THESIS

THE FOOD VALUE OF SUGAR BEETS GROWN IN MICHIGAN

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"THE FOOD VALUE OF SUGAR BEETS GROWN IN MICHIGAN."

by

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With sugar beets, as with all other food materials, there is a wide variation in composition. This is due to the fact that they are grown under widely different conditions.

With a rich sandy loam, a summer temperature of about 70° F. and a rainfall such as Michigan has, sugar beets may be profitably grown for feeding purposes.

For this analysis twelve samples of sugar beet were obtained from different portions of the state.

Table I merely presents a tabulation of the growers, their location and the nature of the soil upon which the beets were grown.

Table II is the result of the analysis of the twelve samples, giving the percents of Crude Protein, Ash, Water, Fat, Crude Fibre and Nitrogen free extract found in each sample.

The methods for the determination of these food elements adopted by the U. S. Department of Agriculture, and used in this analysis, are as follows: Crude Protein is determined by the Kjeldahl method, which consists in digesting a known amount of the substance to be analyzed 20 c.c. of Sulphuric Acid, using Mercury to hasten the Potassium Permanganate to the oxidation of the nitrogenous substances. Then the mercury is precipitated with Potassium sulphide and the excess of acid is neutralized with Sodium hydrate. The nitrogen, in the form of ammonia, is distilled off, and this multiplied by the factor

Table I.

No.	Grower	Location	Soil	Sugar	Remarks
1	Geo. W. Williams	Muskegon	Sandy Loam	20.07	
2	A. Vogel	Ludington	" "	17.58	
3	A. Meyer	Shepherd	" "	18.58	
4	G. M. Chamberlain	Shelby	" "	18.06	
5	J. E. Meyer	Shepherd	" "	7.62	Red Beet
6	A. Fairbrothers	White Cloud	" "	21.61	
7	J. Fairbrothers	White Cloud	" "	16.99	
8	J. B. Cook	White Cloud	New Ground	20.32	
9	Godfrey Erne	Ludington	Sandy Loam	14.62	
10	J. W. Rhodes	Onekama	Sand with Clay	16.99	
11	John Smith	Hart	Sandy Loam	13.99	Red Beet
12	W. W. Blake	Ann Arbor	" "	16.24	

6.25 gives the crude protein contained in the substance.

The Ash is determined by burning a definite amount of the substance in a ruffle oven at a low, red heat, until the ash is white.

The water is determined by drying the substance in an oven to a uniform weight. This is called air drying and renders the substance sufficiently dry for the dertermination of nitrogen. But for the determination of the fat a known weight of the air-dried material must be dried in a stream of dry hydrogen for about 5 hours to expel the hygroscopic moisture.

The crude Fibre is determined by boiling one gram of the substance in 200 c. c. of 1.25 % Sulphuric Acid for 30 minutes, then in 200 c. c. of 1.25 % Sodium hydrate for the same length of time, from which it is filtered into a Gooch crucible, dried, weighed and burned, and loss of weight is Crude Fibre.

The Carbohydrates are determined by difference.

Chart III illustrates the variation in the percentage of ash throughout the twelve samples.

Chart IV is intended to show the amount of Ether Extract, Carbohydrates and Protein in Sugar Beets as compared with the amount of the same materials found in other food stuffs.

Taking the average of the twelve samples analyzed, I found that Sugar Beets contained 75 % Carbohydrates, 7.95 % Protein and .261 % Ether Extract. For the amounts of protein, carbohydrates and fat contained in the other root crops and foods compared I consulted the results of the Experiment Station Analysis. The result of this comparison credits sugar beets with exceeding all the other root crops in Fats except carrots. Rating higher ~~than~~ in carbohydrates than all other

Table II.

No.	Crude Protein	Ash	Water	Fat	Crude Fibre	Nitrogen free extract	Dry Matter
1	4.63%	3.14%	76.95%	.575%	4.69%	81.92%	20.27%
2	8.01	5.29	81.22	.342	3.84	77.65	19.78
3	7.04	4.25	80.02	.2	5.11	76.42	21.47
4	4.94	4.55	78.24	.21	4.26	79.87	23.19
5	11.2	8.3	88.82	.185	3.42	67.79	11.18
6	5.95	3.59	75.47	trace	4.54	78.64	26.45
7	6.24	4.48	81.09	.155	4.34	77.85	20.31
8	9.97	4.75	77.95	.11	5.81	73.69	23.37
9	13.12	8.42	86.87	.43	3.38	68.14	13.13
10	7.7	4.32	80.21	.76	5.56	74.71	21.26
11	7.65	7.28	84.34	.27	4.01	72.14	17.14
12	9.01	4.54	76.7	.14	5.76	74.8	24.72
				Average			20.52 %

stock feeds compared, in which were included Corn, Red Beets, Clover hay, Bran and Oats, and comparing favorably with Corn, Bran, Middlings and Oats in protein. It must be remembered that the comparisons between the Fat, Carbohydrates and Protein contained in the various food materials given in Chart IV are reckoned from a basis of purely dry matter.

Chat V shows the relative comparison between the Protein and Carbohydrates found in the twelve samples. With the exception of Nos. 3, 11 and 12, it was found that any marked increase in the carbohydrates was accompanied by a correspondingly decrease in the protein.

Chart VI is an attempt to show the relative amount of dry matter in sugar beets, as compared with the other roots. I found that sugar beets contained nearly double the amount of dry matter found in any other root used for stock food.

Knowing that the feeding value of any material depends upon the percent of protein, carbohydrates and fat that it contains, the results shown in the above table proves conclusively that sugar beets stand high as a food stuff. Perhaps sugar beets are a little more expensive to raise than the other root crops, due to the fact that they grow deeper in the ground, but this is more than compensated by their greater richness in carbohydrates. Repeated experiments in feeding sugar beets to stock shows them to be an excellent food. The average farmer who does not use silage cannot afford to commence the winter feeding without a good supply of this or some other succulent food.

They yield equally with mangolds and excel them in food value.

Under favorable conditions they may be made to yield with carrots and rutabagas, and as food for dairy cows they are

much more satisfactory, as the constant precaution against tainted butter and milk is thus eliminated.

Mr. R. M. Allen, foreman of the Standard Cattle Co., of Ames, Nebraska, writes as follows: "I believe that sugar beets may be profitably grown, to a limited extent, by the general farmer for stock feeding. We feed from 3,000 to 5,000 cattle annually, and sugar beets figure extensively in our feeding ration. No one who becomes accustomed to growing and feeding roots ever abandons them. In addition to a large acreage of our own growing, we annually purchase several hundred tons for feeding purposes only."

The experience of up-to-date stock feeders goes to show that a root crop of some sort should be raised, and farmers and stock feeders all over the state are beginning to recognize this fact and are growing a few acres of roots for their stock. The question naturally arises which is the most profitable root crop for them to raise. The plot experiments at the College Experiment Station show the greatest returns in dry matter by sugar beets, with rutabagas second and carrots third. In the yield per acre the sugar beets fell a few hundred pounds below that of rutabagas and carrots, but this is counteracted by the higher percentage of protein and carbohydrates contained in sugar beets. These facts, together with the relatively higher per cent of dry matter and the fact that stock eat them as well, if not better, than other roots, make them the most profitable of all the root crops.

III.