

### 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 1935. Selection in the  $F_2$  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. Muckols 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:

STRAINS-VARIETIES TEST, FORT COLLINS, COLORADO, 1939

Key to Strains and Varieties

1. Inbred. 1933 Family 111. Selfed once, followed by 3 group increases.
2. " " " 132. " " " " " " " "
3. " " " 145. " " " " " " " "
4. " " " 161. " " " " " " " "
5. Inbred (?). 1936 two overwinter stockings (Kropf), followed by one group increase.
6. Inbred. 1933 Family 6. Selfed once, followed by 3 group increases.
7. " " " 64. " " " " " " " "
8. " " " 62. " " " " " " " "
9. " " " 40. " " " " " " " "
10. Inbred. Early pedigree lost (Possibly 1933 Family 69). Selfed 1936; followed by one group increase.
11. Inbred. 1933 Family 50. Selfed once, followed by 3 group increases.
12. Inbred. 1933 Family 94. Selfed once, followed by 3 group increases.
13. " " " 104. " " " " " " " "
14. " " " 137. " 1932; grouped 1934; 2 roots selfed and group increase in 1936; progeny of these three grouped 1938.
15. Inbred. 1933 Family 138. Selfed 1932; 1934; Selfed and grouped 1936; progeny of 1936 seed lots grouped in 1938.
16. Inbred. 1933 Family 141. Selfed once, followed by 2 group increases.
17. 1933 Family 124. Selfed 1932; probably crossed 1934; 3 good high sugar roots grouped 1936; group increase 1938.
18. Mass selection for high percent sucrose.
19. Mass selection for good shape and crown.
20. American commercial check.
21. Nebraska No. 30.
22. U. S. No. 22.
23. U. S. No. 10.
24. U. S. No. 34, reselected.



STRAINS-VARIETIES TEST, FORT COLLINS, COLORADO, 1939  
PLOT SUMMARIES

Variety	Plot No.	Beets	T. Beets	\$	App. Coef of Pur.	Lbs. Sug. Per A.	
		Harv.	Per A.	Sug.		Gross	Ind. Av.
1.	416	187	15.17	17.25	91.80	5235	4806
	462	167	10.59	17.30	91.50	3665	3353
	469	167	11.51	17.40	92.20	4004	3692
	491	179	11.83	18.00	91.75	4260	3909
	533	169	12.96	17.00	87.95	4406	3875
	536	173	11.94	17.75	91.05	4240	3861
	Mean		174	12.33	17.45	91.04	4302
2.	427	169	16.48	18.65	91.75	6147	5640
	456	167	10.60	18.00	93.10	3816	3553
	471	170	9.99	17.55	93.15	3506	3266
	501	169	10.67	17.10	91.35	3690	3334
	531	167	8.06	16.70	91.00	2692	2450
	541	167	12.52	18.40	90.60	4606	4173
	Mean		168	11.39	17.73	91.82	4070
3.	420	171	14.66	18.70	92.75	5482	5085
	449	168	11.38	18.55	90.50	4223	3822
	463	161	9.31	18.70	92.25	3481	3211
	496	162	11.59	18.20	90.70	4218	3826
	530	168	8.23	17.45	90.55	2871	2600
	537	163	9.16	17.70	90.65	3243	2940
	Mean		166	10.72	18.22	91.23	3920
4.	419	178	15.49	18.15	91.50	5621	5143
	440	184	14.66	18.35	91.60	5379	4927
	473	172	11.54	17.60	93.45	4061	3795
	490	165	14.75	17.60	91.70	5190	4759
	522	167	15.58	16.90	90.05	5266	4742
	551	164	13.40	17.45	90.55	4677	4235
	Mean		172	14.24	17.68	91.48	5032
5.	437	188	15.09	17.45	91.60	5265	4823
	458	167	12.18	18.15	91.05	4420	4024
	475	173	11.55	17.50	91.50	4043	3699
	500	185	11.85	16.00	91.65	3791	3474
	515	175	8.23	16.60	90.70	2733	2479
	544	150	9.54	15.45	86.85	2948	2560
	Mean		173	11.41	16.86	90.56	3867

<u>Variety</u>	<u>Plot No.</u>	<u>Beets Harv.</u>	<u>T. Beets Per A.</u>	<u>S</u> <u>Sucre.</u>	<u>App. Coef of Pur.</u>	<u>Lib. Sug. Per A.</u> <u>Gross</u>	<u>Ind. Av.</u>
6.	436	163	12.51	16.95	90.75	4241	3849
	454	157	11.47	17.30	91.25	3969	3622
	467	166	9.08	16.40	92.55	2979	2757
	498	167	6.62	15.40	90.70	2039	1869
	518	162	6.38	13.75	87.50	1755	1536
	547	148	9.83	15.90	89.00	3126	2782
	Mean		160	9.32	15.95	90.29	3018
7.	428	173	12.62	18.60	89.65	4694	4208
	443	172	11.31	18.25	92.30	4129	3811
	485	166	9.15	18.05	91.85	3305	3036
	487	158	9.76	17.25	90.80	3369	3059
	520	173	11.37	16.80	88.60	3820	3385
	539	174	10.08	17.60	90.55	3547	3212
	Mean		169	10.72	17.76	90.62	3811
8.	430	158	13.84	17.00	89.05	4705	4190
	455	183	12.49	16.90	91.05	4221	3843
	484	156	8.71	16.20	92.10	2823	2600
	508	163	10.29	15.35	90.30	3160	2853
	514	162	9.34	14.40	88.85	2689	2389
	542	156	13.90	15.85	87.90	4405	3872
	Mean		163	11.43	15.95	89.88	3667
9.	434	174	13.67	17.80	92.35	4867	4495
	442	182	12.73	17.30	90.60	4406	3992
	486	170	9.26	17.55	91.00	3249	2957
	489	179	15.11	17.30	90.25	5227	4717
	527	169	7.87	16.35	92.35	2573	2376
	545	169	14.22	15.80	90.65	4492	4072
	Mean		174	12.14	17.02	91.20	4136
10.	424	165	15.89	15.40	89.35	4895	4374
	445	163	15.70	16.45	90.85	5164	4691
	478	173	12.67	16.30	91.65	4130	3785
	507	169	14.23	15.95	90.30	4539	4099
	517	163	9.41	16.45	90.40	3096	2799
	548	167	11.94	15.95	90.85	3810	3461
	Mean		167	13.31	16.08	90.57	4272



<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>
11.	418	175	14.29	17.85	89.80	5103	4582
	460	167	9.88	17.45	92.60	3448	3193
	479	172	9.54	16.75	93.25	3196	2980
	505	175	12.39	17.95	89.85	4446	3995
	526	176	7.75	16.50	90.85	2559	2325
	555	152	11.97	17.05	89.85	4082	3668
Mean		170	10.97	17.26	91.03	3806	3457
12.	423	176	16.86	17.00	90.55	5732	5190
	451	155	11.57	17.85	91.30	4131	3772
	481	170	11.21	18.00	92.35	4035	3726
	509	166	11.55	17.35	90.70	4008	3635
	525	169	7.01	15.55	88.05	2179	1919
	540	173	12.39	17.45	90.60	4323	3917
Mean		168	11.76	17.20	90.59	4068	3693
13.	438	177	12.63	18.85	92.70	4760	4413
	452	147	9.31	18.80	90.95	3502	3185
	468	170	8.99	18.50	91.25	3326	3035
	503	154	7.80	18.65	91.20	2908	2652
	513	175	8.16	17.90	90.35	2921	2639
	543	150	10.18	18.35	91.00	3736	3400
Mean		163	9.51	18.51	91.24	3526	3221
14.	429	173	12.92	17.75	90.65	4588	4199
	446	176	10.96	17.45	93.15	3823	3561
	483	166	10.35	17.55	94.30	3634	3427
	492	172	9.77	17.90	92.15	3498	3223
	511	159	7.70	15.75	89.20	2426	2164
	546	157	12.41	15.80	89.60	3923	3515
Mean		167	10.68	17.03	91.51	3649	3342
15.	425	177	15.73	16.45	90.20	5176	4669
	457	170	12.12	18.30	91.50	4435	4058
	466	170	11.25	17.80	91.55	4003	3665
	497	177	10.59	17.20	91.80	3644	3345
	529	162	11.68	17.85	89.80	4170	3745
	538	163	11.32	17.05	89.90	3860	3470
Mean		170	12.12	17.44	90.79	4215	3825

<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. Suc. Per A.</u>	
						<u>Gross</u>	<u>Ind. Av.</u>
16.	422	159	14.25	17.45	89.75	4974	4464
	448	162	11.85	18.00	91.85	4265	3917
	477	172	11.70	17.75	92.95	4152	3859
	493	159	11.33	18.40	92.65	4168	3862
	532	160	8.58	14.55	86.55	2497	2161
	535	143	9.25	17.50	90.15	3237	2918
	Mean		159	11.16	17.28	90.65	3882
17.	421	172	17.24	18.75	89.75	6463	5801
	450	177	12.63	19.40	92.55	4901	5536
	464	165	10.84	19.35	91.95	4195	3857
	494	165	12.46	19.15	92.55	4771	4416
	534	166	11.29	17.50	91.00	3951	3995
	550	137	9.89	18.00	89.80	3560	3197
	Mean		164	12.39	18.69	91.27	4640
18.	431	172	15.46	18.00	92.10	5567	5127
	459	175	12.51	17.30	91.95	4328	3980
	465	181	11.64	17.55	91.65	4085	3744
	504	176	11.94	17.65	92.50	4213	3897
	519	173	10.98	16.80	90.05	3691	3324
	549	178	12.23	17.35	89.65	4242	3803
	Mean		176	12.46	17.44	91.32	4354
19.	415	175	19.75	17.00	90.50	6714	6076
	444	164	15.06	17.50	90.35	5273	4764
	474	172	9.25	16.30	92.20	3015	2780
	502	169	13.69	16.10	91.25	4409	4023
	528	175	12.09	17.50	90.50	4231	3829
	558	159	16.29	17.00	91.80	5539	5085
	Mean		169	14.36	16.90	91.10	4864
20.	433	175	17.92	17.35	91.45	6217	5685
	441	173	13.50	16.40	92.50	4427	4095
	472	164	10.41	16.40	92.95	3415	3174
	488	185	14.55	16.30	92.85	4743	4404
	521	177	15.20	16.00	90.15	4865	4386
	553	158	13.77	17.15	91.15	4724	4306
	Mean		172	14.22	16.60	91.84	4732



<u>Variety</u>	<u>Plot No.</u>	<u>Beets Harv.</u>	<u>T. Beets Per A.</u>	<u>S</u> <u>Sucr.</u>	<u>App. Coef of Pur.</u>	<u>Lbs. Sucr. Per A.</u> <u>Gross</u>	<u>Ind. Av.</u>
21.	435	170	17.28	16.95	91.60	5858	5366
	439	176	16.94	17.75	90.10	6013	5418
	480	176	12.40	16.35	90.45	4055	3668
	499	161	10.33	15.75	90.10	3254	2932
	516	170	9.62	16.10	89.15	3097	2761
	556	151	16.77	17.20	90.45	5769	5218
	Mean		167	13.89	16.68	90.31	4674
22.	426	181	18.96	16.40	90.35	6218	5618
	453	169	15.03	17.30	91.90	5200	4779
	482	173	11.69	17.25	94.50	4033	3811
	506	176	14.15	16.80	91.15	4754	4333
	512	174	12.19	15.30	91.15	3730	3400
	557	171	18.76	16.80	90.45	6303	5701
	Mean		174	15.13	16.64	91.58	5040
23.	432	175	15.01	18.10	92.00	5432	4997
	447	172	14.41	16.95	91.90	4885	4489
	476	167	12.76	16.85	93.45	4299	4017
	510	175	10.66	16.95	92.70	3613	3349
	524	177	9.26	16.30	90.75	3020	2741
	552	150	11.24	16.75	91.10	3765	3430
	Mean		169	12.22	16.98	91.98	4169
24.	417	172	16.50	16.95	90.70	5594	5074
	461	172	13.23	16.85	92.05	4458	4104
	470	162	11.96	16.55	91.45	3958	3620
	495	172	18.36	17.30	89.60	6353	5692
	523	156	6.90	15.40	90.10	2124	1914
	554	160	13.52	16.95	90.25	4583	4136
	Mean		166	13.41	16.67	90.69	4512

STRAINS-VARIETIES TEST, PORT COLLINS, COLORADO, 1939  
GENERAL SUMMARY

Variety	Beets	T. Beets	%	Ann. Coef	Lbs. Sug. Per A.		Gross Sug. Rank
	Harv.	Per A.	Sugr.	of Pur.	Gross	Ind. Av.	
1.	174	12.33	17.45	91.04	4302	3916	9
2.	168	11.39	17.73	91.82	4070	3736	14
3.	166	10.72	18.22	91.23	3920	3581	16
4.	172	14.24	17.68	91.48	5032	4600	2
5.	173	11.41	16.86	90.56	3867	3510	18
6.	160	9.32	15.95	90.29	3018	2732	24
7.	169	10.72	17.76	90.62	3811	3452	19
8.	163	11.43	15.95	89.88	3667	3291	21
9.	174	12.14	17.02	91.02	4136	3768	13
10.	167	13.31	16.08	90.57	4272	3868	10
11.	170	10.97	17.26	91.03	3806	3457	20
12.	168	11.76	17.20	90.59	4068	3693	15
13.	163	9.51	18.51	91.24	3526	3221	23
14.	167	10.68	17.03	91.51	3649	3342	22
15.	170	12.12	17.44	90.79	4215	3825	11
16.	159	11.16	17.28	90.68	3882	3530	17
17.	164	12.39	18.69	91.27	4640	4234	6
18.	176	12.46	17.44	91.32	4354	3979	8
19.	169	14.36	16.90	91.10	4864	4426	3
20.	172	14.22	16.60	91.84	4732	4342	4
21.	167	13.89	16.68	90.31	4674	4227	5
22.	174	15.13	16.64	91.58	5040	4607	1
23.	169	12.22	16.98	91.98	4169	3837	12
24.	166	13.41	16.67	90.69	4512	4090	7
Mean		12.14	17.17	91.02	4176	3803	
F		5.08**	8.50**	1.74*	4.08**	4.30**	
S.E. of Mean		.679	.246	.41	247.3	222.4	
S.E. of Mean in % of Mean		5.59	1.43	.45	5.92	5.85	
Twice S.E. of a Difference		1.92	.70	1.16	699	629	



## Discussion:

Most of the inbreds appear to be superior to the check variety in sucrose percentage and it is probable that the inbreds from Flat Foliage origin now in the breeding lines of the station are, for the most part, "High Sugar" types and this should be kept in mind in their future use. The yield of the inbreds, measured as gross sugar per acre, varies between rather wide limits. Twelve of the 16 fall in the low half of the test as a whole and only one, No. 4, stands close to the top; ranking above most of the varieties and mass selections in the test. This one may have merit as it is; or since it has relatively high percent sucrose with fair yield of roots it might be advantageously combined with a strain characterized by high yield of roots. Some measure of the combining ability of the other fifteen inbreds will be necessary before their utilization or discard can be planned. No. 19 may have value since quite good percent sucrose appears to be present with a good yield of roots. Nebraska 30 is a rank growing, coarse beet with a tendency to have large crowns and ranked fifth in the production of gross sugar per acre in this test. Its performance in this test is consistent with previous tests in Colorado. The curly top resistant line, U. S. No. 22, ranked first in this test and it is probably the best of these lines so far tried in Colorado. The performance of U. S. Nos. 10 and 34, reselected, was consistent with previous tests with similar strains. In general the curly top resistant strains are probably not particularly adapted to Colorado conditions.

## "520" STRAINS TESTS

In previous tests the selected  $F_2$  of a sugar beet-garden beet hybrid known as "520" has rather consistently produced high yields of roots and a satisfactory yield of sugar per acre in spite of relatively low percent sucrose, which characterizes this hybrid selection. In the spring of 1939 seed of various selected and non-selected increases and certain group hybrids of this strain was available for testing. Twelve of these lines with an American commercial variety check were included in a test at the Fort Collins headquarters, seven lines with the same check variety were included in a test at Rocky Ford, Colorado, five lines were planted in strips in a farmer's field at Fort Morgan, Colorado, six lines were included in a large variety test by the Holly Sugar Corporation at Sheridan, Wyoming and one line in a similar test at Sydney, Montana.

The Fort Collins test was planted in eight randomized blocks, plots eight rows 30 feet long. The six inside rows, 180 feet of row per plot were harvested. The Rocky Ford test was a 9 x 9 Latin square, plots four rows 30 feet long. Part of this test occupied a poor spot in the field. Stands varied from poor to very good. The best 56 feet of row of each plot was harvested. The five four row strips at Fort Morgan were alternated with strips of the American commercial check variety. Nine samples were harvested from each of these strips; each sample consisting of ten feet of the inside two rows, 20 feet of row per sample. Conditions of the tests in Wyo. and Montana are not definitely known. Keys to the varieties in these tests and summary tables follow: