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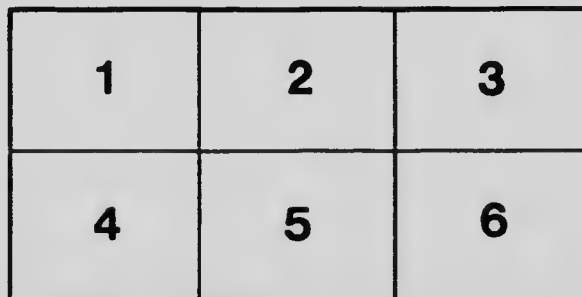
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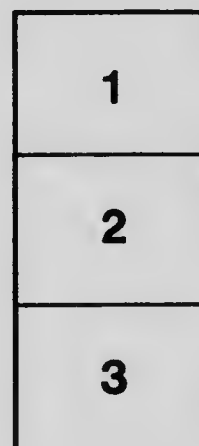
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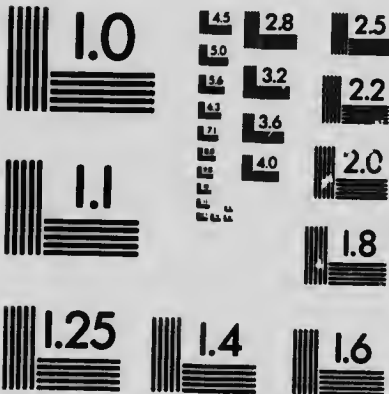
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91
DEPARTMENT OF AGRICULTURE
PROVINCE OF NOVA SCOTIA

BULLETIN NO. 4.

ISSUED APRIL, 1908.



TURNIP FIELD, AGRICULTURAL COLLEGE FARM, TRURO

ROOT GROWING IN NOVA SCOTIA

BY F. L. FULLER,

SUPERINTENDENT OF AGRICULTURAL SOCIETIES

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INTRODUCTION.

To the readers of this Bulletin, I would like to say that for some years I have had a growing conviction that we in Nova Scotia have been falling far short of our possibilities in Root Culture.

The rapidity with which food stuffs have advanced in price during the past few years has made the question of the economical productions of animals and their bye-products a serious one. Having discussed this subject with Principal Cumming, we considered it advisable to make an effort to encourage the growth of this crop. With this object in view, a number of questions bearing on the subject were sent to leading farmers in different parts of this province.

The replies to these questions were of a nature to further stimulate our efforts; hence this bulletin. The contents are largely in accord with the replies received, and are of a decidedly practical nature.

To any reader who may think there is a lack of scientific data, we would say that the chief object is to enlist "recruits" and encourage beginners. Older growers have the necessary incentive in the results obtained.

That this pamphlet may be accepted as a sincere effort to stimulate the growth of a crop, which has such an important bearing on successful Agriculture, is the wish of the Author.

ROOT CULTURE.

Experience points to the fact that in order to put animal products on the market at the greatest profit, it is necessary to provide some succulent food for our Live Stock during the winter months.

There is no place in Canada where this applies with greater force than in the Maritime Provinces.

Our winters are long, the period in which our stock get their own food comparatively short, and the by products, which to some extent takes the place of succulent foods, are expensive.

Practically we have two crops which supply this necessary food, viz., roots and ensilage.

While our short summer makes the growing of varieties of corn which yield a good crop of a sufficient state to make good ensilage, is uncertain, the conditions for growing the best possible root crops are unsurpassed.

Corn has been grown on the Provincial Farm at Truro (not the most favorable locality for this crop in Nova Scotia) with fair success for fifteen years, and we do not say that it was an unprofitable crop.

We do, however, emphatically assert that in our opinion it would be a great mistake to grow corn to the exclusion of roots.

When we use the term root crops we have turnips chiefly in mind. Mangels are scarcely better food, comparatively more uncertain, require more labor, and are not as well adapted to all kinds of soil.

The assertion that our conditions for the growth of this crop are unsurpassed will stand the test of investigation.

Anybody who makes a careful study of this question will be forced to admit that the average yield of roots in the Maritime Provinces is about 200 bushels per acre greater than in Ontario. Yet no Ontario farmer thinks of trying to raise live stock without devoting a large percentage of his cultivated fields to the growth of this crop. Moreover, he does this in the face of the fact that

his conditions for growing corn are more favorable than ours and also the price of the foodstuffs which take the place of succulent foods is considerably cheaper there than here.

The Ontaric men who visit our province have been amazed at the fields of magnificent roots they have seen, and are at a loss to understand why a much larger portion of our farms are not devoted to so important a crop. In traveling through the Eastern portion of the province we were much impressed with the regrettable fact that comparatively few roots are grown.

In trying to devise some means of inducing more of our farmers to take up Root Growing we were led to send out a number of questions to some of the leading root growers in different parts of the province. Questions were sent to forty farmers, and complete answers were received from twenty five of them.

The replies to these questions are interesting and instructive, and as they are so in accord with our own views on this subject, and are of a nature which should inspire any ambitious farmer to greater efforts along this line, they would seem to justify their publication.

Question 1 was: How many acres of roots do you grow? The replies varied from 1 to 15, and averaged $3\frac{3}{8}$ acres per farm.

For yield per acre, we have 600 bushels for the minimum and 1200 for the maximum; the average being 864.

As to cost per bushel, we received but 20 answers, ranging from $2\frac{1}{2}$ to 15 cents, with 6.4 cents for an average.

Opinions as to drills and level culture only found one advocate of the latter.

Twenty-one used some commercial fertilizer in addition to stable manure, and four used none.

The proper distance apart in the row had advocates of from 10 to 18 inches, the average being 12.4 inches.

As to methods of thinning, ten used the hoe only, and fifteen used both hoe and hands.

The question as to whether turnips were fed to milking cows or not, brought out twenty-five affirmative replies.

And the question as to which was considered the better food, Turnips or Mangels, we have found four who think they are equally good; three favor mangels; two favor turnips, and six think turnips better for cattle and sheep, but mangels better for hogs.

While in some cases there were wide margins between maximum and minimum figures in reply to several questions, we wish to say that the great majority of the replies were very close to the average, thus showing a careful and intelligent consideration of the subject.

The following quotations from the replies sent in should certainly be worthy of consideration :

Messrs. C. J. McFarlane & Sons, of Fox Harbor, Cumberland County, grow from 3 to 4 acres each year. They say that they consider the root crop the most valuable one grown on the farm, and that they would not know how to attempt to feed stock through the long winters without roots.

Mr. J. R. Semple, of Brule, Colchester Co., who grows 3 acres, says that he does not think stock can be fed profitably in our Province without a liberal supply of roots.

Mr. C. A. Archibald, of Truro grows from 10 to 15 acres; and says he would not attempt to raise and feed cattle without roots. He has made excellent beef and raised fine stock on turnips and mixed hay and straw, with no grain whatever.

Mr. F. D. McCurdy, of Middle Musquodoboit, Halifax Co., grows about 3 acres annually. He says: "It gives me pleasure to speak a word on behalf of the Turnip, which in my mind is the most essential crop for the Maritime Province farmer to grow. It is only necessary to give this crop a fair trial and the question is settled, as no lover of stock will ever attempt to winter stock on dry fodder or once seeing the beneficial results of a generous supply of roots.

Ronald Chisholm, of Antigonish, says he considers Turnips the most important farm crop, and he would not attempt to do business without them. He now grows 2 acres, and explains that, owing to improved methods employed, he can handle the two acres as easily as he could a half an acre a few years ago.

D. R. Nicholson, of Coxheath, C. B., who grows 5 acres, says there should be no trouble to get farmers to grow roots. He considers the crop requires less labor than any other farm crop and never fails.

Samuel Dickie, Onslow, Colchester Co., who grows about 8 acres, says he would not like to have to raise any kind of stock without roots. He says they are almost as essential as hay. They improve digestion, and cattle that are fed a liberal supply of roots are more healthy than those fed on dry fodder alone.

James A. Thompson, of Durham, Pictou Co., says if he had to stop growing turnips he would stop farming, as he does not consider it possible to raise stock profitably without roots.

F. R. Trotter, M.P.P., Antigonish, who grows about 5 acres, says that if every farmer in the province could be persuaded to grow turnips, the enormous sum annually sent out for bran could be largely saved to the province.

William O'Brien, of Windsor Forks, Hants Co., considers root growing indispensable to good farming. He is of the opinion that milk dairying or beef producing cannot be successfully carried on without a liberal supply of roots.

R. S. Starr, of Port Williams, King's Co., thinks that we should raise more turnips. In his opinion nothing will take their place as food for young and growing stock.

F. W. Foster, of Kingston, Kings Co., thinks that milk, beef or young cattle can be produced more cheaply on turnips than on any other kind of food. He says he feeds turnips regularly to dairy cows, and he has been selling butter in large quantities (as high as 5000 lbs. a year to one firm) for fifteen years, and has never had a complaint.

J. E. Baker, of Barronsfield, Cumberland Co., writes as follows, under date of February 18th, 1908:

MR. F. L. FULLER, Tyuro, N. S.:

DEAR SIR:— "I think that the farmer in Nova Scotia who says that he cannot grow turnips must be like I was thirty-five years ago when I commenced. I ploughed the land, shook the harrow at it, struck out the rows and filled them with fresh manure, ran the plough through to cover it, sowed the seed. When up high enough, and if time permitted, ran the cultivator through them once. They were left to care for themselves with the result of three or four hundred bushels per acre of little hard woody things so strong that you could not eat them. A little white grub in the fresh manure had eaten off all the small rootlets and had killed the growth. Or he may be like a neighbour that I have, who puts them in and they come up fine. If he had some one to thin them out he would have a fine crop, but it's a waste of land, in his estimation, to leave the plants more than four or five inches apart.

"I do not believe that there is an acre of land in Nova Scotia but to-day that, if properly worked, would give from seven hundred to one thousand bushels per acre.

"We plough about four inches deep, harrow well and put on a dressing of manure, and plough. Then give it a good harrowing with Disc Spring-tooth and Spike-tooth harrows. Make the rows and put in them about five hundred pounds of bone and potash to the acre. Cover it in and sow the seed with a horse-seeder. As soon as they are up nicely run the cultivator through to kill any weeds and to loosen up the earth. When about four inches high thin out to about twelve inches, all done with a hoe, pull and shove. One man can thin out one-half acre per day. As soon as the young plants straighten up put the cultivator through, and keep putting it through. The oftener the cultivator goes through the larger the turnips will be. We often run through them the second time to clean out with a hoe any weeds that may be left. A man can go over a second time almost as fast as he can walk, and we have never had any trouble to raise from eight hundred to one thousand bushels per acre.

"Four years ago we had fourteen hundred bushels per acre. Last year was our poorest crop. Our land is clay, and being a wet season, the turnips did not get the amount of cultivating they should have had at the proper time.

"I do not believe that there is any crop that can be grown as cheaply as turnips, and none that is relished more by all kinds of stock. I would advise every man to try a small piece, and feel certain that if he did it would only be a few years before he would sow a much larger piece.

"Yours truly,

J. E. BAKER.

S. A. Logan, Agriculturist at the College Farm, Truro, says: "Any stock breeder in the Maritime Provinces who does not raise turnips is not getting the full advantage of his heritage. Turnips keep animals of all kinds in a healthy condition and help them to assimilate other feeds. They are unsurpassed as food for beef production and young stock, and as to feeding dairy cattle I may say that we have fed turnips to cows for the last twelve years and produced as high as 180 lbs. of butter per week, and have never yet had any complaint from customers as to turnip flavor in butter. I would not attempt to farm in Nova Scotia if I could not raise turnips."

Nowhere have farmers turned to better account the natural conditions of soil and climate than in Ayrshire, Aberdeen and other sections of Scotland, parts of Great Britain in which the success of agriculture is dependent almost entirely on cattle, "neeps" (turnips), straw and cake. On one of the most noted farms in Aberdeen visited by the writer, out of a total area of 300 acres, 65 were devoted to turnips. Moreover, we were informed that nearby farms produced even a larger proportion of this crop. A bushel of roots per head per day is no uncommon amount to feed, and we have known of feeders giving from two to three bushels per day. On straw and turnips alone cattle keep in good condition, and this, supplemented with a little cake (linseed meal or other oil cake), is responsible for the best beef that goes into London market.

As in the College farm, barnyard manure is the principal fertilizer used. It is generally, however, supplemented by some commercial fertilizers. For this purpose fertilizers containing phosphoric acid have proved the most useful. However, on many soils an addition of potash has given splendid results. When barnyard manure is scarce and the soil in poor condition, a complete fertilizer containing the above two elements and in addition Nitrogen is used.

For phosphoric acid, such standard fertilizers as basic slag, bone meal and acid phosphate are used. For potash, the muriate or sulphate of potash, or wood ashes, are used; and for nitrogen, small quantities of sodium nitrate or ammonium sulphate is used to stimulate the early growth and the cheaper tankage; blood meal and in a measure bone meal are used to encourage the later growth. However, the better farmers experiment considerably with different fertilizer mixtures, and ascertain for themselves the most efficient fertilizer for their own farms.

In Germany, Denmark and other countries of Europe, mangels, sugar beets, etc., are grown and fed more extensively than turnips. The methods of growing are, however, largely similar, the principal difference being that more resort is had to commercial fertilizers.

Throughout the United States the cheaper grown corn is produced for the most part to the exclusion of roots. However, even in the centre of the corn belt, the leading stock men grow a considerable acreage of roots.

Throughout Canada the practice of root growing is almost universal, the system being most extensively followed in the province of Ontario, in which province turnips and mangels are for the most part grown with barn-yard manure alone as a fertilizer.

We hope, however, ere long to see the day when in the Maritime Provinces root growing will be at least as extensively practiced as in any of the above countries, and when that day comes we will see agriculture flourishing as it should in these Eastern provinces.

Writer's Personal Experience

The experience of the writer of this pamphlet dates from the time he was big enough to pull up a turnip. The early part of my life was spent on a farm where Turnips were considered an important crop. This particular farm contained a great variety of soil, in fact, everything from gravel to the hardest clay, and I have seen a good crop of turnips growing on every acre of it.

During the first two years of the existence of the Experimental Farm at Nappan, I was employed there. Colonel W. M. Blair, who was then manager, was a firm believer in root culture, and although the fields presented an unfavorable appearance we succeeded in getting a fair crop of turnips. The turnip crop at that farm has occupied an important place in the rotation ever since its inception, and I have never seen less than 800 bushels per acre, and have seen as high as 1200 bushels. When I took charge of the Agricultural College Farm fifteen years ago, I determined to grow roots extensively, but was advised by farmers in the vicinity to go cautiously, as the soil was not adapted to the growth of roots. We began with one acre, and have increased until last spring when Mr. Logan took charge, there was a 10-acre field prepared for roots. The yield for the fifteen years has averaged about one thousand bushels per annum.

Methods of Growing.

Our root crop either follows a clover sod or a hay field which has grown a crop of oats the previous year. If the former we plough at three or four inches deep as soon as possible after the clover is taken off. We then roll and harrow immediately. The rolling and harrowing early in the season greatly assists in rotting the sod, thus putting the field in shape for the following season. Later in the season we manure at the rate of about 25 loads per acre and plough again somewhat deeper than before. This time we do not harrow as we wish to leave as much surface as possible exposed to the beneficial action of the frost. If a stubble field is to be used the only difference in the above treatment would be that we would disc harrow the field as soon as the oats were removed and plough once instead of twice.

While I do not consider it necessary to manure the field we always make it a point to save enough manure during the summer to give our root field a dressing in the autumn.

Perhaps the chief advantages are that you get through with quite a lot of work when time is not as precious as it is in the Spring, and if the manure is coarse it will give you less trouble in the drilling and handling roots if applied in the fall.

As soon as the field is dry enough in the Spring we prefer to harrow it in order to start the weed seeds. As soon as we are ready the field is ploughed thoroughly, worked up, drilled, and then the seed is sown.

When drilling we use from 600 to 1000 lbs. Commercial Commercial Fertilizer. This is applied by sowing in a light mark made by the drill plough and making the drill directly over it. The most profitable kind of fertilizer should be determined by conducting some simple experiments.

We soon discovered that we were getting poor returns for the use of potash and that the best results were obtained by using fertilizers containing a large percentage of phosphoric acid. Experiments along this line demonstrated the fact that where potash alone was used the increase in yield as a result cost about \$1.00 per bushel, and that when acid phosphate (a purely phosphoric acid fertilizer) was used the increase yield cost only 2.9 cts. per bushel.

I do not wish to convey the impression that acid phosphate is the proper kind of fertilizer but rather to set forth the probabilities of serious loss unless some means is taken to discover what element of plant food is needed in your own particular case.

Regarding our method of sowing the fertilizer I think that equally good results would be obtained with less labor by sowing it broadcast on the land just before making the drills. Our chief reason for sowing it in the drills is that it is necessary in connection with experimental work.

Our drills are made 28 inches apart, and until a few years ago we made it a practice to drill up only the number of drills we intended to sow immediately. This was done in order to give the seeds the benefit of fresh moist earth to start germination. As this farm was badly infested with "wild mustard" I attempted to overcome it by drilling a small portion of our turnip field early in the season. This allowed all the

weed seeds to germinate before it was necessary to sow the crop. When we were ready to sow the seeds we went over the drills with a chain harrow (a brush harrow or half of a spike tooth harrow turned upside down would do) and sowed the seed immediately. This proved to be a splendid process for killing weeds. But as the season was very dry we had some fears lest the seed would not germinate well. To our surprise, however, the seed on this portion of the field came up much more quickly and grew more rapidly than on the adjoining portion of the field where the drills were made and the seed sown the same day. The following year we tried a larger portion of our field with even better result, and for the past few years have made it a practice to handle our entire root field in this way.

This system may not be suitable for all parts of Canada nor all kinds of soils but so far it has certainly proved satisfactory on the College farm.

The quantity of seed sown per acre is from 2 to 3 lbs. This is sown with a seeder imported from Scotland and which is the best machine of the kind I have yet seen. While I am aware that unless you have an absolutely reliable machine it is not safe to seed so lightly, it must be borne in mind that within the safety limit the less seed you sow the less labor you will have in thinning. I would further add that nobody should be deterred from growing turnips simply because it may be impossible to get a seeder in the neighborhood. It is not a very serious matter to sow quite a large field of turnips by hand. A bottle with a quill through the cork or a tin paint cup with a hole punched through the bottom are both good devices for hand sowing. A pointed stake makes a very good implement for making a mark for the seed which can be well covered with the back of a hand hay rake.

We start the cultivation as soon as the plants are up sufficiently to enable one to follow the row and we keep it going at intervals of from a week to ten days until the leaves are so large as to prevent it.

We begin thinning as soon as the third leaf is well out, using a hoe only. The plants are left to from 12 to 15 inches apart at the first trimming.

But we find it necessary to go over this the second time to cut out plants which may have been missed during thinning and to kill any weeds which have so far escaped.

A detailed statement of the average cost of growing an acre of turnips is as follows:

In the fall of 1901 a stubble field was taken and disc harrowed as soon as the oats were taken off :

1901	Cost per acre of harrowing	\$.75
"	25 loads stable manure	25.00
"	Hauling and spreading manure	8.00
"	Ploughing field	3.00
1902	Harrowing field (before ploughing)75
"	Ploughing.	3.00
"	Preparing for drilling	1.50
"	Drilling.	2.00
"	Commercial Fertilizer	10.00
"	Sowing Fertilizer75
"	Seed.60
"	Sowing seed.50
"	Thinning.	5.00
"	Cultivating.	3.00
"	Hoeing (second time).	3.00

CR

\$ 66.85

By half value stable manure \$ 12.50

" one third value of Com. Fertilizer 3.33

\$ 15.83

The yield was 1000 bushels \$ 51.02

which would make the cost of growing 5.1 cts. per bushel. When you add to this 1 ct. or less for harvesting you still have the cost out 6 cts. per bushel.

If the items of credit for manure left in the field need any explanation I think it can be found in the fact that we expect this field to produce a crop of grain and at least two crops of hay without any further dressing of fertilizer and then expect the field to be in as good shape as it was when we began with it. If this result is obtained (and experience bears it out) I think our estimate is sufficiently low. That liberal allowance has been made for the other items will I think be generally conceded. If to anybody the amount for thinning and hoeing seems small I may state that I have for several years hired a man for \$1.50 per day, who did his work well and made a daily average of one half of an acre.

I am aware that some farmers would grow more roots if they had better cellar accommodation. Those who have basement stables should not be confronted with this trouble. To others I would say it is not necessary to have expensive cellars for keeping roots.

The ordinary barn usually has one main driveway or floor and a hay mow on either side, or a hay mow on one side and a stable on the other.

This floor is usually several feet from the ground, and a good cellar may be cheaply made by digging out under this floor to get a sufficient depth, and putting up ordinary wooden partitions next the hay mows. If a single partition is not considered safe, a double partition may be made of rough boards and the space between stuffed with straw.

Difficulties

The chief difficulties that may be encountered in connection with growing are the ravages of the Turnip Flea Beetle, or "Turnip Fly," and Club Root. We often hear farmers say that they would grow turnips if it were not for the turnip fly. I am free to admit that I have seen small patches of turnips almost entirely destroyed by these pests, but have never seen a large field seriously affected, and am of the opinion that as a menace to root growers this trouble is more imaginary than real. Several remedies are suggested, which are more or less effectual. The best remedy is to have your field in a good state of cultivation and use good seed. The plants will then grow rapidly, and give the fly little opportunity to get in its work. It is considered by some to be a wise precaution to sow late. I do not, however, consider this necessary, because if the first sowing should happen to be destroyed, the field can be reseeded with a good chance of success.

Club Root, once a foothold is gained, is of a more serious nature and needs to be carefully guarded against. As a precautionary measure, roots should not be grown frequently on the same piece of land. At the first appearance of the disease, the affected roots should be carefully separated and not allowed to get into the manure which is to be subsequently used for growing this crop. In every case where I have known of any serious trouble with this disease it has been on farms where roots have been grown for several years in succession on the same fields. Where a judicious rotation of crops is followed, the disease is almost unknown.

FEEDING VALUE OF ROOTS.

M. CUMMING.

Theoretical Considerations

The value of any fodder for feeding purposes depends largely upon the amount of digestible food it contains. For purpose of investigation the agricultural chemist divides the important food elements into three groups, viz.: (1) protein—the part containing nitrogen, used in the system to form muscle, tissue, and the solids-not-fat part of milk; (2) carbohydrates—the part containing carbon, hydrogen and oxygen, the latter two in the same proportion as in water, used to supply heat and to store up fat: (3) fat—containing also carbon, hydrogen and oxygen, and also used to supply heat and to store up fat in the system, a given quantity of this being about $2\frac{1}{2}$ times as efficient for this purpose as the same quantity of carbohydrates. For purpose of comparison the following table is given, presenting the analysis of turnips and mangels as compared with wheat bran. It may be stated however that the analyses are only averages there being actually as much difference between different varieties of turnips or between the same variety of turnips grown under different soil and climatic conditions as between turnips and mangels generally.

The following analyses are from "Feeds and Feeding," by Henry:

FODDER	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds		
		Protein	Carbohydrates	Fat
TURNIPS	11.4	1.0	8.1	0.2
MANGELS	9.1	1.1	5.4	0.1
BRAN	88.1	12.2	39.2	2.7
Ditto in 1 Ton (2000 Pounds).				
TURNIPS	228	20	162	4
MANGELS	182	22	108	2
BRAN	1762	244	784	54

On the basis of the above analyses 8 tons of turnips contain a little more dry matter, considerably less digestible protein, much

more digestible carbohydrates and a little less digestible fat than 1 ton bran, as below :

FODDER	Dry Matter in 8 Tons	Digestible Nutrients in 8 Tons		
		Protein	Carbohydrates	Fat
TURNIPS.	1824	160	1296	32

All things considered, therefore, we may say that 8 tons of turnips contains an amount of feed. ing matter equal to that contained in 1 ton bran, and there is in addition the 90 per cent. of water, the importance of which is recognized by scientists and farmers alike, but the exact value of which it is difficult to estimate. In this connection, it will be noted that under practical considerations we have indicated a higher value for roots than in the above. The difference may partly represent the value of the water in roots. However the water possesses a value other than this, referred to at the close of the next section—a hygienic value which all feeders of roots recognize.

Practical Considerations.

The report of the Copenhagen Station, Denmark, for the year 1890, gives the result of eighteen series of experiments conducted for three successive years, with 62 different lots of cattle, in which roots were fed in comparison with concentrated feeds. Summarizing these we note that 10 lbs. of roots proved equal to 1 lb. of a mixture of grain, bran and oilcake. This latter is a heavy grain mixture, and would cost as much as $1\frac{1}{2}$ lbs. of bran : so that according to the above, $7\frac{1}{2}$ lbs. roots is equal to 1 lb. of bran.

In the same report a comparison is made of roots vs. a mixture of grains for feeding pigs, the result being that 8 lbs. of roots were found to be equal to 1 lb. of mixed grains; or, if that fodder could be fed, 6 lbs. roots equal to 1 lb. bran.

In "Feeds and Feeding," by Henry, page 570, a summary is presented of experiments carried on at Ottawa, Utah and Ohio, to determine the value of roots as compared with mixed grains as a feed for hogs. Averaging these, the estimate is made that 615 lbs. of roots would save 100 lbs. of mixed grain, i. e., as above 461 lbs. of roots equal 100 lbs. of bran.

From the above it is evident that in practical experiments, from about 5 to $7\frac{1}{2}$ lbs. of roots have been found equal to 1 lb. of

bran. Now 1 lb. of bran costs in Nova Scotia about $1\frac{1}{4}$ cts.; so that, taking the most unfavorable comparison as a basis, $7\frac{1}{2}$ lbs. roots are equal to $1\frac{1}{4}$ cents worth of bran: i. e., 1 BUSHEL OF ROOTS IS WORTH FOR FEEDING PURPOSES 10 CENTS. According to the figures presented by Mr. Fuller, 1 bushel of roots can be raised under average conditions for 62-5 cents. Need anything more be said?

Nor have we exhausted the value of roots for feeding purposes. The above experiments were carried on with stock that were already fairly well housed and fed. Had they been carried on with stock in inferior condition, the results would have been even more favorable for roots. Where a farmer is almost reduced to straw or poor hay as a feed for stock, the value of roots will be even more marked. Moreover, there will be fewer cattle "off-feed" or in an unhealthy condition in the stable where roots are fed, than when cattle are compelled to live upon dry forage. Roots cool the blood, distend the digestive tract, improve the appetite, add relish to the other foods, and, best of all, they will save many a dollar that heretofore has found its way out of the province to purchase bran and other mill feeds.

GROW AND FEED ROOTS.

