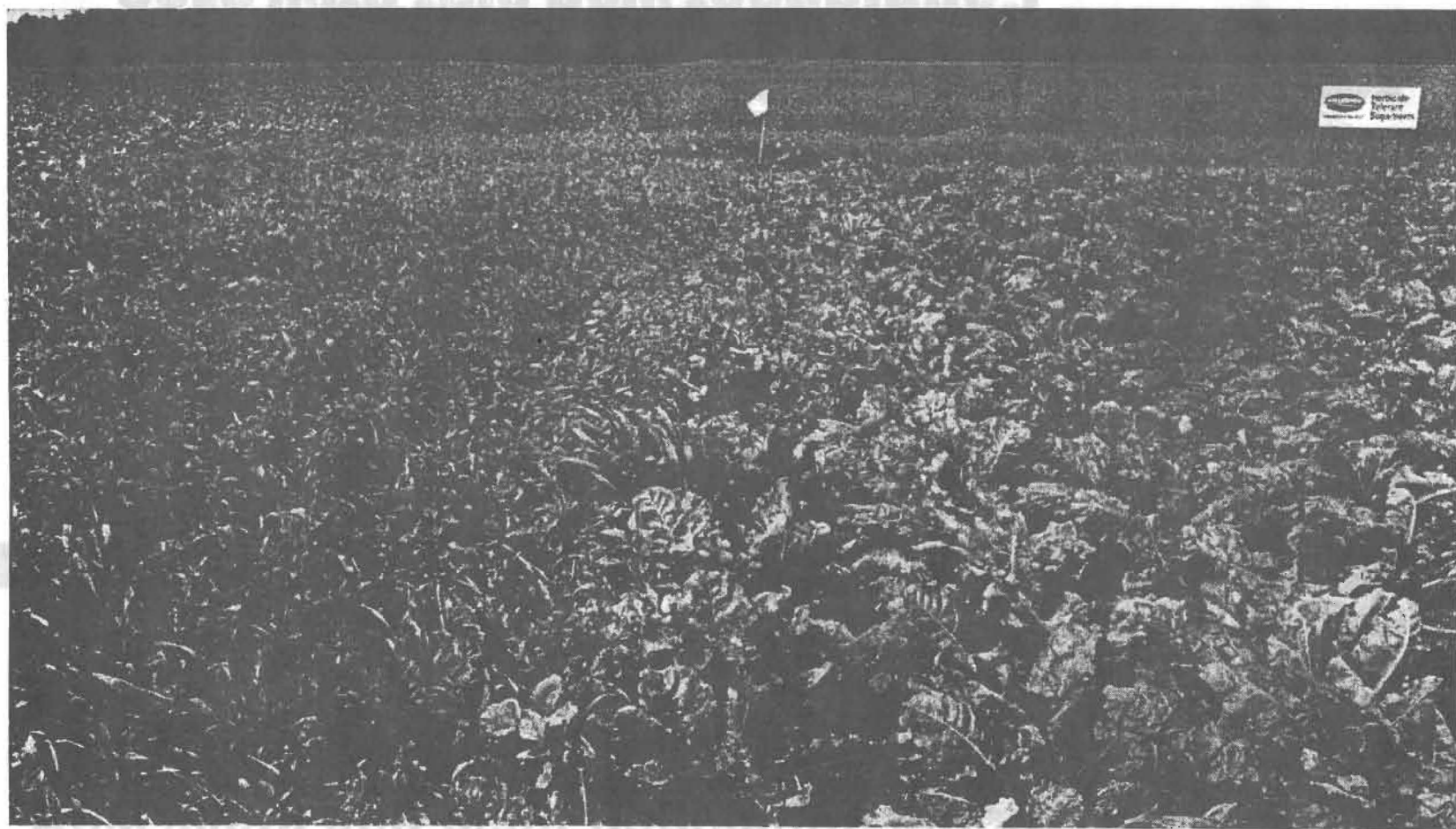
# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets

By  
Carl Stael von Holstein

CSvH

COAH

# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets





**Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets**



**Reason for this study**

- **Looking at new agronomics with the introduction of Glyphosate resistant sugarbeets.**
- **Can we increase the sugar production per acre with this new technique?**

Row width and plant population study  
with transgenic glyphosate resistant  
sugarbeets



Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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**Three sites were used this year**

→ **University of Nebraska**

**Robert Wilson**

→ **Oregon State University**

**Corey Ransom**

→ **North Dakota State University**

**Joseph Giles, Allan Cattanach**

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# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets



## Target populations

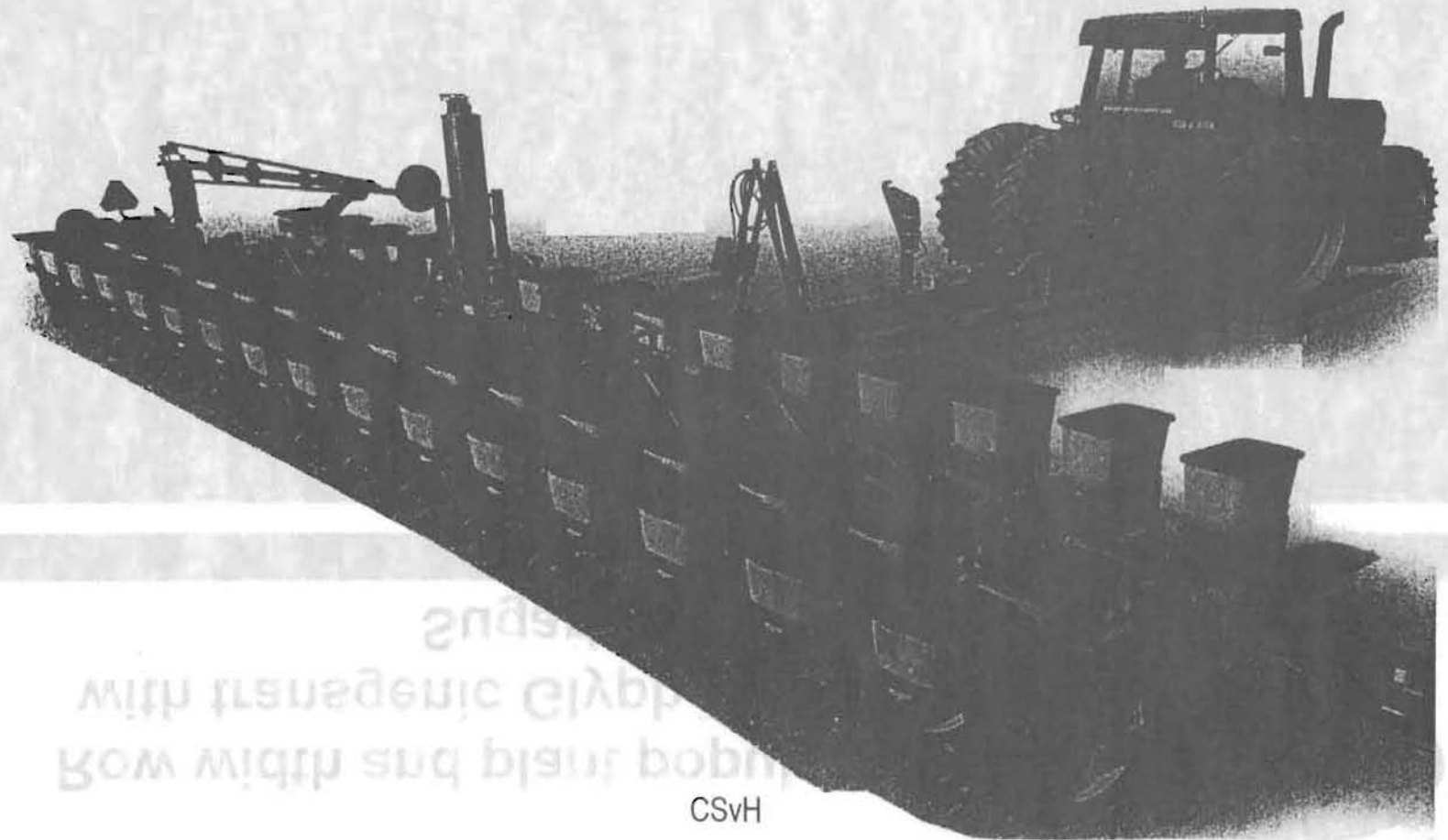
Plants per Acre	11" wide rows Spacing between plants (Inches)	22" wide rows Spacing between plants (Inches)
23,760		12
29,700		9.6
35,640	16	8"
41,580	13.8	6.9
47,520	12	6
59,400	9.6	
71,280	8	

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# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets

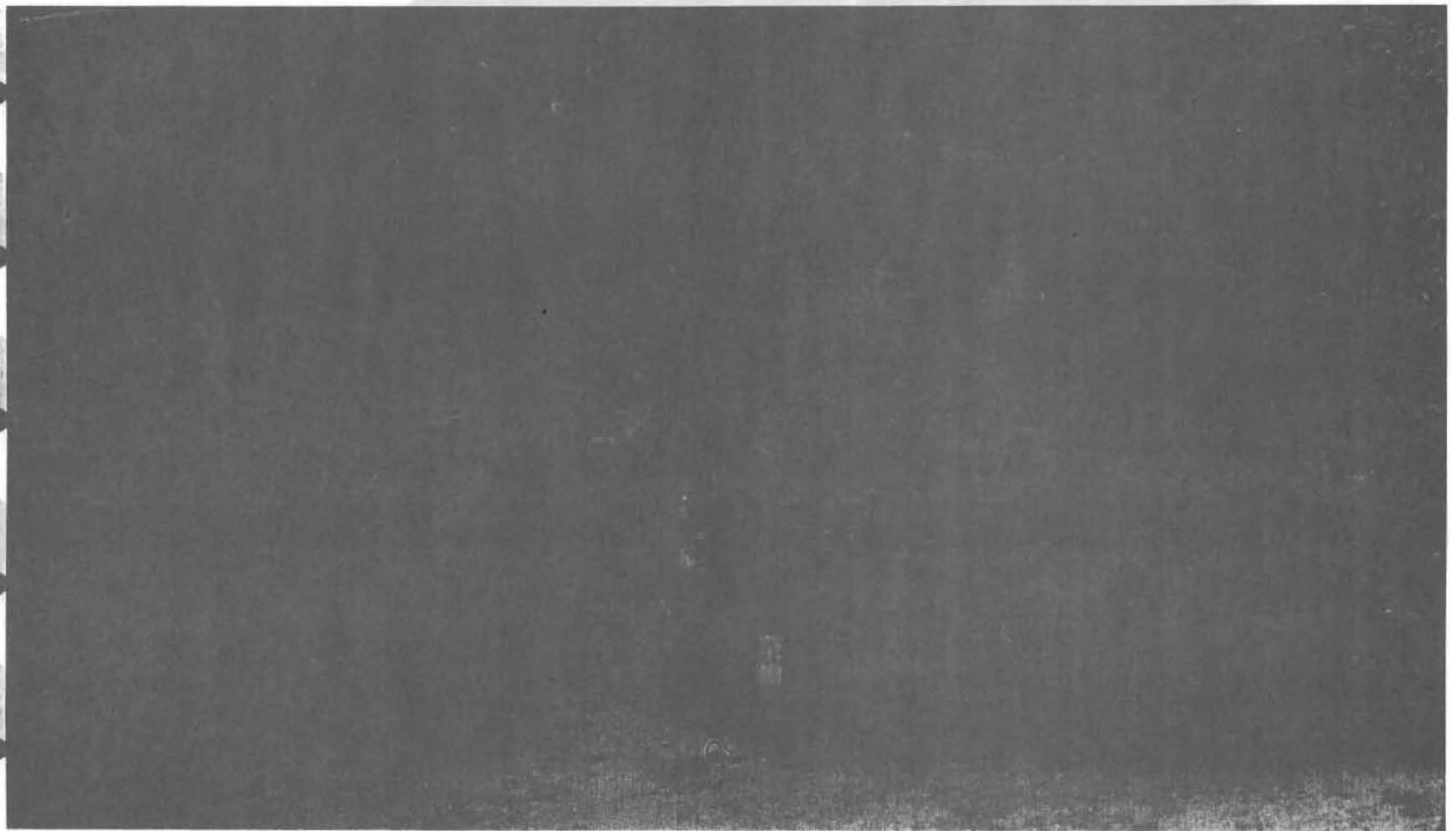
**HILLESHÖG**



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Row width and plant population study  
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Sugarbeets

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Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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**Scottsbluff NE.**

- **Planted: 4/27 Randomized complete block  
Six row plots , Six replications. HM 1605 RR.**
- **Sprayed: 5/18, 5/26,6/10 with 1.5 pint of  
Round-Up Ultra.**
- **Thinned to target population on 6/12.**
- **Harvested: 9/28**

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# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets



1998 Row Width Study  
Scottsbluff, NE

Row Spacing	Planting Pop./Acre	Seed Spacing	% Sugar		% LTM		Root Yield/Acre		Recov. Sugar/T		Extrac. Sugar/A	
11"	35,640	16"	12.4	abc	1.8	ab	39.9	ab	211		9,898	abc
11"	41,580	14"	12.8	ab	1.7	ab	44.5	a	222		11,458	a
11"	47,520	12"	12.9	ab	1.6	b	40.8	ab	226		10,511	ab
11"	59,400	9.5"	12.6	abc	1.7	ab	38.0	b	218		9,649	bc
11"	71,280	8"	13.1	a	1.6	b	40.5	ab	230		10,623	ab
22"	23,760	12"	<b>11.6</b>	c	1.9	a	<b>36.9</b>	b	195		<b>8,639</b>	c
22"	29,700	9.5"	11.9	bc	1.8	ab	38.6	ab	202		<b>9,218</b>	bc
22"	35,640	8"	12.0	bc	1.8	ab	38.6	ab	204		9,307	bc
22"	41,580	7"	12.4	abc	1.6	b	42.4	ab	216		10,582	ab
22"	47,520	6"	12.4	abc	1.7	ab	41.9	ab	214		10,420	abc
11" Mean			12.8		1.7		38.7		222		10,428	
22" Mean			12		2		40		206		9,633	
LSD 5%			1.0		0.2		6.0				1,798	

Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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**Conclusions Nebraska**

- **Sugar % significantly lower in low populations 22"**
- **LTM has a tendency to be lower in the high populations.**
- **Extractable sugar/ acre lower in the low population 22"**

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Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets



University of Oregon

- **Planted: 4/20 Randomized complete block  
4 and 7 row plots, Six replications, Pillar RR**
- **Sprayed: 5/8, 6/8, 6/22 With 1 Quart of  
Round-Up ultra.**
- **Thinned to target population on 5/18.  
Harvested: 10/15-16**



# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets



1998 Row Width Study  
Ontario, OR

Row Spacing	Planting Pop./Acre	Seed Beet Spacing	Seed Beet Size	% Sugar	% Extraction	Root Yield	Recov. Sugar/T	Extrac. Sugar/A
11"	35,640	16"	2.47 b	15.6 a	88.3 ab	<b>44.0</b> a	275 a	<b>12,047</b> a
11"	47,520	12"	1.76 c	15.7 a	89.2 a	41.8 ab	280 a	<b>11,665</b> a
11"	71,280	8"	<b>1.11</b> de	15.6 a	88.4 ab	39.6 abc	276 a	10,927 ab
22"	23,760	12"	<b>3.14</b> a	<b>14.5</b> c	86.5 c	37.4 abc	251 c	9,322 b
22"	35,640	8"	1.96 c	15.1 b	87.1 bc	34.9 c	264 b	9,317 b
22"	47,520	6"	1.49 cd	15.4 ab	88.3 ab	35.3 bc	271 ab	9,592 b
11" Mean			1.8	15.6	88.6	41.8	277	11,546
22" Mean			2	15	87	36	262	9,410
LSD 5%			0.4	0.4	1.3	6.6	10.4	1,830

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Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets



**Oregon Conclusions**

- ⇒ **Low population 22" gives significantly larger beets and a significantly lower sugar %**
- ⇒ **Root yield significantly higher in 11" rows.**
- ⇒ **Extractable sugar / acre significantly higher in 11" rows except for the extreme high population**



Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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**North Dakota State University (Gly)**

- **Planted: 4/28 Randomized complete block  
Six row plots, eight replications, Empire RR**
- **Sprayed: 5/19 Microrate, 5/22, 7/13, 1.5 Pint  
of Round-Up Ultra.**
- **Thinned to target population on 6/9.**
- **Harvested: 10/1**

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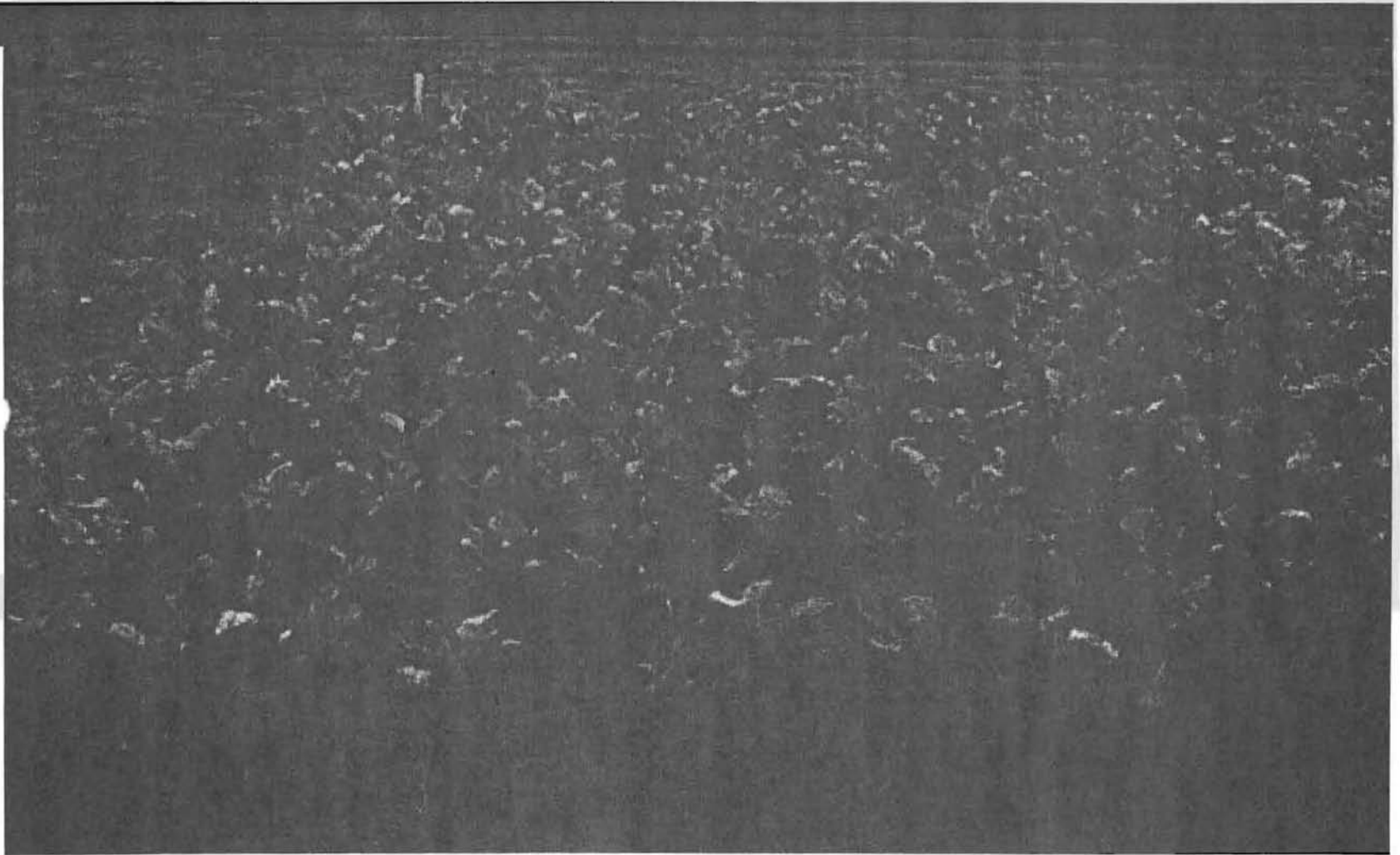
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Row width and plant population study  
→ with transgenic Glyphosate resistant  
Sugarbeets



**Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets**

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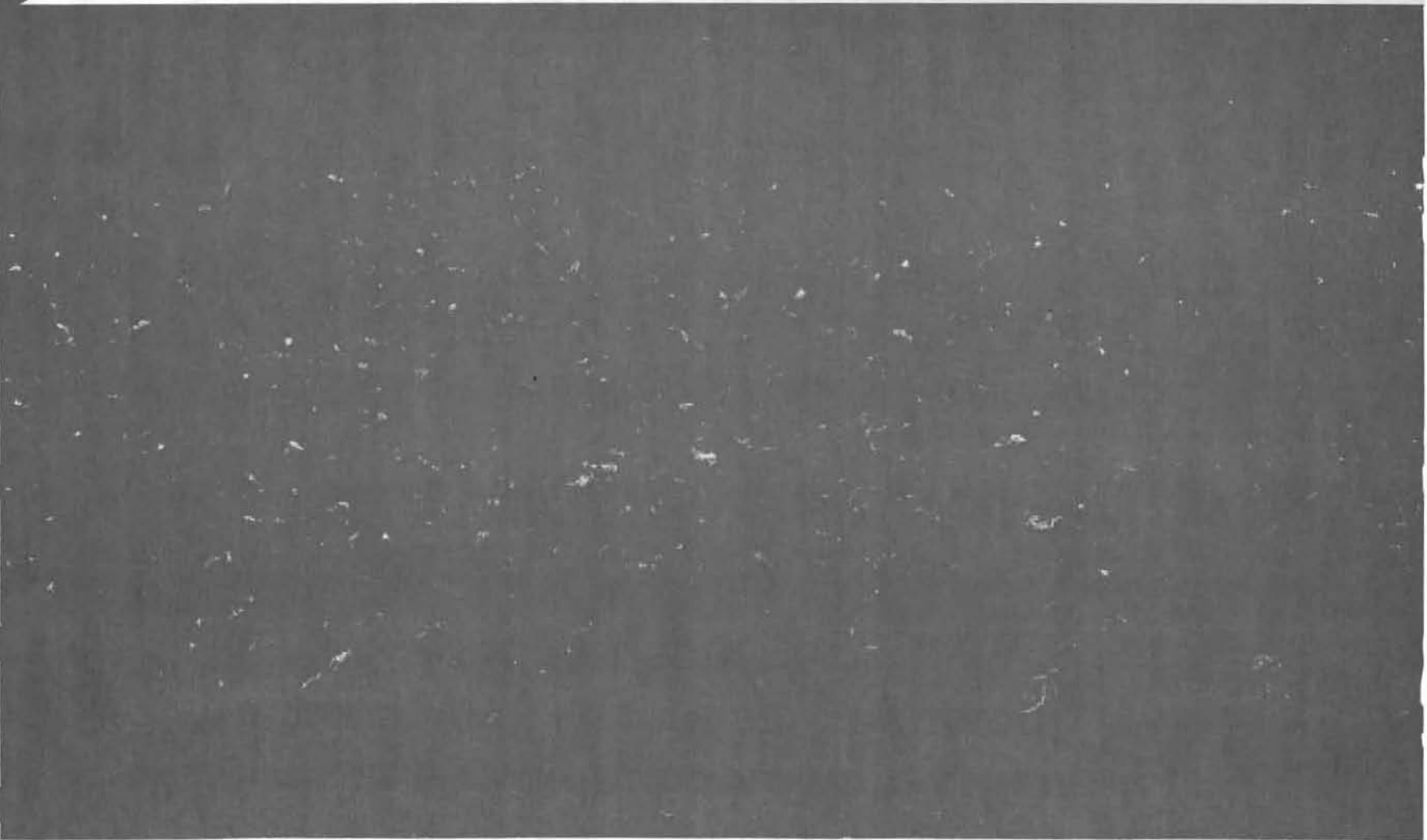


Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets





# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets



1998 Row Width Study  
Glyndon, MN

Row Spacing	Planting Pop./Acre	Seed Spacing	% Sugar	% LTM	Root Yield/Acre	Recov. Sugar/T	Extrac. Sugar/A	Harvest Pop./Acre			
11"	23,760	24"	14.4	2.0	28.4	b	248	6,974	b	23,144	d
11"	35,640	16"	14.6	2.0	<b>31.9</b>	a	251	<b>7,902</b>	a	33,969	c
11"	47,520	12"	14.3	2.0	<b>32.5</b>	a	246	<b>7,913</b>	a	44,441	b
11"	71,280	8"	14.5	2.0	29.0	b	251	7,215	b	58,433	a
22"	23,760	12"	14.7	2.0	28.4	b	255	7,164	b	22,374	d
22"	35,640	8"	<b>15.2</b>	1.9	<b>31.2</b>	a	267	<b>8,246</b>	a	33,001	c
22"	47,520	6"	14.1	1.9	27.8	b	243	6,672	b	40,525	b
22"	71,280	4"	14.9	1.9	27.8	b	261	7,176	b	<b>44,683</b>	b
11" Mean			14.5	2.0	30.5		249	7,501		39,997	
22" Mean			15	2	29		257	7,315		35,146	
LSD 5%			NS	NS	1.9		NS	684		4,187	
					CSvH						



88



# Row width and plant population study with transgenic Glyphosate resistant Sugarbeets



## Conclusion Glyndon

- **The 11" row 35.000 and 47.000 population were significantly better in both Root yield and extractable sugar / acre**
- **The 22" row 71.000 population seem to have had to much competition and consequently lost harvest stand.**



Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

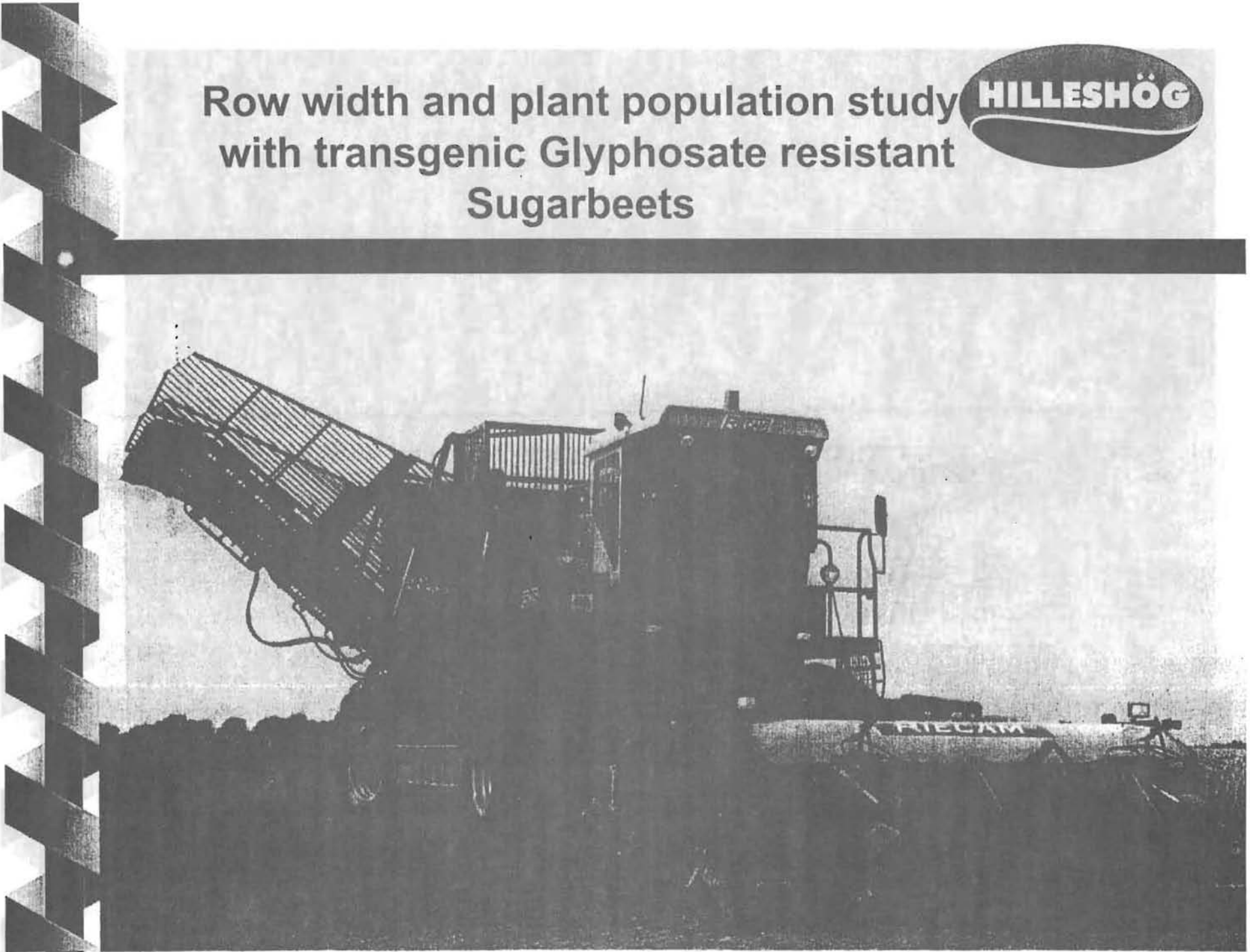


**Overall Conclusion**

- **The 11" treatment tended to have a higher level of consistency for increased sugar %, Lower % LTM and a greater amount of extractable sugar / acre**
- **In the 22" row it looked like we should try and move towards thicker population 40'- 45.000 beets / acre**



Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets



Row width and plant population study  
with transgenic Glyphosate resistant  
Sugarbeets

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