1988 Research Report

SMBSC

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Southern Minnesota Beet Sugar Company
SMBSC

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Introduction

This research report summarizes the most significant projects conducted at SMSC during 1988. Some projects are long term by design (5 - 8 years duration), while the objectives of other projects may be completed in 2 - 3 years.

The growing season for 1988 complicated most research projects in that the hot dry conditions prevented full expression of some treatments. The objectives of all research projects will be reviewed for 1989 so that the most important aspects of future sugarbeet production practices are properly identified and possible grower options are properly evaluated.

Sugarbeet research projects make step - wise progress, it is beyond the scope of most research programs to revolutionize the industry based on the results of a single trial or year of evaluation. Although differences among the various treatments were small in 1988, the accumulated data over years establishes significant differences, and highlights important trends.

Early crop predictions for 1989 are looking at average to below average yields. Subsoil moisture is rated as short to very short so the crop will depend on timely and adequate rainfall. This prospect presents challenges to growers for selection and adaptation of all production practices in order to maintain normal yields and high quality.

Growers must accept, as a matter of practice, realistic goals for both yield and percent sugar. Fertilizer applications may be made for yield goals of 25 - 28 T/A; however, if these yields are not realized at harvest, quality of the crop will be significantly lower. Realistic yield goals for 1989 should be 18 - 20 T/A and 16.5 - 17.0% sugar.

Growers should also plan their production practices around an early harvest. The Cooperative will plant 75,300 acres in 1989 and with normal yields the crop should produce 1,400,000 net tons (@ 18.7 T/A) or a 175 day slice campaign. Harvest of this size crop must begin the first week of September.

Your challenge, as a grower/shareholder, is to integrate all production factors to achieve a level of sugar at 14.0% by the first week of September, and final sugar at 17.0%.

Planning for 25 - 28 T/A is the easy part of the formula. Simply plant early and use high rates of nitrogen. The trick is to achieve this level of tonnage at 17.0% sugar. Some growers are able to do their magic and accomplish both high tonnage and high quality; however, most growers tend to ignore sugar content in establishing yield goals.

Consider this fact -- based on the projected payment for the 1988 crop, a 1% increase in sugar content is equivalent to $3.24 per ton, and a 1% increase in sugar content is equivalent to 1.5 - 2.0 tons per acre.

For example, if a grower had 19.0 T/A and 16.0% sugar content, the gross return per acre would be the same or slightly higher at 17.5 T/A and 17.0% sugar. Conclusion -- establish realistic goals for yield and sugar content.

The purpose of this research report, related seminars and extension bulletins is to inform the growers of various options that could be utilized on the farm. We appreciate suggestions on further research projects. The authors do not make any guarantees or offer any warranties either stated or implied, on data summarized in this report.

Good luck in 1989 - make your magic to continue the trend to higher quality beets without a significant yield reduction.

Jimmy N. Widner, PhD
Vice-President, Agriculture

Mark Law, M.S.
Research Agronomist

1. Variety Evaluations. Two new varieties have been added to the approved list. Three varieties fell below the minimum standards set by the cooperative and will not be available for 1989. In addition, four varieties were voluntarily withdrawn by the seed companies. Two varieties are available for special use (moderate root rot tolerance), and three other varieties were approved for test market.

2. Date of Harvest. A summary of data from 1986 - 1988 indicate that there are differences among the 10 varieties tested in ability to accumulate relatively high levels of sugar early in the growing season. Several factors, including variety, must be considered in making comparisons between fields for early harvest.

3. Root Rot Control with Seed Treatments. Seed treatments were evaluated to determine their effect on root rot disease. The experimental fungicide Tachagaren significantly reduced the visual symptoms associated with seedling root rot.

4. Root Rot - Herbicide Interaction Study. Many commonly used herbicide treatments were evaluated to determine if herbicide stress increased the level of visual infection from seedling root rot. The study was conducted in 1987 and 1988, however; no herbicide treatment significantly increased the root rot symptoms over the check plot.

5. Effects of Petiole Material on Tare Lab Sugar Analysis. Comparisons were made evaluating topped sugarbeets vs poorly topped sugarbeets in 1987 and 1988. On average, poorly topped sugarbeets significantly reduced the tare lab sugar analysis over sugarbeets with most petiole material removed.

6. Disease Index Summary of 1988. A Cercospora model was again used to determine relative activity of the leaf spot spores at three locations throughout the SMSC growing area. Hourly temperature and relative humidity readings were used to calculate infection potential. Accurate measurement of conditions favorable for leaf spot spore germination and infection will enable growers to apply fungicides when the spores are most active.

7. Harvester Performance Summary 1988. Harvester performance data was collected for all growers that use the same type of harvester in their farming operation. The harvester data is split up into

machines with 4 and 6 rows. Averages are shown for % first dirt, % tare, and total dirt. Ranges for % tare and total dirt are also included. The harvester data is also separated by receiving station for comparison.

8. Weather Data for 1988. The growing season of 1988 was exceptionally hot and dry with precipitation less than 2 inches/month at most reporting stations throughout the summer. The month of August was the high precipitation month with a range of stations reporting 4 - 5.5 inches. Many record temperatures were broken in the summer of 1988.

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Planned Research for 1989

The 1988 sugarbeet crop proved to be one of the most challenging in recent years. The spring planting started early and in a short time a large majority of the sugarbeet crop was planted. Following seedling emergence, strong winds forced a large proportion of the crop to be replanted. Throughout the growing season frontal systems came and went with no rainfall. Southern Minnesota sustained some of the highest temperatures in history. Despite the adverse environmental conditions of 1988 a respectable yield of over 17 tons per acre and the highest sugar content of 17.15 were recorded after harvest. The success of the 1988 crop is largely attributable to improved varieties, soil moisture management through tillage practices, weed control, general pest control, a longer growing season due to delayed harvest and August rains. The goal for research in 1989 is to continue many of the past projects and to expand research efforts dealing with root rots, fertility and sugarbeet storage.

Root rot is steadily increasing the number of affected acres and the effects are felt well out of the SMSC growing area. As new seed treatments surface they will be tested for their efficacy on Aphanomyces. With the new label of Stinger herbicide on sugarbeets, many new questions arise about tank-mix combinations and weed spectrum.

The cooperative continually strives to process the highest quality sugarbeet possible. To aid in this endeavor, fertility trials will become an ever increasing part of the research trials. The "Drought of 88" has left it's mark in form of very high residual nitrogen levels in the soil. Proper N management will be paramount in 1989 to achieve the sugar and tonnage goal.

The additional acreage will add many challenges to the cooperative. To facilitate the potential tonnage, the factory will have to begin slicing as early as possible. The prepile season could last over a longer period and achieving the highest sugar and tons is very important. The date of harvest trials have been expanded to include 3 harvest dates throughout the harvest period. The second challenge with the added acreage will be beet storage associated with a large crop. In 1988 the cooperative tested the feasibility of sugarbeet pile ventilation. This study will continue in 1989.

Two more remote weather stations were added in the growing area and information gathered daily will again aid in Cercospora modeling.

Some of these research projects will be conducted solely by SMSC; other projects including fertility and disease trials will be conducted in cooperation with university scientists. Specific treatments and additional projects may be included in response to the growing season and environmental conditions.

VARIETY EVALUATIONS

A total of 54 varieties were evaluated in coded trials at three locations in Southern Minnesota Sugar Cooperative (SMSC) growing area. The trials were conducted by American Crystal Sugar Research Center. Entries were contributed by nine seed companies.

The Board of Directors approved 19 varieties for unlimited sales in 1989. In addition, two varieties are available for special use (moderate root rot tolerance), and three other varieties were approved for test market.

Table 1 shows all the approved varieties for SMSC since 1980.

The most popular varieties planted in 1988 were:

KW 3265 - 39%

Hilleshog 5135 - 18%

Maribo 403 - 5%

Maribo Ultramono - 11%

Strong spring winds forced the replanting of a substantial amount of acreage. The original seed issued was 126,190 lbs. Seed amounting to 66,535 lbs was issued for replanting purposes or almost 53% replant seed.

Table 2 shows the relative improvement of varieties since 1981. Recoverable sugar per acre and tons/acre have remained relatively stable; however, percent sugar and

recoverable sugar per ton have made steady and significant improvement with the approval of the newer varieties.

The list of approved varieties for 1989 are shown in Tables 3 (actual data) and 4 (% of mean). The two year performance of the test market varieties for 1989 are shown in Tables 5 (actual data) and 6 (% of mean).

Test results of all varieties evaluated for the past three years are summarized in Tables 7 through 13.

Southern Minnesota Sugar Cooperative

List of Approved Varieties Since 1980

Table 1.

1980	1981	1982	1983
Beta 1443	Beta 1443	Beta 1237	Beta 1230
Beta 1345	Beta 1345	Beta 1230	Beta 1237
Beta 1237	Beta 1237	Mono-Hy R1	Mono-Hy R1
Mono-Hy R1	Beta 1230	Mono-Hy M7	Mono-Hy M7
Mono-Hy E4	Mono-Hy R1	Mono-Hy M8	Mono-Hy M8
BJ MonoFort	Mono-Hy M8	Mono-Hy E4	ACH 14
Holly HH33	Mono-Hy M7	BJ Monofort	ACH 30
ACH 14	Mono-Hy X73	Holly HH33	BJ Monofort
ACH 12	ACH 14	ACH 14	Maribo Ultramono
ACH 17	ACH 30	ACH 17	
ACH 30	ACH 151	ACH 145	
	Maribo Unica		
	Maribo Ultramono		
	Holly HH33		
	BJ Monofort		

1984	1985	1986	1987
ACH 30	ACH 30	ACH 30	ACH 164
ACH 145	ACH 145	ACH 146	Beta 1230
ACH 154	ACH 154	ACH 164	Beta 5494
Beta 1230	Beta 1230	Beta 1230	Beta 6264
BJ Monofort	BJ Monofort	Beta 6264	BJ Monofort
Mono-Hy R1	Mono-Hy R1	BJ Monofort	BJ 1310
Mono-Hy M7	Mono-Hy M7	BJ 1310	KW 1132
KW 3394	KW 1132	Mono-Hy M7	KW 3265
Maribo Ultramono	KW 3394	KW 1132	KW 3394
	Maribo Ultramono	KW 3394	Hilleshog 4046
	Maribo 401	KW 3265	Hilleshog 5090
		Maribo Ultramono	Hilleshog 5135
		Maribo 401	Maribo Ultramono
		Maribo 403	Maribo 403
			Mono-Hy M7
			Mono-Hy R103
			Mono-Hy R117
			Mitsui Monohikari

1988	1988 Cont.	1989	1989 Cont.
ACH 164	Hilleshog 5135	ACH 164	KW 3265
* ACH 178	** Hilleshog 8277	ACH 180	KW 3394
ACH 180	KW 1014	ACH 181	Maribo 403
ACH 181	* KW 1132	ACH 198	Maribo 411
* Beta 1230	KW 3145	Beta 3614	Maribo Ultramono
Beta 3614	* KW 6264	Beta 6269	Mitsui Monohikari
Beta 3265	KW 3394	Beta 6625	Mono-Hy R-103
Beta 6625	Maribo 403	Hilleshog 4046	
** BJ 1310	Maribo 411	Hilleshog 5090	
** BJ Monofort	Maribo Ultramono	Hilleshog 5135	
Hilleshog 4046	Mitsui Monohikari	KW 1014	
Hilleshog 5090	Mono-Hy R-103	KW 3145	

* Voluntarily withdrawn by seed company.
** Fell below minimum standards of performance.

Comparison of Approved Varieties for SMSC over a Nine-Year Period

Table 2

Year	No. of Approved	Recoverable Sugar/Acre Mean of Approved	Sugar/Ton Mean of Approved	Tons/Acre Mean of Approved	% Sugar Mean of Approved	Leaf Spot Rating Mean of Approved
1981 (78-79-80)	15	6724	264.5	25.7	15.40	4.43
1982 (79-80-81)	12	6282	262.6	23.9	15.50	4.31
1983 (80-81-82)	9	7053	261.9	26.9	15.60	4.84
1984 (81-82-83)	9	6823	253.1	26.9	15.30	4.80
1985 (82-83-84)	11	7682	269.7	28.6	15.90	4.87
1986 (83-84-85)	14	7837	280.9	27.9	16.10	4.80
1987 (84-85-86)	18	7764	300.4	25.9	16.70	4.68
1988 (85-86-87)	24	8884	308.7	28.7	16.95	4.93
1989 (86-87-88)	19	8689	318.6	27.2	17.40	4.70

SOUTHERN MINNESOTA SUGAR COOPERATIVE
List of Approved Varieties for 1989.

Table 3. Three year performance summary from coded trials conducted at SMSC, 1986-88.

VARIETY	RECOVERABLE SUGAR/ACRE	RECOVERABLE SUGAR/TON	LEAF SPOT RATING **	TONS/ACRE	% SUGAR	% LOSS TO MOLASSES	SEEDLING VIGOR **
ACH 164	8641	313.6	4.78	27.4	17.2	1.52	1.6
ACH 180	8620	321.1	4.70	26.8	17.6	1.56	1.8
ACH 181	9027	315.0	4.45	28.6	17.3	1.58	1.9
ACH 198	8785	319.9	4.43	27.5	17.5	1.57	1.6
Beta 3614	8372	323.7	4.61	25.8	17.7	1.48	1.5
Beta 6269	8567	323.6	4.71	26.4	17.1	1.52	1.6
Beta 6625	8629	332.7	4.86	25.9	18.1	1.45	1.9
Hilleshog 4046	8610	319.7	4.87	26.9	17.6	1.58	1.7
Hilleshog 5090	8819	315.8	5.00	27.9	17.3	1.52	1.5
Hilleshog 5135	8865	323.7	4.98	27.4	17.7	1.54	1.4
H-Mono-Hy R103	8534	315.3	4.47	27.1	17.3	1.54	1.4
KW 1014	8840	318.9	4.46	27.6	17.4	1.48	1.4
KW 3145	8904	312.0	5.00	28.3	17.1	1.53	1.8
KW 3265	8870	312.6	4.80	28.3	17.1	1.52	1.8
KW 3394	8763	318.3	4.85	27.6	17.5	1.54	1.8
Maribo 403	8702	314.9	4.60	27.6	17.4	1.61	1.4
Maribo 411	8496	320.2	4.88	26.5	17.6	1.54	1.4
Maribo Ultramono	8576	316.8	5.03	27.0	17.4	1.57	1.3
Mitsui Monohikari	8478	315.8	4.62	26.7	17.2	1.42	2.5
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Mean of Approved	8689.4	318.6	4.7	27.2	17.4	1.5	1.6

** Lower numbers indicate better resistance and seedling vigor.

SOUTHERN MINNESOTA SUGAR COOPERATIVE
List of Approved Varieties for 1989.

Table 4. Three year performance summary (% of Mean) from coded trials conducted at SMSC, 1986-88.

VARIETY	RECOVERABLE SUGAR/ACRE	RECOVERABLE SUGAR/TON	LEAF SPOT RATING **	TONS/ACRE	% SUGAR	% LOSS TO MOLASSES	SEEDLING VIGOR **	ESTIMATED GROWER RETURN/TON
ACH 164	99.4	98.4	101.7	100.7	98.9	101.3	100.0	98.0
ACH 180	99.2	100.8	100.0	98.5	101.1	104.0	112.5	101.1
ACH 181	103.9	98.9	94.7	105.1	99.4	105.3	118.8	98.8
ACH 198	101.1	100.4	94.3	101.1	100.6	104.7	100.0	100.3
Beta 3614	96.3	101.6	98.1	94.9	101.7	98.7	93.8	101.9
Beta 6269	98.6	101.6	100.2	97.1	98.3	101.3	100.0	101.9
Beta 6625	99.3	104.4	103.4	95.2	104.0	96.7	118.8	105.1
Hilleshog 4046	99.1	100.3	103.6	98.9	101.1	105.3	106.3	101.1
Hilleshog 5090	101.5	99.1	106.4	102.6	99.4	101.3	93.8	98.8
Hilleshog 5135	102.0	101.6	106.0	100.7	101.7	102.7	87.5	101.9
H-Mono-Hy R103	98.2	99.0	95.1	99.6	99.4	102.7	87.5	98.8
KW 1014	101.7	100.1	94.9	101.5	100.0	98.7	87.5	99.6
KW 3145	102.5	97.9	106.4	104.0	98.3	102.0	112.5	97.2
KW 3265	102.1	98.1	102.1	104.0	98.3	101.3	112.5	97.2
KW 3394	100.8	99.9	103.2	101.5	100.6	102.7	112.5	100.3
Maribo 403	100.1	98.8	97.9	101.5	100.0	107.3	87.5	99.6
Maribo 411	97.8	100.5	103.8	97.4	101.1	102.7	87.5	101.1
Maribo Ultramono	98.7	99.4	107.0	99.3	100.0	104.7	81.3	99.6
Mitsui Monohikari	97.6	99.1	98.3	98.2	98.9	94.7	156.3	98.0
Mean of Approved	8689.4	318.6	4.7	27.2	17.4	1.5	1.6	

** Lower numbers indicate better resistance and seedling vigor.

SOUTHERN MINNESOTA SUGAR COOPERATIVE
Test Market Varieties for 1989

Table 5. Two year performance summary from coded trials conducted at SMSC, 1987-88.

VARIETY	RECOVERABLE SUGAR/ACRE	RECOVERABLE SUGAR/TON	LEAF SPOT RATING **	TONS/ACRE	% SUGAR	% LOSS TO MOLASSES	SEEDLING VIGOR **
1989 Approved Varieties							
ACH 164	9941	319.3	4.76	31.1	17.6	1.60	1.7
ACH 180	9819	328.1	4.58	30.1	18.1	1.67	1.7
ACH 181	10439	320.1	4.57	32.7	17.7	1.71	1.8
ACH 198	10057	325.7	4.50	31.1	17.9	1.66	1.8
Beta 3614	9519	329.5	4.89	28.9	18.1	1.60	1.5
Beta 6269	9716	327.3	4.69	29.7	18.0	1.66	1.8
Beta 6625	9812	338.4	4.97	29.0	18.5	1.56	2.0
Hilleshog 4046	9705	328.0	4.97	29.7	18.1	1.69	1.8
Hilleshog 5090	10050	322.6	5.40	31.2	17.7	1.60	1.6
Hilleshog 5135	10081	330.1	5.25	30.6	18.1	1.63	1.3
H-M R-103	9690	322.9	4.62	30.1	17.8	1.62	1.5
KW 1014	10144	324.1	4.60	31.3	17.8	1.58	1.3
KW 3145	10232	317.1	5.21	32.2	17.5	1.65	1.9
KW 3265	10075	318.9	5.02	31.8	17.6	1.65	1.9
KW 3394	9989	324.8	4.98	30.9	17.9	1.65	1.9
Maribo 403	9974	321.0	4.87	31.2	17.8	1.71	1.3
Maribo 411	9606	326.7	5.11	29.5	18.0	1.64	1.5
Maribo Ultramono	9827	323.8	5.15	30.5	17.9	1.68	1.3
Mitsui Monohikari	10024	323.9	4.82	31.0	17.7	1.50	2.5
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Mean of Approved	9931.6	324.9	4.9	30.7	17.9	1.6	1.7
Test Market Varieties:							
KW 1745	10390	323.8	5.00	32.1	17.8	1.66	2.3
Beta 2007	9562	323.8	5.27	29.7	17.8	1.67	1.5
HM 2401	9756	331.6	5.05	29.5	18.2	1.67	1.8

** Lower numbers indicate better resistance and seedling vigor.

SOUTHERN MINNESOTA SUGAR COOPERATIVE
Test Market Varieties for 1989

Table 6. Two year performance summary (% of Mean) from coded trials conducted at SMSC, 1987-88.

VARIETY	RECOVERABLE SUGAR/ACRE	RECOVERABLE SUGAR/TON	LEAF SPOT RATING **	TONS/ACRE	% SUGAR	% LOSS TO MOLASSES	SEEDLING VIGOR **	ESTIMATED GROWER RETURN/TON
1989 Approved Varieties								
ACH 164	100.1	98.3	97.1	101.3	98.3	100.0	100.0	97.8
ACH 180	98.9	101.0	93.5	98.0	101.1	104.4	100.0	101.6
ACH 181	105.1	98.5	93.3	106.5	98.9	106.9	105.9	98.5
ACH 198	101.3	100.2	91.8	101.3	100.0	103.8	105.9	100.0
Beta 3614	95.8	101.4	99.8	94.1	101.1	100.0	88.2	101.6
Beta 6269	97.8	100.7	95.7	96.7	100.6	103.8	105.9	100.8
Beta 6625	98.8	104.2	101.4	94.5	103.4	97.5	117.6	104.6
Hilleshog 4046	97.7	101.0	101.4	96.7	101.1	105.6	105.9	101.6
Hilleshog 5090	101.2	99.3	110.2	101.6	98.9	100.0	94.1	98.5
Hilleshog 5135	101.5	101.6	107.1	99.7	101.1	101.9	76.5	101.6
H-M R-103	97.6	99.4	94.3	98.0	99.4	101.3	88.2	99.3
KW 1014	102.1	99.8	93.9	102.0	99.4	98.8	76.5	99.3
KW 3145	103.0	97.6	106.3	104.9	97.8	103.1	111.8	97.0
KW 3265	101.4	98.2	102.4	103.6	98.3	103.1	111.8	97.8
KW 3394	100.6	100.0	101.6	100 7	100.0	103.1	111.8	100.0
Maribo 403	100.4	98.8	99.4	101.6	99.4	106.9	76.5	99.3
Maribo 411	96.7	100.6	104.3	96.1	100.6	102.5	88.2	100.8
Maribo Ultramono	98.9	99.7	105.1	99.3	100.0	105.0	76.5	100.0
Mitsui Monohikari	100.9	99.7	98.4	101.0	98.9	93.8	147.1	98.5
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Mean of Approved	9931.6	324.9	4.9	30.7	17.9	1.6	1.7	
Test Market Varieties:								
KW 1745	104.6	99.7	102.0	104.6	99.4	103.8	135.3	99.3
Beta 2007	96.3	99.7	107.6	96.7	99.4	104.4	88.2	99.3
HM 2401	98.2	102.1	103.1	96.1	101.7	104.4	105.9	102.3

** Lower numbers indicate better resistance and seedling vigor.

TABLE 7. Three Year Performance Summary of 1988 SMSC Commercial Coded Entries*
Three Locations

Variety	Recoverable Sugar / Ton (pounds) 1988	2 Yr Mean 87-88	3 Yr Mean 86-88	3 Yr % Mean 86-88	Recoverable Sugar / Acre (pounds) 1988	2 Yr Mean 87-88	3 Yr Mean 86-88	3 Yr % Mean 86-88	Loss to Molasses (%) 1988	2 Yr Mean 87-88	3 Yr Mean 86-88	3 Yr % Mean 86-88
ACH 164	322.7	319.3	313.6	99.0	8834	9941	8641	99.1	1.56	1.60	1.52	99.0
ACH 178	318.6	320.2	317.3	100.1	8489	9845	8597	98.6	1.70	1.72	1.59	103.4
ACH 180	329.3	328.1	321.1	101.3	8335	9819	8620	98.9	1.65	1.67	1.56	101.2
ACH 181	320.5	320.1	315.0	99.4	9001	10439	9027	103.5	1.71	1.71	1.58	102.9
ACH 194	331.7	333.7			8494	9880			1.64	1.65		
Beta 3614	332.1	329.5	323.7	102.1	8429	9519	8372	96.0	1.59	.60	1.48	96.4
Beta 5266	313.0	314.0	308.9	97.5	8237	10069	9086	104.2	1.69	.71	1.59	103.1
Beta 6269	325.0	327.3	323.6	102.1	8265	9716	8567	98.3	1.65	1.66	1.52	98.6
Beta 6625	334.5	338.4	332.7	105.0	8319	9812	8629	99.0	1.50	1.56	1.45	94.5
Bush Johnson 1310	316.4	313.8	306.5	96.7	9174	10355	8984	103.0	1.61	1.65	1.54	100.1
Bush Johnson Monofort	313.1	311.7	306.3	96.7	8799	10172	8875	101.8	1.70	1.74	1.62	105.5
Hilleshög 4046	327.3	328.0	319.7	100.9	8262	9705	8610	98.8	1.70	1.69	1.58	102.7
Hilleshög 5090	323.7	322.6	315.8	99.7	8697	10050	8819	101.1	1.53	1.60	1.52	98.6
Hilleshög 5135	332.2	330.1	323.7	102.2	8654	10081	8865	101.7	1.61	1.63	1.54	99.9
Hilleshög 8277	317.6	319.5	315.4	99.5	8420	10065	8686	99.6	1.61	1.66	1.54	100.3
HM R103	322.5	322.9	315.3	99.5	8200	9690	8534	97.9	1.59	1.62	1.54	100.1
KW 1014	324.9	324.1	318.9	100.6	8761	10144	8840	101.4	1.56	1.58	1.48	96.4
KW 1745	323.3	323.8			9122	10390			1.59	1.66		
KW 3145	315.5	317.1	312.0	98.5	8574	10232	8904	102.1	1.63	1.65	1.53	99.2
KW 3265	318.9	318.9	312.6	98.6	8588	10075	8870	101.7	1.61	1.65	1.52	98.8
KW 3394	329.0	324.8	318.3	100.5	8625	9989	8763	100.5	1.62	1.65	1.54	100.1
Maribo 403	320.8	321.0	314.9	99.4	8486	9974	8702	99.8	1.69	1.71	1.61	104.9
Maribo 411	326.1	326.7	320.2	101.0	8368	9606	8496	97.4	1.59	1.64	1.54	99.9
Maribo 865	320.5	322.4			8987	10336			1.68	1.67		
Maribo 875	324.0	325.1			8523	10009			1.69	1.71		
Maribo Ultramono	329.3	323.8	316.8	100.0	8389	9827	8576	98.4	1.65	1.68	1.57	102.1
Mitsui Monohikari	326.1	323.9	315.8	99.6	8604	10024	8478	97.2	1.43	1.50	1.42	92.3
Mean	323.7	323.4	316.9	100.0	8579	9991	8719	100.0	1.62	1.65	1.54	100.0

* 1988 data from Bird Island, Renville and Clara City. 1987 data from Bird Island, DeGraff and Maynard.

TABLE 8. Three Year Performance Summary of 1988 SMSC Commercial Coded Entries*
Three Locations

Variety	Sugar Content (%) 1988	Sugar Content (%) 2 Yr Mean 87-88	Sugar Content (%) 3 Yr Mean 86-88	Sugar Content (%) 3 Yr % Mean 86-88	Root Yield (Tons / Acre) 1988	Root Yield (Tons / Acre) 2 Yr Mean 87-88	Root Yield (Tons / Acre) 3 Yr Mean 86-88	Root Yield (Tons / Acre) 3 Yr % Mean 86-88	Seedling Vigor Rating** (1=Ex, 5=Poor) 1988	Seedling Vigor Rating** (1=Ex, 5=Poor) 2 Yr Mean 87-88	Seedling Vigor Rating** (1=Ex, 5=Poor) 3 Yr Mean 86-88	Seedling Vigor Rating** (1=Ex, 5=Poor) 3 Yr % Mean 86-88
ACH 164	17.7	17.6	17.2	98.9	27.4	31.1	27.4	99.8	2.0	1.7	1.6	95.9
ACH 178	17.6	17.7	17.5	100.4	26.7	30.8	27.1	98.7	1.6	1.6	1.4	82.9
ACH 180	18.1	18.1	17.6	101.3	25.5	30.1	26.8	97.6	1.8	1.7	1.8	105.6
ACH 181	17.7	17.7	17.3	99.7	28.2	32.7	28.6	104.0	2.1	1.8	1.9	114.5
ACH 194	18.2	18.3			25.8	29.7			1.4	1.3		
Beta 3614	18.2	18.1	17.7	101.7	25.5	28.9	25.8	93.8	1.8	1.5	1.5	90.4
Beta 5266	17.3	17.4	17.0	98.0	26.5	32.1	29.4	106.8	2.0	2.0	1.9	112.5
Beta 6269	17.9	18.0	17.7	101.8	25.6	29.7	26.4	96.2	2.0	1.8	1.6	93.4
Beta 6625	18.2	18.5	18.1	104.1	25.0	29.0	25.9	94.3	2.3	2.0	1.9	111.2
Bush Johnson 1310	17.4	17.3	16.9	97.0	29.1	33.1	29.2	106.3	2.0	2.0	1.9	110.8
Bush Johnson Monofort	17.4	17.3	16.9	97.5	28.3	32.8	29.0	105.5	1.6	1.6	1.5	92.0
Hilleshög 4046	18.1	18.1	17.6	101.1	25.4	29.7	26.9	97.8	1.9	1.8	1.7	102.3
Hilleshög 5090	17.7	17.7	17.3	99.6	26.9	31.2	27.9	101.5	1.8	1.6	1.5	90.6
Hilleshög 5135	18.2	18.1	17.7	102.0	26.2	30.6	27.4	99.6	1.5	1.3	1.4	80.9
Hilleshög 8277	17.5	17.6	17.3	99.6	26.9	31.7	27.6	100.3	2.4	2.4	2.3	137.9
HM R103	17.7	17.8	17.3	99.6	25.6	30.1	27.1	98.4	1.5	1.5	1.4	83.5
KW 1014	17.8	17.8	17.4	100.3	27.2	31.3	27.6	100.5	1.4	1.3	1.4	85.3
KW 1745	17.8	17.8			28.4	32.1			2.6	2.3		
KW 3145	17.4	17.5	17.1	98.6	27.3	32.2	28.3	103.1	2.4	1.9	1.8	104.0
KW 3265	17.6	17.6	17.1	98.6	27.2	31.8	28.3	103.1	2.0	1.9	1.8	109.0
KW 3394	18.1	17.9	17.5	100.4	26.4	30.9	27.6	100.2	2.0	1.9	1.8	103.8
Maribo 403	17.7	17.8	17.4	99.9	26.6	31.2	27.6	100.5	1.4	1.3	1.4	83.3
Maribo 411	17.9	18.0	17.6	101.0	25.9	29.5	26.5	96.5	1.6	1.5	1.4	82.9
Maribo 865	17.7	17.8			28.2	32.1			1.7	1.4		
Maribo 875	17.9	18.0			26.6	30.9			1.8	1.5		
Maribo Ultramono	18.1	17.9	17.4	100.1	25.5	30.5	27.0	98.4	1.5	1.3	1.3	78.9
Mitsui Monohikari	17.7	17.7	17.2	99.0	26.5	31.0	26.7	97.1	2.8	2.5	2.5	148.5
Mean	17.8	17.8	17.4	100.0	26.7	31.0	27.5	100.0	1.9	1.7	1.7	100.0

* 1988 data from Bird Island, Renville and Clara City. 1987 data from Bird Island, DeGraff and Maynard.
** 1987 vigor data from DeGraff and Maynard.

TABLE 9.

COMBINED ANALYSIS
SOUTHERN MINN SEMI COMMERCIAL CODED TEST
1988
AMERICAN CRYSTAL SUGAR COMPANY RESEARCH CENTER

27 varieties 20 repsXlocs 3 tests combined

VARIETY	CODE	Rec. lbs/T	Rec. lbs/A	Loss to Mol.	Sugar %	Yield T/A
ACH 192	155	320.9(101.0)	8773(104.2)	1.64(99.2)	17.69(100.8)	27.73(103.7)
ACH 196	148	321.3(101.1)	8446(100.4)	1.72(104.1)	17.79(101.4)	26.36(98.5)
ACH 198 (84-239)	158	314.9(99.1)	8789(104.4)	1.65(99.9)	17.40(99.1)	28.26(105.6)
ACH 85-592	163	312.6(98.4)	8250(98.0)	1.87(112.9)	17.50(99.7)	26.49(99.0)
ACH 86-258	167	329.9(103.8)	8168(97.0)	1.62(98.0)	18.12(103.2)	24.81(92.7)
Beta 1238	152	325.0(102.2)	8676(103.1)	1.63(98.7)	17.88(101.9)	27.10(101.3)
Beta 2007	169	310.7(97.8)	7769(92.3)	1.70(103.0)	17.24(98.3)	25.31(94.6)
Beta 2988	151	322.6(101.5)	8708(103.5)	1.61(97.2)	17.74(101.1)	27.40(102.4)
Beta 5657	165	317.3(99.8)	8980(106.7)	1.62(97.6)	17.48(99.6)	28.58(106.8)
Beta 6118	164	328.8(103.5)	7787(92.5)	1.53(92.6)	17.97(102.4)	23.88(89.3)
Bush Johnson 1320	147	317.7(99.9)	8300(98.6)	1.64(99.1)	17.52(99.9)	26.25(98.1)
Bush Johnson 1330	144	318.0(100.0)	8336(99.0)	1.69(102.1)	17.59(100.2)	26.52(99.1)
Hilleshog 5135 (check)	159	321.8(101.3)	8698(103.3)	1.62(98.1)	17.72(101.0)	27.20(101.6)
Hilleshog 8362	146	307.4(96.7)	8446(100.3)	1.66(100.3)	17.03(97.1)	27.85(104.1)
HM 2401	166	317.1(99.8)	8386(99.6)	1.72(103.9)	17.57(100.2)	26.60(99.4)
HM 2402	150	313.8(98.7)	8365(99.4)	1.60(96.4)	17.29(98.5)	26.99(100.9)
KW 1286	143	315.3(99.2)	8562(101.7)	1.66(100.5)	17.43(99.3)	27.52(102.9)
KW 2398	149	323.9(101.9)	8945(106.3)	1.61(97.1)	17.80(101.5)	28.12(105.1)
KW 3265 (check)	156	313.9(98.8)	8504(101.0)	1.66(100.0)	17.35(98.9)	27.40(102.4)
Maribo 862	168	318.8(100.3)	8299(98.6)	1.68(101.3)	17.62(100.4)	26.26(98.2)
Maribo 871	145	321.2(101.1)	8046(95.6)	1.73(104.5)	17.79(101.4)	25.19(94.2)
Maribo 872	157	316.9(99.7)	8388(99.7)	1.61(97.4)	17.46(99.5)	26.64(99.6)
Maribo 883	153	322.5(101.5)	8387(99.7)	1.64(98.9)	17.76(101.2)	26.48(99.0)
Maribo 885	154	316.7(99.6)	8156(96.9)	1.75(105.8)	17.58(100.2)	25.98(97.1)
Maribo Ultramono (check)	161	315.6(99.3)	8697(103.3)	1.71(103.5)	17.49(99.7)	28.00(104.6)
Seedex SX-1001	162	310.6(97.7)	8505(101.1)	1.46(88.4)	16.99(96.9)	27.58(103.1)
Van der Have Puressa II	160	305.7(96.2)	7876(93.6)	1.65(99.8)	16.94(96.5)	25.89(96.8)

General Mean Across Varieties	317.81	8416.22	1.66	17.55	26.75
Coeff. of Var. (%)	2.92	8.60	8.85	2.42	8.31
Variety Mean Square	705.42	2113851.00	0.11	1.69	24.52
Error Mean Square (Error B)	87.36	519113.44	0.02	0.18	4.81
F Value	8.07**	4.07**	5.08**	9.25**	5.09**
L.S.D. (.05)	5.76	444.13	0.09	0.26	1.35
L.S.D. (.01)	7.37	568.28	0.11	0.34	1.73

* significant at 5% ** significant at 1% ns not significant

Value in parenthesis represents percent of check.
General Mean used as check.

TABLE 10.

COMBINED ANALYSIS
SOUTHERN MINN SEMI COMMERCIAL CODED TEST
1988
AMERICAN CRYSTAL SUGAR COMPANY RESEARCH CENTER

VARIETY	CODE	No ppm	K ppm	Am.N ppm	Gr.Sugar lbs/A	Vigor+
ACH 192	155	176(105.9)	2257(100.2)	609(97.6)	9717(104.2)	1.88(89.9)
ACH 196	148	161(96.7)	2339(103.8)	656(105.1)	9370(100.5)	2.40(114.9)
ACH 198 (84-239)	158	144(86.8)	2161(95.9)	655(104.9)	9766(104.7)	2.19(104.9)
ACH 85-592	163	158(95.4)	2403(106.6)	753(120.6)	9264(99.3)	1.52(72.9)
ACH 86-258	167	135(81.4)	2152(95.5)	636(101.9)	8994(96.4)	2.54(121.9)
Beta 1238	152	185(111.5)	2210(98.1)	611(97.9)	9587(102.8)	2.04(97.9)
Beta 2007	169	147(88.3)	2284(101.4)	661(105.9)	8654(92.8)	2.71(129.9)
Beta 2988	151	166(100.2)	2231(99.0)	595(95.3)	9627(103.2)	2.13(101.9)
Beta 5657	165	162(97.3)	2257(100.1)	594(95.1)	9928(106.4)	1.67(79.9)
Beta 6118	164	142(85.4)	1997(88.6)	606(97.1)	8538(91.5)	2.48(118.9)
Bush Johnson 1320	147	181(108.8)	2255(100.1)	606(97.1)	9188(98.5)	2.69(128.9)
Bush Johnson 1330	144	182(109.5)	2220(98.5)	654(104.7)	9249(99.2)	1.73(82.9)
Hilleshog 5135 (check)	159	167(100.7)	2233(99.1)	604(96.8)	9606(103.0)	1.83(87.9)
Hilleshog 8362	146	146(88.0)	2291(101.7)	625(100.2)	9395(100.7)	2.60(124.9)
HM 2401	166	176(105.8)	2280(101.2)	663(106.2)	9327(100.0)	1.81(86.9)
HM 2402	150	154(92.9)	2133(94.7)	614(98.4)	9258(99.3)	2.65(126.9)
KW 1286	143	169(101.6)	2316(102.8)	613(98.2)	9509(101.9)	2.21(105.9)
KW 2398	149	178(107.3)	2220(98.5)	592(94.8)	9881(105.9)	1.94(92.9)
KW 3265 (check)	156	176(106.1)	2231(99.0)	626(100.2)	9433(101.1)	2.17(103.9)
Maribo 862	168	168(101.0)	2275(101.0)	634(101.6)	9197(98.6)	1.79(85.9)
Maribo 871	145	163(98.3)	2348(104.2)	658(105.4)	8945(95.9)	2.73(130.9)
Maribo 872	157	177(106.7)	2294(101.8)	576(92.4)	9266(99.3)	1.46(69.9)
Maribo 883	153	171(102.8)	2256(100.1)	607(97.3)	9265(99.3)	1.52(72.9)
Maribo 885	154	183(110.3)	2291(101.7)	681(109.2)	9088(97.4)	1.69(80.9)
Maribo Ultramono (check)	161	181(108.9)	2315(102.8)	646(103.6)	9697(104.0)	1.58(75.9)
Seedex SX-1001	162	148(88.9)	2232(99.1)	489(78.3)	9334(100.1)	2.42(115.9)
Van der Have Puressa II	160	188(113.5)	2356(104.6)	586(93.9)	8755(93.9)	1.96(93.9)

General Mean Across Varieties	166.04	2253.27	624.02	9327.38	2.09
Coeff. of Var. (%)	19.60	7.48	14.30	8.58	30.67
Variety Mean Square	3911.59	134567.39	40780.06	2526917.00	2.49
Error Mean Square (Error B)	1044.05	28944.55	7678.50	632028.31	0.40
F Value	3.75**	4.65**	5.31**	4.00**	6.19**
L.S.D. (.05)	19.91	104.85	54.00	490.06	0.47
L.S.D. (.01)	25.47	134.08	69.06	627.05	0.61

* significant at 5% ** significant at 1% ns not significant

Value in parenthesis represents percent of check.
General Mean used as check.
+Vigor data from 2 locations.

TABLE 11.

COMBINED ANALYSIS
SOUTHERN MINN SEMI COMMERCIAL CODED TEST
1988
AMERICAN CRYSTAL SUGAR COMPANY RESEARCH CENTER

VARIETY	CODE	Bolters %	Emergence %
ACH 192	155	0.000(0.0)	0.0(0.0)
ACH 196	148	0.000(0.0)	0.0(0.0)
ACH 198 (84-239)	158	0.000(0.0)	0.0(0.0)
ACH 85-592	163	0.000(0.0)	0.0(0.0)
ACH 86-258	167	0.000(0.0)	0.0(0.0)
Beta 1238	152	0.000(0.0)	0.0(0.0)
Beta 2007	169	0.074(300.0)	0.0(0.0)
Beta 2988	151	0.000(0.0)	0.0(0.0)
Beta 5657	165	0.074(300.0)	0.0(0.0)
Beta 6118	164	0.000(0.0)	0.0(0.0)
Bush Johnson 1320	147	0.000(0.0)	0.0(0.0)
Bush Johnson 1330	144	0.000(0.0)	0.0(0.0)
Hilleshog 5135 (check)	159	0.000(0.0)	0.0(0.0)
Hilleshog 8362	146	0.000(0.0)	0.0(0.0)
HM 2401	166	0.000(0.0)	0.0(0.0)
HM 2402	150	0.000(0.0)	0.0(0.0)
KW 1286	143	0.000(0.0)	0.0(0.0)
KW 2398	149	0.000(0.0)	0.0(0.0)
KW 3265 (check)	156	0.000(0.0)	0.0(0.0)
Maribo 862	168	0.000(0.0)	0.0(0.0)
Maribo 871	145	0.000(0.0)	0.0(0.0)
Maribo 872	157	0.000(0.0)	0.0(0.0)
Maribo 883	153	0.000(0.0)	0.0(0.0)
Maribo 885	154	0.000(0.0)	0.0(0.0)
Maribo Ultramono (check)	161	0.000(0.0)	0.0(0.0)
Seedex SX-1001	162	0.000(0.0)	0.0(0.0)
Van der Have Puressa II	160	0.521(>999.9)	0.0(0.0)

General Mean Across Varieties	0.02	0.00
Coeff. of Var. (%)	844.95	0.00
Variety Mean Square	0.22	0.00
Error Mean Square (Error B)	0.05	0.00
F Value	4.37**	0.00
L.S.D. (.05)	0.14	ns
L.S.D. (.01)	0.18	ns

* significant at 5% ** significant at 1% ns not significant

Value in parenthesis represents percent of check.
General Mean used as check.

TABLE 12. 1988 Cercospora Leaf Spot Ratings for SMBSC Commercial Coded Entries
Betaseed Nursery - Shakopee, MN

Code	Entry	Average Rating at Each Date (1988)* 8/10	8/15	8/19	8/24	8/29	Mean All Ratings* 1988	2 Yr Mean	3 Yr Mean	3 Yr % Mean
57	ACH 164	2.25	3.00	4.00	5.50	5.75	4.10	4.76	4.78	100.4
70	ACH 178	2.25	3.00	3.25	4.75	5.25	3.70	4.41	4.32	90.8
78	ACH 180	2.25	3.00	4.25	4.75	5.50	3.95	4.58	4.70	98.6
80	ACH 181	2.75	3.00	3.75	4.50	5.25	3.85	4.57	4.45	93.5
73	ACH 194	2.50	3.00	4.50	6.00	6.50	4.50	5.12		
69	Beta 3614	2.50	3.00	4.00	4.75	5.75	4.00	4.89	4.61	96.8
67	Beta 5266	2.75	3.25	4.50	6.00	6.75	4.65	4.93	4.77	100.2
76	Beta 6269	2.50	3.25	4.50	5.25	5.75	4.25	4.69	4.71	98.9
77	Beta 6625	2.25	3.00	4.25	6.00	6.25	4.35	4.97	4.86	102.0
59	Bush Johnson 1310	2.25	2.75	3.75	4.75	5.50	3.80	4.36	4.30	90.3
74	Bush Johnson Monofort	2.50	3.00	4.75	5.75	6.25	4.45	5.25	5.08	106.7
63	Hilleshög 4046	2.50	3.25	4.25	5.75	6.25	4.40	4.97	4.87	102.3
81	Hilleshög 5090	2.75	2.75	4.50	5.75	6.75	4.50	5.40	5.00	105.0
60	Hilleshög 5135	2.50	3.50	5.00	6.25	6.50	4.75	5.25	4.98	104.5
64	Hilleshög 8277	3.00	3.75	5.50	7.25	7.50	5.40	5.85	5.38	113.0
68	HM R103	2.25	3.00	4.25	5.50	5.75	4.15	4.62	4.47	93.9
66	KW 1014	2.15	2.65	4.00	4.32	5.35	3.70	4.60	4.46	93.6
61	KW 1745	2.25	3.00	4.50	5.50	6.00	4.25	5.00		
62	KW 3145	2.75	3.50	4.50	5.75	6.25	4.55	5.21	5.00	105.0
65	KW 3265	3.00	3.50	4.00	5.75	6.25	4.50	5.02	4.80	100.8
79	KW 3394	2.50	3.00	4.00	5.75	6.00	4.25	4.98	4.85	101.9
75	Maribo 403	2.50	3.00	4.00	5.50	5.75	4.15	4.87	4.60	96.7
55	Maribo 411	2.75	3.00	4.75	6.00	6.25	4.55	5.11	4.88	102.5
56	Maribo 865	2.50	3.00	4.50	5.75	6.25	4.40	4.85		
72	Maribo 875	2.00	3.00	4.75	5.75	6.25	4.35	4.87		
58	Maribo Ultramono	3.25	3.50	4.25	6.00	5.75	4.55	5.15	5.03	105.6
71	Mitsui Monohikari	2.25	3.00	4.25	5.00	5.75	4.05	4.82	4.62	97.0
	Mean	2.51	3.10	4.31	5.54	6.04	4.30	4.93	4.76	100.0

* Lower numbers indicate better leaf spot resistance. (1=Ex, 9=Poor)

TABLE 13.

1988 Cercospora Leaf Spot Ratings for SMBSC Semi Commercial Coded Entries
Betaseed Nursery - Shakopee, MN

Code	Entry	Average Rating at Each Date (1988)* 8/10	8/15	8/19	8/24	8/29	Mean
155	ACH 192	2.75	3.50	4.75	6.25	6.50	4.75
148	ACH 196	3.00	3.50	5.25	6.25	6.50	4.90
158	ACH 198	2.50	2.75	3.75	4.50	5.25	3.75
163	ACH 85-592	2.50	3.00	4.00	5.75	6.00	4.25
167	ACH 86-258	2.25	2.75	4.00	5.75	6.00	4.15
152	Beta 1238	2.75	3.50	5.00	5.50	6.25	4.60
169	Beta 2007	2.25	3.25	4.75	6.50	7.00	4.75
151	Beta 2988	2.50	3.50	4.75	6.50	6.75	4.80
165	Beta 5657	2.00	2.75	3.25	5.25	5.75	3.80
164	Beta 6118	3.00	3.50	4.75	6.00	6.25	4.70
147	Bush Johnson 1320	2.75	3.75	4.25	5.25	5.75	4.35
144	Bush Johnson 1330	2.75	3.00	4.50	5.50	6.00	4.35
146	Hilleshög 8362	2.25	3.00	4.00	5.50	6.00	4.15
166	HM 2401	2.50	3.25	4.25	5.75	6.00	4.35
150	HM 2402	2.50	3.75	5.25	6.50	6.50	4.90
143	KW 1286	2.50	3.00	4.00	6.00	6.00	4.30
149	KW 2398	2.50	3.25	5.00	5.75	6.25	4.55
168	Maribo 862	2.50	3.00	4.75	6.00	6.25	4.50
145	Maribo 871	3.25	3.50	4.50	6.50	6.75	4.90
157	Maribo 872	2.00	3.25	5.00	6.25	6.25	4.55
153	Maribo 883	2.47	3.00	5.00	5.97	6.35	4.55
154	Maribo 885	2.50	3.50	5.25	6.00	6.00	4.65
162	Seedex SX-1001	2.00	3.00	4.00	5.25	5.50	3.95
160	Van der Have Puressa II	2.25	3.25	4.25	5.75	5.75	4.25
	Mean	2.51	3.23	4.51	5.84	6.15	4.45

* Lower numbers indicate better leaf spot resistance. (1=Ex, 9=Poor)

Date of Harvest Study

Objectives

Evaluate 10 sugarbeet varieties for relative root yields and quality characteristics harvested early and late.

Experimental Procedures

Trials were planted at three locations in 1986, 1987 and 1988. One location was harvested in 1986, two in 1987, and two in 1988.

The varieties included in these three 1988 trials were:

Beta 3614	Ultramono
Beta 6625	Maribo 403
Monohikari	ACH 181
Hilleshog 8277	KW 3265
Hilleshog 5135	KW 3394

The varieties Hilleshog 8277 and Beta 3614 have only 1987 and 1988 data. Varieties Beta 6625 and ACH 181 have only 1988 data.

All varieties were planted in 4 row plots 30 ft in length and six replications. In 1986 and 1987, harvest dates were scheduled to begin about September 20 for the early date and October 25 for the late harvest. Harvest dates were split into three intervals in 1988 to represent the expected increase prepile period from the increase in acres. The harvest dates were September 22, October 6 and October 25 for the early, mid-harvest and late harvest dates respectively. Planting dates were May 28-29, April

20-23, and April 25-27 for 1986,1987 and 1988, respectively. All trials were hand thinned to a final population of 120-130 plants per 100 feet. Standard production practices were utilized for weed and disease control.

Results And Discussion

Variety Performance data for the early, mid harvest and late harvest dates are shown in tables 1, 2, 3 and 4. The average increase in percent sugar for 1988 over the harvest period was 3.83% (Table 1). Average root yield increased 3.91 ton per acre from the early to mid harvest (Table 2).

August precipitation was a major attributing factor for the large increase in sugar and tons per acre over the harvest period. If the August rains had not developed the drought of 1988 would have reflected a much lower tonnage increase over the harvest period and would have likely reduced sugar content. Data combined for three years (1986-1988) increased an average of 2.61 tons per acre and 2.75% in sugar.

Average deviations from percent of mean for sugar content, tons per acre, recoverable sugar per ton (RST) and recoverable sugar per acre (RSA) for 1988 are presented in figures 1, 2, 3 and 4. Data for combined 1986-1988 are contained in figures 5, 6, 7 and 8. Certain varieties appear to be better selections than others for early

harvest. Although quality increased from early to mid harvest, to late harvest, some varieties may show a greater potential to accumulate a relatively higher level of sugar earlier in the growing season. Also certain varieties appear to have the ability to accumulate tons and sugar more rapidly than others. Data for 1988 may not reflect the normal situation due to the drought, however; if just 1988 is considered these data would indicate that KW 3614, Beta 6625, Monohikari, Hilleshog 8277 and Hilleshog 5135 would be likely candidates for early sugar. Varieties particularly strong for early tons per acre would be Beta 6625, KW 3265, Ultramono and Monohikari. Varieties evaluated for 3 years show that Hilleshog 5135, and Ultramono show high sugar content early. Varieties such as Monohikari, KW 3265 and KW 3394 were higher in tons per acre early over other varieties evaluated. Early harvest selections should be selected for both early tons and early sugar. Other varieties not included in this study may also be well suited for early harvest.

A grower must consider several factors including variety when making a determination of which field to harvest early or late.

The decision making process will be complicated in 1989 with the large Nitrogen residual left in the soil from 1988. High levels of Nitrogen could seriously impact the quality of the crop so attention to fertility may be more

important than ever before. A variety such as Monohikari, which is significantly lower in LTM, may be used in a field high in Nitrogen. Some considerations other than simply sugarbeet varieties are as follows:

1) Plant population.
2) General plant growth and development throughout the growing season.
3) Plant stress caused by excess/deficient water, hail, insects, temperature, disease, weeds, etc.
4) Relative soil fertility.
5) Relative planting dates, emergence dates, speed of plant growth, etc.
6) Relative ability for plants to respond to the environment and continue rapid growth.

Any single factor or combination of the above list could overwhelm a "high sugar variety" planted specially for early harvest, and actually have lower quality than a "tonnage" variety.

Table 1. Three Year Performance of 1988 Varieties Harvested Early, Mid-season and Late for Sugar Content.*

	Sugar Content (%)									
Variety	Early 1988	Mid 1988	Late 1988	Change E -> L	Early 2 Yr Mean 87-88	Late 2 Yr Mean 87-88	Early 3 Yr Mean 86-88	Late 3 Yr Mean 86-88	Early 3 Yr % Mean 86-88	Late 3 Yr % Mean 86-88
Beta 3614	15.19	17.30	18.41	3.22	15.62	18.07				
Beta 6625	15.31	17.90	18.51	3.20						
Monohikari	14.92	17.22	18.89	3.97	15.37	18.45	14.91	17.75	99.60	100.16
Hilleshog 8277	14.72	17.07	17.80	3.08	15.29	17.86				
Hilleshog 5135	14.73	17.40	18.57	3.84	15.32	18.12	15.22	17.75	101.67	100.16
Ultramono	14.45	17.22	18.87	4.42	15.26	18.42	15.07	17.82	100.69	100.59
Maribo 403	13.90	17.34	18.58	4.68	15.02	18.33	14.77	17.77	98.64	100.27
ACH 181	14.35	16.79	18.00	3.65						
KW 3265	14.46	17.18	18.57	4.11	15.19	18.22	14.90	17.57	99.51	99.18
KW 3394	14.53	17.13	18.65	4.12	15.26	18.24	14.95	17.65	99.89	99.63
Mean	14.66	17.26	18.49	3.83	15.29	18.21	14.97	17.72	100.00	100.00

* 1986 Data from Sacred Heart.
1987 Data from Renville and Clara City.
1988 Data from Renville and Bird Island.

Table 2. Three Year Performance of 1988 Varieties Harvested Early, Mid-season and Late for Root Yield.*

	Root Yield Tons/Acre									
Variety	Early 1988	Mid 1988	Late 1988	Change E -> M	Early 2 Yr Mean 87-88	Late 2 Yr Mean 87-88	Early 3 Yr Mean 86-88	Late 3 Yr Mean 86-88	Early 3 Yr % Mean 86-88	Late 3 Yr % Mean 86-88
Beta 3614	17.81	20.89	23.63	3.08	20.46	24.99				
Beta 6625	19.68	21.97	22.03	2.29						
Monohikari	18.30	23.17	22.44	4.87	20.69	24.92	21.25	22.96	101.65	97.62
Hilleshog 8277	16.45	22.09	26.91	5.64	20.54	27.16				
Hilleshog 5135	17.10	22.96	24.22	5.86	19.94	26.29	20.12	23.97	96.23	101.92
Ultramono	18.76	21.13	25.63	2.37	21.53	26.56	20.74	24.16	99.22	102.71
Maribo 403	16.55	20.63	21.90	4.08	19.55	24.84	20.34	23.04	97.28	97.94
ACH 181	17.44	22.54	23.26	5.10						
KW 3265	18.99	22.35	21.65	3.36	21.13	24.56	21.08	23.13	100.82	98.33
KW 3394	20.22	22.68	21.75	2.46	21.88	25.02	21.91	23.87	104.80	101.48
Mean	18.13	22.04	23.34	3.91	20.71	25.54	20.91	23.52	100.00	100.00

* 1986 Data from Sacred Heart.
1987 Data from Renville and Clara City.
1988 Data from Renville and Bird Island.
Change in Tons/Acre is from Early to Mid-Harvest.

Table 3. Three Year Performance of 1988 Varieties Harvested Early, Mid-season and Late for Recoverable Sugar/Ton.*

	Recoverable Sugar/Ton									
Variety	Early 1988	Mid 1988	Late 1988	Change E -> L	Early 2 Yr Mean 87-88	Late 2 Yr Mean 87-88	Early 3 Yr Mean 86-88	Late 3 Yr Mean 86-88	Early 3 Yr % Mean 86-88	Late 3 Yr % Mean 86-88
Beta 3614	276	321	343	67	286	337				
Beta 6625	278	335	347	69						
Monohikari	274	322	354	80	283	345	275	332	100.20	100.34
Hilleshog 8277	267	317	332	65	280	334				
Hilleshog 5135	261	318	346	85	277	337	277	331	100.93	99.93
Ultramono	261	320	352	91	279	344	277	333	100.93	100.54
Maribo 403	249	323	344	95	274	342	270	332	98.38	100.24
ACH 181	260	311	333	73						
KW 3265	262	320	347	85	277	340	273	328	99.47	99.23
KW 3394	264	319	349	85	279	341	274	330	100.08	99.73
Mean	265	321	345	80	279	340	274	331	100.00	100.00

* 1986 Data from Sacred Heart.
1987 Data from Renville and Clara City.
1988 Data from Renville and Bird Island.

Table 4. Three Year Performance of 1988 Varieties Harvested Early, Mid-season and Late for Recoverable Sugar/Acre.*

	Recoverable Sugar/Acre									
Variety	Early 1988	Mid 1988	Late 1988	Change E -> M	Early 2 Yr Mean 87-88	Late 2 Yr Mean 87-88	Early 3 Yr Mean 86-88	Late 3 Yr Mean 86-88	Early 3 Yr % Mean 86-88	Late 3 Yr % Mean 86-88
Beta 3614	4992	6641	8119	1649	5923	8407				
Beta 6625	5449	7287	7664	1838						
Monohikari	4949	7434	9007	2485	5836	9106	5487	8025	95.17	101.73
Hilleshog 8277	4444	6958	8945	2514	5822	9063				
Hilleshog 5135	4826	7379	8395	2553	5742	8858	5722	7961	99.25	100.93
Ultramono	4970	6701	9032	1731	6089	9119	5798	8102	100.56	102.71
Maribo 403	4410	6600	7555	2190	5560	8470	5614	7674	97.37	97.28
ACH 181	4505	6897	7739	2392						
KW 3265	5009	7114	7540	2105	5893	8407	5781	7676	100.26	97.31
KW 3394	5314	7138	7591	1824	6377	8501	6191	7891	107.38	100.04
Mean	4887	7015	8159	2128	5905	8741	5766	7888	100.00	100.00

* 1986 Data from Sacred Heart.
1987 Data from Renville and Clara City.
1988 Data from Renville and Bird Island.
Change in Recoverable Sugar/Acre is from Early to Mid-Harvest.

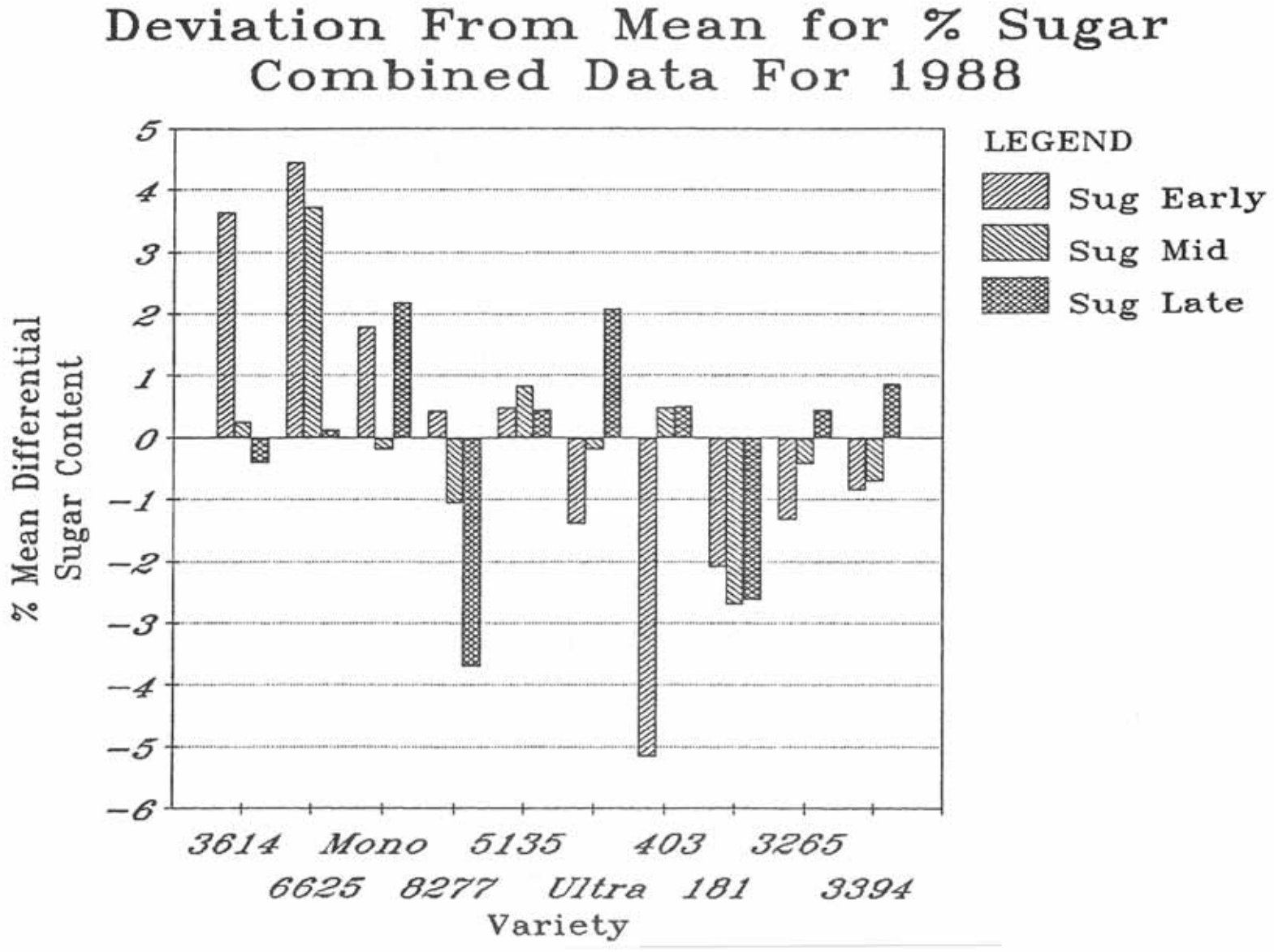

Figure 1. The average deviation from the mean for % sugar in 1988.

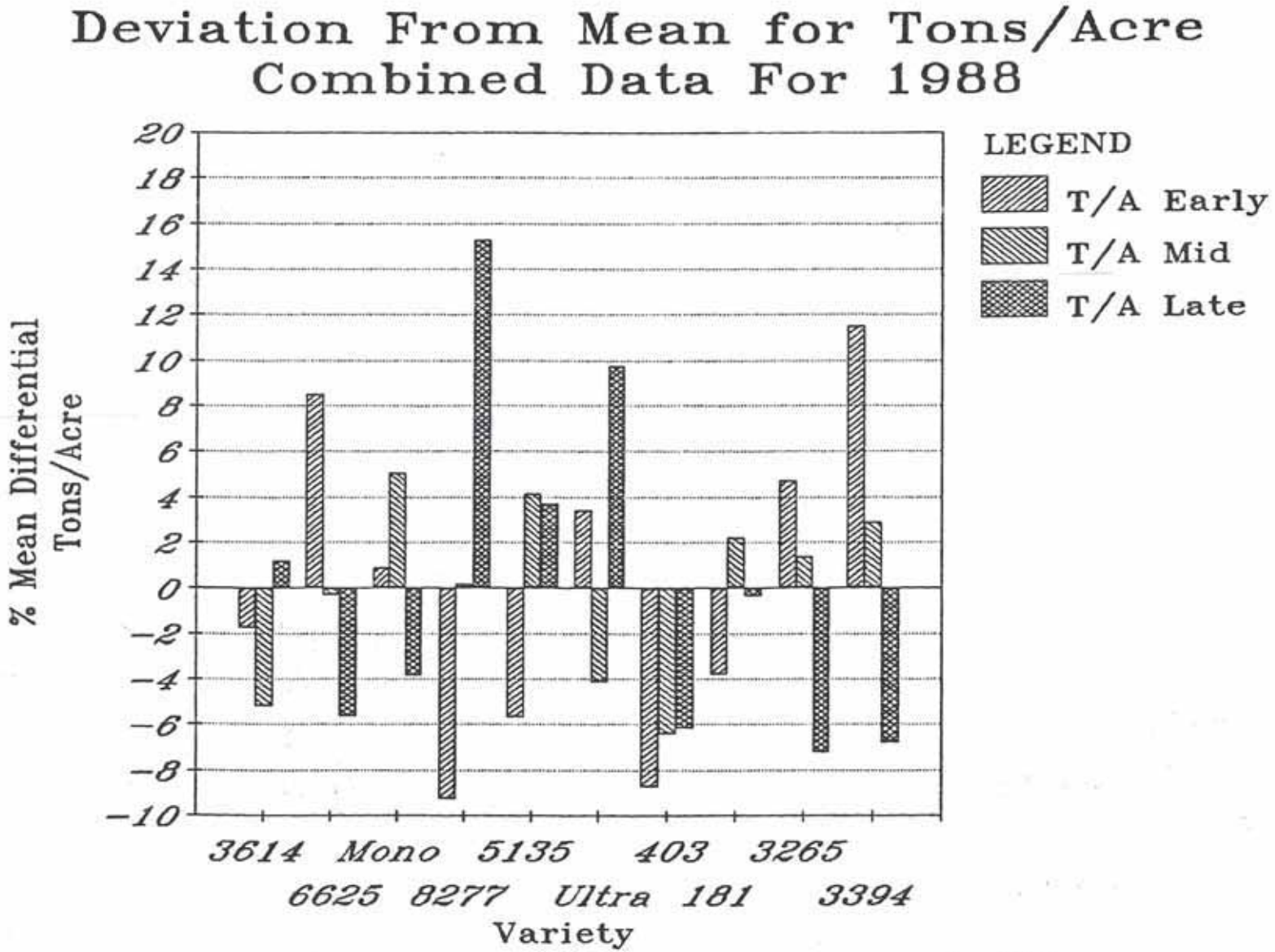

Figure 2. The average deviation from the mean for tons/acre in 1988.

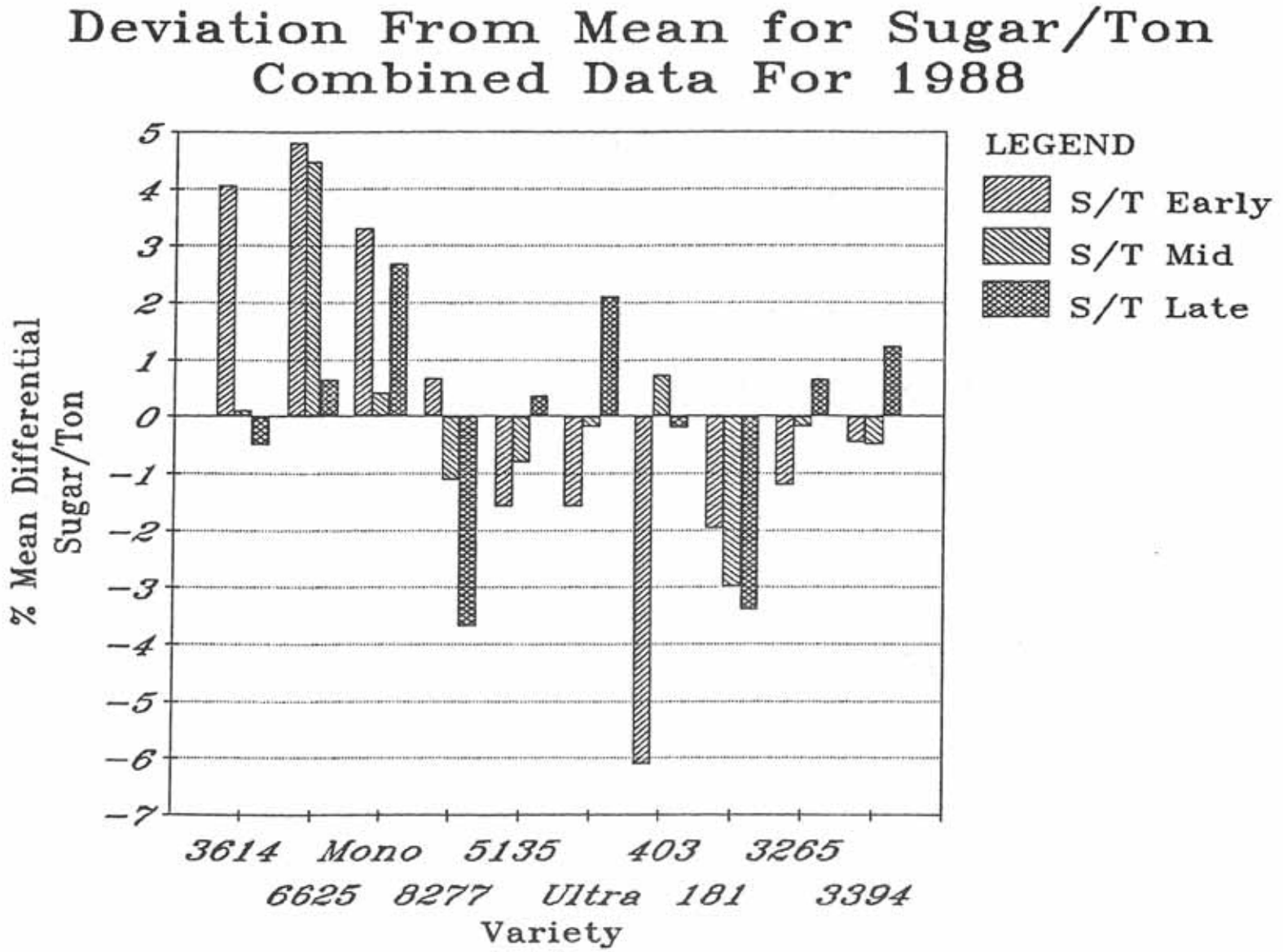

Figure 3. The average deviation from the mean for recoverable sugar per ton in 1988.

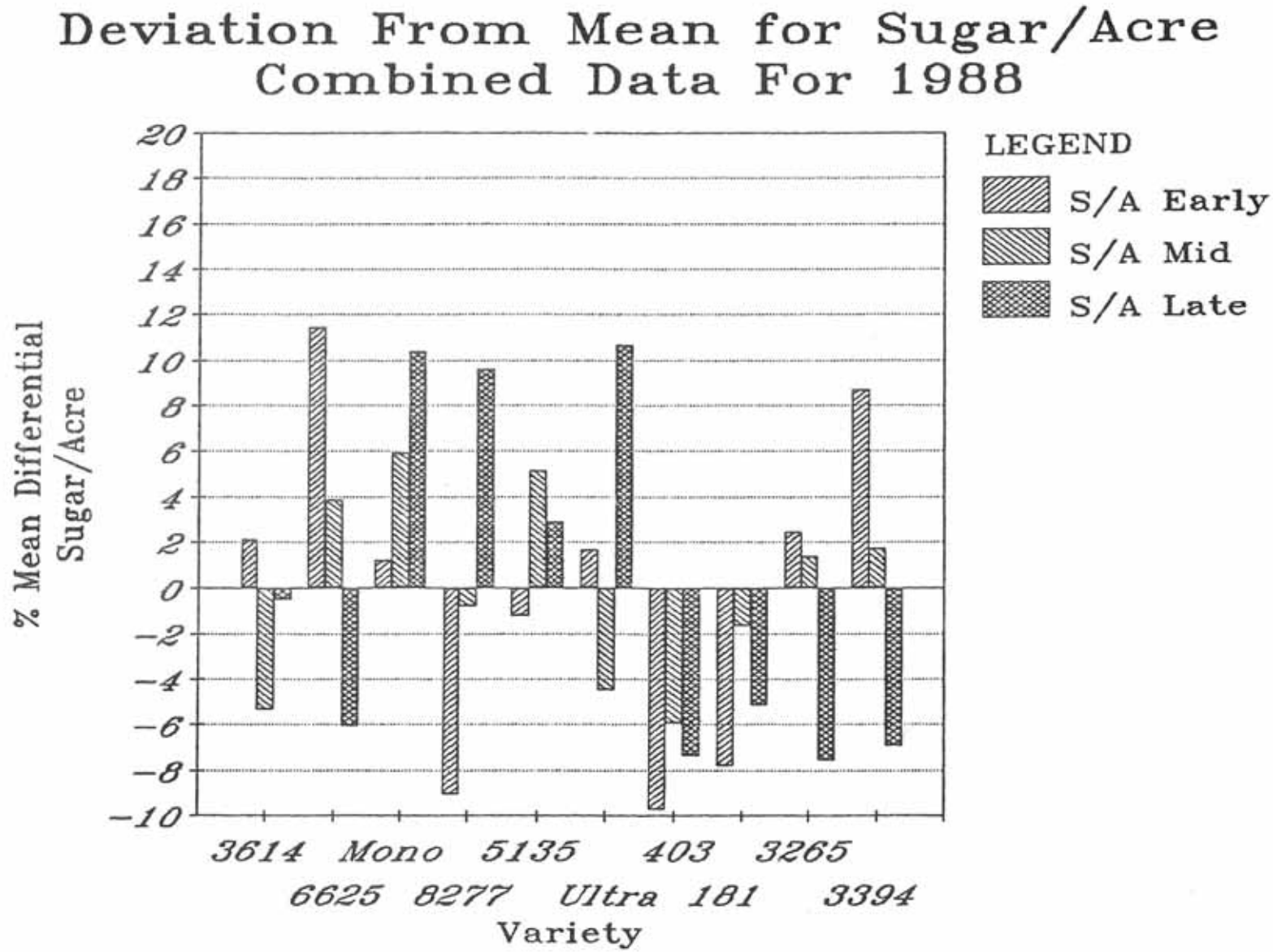

Figure 4. The average deviation from the mean for recoverable sugar per acre in 1988.

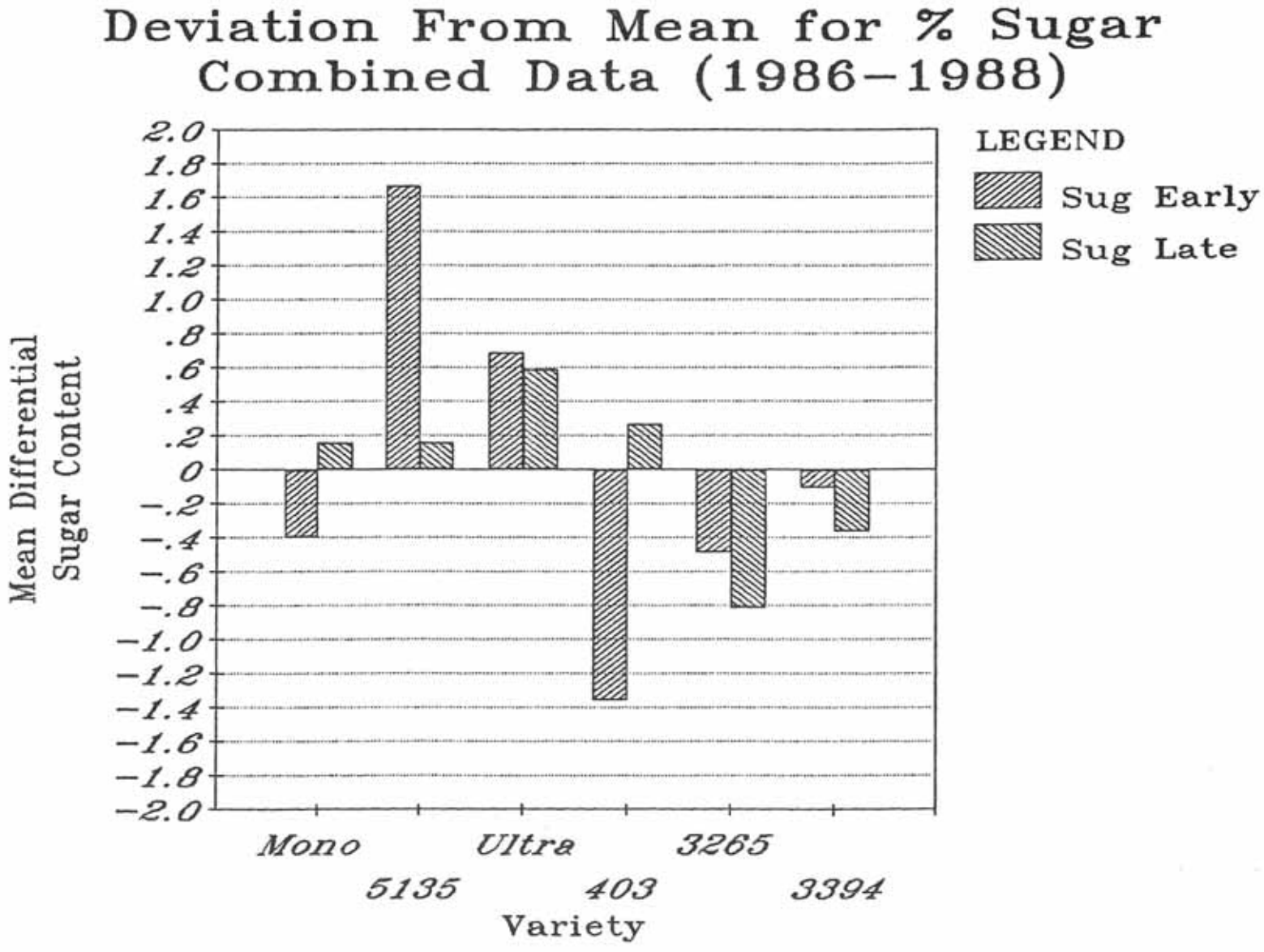

Figure 5. The average deviation of the % of the mean for % sugar combined data 1986 - 1988.

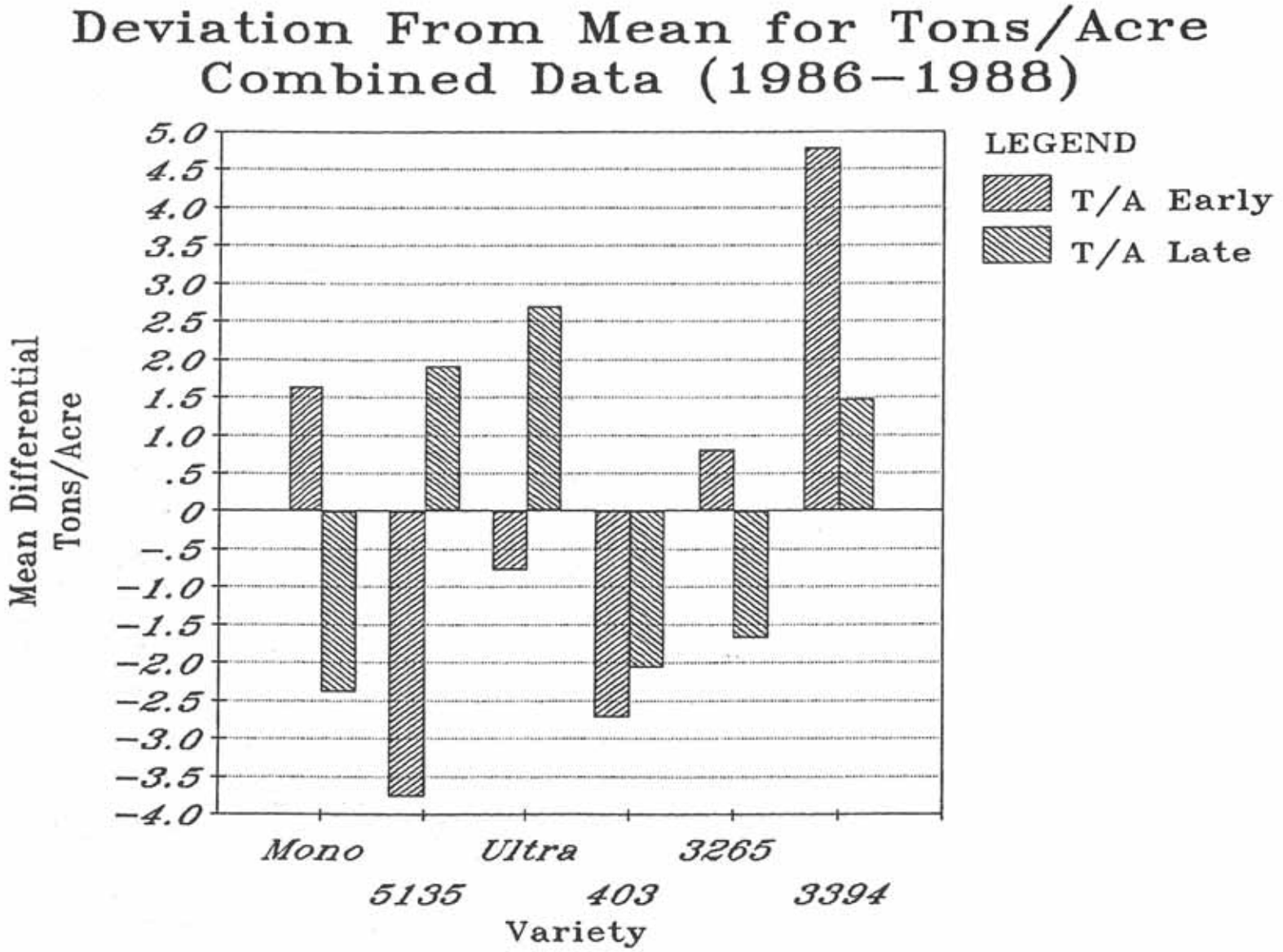

Figure 6. The average deviation of the % of the mean for tons/acre combined data 1986 - 1988.

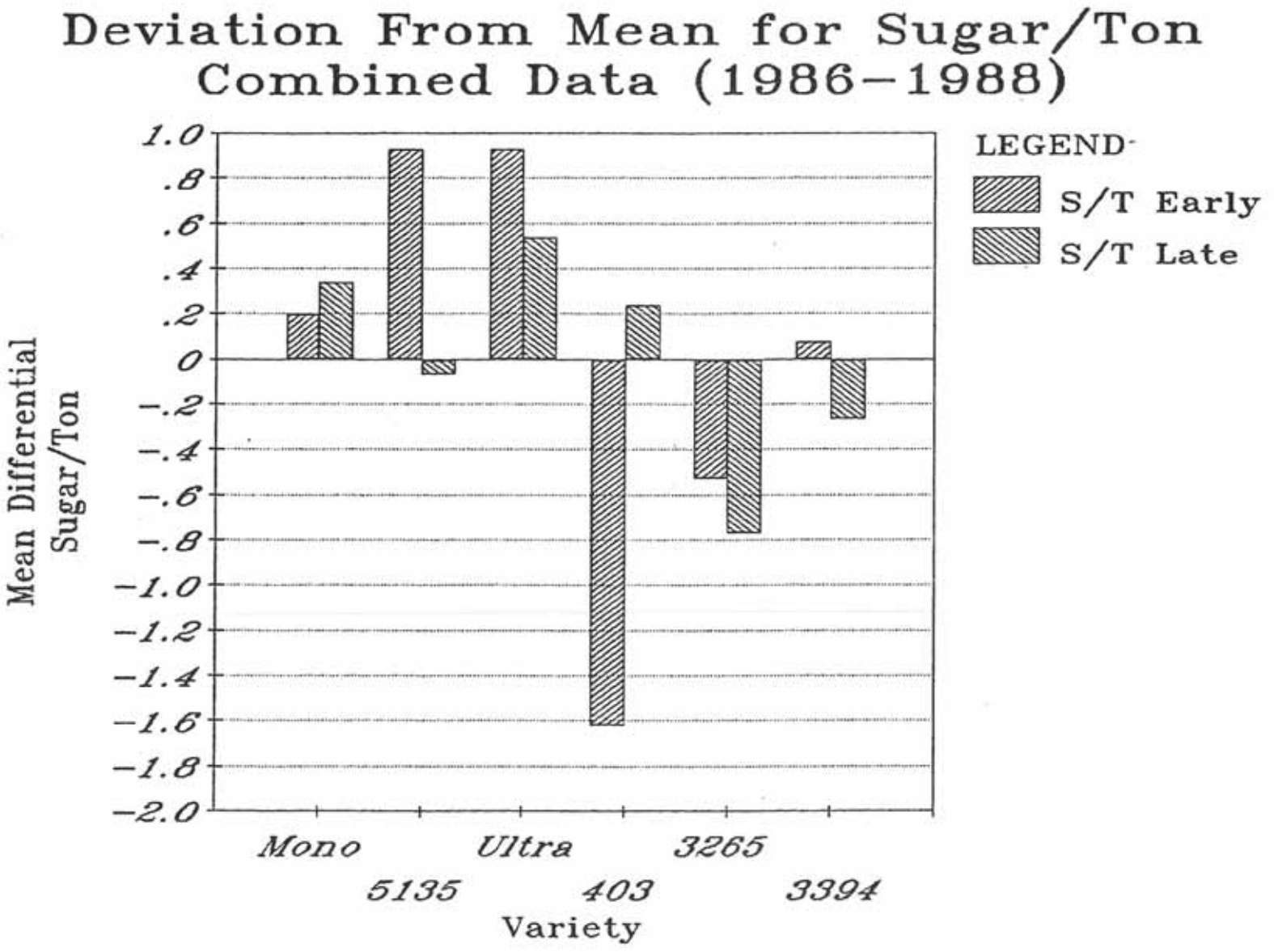

Figure 7. The average deviation of the % of the mean for recoverable sugar/ton combined data 1986 - 1988.

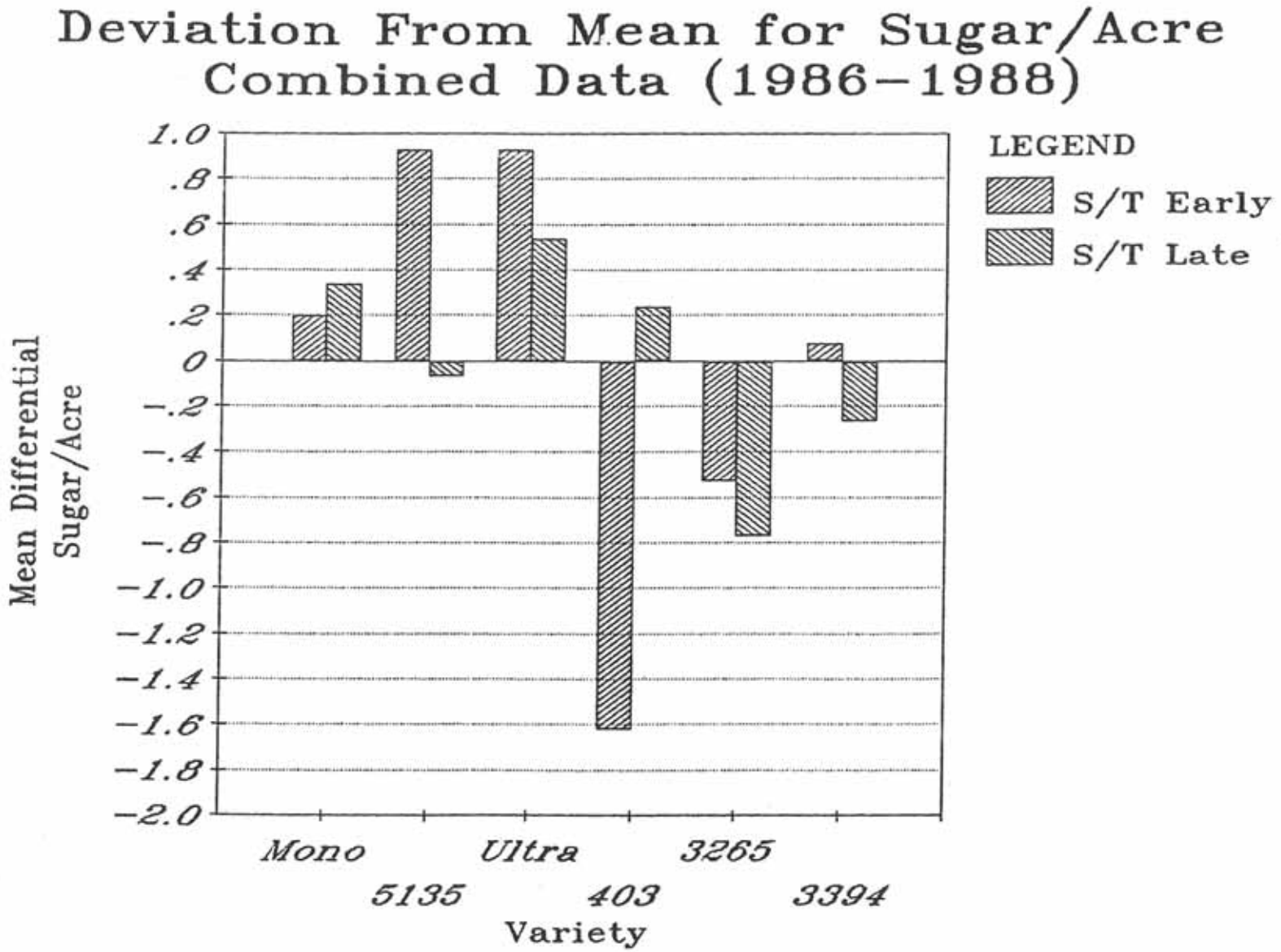

Figure 8. The average deviation of the % of the mean for recoverable sugar/acre combined data 1986 - 1988.

Root Rot Control With Seed Treatments

Objective

To determine if a particular seed treatment will control sugarbeet seedlings infected with Aphanomyces.

Experimental Procedure

One location was selected near Hector, Minnesota which has had a high incidence of root rot in past years. Ten seed treatments were used to evaluate control (Table 1). The experiment was planted with 4 row plots, 30 ft in length. Each treatment was replicated 4 times.

The first two treatments included Thiram, which was used as a commercial check. Treatments 3, 4, 5, 6, 7, and 8 contained Tachagaren at various rates along with Thiram and Apron. Tachagaren has been used effectively in Europe to control Aphanomyces, however; Tachagaren is not labeled for use in the United States. Previous work has indicated that for Tachagaren to be active enough to control Aphanomyces, the compound must be applied to a pellet as a bare seed does not have enough surface area for the chemical to adhere. Also, high rates of Tachagaren are toxic to the bare seed. Treatment 9 is Maneb which the most common seed treatment used in the Southern Minnesota Sugar growing area. Treatment 10 is an untreated pellet.

The experiment was planted on May 5 with dry conditions developing throughout the experiment. Despite the dry

conditions, seedling disease developed quickly. When the seedlings were approximately in the 4-6 leaf stage, 10 seedlings were harvested and visually evaluated for root rot symptoms. The following is a list of the criteria used for evaluation.

0) No apparent symptoms.

1) Slightly brown or discolored hypocotyl but firm under pressure. Very little root pruning.

2) Dark and or discolored hypocotyl with slight girdling of the hypocotyl with evident root pruning and slightly soft root tissue.

3) Very dark hypocotyl and roots with collapsing root tissue but not to the degree of 4. Very evident hypocotyl girdling but main tap root intact, however; very soft and deteriorated. Severe root pruning.

4) Very darkly discolored hypocotyl and roots. Root tissue completely collapsed or main tap root severed as a result of severe hypocotyl girdling. No evidence of secondary root system.

5) Dead or dying plant.

Results and Discussion

The stands in 1988 were much better than 1987 as a result of finer seedbed preparation. Treatments that contained Tachagaren appeared to reduce the amount of visual symptoms of the root rot (Table 1). The beneficial effects of Tachagaren appeared to be greatest as rate was increased, however; the best treatments were Tachagaren alone in a pellet. Treatment of Tachagaren and Thiram showed slightly higher index values than Tachagaren alone.

There was virtually no disease suppression from treatments which did not contain Tachagaren. Tachagaren appears to be an effective means of control of the seedling stage of Aphanomyces, however; due to labeling restrictions, Tachagaren can not be used on sugarbeet seed in the United States. Research will continue with Tachagaren to evaluate the compound further under varying conditions.

Table 1. List of treatments and results for seed treatment study.

Treatment No.	Seed Treatment	Rate per cwt seeds	Root Rot Index *
1	Bare Seed Thiram	 8 fl oz	 2.80 a
2	Pellet Thiram	 8 fl oz	 2.68 ab
3	Pellet Thiram Tachagaren	 8 fl oz 2.6 lbs	 2.05 ab
4	Pellet Thiram Tachagaren	 8 fl oz 5.3 lbs	 1.83 ab
5	Pellet Tachagaren	 2 lbs	 1.93 ab
6	Pellet Tachagaren	 4 lbs	 1.70 b
7	Pellet Tachagaren	 5.9 lbs	 1.65 b
8	Pellet Tachagaren Apron	 2 lbs 2 fl oz	 2.83 ab
9	Pellet Maneb	 10 fl oz	 2.65 ab
10	Pellet		2.72 ab
	Mean LSD 5%		2.24 0.90

* Means represent a visual rating from 0-5. Means with larger numbers represent more severe visual symptoms. Means within columns for each treatment followed by the same letter do not differ significantly using Duncan's multiple range test at the 5% level.

Root Rot Herbicide Interaction Study

Objective

Determine if various commonly used herbicide treatments predispose sugarbeets to higher levels of infection from root rot diseases.

Experimental Procedure

The trial was located at Hector, Minnesota. The location was selected because of the land's history of infectious root rot diseases. The experiment consisted of 15 treatments (Table 1). The variety Maribo Ultramono was selected and planted on 4/20/88 with six row 30 ft plots replicated 4 times. The center 4 rows were treated for evaluation. The preplant incorporated treatments were applied on 4/20/88 with an air temperature of 50°F and soil temperature of 46°F. The first postemergence application was applied on 5/18/88 with an air temperature of 80°F and the sugarbeets were in the 2-4 leaf stage. The second postemergence application was applied on 6/2/88 with an air temperature of 92°F and the sugarbeets were in the 6 leaf stage.

The precipitation throughout the growing season was minimal and experiment sustained extreme temperatures throughout the growing season. Seedling stand was adequate and seedling disease developed quickly. The seedlings were sampled at 10 plants per plot and evaluated for visual root rot symptoms when they were in the 6-8 leaf stage.

The following is a description of the criteria for the evaluations:

0) No apparent symptoms.

1) Slightly brown or discolored hypocotyl but firm under pressure. Very little root pruning.

2) Dark and or discolored hypocotyl with slight girdling of the hypocotyl with evident root pruning and slightly soft root tissue.

3) Very dark hypocotyl and roots with collapsing root tissue but not to the degree of 4. Very evident hypocotyl girdling but main tap root intact, however; very soft and deteriorated. Severe root pruning.

4) Very darkly discolored hypocotyl and roots. Root tissue completely collapsed or main tap root severed as a result of severe hypocotyl girdling. No evidence of secondary root system.

5) Dead or dying plant.

Late season evaluations were made for weed control which was not associated to the herbicide root rot trial. The data are summarized in tables 1 and 2.

Results and Discussion

The average infection index value for the entire experiment was 1.90 (Table 1). There was no significant treatment that either increased or decreased the visual effects of the root rot.

The results may be affected by the high level of inoculum that exists in that particular experiment location. Any treatment difference may be masked by the

overwhelming effect of the disease itself. Some soil applied herbicides have shown to increase the pathogenicity of some organisms in peas and this scenario may carry over in sugarbeets. To further evaluate the effect of herbicide root rot interactions, additional testing under laboratory conditions are required to better evaluate any effects that may not be measurable under field conditions.

The results from the weed control evaluations are summarized in Table 2. None of the treatments significantly affected stand or sugarbeet injury. The best control of common Lambsquarter was from treatment 10 and 15, Betamix and Betanex, respectively. Treatment of Antor (5), Dual (8), Betamix (10) and Betanex (15) shows some control on Red Root Pigweed. As would be expected foxtail control was best with Poast/Dash (11) and Fusilade/Crop Oil (12). Some good foxtail control was achieved with Dual (7,8).

Table 1. List of treatments and root rot index values for herbicide rot root interaction. Treatments applied on the same day were tankmixed.*

Trt.	Chemical	Rate lb ai/A	Timing	Date Applied	Root Rot Index
1)	Eptam	2.00	PPI	04/20/88	2.10
2)	Eptam	3.00	PPI	04/20/88	2.07
3)	Ro-Neet	4.00	PPI	04/20/88	1.72
4)	Eptam	2.00	PPI	04/20/88	1.55
	Ro-Neet	2.00	PPI	04/20/88	
5)	Antor	6.00	PPI	04/20/88	2.00
6)	Nortron	3.50	PPI	04/20/88	2.05
7)	Dual	2.00	PPI	04/20/88	1.80
8)	Dual	3.00	PPI	04/20/88	1.80
9)	Check				1.86
10)	Betamix	0.33	POST	05/18/88	2.08
	Betamix	0.50	POST	06/02/88	
11)	Poast	0.20	POST	06/02/88	1.76
	Dash	2.00	POST	06/02/88	
12)	Fusilade	0.19	POST	06/02/88	1.81
	Crop Oil	2.00	POST	06/02/88	
13)	Stinger	0.19	POST	06/02/88	1.85
14)	H-273	0.75	POST	06/02/88	1.95
15)	Betanex	0.33	POST	06/02/88	2.11
	Betanex	0.50	POST	05/18/88	
	Mean				1.90
	LSD 5%				0.75

* Means represent a visual rating from 0-5. Means with larger numbers represent more severe visual symptoms.

Table 2. List of treatments and weed control ratings for herbicide root rot interaction Treatments applied on the same day were tankmixed.*

Trt.	Chemical	Rate lb ai/A	Timing	Date Applied	SUGB Injury (%)	COLQ Control (%)	RRPW Control (%)	FOTA Control (%)
1)	Eptam	2.00	PPI	04/20/88	0.00	0.00	5.00	67.50
2)	Eptam	3.00	PPI	04/20/88	0.00	0.00	17.50	70.00
3)	Ro-Neet	4.00	PPI	04/20/88	0.00	0.00	10.00	65.00
4)	Eptam	2.00	PPI	04/20/88	0.00	45.00	36.25	86.25
	Ro-Neet	2.00	PPI	04/20/88				
5)	Antor	6.00	PPI	04/20/88	0.00	0.00	58.75	60.00
6)	Nortron	3.50	PPI	04/20/88	0.00	22.50	48.75	20.00
7)	Dual	2.00	PPI	04/20/88	0.00	0.00	41.25	88.75
8)	Dual	3.00	PPI	04/20/88	0.00	15.00	56.25	85.00
9)	Check				0.00	0.00	0.00	0.00
10)	Betamix	0.33	POST	05/18/88	1.25	85.00	68.75	33.75
	Betamix	0.50	POST	06/02/88				
11)	Poast	0.20	POST	06/02/88	0.00	0.00	0.00	93.75
	Dash	2.00	POST	06/02/88				
12)	Fusilade	0.19	POST	06/02/88	0.00	0.00	0.00	91.25
	Crop Oil	2.00	POST	06/02/88				
13)	Stinger	0.19	POST	06/02/88	0.00	0.00	0.00	0.00
14)	H-273	0.75	POST	06/02/88	0.00	0.00	0.00	20.00
15)	Betanex	0.33	POST	06/02/88	0.00	71.25	61.25	22.50
	Betanex	0.50	POST	05/18/88				
	Mean				0.08	19.92	26.92	53.58
	LSD 5%				1.45	45.32	35.50	39.67

* Means represent a visual rating from 0-5. Means with larger numbers represent more severe visual symptoms.

Effects of Petiole Material on Tare Lab Sugar Analysis

Objectives

To determine the effect of green petiole material on tare lab sugar analysis.

Experimental Procedures

One location was selected in 1988 in Renville, Minnesota, and two locations at Renville, Minnesota and Bird Island, Minnesota in 1987. A defoliator set to high was driven over the plot sites at harvest. The above method was to stimulate the effects of inadequate topping that may occur under field conditions.

The sugarbeets were hand harvested and each sugarbeet was split down the middle. One half was placed in a tare bag untouched. The other half was scalped by hand to remove any excess green material and then placed into another tare bag. When both bags contained approximately 15 lbs they were sealed and delivered to the tare lab for analysis. The samples were considered paired samples during data analysis. The above procedure was performed on 27 paired samples in 1987 and 20 paired samples in 1988 or a total of 96 tare bags. The tare bags were analyzed for sugar content, and ppm K, Na, and Amino N.

Results and Discussion

The sampled data was analyzed with a T Test. The two

means were found to be significantly different with a difference of almost 0.2 for sugar content (Table 1). There were some isolated samples where the differences in sugar content did not occur (Figure 1). However, in general, the sugar content observed in the tare lab was consistently lower on sugarbeets with petiole material as compared to that same sugarbeet with a cleaner crown. In addition to the sugar content, the level of impurities observed were higher on average in poorly topped sugarbeets which reflected in higher loss to molasses and lower recoverable sugar per ton.

The emphasis of this experiment is to determine the effects of poorly topped sugarbeets. Excessive scalping could result in reduced yield and higher storage losses, however; close scrutiny of the defoliating operation could be rewarded with higher sugars and less impurities.

Table 1. Results from topping experiment with a comparison of topped vs poorly topped sugarbeets and the resultant sugar quality. The Data is Combined for 1987 and 1988 with sample number 28 and above representing 1988 data.

Sample No.	Topped Sugar Content	Topped K	Topped Na	Topped Amino N	Topped Loss To Mol.	Topped Recov. S/T	Poorly Topped Sugar Content	Poorly Topped K	Poorly Topped Na	Poorly Topped Amino N	Poorly Topped Loss To Mol.	Poorly Topped Recov. S/T
1	17.16	2443	158	150	1.103	321	17.14	2483	169	155	1.128	320
2	17.08	2677	129	165	1.186	318	16.68	2707	172	238	1.313	307
3	18.18	2562	161	130	1.119	341	17.20	2438	175	277	1.274	319
4	17.62	2575	236	138	1.169	329	16.96	2634	243	149	1.207	315
5	17.58	2640	115	197	1.210	327	16.88	2711	168	173	1.229	313
6	17.44	2537	218	136	1.145	326	16.94	2532	169	234	1.247	314
7	16.74	2427	315	175	1.204	311	16.98	2578	244	177	1.225	315
8	17.52	2343	134	117	1.014	330	16.74	2706	283	132	1.229	310
9	17.74	2195	133	162	1.022	334	17.90	2405	165	72	0.992	338
10	16.94	2485	168	202	1.188	315	17.06	2432	195	107	1.061	320
11	17.26	2217	166	74	0.931	327	16.57	2571	208	260	1.313	305
12	17.60	2325	134	84	0.965	337	17.44	2255	151	137	1.018	328
13	17.54	2361	158	101	1.011	331	17.56	2494	194	94	1.065	330
14	17.66	2110	142	126	0.950	338	17.04	2416	148	134	1.068	319
15	17.75	2453	167	142	1.100	333	17.30	2612	190	87	1.097	324
16	15.98	2341	240	271	1.284	294	15.72	2163	234	260	1.186	291
17	15.14	2192	240	381	1.355	276	16.00	2050	221	336	1.240	295
18	16.38	2004	213	273	1.139	305	16.12	1832	191	287	1.088	301
19	15.72	2099	237	236	1.134	292	15.35	2165	212	225	1.131	284
20	15.87	2033	185	271	1.132	295	15.84	2093	189	250	1.128	294
21	16.32	2194	169	253	1.156	303	16.00	2116	252	205	1.107	298
22	15.76	2023	232	304	1.194	291	15.04	2112	214	301	1.212	277
23	15.38	2262	266	332	1.328	281	16.22	2108	323	376	1.360	297
24	16.94	1986	163	236	1.061	318	15.93	1977	240	299	1.176	295
25	16.59	1957	189	297	1.142	309	16.14	1920	253	267	1.121	300
26	16.24	2011	220	298	1.177	301	16.56	2077	269	271	1.188	307
27	16.70	2011	199	275	1.137	311	16.27	2078	205	314	1.213	301
28	17.22	2532	231	547	1.682	311	16.64	2749	229	528	1.731	298
29	16.45	2606	230	447	1.577	297	16.51	2802	245	532	1.714	296
30	16.72	2688	270	556	1.766	299	15.84	2704	281	544	1.761	282
31	15.62	2665	269	404	1.560	281	16.78	2760	228	497	1.696	302
32	16.28	2537	221	442	1.543	295	16.53	2915	240	481	1.731	296
33	16.73	2674	231	492	1.659	301	16.98	2911	248	522	1.787	304
34	16.56	2814	226	453	1.654	298	15.92	2983	272	497	1.791	283
35	16.46	2830	281	379	1.590	297	16.50	2880	269	372	1.524	300
36	17.01	2764	230	527	1.735	306	16.10	2944	268	569	1.869	285
37	16.72	2640	259	490	1.658	301	16.88	2891	227	499	1.672	304
38	16.42	2655	212	381	1.500	298	16.30	2848	259	443	1.668	293
39	16.02	2652	270	484	1.728	286	15.68	2750	289	476	1.692	280
40	16.97	2675	221	339	1.457	310	15.54	2820	227	331	1.430	282
41	16.30	2797	310	587	1.862	289	16.85	2833	283	473	1.645	304
42	17.08	2526	198	437	1.522	311	15.42	2860	280	423	1.657	275
43	16.85	2881	279	574	1.859	300	16.00	2740	242	449	1.631	287
44	16.04	2734	253	477	1.671	287	16.74	2689	253	371	1.518	304
45	16.52	2755	264	481	1.688	297	18.76	3223	313	539	1.946	336
46	16.36	2737	271	450	1.645	294	15.78	2927	270	497	1.771	280
47	17.00	2522	229	417	1.509	310	18.54	3247	279	527	1.923	332
Average	16.74	2454	214	317	1.349	308	16.55	2536	232	327	1.399	303
High	18.18	2881	315	587	1.862	341	18.76	3247	323	569	1.946	336
Low	15.14	1957	115	74	0.931	276	15.04	1832	148	72	0.992	275

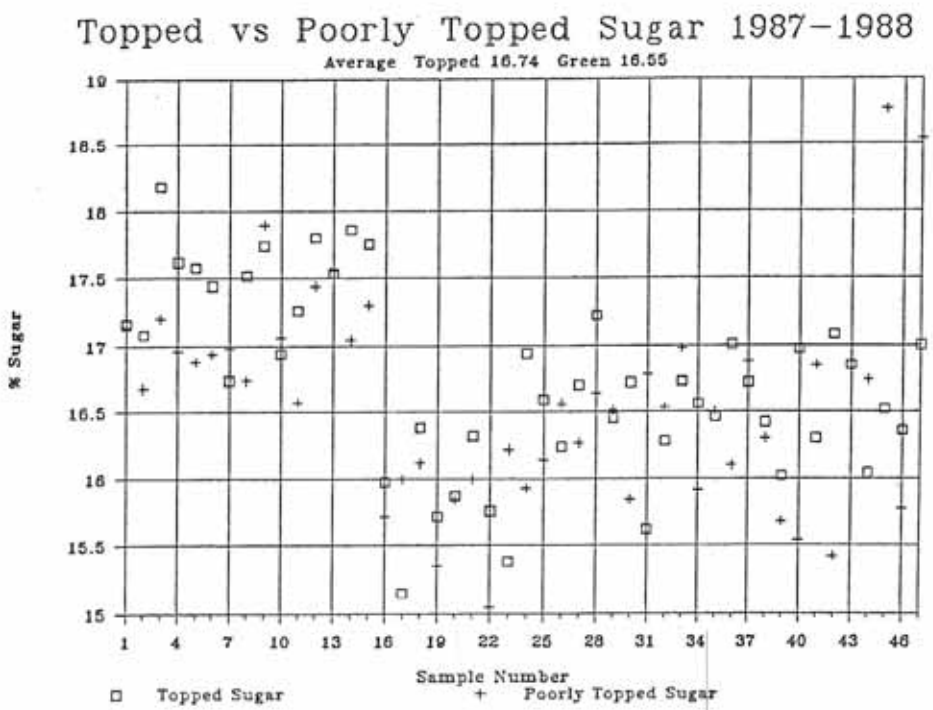

Figure 1. Sugar content comparison for topped vs poorly topped sugarbeets.

Disease Index Summary of 1988

Introduction

Two more remote weather stations were added to monitor leaf spot. Installations were south of Sacred Heart two miles, North of Clara City 9 miles, and 5 miles North on county road 16 between Bird Island and Hector. Mid season the Bird Island station received a lighting strike and was out of service for the remainder of the season. The station monitored air temperature, soil temperature at 4 and 8 inches, relative humidity, leaf wetness and precipitation. The Sacred Heart station also monitored wind speed and wind direction. During harvest, temperature probes were placed in the crown of the sugarbeet and the resulting temperatures were used to aid in the decision for piler shutdown during freezing conditions. The recorded data were used in a Cercospora computer model developed by Shane and Teng of the University of Minnesota. The purpose of the program is to give the sugarbeet grower and indication of a high probability of leaf spot infection. The predictive nature of leaf spot lead to the development of a model that uses temperature, relative humidity and time. It is important to note, canopy sensor placement is paramount to adequately model the Cercospora disease. Sugarbeet fields are highly variably in spore number, consequently; the model should be used in conjunction with field disease monitoring. The table for calculating

disease index values is on Table 1. The data for 1988 are presented in Figures 1 through 8.

Results

The growing season of 1988 did not have many days at which the disease index value was in the favorable category (greater or equal to 6 for a 2 day total Figure 1; greater or equal to 3 on a single day Figure 2). The excessive hot dry weather attributed mainly to the reduced level of disease index values. The spores require high relative humidity (90% to free moisture) and high temperatures (65 - 80°). In 1988 high temperatures were present, however; accompanying high humidities did not develop.

Leaf spot did develop despite the drought, however; the spots were most evident in protected areas and in field edges adjacent to fields which had sugarbeets the previous year. In general, leaf spot modeling correlated very well with the visual scouting reports, however; due to the extremely variable rainfall good scouting efforts were necessary to discover hot spots.

In 1988, a prototype relative humidity sensor was evaluated to collect more accurate RH data. The sensor proved to be effective and should replace the old sensors in 1989.

Table 1. Daily infection condition values based on number of hours of high relative humidity and mean temperature

Hrs	Daily infection condition values
24	1,2,4,5,5,6,6,6,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
23	1,2,3,4,5,6,6,6,6,6,6,6,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
22	1,1,3,4,5,6,6,6,6,6,6,6,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
21	0,1,2,4,4,5,5,5,5,5,5,6,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
20	0,1,2,3,4,5,5,5,5,5,5,5,6,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
19	0,0,1,3,4,5,5,5,5,5,5,5,5,6,6,6,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
18	0,0,1,2,3,4,4,4,4,4,4,5,5,5,5,5,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
17	0,0,1,2,3,4,4,4,4,4,4,4,4,5,5,5,5,5,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
16	0,0,0,2,3,4,4,4,4,4,4,4,4,4,4,4,5,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
15	0,0,0,1,3,4,4,4,4,4,4,4,4,4,4,4,4,5,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
14	0,0,0,1,3,3,3,3,3,3,3,4,4,4,4,4,4,4,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
13	0,0,0,0,3,3,3,3,3,3,3,3,4,4,4,4,4,4,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
12	0,0,0,0,2,3,3,3,3,3,3,3,3,4,4,4,4,4,4,5,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
11	0,0,0,0,2,3,3,3,3,3,3,3,3,3,3,3,3,3,4,5,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
10	0,0,0,0,2,2,2,2,2,2,2,3,3,3,3,3,3,3,4,4,6,6,7,7,7,7,7,7,7,7,7,7,7,7,7,7,3
9	0,0,0,0,2,2,2,2,2,2,2,2,2,2,2,2,2,3,3,3,4,5,6,6,6,6,6,6,6,6,6,6,6,6,6,6,3
8	0,0,0,0,1,2,2,2,2,2,2,2,2,2,2,2,2,2,2,3,3,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,3
7	0,0,0,0,1,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,3,4,4,4,4,4,4,4,4,4,4,4,4,4,4,4,3
6	0,0,0,0,0,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,3,4,4,4,4,4,4,4,4,4,4,4,4,4,4,4,3
5	0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,2,2,3,3,3,3,3,3,3,3,3,3,3,3,3,3,3,3
4	0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2
3	0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2
2	0,0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1	0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1

60 65 70 75 80 85 90

Average Temperature (Fahrenheit)

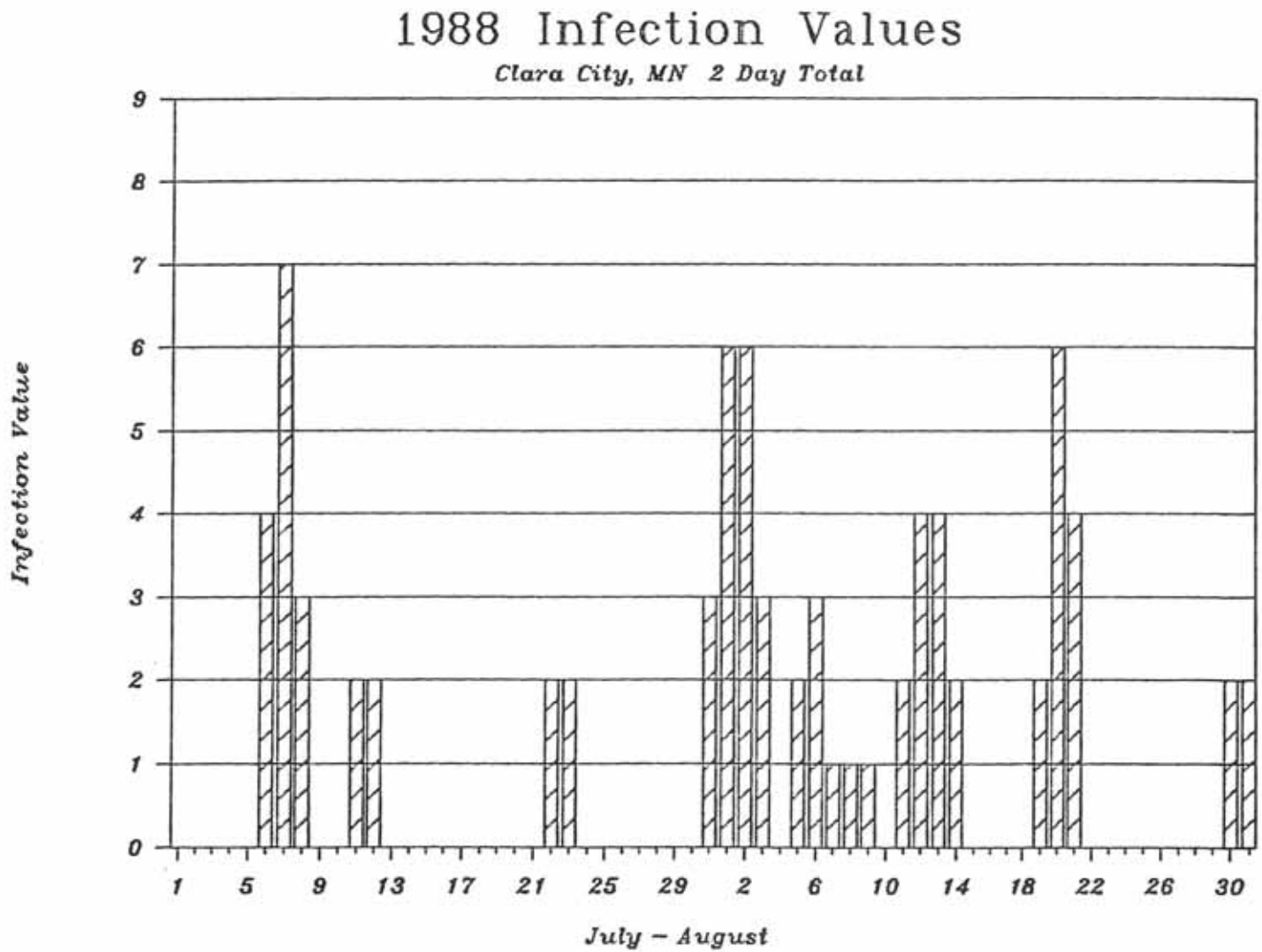

Figure 1. Two day total infection values from July through August 1988 for Clara City, MN.

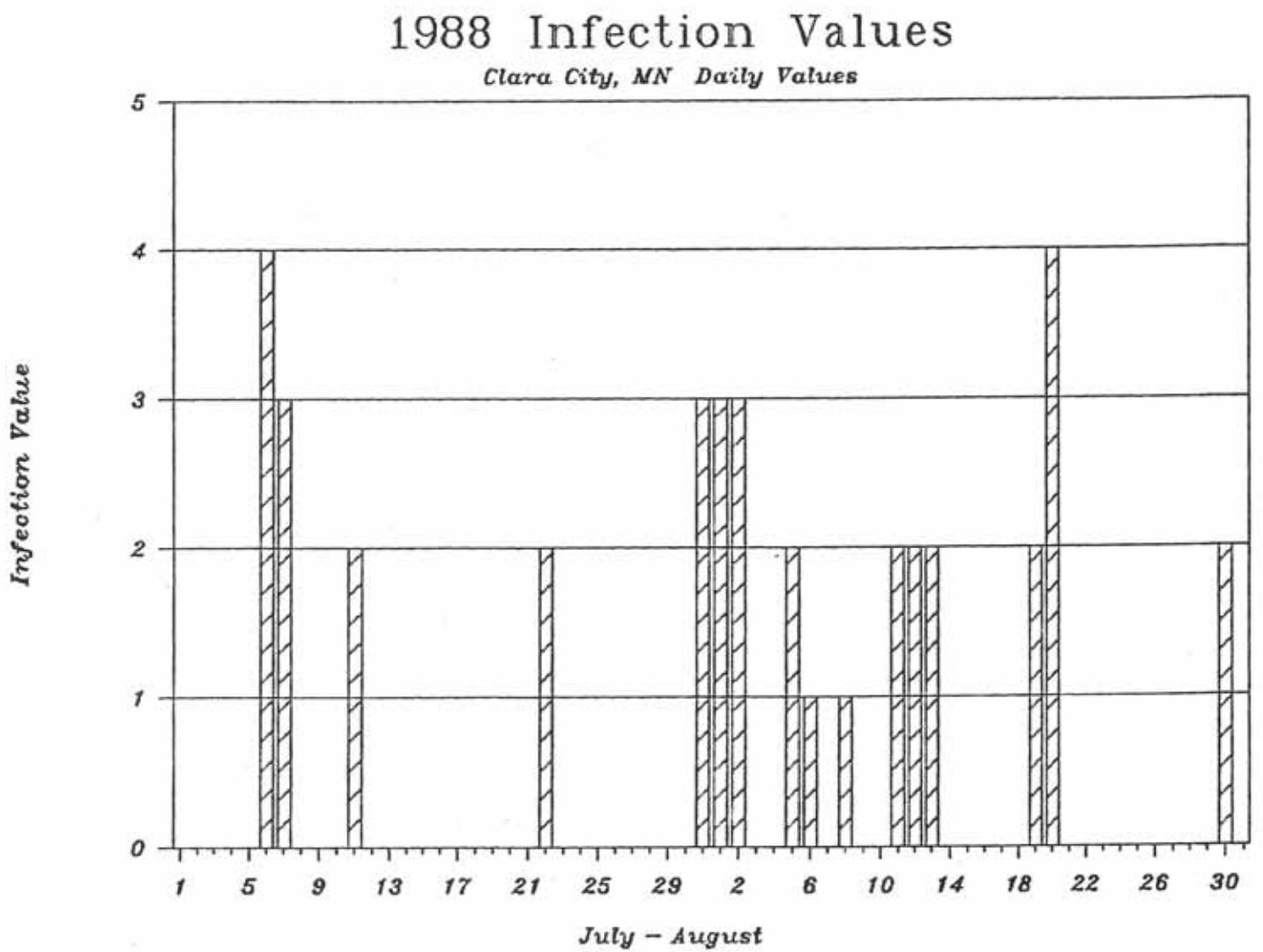

Figure 2. Daily infection values from July through August 1988 for Clara City, MN.

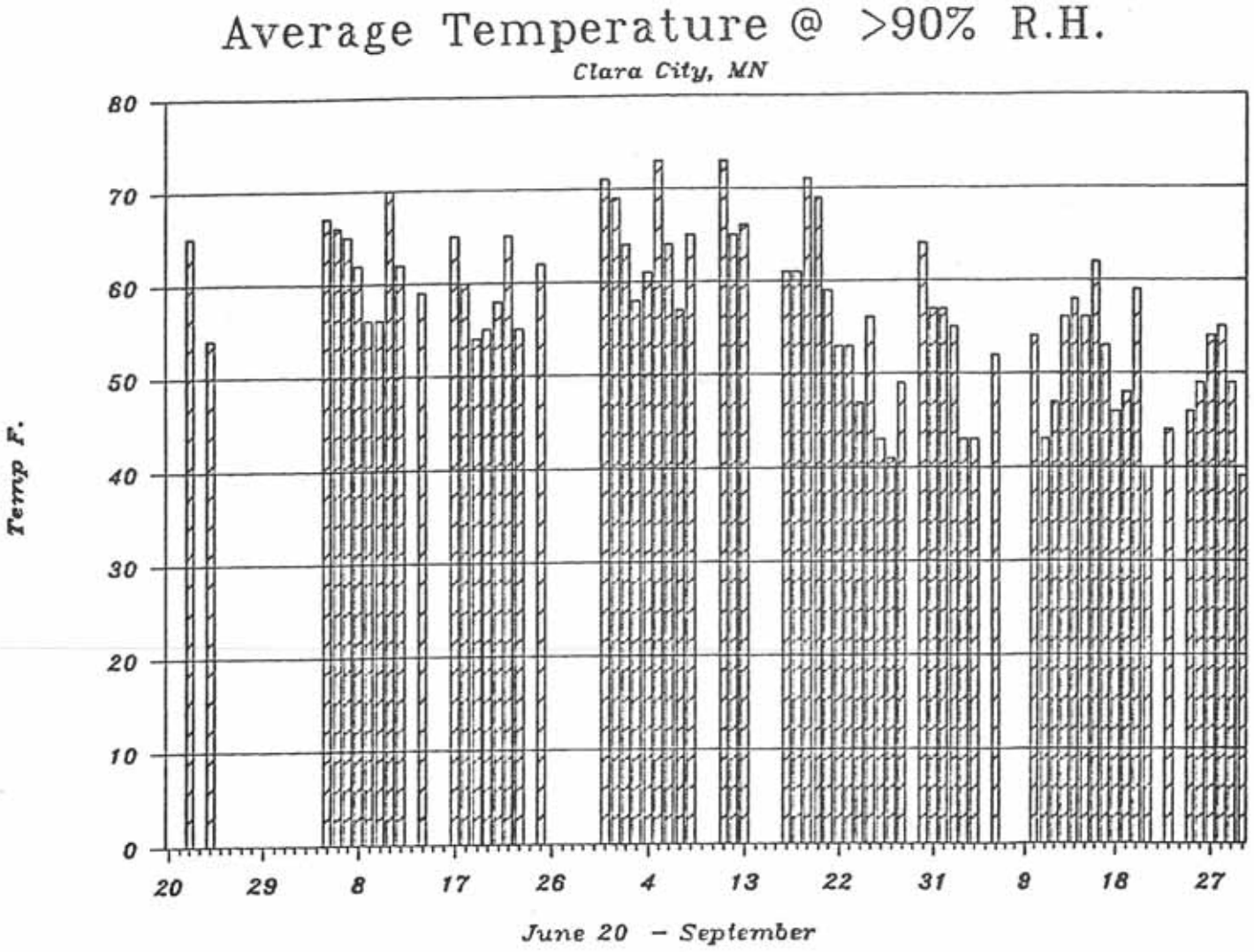

Figure 3. The total number of hours at which the relative humidity was over 90% for June through September 1988 for Clara City, MN.

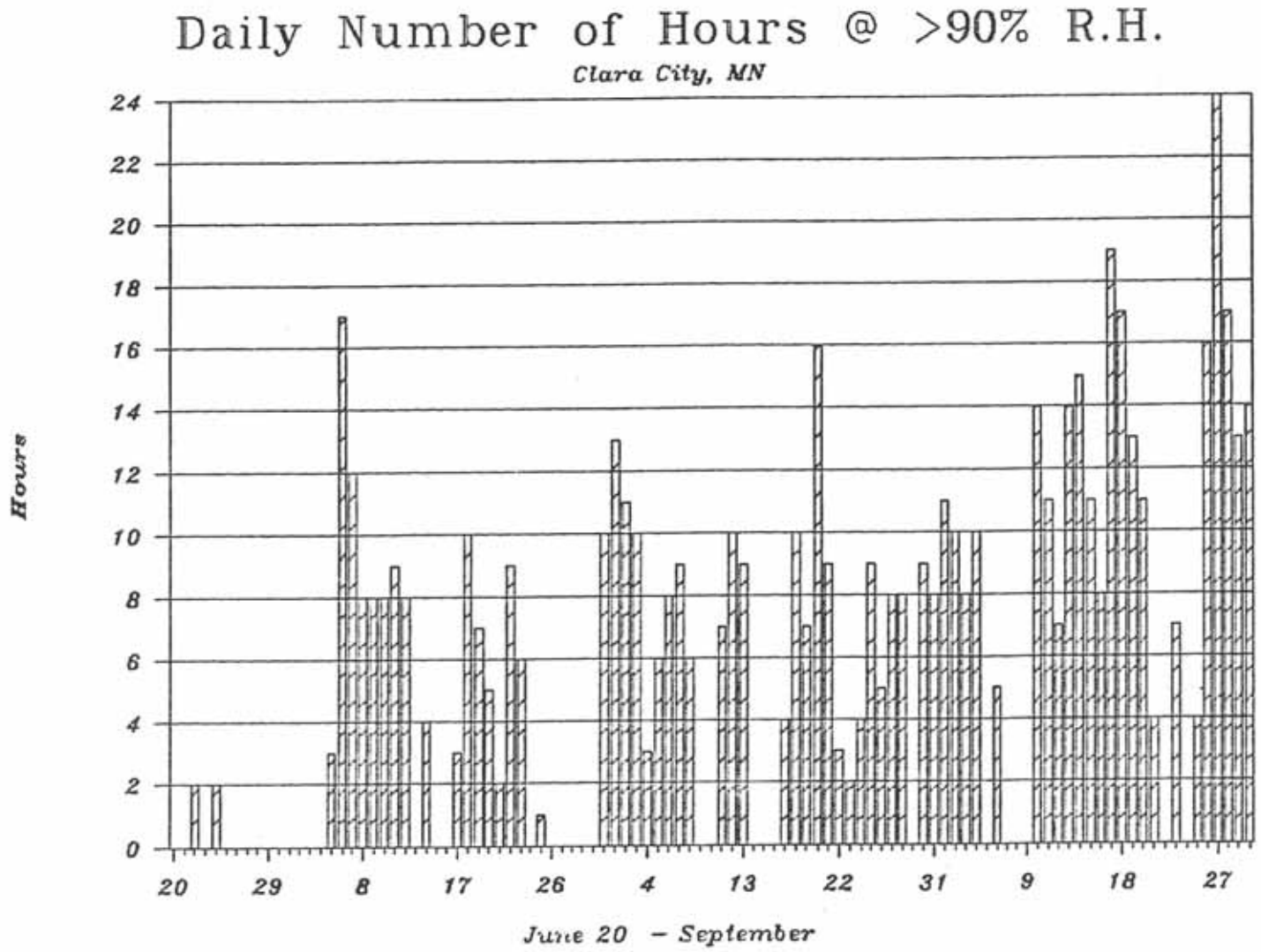

Figure 4. The average temperature at which the relative humidity was over 90% for June through September 1988 for Clara City, MN.

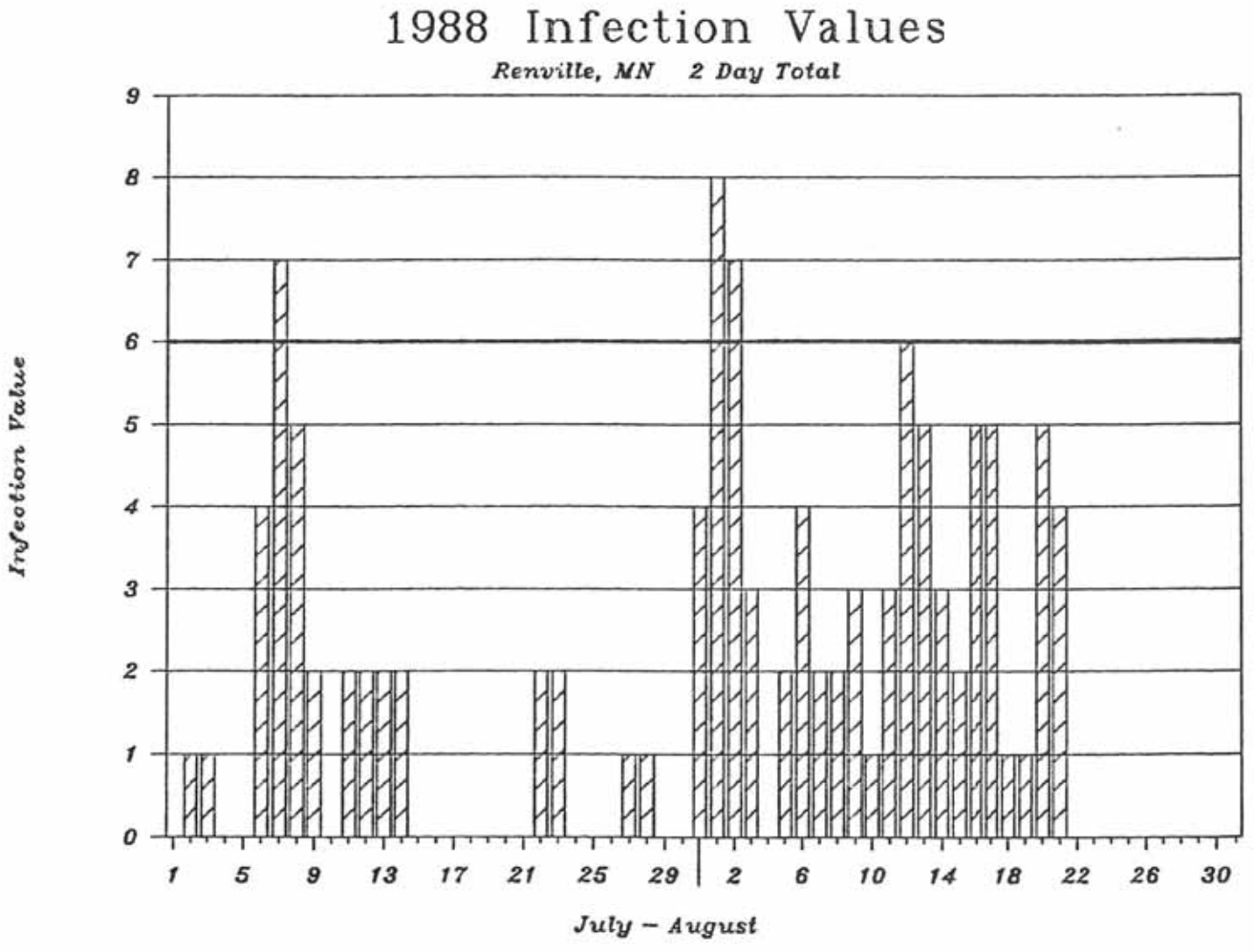

Figure 5. Two day total infection values from July through August 1988 for Renville, MN.

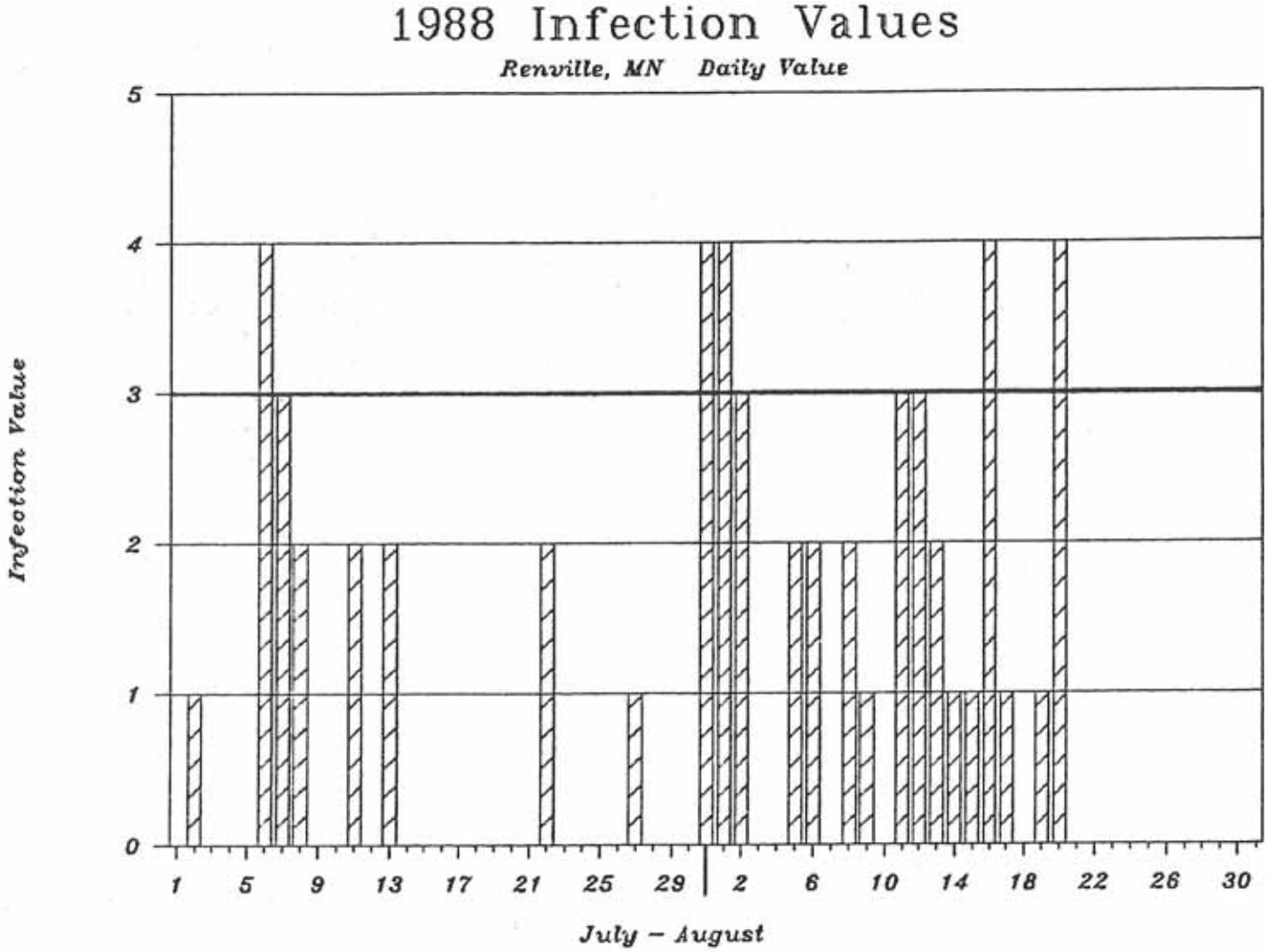

Figure 6. Daily infection values from July through August 1988 for Renville, MN.

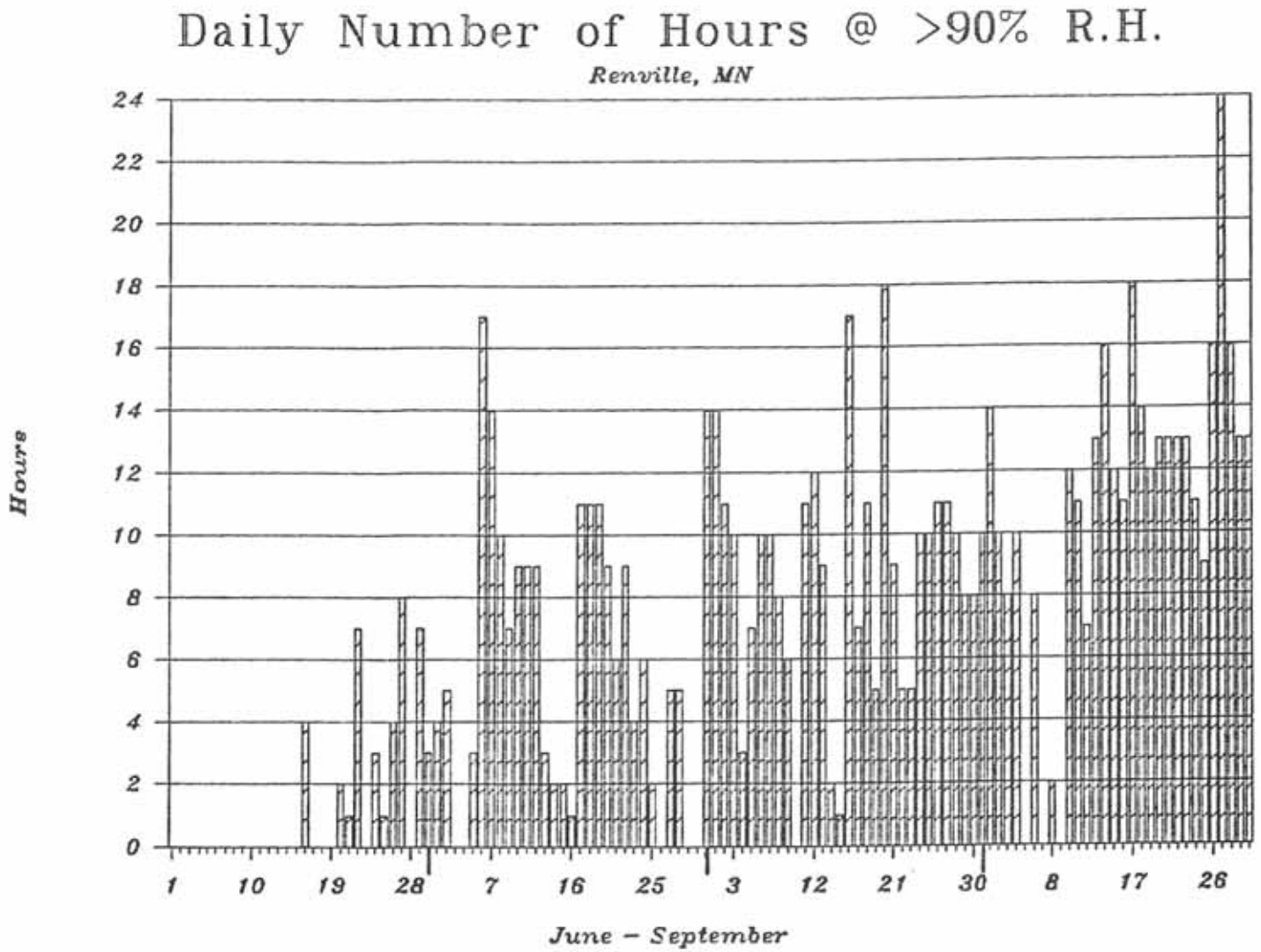

Figure 7. The total number of hours at which the relative humidity was over 90% for June through September 1988 for Renville, MN.

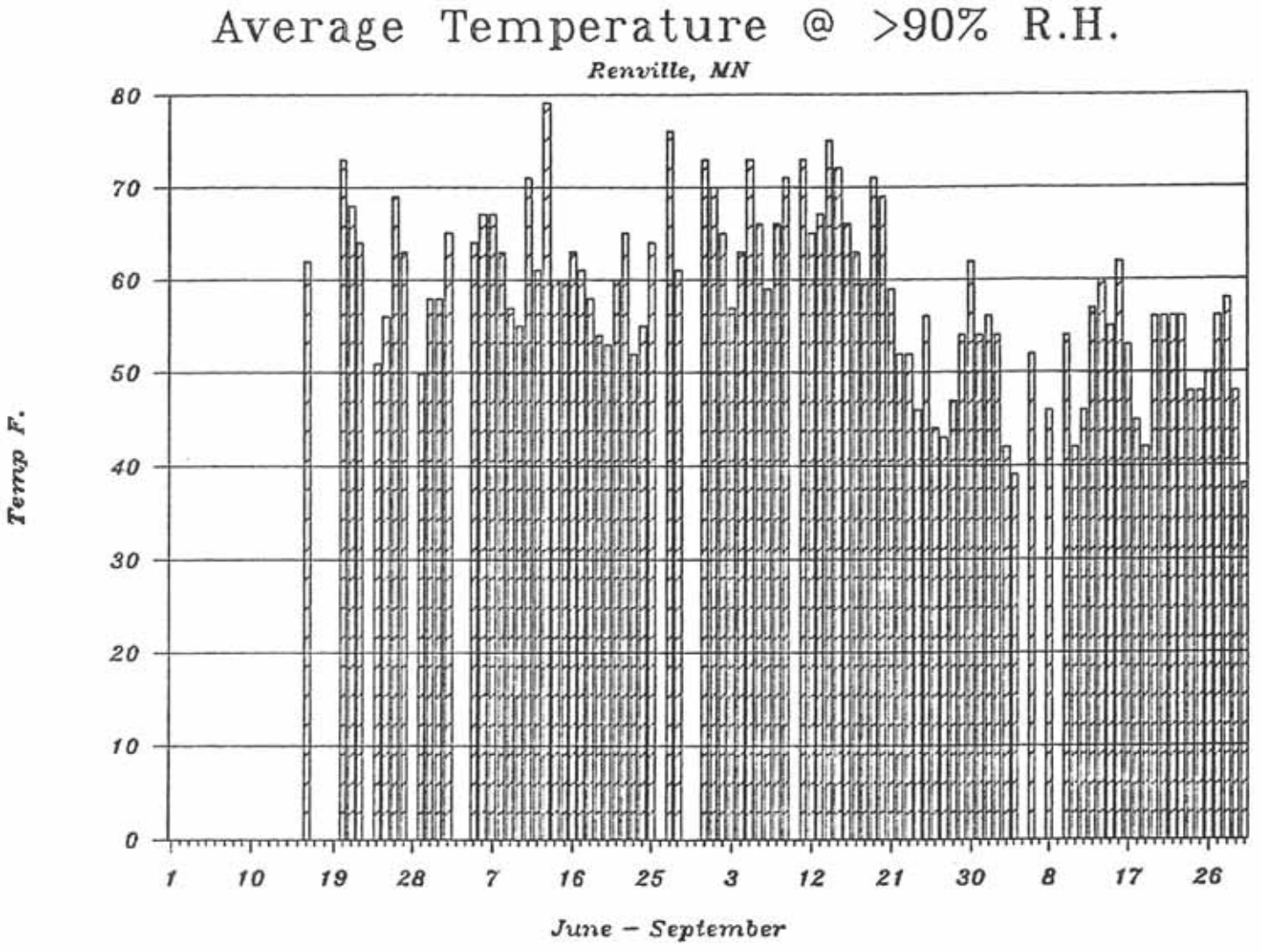

Figure 8. The average temperature at which the relative humidity was over 90% for June through September 1988 for Renville, MN.

Weather Summary For 1988

The following is a summary of the weather data for the 1988 growing season.

Figure 1. Comparative rainfall amounts between April and November for Montevideo, Morris, Hutchinson, Willmar, Olivia and Redwood Falls for 1988

Figure 2. Total rainfall amounts between April and November for Montevideo, Morris, Hutchinson, Willmar, Olivia and Redwood Falls for 1988

Figure 3. Growing Degree Days between April and October for Sacred Heart Minnesota for 1988.

Figure 4. The maximum, minimum and average relative humidity summary for Renville, MN May 1988.

Figure 5. The maximum, minimum and average relative humidity summary for Renville, MN June 1988.

Figure 6. The maximum, minimum and average relative humidity summary for Renville, MN July 1988.

Figure 7. The maximum, minimum and average relative humidity summary for Renville, MN August 1988.

Figure 8. The maximum, minimum and average relative humidity summary for Renville, MN September 1988.

Figure 9. The maximum, minimum and average relative humidity summary for Renville, MN October 1988.

Figure 10. The maximum, minimum and average temperature summary for Renville, MN May 1988.

Figure 11. The maximum, minimum and average temperature summary for Renville, MN June 1988.

Figure 12. The maximum, minimum and average temperature summary for Renville, MN July 1988.

Figure 13. The maximum, minimum and average temperature summary for Renville, MN August 1988.

Figure 14. The maximum, minimum and average temperature summary for Renville, MN September 1988.

Figure 15. The maximum, minimum and average temperature summary for Renville, MN October 1988.

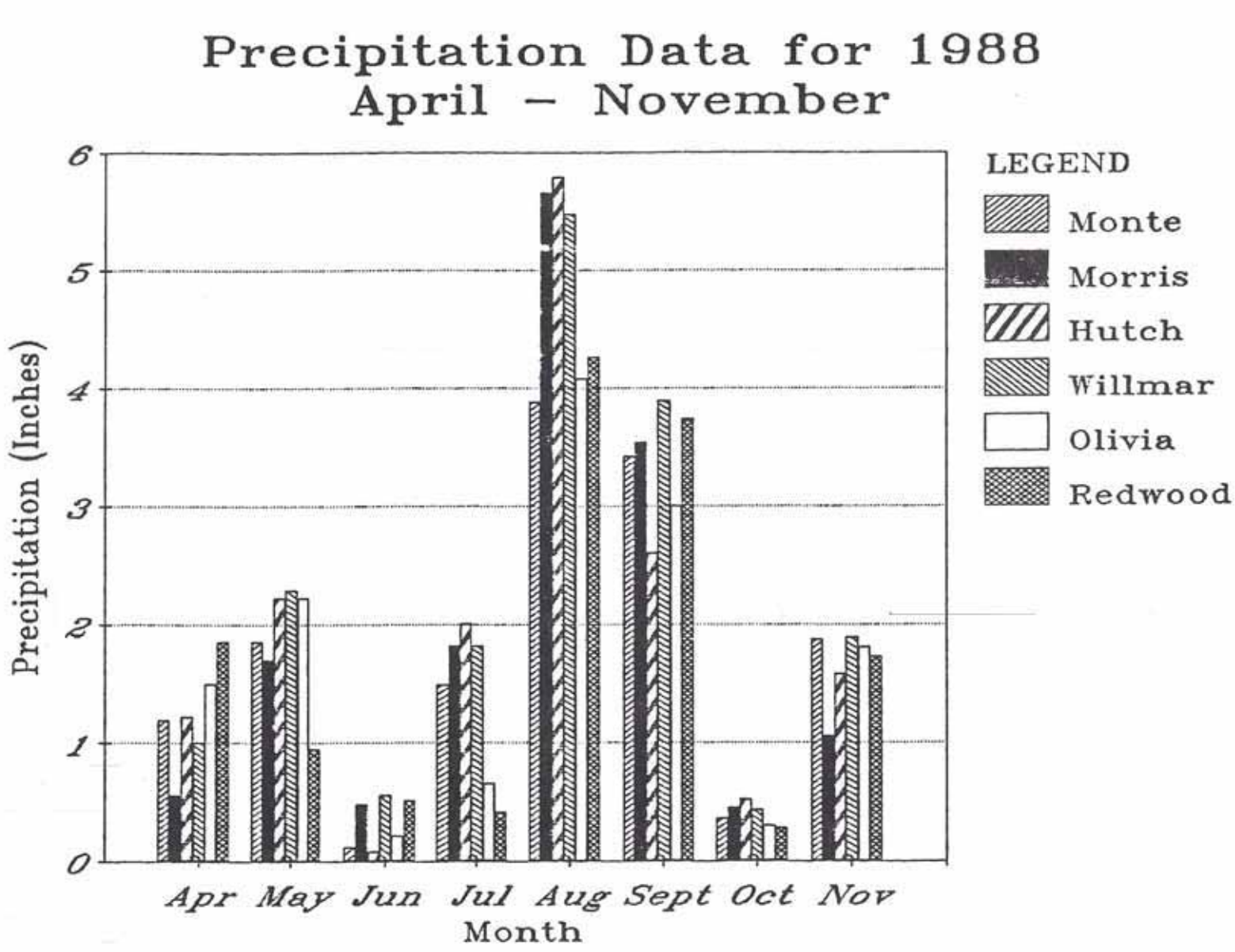

Figure 1. Comparative rainfall amounts between April and November for Montevideo, Morris, Hutchinson, Willmar, Olivia and Redwood Falls for 1988

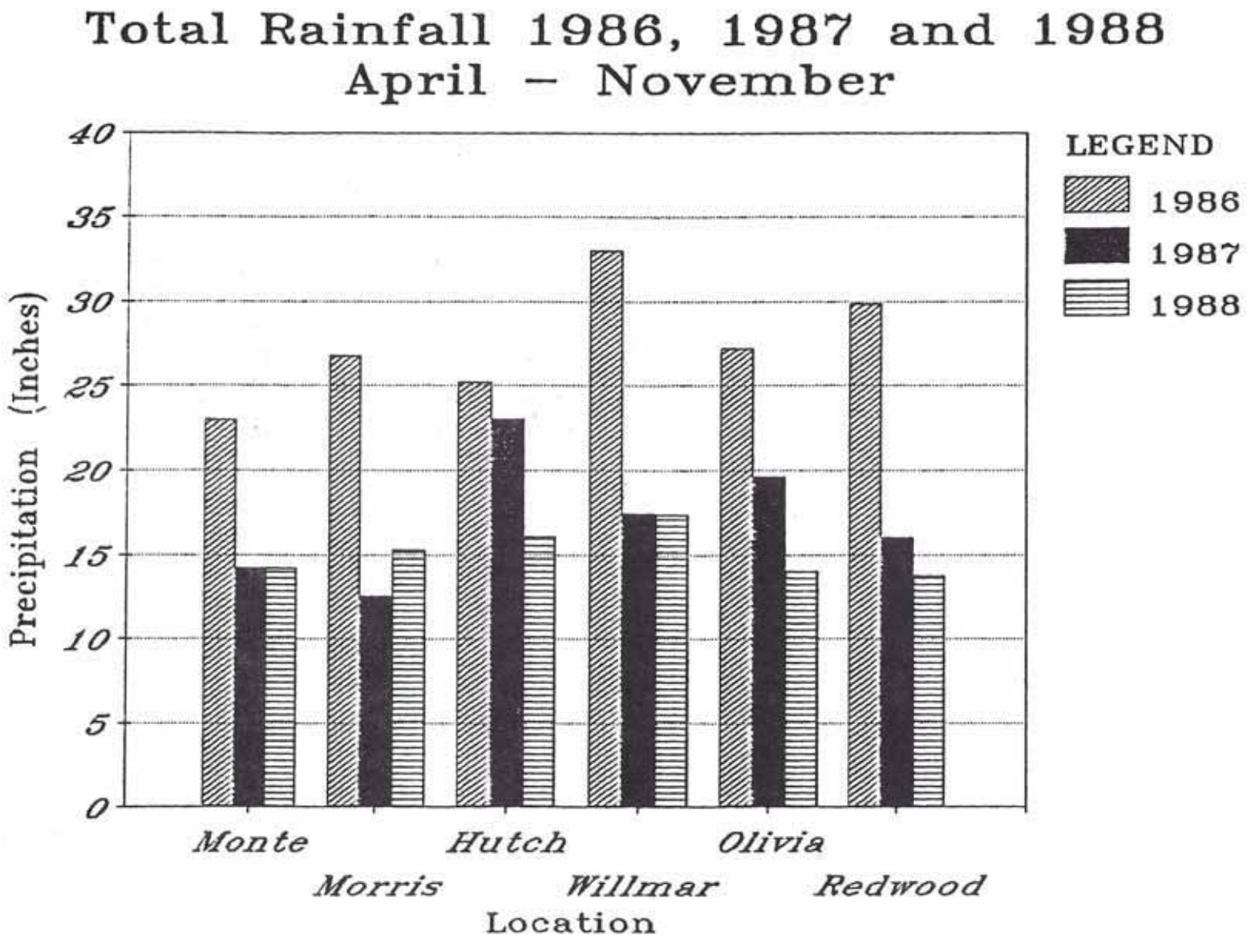

Figure 2. Total rainfall amounts between April and November for Montevideo, Morris, Hutchinson, Willmar, Olivia and Redwood Falls for 1988

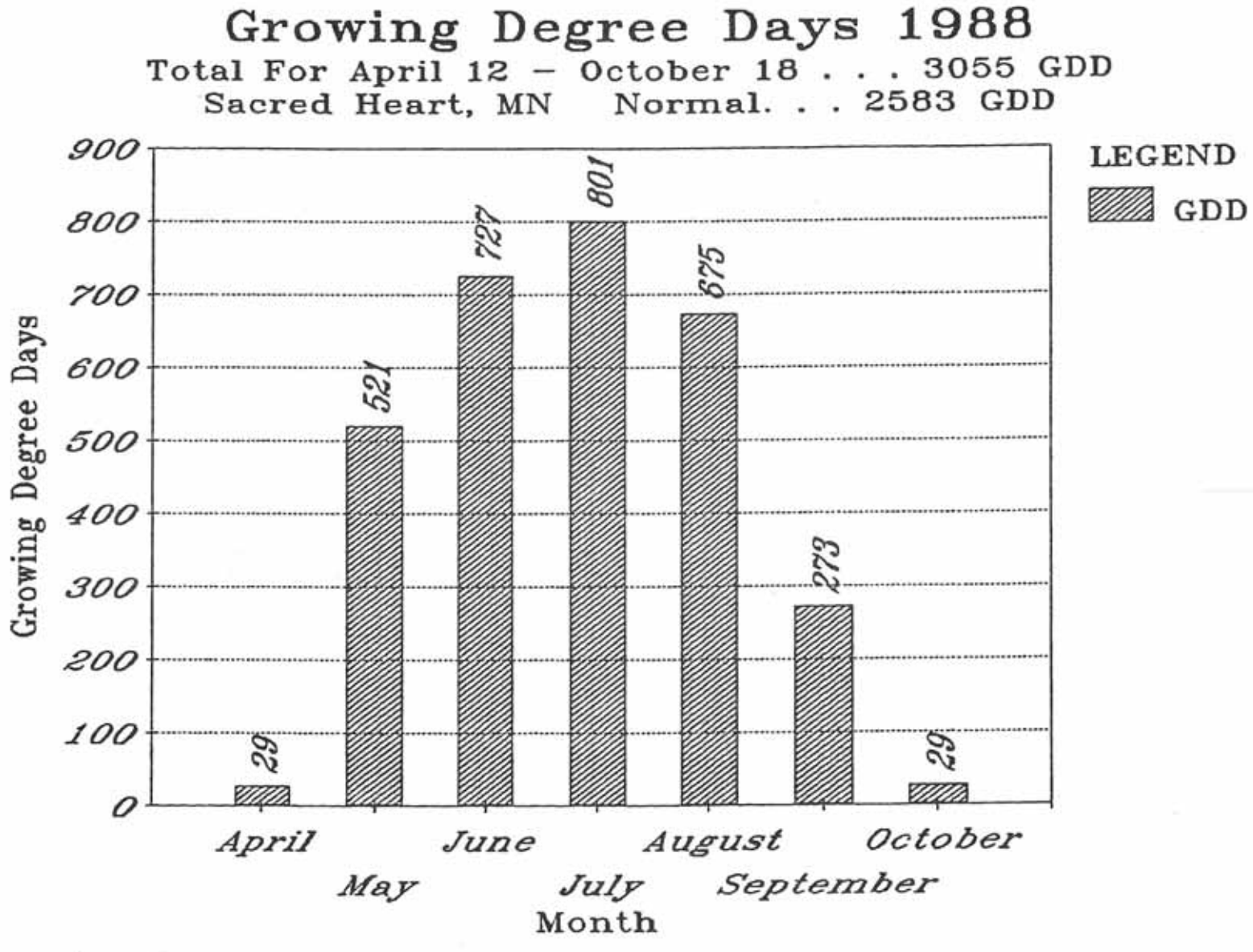

Figure 3. Growing Degree Days between April and October for Sacred Heart Minnesota for 1988.

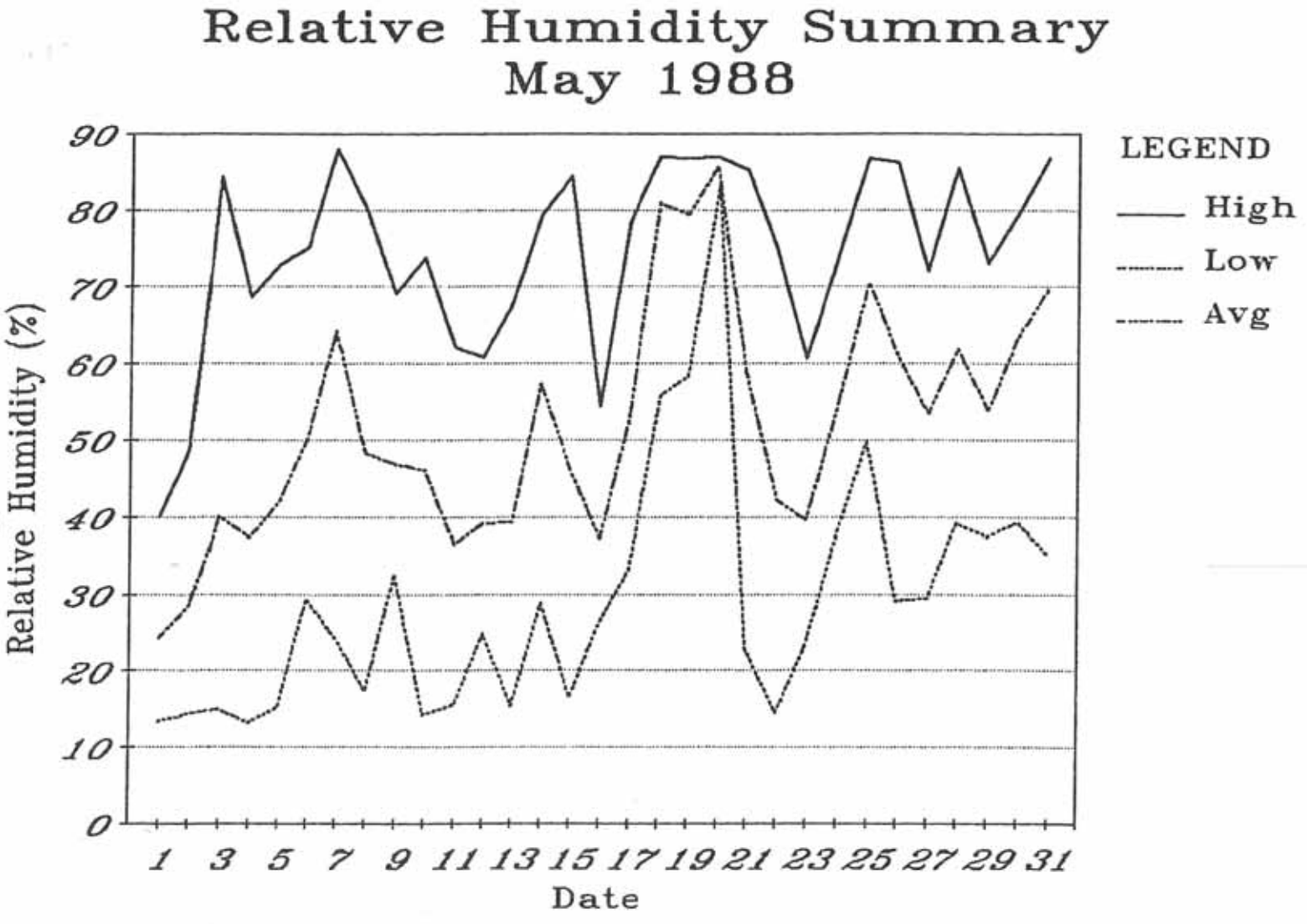

Figure 4. The maximum, minimum and average relative humidity summary for Renville, MN May 1988.

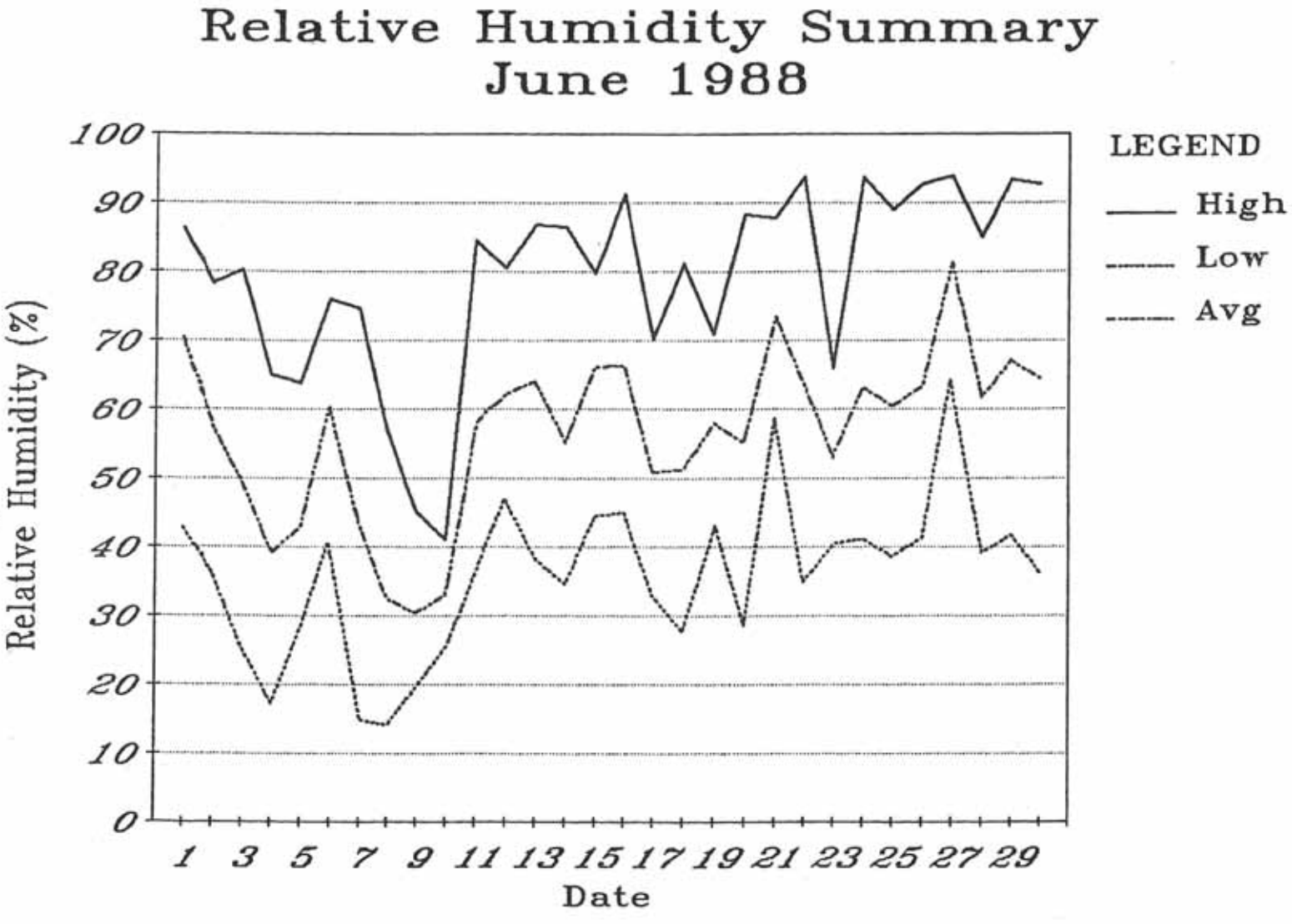

Figure 5. The maximum, minimum and average relative humidity summary for Renville, MN June 1988.

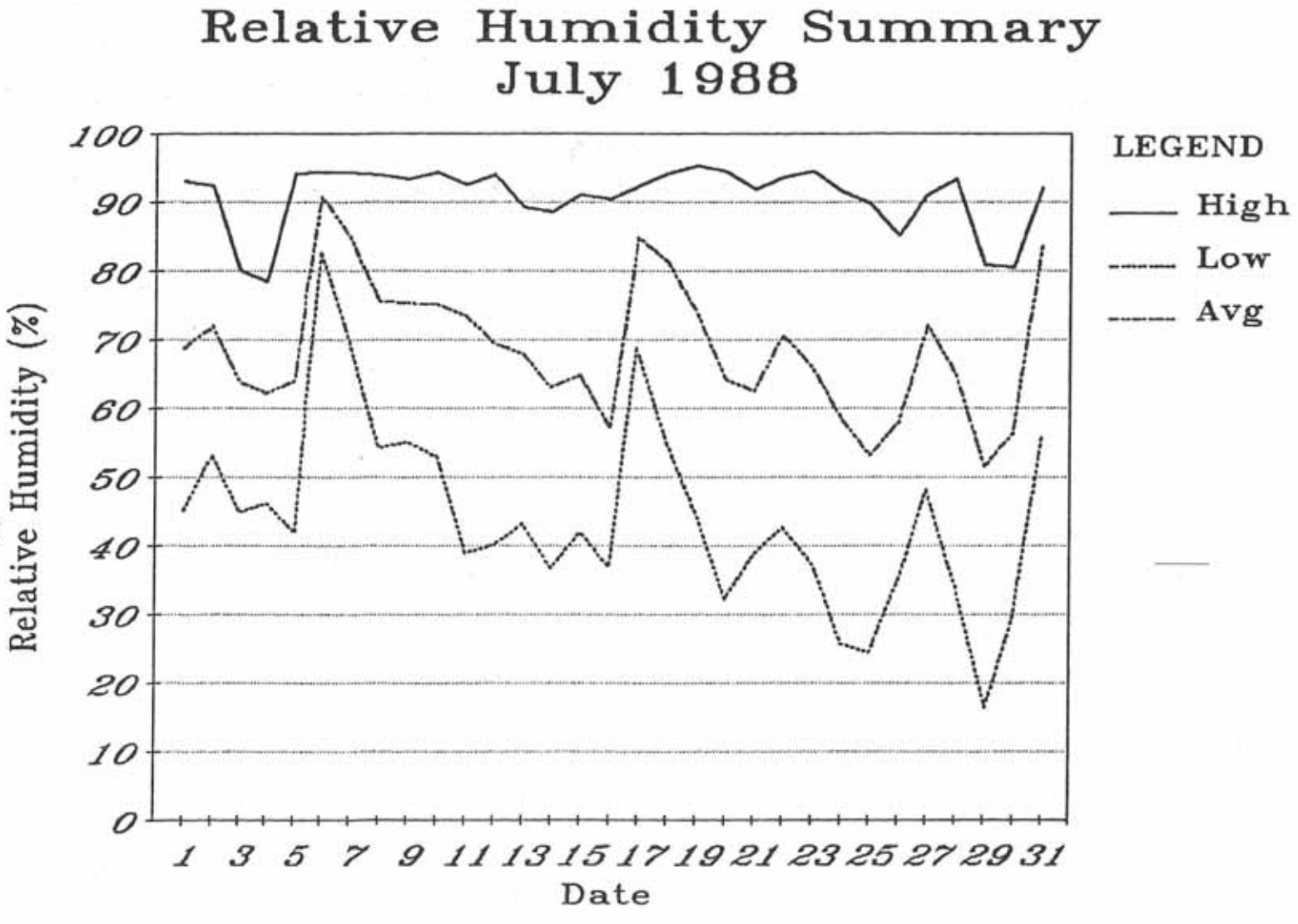

Figure 6. The maximum, minimum and average relative humidity summary for Renville, MN July 1988.

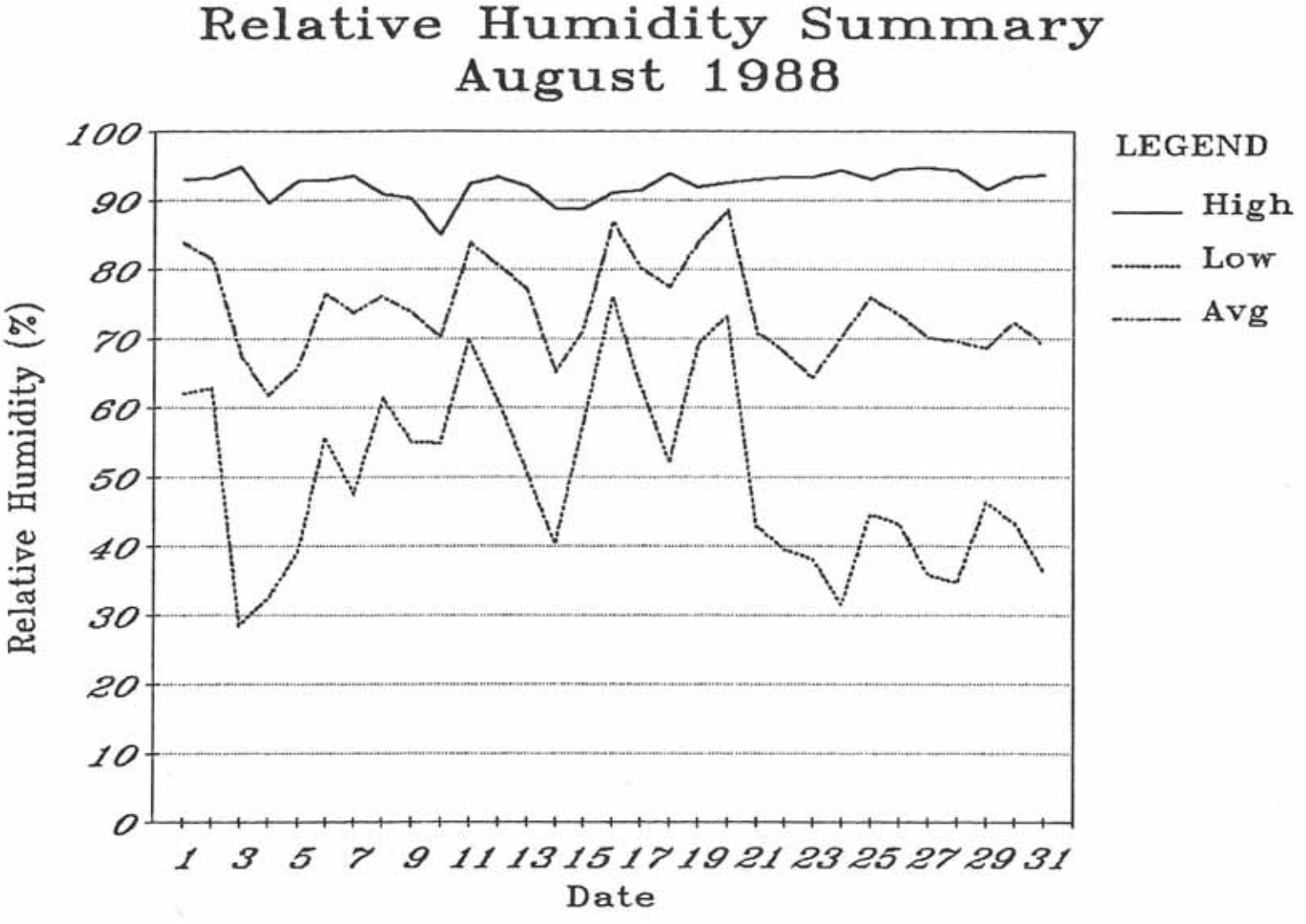

Figure 7. The maximum, minimum and average relative humidity summary for Renville, MN August 1988.

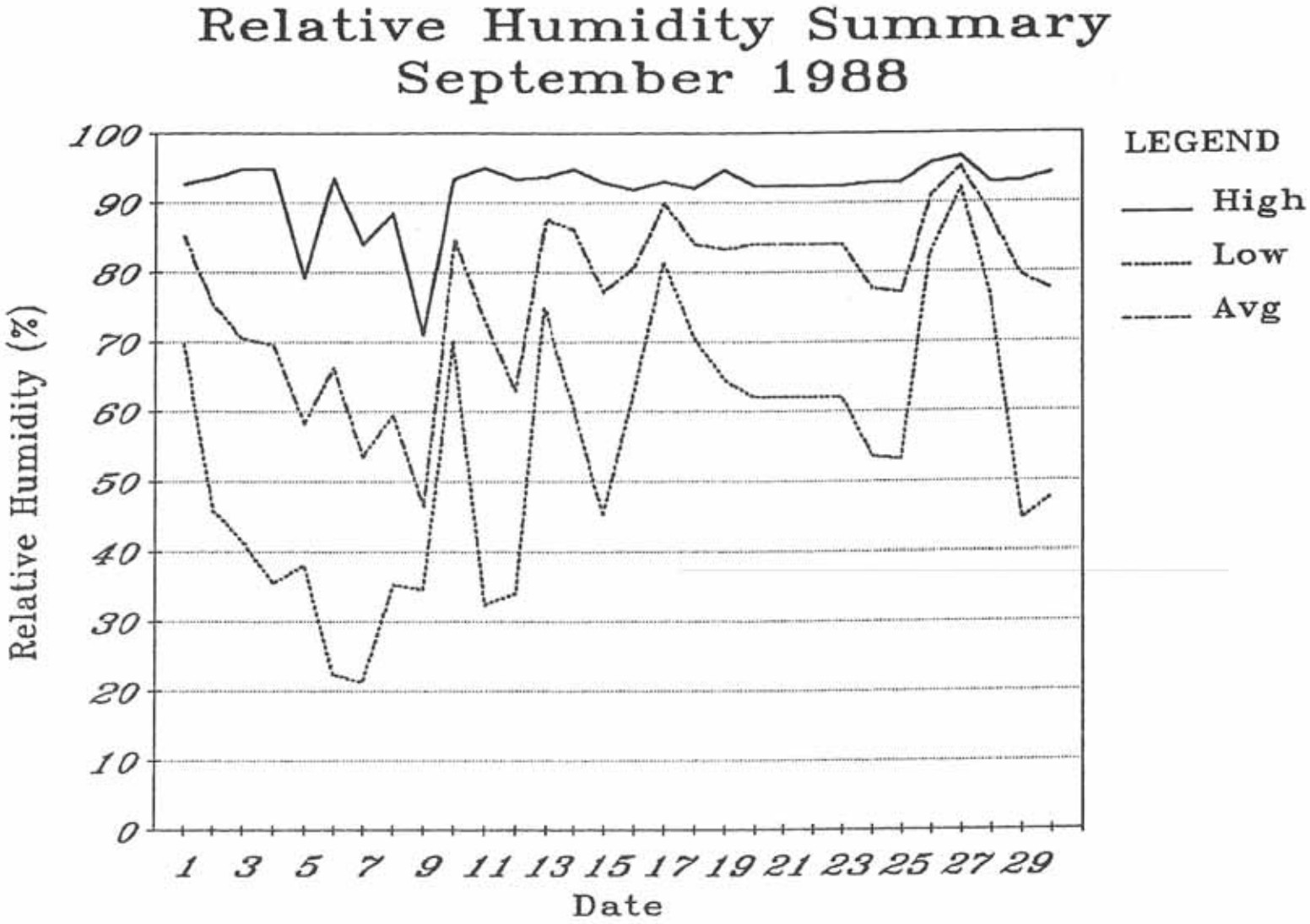

Figure 8. The maximum, minimum and average relative humidity summary for Renville, MN September 1988.

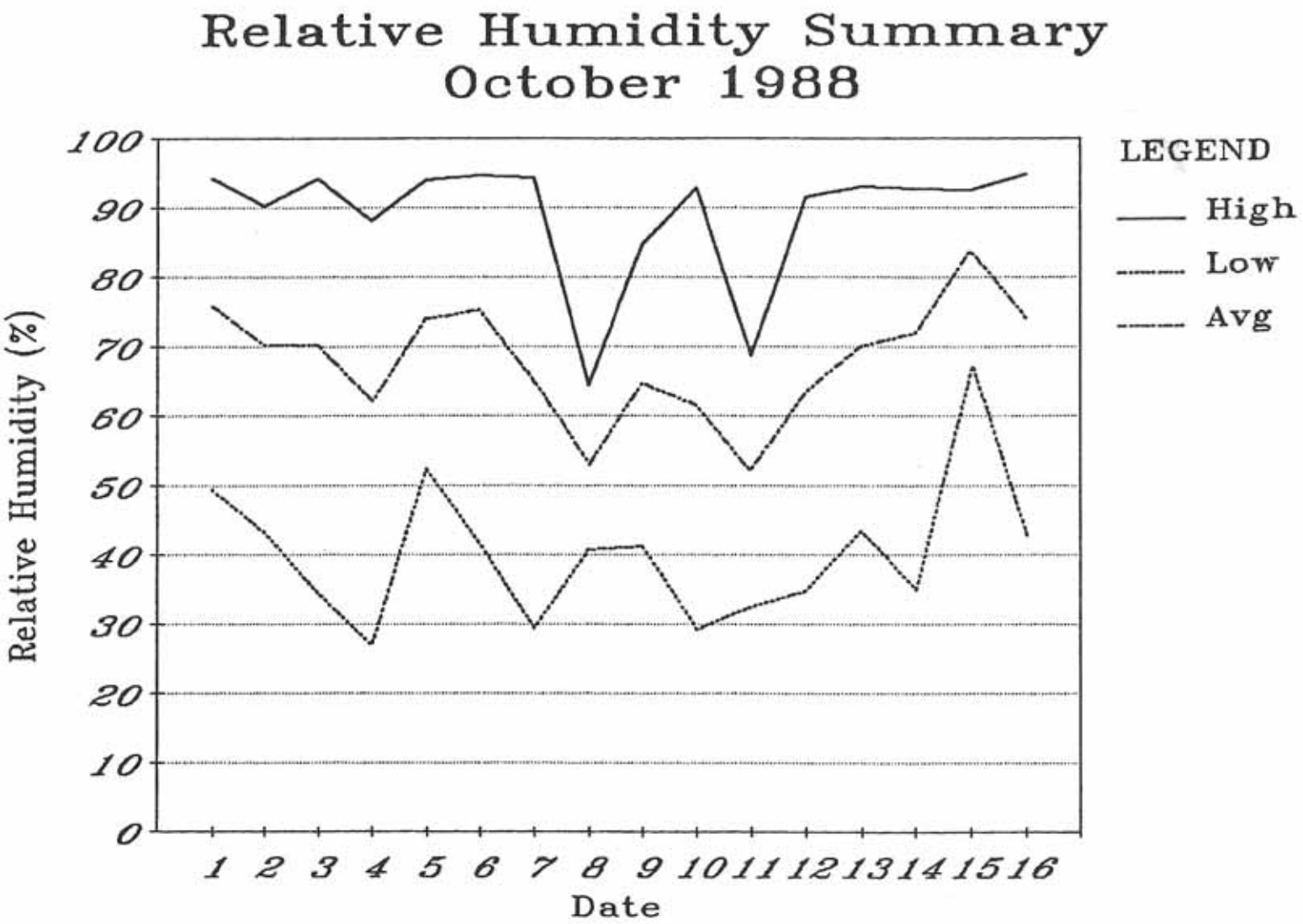

Figure 9. The maximum, minimum and average relative humidity summary for Renville, MN October 1988.

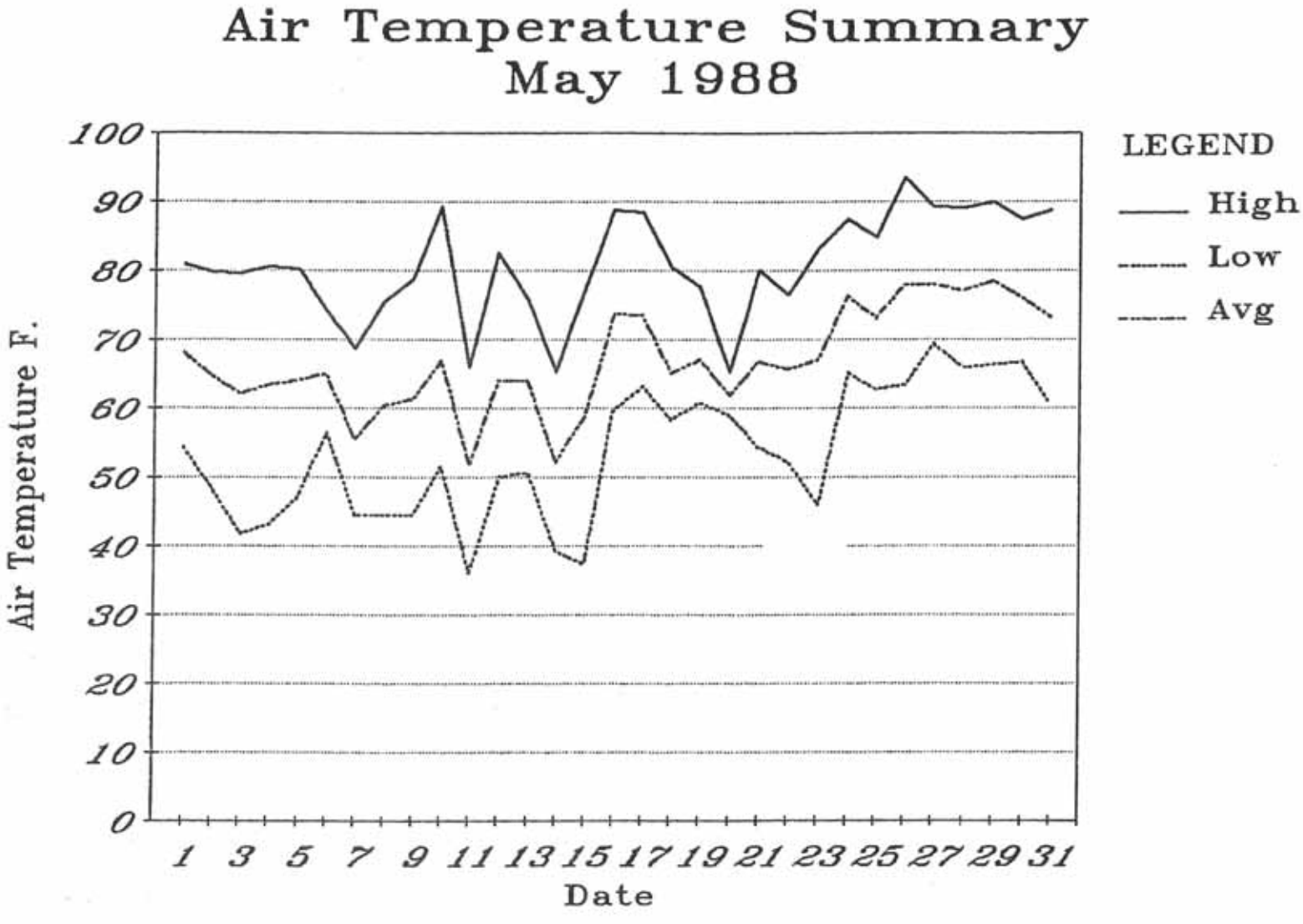

Figure 10. The maximum, minimum and average temperature summary for Renville, MN May 1988.

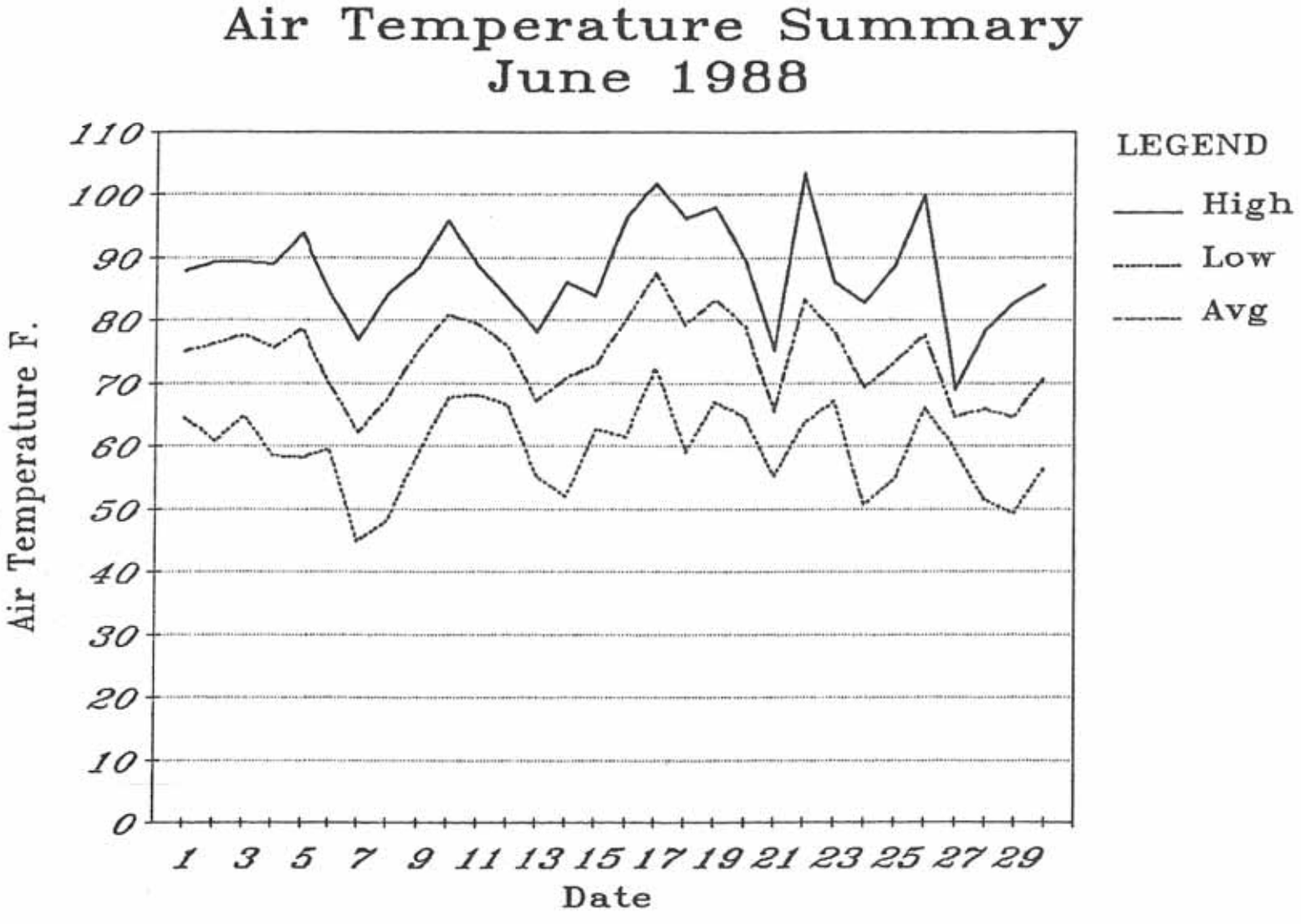

Figure 11. The maximum, minimum and average temperature summary for Renville, MN June 1988.

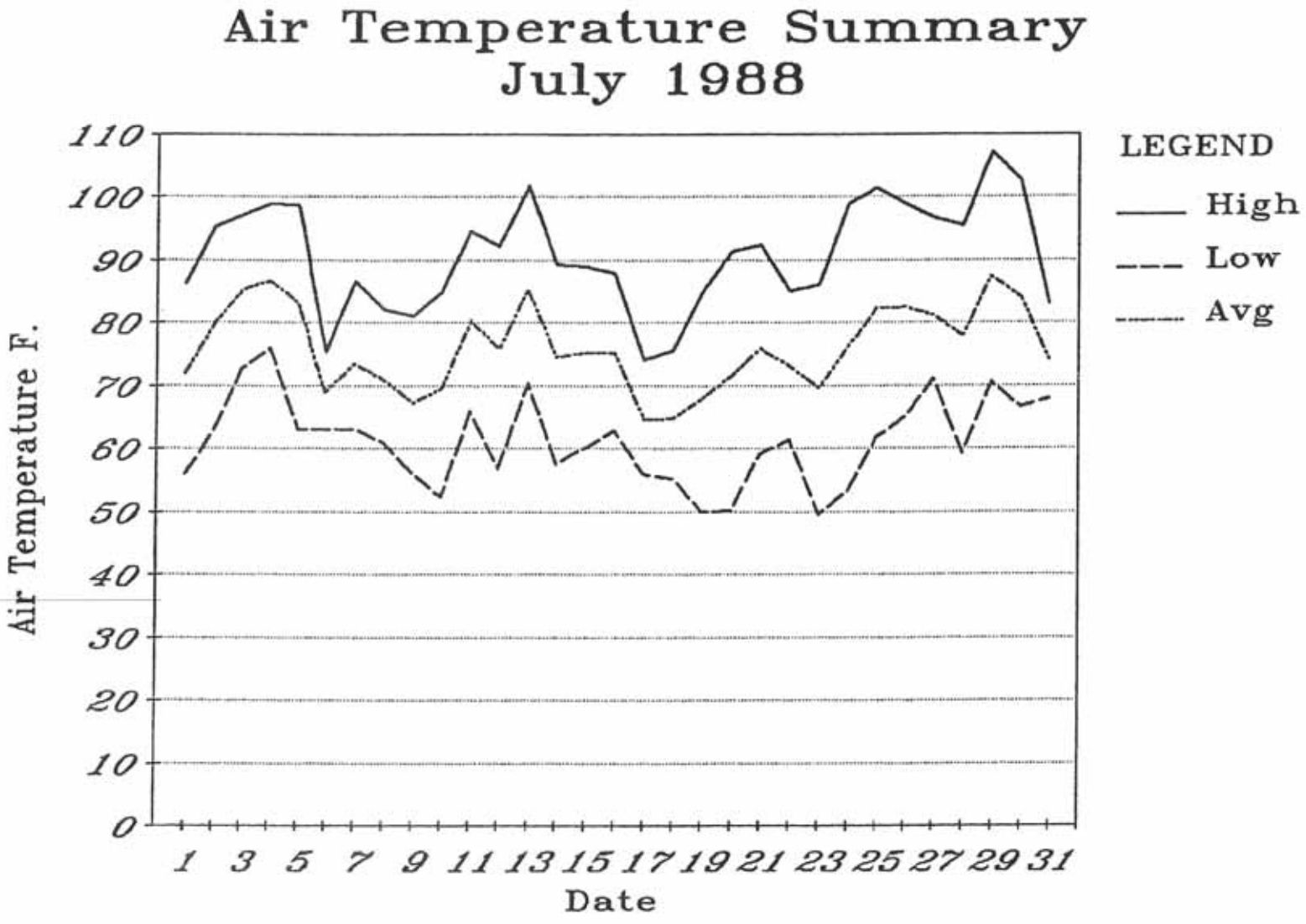

Figure 12. The maximum, minimum and average temperature summary for Renville, MN July 1988.

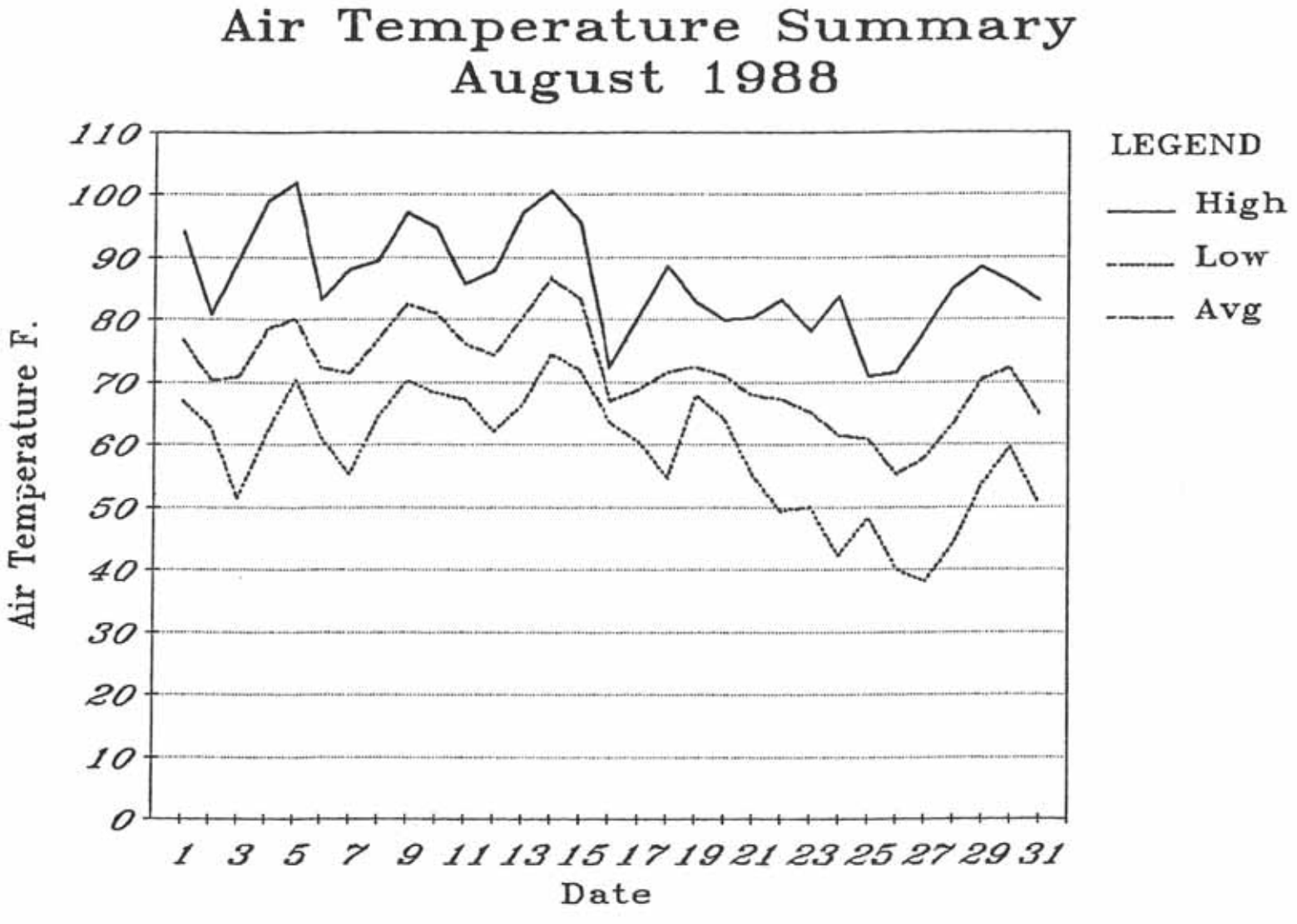

Figure 13. The maximum, minimum and average temperature summary for Renville, MN August 1988.

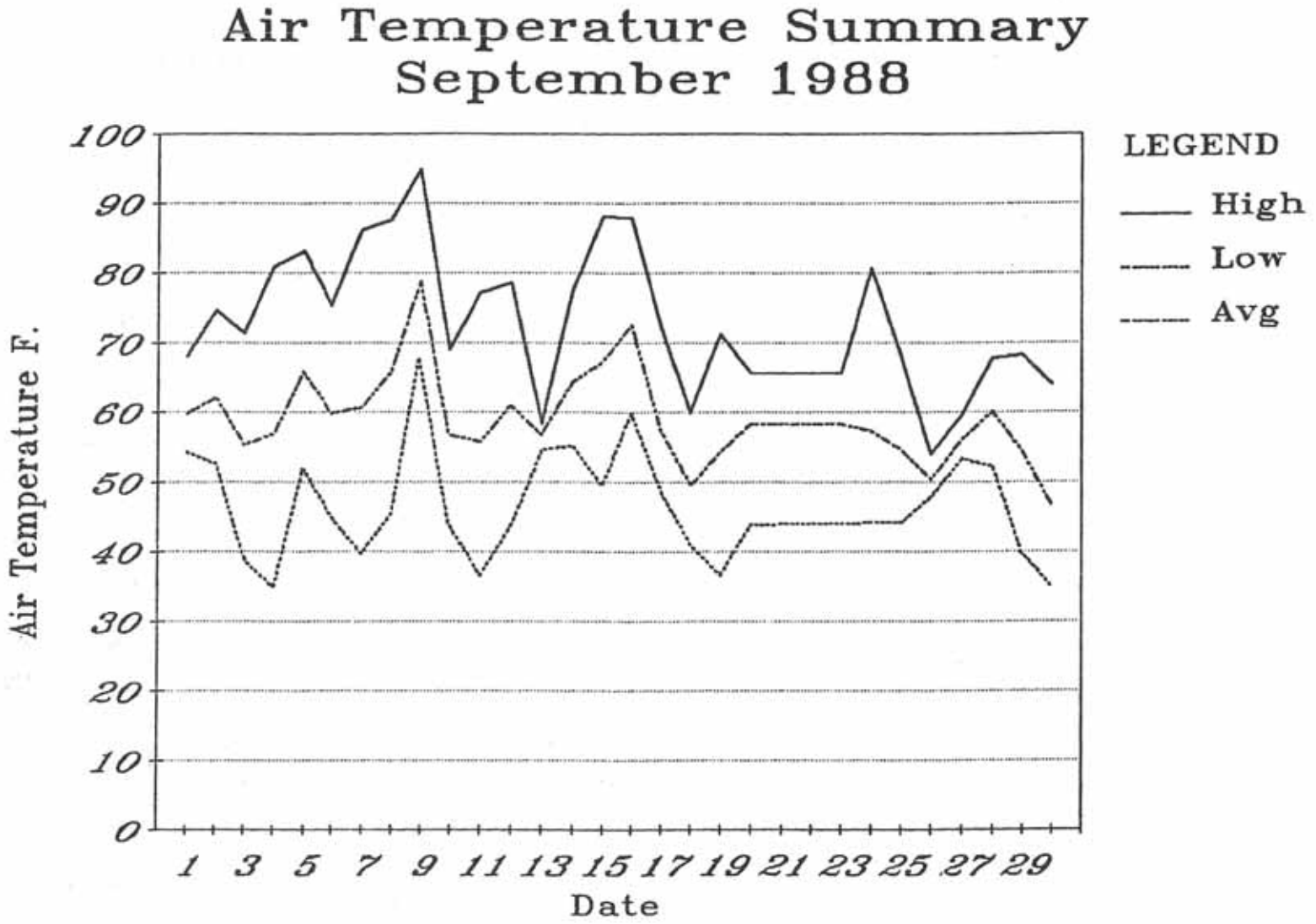

Figure 14. The maximum, minimum and average temperature summary for Renville, MN September 1988.

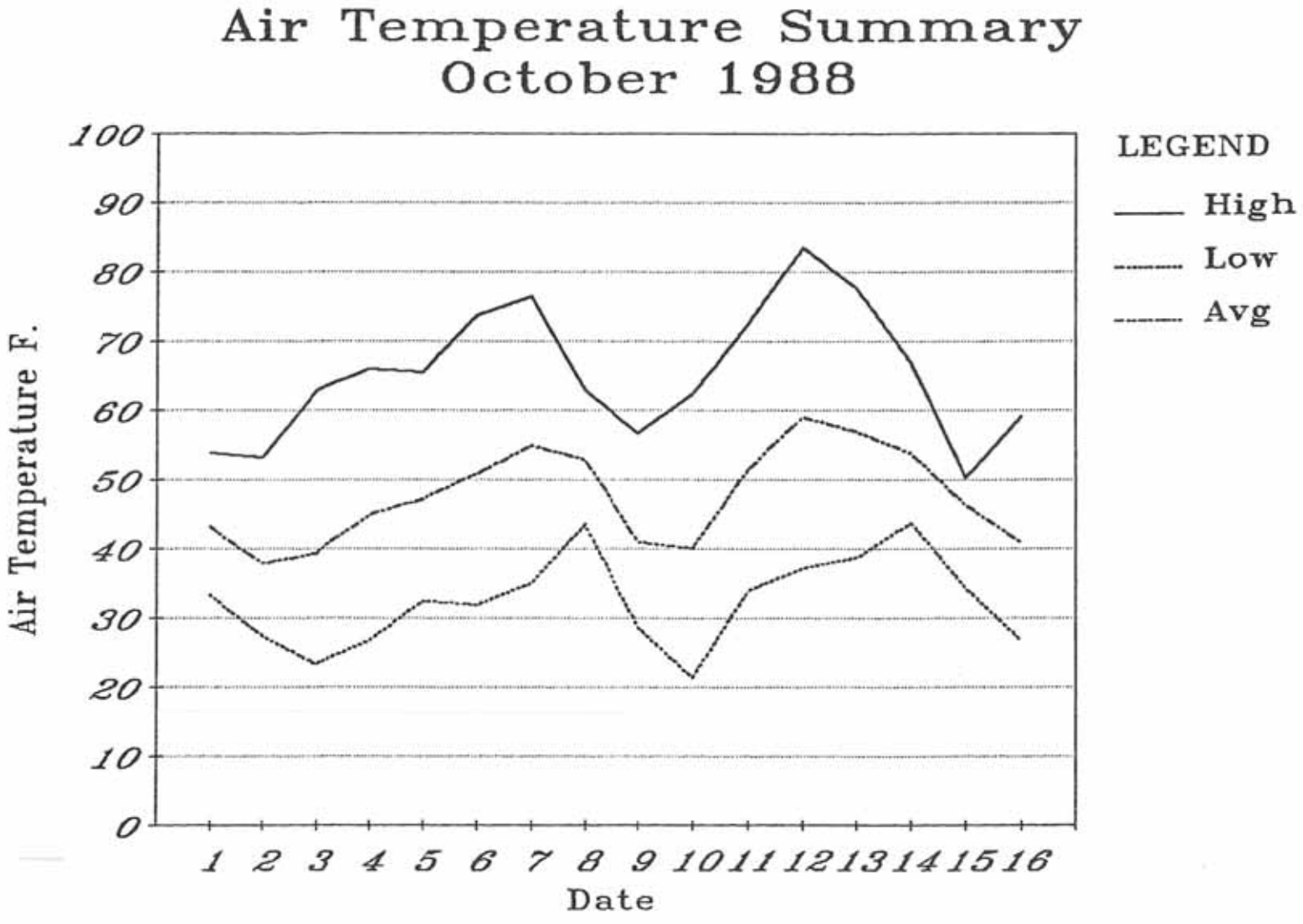

Figure 15. The maximum, minimum and average temperature summary for Renville, MN October 1988.

Southern Minnesota Sugar Cooperative

Harvester Comparison

The following Tables summarize the 1988 data accumulated from the different machines by district combined over the entire Cooperative.

The harvest conditions of 1988 were dry, so a wide spread among the various machines on percent first dirt. (dirt removed by the piles) and percent tares (dirt that goes into the piles) did not occur.

Operator of the machines still has a predominant effect on performance. The high and low ranges within each category indicates the advantages of the combined performance of the operation and a properly equipped machine.

Table 1. Southern Minnesota Sugar Cooperative combined Harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	86	5626	1.9	2.5	4.3	1.2	5.0	3.0	7.8
WIC	4	38	3027	2.1	2.3	4.3	1.4	4.7	2.8	6.8
Farmhand	4	18	1572	2.2	2.1	4.3	1.2	3.0	3.0	5.3
John Deere	4	21	1335	2.4	2.3	4.7	1.3	3.3	3.4	5.8
Hesston	4	58	3639	2.6	2.4	4.9	1.4	4.5	3.4	7.9
	Total		15198	2.2	2.3	4.5	1.3	4.1	3.1	6.7
Heath	6	280	21674	1.7	2.2	3.9	1.0	3.9	2.5	7.5
WIC	6	137	12842	1.8	2.2	4.0	0.4	3.7	2.4	6.2
Farmhand	6	15	1220	2.1	2.2	4.3	1.4	2.9	3.6	5.1
John Deere	6	68	5800	2.1	2.1	4.2	0.6	3.5	2.5	6.3
Hesston	6	25	1938	2.1	2.4	4.4	1.5	3.8	3.3	6.0
Red River Special	6	45	3223	2.0	2.2	4.2	1.3	3.7	3.2	6.6
Parma	6	17	1084	2.1	2.3	4.4	1.5	3.2	3.4	5.8
	Total		47780	2.0	2.2	4.2	1.1	3.5	3.0	6.2
	Grand Total		62978							

Table 2. Renville harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	26	1582	2.1	2.1	4.2	1.2	3.5	3.1	6.1
WIC	4	17	1360	2.5	2.2	4.7	1.5	3.6	3.8	6.2
Farmhand	4	13	1116	2.2	2.1	4.2	1.5	3.0	3.0	5.1
John Deere	4	1	97	2.9	2.2	5.1	2.2	2.2	5.1	5.1
Hesston	4	25	1598	2.5	2.1	4.6	1.4	2.9	3.4	5.8
	Total		5753	2.4	2.1	4.6	1.6	3.0	3.7	5.7
Heath	6	58	5078	1.8	2.0	3.8	1.0	3.2	2.7	6.0
WIC	6	51	5160	1.9	2.1	3.9	0.4	3.2	2.4	6.2
Farmhand	6	9	744	2.2	2.2	4.5	1.4	2.8	3.6	5.1
John Deere	6	12	974	2.0	2.0	4.0	0.6	2.5	2.5	4.5
Hesston	6	4	474	2.0	2.3	4.3	1.8	2.7	3.7	4.6
Red River Special	6	41	2876	2.1	2.2	4.3	1.3	3.7	3.3	6.6
	Total		15305	2.0	2.1	4.1	1.1	3.0	3.0	5.5
	Grand Total		21058							

Table 3. Bird Island harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
WIC	4	11	700	1.8	2.2	4.0	1.4	4.7	3.1	6.8
John Deere	4	5	260	2.6	2.1	4.7	1.9	2.3	3.7	5.8
	Total		960	2.2	2.2	4.3	1.7	3.5	3.4	6.3
Heath	6	36	2828	1.5	2.0	3.5	1.2	2.8	2.5	4.5
WIC	6	30	3170	1.5	2.0	3.6	1.6	2.6	3.0	4.1
John Deere	6	12	1239	2.1	2.2	4.3	1.7	3.0	3.6	5.1
Hesston	6	4	303	1.8	1.9	3.8	1.7	2.1	3.5	3.8
Red River Special	6	4	347	1.8	1.9	3.6	1.5	2.1	3.2	3.9
Parma	6	12	716	2.0	2.1	4.0	1.5	2.8	3.4	4.7
	Total		8603	1.8	2.0	3.8	1.5	2.6	3.2	4.3
	C and Total		9562							

Table 4. Hector harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	6	602	1.8	2.1	4.0	1.5	2.8	3.0	4.8
Farmhand	4	4	275	2.4	1.9	4.3	1.2	2.7	3.5	5.3
John Deere	4	1	42	3.5	1.3	4.8	1.3	1.3	4.8	4.8
Hesston	4	19	986	2.2	2.1	4.4	1.5	3.4	3.6	5.8
	Total		1905	2.5	1.9	4.4	1.4	2.6	3.7	5.2
Heath	6	36	2758	1.8	2.0	3.8	1.3	3.1	2.9	5.0
WIC	6	10	643	2.0	2.2	4.2	1.4	3.2	3.0	5.7
John Deere	6	40	3102	2.1	2.1	4.1	1.2	3.0	2.9	5.4
Hesston	6	7	513	2.4	2.2	4.6	1.5	2.9	3.6	5.3
	Total		7016	2.1	2.1	4.2	1.4	3.1	3.1	5.3
	Grand Total		8921							

Table 5. Clara City East harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	22	1674	1.8	2.6	4.3	1.6	3.8	3.3	5.6
WIC	4	3	183	1.7	2.7	4.4	2.5	2.9	4.3	4.6
Farmhand	4	1	181	2.5	2.5	5.0	2.5	2.5	5.0	5.0
John Deere	4	5	235	1.8	2.3	4.1	1.8	2.8	3.4	4.7
	Total		2273	1.9	2.5	4.5	2.1	3.0	4.0	5.0
Heath	6	14	980	1.6	2.3	4.0	1.6	3.1	3.3	5.0
Farmhand	6	6	476	1.9	2.2	4.1	2.0	2.9	3.8	4.6
	Total		1456	1.8	2.3	4.1	1.8	3.0	3.5	4.8
	Grand Total		3729							

Table 6. Clara City West harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	6	7	605	2.0	2.4	4.4	1.6	3.1	3.5	5.2
WIC	6	9	585	1.7	2.9	4.7	2.3	3.7	4.2	5.3
John Deere	6	4	485	2.4	2.8	5.2	2.1	3.5	4.1	6.3
	Total		1675	2.0	2.7	4.7	2.0	3.4	3.9	5.6

Table 7. Murdock harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	5	336	1.8	2.5	4.2	2.0	3.1	3.7	5.0
Hesston	4	5	537	3.8	3.4	7.2	2.8	3.8	6.1	7.8
	Total		873	2.8	2.9	5.7	2.4	3.5	4.9	6.4
Heath	6	49	3935	1.9	2.4	4.3	1.6	3.1	3.3	5.4
WIC	6	27	2399	1.7	2.4	4.1	1.2	3.7	2.9	5.7
	Total		6334	1.8	2.4	4.2	1.4	3.4	3.1	5.6
	Grand Total		7207							

Table 8. Maynard harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	21	1177	1.5	2.6	4.1	1.6	3.6	3.0	5.3
WIC	4	3	278	1.2	2.0	3.2	1.6	2.3	2.8	3.5
John Deere	4	9	701	2.4	2.6	5.0	2.1	3.3	4.5	5.7
	Total		2156	1.7	2.4	4.1	1.8	3.1	3.5	4.8
Heath	6	44	2786	1.5	2.3	3.8	1.5	3.8	2.6	5.4
	Total		2786	1.5	2.3	3.8	1.5	3.8	2.6	5.4
	Grand Total		4942							

Table 9. Milan harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
Heath	4	6	255	2.6	3.8	6.4	2.8	5.0	5.4	7.8
Hesston	4	7	399	2.8	3.4	6.2	2.9	4.5	5.2	7.9
	Total		654	2.7	3.6	6.3	2.9	4.8	5.3	7.8
Heath	6	28	2173	1.8	2.8	4.5	1.9	3.9	3.5	7.5
WIC	6	7	541	1.6	2.6	4.2	1.7	3.3	3.3	5.1
Hesston	6	10	648	1.9	2.7	4.6	1.7	3.8	3.3	6.0
Parma	6	5	368	2.3	2.9	5.2	2.6	3.2	4.7	5.8
	Total		3730	1.7	2.7	4.4	1.8	3.6	3.4	6.3
	Grand Total		4384							

Table 10. Redwood Falls harvester results 1988.

Harvester	Rows	No. Fields	No. Acres	Avg. % 1st Dirt	Avg. % Tare	Total Dirt	% Tare Range Low	% Tare Range High	Total Dirt Range Low	Total Dirt Range High
WIC	4	4	506	2.1	2.5	4.5	1.7	3.1	3.4	5.9
Hesston	4	2	119	2.3	2.5	4.7	2.2	2.7	4.5	5.0
	Total		625	2.2	2.5	4.6	2.0	2.9	4.0	5.4
Heath	6	8	531	1.3	1.8	3.2	1.3	2.6	2.5	3.7
WIC	6	3	345	2.3	2.2	4.5	2.2	2.3	4.2	5.1
	Total		875	1.8	2.0	3.8	1.8	2.5	3.4	4.4
	Grand Total		1500							