

# Composition of Beets Grown in Widely Separated Areas

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From time to time during the past twenty years our research laboratory has made rather complete analyses of 24-hour composite samples of cossettes. These samples are normally taken on the same day in October and cover six to ten factories, so located that we know they cover different climatic conditions and to some extent different soil types. By comparing these figures over a period of years we can recognize certain trends in quality of beets and try to correct them as far as possible by improved cultural methods and improved seed varieties.

This year I decided it would be interesting to secure samples from a much wider area, so will in this paper report results of 24-hour composite cossette samples from the following ten factories:

Brighton, Colorado  
Eaton, Colorado  
Brush, Colorado  
Gering, Nebraska  
Lovell, Wyoming  
Nyssa, Oregon  
Mason City, Iowa  
Garden City, Kansas  
Picture Butte, Alberta  
Winnipeg, Manitoba

The last three factories were chosen in order to include northern and southern latitudes, Picture Butte and Winnipeg being at a latitude of approximately 50° and Garden City at 38°. The effect of latitude on the quality of beets is rather well known: a northern latitude normally produces a high quality beet. This year, however, the quality of beets at the two Canadian factories was below normal, particularly at Picture Butte, where I understand serious damage was done by root aphids. The Winnipeg area suffered a serious drouth during July, August and September which hurt the quality of beets grown there.

On the whole, the analyses in the following tables show more uniformity in the ash constituents than I expected. The quality of beets was generally good, being above 85.5 purity in all cases except Garden City. Climatic conditions at Garden City are those of a southern latitude, tending to produce beets of low purity and high ash content. It will always be true that a climate which produces excellent yields of corn will not produce high quality sugar beets.

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Table 1.—Research Laboratory—The Great Western Sugar Company Analysis of Cossettes of 1949-50 Campaign.

Factory	Brighton	Eaton	Brush	Gering	Lovell	Nyssa	Mason City	Garden City	Canadian		
									Picture Butte	High Sugar	Low Sugar
<b>FACTORY ANALYSIS</b>											
% Sugar	17.36	16.62	15.32	15.24	16.88	15.64	16.92	14.08	15.28	18.6	16.6
Purity	88.6	88.8	87.7	87.3	89.4	90.2	86.7	80.6	87.1	83.7	83.5
<b>RESEARCH LABORATORY ANALYSIS</b>											
Percent on Original Beets											
% Dry Sub.	22.50	22.40	20.32	21.28	22.27	19.77	22.67	20.12	20.50	24.40	20.46
% Total—N	0.147	0.117	0.146	0.172	0.137	0.145	0.230	0.184	0.135	0.202	0.225
% NO <sub>2</sub> —N	0.0098	0.0056	0.0055	0.0318	0.0150	0.0049	0.0109	0.0118	0.0231	0.0050	0.0119
% Ash Total	0.615	0.650	0.717	0.716	0.754	0.589	0.691	0.887	0.828	0.815	0.842
Converted for Insoluble	0.592	0.613	0.670	0.697	0.544	0.566	0.666	0.845	0.714	0.670	0.783
% CaO	0.0435	0.0428	0.0381	0.0421	0.0520	0.0410	0.0396	0.0574	0.0223	0.0703	0.0396
% MgO	0.0694	0.0705	0.0695	0.0662	0.0743	0.0626	0.0857	0.0721	0.0695	0.0783	0.0958
% K <sub>2</sub> O	0.237	0.264	0.280	0.293	0.200	0.210	0.283	0.348	0.237	0.210	0.340
% Na <sub>2</sub> O	0.0353	0.0415	0.0569	0.0518	0.0421	0.0412	0.0404	0.0871	0.0770	0.0911	0.0509
% Fe <sub>2</sub> O <sub>3</sub>	0.0683	0.0517	0.0327	0.0471	0.0393	0.0632	0.0561	0.0074	0.0517	0.0558	0.0578
% SO <sub>3</sub>	0.0211	0.0235	0.0258	0.0196	0.0224	0.0207	0.0255	0.0500	0.0226	0.0248	0.0246
% Cl	0.0364	0.0380	0.0728	0.0458	0.0314	0.0334	0.0260	0.1058	0.0230	0.0270	0.0354

<sup>1</sup> Purity of Press Juice

The following comparisons may be of interest, particularly from the standpoint of molasses production:

<b>Factories with Ash Content Below 2.80% on D.S.</b>	<b>Factories with Ash Content Above 2.80% D.S.</b>		
Lovell .....	2.44%	Nyssa .....	2.86%
Brighton .....	2.63	Mason City .....	2.94
Eaton .....	2.70	Gering .....	3.28
Manitoba		Brush .....	3.50
(High Sug.) .....	2.77	Picture Butte .....	3.47
		Manitoba	
		(Low Sug.) .....	3.83
		Garden City .....	4.19

There is considerable variation in the total nitrogen content, % on dry substance, and these figures also have an important bearing on molasses production.

<b>Factories with Nitrogen Content Below 0.76% on D.S.</b>	<b>Factories with Nitrogen Content Above 0.75% on D.S.</b>		
Lovell .....	.616%	Gering .....	.806%
Eaton .....	.649	Manitoba	
Brighton .....	.656	(High Sug.) .....	.827
Brush .....	.718	Garden City .....	.913
Nyssa .....	.734	Mason City .....	1.015
Picture Butte .....	.751	Manitoba	
		(Low Sug.) .....	1.149

The detailed figures for the analyses are given in Tables 1 and 2.

The following comments are made on some of the outstanding differences in the analysis of the ash itself.

Picture Butte has a curiously high CaO content and the low sugar sample from Manitoba is abnormally low in CaO.

Beets from the most northerly latitudes—Lovell, Nyssa, Picture Butte and Manitoba—have the lowest K<sub>2</sub>O content in the ash. This is probably due more to climatic conditions than it is to the available potash in the soil.

The analyses of beets from this wide area confirm the conclusions we had reached previously from hundreds of analyses made of beets in Great Western territory. These conclusions are that mature beets of high sugar content and purity normally have the following characteristics:

- Low ash
- Low total nitrogen
- Low nitrates
- Low sodium content
- CaO plus MgO = 18% or more of the soluble ash

Beets with the above characteristics should give a non-Steffen sugar loss in molasses of 1.7 to 2.0% on beets. Mr. Fort reported in his June, 1949,

Table 2.—Analysis of Cigarettes of 1949-50 Campaign—(Continued)

Factory	Brighton	Eaton	Brush	Gering	Lovell	Nyssa	Mason City	Garden City	Canadian		
									Picture Butte	High Sugar	Low Sugar
<b>ANALYSIS—% on Dry Substance</b>											
Total—N	0.656	0.649	0.718	0.806	0.616	0.734	1.015	0.913	0.751	0.827	1.149
NO <sub>x</sub> —N	0.004	0.025	0.027	0.149	0.067	0.025	0.048	0.059	0.112	0.025	0.058
Ash—Cor.	2.63	2.70	3.30	3.28	2.44	2.86	2.94	4.19	3.47	2.77	3.83
% CaO	0.193	0.189	0.188	0.198	0.237	0.207	0.175	0.186	0.447	0.288	0.194
% MgO	0.808	0.311	0.328	0.343	0.334	0.317	0.378	0.358	0.338	0.321	0.468
% K <sub>2</sub> O	1.05	1.16	1.57	1.38	0.90	1.11	1.25	1.73	1.15	0.86	1.66
% Na <sub>2</sub> O	0.157	0.183	0.280	0.243	0.189	0.208	0.178	0.433	0.377	0.573	0.249
% P <sub>2</sub> O <sub>5</sub>	0.504	0.228	0.260	0.221	0.266	0.320	0.248	0.335	0.251	0.229	0.282
% SO <sub>3</sub>	0.094	0.103	0.127	0.092	0.100	0.103	0.113	0.149	0.110	0.102	0.120
% Cl	0.162	0.167	0.359	0.215	0.141	0.169	0.115	0.326	0.112	0.113	0.173
<b>ANALYSIS OF ASH—% on Ash</b>											
% CaO	7.34	6.99	5.68	0.04	9.71	7.25	5.95	4.44	12.93	10.40	5.06
% MgO	11.72	11.51	9.92	9.50	13.65	11.06	12.87	8.56	9.74	11.58	12.23
% K <sub>2</sub> O	40.0	43.1	41.7	42.0	36.8	38.7	42.5	41.3	33.2	31.1	43.4
% Na <sub>2</sub> O	6.0	6.8	8.5	7.4	7.7	7.5	6.1	10.3	10.9	13.5	6.5
% P <sub>2</sub> O <sub>5</sub>	11.54	8.44	7.86	6.73	10.89	11.17	8.43	8.00	7.25	8.25	7.37
% SO <sub>3</sub>	3.57	3.83	3.85	2.82	4.11	3.66	3.83	3.57	3.17	3.67	3.14
% Cl	6.45	6.20	10.87	6.57	5.77	5.90	3.90	12.55	3.22	4.08	4.52

"Report of Studies on the Uniformity of Quality of Beet Sugar," that the average sugar loss in molasses for 35 non-Steffen factories in the U.S.A. for the last ten-year period was 2.13% on beets.

It would be of interest if a number of sugar companies would make similar analyses of cossettes and report them at the next meeting of the Society. It would be of especial value to have more analyses from the non-irrigated areas east of the Mississippi, from beets grown *in* the peat soils of California and from beets grown through the winter in the Imperial valley.

I am indebted to our research staff for the detailed analyses reported in this paper, and to the various sugar companies which kindly furnished the samples of cossettes.