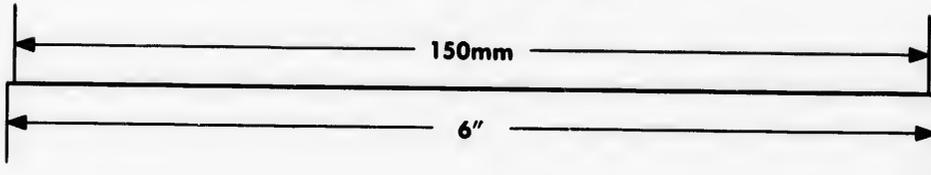
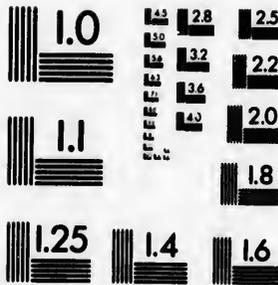
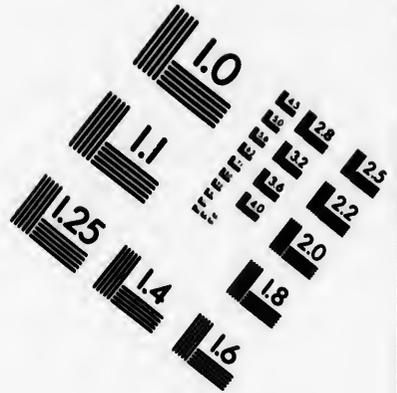
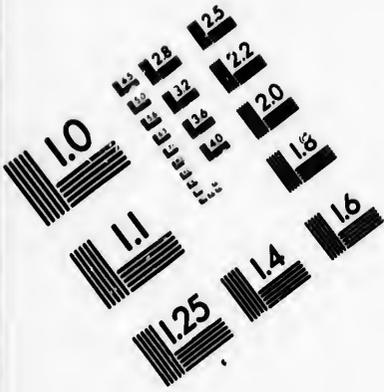
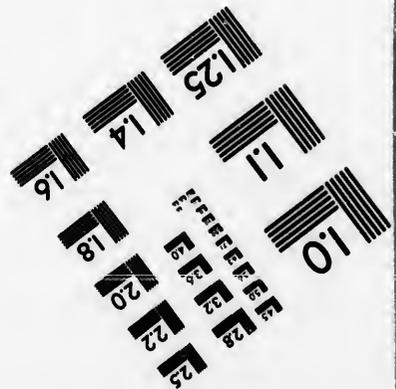


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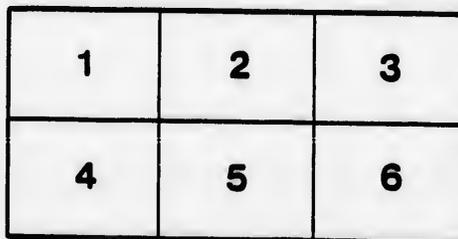
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ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXIII

PITTING THE SUGAR BEET

BY C. C. JAMES, M.A., PROFESSOR OF CHEMISTRY

*PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
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BULLETIN LXIII

EFFECTS OF PITTING ON SUGAR BEETS FOR SUGAR MANUFACTURE AND FOR FEEDING.

The report upon our investigations in regard to the growing of sugar beets for sugar production has been given in the lately published report of the Ontario Agricultural College and Experimental Farm for 1890, pp. 66 to 75 and 96 to 98, to which the attention of the reader is directed in connection with this bulletin.

PRESERVATION OF BEETS. The preservation of the sugar beet between the time of its removal from the ground until it can be worked over in the factory will be a matter of very great importance in this province where the winters are severe and sometimes quite changeable. When the growth of the beet has stopped and the products of the leaves have been transferred to the root, the beet is said to be "ripe," and is ready to be harvested. The signs of this condition in the leaves are the color and the drooping of the leaves; the color changes to a yellowish green and the outer leaves droop or wither and fall as though showing that their season is done. If the beets are to be taken straight to the factory the green heads or collars as well as the leaves may be cut off and left upon the field, but if they must be preserved for some time it is customary not to cut them down too much. "Generally the beets that have been cut close show no tendency whatever to sprout, that is to show leaves in the silo. But their sprouting is a sign of the cessation of all vegetable life, and is generally accompanied by an undesirable change known as 'hardening' in the juice, which is more injurious in the manufacture than the development of sprouts, and which latter, if it has not progressed too far, is preferred by the manufacturer." (*Report by L. S. Ware, 1889.*)

In the preservation of the beets, whether in cellar or in pit, four conditions are to be avoided, viz., excessive cold, as freezing and thawing inverts the sugar and causes loss in the factory; excessive

heat, as the resulting growth uses up sugar rapidly; excessive moisture inducing decay; and excessive dryness causing a withering. The conditions, therefore, are moderate and the aim is to preserve the beet in about the same condition in which it is as it comes from the ground before frost.

EARTH PITS. The earth pit or silo is most extensively used in Europe where the preservation in winter is as great a difficulty as with us in Ontario. These pits may be temporary and simple in construction or they may be permanent, well paved and walled. They are about six feet deep, ten feet wide, and as long as the extent of the crop demands. A small ditch down the centre of the pit permits the excess of water to escape and a free circulation of air is allowed by having an open floor of holes and a ventilating shaft through the centre. The beets, culled and sorted, are then carefully piled in, a sloping roof-shaped heap formed by them above ground, and then they are covered with earth. The depth of earth required in this province and the advisability of using straw between the beets and the earth will be matters of experiment for the future. The depth will, no doubt, be largely controlled by the severity of the weather.

OUR EXPERIMENT. The sugar beets grown at this farm in 1890 were placed in a pit or silo by Prof. Shaw, and the pit was opened on March 12th, 1891 (about the end of the sugar making season), for the purpose of examining the beets and of obtaining samples for analysis. Shortly afterwards the beets were fed to the stock. In general appearance the beets seemed about as when first pitted, except that sprouting had taken place in some. The loss in sugar amounting to a little over two per cent. would seem to indicate that they would have turned out a little better, for the producer at least, if they had been topped a little closer. The loss of sugar in the silo should not much exceed one per cent. At the same time the beets analysed weighed over one pound, a fraction more than the average taken last fall, whereas to get results fairly comparable, they should have weighed a little under one pound. The beets taken out were analysed in three lots. I give the results and also the average of 53 beets analysed by Mr. W. Skaife and myself of the freshly harvested beets, omitting however the larger beets from the outside row.

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Allowing for any errors in sampling we can safely conclude that the beets lost about two per cent. of sugar in the silo, that the co-efficient of purity, however, remains about as before, and that the beets even after being preserved five months in a simple earth silo came out in a condition very favorable to the production of sugar. There seems to be no doubt that in this province the sugar beet can be preserved as long as necessary through our winter months in a condition suitable for sugar making.

ANALYSIS OF PITTED SUGAR BEETS.

No. of beets taken.	Weight lb. oz.	Analysis of juice.			Remarks.
		Solids.	Sugar.	Purity.	
4	4 0	15.00	12.58	83.86	Slightly sprouted.
4	5 0	16.00	13.02	81.38	Grown above ground.
4	4 10	14.76	12.01	81.37	Well grown, fair.
Average after pitting	1 2	15.28	12.54	82.20	
Average before pitting	1 1	18.02	14.77	81.97	

SUGAR BEETS AS FODDER. In many parts of Ontario sugar beets have for years past been grown for stock feeding, and the acreage will this year probably far exceed that of former years, as in some districts extensive experiments are being carried out to determine the practicability of beet sugar production. The farmer in these circumstances always has the second string to his bow, if he cannot find a factory for his beets he can feed them to his stock. With the view of determining their value in stock feeding in comparison with other roots we have analysed sugar beets from the pit and turnips and mangels from the farm root cellars, all of them taken about the end of March. The value of roots in a ration consists principally in their high percentage of carbohydrates (starch and sugar). By their water they offset the dryness of hay, straw and grain. They are usually quite palatable and appetising and have

a toning up effect upon animals that is not brought out in a chemical analysis or statement. I give the next analyses of these three roots, stating first their composition, dry or water free, and below that as

	Water.	Crude protein.	Crude fat.	Carbo hydrates.	Crude fibre.	Ash.
1. Dry.						
Sugar beets.....		9.08	0.67	80.39	6.09	3.82
Turnips.....		11.89	1.35	73.73	8.67	4.46
Mangels.....		17.60	0.91	67.98	6.44	6.98
2. As fed.						
Sugar beets.....	82.93	1.54	0.11	13.73	1.04	0.65
Turnips.....	87.09	1.54	0.17	9.53	1.10	0.58
Mangels.....	91.00	1.59	0.08	6.12	0.58	0.63

The sugar beets contain far less water than the other roots and far more carbohydrates, and as the feeding value consists principally of sugar and starch, it will at once be seen how much more valuable pound for pound the sugar beets are than mangels or turnips. If we compare them on the basis of their value as heat and force producers (which is their principal use in a ration) the beets, turnips and mangels will have about the values of 4, 3 and 2 respectively. The great value of sugar beet for fodder, apart from their value as a source of sugar ought to be carefully considered by the farmers of this province. The use of sugar beets in feeding for milk production in preference to turnips need not be dwelt upon here. Another point to be observed is that the sugar beets most valuable for sugar making are also most valuable for feeding; the high percentage of sugar so profitable for the sugar factory is as much to be desired for feeding, and the use of "thoroughbred" seed and the practice of the best methods ought to be strongly emphasised. The same care used in the production of beets for the factory will pay in the raising of beets for fodder. Suppose we take an example—an acre of sugar beets is grown containing say 15 tons; one sample of medium sized beets

last year gave us 11.5 per cent. sugar, while another sample, the best, of about the same size had 17.5 per cent. sugar. The former would contain about 3,280 lb. of sugar per acre, the latter would contain about 4,990 lb., an increase in value of over 50 per cent. above the former, whether for sugar making or for feeding, and as this sugar comes entirely from constituents found in the air and is not produced at the expense of the soil it follows that the growing of the best sugar beets, the richest in sugar and the purest in quality, is to be recommended.

1. Use only reliable seed, highly developed, sugar producing in its strain, imported fresh from the best French or German sources.
2. Grow beets of moderate size rather than too large, the moderate sized beets have more sugar and less water than the larger beets.
3. Keep them well covered all the season through as sugar is found principally in the portion below ground.

CULTIVATION. The closing paragraph in a late publication from the great French sugar beet firm, Vilmorin Andrieux & Co., is so important in regard to the production of sugar beets for sugar purposes and for fodder, and is so authoritative that I take the opportunity of closing this bulletin with a translation of the same: "We cannot insist too much upon the necessity of choosing well and of preparing properly the land intended for the cultivation of sugar beets. It happens almost daily that the seeds and those who have furnished them are held responsible for failures and mistakes arising solely from the bad conditions under which the growth has taken place. Every one desires, and rightfully so, to obtain only beets that are long, clean, compact (without branching roots), but it must be considered that to be developed in this condition the beets must necessarily find a depth of earth sufficiently mellow to be produced there without hindrance; nothing promotes so surely the development of lateral roots as the prevention of the lengthening of the tap root owing to the hardness or poor quality of the sub-soil. It is the height of inconsistency to expect roots to be long, clean and under ground, and to refuse them the room absolutely necessary for their development. The food or manure ought to be carefully suited to the local circumstances; the multiplication of fields of experiment has contributed for some years past in furnishing more and more

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fully all the instructions necessary for this subject. The adoption of the best methods of growth is of great importance after the choice of the best varieties, for the *maximum* of produce, both in weight and in quality, can be obtained only from the best seeds well cultivated."

On page 5 of the bulletin issued April 15th, 1891, on "Determination of Fat in Milk," prices were given of machines handled by Cornish, Curtis & Greene, ; the Creamery Package Co. ; and D. H. Roe & Co. It should have been stated that the prices for the Cornish, Curtis & Greene machine are those from the circular of John S. Pearce & Co., London, and are Canadian prices ; the others are United States prices. Whether to get the Canadian prices for the other machines it would be necessary to add 30 per cent. for duty or not I cannot definitely say, as these machines may perhaps be sold to Canadians at lower rates than those published to meet the duty in part. As it has been considered ^{as} advisable ^{by} those interested to call attention to this difference, I add this note to the present bulletin.

