PLANT POPULATION STUDIES 2000 – PLANT TO STAND

Mohamed F. R. Khan[1] & Norman Cattanach[2]
[1]Extension Sugarbeet Specialist
North Dakota State University / University of Minnesota
[2]Soil Science Dept, North Dakota State University

INTRODUCTION AND OBJECTIVE

Sugarbeet breeders aim to produce stable, dependable varieties, which consistently give the highest possible yield of sugar per unit area in relation to production cost, and which meet various other specific requirements of the growers and sugar cooperatives. The selection for sugar yield, a product of root yield and sugar content, is a selection for greater physiological efficiency. It will be ideal to have varieties expressing simultaneously high root yield and high sugar content. It is difficult to obtain a variety high in root yield and sugar content because there is almost invariably a negative correlation between root yield and sugar content. Consequently, our varieties are considered to be high tonnage, high sugar, or normal that is intermediate in yield and sugar. The choice of the most suitable variety for a particular area is influenced by a number of factors, including nutrient status of soil, prevalent diseases, and payment system for the roots.

Our current recommendation for plant population is to have at harvest about 35,000 uniformly spaced plants per acre for good yields of high quality sugarbeet. This means that there should be about 150 plants per 100 linear row feet after thinning or at the six-leaf growth stage.

The objective of this research was to determine the seed spacing at planting of high tonnage and high sugar varieties that would result in a plant population at harvest that will produce the highest recoverable sugar per acre (RSA) and/or the highest recoverable sucrose per ton of sugarbeet (RST).

MATERIALS AND METHODS

Research was conducted at Fargo, ND, on a Fargo silty clay soil and at Breckenridge, MN, on a silty clay loam soil. The high sugar variety was Beta 6447 and the high tonnage variety was Seedex Thunder. At Fargo, planting was done on 5 May, and at Breckenridge, 2 May. Planting was done with a John Deere MaxEmerge 2 planter into plots 11 feet in width and 30 feet in length. Seeds were placed 1.25 inches deep and (as close as possible as the planter specifications will allow to) 4, 4.5, 5, 5.5, and 6 inches apart in rows that were 22 inches wide. Counter was applied at 11.9 lb/acre at planting to control sugarbeet root maggot. The experiment was arranged in a randomized complete block design with four replications. Fertilization was done according to standard recommendation for sugarbeet. Plots were kept weed free using micro-rates of herbicides recommended for sugarbeet. Eminent and Supertin were used for controlling Cercospora leaf spot.

The middle two rows of each 6-rows plot were counted and harvested at Fargo and Breckenridge on 19 and 26 September, respectively. Yield was determined, and quality analysis performed by American Crystal Sugar Company Quality Tare Laboratory, East Grand Forks, Minnesota. Data

was analyzed for differences by analysis of variance and LSD using Agriculture Research Manager, version 6.0.

Summary of Results

(Please note that this is one year of research work at two locations).
At Fargo, Beta 6447 was significantly higher in RSA at the 4.5 inch spacing than at the 6 inch spacing, and was also significantly higher in RTA at the 5.5 inch than at the 6 inch plant spacing. Beta 3843 was significantly higher in RSA at the 5 inch spacing than at the 5.5 inch spacing. Seedex Thunder was significantly higher in RTA at the 4 inch spacing than at the 5 inch spacing. Beta 2084, Seedex Thunder, Croplan 101, and VDH 66283 showed no significant difference in RSA, and Beta 2084, Beta 3843, Croplan 101, and VDH 66283 showed no significant difference in RST at the different seed spacings.
At Breckenridge, there was significant difference in RSA only for Beta 3843 at 4.5 inch compared to 6 inch spacing, and VDH 66283 at 4.5 inch compared to 4 inch spacing. There was significant difference in RST only for Beta 2084 at the 4.5 inch compared to 5.5 inch seed spacings.
Conditions were more favorable for plant growth and production at Breckenridge than at Fargo where there was unusually high rainfall in June.

ACKNOWLEDGEMENT

Thanks to the Sugarbeet Research and Education Board of Minnesota and North Dakota for their financial support to this research. Thanks to Charles Hotvedt of American Crystal Sugar Company Quality Tare Laboratory, East Grand Forks, Minnesota, for sugarbeet quality analysis. Thanks to Mr. Doug Tischer for permission to conduct research in his field.

Table 1. Effect of Seed Spacing At Planting On Sugarbeet Yield and Quality at Fargo, ND, 2000.

Treatment	Recoverable Sucrose Lb/A	Recoverable Sucrose Lb/T	Yield T/A	Sucrose Content (%)	Sugar Loss to Molasses (%)	Plant population at 6-leaf Stage	Plant population at harvest
Beta 6447 – 4”	6566	336	19.9	17.8	0.9	140	123
Beta 6447 – 4.5”	6865	334	21.0	17.6	1.0	125	113
Beta 6447 – 5”	6459	324	20.4	17.2	1.0	114	101
Beta 6447 – 5.5”	6417	339	19.3	17.9	1.0	98	92
Beta 6447 – 6”	5462	322	17.4	17.1	1.1	73	70
Beta 2084 – 4”	6394	326	20.0	17.3	1.0	121	111
Beta 2084 – 4.5”	6163	323	19.5	17.1	1.0	113	103
Beta 2084 – 5”	5591	317	17.9	16.9	1.1	84	70
Beta 2084 – 5.5”	6014	326	18.8	17.3	1.0	82	67
Beta 2084 – 6”	5551	317	17.9	16.9	1.1	75	67
Beta 3843 – 4”	5658	319	17.9	16.9	1.0	109	77
Beta 3843 – 4.5”	5409	318	17.3	16.9	1.0	82	74
Beta 3843 – 5”	5914	304	19.9	16.2	1.0	93	71
Beta 3843 – 5.5”	4630	314	15.0	16.7	1.0	83	59
Beta 3843 – 6”	5348	320	16.9	17.0	1.0	70	56
Seedex Thunder – 4”	7091	321	22.6	17.1	1.0	126	118
Seedex Thunder – 4.5”	6565	313	21.5	16.7	1.1	121	117
Seedex Thunder – 5”	6553	304	22.1	16.3	1.1	105	105
Seedex Thunder – 5.5”	6707	315	21.8	16.9	1.1	105	99
Seedex Thunder – 6”	6490	310	21.4	16.6	1.1	106	92
Croplan 101 – 4”	6390	315	20.7	16.8	1.0	110	96
Croplan 101 – 4.5”	6413	313	20.9	16.7	1.1	100	92
Croplan 101 – 5”	6890	315	22.5	16.8	1.1	86	86
Croplan 101 – 5.5”	6946	313	22.9	16.7	1.1	85	81
Croplan 101 – 6”	6768	310	22.4	16.6	1.1	82	82
VDH 66283 – 4”	6739	310	22.3	16.5	1.0	113	99
VDH 66283 – 4.5”	6661	316	21.6	16.8	1.0	109	102
VDH 66283 – 5”	6694	309	22.2	16.5	1.1	106	101
VDH 66283 – 5.5”	5865	310	19.3	16.5	1.0	86	72
VDH 66283 – 6”	6705	310	22.2	16.5	1.0	87	83
LSD (P=0.05)	1236	17	3.8	0.8	0.1	21	23.5
CV	15.8	4.2	15.1	3.6	8.2	17.0	21.0

Table 2. Effect of Seed Spacing At Planting On Sugarbeet Yield and Quality at Breckenridge, MN, 2000.

Treatment	Recoverable Sucrose Lb/A	Recoverable Sucrose Lb/T	Yield T/A	Sucrose Content (%)	Sugar Loss to Molasses (%)	Plant population at 6-leaf Stage	Plant population at harvest
Beta 6447 – 4”	8293	384	21.9	20.4	1.2	144	108
Beta 6447 – 4.5”	8220	386	21.5	20.4	1.1	130	108
Beta 6447 – 5”	8485	377	22.9	20.1	1.2	125	104
Beta 6447 – 5.5”	9255	372	25.4	19.8	1.2	110	86
Beta 6447 – 6”	8821	376	23.9	20.0	1.3	106	88
Beta 2084 – 4”	9245	362	26.1	19.4	1.3	150	118
Beta 2084 – 4.5”	9253	348	27.3	18.7	1.3	139	105
Beta 2084 – 5”	9237	371	25.3	19.8	1.2	125	100
Beta 2084 – 5.5”	9017	385	23.7	20.5	1.2	117	97
Beta 2084 – 6”	9734	369	27.1	19.7	1.3	105	95
Beta 3843 – 4”	8994	366	25.2	19.5	1.2	127	99
Beta 3843 – 4.5”	6710	355	18.3	19.1	1.2	128	98
Beta 3843 – 5”	9110	374	24.8	20.0	1.3	108	86
Beta 3843 – 5.5”	8779	372	24.0	19.8	1.2	98	87
Beta 3843 – 6”	9179	363	25.9	19.4	1.3	90	78
Seedex Thunder – 4”	9760	354	28.2	18.9	1.2	166	129
Seedex Thunder – 4.5”	9894	366	27.6	19.5	1.2	144	117
Seedex Thunder – 5”	9494	352	27.6	18.9	1.3	132	110
Seedex Thunder – 5.5”	8618	350	25.1	18.8	1.3	122	103
Seedex Thunder – 6”	9567	368	26.5	19.7	1.3	117	103
Croplan 101 – 4”	9678	378	26.1	20.1	1.1	132	105
Croplan 101 – 4.5”	10437	362	29.6	19.4	1.4	123	99
Croplan 101 – 5”	9210	350	27.0	18.9	1.4	114	102
Croplan 101 – 5.5”	9794	364	27.8	19.5	1.3	99	89
Croplan 101 – 6”	9351	352	27.3	19.0	1.4	92	86
VDH 66283 – 4”	10358	352	30.3	18.9	1.3	137	103
VDH 66283 – 4.5”	10247	351	30.2	18.9	1.4	134	97
VDH 66283 – 5”	7258	350	20.8	18.9	1.4	112	90
VDH 66283 – 5.5”	9374	346	28.0	18.7	1.4	105	89
VDH 66283 – 6”	7075	338	21.1	18.4	1.5	98	87
LSD (P=0.05)	2103	32.3	6.8	1.4	0.2	10.7	10.8
CV	18.5	7.1	21.1	5.9	14.2	7.1	8.7