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UNITED STATES OF AMERICA.

ROOT CROPS
FOR
STOCK FEEDING,
AND
HOW TO GROW THEM.

COMPILED FROM THE PRIZE ESSAYS AND PRACTICAL
EXPERIENCE.

EDITED BY
W. ATLEE BURPEE.

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PREFACE.

IN BURPEE'S FARM ANNUAL FOR 1887 we offered a series of cash prizes for the best and second-best essays on four subjects of importance in garden and farm topics; among these was "Root Crops for Stock Feeding, and How to Grow Them." While we received in all one hundred and twelve essays in competition, but seven of these were on root crops. This fact confirmed our belief that the value of these crops is comparatively but little known. It is our object in publishing this treatise to furnish the needed information in a concise and practical form, showing both the advantages of raising roots for feeding purposes and also how to grow, store and feed them.

For the best essays on this subject the first prize was awarded to MR. D. H. STUART, Farmville, Prince Edward County, Virginia, and the second prize to MR. F. E. CARLILE, Little York, Washington County, Indiana. Although these essays were both good, they did not cover the subject as fully in detail as we desired, and hence are not published in their original forms, with only additional

foot-notes, as are the prize essays on onions, and cabbages, and cauliflowers, in our books on those subjects. This little book has been carefully compiled, however, embracing all the important points of the prize essays, together with considerable other information. As the subject will be new to many of our readers, we have also added an illustrated descriptive list of the different varieties of roots suitable for stock feeding.

W. ATLEE BURPEE.

PHILADELPHIA, *January* 11th, 1888.

ROOT CROPS FOR STOCK FEEDING, AND HOW TO GROW THEM.

The rapid settling of the cheap and fertile lands of the West, and the low rates of transportation, have so reduced the price of cereals, that our farmers in the Eastern States can no longer grow them on their farms at a profit, without heavy and expensive manuring, the natural fertility of the soil having been exhausted many years ago. The amount of capital invested in the farm also requires that the eastern farmer shall have a larger return per acre than the farmer on virgin prairie soil, where the land is obtained for from one-tenth to one-quarter the amount required to purchase land in the older and more thickly populated States. The new land requires but to be plowed and planted, and the crops to be harvested, in most cases being thrashed and marketed at once, thus doing away with the expense of storage barns, which enables a farmer to clear a profit on a crop of from ten to fifteen bushels of wheat per acre, while on the older and higher-priced farms in the Eastern States, a crop of twenty bushels per acre will barely pay the expenses of raising it. In the

report of the Commissioner of Agriculture, for 1886, the average yield of wheat per acre for the last six years has been a small fraction over twelve bushels per acre; we believe that fifteen bushels per acre would be the average yield for the Middle and New England States. It will be seen that the farmer who grows wheat on land worth from sixty to one hundred dollars per acre, is losing money on this standard crop. Of course, this cannot long continue, and our farmers are largely turning their attention to increasing their bank account and the fertility of their land by the fattening of stock and by dairy farming, by this means selling the crop in a concentrated and higher-priced form, and still retaining the bulk of it to return to the land, in the shape of manure. Since dairy farming has grown to be one of our most important industries, all subjects pertaining to it are of interest and importance, and it is our object in presenting this treatise to call attention to what we believe to be one of the greatest helps to profitable farming—the growing and feeding of roots.

THE SOILING SYSTEM IN RELATION TO WINTER FEEDING.

All works on farming, and the leading agricultural papers, continually set forth the advantages of the soiling system, that is, the growing of heavy crops of green food of various sorts and feeding the same to the milch cows or cattle

in the barn, thus greatly increasing the number of animals that can be kept on a given number of acres, and likewise increasing the quantity of manure that can be returned to the soil, so that a larger crop can be raised the next season, increasing the richness of the soil each year until the highest state of fertility is attained.

When cattle, dairy stock, swine and poultry are supplied with roots in winter, their general health and appearance is much better than when supplied with dry foods alone. The roots aid them in digesting the dry meals and fodder, and impart a free, natural action to the bowels; this tends to keep the skin loose and the coat smooth and glossy.

THE VALUE OF ROOTS IN FATTENING CATTLE, SWINE, ETC.

While cattle and swine fed wholly on roots will not take on much flesh, they can be wintered in good condition when fed on these alone. When the roots are fed with grain or the rich dry meals, their value is about three to one, as compared with the same weight of hay. Five tons of hay per acre is probably as heavy a crop in proportion as twenty tons of carrots or forty tons of mangels per acre, and the expense per ton of growing the roots is less than the cost of the hay, thus refuting the argument of many writers against the use of roots, "that they are too expensive to raise." The greatly-increased amount of food that

can be raised per acre, and the superior richness of it, can readily be seen from this statement, but the root *par excellence* for cattle, etc., is the turnip, an enormous crop of which can be raised as a second crop on ground that has been well manured, at a cost of about five cents per bushel.

HOW ROOT CROPS INCREASE THE VALUE OF THE FARM.

While the manure from animals fed solely on root crops is of low value, the raising and feeding of them in connection with grain in various forms enable the farmer to keep the largest number of cattle possible on a given number of acres, and, by keeping the cattle in the best of health, enable them to assimilate the largest quantities of rich grain food possible, and in both these ways add largely to the bulk and value of the manure pile, which will assist in the growing of larger crops of grains and roots in the succeeding years. This increased supply of manure, not only enables the farmer to raise large crops of the regular farm products, but also makes it possible for him to engage in the profitable raising of farm-garden crops, when situated within reach of transportation to the large cities.

ADVANTAGES OF RAISING FARM-GARDEN CROPS IN CONNECTION WITH THE DAIRY OR CATTLE FARM.

We believe that the raising of what are known as Farm-Garden crops, such as onions, cauli-

flower, cabbages, melons, beans, etc., in connection with dairy farming, is one of the most profitable forms of agriculture at the present time. An important gain in the union of root-fed cattle with the growing of farm-garden crops is, that not only the supply of manure is largely increased, but that the land in which the roots have been grown is in the very best condition for growing the market vegetables. It is conceded by all growers, that roots, especially carrots, are the best crop to prepare the soil for a crop of onions. To ensure a large crop of roots the ground must be heavily manured and thoroughly cultivated throughout the season, and the roots and tops are carefully gathered, leaving the ground free from weeds or litter, while the deep cultivation of the crop and the action of the roots have left the soil in a fine, friable condition. In respect to leaving the soil in a fine, loose texture, carrots are nearly, if not quite, equal to clover.

INCREASE OF PROFITS AND DECREASE OF EXPENSES ATTENDING THE GROWING AND FEED- ING OF ROOT CROPS.

While nearly all farmers are aware of the value of roots for feeding, most of them hesitate to raise them, partly because the idea is new to them, and they do not take readily to novelties of their own accord, waiting, rather, for them to be forced upon their attention by some agent or by the successful practice of some progressive neighbor. The idea prevails in the minds of most farmers who

are not conversant with the subject, that root crops are expensive and laborious to raise, but when the large amount of food that can be raised per acre, as compared with other crops, is taken into account, we think the balance in favor of the roots will readily be seen. We trust, also, that the directions for culture, given with the different kinds of roots, will prove that it is not such a laborious matter to raise a crop of roots as it is often thought to be.

Where the farms are large, the market distant, and the price of land, consequently, low, we have no doubt it would be cheaper to raise large quantities of hay to feed than to depend on roots; but where the farm is of moderate size, and it is desired to stock it as heavily as possible, the advantages of raising roots is apparent. The average crop of mangels is from fifteen to twenty tons on good land, with a good coat of manure; by doubling the manure applied, the crop can be doubled, thus largely decreasing the price per bushel, the sole increase for the second half of the crop being the value of the manure and the labor of harvesting the roots. The same rule applies to the other varieties of roots for feeding, and the moral we would draw is, only to plant so large a patch of roots as you can manure and cultivate well, if you wish to raise them cheaply. To those who have never fed roots we would suggest that two tons is ample to carry a cow throughout the winter, and that by taking this in conjunction

with the preceding figures, the cost of the winter supply and the amount of land that should be planted can easily be calculated.

ADVANTAGES OF ROOTS OVER DRY FODDER.

Some writers on agricultural topics deny, in the first place, that the roots have any medicinal properties, and claim that even if they do possess such properties, acting to keep the bowels in a free and healthy state, the same result can be obtained by the use of the rich cake meals, when added to the regular dry feed. We think this reasoning is weak and not sustained by the facts. First, there is the natural craving of all animals for green food. It is well known that, to obtain the most profitable results from cows, they must be kept quiet and contented as well as healthy and well fed. How can this be done better than by giving them such food as they naturally crave? We do not recommend the feeding of roots alone, but feeding them in conjunction with the grain, meals and rich oil cake, so as to produce the best results. The roots not only give the bulk required in a fresh, green state, but also aid greatly in the digestion of the grain or meals.

By feeding the cow on the rich, dry, concentrated food alone, she is forced to the highest production in an unnatural manner, and is much more liable to disease, especially the "milk fever," which carries off so many of the best-bred cows, than

when the same result is obtained by a mixture of fresh feed in her daily rations.

Secondly, to buy the cake or corn meals necessitates a greater or less outlay of cash, which must be subtracted from the profits, together with the interest of the purchase money, while in feeding the roots the outlay is the interest of the investment in the land, the manure applied, and the labor of cultivation. A very small part of the outlay is in actual money, and as for time and manure, these are the farmer's working capital, and must be employed in some profitable manner. Can they be more profitably employed than when engaged in raising, on his own land, the food which he will require for the winter feeding of his stock?

This need of fresh food for winter use is becoming more strongly felt each season, and many progressive farmers have tried to produce it by the use of ensilage. This requires not only large and expensive pits for storage, but requires also considerable skill and experience on the part of the farmer, to preserve it in just the right condition; so we think that the use of roots for this purpose will be much more satisfactory to the average farmer. Again, many of our creameries refuse to receive the milk from cows fed on ensilage, while the feeding of carrots and ruta bagas increases the richness of the milk and butter very perceptibly.

RELATIVE VALUE OF THE DIFFERENT VARIETIES
OF ROOTS FOR FEEDING.

Taking the value of good hay at one dollar per hundred pounds as the basis of our calculations, and the average value of the roots from the Government analytical tests, together with the figures of practical farmers, we find that—

Carrots, Parsnips and Mangels are worth	
from.....	20 to 30 cts. per bus.
Ruta bagas or Swedes are worth from.....	20 “ 25 “ “
For feeding to Cattle or Swine, Turnips are	
worth from... ..	12 “ 15 “ “

The different kinds possessing different values, the question at once arises, why not confine ourselves to the most valuable? There are several reasons for not doing so: first, all the different roots mentioned have each some particular merit, suiting it, above the others, to a peculiar condition of soil and climate. Second, the desire to furnish a variety of food, and to feed it at the time when it is in the best condition, that the relish of the animal may be kept up to the highest point, and so result in the largest yield of milk. Third, carrots are ready for use early in the fall, as soon as the green soiling crops have been destroyed by frost, and they are not good keepers, being liable to sprout and grow. Mangels should hardly be fed before the middle of January, but if carefully stored, will keep in good condition throughout the winter, while if the parsnip is left in the ground until spring it acquires a stronger saccharine

quality, and is more valuable for feeding than in the fall.

HOW TO MANURE AND PREPARE THE GROUND.

The plot to be planted in roots should be as nearly level as possible, so that there will be no danger of washing the young plants out by heavy rains, but at the same time it should be high enough or have sufficient slope to be well drained. The soil should be of a loose, loamy texture, though mangels and turnips can be grown on a sandy soil that would not be at all suitable for carrots. The heavier the texture of the loam the better it will hold and retain the large quantities of manure which are required to produce the heaviest crops.

The surface should be free from stones or litter that will be in the way of bringing the seed bed to a proper state of fineness, or that would damage the young plants in subsequent cultivation. The better the ground has been manured and the more thoroughly it has been cultivated for the preceding crop, the larger will be the crop of roots. With the exception of turnips, root crops can be grown on the same ground several years in succession if the supply of manure is kept up, so that what might seem an expensive preparation of the land for a single crop, becomes much less when the cost is divided by the number of years for which the crop can be grown on the same ground; not only this, but the stones

once removed, the ground is in better condition for all succeeding years.

The amount of manure applied and the weight of the crop are in direct proportion to each other : thus, on fairly good land, manuring with twenty large two-horse loads of good rich manure will result in a crop of about twenty tons of mangels per acre, while an application of twice the quantity would result in a crop of forty tons, or even more, in a favorable season. In Scotland, where the summer is cool and moist and season longer than with us, crops of sixty to eighty tons per acre are frequently grown, and as the tops are carefully gathered and fed there, this results in the enormous amount of seventy to eighty tons of food raised to the acre.

While this rule of the heavy manuring increasing the bulk of the crop is everywhere true, the manure must be applied with judgment, as if applied too heavily on poorly-drained land, or in a wet season, the beets would continue to grow too late in the fall, and would not be sufficiently ripened, thus greatly diminishing their keeping and feeding value.

Where the soil is in good rich condition to the depth of ten or twelve inches, it should be plowed as deeply as possible, and if some very long-rooted variety of beet or carrot is to be grown, it will be of advantage to loosen and turn over the sub-soil, without raising any of it to the surface. The ground should then be rolled with a heavy

roller or gone over with a good clod crusher, to break up all lumps that may be on the surface. The land is now ready for the manure, which should be in as fine and well-rotted condition as it is possible to have it. The finer the manure is, the better it will be for inducing a quick, strong growth in the roots early in the season, and by the time that it is exhausted the further growth of the roots will be toward ripening and developing their rich feeding qualities in a proper manner. If the manure is forked over once or twice in the barnyard, and spread with one of the new patent spreading wagons, it will reach the ground in the best possible condition.

The manure being evenly spread over the surface, the ground is cross-plowed to the depth of from four to five inches, and the surface alternately rolled until it is as fine as a hand-raked garden bed. This can easily be accomplished if the soil is worked at just the right state of dampness to crumble up easily; if worked when either too wet or too dry to do this, it will be almost impossible to bring it to the right condition without hand raking.

If mangels are the crop to be grown, and the seed is not to be sown at once, a thousand pounds of coarse or refuse salt should be sown on the freshly-plowed ground and harrowed in, as it has a wonderful effect in producing a large crop of these roots; if the seed is to be sown at once, the salt should not be applied until the young plants

are from three to four inches in height, and should then be broadcasted and worked in with the cultivator. The use of salt gives a quick growth and large crop. If the ground can be prepared two or three weeks in advance of the proper time for sowing, and then harrowed once a week until wanted, it will bring the surface into still finer condition, and will destroy any weeds that may be in the surface soil.

In plowing the land and turning under the manure, the depth to which the roots of the variety to be raised penetrate the soil must be taken into account, or it may happen that the manure will be placed so far under the surface as to put it out of reach until late in the season ; whereas, it is desirable that they should be fed in the early stages of their growth and checked in time to become well ripened.

The land for turnips should be prepared in the same manner and kept well harrowed until wanted for planting, though the first plowing should not be over six or eight inches in depth, and where they are to be raised as a second crop, if the ground is plowed and made from five to six inches deep, it will be sufficient, unless the manure for the first crop was buried deeper, in which case it should be returned to the surface.

Where the supply of barnyard manure is not large enough to admit of such heavy manuring, commercial fertilizers may be used instead. These can be used to the best advantage in raising car-

rots and beets, and can be applied at the rate of one thousand to fifteen hundred pounds per acre, and of the least advantage when applied to the turnip crop, when not over two or three hundred pounds per acre should be used. If it is desired to use both manures in connection with the crop, the long, coarse barnyard manure could be spread and plowed down in the fall and returned to the surface in the spring plowing, and enough phosphate applied to bring the ground up to the proper state of richness to ensure a heavy crop.

The use of commercial fertilizers in connection with the root crops has the advantage of quickly freeing the elements in the soil needed by the plant to perfect its growth, so that the root attains a large size early in the season and is well ripened by the time that they should be harvested and stored.

SOWING THE SEED OF CARROTS, BEETS, ETC.

For this purpose, every farmer who plants over half an acre of roots should have a small-sized drill, as it will about save its cost in a single season. It should be a simple seed sower, and not a drill combined with a hoeing and plowing machine; not only is the plain style much cheaper, but it works much more reliably, and is not so apt to break or get out of order. These machines need only to run the first row by the line, as an arm marks off the second row as the first one is sown. The drill should be entrusted to a careful

hand who can be depended on to see that the rows are exactly straight and at even distances apart, that no places are missed by the machine getting choked, and that the rows are covered at an even and proper depth. Where the patch is small, or for some other reason the sowing is to be done by hand, the seed can be sown in continuous drills, as is done in the garden; but we think a better way would be to stretch a line where the row is to be, and run a wooden wheel along it, having projecting knobs or teeth on its circumference at the proper distance apart for the roots to grow. This implement could easily be made by any farmer, and would save a great deal of time not only in the sowing of the seed, but in the subsequent thinning of the crop, and not nearly so much seed would be used as in sowing in the open drill; the projecting teeth should be just as long as the seed is to be buried in depth, and four or five seeds of parsnip or carrot should be dropped in each place, while one or two beet seed would be sufficient to each place. When the seed has been dropped for the whole row it can be covered with a hand roller, or can be trodden in with the foot as dropped. Sowing the seed with a good drill will take the following quantities of seed per acre, when planted in drills sufficiently far apart to admit of horse culture—that is, two and one-half feet apart.

Beets	6	lbs. of seed per acre.
Carrots.....	4	“ “ “
Parsnips.....	5	“ “ “
Turnips.....	2	“ “ “

Where the crop is to be worked with wheel hoes, and the rows to be from eighteen to twenty-four inches apart, about one-third more seed will be required. In planting the seed the size the variety of root sown attains must be taken into account, and to produce the best results they should stand as thickly in the row as they can be grown, about three inches apart for small carrots, five to six for the larger-growing kinds and for parsnips, while beets and large turnips should be about eight inches apart. Larger roots can be grown if more room is given, but are not nearly so valuable for feeding purpose as those of medium and small size. It has frequently been proven by analytical as well as practical tests, that the medium-size beet contains nearly twice the percentage of sugar that the large, overgrown one does.

CULTIVATION.

Cultivation should begin as soon as the young plants are large enough to permit the row to be seen, and should be kept up until it is time for the roots to be ripened off. As the roots grow in size and take a firm hold of the soil, the cultivator must be run deeper and deeper, working the soil up fine and loose deeply as possible and letting the air down to the roots. Where the cultivation is done with wheel hoes, the soil can be loosened to a much greater depth if it is first gone over with a hand plow, but we would not advise the planting of the deep-growing kinds, except where they are

to be cultivated by horse power, as the soil cannot be stirred deeply enough to produce the best growth in them with the wheel hoe.

Some years ago carrots and beets were extensively sown on ridges; that is, two furrows were cast together and the seed sown in a drill on top of this ridge. This was deemed of advantage for several reasons, one of which was that the young seedlings were in a well-drained situation, but it frequently happened, if they were planted a little late, the soil was too dry for them to germinate quickly and the young seedlings sometimes burned up; the main advantage of the ridges was, that horse cultivation could be done at once without danger to the young roots, as they were safely elevated and were worked with the hand hoe until well started; another advantage was, that in harvesting the long-rooted varieties the dirt could be plowed away from one side, and they could easily be pulled, as the ridge prevented them from penetrating the ground so deeply. This method of planting has almost entirely disappeared, as the labor involved was much more than was compensated by the advantages gained.

THINNING.

This should be done as soon as the young plants have made the third or fourth leaf, and only one plant should be left in a place; where the seed is in clumps or hills, all but the best one must be pulled out by hand. When the seed is in continu-

ous drills it can be clumped to the proper distance apart with a sharp, narrow-bladed hoe, and the balance pulled out by hand a week or so later. The use of the hoe in clumping will save a great deal of hand labor.

CARROTS.

These rank high among the most nutritious roots for feeding, and are especially valuable for feeding to milking cows. Not only do they greatly increase the quantity and richness of the milk, but they impart that rich color to the butter which it now requires to make it salable at the best figures, and for which the creameries and many farmers depend on artificial colorings that are more or less injurious to the health of the consumer. The greatest disadvantage in raising carrots for winter feeding is that, without they are stored in well-ventilated cellars where they can be well aired whenever the state of the weather will permit, they do not keep well. Where they cannot be kept in this manner, we would advise the raising of a sufficient supply to feed until the first or fifteenth of January, and depending on the mangels and other roots after that date. Unlike the other roots, carrots will keep better if the roots are in a comparatively green and growing state when harvested, and if a slice of the crown is cut off when they are topped, it will keep them from sprouting, which they are very apt to do when the top is left on. As will be readily seen from the

above statement, it is a matter of policy not to sow the crop too soon, so that while we would advise the preparation of the ground early, and the keeping of it worked until needed for planting, we would not sow the seed before the first of June, for the large-growing varieties, and even later for the small, early kinds.

Carrots can be grown so closely together that the roots become flattened against each other when matured, but for our own use we would thin out to three inches apart for the medium-sized varieties and to four and five inches apart in the row for large kinds. The carrot delights in a rich, light loam, but can be well grown in almost any of the heavier soils, providing the soil is not too wet; where this is the case, it returns to a root nearly resembling its original parent and becomes of small size, woody and worthless for feeding purposes.

VARIETIES OF ROOTS,

GROWN FOR STOCK FEEDING.

CARROTS.

CORELESS HALF-LONG.

CORELESS HALF-LONG CARROT.

CORELESS LONG RED CARROT.

This is a very early carrot of fine quality ; the skin is smooth, and both the skin and the flesh are

very rich colored. The flesh is fine grained, of excellent flavor, and entirely without core. In the young or early state it is of fine quality for table use.

CORELESS LONG RED.

A very handsome variety, growing from twelve to sixteen inches in length, and from two to three inches in diameter. It is a stump-rooted variety, being of large diameter throughout its length, giving a large bulk of roots for the amount of land occupied. It is of perfect form, has a very rich coloring, and is of excellent quality for table use. It imparts richness to the milk of cows fed on this variety, and greatly improves the color of the butter.

BURPEE'S IMPROVED LONG ORANGE.

This is a greatly-improved strain of the long orange, the quality of the new strain being much superior to the old sort, which was generally grown as a field variety for feeding purposes only. The roots grow remarkably smooth and uniform in shape, being always well formed and average of a larger size than the old variety. The length of the root is about six times its diameter, and though it penetrates the soil deeply, it also grows about one-quarter of its entire length above ground, forming a good handle by which to pull it up when harvesting. It is a good keeper, and forms a highly-nutritious food for stock.

DANVERS HALF-LONG ORANGE.

DANVERS
HALF-LONG
ORANGE CARROT.

This variety originated among the market gardeners of Danvers, Mass., from the same source as the widely-known and popular yellow onion, which also bears the name of "Danvers." In that locality the raising of carrots is a special feature, and twenty to thirty tons per acre is not considered as an unusually large crop. The smooth, symmetrical form of this variety is well shown in the illustration, and it is claimed by the Danvers growers that it will yield the greatest bulk per acre, with the shortest

length of root, of any carrot now in cultivation. The root is of rich dark orange color, and is especially valuable to the dairy farmer who makes butter and cheese from his milk, adding greatly to their rich coloring. This variety does well, and produces large crops under widely-varying condition of soil, and, owing to the shortness of its roots, it is very easily harvested.

BURPEE'S
IMPROVED
LONG
ORANGE
CARROT.

LONG RED ALTRINGHAM.

This kind is similar to the Long Orange in growth, but the flesh is of a bright red color. It

is also more slender in shape, and while sometimes attaining a length of twenty inches in deep, rich soil, grows but one or two inches above the surface. The flesh is of a very fine quality for table use, but owing to its great length, it requires a deep, rich soil to produce a large crop, and a great amount of labor to harvest the roots, which frequently break in the digging.

LARGE WHITE VOSGES.

This variety is a large-growing kind, that is especially suited for soils that are not very deep. It is very productive, easily pulled and is a good keeping variety when stored for winter feeding. This carrot, unlike the White Belgian, grows entirely below the surface. It is very broad at the top, averaging from four to five inches in diameter, and is about eight inches in height, tapering gradually from the shoulder to the point of the root. Growing beneath the surface, the entire skin, as well as the flesh, is pure white in color.

LARGE YELLOW BELGIAN.

This variety attains about the same length as the White Belgian, but does not equal it in diam-

eter, which is only about one-sixth of its length. The root grows about one-quarter of its entire length above the surface, and this portion is of a deep green color, while the portion growing below the surface is of a pale orange color. It is a good keeper, and cattle fed upon it soon attest its nutritious properties.

LARGE WHITE
BELGIAN.

LARGE WHITE BELGIAN.

This attains the largest size, and will yield more in bulk than any other kind grown. A prominent French writer states, that there is hardly a farm in France upon which this carrot is not grown for feeding stock, especially horses. The root is thick and long, growing from one-quarter to one-third of its length above the surface. The flesh is of a light green or bronze color above the soil, while that portion growing underground is a yellowish white. This is the heaviest cropping variety, in this respect rivaling the mangel wurzel, and, owing to its growth partly above ground, the crop can be pulled by hand, if a furrow is plowed close to the side of the row to loosen the soil. It produces a large crop of leaves, which make an excellent soiling food if

fed when the crop is harvested. This variety should be gathered before there is danger of frost, as a very light frost (four or five degrees) will greatly injure its quality and value for feeding purposes

OX-HEART OR GUERANDE.

This new carrot comes from France, and is a decided advance in shape, as it combines large bulk with a medium length of root, as will be seen

OX-HEART CARROT.

from the illustration. It is a thick carrot, five or six inches in length, three to four inches in diameter at the shoulder, and very blunt at the bottom of the root. It grows rapidly, and single roots often weigh a pound each when full grown. It is a splendid variety for a light or shallow soil, and will produce large crops when the soil is well manured. The neck of the root is very fine, and the few leaves are of small size, which enables them

to be grown very closely in the row. The color of the root is orange red on the outside, shading to yellow at the core. It is of excellent quality for table use, being tender and fine flavored.

SAINT VALLERY.

SAINT VALLERY CARROT.

This is a large, handsome variety, of intermediate length. The appearance of the roots is very handsome, as they grow very regular and smooth, and are entirely free from all small rootlets. They are of good size, being from ten to twelve inches in length and two to three inches in diameter at the top, tapering gradually from the shoulder to the tip of the root. The leaves

are small and very few for the size of the roots, and it is a very valuable kind, not only for its great productiveness, but also for its rich, handsome color and the thick, sweet and tender flesh.

SUGAR BEETS AND MANGEL WURZELS.

Taking into consideration the value of these roots for feeding, the ease with which they can be grown, the enormous bulk they yield per acre, and the widely-varying conditions of soil and climate under which they can be grown, they are, without doubt, the most valuable roots to grow for feeding purposes. The question is frequently asked us, "What is the difference between the sugar beets and the mangel wurzels?" For stock feeding there is *no* difference, excepting that some of the best varieties of the sugar beets contain a higher percentage of rich saccharine food than a poor, coarse-fleshed mangel, that has been grown for its large size, under the mistaken idea that a large bulk of roots is the only object to be sought in growing them.

The making of sugar from beets has created a demand for beets the flesh of which is entirely white or colorless, and this demand has resulted in the production of mangels which grow nearly their whole length under the surface, and the flesh of which is either entirely or very nearly colorless, and these kinds are known by the special name of Sugar Beets. The advantages of these beets to the sugar manufactories will readily be seen, as the process of clarifying the sugar is very much simplified by using the light-fleshed beets.

We also wish to call the attention of the root

grower to the large-growing varieties of what are known as table beets, of which we describe three varieties, and which, while they do not produce the bulk of crop per acre which can be grown in the form of mangels, we think surpass them in the amount of rich food taken from the same area. As these beets do not attain such large size, they can be grown much closer together, and where the wheel hoe is depended upon for cultivation the rows can be made as close as eighteen inches apart, thus giving a very large yield per acre if the ground is properly enriched. The seed of beets should be sown early and should be of the best quality; this early sowing of the seed not only gives the roots longer time to grow and ripen properly, but the seed germinates much more evenly in the moist condition of the soil in the early spring. We would advise having the seed sown by the fifteenth or twentieth of June, and if it can be done earlier it will be of advantage. It has been claimed that the mangel seed does not germinate reliably, leaving blank spaces in the rows, but we have never noticed this in our own sowings made as above, and we think the trouble is largely with the inferior quality of the seed. The distance apart to which the young plants are thinned must be determined by the diameter which the full-grown roots attain, which, of course, varies with the kind; as a general rule, we would say that there should be one inch at least of clear space between each perfected beet and its imme-

diate neighbors. From their manner of growth, the root growing a good portion of its length above the soil, beets are much more easily harvested than the varieties of carrots and parsnips, which is quite an item to be considered when large crops are grown. Where blanks occur in the row, young plants can be transplanted before the thinning out is done, if the ground is sufficiently wet, care being taken that the tap root is not injured; the transplanting should be done on a rainy day.

VARIETIES OF BEETS FOR STOCK FEEDING.

BURPEE'S IMPROVED BLOOD TURNIP BEET.

This is a carefully-selected strain of the Early Blood Turnip, and is remarkable for the perfect symmetry of shape, the freedom from small fibrous roots and fine quality. It is a splendid table variety, and when raised in large quantities for winter feeding to stock should not be planted too early in the season, as a good crop can be raised if planted as late as the first of July.

BURPEE'S IMPROVED BLOOD
TURNIP BEET.

LONG SMOOTH, BLOOD-RED BEET.

This is an excellent late variety, both for the table and for cattle. The beets are long and free

from small roots, the flesh is a deep blood red, and is very sweet and tender. It can be planted earlier than the preceding, as it attains a large

size and well resists the hot, dry weather of the summer. To produce a large crop, the seed should be sown not later than the middle of June. These beets keep well throughout the winter when carefully stored.

BASTIAN'S HALF-LONG BEET.

A handsome variety, of very quick growth, being ready for table use with the second earliest. If planted about the middle of July, it will make large, fine roots, of rich quality, and will be a very valuable addition to the winter rations of the stock.

BASTIAN'S HALF-LONG BEET.

The roots do not penetrate the soil so deeply as the preceding kinds, while the color is of the same deep blood red.

VARIETIES OF SUGAR BEETS.

WHITE SILESIAN SUGAR BEET.

This is the original variety from which all the various large white mangels, or sugar beets, have been raised. The root grows almost entirely underground, is about ten inches in length and about

three inches in diameter in the average specimens. While the kinds known as sugar beets do not attain the size of mangels, they contain nearly twice as much available food for stock purposes as the coarser mangel, so that what is lost in bulk is gained in quality, and the relative amount of food that can be taken from the soil in a crop of mangels and a crop of sugar beets is about the same. Under average culture in a good season, this variety would yield about fifteen tons per acre, and the medium and small-sized beets would contain as high as ten or twelve per cent. of sugar.

RED-TOP SUGAR BEET.

This is a productive, hardy and symmetrically shaped variety that is very extensively grown in France. The foliage is abundant, standing erect, so that it admits of close cultivation. The root is slender, being about three to four inches in diameter at the shoulder, and tapers gradually to a point, resembling strongly in form the St. Vallery carrot. The upper portion of the root is rose colored, while the lower portion is white. Under average conditions, this variety will yield a crop of nearly twenty tons to the acre, containing about twelve per cent. of sugar.

LANE'S IMPROVED IMPERIAL SUGAR BEET.

This is the most popular variety and the best sugar beet to grow for feeding purposes, as it will

LANE'S IMPROVED IMPERIAL
SUGAR BEET.

NEW GOLDEN TANKARD YELLOW-
FLESHED MANGEL.

equal most of the varieties of mangels in the amount of bulk and weight, while averaging as

high as eight per cent. of sugar in its composition. One specimen of this variety contained as high as 11.41 per cent. of sugar as analyzed by the Department of Agriculture (see page 342, Department of Agriculture Report of 1886). This variety has yielded from thirty to forty tons per acre, at the cost of five cents per bushel! It grows to a large size, is free from small roots, and the crop is very easily harvested. The flesh is a fine white, and is very crisp, tender and sweet.

VARIETIES OF MANGEL WURZELS.

GOLDEN TANKARD YELLOW-FLESHED MANGEL.

This new and distinct variety is a most important addition to our list of roots for stock feeding, as it contains a smaller percentage of water and a larger percentage of sugar than any other variety of mangel. A special feature is the rich, deep yellow color of the flesh, the rich appearance of which is fully sustained by its nutritious and milk-producing qualities. In England, where roots are very extensively grown for feeding, it is considered indispensable for dairy purposes. Large dairy farmers state that they are not only able to obtain a higher price per gallon for milk from cows fed on this mangel, but also that the cows are in a much healthier and better condition fed on hay and the Golden Tankard than when fed entirely on hay (see chapter on feeding.) Sheep fed on this variety thrive far better than on other kinds, and if the Golden Tankard is fed to

them mixed with other mangels, the sheep will pick out every piece of it before touching the others. On account of its peculiar shape it can be left very close together in the rows, therefore giving the largest number of beets to the row. In England, where the summer is moist and heavy manuring is practiced, it has yielded upward of seventy-five tons per acre. As will be seen from the illustration, it grows partly above ground, and can be harvested very easily and quickly.

NEW KINVER YELLOW GLOBE MANGEL.

NEW KINVER YELLOW GLOBE MANGEL. A writer in the London *Times* says of this variety: "This splendid variety possesses most distinctive features in size, shape and color. Unlike the ordinary Globe Mangel, it is of greater width at the top or shoulder than at the middle of the bulb, whence it gradually tapers to a perfect tap root. Its skin, which is as fine as that of an apple, is, as far as it penetrates the soil, of a bright orange tint. It is of superb quality and an enormous cropper, the great weight of eighty-

four tons per acre having been grown of it." To this description we would only add that it is one of the very best strains of Yellow Globe mangels in cultivation, both for its high-feeding value and the enormous weight of roots that can be produced per acre under good cultivation.

LARGE YELLOW OBERNDORF MANGEL.

This variety has lately been introduced from

LARGE YELLOW OBERNDORF MANGEL.

Germany, where it has been grown for many years, and is very highly prized by all dairy farmers. It

is a very heavy cropper, as the roots grow to a large size. As will be seen from the illustration, it is particularly adapted to light or shallow soils, producing good crops where the long varieties will not succeed, and their peculiar shape and mode of growth render it a very easy matter to harvest them. In color they are a bright yellow; they are very nutritious and are highly relished by the cattle.

YELLOW OR ORANGE GLOBE MANGEL.

This is one of the most generally grown of all the different varieties of mangels, as it is very productive, easily pulled and an excellent keeper when stored in heaps for winter use. It is spherical in shape and is of an orange yellow color, though the portion growing above the surface is tinged with green. It is well supplied with erect green leaves, but not so many as would interfere with the bulbs ripening thoroughly. The flesh of the root is white, firm and sugary, and cattle are particularly fond of it.

RED GLOBE MANGEL.

This variety does not attain to the large size characteristic of most mangels, but is remarkable for its earliness and its smooth, symmetrical, globe-shaped roots. The roots are seldom over eight inches in length, but the length is fully equaled by the diameter, and as they can be grown very closely together they make as large a bulk per acre as the sugar beets; and on account of the

earliness with which they mature, a good crop of them can be grown as a second crop on rich ground if they can be sown by the middle of July.

YELLOW OVOID MANGEL.

This is a very handsome olive-shaped variety. It has all the good qualities of the Yellow Globe Mangel, and at the same time yields a much heavier crop. It is an excellent variety for limestone soils. It is very productive, and as it grows fully two-thirds of its length above the surface it is very easily pulled. The skin is an orange yellow, while the flesh is white, firm and highly nutritious. The quality of this beet is so rich that, owing to this and the fact that they will produce twice the bulk of sugar beets on the same area, the amount of food per acre that can be taken from the soil in this variety exceeds that in a crop of sugar beets.

YELLOW OVOID MANGEL

MAMMOTH PRIZE LONG RED MANGEL.

MAMMOTH PRIZE LONG RED
MANGEL.

This is the heaviest cropping and possesses the finest feeding quality of the long mangels. It grows to an immense size, single roots weighing from twenty to thirty pounds each, and is always of very fine texture and good quality. It is remarkable for the broad shoulder and massive shape of the root, by which great weight is obtained, without that coarseness inherent in unimproved strains of seed. This variety has produced from sixty to seventy-five tons of roots per acre, and from its fine quality is one of the most valuable for feeding to cattle. At the Smithfield Club Cattle Show, in England, specimens of this variety were exhibited weighing fifty pounds each.

PARSNIPS.

These are well known as a table delicacy, but their value for the purpose of feeding cows and cattle is but little appreciated. The parsnip is rich in saccharine food, which adds greatly to the richness of the milk when fed to cows, while the fresh succulent roots increase the flow of milk as greatly as does the use of fresh green food in the spring. The parsnip is especially valuable for this purpose from its extreme hardiness, as the roots can be left in the ground all winter and improve in quality by the continued freezing. They can be dug as wanted when the ground thaws in the spring, and will bridge over a gap between the end of the carrots and beets stored for winter feeding and the fresh soiling crops of later spring and early summer.

IMPROVED GUERNSEY PARS-
NIP.

VARIETIES OF PARSNIPS.

IMPROVED GUERNSEY.

Four years ago we secured twenty-five pounds of seed of this greatly improved and remarkably fine kind, from a seed grower in New York, a

portion of which we distributed among our customers for trial, all of whom were unanimous in praising the very choice quality of this parsnip. The roots do not grow as deeply as in the Hollow Crown Parsnip, but are very bulky, we having just dug specimens measuring fully five inches in diameter at the shoulder. This is of great advantage in growing them for stock feeding, as they not only yield a greater bulk per acre, but are much more easily harvested. The roots are smooth and free from small rootlets, while the flesh is of rich, fine flavor, and free from any core.

HOLLOW
CROWN
PARSNIP.

LONG SMOOTH OR HOLLOW CROWN.

This variety is the one most generally grown; it is a great cropper, tender and sugary. The roots are of large size and penetrate the soil deeply, and while it is an excellent parsnip it is not so satisfactory as the Improved Guernsey.

RUTA BAGAS.

These are the Swedish or Russian turnips, but as they grow much larger in size, require a longer season in which to grow, and are of greater value for feeding purposes than the ordinary turnips; we will treat on their culture, merits and varieties

in a separate chapter. Great care must be taken in feeding ruta bagas and turnips to milking cows, especially the coarser and larger growing varieties, or they will impart a strong taste to the products of the dairy, and will greatly injure the sale of the butter. While they are, for this reason, of doubtful value to the dairy farmer for feeding to cows in profit, for the purpose of feeding to cows which have gone dry before calving, and to stock kept for fattening, they form a healthy, cheap and highly nutritious food.

The ground for raising the ruta bagas is prepared and sown in the same manner as for beets or carrots, and their general culture is the same. They require a richer soil and heavier manuring than the turnip, and the seed should be sown from the middle of June to the middle of July.

The ruta бага is a splendid keeper when stored, and should be kept until the other roots, excepting the parsnip, have all been fed.

VARIETIES OF RUTA BAGAS.

LARGE WHITE.

Remarkable for its nutritious properties, hard flesh and long keeping. It grows to a large size, and is very rich and sweet flavored. It is superior, both for table use and for stock feeding. Owing to its hard flesh and long keeping qualities, it is invaluable for use in the late spring months. This variety should be sown late (about the middle of July) to have it in perfection.

LAING'S IMPROVED STRAP-LEAVED RUTA BAGA.

The bulb of this variety is round, being almost a perfect globe. The portion of the root growing above the surface is of a purplish-red color. This kind is especially distinguished from the other varieties of ruta bagas by its having the leaves entire. It matures early and is of good table quality, the yellow flesh being rich and fine grained.

BURPEE'S IMPROVED PURPLE TOP YELLOW RUTA BAGA.

BURPEE'S IMPROVED PURPLE TOP RUTA
BAGA.

This magnificent Swede is the result of judicious selection, and is the hardiest, most productive and the most nutritious variety in cultivation. It is a large purple top, yellow-fleshed variety; the shape is oval, with a single tap root, the bulb being free from small fibrous rootlets. The neck is free from coarse, hard flesh, and for uniformity of cropping, and good keep-

ing qualities, it is superior to all other Swedes. It produces a very heavy weight per acre, and keeps sound and good until late in the spring,

while the flesh is always fine grained, sweet, and rich in flavor.

IMPERIAL HARDY.

A purple-topped variety, growing to a large size. It has a single tap root and small fine leaves. It has a fleshy top, the leaf stems breaking almost immediately above the crown of the bulb, and is perfectly free from any hard, coarse flesh at the roots. It is a strong, robust grower, and is a certain cropper.

IMPERIAL HARDY RUTA BAGA.

TURNIPS.

A large crop of turnips can be grown on a sandy soil where other roots would not succeed; they can also be grown as a second crop to follow such grains as are not sown with grass or after other early crops, while in some sections a crop of turnips is raised by broadcasting the seed among the corn after the cultivator has been used for the last time. In these cases where they are grown as a second crop, the heavy manure which has been applied for the first crop will serve to produce a large crop of turnips as well. Thus the turnip crop is raised at very small expense, the only items being

the small outlay for seed and the labor of preparing the soil and harvesting the bulbs. It is these advantages, combined with the ease with which the crop can be stored and kept for winter use, which give the turnips their value when compared with other roots. In addition to the advantages already named, the turnip crop is sown and cultivated at a time when the rush of spring sowing and harvest work are over, and there is not the same necessity for early harvesting the bulbs as with the mangels, as they are not injured by light frosts. Thus both the planting and harvesting come at a leisure time, which enables the farmer to profitably grow these as a root crop where the raising of carrots and mangels would involve additional expenditure for labor.

While, as just stated, land that has been well manured for the first crop will produce a heavy crop of turnips without any further enriching, it might be of advantage to sow two or three hundred pounds of a good superphosphate per acre, broadcast, and harrow well in before sowing the seed, as it will help them to a quick, early growth. Do not apply more than the quantity named, for, while turnips grown entirely with commercial fertilizers attain a quick growth, large size and handsome appearance, their quality and feeding value are greatly deteriorated, nor do they keep nearly so well as those grown with barnyard manure.

As generally grown in this country, the ground

to be planted in turnips is thoroughly worked and made fine, the seed is then broadcasted and rolled in and they receive no further attention until the crop, which consists of all sizes of roots, as they have had more or less room to stand and grow in, is ready for harvesting. While this is the only way in which they can be grown in connection with a standing crop, such as corn, where both of the crops occupy the ground at the same time, we think that where the ground has been cleared of the preceding crop, it is much more profitable, taking into account the largely increased bulk of the crop and the improved quality and size of the individual bulbs, to sow the seeds in drills as closely as they can be worked. The young plants are then thinned out with a sharp hoe when they have shown the third leaf, and each has sufficient room to become fully developed, and no blank spaces are left, as is frequently the case with broadcasted seed. The soil is kept well stirred and all weeds killed, by frequent cultivation; the soil being in a fine, loose condition, enables the turnip to grow rapidly, so that the flesh is much finer in quality and the roots attain a much superior size. To secure a large crop, the seed should be sown as soon after the first of July as it is possible to prepare the ground in good order for sowing, although large crops may be grown from seed sown as late as the middle of August, if an early variety is sown. It frequently happens that at this season of the year the soil when prepared for

sowing the turnip seed is nearly or perfectly dry; in this case the seed should be sown as the ground is made ready and well rolled in. It will then germinate without much moisture, and the young plants will take advantage of the first good shower to start into a quick growth. The rule to be followed in rolling all seed is that the drier the surface of soil is the more compactly it must be firmed around the seed, while if the soil were quite moist it would be sufficient to lightly cover the seed; any rolling or packing of the soil while in this latter state would make the surface hard and lumpy.

If, when the young turnips or ruta bagas first appear, they are attacked by the black turnip fly, a slight dressing of land plaster or air-slaked lime should be broadcasted over the leaves early in the morning, while they are still wet with the heavy dew, care being taken not to apply it heavily enough to burn up or destroy the young plants.

VARIETIES OF TURNIPS FOR STOCK FEEDING.

EXTRA EARLY PURPLE-TOP MILAN TURNIP.

This splendid new turnip is the earliest in cultivation. It is fully two weeks earlier than the purple-top strap-leaf, the latter being the excellent "Red-topped" kind that has been most extensively grown for table purposes. The bulb of the Early Milan is very flat, of good size, smooth, delicate skin and handsome appearance. The flesh is pure white, fine grained, and very delicate in

flavor, and the roots keep all winter. With us the past season (1887) this variety has produced

EXTRA EARLY MILAN TURNIP.

the largest crop and the finest table turnips of any table variety that we have grown.

A very popular variety in the Southern States,

LARGE YELLOW OR AMBER GLOBE.

YELLOW OR AMBER GLOBE
TURNIP.

YELLOW ABERDEEN

and one of the best and surest croppers. The bulbs grow to a large size, while the rich yellow

flesh is solid, fine grained and sweet. It is quite hardy, and keeps in excellent condition until late in the Spring.

YELLOW ABERDEEN.

This variety is of round form, with pale yellow flesh of fine texture. It is very solid, nutritious and an excellent keeper. It is one of the most popular varieties for feeding purposes, and is also of excellent quality for table use late in the season.

ROBERTSON'S GOLDEN BALL OR ORANGE JELLY.

The flesh of this variety is rich, sweet and pulpy. It is of quick growth and an excellent keeper. It is fine for stock feeding and for table use.

POMERANIAN WHITE GLOBE.

This is a quick, strong-growing kind, with rough leaves. The bulbs are of fine quality for

POMERANIAN WHITE GLOBE TURNIP.

stock feeding. It is very productive, hardy, and is a splendid autumn variety.

RED TOP STRAP LEAVED.

Very similar to the White Dutch, excepting that portion of the bulb which grows above the surface is of a bright red or purple color, adding very much to its attractive appearance. It is very early, and stands for some time without running to seed when sown early in the spring.

The flesh is pure white, fine-grained and of mild flavor. The bulbs can be kept in good condition throughout the winter.

RED TOP STRAP LEAVED.

EARLY WHITE FLAT DUTCH.

This is a strap-leaf variety; that is, the foliage is one continuous band in each leaf, and not deeply serrated, as in some of the other varieties. The bulbs are very flat, like a broad dish in shape, being four to five inches in diameter and only from one to one and a half inches in thickness. It is a very early variety and is suitable for sowing late in the season, as it will perfect a crop in less time than most other kinds. The skin and flesh

are clear white, and the quality of the flesh is excellent, being sweet, juicy, and of mild flavor.

WHITE GLOBE STRAP LEAVED.

The bulb produced by this new variety is of a perfect globe shape, and is about five to six inches in diameter. The smooth, thin skin is pure white in color, as is also the flesh. The flesh is firm and crisp, and of remarkably fine quality. The leaves are erect in growth and of pale green color. The roots grow quickly, and swell into the globe shaped bulbs at an early stage. It is a very handsome and valuable variety, surpassing all other round white turnips.

RED TOP WHITE GLOBE.

RED TOP WHITE GLOBE TURNIP.

This is one of the best early varieties grown, and has become very popular. The bulbs are of large size and rapid growth. The roots are globe-shaped as in the preceding kind with the upper portion of the bulb of a bright red or purple color. The flesh is fine grained, sweet, solid, and of very fine quality. It is one of the handsomest and most attractive varieties for marketing; it is ready for sale early in

EARLY WHITE FLAT DUTCH TURNIP.

STRAP-LEAVED WHITE GLOBE TURNIP.

the season, and keeps in good condition throughout the winter.

WHITE EGG.

WHITE EGG TURNIP.

This is an excellent variety for early or late use. The roots are egg-shaped, being about one-third greater in length than in breadth. The skin is thin, very white and very smooth, while the flesh is pure, white, firm, fine grained and delicately flavored. It grows to a good size and is a good keeper.

JERSEY NAVET.

JERSEY NAVET TURNIP

This is an excellent variety for autumn sowing, as the bulb attains maturity in from two to two and a-half months after sowing. The bulb is nearly cylindrical, but is larger at the lower end than at the shoulder. The roots are about two inches in diameter at the thickest part. The flesh is white, very tender and sugary; the leaves are numerous, short, and of a dark shining green. The roots become hollow if allowed to attain too large a size.

LONG WHITE, OR COWHORN.

The roots of this variety are very long, and are cylindrical in shape, tapering to a point at the lower extremity. They are very often twisted or bent in shape after the manner implied in their name. The roots grow from six to eight inches in length and are from two to three inches in diameter. About two or three inches of the root grows above the surface; this upper portion is cream colored or even bright green sometimes, while the portion growing beneath the surface is entirely white. The flesh is white, fine grained and sugary.

LONG COWHORN
TURNIP.

SWEET GERMAN.

The flesh of this variety is white, hard and firm, partaking very much of the nature of a ruta бага. It must be sown much earlier than the flat turnip. In the autumn and early winter it is apt to be hard, but becomes mellow like an apple by keeping.

SELECTING THE VARIETIES TO GROW.

Selecting the variety to be grown is one of the most important points in connection with growing and feeding root crops. To obtain the most profitable results, it must not only be the variety best suited to the soil and the one that can be grown at the lowest cost per bushel, but must also produce the greatest return when fed to the cows or fattening stock.

We will first speak of the choice of varieties for feeding in the dairy. It is a generally conceded fact, which we will speak of in the chapter on feeding, that coarse, rank varieties of turnips will impart a strong, unpleasant flavor to the milk or butter when fed to cows in profit. We think that this great objection could be largely overcome by raising for feeding purposes the same fine varieties that we raise for table use. Not only is the flavor of these fine varieties much milder than those generally raised for feeding purposes, but the quality is much richer and sweeter, and these latter properties will tend to make the milk and butter proportionately richer than would the coarser-fleshed and poorer-flavored varieties. In feeding the roots to milk cows the period between the root in the raw state and the consumption of

the milk or butter is comparatively brief, and it can easily be seen that the finer the quality of the root the finer will be the milk. Not only would we advise the dairy farmer to grow the finest varieties of various roots for the above reasons, but because the dairy farm is frequently within reach of a market where he could dispose of a portion of his root crop for table use at a price much higher than what they would be worth to feed, and if the amount so realized were subtracted from the cost of growing the crop it would give him the balance left for feeding at a still lower cost per bushel. Too many of our farmer friends are apt to commence to reason at the other end, and think because the article is good for table use and a limited quantity will command a good price in the market, that it is too valuable to feed to cattle. A glance at any seedman's catalogue will show that the difference in the cost of the best varieties of seed and the coarser growing kinds, good only for feeding purposes, is not one-tenth of a cent per bushel in a good crop, and the expense of raising the two kinds is in other respects the same.

Where the roots are to be fed to cattle, sheep or swine for fattening purposes, the fine flavor is not so much a matter for consideration, as the period between the consumption of the root by the steer or sheep and the consumption of the meat by the individual is much longer; but even here it would be more profitable to use a kind

which will not only yield the largest bulk of food, but in which the quality shall be rich, sweet and nutritious in the highest degree, as it will naturally tend to increase not only the quantity but the quality of flesh formed.

HARVESTING.

This process, where the crop to be gathered and stored is so great in bulk, should be carefully studied, so that it may be accomplished with the least expenditure of time and labor. As the tops of all the root crops must be removed before storing, the question arises whether it can best be done before the roots are pulled or afterwards. The advantages of topping before gathering are, that the roots are firmly held in position and stand in line ready for the operation, so that the operator has the advantages of having both hands free and can proceed along the row very rapidly, while if the roots have been pulled and thrown in rows or heaps he must reach out for each root with one hand, grasp it tightly, and remove the top with the other. On the other hand, where the tops are not removed until the roots have been pulled, they serve as a handle by which the root can be lifted from the soil; this would be of especial advantage in the case of carrots and parsnips, were it not that the top generally breaks off, leaving the root still fast in the ground. On the whole, we would prefer to top the roots and remove or rake into windrows the loose leaves, before gathering the roots. This

topping is done in a different manner for each of the different kinds of roots; thus, for carrots we use a very sharp hoe, passing along the row and cutting a small slice of the crown off of each root; this removes the leaves and crown at one stroke, and, as stated in the chapter on carrots, checks the tendency to sprout when stored. For beets the leaves are gathered in a bunch in the hand, grasping them close to the neck of the bulb, they are then twisted or wrenched off, as if cut they are liable to bleed, which would tend to wither and spoil the root. The leaves should be thrown in windrows or heaps when wrenched from the bulbs, thus saving the operation of raking. For topping ruta bagas and turnips, a large knife should be used, one that is quite heavy and having a blade eight to ten inches in length, and it will add to the speed of the operation if it is kept sharp. The leaf stalks should be cut from one-half to one inch above the bulb, and by the use of a heavy knife, as described, they can be removed from each bulb by a single stroke. Of course, this method is only practicable where the turnips are grown in drills; where they are sown broadcast they can be pulled and thrown in heaps and then topped singly, but the latter is a much more laborious operation.

After the roots are topped, all those which grow a sufficient portion of their length above the surface can be pulled by hand and loaded directly into wagons or put into baskets; care must be taken while handling the roots that they are

not bruised, or they will start to rot. Where the roots are too deep in the soil to admit of pulling, the plow can be run as closely to the row as possible without injuring the roots, and they can then be dug with spades and digging forks, easily and rapidly. The harvesting and storing can be accomplished much more rapidly, and the roots will be much cleaner and will keep better, if gathered at a time when the soil is loose and comparatively dry, as it will then be all shaken off by the repeated handlings.

The beets must be gathered before there is danger of severe frost, as it will spoil them both for keeping and feeding. While the carrots are more hardy, yet for the reasons above stated, that is the ease of harvesting and cleansing them, we would dry and store them early, for when the frosts come the ground will be wet and heavy, increasing the labor of digging them and necessitating the washing of the roots before they can be fed. The turnips are improved by light frost, and should be left out in the latitude of Philadelphia until about the second week in November, or until there is danger of the ground being frozen hard.

STORING THE ROOTS.

For winter storage the idea generally prevails that expensive and elaborate root cellars are necessary. While we concede the advantages of such facilities for storage, we claim that the roots can be kept in as good condition by the method which

we have used with unvarying success, and which is practiced by the leading dairymen of the vicinity. We have had an illustration of this method made, believing that it will greatly help the readers to clearly understand the directions for storing roots in this manner.

A well-drained location is selected, and clean straw is spread on the ground two inches in depth, and covering a circle about four feet in diameter ; the roots are then stacked on this straw in a pyramid

Method of storing roots in heaps. S, covering bed and ventilating chimney of straw. D, covering of soil, six inches thick.

until no more can be added without rolling off. The heap of roots is then covered with two inches of straight clean straw, which is drawn together at the top and carried up one foot above the heap to form a ventilating chimney. This chimney should be about six inches in diameter, and if properly made will permit the escape of any gases or heat arising from the roots, and at the same time will keep out the frost ; the straw is then covered with three inches of soil, as shown in

the illustration, and a slight ditch dug round the heap to carry off any water which may collect. When there is danger of the ground freezing hard, this covering of soil must be increased until it is at least six inches in depth.

It has been claimed by some writers that the use of straw or litter to cover the roots, as here described, causes the roots on the outer surface of the heap to rot or mould, but this has not been our experience, and, as above stated, we have used this method for beets and turnips, and have never lost any from this cause. We have always been careful to use straight, clean rye straw, and are strongly in favor of this manner of covering, on account of the complete ventilation that it insures. We would recommend storing the entire crop in heaps containing from fifteen to forty bushels each, so that when a heap is opened, its whole contents are taken into the barn and fed before another is opened, thus insuring their keeping in good condition. It is, however, a common practice to pile the beets or turnips in long heaps, four feet broad, three feet in height, and as long as is necessary to contain the crop; this is then covered directly with soil, adding to the thickness of the covering as the cold weather advances, until it is nearly or quite a foot in depth. When stored in this manner, a drain pipe should be set every five feet along the top of the heap, to act as a ventilating chimney, and on the approach of severe cold weather these must be stopped up with straw.

While this method of storing can be more quickly performed, we do not think it is nearly so successful or desirable as the system of storing in smaller quantities in separate heaps.

Carrots may be stored in the same manner, but as they are to be fed at the beginning of the winter, we would haul as many as can be conveniently stored directly into the barn, putting the balance of the crop into ventilated heaps, as above directed.

STORING THE TOPS.

This valuable portion of the crop is too often allowed to go to waste, and where not wanted for feeding, should either be hauled into the manure yard, to increase the supply of fertilizers or should be spread on the ground where the roots were grown, and at once plowed under. The tops of the root crops are nearly of equal value for feeding purposes as the roots themselves, and as the weight of the tops is nearly one-third of that of the roots, the advantages of saving them to feed will at once be seen. The tops of carrots are fed the same as any other green soiling food, and should all be used before feeding the roots. The leaves of the beets may either be fed in a fresh, green state or can be stored and cured as described for the turnip leaves. The tops of the mangels and turnips, if required for feeding, can be kept for a long time with but little trouble. A trench should be dug in a well-drained situation, five feet wide and one foot in depth, the length being regulated

by the quantity of leaves to be stored. The leaves should be dry, and should be spread in the trench six to nine inches in depth : they should be laid in evenly and regularly and should be gently pressed down. Then sprinkle salt over them at the rate of one pound for each square yard of surface. Another layer of tops is then added and more salt sprinkled on, increasing the quantity of salt as the heap rises. The heap of leaves should be rounded and brought to a ridge at the top, pressing and packing them down as you proceed. When the heap is finished, cover with one or two inches of clean, straight straw, and then cover the whole with earth, as in storing the roots, packing the surface of the soil so that the rain will not penetrate the heap. In about two months the curing of the tops will be complete and they will be fit for feeding. They will be brown, but not the less nourishing or profitable, and cows fed on them will soon show it by the increased richness of their milk.

FEEDING.

What roots to raise for feeding, the farmer must determine from his soil and the needs of his market, but where the question is one of supplying the greatest quantity of green food that the cow can consume, we would advise the growing and feeding of a variety of roots. Thus, we would divide the cultivated crop of roots into one-third for carrots for early winter feeding, and two-thirds of mangels, the latter to be followed by turnips,

raised as a second crop, as described. This method not only insures a constant supply, but gives the cattle the widest range of variety, which is necessary to maintain their relish for the food and enables the largest quantity to be fed. In the matter of quantity that can be fed, the advantages of roots over hay can readily be seen, as, according to the best authorities, a cow can only digest three pounds of the best hay per day to one hundred pounds of her live weight, while as high as one hundred pounds of roots per day have been fed to cows, with no injurious results. We do not, however, recommend the feeding of such large quantities of roots, as the cow soon tires of them under such circumstances, and all their good properties are lost. The quantity generally given is a large scoop shovelful of the chopped root to each animal night and morning, accompanied by four quarts of corn meal. We have found this practice to give good results. For richness of food and relative feeding value, the roots rank as follows: first parsnips, then carrots, beets, Swedes and turnips, and are fed in about the same quantities, excepting beets, of which double the quantity can be given. For the reasons stated in the chapter on turnips, these should not be fed to cows in profit, or if they are fed should be given directly after milking, that the taste imparted to the milk may be as slight as possible. It is well known that if cows on fresh pasturage in the spring are milked within an hour or two after coming in, the

taste in the milk will be strong, while if brought in at noon and allowed to stand several hours before milking, the taste is hardly preceptible; thus, we think that if the finest varieties of turnips were fed, as above described, this objection might be entirely removed, though we have not yet tested it.

Where roots are fed in large quantities, a root cutter will, of course, be indispensable, and we would advise the use of one which cuts the roots in slices one-half inch or less in thickness, rather than one of the machines cutting the roots in chunks; in the latter the roots must be cut much smaller, as the cow will very often swallow the pieces whole, with danger of choking; but if the roots are cut in thin slices, and the cow *is not disturbed or frightened* while eating, there is no danger of any such trouble arising. If by any mischance such a thing were to occur, the piece of root should be at once removed with the hand.

Where there are only small quantities of roots to be fed, the expense of a root cutter can be saved by grinding the edge of a spade and cutting the roots with it in a stout box or trough; the meal is then placed on them and the whole mixed together; we consider this a better way than putting the cut roots in the feeding trough and then placing the meal over them.

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