

Discussion of Three Year Summary:

On the basis of actual yields 12 and 16 inch spacings were equal and slightly superior to 8 inch spacing. As an average of the three years two irrigations were insufficient to produce a maximum yield. The increase in yield from six irrigations as compared to four irrigations was statistically insignificant and certainly not great enough to pay the costs of the two extra applications of water. It is probable that at Fort Collins four irrigations are sufficient for the production of a satisfactory crop of beets except in those years of exceptionally low rainfall or in years of unusually poor seasonal distribution of natural moisture. The effect of the interaction of spacings and irrigations for these years appears to have been small or negligible. This lack of effect of the interaction may or may not be principally due to the small range in spacing intervals which was used in the tests.

HYBRIDS TEST

In 1938 seed was produced by 18 different group plantings of 10 or more roots each of two more or less inbred lines for each group. These 18 lots of seed with five others of similar type and a American check variety were planted in six randomized blocks. The plots were eight rows wide and thirty feet long. The six inside rows, 180 feet of row per plot, were harvested. A key to the variety numbers, plot and general summaries follows:

HYBRIDS TEST - KEY TO VARIETIES

<u>Var. No.</u>	<u>Cross or Description</u>	<u>Approximate Average Weights and % Sucrose of Roots Producing Seed</u>
1.	160 ^{1/} x Schreiber ^{2/}	1.6 lb. 16.4% x 1.8 lb. 16.6
2.	Selected F ₂ of 145 x 146	2.0 lb. 15.5 %
3.	62 x 80	3.5 lb. 9.4% x 1.0 lb. 16.0 %
4.	124 x Synthetic Check ^{3/}	2.2 lb. 16.4% x 3.2 lb. 12.8%
5.	145 x Ft. Collins Line ^{4/}	1.6 lb. 17.0% x 4.0 lb. 10.8%
6.	145 x 62	1.8 lb. 16.5% x 3.2 lb. 13.2%
7.	145 x 6	2.0 lb. 16.6% x 3.0 lb. 12.0%
8.	4 x 160	2.7 lb. 12.7% x 1.8 lb. 15.9%
9.	64 x Two Ft. Collins Lines ^{4/}	1.8 lb. 15.5% x 3.9 lb. 9.6%
10.	6 x 137	2.8 lb. 12.5% x 2.2 lb. 15.9%
11.	62 x 156	3.8 lb. 11.0% x 2.2 lb. 16.2%
12.	50 x 138	2.1 lb. 13.4% x 2.3 lb. 16.0%
13.	102 x 137	2.3 lb. 14.7% x 1.9 lb. 15.9%
14.	36 x 69	2.9 lb. 15.2% x 2.0 lb. 13.6%
15.	40 x 161	2.4 lb. 15.2% x 1.5 lb. 15.2%
16.	9 x 116	1.9 lb. 14.7% x 1.9 lb. 15.7%
17.	9 x Unknown ^{5/}	2.7 lb. 13.5% x 3.7 lb. 13.4%
18.	9 x U. S. No. 215	2.1 lb. 15.2% No record
19.	Seed from approximately 300 roots; two or more times selfed originating about half from Flat Foliage and balance from Original Normal and Pioneer.	
20.	Selected F ₃ from Selected F ₂ of Chard-Sugar Beet Hybrid.	
21.	Selected F ₂ of similar origin as No. 1.	
22.	Selected F ₂ from 7 F ₁ s involving 13 inbred lines from Flat Foliage origin.	
23.	Seed from plot of Schreiber SS grown in field of Great Western.	
24.	Great Western Commercial Check.	

- ^{1/} Numbers all refer to Flat Foliage lines; first selfed in 1932. Most of these lines have been twice selfed or sibbed since the original selfing.
- ^{2/} This Schreiber line selfed in 1934, sibbed in 1936.
- ^{3/} Selfed once only.
- ^{4/} Origin records lost, but probably Original Normal or Pioneer selfed at least once.
- ^{5/} Recorded as "Edmonds Low Sugar Group" 1934. Probably a group cross of a low sugar inbred line and big, low sugar roots from several commercial brands. Apparently heterozygous for low and fairly high sugar percent.

HYBRID TEST, FORT COLLINS, COLORADO, 1939
PLOT SUMMARIES

Variety	Plot No.	Beets	T. Beets	S	App. Coef of Pur.	Lbs. Sug. Per A.	
		Harv.	Per A.	Sug.		Gross	Ind. Av.
1.	563	170	16.41	18.30	90.95	6005	5462
	609	168	16.41	19.00	91.10	6235	5680
	616	176	12.07	16.90	93.80	4081	3828
	638	164	10.44	17.85	93.50	3727	3485
	680	152	8.89	17.60	91.35	3128	2857
	683	149	11.99	18.45	90.75	4423	4014
	Mean		163	12.70	18.02	91.91	4600
2.	574	179	16.74	18.35	92.20	6144	5665
	603	194	16.17	18.45	92.65	5966	5527
	618	174	14.98	18.95	92.25	5679	5239
	648	160	9.84	18.65	92.90	3669	3409
	678	166	14.60	18.20	92.20	5314	4900
	688	182	16.07	17.65	91.60	5674	5197
	Mean		176	14.73	18.38	92.30	5408
3.	567	176	18.66	16.70	90.90	6232	5665
	596	151	18.07	17.40	91.60	6288	5760
	610	163	10.60	17.40	92.70	3689	3420
	643	160	8.77	17.40	91.00	3052	2777
	677	170	12.61	17.50	91.00	4414	4017
	684	152	14.59	16.90	88.20	4932	4350
	Mean		162	13.88	17.22	90.90	4768
4.	566	185	20.98	16.30	88.10	6840	6026
	587	175	16.11	18.55	89.65	5977	5358
	620	168	15.99	17.90	90.80	5726	5199
	637	171	13.09	18.60	92.80	4869	4518
	669	176	14.93	16.40	90.40	4896	4426
	698	154	15.14	17.75	93.65	5376	5035
	Mean		172	16.04	17.58	90.90	5614
5.	584	176	19.18	17.15	91.25	6579	6003
	605	179	18.08	17.75	92.60	6420	5945
	622	173	10.41	18.10	92.70	3769	3494
	647	168	9.98	17.95	93.50	3584	3351
	662	177	16.48	17.10	90.75	5636	5115
	691	164	19.68	16.50	89.85	6495	5836
	Mean		173	15.64	17.42	91.78	5414

<u>Variety</u>	<u>Plot No.</u>	<u>Beets Harv.</u>	<u>T. Beets Per A.</u>	<u>% SUGAR.</u>	<u>ADD. Coef of Pur.</u>	<u>Lbs. Sug. Per A.</u>	
						<u>Gross</u>	<u>Ind. Av.</u>
6.	583	170	16.15	17.85	91.00	5764	5245
	601	170	13.14	18.85	91.90	4954	4553
	614	176	11.75	16.95	91.20	3982	3632
	645	162	9.76	15.45	88.35	3015	2664
	665	169	10.76	17.50	92.40	3766	3480
	694	171	13.57	16.85	91.55	4573	4187
	Mean		170	12.52	17.24	91.07	4342
7.	575	177	18.32	18.25	91.35	6686	6108
	590	187	18.16	17.75	90.65	6448	5845
	632	153	10.06	17.55	91.30	3529	3222
	634	173	10.26	17.80	92.90	3652	3393
	667	156	10.94	16.70	90.90	3654	3321
	686	170	15.32	16.50	90.75	5055	4587
	Mean		169	13.84	17.42	91.31	4837
8.	577	169	17.34	18.60	90.80	6449	5856
	602	173	14.87	18.70	91.90	5561	5111
	631	163	11.30	19.05	92.55	4307	3986
	655	156	8.97	17.90	91.75	3212	2947
	661	175	14.66	18.00	92.15	5277	4863
	689	149	14.99	17.85	92.45	5352	4948
	Mean		164	13.69	18.35	91.93	5026
9.	581	167	18.16	17.10	90.90	6212	5622
	589	164	16.86	18.25	91.25	6153	5615
	633	162	16.10	16.25	88.30	5233	4621
	636	164	11.30	18.10	93.20	4089	3811
	674	175	15.81	16.35	90.30	5171	4669
	692	172	18.28	17.80	91.30	6508	5942
	Mean		167	16.08	17.31	90.81	5561
10	571	172	14.48	16.90	90.65	4893	4436
	592	174	14.17	17.75	91.40	5031	4598
	625	159	8.58	17.50	92.10	3003	2766
	654	160	8.72	17.25	92.30	3008	2776
	664	158	9.50	17.00	90.30	3231	2918
	695	158	11.84	17.25	91.15	4085	3723
	Mean		164	11.22	17.28	91.32	3875

Variety	Plot No.	Beets Harv.	T. Beets Per A.	S Suor.	App. Coef of Pur.	Lbs. Sug. Per A.	
						Gross	Ind. Av.
11.	565	173	16.79	17.50	90.15	5875	5296
	607	170	17.32	18.65	91.35	6461	5902
	626	156	10.67	17.25	92.40	3682	3402
	652	176	8.89	16.50	90.50	2935	2656
	673	172	14.06	16.90	89.20	4753	4240
	702	151	13.61	17.70	91.75	4816	4419
	Mean		166	13.56	17.42	90.89	4754
12.	570	167	16.39	15.90	88.45	5213	4611
	598	172	12.20	17.45	91.35	4257	3889
	628	185	11.77	17.70	92.10	4166	3837
	656	158	5.83	15.55	90.00	1813	1632
	672	166	14.71	17.70	90.60	5207	4718
	687	168	14.75	17.35	90.95	5119	4656
	Mean		169	12.61	16.94	90.58	4296
13.	585	176	17.58	17.70	91.65	6225	5705
	599	179	12.55	18.55	93.65	4654	4358
	615	168	13.29	17.25	93.00	4584	4263
	650	175	12.25	17.70	92.30	4336	4002
	660	174	15.10	17.80	91.40	5376	4914
	690	174	17.35	18.35	90.95	6368	5792
	Mean		174	14.69	17.89	92.16	5257
14.	576	175	21.93	17.70	90.85	7762	7052
	593	184	19.92	18.00	92.85	7172	6659
	630	168	13.63	18.50	91.60	5042	4618
	639	163	11.62	17.60	92.45	4089	3780
	658	175	15.07	17.90	91.20	5396	4921
	693	166	17.08	17.65	91.30	6028	5504
	Mean		172	16.54	17.89	91.71	5915
15.	572	172	18.21	17.60	90.40	6409	5794
	604	173	15.07	18.25	92.00	5501	5061
	613	168	11.06	18.60	93.35	4113	3839
	644	174	7.37	17.20	92.05	2535	2333
	676	169	12.38	17.15	90.85	4246	3857
	685	157	14.37	17.50	91.25	5031	4591
	Mean		169	13.08	17.72	91.65	4639

<u>Variety</u>	<u>Plot No.</u>	<u>Beets Harv.</u>	<u>T. Beets Per A.</u>	<u>% Sugar.</u>	<u>App. Coef of Pur.</u>	<u>Lbs. Sugar Per A. Gross</u>	<u>Ind. Av.</u>
16.	569	174	17.11	16.25	91.15	5561	5069
	595	173	20.58	17.75	92.15	7307	6733
	624	168	10.74	17.50	93.45	3758	3512
	640	160	8.99	16.85	92.55	3029	2803
	679	169	15.06	17.70	92.55	5333	4936
	682	165	14.43	17.00	89.90	4907	4411
Mean		168	14.48	17.18	91.96	4982	4577
17.	568	175	20.04	16.10	90.45	6452	5836
	597	168	19.24	16.55	90.05	6368	5734
	611	155	11.50	17.25	92.65	3967	3675
	641	166	9.71	16.05	92.25	3116	2875
	681	124	10.70	16.35	91.25	3499	3193
	697	170	16.68	16.40	91.35	5470	4997
Mean		160	14.64	16.45	91.33	4812	4385
18.	578	170	17.04	16.70	90.55	5691	5153
	606	172	19.26	18.65	92.40	7184	6638
	612	177	12.65	18.20	92.95	4606	4281
	651	180	13.71	18.00	91.95	4937	4540
	666	164	13.00	18.50	91.60	4808	4404
	696	159	15.39	17.40	91.80	5356	4917
Mean		170	15.18	17.91	91.88	5430	4989
19.	562	176	20.55	17.75	91.20	7294	6652
	591	180	16.96	18.10	92.60	6139	5685
	621	150	14.74	17.70	92.10	5217	4805
	649	150	11.94	17.90	92.80	4275	3967
	675	163	16.07	18.15	92.60	5835	5403
	705	162	15.03	17.30	90.55	5200	4709
Mean		164	15.88	17.82	91.98	5660	5204
20.	580	169	13.26	17.50	93.05	4642	4319
	588	165	13.57	18.80	92.45	5102	4717
	619	177	12.65	18.55	91.75	4695	4308
	635	165	7.90	17.90	92.75	2828	2623
	668	165	6.98	17.60	91.70	2458	2254
	700	161	11.09	16.85	93.35	3738	3489
Mean		167	10.91	17.87	92.51	3910	3618

<u>Variety</u>	<u>Plot No.</u>	<u>Beets Harv.</u>	<u>T. Beets Per A.</u>	<u>% Sucr.</u>	<u>App. Coef of Pur.</u>	<u>Lbs. Sucr. Per A.</u>	
						<u>Gross</u>	<u>Ind. Av.</u>
21.	582	163	13.42	17.55	90.75	4712	4276
	586	178	13.53	18.85	92.40	5102	4714
	627	188	10.91	18.00	92.50	3928	3633
	646	167	8.90	17.95	91.50	3195	2923
	663	173	14.08	18.60	93.00	5237	4870
	703	152	11.78	17.85	91.75	4204	3857
	Mean		170	12.10	18.13	91.98	4396
22.	573	174	16.22	16.90	90.20	5482	4945
	600	150	10.69	18.80	91.10	4021	3663
	629	163	10.24	17.75	93.60	3634	3401
	653	176	8.00	16.40	90.45	2624	2373
	659	169	12.00	18.30	91.50	4392	4019
	704	163	12.45	17.30	92.35	4308	3978
	Mean		166	11.60	17.58	91.53	4077
23.	579	177	18.48	17.30	91.60	6395	5858
	594	170	19.16	17.95	92.50	6878	6362
	623	169	9.39	17.30	92.95	3248	3019
	657	168	13.58	15.50	88.95	4209	3744
	671	155	14.11	17.70	91.85	4996	4589
	699	162	15.69	16.60	98.45	5209	4816
Mean		167	15.07	17.06	91.72	5156	4731
24.	564	168	21.03	16.80	90.80	7067	6417
	608	169	20.99	17.65	90.80	7409	6727
	617	167	16.62	17.05	90.75	5667	5143
	642	149	10.09	17.70	93.70	3572	3347
	670	163	15.14	17.00	90.55	5149	4662
	701	156	16.39	16.20	90.50	5309	4805
Mean		162	16.71	17.07	91.18	5696	5184

HYBRID TEST, FORT COLLINS, COLORADO, 1939
GENERAL SUMMARY

Var. No.	Beets	T. Beets	%	App. Coef	Lbs. Sug. Per A.		Rank	
	Harv.	Per A.	Sugr.	Of Pur.	Gross	Ind. Av.	Tons	Gross Sug.
1.	163	12.70	18.02	91.91	4600	4221	18	18
2.	176	14.73	18.38	92.30	5408	4990	9	8
3.	162	13.88	17.22	90.90	4768	4332	13	15
4.	172	16.04	17.58	90.90	5614	5094	4	4
5.	173	15.64	17.42	91.78	5414	4997	6	7
6.	170	12.52	17.24	91.07	4342	3960	20	20
7.	169	13.84	17.42	91.31	4837	4413	14	13
8.	164	13.69	18.35	91.93	5026	4618	15	11
9.	167	16.08	17.31	90.81	5561	5047	3	5
10.	164	11.22	17.28	91.32	3875	3536	23	24
11.	166	13.56	17.42	90.89	4754	4319	16	16
12.	169	12.61	16.94	90.58	4296	3890	19	21
13.	174	14.69	17.89	92.16	5257	4839	10	9
14.	172	16.54	17.89	91.71	5915	5422	2	1
15.	169	13.08	17.72	91.65	4639	4246	17	17
16.	168	14.48	17.18	91.96	4982	4577	12	12
17.	160	14.64	16.45	91.33	4812	4385	11	14
18.	170	15.18	17.91	91.88	5430	4989	7	6
19.	164	15.88	17.82	91.98	5660	5204	5	3
20.	167	10.91	17.87	92.51	3910	3618	24	23
21.	170	12.10	18.13	91.98	4396	4046	21	19
22.	166	11.60	17.58	91.53	4077	3730	22	22
23.	167	15.07	17.06	91.72	5156	4731	8	10
24.	162	16.71	17.07	91.18	5696	5184	1	2
Mean	168	14.06	17.55	91.55	4934	4514		
F		5.62**	3.73**	1.40	5.37**	5.43**		
S.E. of Mean		.7165	.242	.438	254.9	232		
S.E. of Mean in % of Mean.		4.10	1.38	.48	5.17	5.14		
Twice the S.E. of a Diff.		2.03	.68	1.24	7.21	6.56		

Discussion:

In general the results of these attempted crosses were disappointing. The most that can be said for the best of them is that they were not significantly poorer than the check variety. Some of the poorer ones were exceedingly poor. In some cases the general appearance of the foliage and roots suggests that little crossing actually occurred. No. 14 involving two lines originating from Flat Foliage appears to be fully equal to the check in this test. The showing of No. 19 was also relatively good and suggests the possibility of applying "Strain Building" for the production of what would be, essentially, a synthetic variety. Nos. 4 and 9 stand next in the order of yields. Both of these involve inbreds from relatively different sources. The yields of Nos. 1 and 21, while low, are of interest. The source of No. 21 is not identical with No. 1 since the seed producing the roots from which No. 21 came was produced by a group planting in 1936 involving the same lines as the group producing No. 1 in 1938. Selection in the F_1 maintained the yield of sugar per acre, but did not improve the strain. No. 20, believed to be a chard-sugar beet hybrid was satisfactory in quality, but definitely low in yield; in addition the roots were much sprangled. The chief problem in producing good strains by this method appears to be to attain a satisfactory tonnage of roots since in most cases percent sucrose is relatively high.

STRAINS AND VARIETIES TEST

In 1932 a considerable number of roots selected from Flat Foliage were selfed by isolation. A considerable number of the breeding lines now on hand go back to this source. A number of these lines have been sibbed (small group plantings) from time to time to guard against the loss of the line in case the single root isolate failed to produce seed. Seed from the sib increases of 16 of these lines was available in the spring of 1939 in quantity sufficient for plot tests. To these lines were added No. 17 which arose from probable outpollination of a once inbred line; Nos. 18 and 19 which are mass selections, one for high percent sucrose and the other for good root and crown type; No. 20 an American commercial variety for a check; No. 21 Nebraska No. 30 from Mr. S. B. Nuckols and Nos. 22, 23, and 24 which are curly top resistant lines received from the Salt Lake City station. These were planted in six randomized blocks. The plots were eight rows, 30 feet long. The inside six rows, 180 feet of row per plot were harvested. The test as a whole was exceedingly variable, both within blocks and within varieties, and standard errors for yield are high. A key to the strains and varieties and plot and general summaries follow: