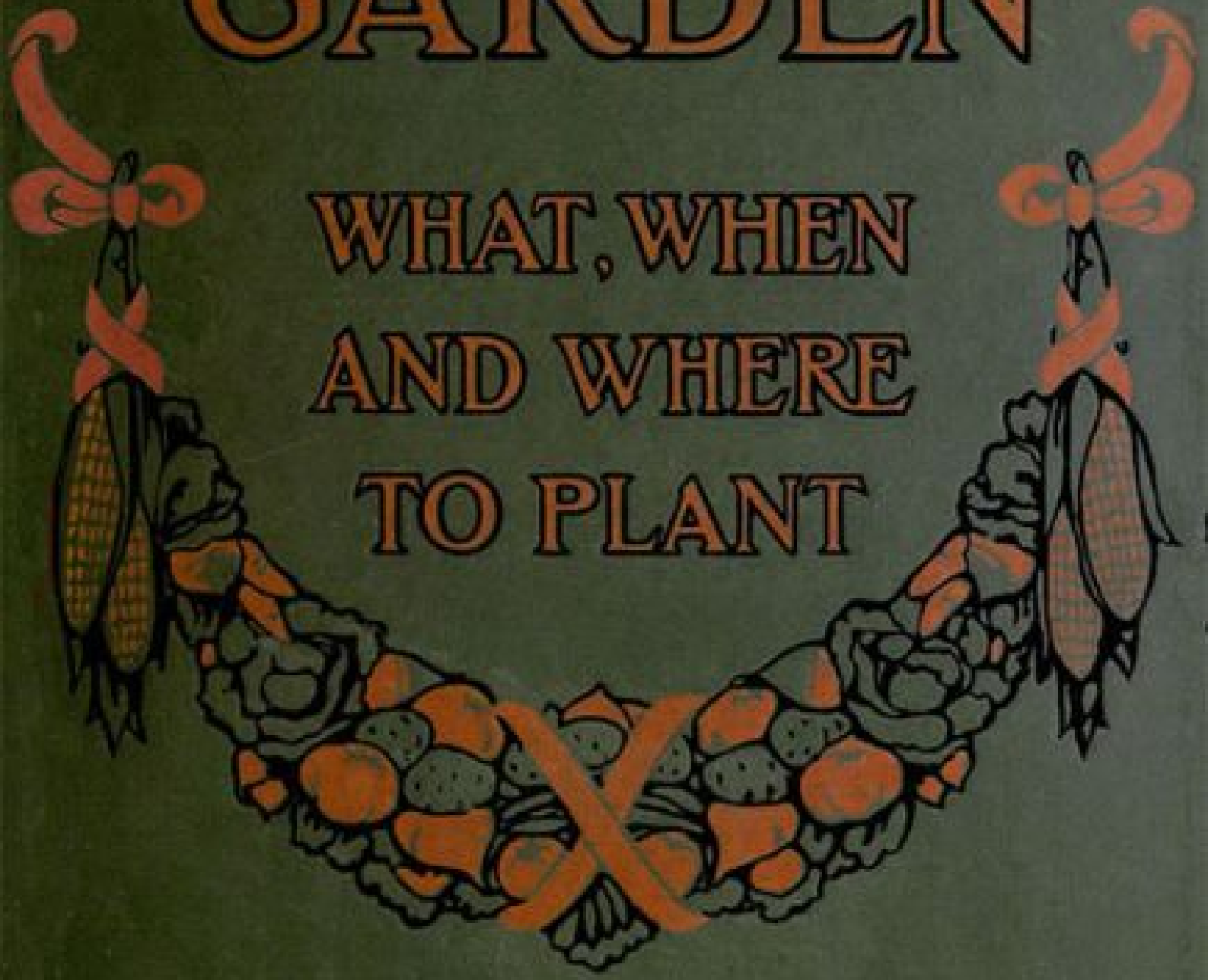
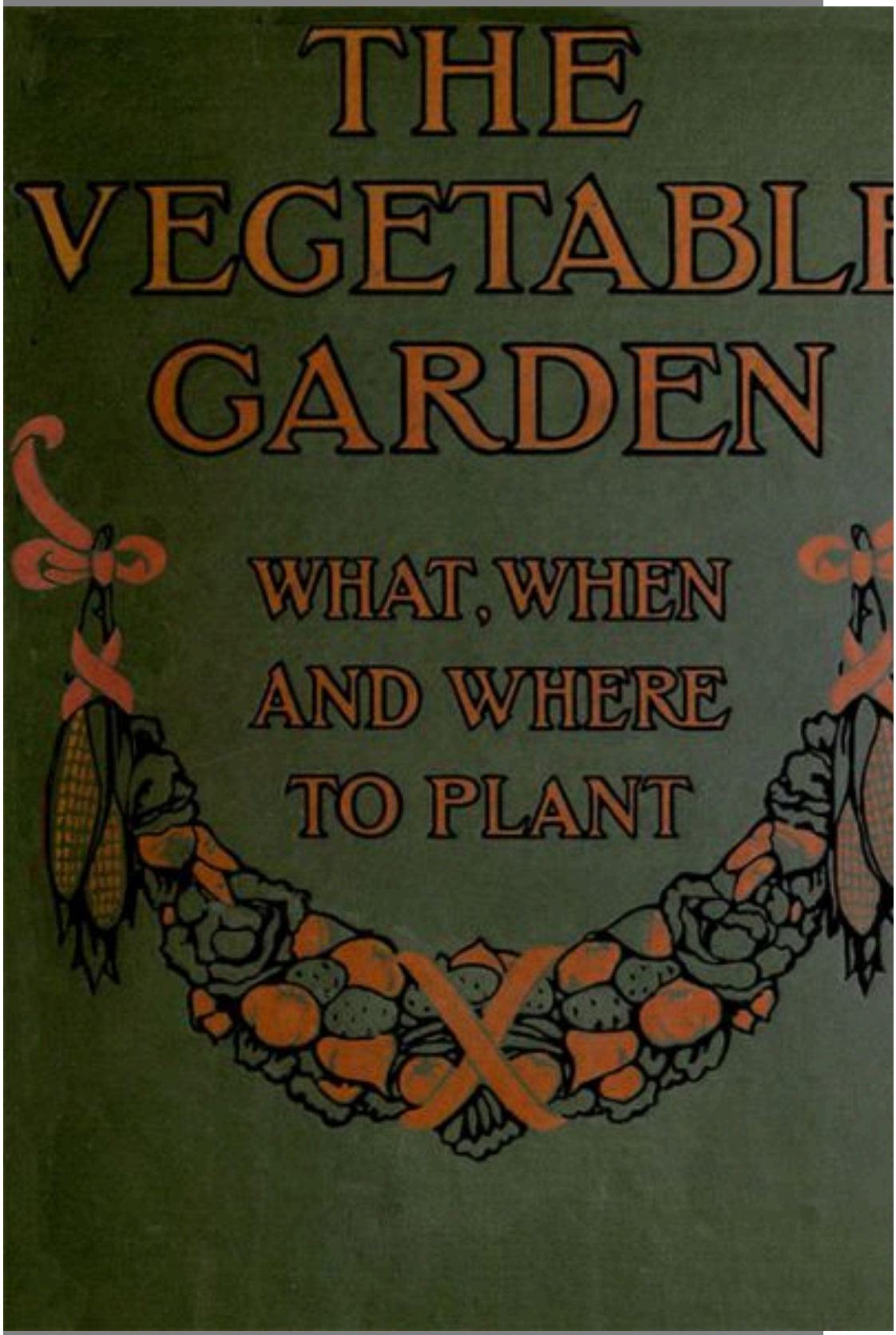
THE VEGETABLE GARDEN

WHAT, WHEN AND WHERE TO PLANT




THE
VEGETABLE
GARDEN
WHAT, WHEN
AND WHERE
TO PLANT

The Project Gutenberg eBook of The Vegetable Garden: What, When, and How to Plant

Title: The Vegetable Garden: What, When, and How to Plant

Author: Anonymous

Release date: August 22, 2013 [eBook #43531]
Most recently updated: October 23, 2024

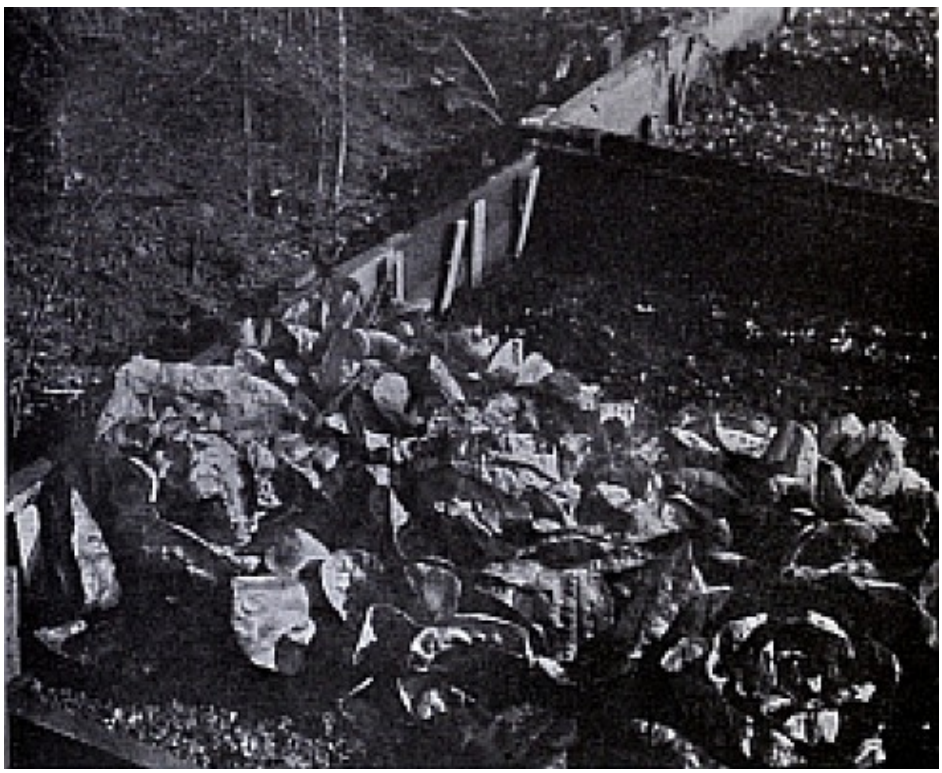
Language: English

Other information and formats: www.gutenberg.org/ebooks/43531

Credits: Produced by Sue Fleming and the Online Distributed Proofreading Team at http://www.pgdp.net (This file was produced from images generously made available by The Internet Archive/American Libraries.)

THE VEGETABLE GARDEN

A GOOD COLLECTION OF HOME-GROWN VEGETABLES



LETTUCE MATURING IN HOME-MADE COLD FRAME

The

Vegetable Garden

WHAT, WHEN, AND HOW TO PLANT

Reprinted from "The Farmer's Cyclopedia"

GARDEN CITY NEW YORK
DOUBLEDAY, PAGE & COMPANY
1917

TABLE OF CONTENTS

	PAGE
Its Importance	3
Location	5
Plan and Arrangement	5
Fertilizers	7
Preparation of the Soil	9
Time of Planting	10
Selection of Seed	10
Sowing and Planting	11
Tools	15
Mulching	15
Irrigation	18
Thinning	19
Transplanting	19
Setting in the Open Ground	20
Protection of Plants	21
Harvesting, Packing and Shipping	22
Canning Vegetables on the Farm	23
Storing	27
Early Plants in Hotbeds	29
Handling Plants	30
Frames Used in Truck Growing	31
Ventilation	33
Soils and Fertilizers	34
Watering Crops	34
Garden Products:	
Anise	35
Artichoke	35
Asparagus	35
Beans	40

Beans, Lima	46
Beets	47
Borage	48
Broccoli	48
Brussels Sprouts	49
Cabbage	49
Calabash	51
Cantaloupe	52
Cardoon	53
Carrot	54
Cauliflower	54
Celeriac	57
Celery	57
Cetewayo	64
Chayote	64
Chervil	64
Chicory	64
Chile	65
Chive	66
Citron	66
Collards	67
Corn Salad	67
Cress	67
Cucumbers	67
Dandelion	71
Dill	72
Egg Plant	72
Endive	72
Fennel	73
Garlic	73
Ginger	73
Herbs	73
Horse Radish	74
Ice Plant	73
Kale	74
Kohl-Rabi	74
Leek	75
Lettuce	75
Lleren	75

Martynia 76
Melon—Muskmelon 76
Melon—Watermelon 81
Mustard 82
Nasturtium 82
New Zealand Spinach 83
Okra 83
Onions 85
Parsley 95
Parsnip 95
Peas 95
Peppers 96
Physalis 96
Potato 97
Pumpkin 116
Radish 116
Rhubarb 116
Ruta-Baga 117
Salsify 117
Scolymus 117
Skirret 117
Sorrel 118
Spinach 118
Squash 118
Stachys 118
Sweet Basil 119
Sweet Corn 119
Sweet Marjoram 119
Sweet Potato 119
Swiss Chard 128
Thyme 128
Tomatoes 128
Turnips 137
Vegetable Marrow 137
Quantity of Seed to Plant 138
Composition of Roots 140

Authorities Consulted 140

LIST OF ILLUSTRATIONS

A Good Collection of Home-Grown Vegetables.	*Frontispiece*
Lettuce Maturing in Home-Made COLD FRAME	FACING PAGE
Liquid Manure is One of the Best Acting Fertilizers	8
The Wheel Hoe is the Handiest Garden Tool	16
The Easiest Running Wheel Hoe Valuable for Maintaining a Dust Mulch	16
Temporary Hotbeds in a City Back Yard	30
Showing Vegetables Growing in Hotbed	32
Celery Banked With Earth to Blanch It	62
Japanese Climbing Cucumbers, Nearly Six Feet From the Ground	68
Well-Grown Cucumbers	68
Thorough Cultivation of the Growing Crop is an	110

THE VEGETABLE GARDEN

Perhaps the most characteristic feature of Northern and Eastern farms is the home vegetable garden. Even where no orchard has been planted, and where the ornamental surroundings of the home have been neglected, a fairly well-kept garden in which are grown a number of the staple kinds of vegetables is generally to be found. In many cases the principal interest in the garden is manifested by the women of the household and much of the necessary care is given by them. A small portion of the garden inclosure is generally devoted to the cultivation of flowers, and a number of medicinal plants is invariably present. Throughout the newer parts of the country it is seen that the conditions governing the maintenance and use of the vegetable garden are somewhat different, and, while a number of vegetable crops may be grown somewhere on the farm, there is wanting that distinction so characteristic of the typical New England kitchen garden.

It would be impossible to make an accurate estimate of the value of crops grown in the kitchen gardens of the United States, but from careful observation the statement can safely be made that a well-kept garden will yield a return ten to fifteen times greater than would the same area and location if devoted to general farm crops. A half acre devoted to the various kinds of garden crops will easily supply a family with $100 worth of vegetables during the year, while the average return for farm crops is considerably less than one-tenth of this amount. A bountiful supply of vegetables close at hand where they may be secured at a few moments' notice is of even more importance than the mere money value.

Fresh vegetables from the home garden are not subjected to exposure on the markets or in transportation and are not liable to become infected in any way. Many of the products of the garden lose their characteristic flavor when not used within a few hours after gathering. By means of the home garden the production of the vegetable supply for the family is directly under control, and in

many cases is the only way whereby clean, fresh produce may be secured. The home vegetable garden is worthy of increased attention, and a greater number and variety of crops should be included in the garden.—(F. B. 255.)

The development and extension of truck farming in the Atlantic coast States have been coincident with the development of transportation facilities throughout that section. In the beginning the points affording water connection with the great consuming centers of the North were those at which truck farming first became established. The phenomenal growth of the great consuming centers of the country has stimulated a corresponding growth and extension of the food-producing territory, especially that capable of producing perishable truck crops. The demands for vegetables out of season, followed later by the continuous demand for fresh vegetables throughout the year by the great cities, led first to the market gardeners located near the cities supplementing their field operations by extensive forcing-house enterprises. Naturally, the products from the greenhouses were expensive and available only to the few who were able to pay fancy prices for green products out of season. The improvement and extension of the transportation facilities which came with the great railway-building era of the United States made it possible to take advantage of the wide diversity of climate offered along the Atlantic coast of the United States to furnish these perishable products to the great cities of the North and East.

Transportation facilities, together with cheap labor and cheap lands at the South, have made it possible to produce in extreme southern locations products out of season at the North in competition with greenhouse products. The greater land area and the smaller amount of capital involved in the production of crops at the South, even though transportation charges were high, have enabled southern growers to produce much larger quantities of the desired crops than could be grown profitably under glass. It was therefore not many years before lettuce, celery, tomatoes, radishes, beets, and bunch beans came to be regular winter and early spring products of gardens located at great distances from the centers of consumption.—(Y. B. 1907.)

It is only necessary to look around the village and town gardens in the South to become convinced of the great need that exists for information in regard to the proper care of the garden,

and particularly that part which is intended to give supplies to the table. There town gardeners are very active in the early spring, and their enthusiasm often leads them to go ahead and plant a great many things at a season too early for their safety, so that a return of cold often compels the almost entire replanting of the garden. But with the production of the early crops in the garden, the enthusiasm of the gardeners oozes out under the influence of the summer's heat, and the garden that at first looked so neat in its spring dress becomes merely a weed patch. Few people realize the advantage that long summers and sunny autumns give for the production of a constant succession of crops in the garden, and still fewer realize that in this climate the garden need at no season of the year be abandoned to the weeds. One of the greatest troubles that results from the common practice of allowing the garden to grow up in weeds after the first peas, corn, cabbage, and tomatoes are secured, is that these weeds are the places where the larvæ of the cut-worm hide, and are ready to begin their destructive work as soon as the garden plants are set in the spring. If the garden is kept clean and cropped continuously all the year round, as it may and should be here, there will be no cut-worms to bother the early plants. From January to January there is no need in the South for any space in the garden unoccupied by crops. From the time the earliest peas go into the ground in January up to the time it is necessary to prepare for them the following year there can be a constant succession of fresh vegetables from the garden, by the exercise of a little forethought. And this succession can be made still more perfect if there be added a frame with some hotbed sashes for the production of lettuce, cauliflower, radishes, carrots, etc., during the colder months; while all through the winter there can be celery, kale, spinach and turnips.—(N. C. Bul. 132.)

LOCATION.

The question of the proximity to the house or other buildings is of great importance when locating the garden. Caring for a garden is usually done at spare times, and for this reason alone the location should be near the dwelling. In case the site chosen for the garden should become unsuitable for any cause, it is not a difficult matter to change the location. Many persons prefer to plant the garden in a different location every five or six years. The lay of the land has considerable influence upon the time that the soil can be worked, and a gentle slope toward the south or

southeast is most desirable for the production of early crops. It is an advantage to have protection on the north and northwest, by either a hill, a group of trees, evergreens, a hedge, buildings, a tight board fence, or a stone wall to break the force of the wind.

Good natural drainage of the garden area is of prime importance. The land should have sufficient fall to drain off surplus water during heavy rains, but the fall should not be so great that the soil will be washed. The surface of the garden should not contain depressions in which water will accumulate or stand. Waste water from surrounding land should not flow toward the garden, and the fall below should be such that there will be no danger of flood water backing up. The garden should not be located along the banks of a creek or stream that will be liable to overflow during the growing season.

A good fence around the garden plot is almost indispensable, and it should be a safeguard against all farm animals, including poultry, and should be close enough to keep out rabbits. A tight board fence will accomplish, this result and also serve as a wind-break.—(F. B. 255.)

PLAN AND ARRANGEMENT.

The garden should be planned with a view to furnishing a large assortment and continuous supply of vegetables through the entire season. Its size will depend primarily upon the amount of land available. On the farm, where any amount of land the owner desires can be reserved, for a garden, vegetables to be stored for winter as well as the summer supply, should be grown. On the village lot, space may be insufficient to grow more than the summer's supply, and it may also be necessary to leave out certain vegetables that require a large amount of space. On a city lot, the space available for growing vegetables is necessarily small, and plantings must usually be confined to those vegetables which produce a large amount of edible product for the space occupied.

Whether the garden is on the farm, in the village, or on the city lot, the principles governing its planting and care are the same although the distances of planting, methods of tillage, and intensity of cropping may differ widely. On the farm, the saving of labor is more important than the saving of space; even the small vegetables are planted in long rows rather than in beds; and horse

power is substituted for hand power wherever possible. In the village and the city, the vegetables must usually be planted as closely as the nature of their growth will permit, and hand tillage employed almost exclusively.

Much loss of time in planting a garden can be avoided by making a definite plan of the garden several weeks or even months before the planting is to begin. After measuring the area to be used for the garden, the next step is to decide what vegetables are to be grown. If space is ample, this will be determined primarily by the personal tastes of the gardener and his family. However, if only a limited amount of time and attention can be given the garden, it may be wise not to undertake the growing of some of the more exacting crops. Whatever the space to be devoted to gardening, the crops to be grown should be decided upon long before the time of planting.

In planning the garden, it is well to arrange the vegetables in the order in which they are to be planted. This facilitates the preparation of the land for planting, and makes it possible to maintain the unplanted portion in a good friable condition with the least expenditure of labor. In order that the vegetables may be so arranged, it is necessary to know the proper time for planting each crop. This depends primarily upon the temperature and moisture requirements of the particular crop in question.

If any of the small fruits, such as raspberries, currants, and gooseberries, are to be planted within the garden enclosure, they should be included with the permanent crops. The area devoted to the hotbed, cold frame, and seed bed should be decided upon, but these may be shifted more or less from year to year or located in some convenient place outside of the garden. Where there is any great variation in the composition of the soil in different parts of the garden it will be advisable to take this into consideration when arranging for the location of the various crops. If a part of the land is low and moist, such crops as celery, onions, and late cucumbers should be placed there. If part of the soil is high, warm, and dry, that is the proper location for early crops and those that need quick, warm soil.

In planning the location of the various crops in the garden, due consideration should be given to the matter of succession in order that the land may be occupied at all times. As a rule it would not

be best to have a second planting of the same crop follow the first, but some such arrangement as early peas followed by celery, or early cabbage or potatoes followed by late beans or corn, and similar combinations, are more satisfactory. In the South as many as three crops may be grown one after the other on the same land, but at the extreme north, where the season is short, but one crop can be grown, or possibly two by some such combination as early peas followed by turnips.—(F. B. 255.)

FERTILIZERS.

The kind of fertilizer employed has a marked influence upon the character and quality of the vegetables produced. For the garden only those fertilizers that have been carefully prepared should be used. Fertilizers of organic composition, such as barnyard manure, should have passed through the fermenting stage before being used. The use of night soil generally is not to be recommended, as its application, unless properly treated for the destruction of disease germs, may prove dangerous to health.

BARNYARD MANURE.

For garden crops there is no fertilizer that will compare with good, well-rotted barnyard manure. In localities where a supply of such manure can not be secured it will be necessary to depend upon commercial fertilizers, but the results are rarely so satisfactory. In selecting manure for the garden, care should be taken that it does not contain any element that will be injurious to the soil. An excess of sawdust or shavings used as bedding will have a tendency to produce sourness in the soil. Chicken, pigeon, and sheep manures rank high as fertilizers, their value being somewhat greater than ordinary barnyard manures, and almost as great as some of the lower grades of commercial fertilizers. The manure from fowls is especially adapted for dropping in the hills or rows of plants.

COMMERCIAL FERTILIZERS.

Commercial fertilizers are sold under a guaranteed analysis, and generally at a price consistent with their fertilizing value. No definite rule can be given for the kind or quantity of fertilizer to be applied, as this varies with the crop and the land. At first the only

safe procedure is to use a good high-grade fertilizer at the rate of from 1,000 to 2,000 pounds to the acre and note the results. Market gardeners frequently apply as much as 2,500 pounds of high-grade fertilizer per acre each year. Farmers who do not have sufficient barnyard manure for their crops should begin gradually to use the commercial fertilizers.—(F. B. 255.)

PROFITS FROM THE USE OF FERTILIZERS.

The aim usually in the use of artificial fertilizers is to so supplement soil supplies of plant-food as to obtain a profit, and, as already intimated, the profits for the different crops will be in proportion to their economical use of the desired constituent. Still, one should not be deterred from the use of fertilizing materials, even if the conditions should render the application apparently wasteful—that is, the farmer should estimate the increase that it is necessary for him to obtain, in order to be regarded as profitable, and if only this is obtained, he should not be discouraged. Many persons seem to have gotten the impression that the use of fertilizers is a gamble at best, and are not satisfied unless the returns from the investment in fertilizers are disproportionately large. We very often hear the statement that by the use of certain fertilizers the crop is doubled or tripled, as if this were a remarkable occurrence, and partook of the nature of a mystery. Such results are not mysterious; they can be readily explained. In an experiment on celery it is shown that the weight of celery from an application of 400 pounds per acre of nitrate of soda is two and one-half times greater than on the land upon which no nitrate was used, and that very great profit followed its use. This result is not mysterious—the nitrogen applied, if all had been used by the crop, would have given a still greater increase; it simply shows that where no extra nitrogen had been applied the plant was not able to obtain enough to make the crop what the conditions of the season and soil, in other respects, permitted. These favorable conditions, however, are not uniform, and variations in return from definite application must be expected.

It is quite possible to have a return of $50 per acre from the use of $5 worth of nitrate of soda on crops of high value, as, for example, early tomatoes, beets, cabbage, etc. This is an extraordinary return for the money invested and labor involved; still, if the value of the increased crop from its use was but $10, it

should be regarded as a profitable investment, since no more land is required, and but little more capital with this return. The waste of nitrogen does not result in loss.

DANGER OF LOSS OF NITRATES BY LEACHING.

The chief difficulties in the use of nitrate of soda are due to promptness in its solubility and availability. The fact that it is so soluble carries with it the very grave danger that losses by leaching may occur if the conditions of soil and crop at the time of its application are not favorable for a rapid absorption of the nitrate by the plant. This danger is greater if it is applied to the soil before rapid growth, when there is a limited number of plants that have not made much growth, or whose roots have not taken possession of the soil, as in the case of the vegetable crops. In meadows, on the other hand, or in grain crops, where there are a large number of plants per unit of area, and in orchards or berry patches, where there are fewer plants, but a wider distribution of the feeding roots, losses are not so liable to occur. There may be, therefore, great disappointment in the returns from the use of nitrate of soda, if opinions as to its usefulness are based entirely upon its availability. Nevertheless, because no unknown conditions enter in, in reference to its availability, it is possible to avoid, in a great degree, the losses liable to occur, and thus to secure a maximum return from the application of this form of nitrogen.

THE INFLUENCE OF QUANTITY APPLIED AND METHOD OF APPLICATION.

If the quantity applied is too small to meet the demands of the crop, unless all seasonal conditions are favorable, the chances are that the results will not be completely satisfactory, as weather conditions are not likely to be perfect; it may be too wet or too dry, too cold or too hot, and hence, during certain periods, the plants would not be able to obtain their food—that is, it would be impossible for the plant to absorb always its food uniformly, or in such amounts and at such times as would result in the best development of the plant. In all cases an amount should be applied that would exceed the needed requirement under perfect conditions.

LIQUID MANURE IS ONE OF THE BEST ACTING FERTILISERS

In the second place, if the quantity found to be necessary for a definite increase of crop, under average conditions, were all applied at once, say in the early spring, a greater opportunity would be offered for losses from leaching than would be the case if the material were given in successive dressings, so that the losses due to the escape of the nitrogen would be minimized; on the other hand, if no losses occurred, the plant might take up more than could be utilized in a normal development, thus defeating the purpose, because resulting in a product of less commercial value. This would apply, of course, only in the case of those crops that are injured by abnormal development in certain directions, as, for example, too large a proportion of straw in cereal grains, too large a root in sugar beets, etc. All these difficulties may be obviated by a fractional application, or, in other words, by supplying the nitrogen at the time and in the quantity best adapted for the plant and for the purpose in view in its growth. The results from the use of nitrogen may be also unsatisfactory if nitrogen only of the elements essential is used. The best results from the use of nitrate can come only when there exist in the soil, or are applied with it, sufficient amounts of the mineral elements to enable the plant to obtain a food suited to its needs—nitrogen is but one element of plant food.—(N. J. A. E. Sta., 157.)

PREPARATION OF THE SOIL.

Where there is considerable choice in the location of the garden plot, it is often possible to select land that will require very little special preparation. On the other hand, it may be necessary to take an undesirable soil and bring it into suitable condition, and it is generally surprising to note the change that can be wrought in a single season.

Plowing.—Autumn is the time for plowing hard or stiff clay soils, especially if in a part of the country where freezing takes place, as the action of the frost during the winter will break the soil into fine particles and render it suitable for planting. Sandy loams and soils that contain a large amount of humus may be plowed in the spring, but the work should be done early in order that the soil may settle before planting. In the Southern States, where there is not sufficient frost to mellow the soil, this process must be accomplished by means of frequent cultivations, in order that the air may act upon the soil particles. It is desirable to plow the garden early, at least a few days sooner than for general field crops.

Sandy soils will bear plowing much earlier than heavy clay soils. The usual test is to squeeze together a handful, and if the soil adheres in a ball it is too wet for working. In the garden greater depth of plowing should be practiced than for ordinary farm crops, as the roots of many of the vegetables go deeply into the soil. Subsoiling will be found advantageous in most cases, as the drainage and general movement of the soil moisture will be improved thereby.

Hand spading should be resorted to only in very small gardens or where it is desirable to prepare a small area very thoroughly.

Smoothing and Pulverizing the Soil.—After plowing, the next important step is to smooth and pulverize the soil. If the soil be well prepared before planting, the work of caring for the crops will be very materially lessened. It is not sufficient that the land be smooth and fine on top, but the pulverizing process should extend as deep as the plowing. Some gardeners prefer to thoroughly cut the land with a disk harrow before plowing, so that when it is turned by the plow the bottom soil will be fine and mellow. After the plow the disk or cutting harrow is again brought into play and

the pulverizing process completed. If the soil is a trifle too dry and contains lumps, it may be necessary to use some form of roller or clod crusher to bring it down. For smoothing the surface and filling up depressions a float or drag made from planks or scantlings will be found serviceable.

TIME OF PLANTING.

No definite rule can be given regarding the time for planting seeds and plants in the garden, for the date varies with the locality and the time that it is desired to have the crop mature. A little practice will soon determine when and how often sowings should be made in order to escape frost and mature the crop at a time when it will be most useful. Certain crops will not thrive during the heated part of the summer, and their time of planting must be planned accordingly.

THE SELECTION AND PURCHASE OF GARDEN SEEDS.

In order to have a good garden it is necessary to plant good seeds. It is not alone essential that the seeds be capable of growing; they must be capable of producing a crop of the desired quality, under the conditions existing where the gardening is to be done. Some varieties of vegetables are restricted in their adaptations, while others thrive over a wide range of territory and under widely different conditions of soil and climate. If the behavior of different varieties in a given locality is not known, the safe plan to follow in selecting varieties for planting is to choose mainly those that have proved themselves adapted to a wide range of conditions and have thereby become recognized as standard sorts. The newer varieties may be tested in small quantities until their suitableness for a given place and purpose has been determined. Particular care should be taken to select varieties that are capable of yielding a product of high quality. Such varieties are numerous, and some are better for one region than another.

It is always a safe plan to have a little more seed on hand than is actually needed to plant the area desired. Sometimes the first planting of a given crop is destroyed by frost or insects, making replanting necessary. In such a case, delay in replanting could be avoided by having the seeds on hand. The additional expense is

slight compared with the value of the crop. In the case of many seeds, an ounce costs but little more than a packet; and in such cases, it is the part of wisdom to purchase an ounce, even though a packet might contain sufficient seed to barely plant the desired area. The more expensive seeds may be purchased in smaller quantities, with less margin between the actual amount required and the quantity purchased.—(U. Ill. B. 154.)

SEED SOWING.

Garden seeds should always be sown in straight rows regardless of where the planting is made. If a window box is employed for starting early plants in a dwelling, the soil should be well firmed and then laid off in straight rows about 2 inches apart. The same method holds good for planting seeds in a hotbed, cold frame, or bed in the garden, except that the rows should be farther apart than in the window box. By planting in straight rows the seedlings will be more uniform in size and shape, and thinning and cultivating will be more easily accomplished. In all cases where the soil of the seed bed is not too wet it should be well firmed or pressed down before laying off and marking for sowing the seeds. After the seeds are sown and covered, the surface should again be firmed by means of a smooth board.

No definite rule can be given for the depth to which seeds should be planted, for the depth should vary with the kind of seed and with the character and condition of the soil. In heavy clay and moist soils the covering should be lighter than in sandy or dry soils. In all cases the depth should be uniform, and when planting seeds in boxes or a bed the grooves in which the seeds are planted should be made with the edge of a thin lath.—(F. B. 255.)

Planting.—The most distinctive feature of the garden on the farm should be the reduction of hand labor to a minimum. In planting the garden, therefore, it should be laid out in long rows, sufficiently far apart to permit the use of a horse and cultivator in tending the crops. Time and confusion will also be saved if the vegetables are grouped according to their cultural requirements, and the number of plantings made as small as is consistent with the demands of the various crops. Each group of crops may then be planted and tended as one crop, and the garden operations thus greatly simplified. When more than one planting of a given crop is desired for the sake of securing a succession, the second planting

may be put in at the same time that other crops are being planted, so that even in this case, the number of plantings need not be multiplied. The use of two or more varieties of the same vegetable, differing in their time of maturity, will also aid in keeping down the number of different plantings.

The arrangement of the garden as to length of rows and time of planting, is not the only labor saving feature that should characterize the typical farmer's garden. Field methods should be practiced in preparing the land for planting, and as much preliminary work done in the fall as is possible, for the sake of both securing an early garden and reducing the amount of labor in spring. After the land is cleared of refuse from preceding crops, it should be heavily manured, and plowed in the fall. The amount of manure to be applied will depend somewhat upon the fertility of the land, but more largely upon the trueness of the farmer's conception of the plant food requirements of garden crops. The best gardens are possible only where plant is supplied much more liberally than is considered ample for field crops. Forty tons of manure per acre is a very moderate application for garden crops, and this amount should be applied annually, even on soils already rich, if maximum crops of vegetables are to be grown.

The plowing under of manure in the fall hastens the drying out of the soil in the spring, so that planting may begin earlier than if the manuring and plowing were deferred until spring. This is both because the soil actually dries out earlier, and also because no time is lost in manuring or plowing after the soil has reached workable condition. It often happens that early in the spring when the cool season crops should be planted, the soil remains in ideal condition for working only a brief period, and then becomes so thoroughly wet by copious rains that further garden work is precluded for two or three weeks. If the manuring and plowing have been done in the fall, it is often possible to plant the early vegetables in the brief period during which the soil is fit to work, while otherwise this entire period might be expended in making preparations, and the actual planting necessarily deferred until the next time the soil was dry. Since the success of many of the early crops depends upon early planting, the wisdom of fall preparation is apparent.

If the land has been manured and plowed in the fall, and is worked at the proper time in spring, very little labor is necessary in the preparation of a seed-bed for the early planting. Soil

containing sufficient humus to grow vegetable crops advantageously, can be fitted for planting without the use of hand tools, if the precaution is taken to work it at the exact time it reaches the right degree of dryness. It will then crumble readily, and a seed-bed can be prepared by the use of a disk, harrow, and planker. The use of these tools saves an enormous amount of labor, and is a vast improvement over the old method of using a hoe and rake.

The actual planting of the garden is a simple matter, provided a definite plan has previously been made, so that no time is lost in deciding which vegetable to plant first, where to plant it, or how much to plant. In the home garden, only a small amount of seed of each kind is planted, so that a seed drill cannot be used to advantage, and the planting is therefore almost invariably done by hand. For the small vegetables, sown in drills, the planting involves four distinct operations: (1) making the drills, (2) dropping the seed, (3) covering, and (4) firming. The most rapid way of making the drills in a garden to be planted in long rows is to use a marker that makes three or four drills each time it is drawn across the area to be planted. With a medium weight marker, and the soil in proper condition for planting, the marks will be of the proper depth for planting seeds of any of the smaller vegetables usually sown in drills. For peas or beans a deeper drill may be made with the plow attachment of a wheel hoe. After the seed is dropped, it is covered with a rake, or in the case of deep planting, with a hoe, or a wheel hoe. The soil is firmed over the seed by the use of the feet, the back of a hoe, or a garden roller. Whatever the means employed, the firming must be thorough, especially in light soil or dry weather; for unless the soil is brought in close contact with the seeds, they will not germinate.—(U. Ill. B. 154.)

Cultivation.—By the proper cultivation of the garden there is accomplished three things: (1) The weeds are kept out so that they do not shade or take away valuable plant food and moisture from the plants which one desires to perfect. (2) The surface soil is brought into the best condition to resist drouth; that is, into the best condition for availing itself to the utmost of the stores of water in the subsoil and to prevent the evaporation of this water from the surface soil. (3) The stores of insoluble plant food are made soluble by the chemical action and fermentation, which are increased by loosening the soil, thereby letting in the air.

Keeping Out the Weeds.—The methods best adapted for keeping the weeds out of the garden are many and varied, and depend much upon the condition and kind of soil in which the weeds grow; upon the kind of crop and upon the habits of the weeds themselves. The most important step in making easy the prevention of weeds in the garden is the harrowing or other thorough cultivation of the land just before the planting of the seed, to kill the young weeds. If this is done thoroughly, the weeds do not have a better chance than the crop. If this is not done, the weeds will be ahead of the crop in growth, and if started even ever so little when the crop is planted, the result generally is that the crop is seriously overgrown by them before it is large enough to be cultivated. *This is a common mistake, and is, perhaps, responsible for more failures in the garden than any other factor which enters into the consideration of this subject*; and it is a very simple matter to prevent any trouble from this source if a little foresight is exercised.

Early Cultivation to Kill Weeds.—The next most important factor in the prevention of weeds in the garden is early cultivation. In the case of seeds that require a long time to germinate, it is an excellent plan to lightly rake over the land with an ordinary fine-toothed rake, even before the crop appears above the ground, providing the work is so carefully done as not to disturb the seeds. When the seed is sown with a drill, the line of the row may be plainly seen even before the plants come up, thus making it easy to commence cultivating it in advance of the weeds. In case of such crops as carrots, onions, parsnips and beets, which are quite delicate when young, cultivation should begin with some hand garden cultivator, even if it is intended later on to cultivate with a horse, and the crop is planted with this purpose in view. Such close and careful work cannot be done with any horse implement now in use as with the best hand implements. With proper tools, the work may be done nearly as quickly by hand as by horse power, and far more perfectly when the plants are small. Careful early cultivation is of the utmost importance, since, if the weeds are removed when they are young, the work of weeding is very small. If allowed to remain until well rooted, their removal is often a very serious matter, and frequently, if neglected at this early stage, the weeds become so firmly established as to make it a question whether to remove them or plow under the whole crop; and often it is the part of wisdom to adopt the latter alternative. Aside from its effect in

the prevention of weeds, early cultivation is of great value in breaking up the crust that packs firmly around the tender growing stems of plants, and that seriously interferes with their growth. It is also, like all surface cultivation, of aid in the conservation of moisture in the soil.

Importance of Not Allowing Weeds to Go to Seed.—A common source of weed infection is often found in the few weeds that are allowed to go to seed toward the end of the growing season in the maturing crop or after the crop has been gathered. To some farmers it often seems a small matter to allow a few plants of pig-weed, purslane, tumble weed and weeds of other kinds to go to seed in the garden, but absolute cleanliness should be the only rule in this particular, and it is by far the most economical in practice in the long run. It requires but little labor and saves much useless expense to destroy weeds that are going to seed. If the preventives for weeds suggested are closely followed hand weeding will be reduced to a minimum and will often be unnecessary with any crop.

Weed Seeds in Manure for the Garden.—The manure applied to the garden is often coarse and contains many weed seeds, and is a fruitful source of weed infection. The manure intended for the garden that contains the seeds of weeds should be piled up and allowed to ferment until the whole mass is thoroughly rotted. By this means the seeds in it will be killed. But in order to rot manure to best advantage, it should be forked over occasionally when well warmed up by fermentation, and the whole turned over, with the outside of the pile thrown into the center. If dry, it should be watered enough to enable fermentation to continue, and to prevent "fire-fanging." It is seldom advisable to use fresh manure in the garden, and manure should only be applied in this condition when free from weeds, and then only for some late-maturing crops, in which case there will be time for it to rot before the crops need it. All early crops need well rotted manure, and require it in much larger quantities than do the late-maturing crops.—(U. Minn. A. E. S. 38.)

General Cultivation.—The methods to be pursued in the general cultivation of garden crops will vary somewhat, according to the soil, season and crop. However, it is very important to remember that the destruction of weeds is but a small part of the work of cultivation. The most important part is to so fit the soil

that it may best withstand drouth. This is accomplished by frequent shallow cultivation during the period of growth. The first implements to use in the care of such crops as are generally cultivated by hand are those that work the soil to only a very slight depth, close to the plants. Such implements may be used just as the seedlings are breaking ground. As soon as the plants have gained some little strength, implements should be used that will go deeper, until a depth of two or three inches can be easily worked without endangering the safety of the crop by covering the plants with dirt. It is doubtful if any of our garden crops should ever be cultivated more than three inches deep, and it is very certain that many crops are injured by cultivating deeply very close to the plants, in which case the roots are cut off near their upper ends and thus wholly destroyed. Cultivation in a period of drouth results in forming a mulch or blanket of dry earth on the surface of the land, which prevents the moisture from passing into the atmosphere, and a rather shallow blanket, say two inches deep, accomplishes this purpose. A compact subsoil readily transmits the water upwards to the surface soil, in the same manner that a lamp wick carries the oil to the flame. At the surface the soil water is prevented from evaporating by a blanket of loose earth, and is thus saved in the upper subsoil and lower and middle parts of the furrow slice for the roots of the crop; loose surface soil is a good non-conductor of water. During the growth of a crop, the surface of the ground should never be left long with a crust on it, but should be stirred after each rain or after artificially watering.

TOOLS.

There are a number of one-horse cultivators that are especially adapted for work in the garden. These may be provided with several sizes of teeth and shovels, and are easily transformed for various kinds of work. In working the crops while they are small the harrow or smaller teeth may be used, and later when the plants become larger the size of the shovels may be increased. Many gardeners, however, prefer to use the harrow teeth at all times. When it is desirable to ridge up the soil around a crop, the wings, or hillers, may be put on either side of the cultivator. A one-horse turning plow is useful for running off rows or throwing up ridges. Aside from the horse tools in general use on the farm, there are only one or two cultivators that will be required for the garden, and these are not expensive.

The outfit of hand tools for the garden should include a spade, a spading fork, a cut-steel rake, a 10-foot measuring pole, a line for laying off rows, a standard hoe, a narrow hoe, dibbles, a trowel, an assortment of hand weeders, a watering can, a wheelbarrow, and if the work is to be done largely by hand the outfit should also include some form of wheel hoe, of which there are a number on the market.

MULCHING.

The term mulch as generally used means a layer of litter applied to the surface of the ground primarily for the purpose of retarding evaporation from the soil. Mulches are thus used as a substitute for cultivation to conserve the moisture in the soil in summer and to keep down weeds. They are also used as winter and spring coverings for low-growing small fruits to retard flowering and fruiting and thus to protect them from injury by late frosts. What is termed a "soil mulch" or "dust mulch" is maintained by frequent cultivation of the surface soil, and, like the ordinary mulch, is an effective means of retarding evaporation. Among the common materials used for mulching crops are straw, marsh hay, and leaves. These materials are usually applied to the whole surface of the soil in layers 4 to 6 inches deep. Mulching crops with straw or other litter is not very common. On a large scale it is too expensive. It frequently happens on a farm, however, that spring finds an old straw stack in the barnyard that will be practically valueless for feed the following winter. Can it be used profitably as a mulch?

This question was investigated quite thoroughly by the Nebraska Station. Experiments were made to determine how mulching vegetables compares with the most thorough cultivation as a general farm practice. Old straw was the material used. After settling, the layer applied was about 4 inches deep. A large number of different vegetables were grown. In general it was found that mulching in Nebraska gave much better results in normal or dry seasons than in wet seasons.

The value of the mulch in conserving the soil moisture was found to be quite marked. Soil samples taken one season in July and August showed the moisture content to a depth of 6 inches to be 18.2 per cent, as compared with 17.1 per cent in cultivated soil. When the mulch was applied early in the season before the ground

became thoroughly wet, it often had a retarding effect on the growth of the vegetables. With early spring vegetables, like lettuce, which require only a few cultivations, it was found cheaper and better to cultivate than to mulch; but with longer-growing crops that require frequent cultivation throughout the season, such as cabbage, tomatoes, etc., mulching usually proved more effective and cheaper than cultivation.

The fact that most vegetables, especially the more tender kinds, can not be mulched, until they have become well established and the weather has become warm, thus requiring some preliminary cultivation, certainly increases the labor required in growing mulched vegetables over what would be necessary if the mulch could be applied earlier. But, if the impracticability of early mulching is a serious drawback to the use of mulches, so is the impracticability of midsummer cultivation under farm conditions a serious objection to dependence upon cultivation alone. For most vegetables mulching should be used to supplement cultivation rather than to displace it. Such cultivation as is commonly given farm gardens is better for most vegetables in early spring than mulching; but mulching is just as surely better in midsummer than the neglect which is the common thing in farm gardens at that time of year. The experiment station tests have indeed shown mulching to be better in many cases than the most thorough cultivation throughout the summer.

The station tests indicate that it is unwise to mulch drilled onions, lettuce, or sweet corn. The stand of the onions and lettuce is injured by mulching, while so few cultivations are required for sweet corn that mulching is hardly profitable, and in wet seasons the yield was decidedly decreased by mulching. With transplanted onions, beets, salsify, parsley, peas, and melons the labor required and yield obtained were found to be about the same by either method of culture. With cabbage, tomatoes, beans, cucumbers, potatoes, and sweet potatoes, very favorable results were secured by mulching. The yields of each of these crops were considerably increased by mulching and the labor required was considerably less than in case of cultivation alone. Mulched cabbage produced larger heads than cultivated cabbage, and there was less injury from rot. The vigor of tomato plants was decreased by mulching, but the yield of fruit increased. The fruit was also cleaner and less subject to rot. Mulched cucumbers produced perfect fruits during dry periods when the fruit from the cultivated plants was small and

imperfect. The quality of potatoes was not hurt by mulching except in wet places.

THE WHEEL HOE IS THE HANDIEST GARDEN TOOL

THE EASIEST RUNNING WHEEL HOE VALUABLE FOR MAINTAINING A DUST MULCH

In a special test of a 4-inch and 8-inch straw mulch and early and late mulching for potatoes a 4-inch mulch applied late in summer after several cultivations gave the best results. In the case of sweet potatoes the vines did not take root through the straw mulch as they do on cultivated ground, which was considered a decided advantage for mulching.

On the whole this work seems to indicate that on the farm where cultivation of the garden is likely to be neglected in midsummer, a mulch of straw can be used profitably as a substitute. For the best results the mulch should not be applied until the ground has become thoroughly warmed up and after two or three cultivations have been given. The mulch may then be safely applied to such vegetables as cabbage, tomatoes, potatoes, and beans, and the garden left to take care of itself the rest of the season.

The same plans were worked at the New Jersey stations. One season it was found that mulching increased the yield of sound fruits of eggplants 66.5 per cent and of tomatoes and peppers about 13 per cent each. The keeping quality of cucumbers also appeared to be slightly benefited by the use of a mulch. The season following, which was considerably more rainy, no advantage resulted from mulching. In this experiment there was no noticeable difference in the effectiveness of new salt hay, old hay, or excelsior as a mulch.

Several of the experiment stations have carried out experiments in mulching potatoes. The favorable results obtained in such experiments in dry seasons at the Nebraska Station have already been referred to. At the Michigan Station the following yields were obtained: Mulched, 167 bushels of potatoes per acre; cultivated, 199 bushels per acre. With another variety the yield of mulched potatoes was 252 bushels, and of cultivated, 385 bushels. The cost of cultivation was less than the cost of mulching, and the profit in both instances was in favor of cultivation. It should be stated, however, that there was a large amount of rain during this season, and that the straw used as a mulch contained a considerable amount of grain, which came up on the mulched plats, both of which conditions were unfavorable to mulching.

At the Oklahoma Station the total potato crop was increased about 50 per cent by mulching, the marketable crop nearly 100 per

cent, and the size of the tubers about 70 per cent. Mulching potatoes with old shavings at the New Jersey stations increased the total number of tubers on a small plat about 16 per cent and the weight of the crop about 35 per cent. At the Georgia Station mulching potatoes with pine straw was not found to be of sufficient value to recommend the practice. These conflicting results secured with potatoes would seem to confirm the conclusion reached at the Nebraska Station that mulching is of greatest value in a dry season.

There is, however, a drawback to mulching that may not at first occur to the reader, viz., the danger it involves from fire. In dry weather a lighted match or cigar dropped upon the mulch may easily start a conflagration that it may be impossible to stop until the orchard is destroyed. It gives disaffected trespassers in the orchard an excellent opportunity to take vengeance upon the owner.

The cost of the mulch will of course depend much upon the price at which the material may be obtained. Clean wheat, rye, or oats straw would answer the purpose well, and in many localities would be cheaper than marsh hay. In some seasons oats sown as a second crop would grow fast enough to make mulching material by the time of frost. In the vicinity of marshes the coarser marsh grasses that have no value as hay may be cut after the ground freezes in autumn and would make excellent material for mulching. Cornstalks have been suggested, but they are probably too coarse to keep down weeds.

It has been suggested that by sowing rye in September, and harvesting the crop the following June, and then sowing the same ground to millet, the rye straw with the millet would mulch an area of plums equal to that on which the two crops were grown, and would leave the thrashed rye to compensate for the labor. This is certainly worth trying by those who have no better source from which to obtain mulching.—(Nebr. Sta. Bul., 79, 80.)

IRRIGATION.

Throughout the portions of the country where rains occur during the growing season it should not be necessary to irrigate except occasionally in order to produce the ordinary garden crops. In arid regions, where irrigation must be depended upon for the

production of crops, the system best adapted for use in that particular locality should be employed in the garden. Wherever irrigation is practiced the water should not be applied until needed, and then the soil should be thoroughly soaked. After irrigation, the land should be cultivated as soon as the surface becomes sufficiently dry, and no more water should be applied until the plants begin to show the need of additional moisture. Constant or excessive watering is very detrimental in every case. Apply the water at any time of the day that is most convenient and when the plants require it.

By the subirrigation method of watering, lines of farm drain tiles or perforated pipes are laid on a level a few inches below the surface of the soil. This system is especially adapted for use in backyard gardens where city water is available and where the area under cultivation is small. Subirrigation is expensive to install, as the lines of tiles should be about 3 feet apart, or one line for each standard row. By connecting the tiles at one end by means of a tile across the rows the water may be discharged into the tiles at one point from a hose, and will find its way to all parts of the system, entering the soil through the openings.

THINNING.

Where plants are not to be transplanted twice, but remain in the plant bed until required for setting in the garden, it may be necessary to thin them somewhat. This part of the work should be done as soon as the plants are large enough to pull, and before they begin to "draw" or become spindling from crowding.

When thinning plants in the plant bed it should be the aim to remove the centers of the thick bunches, leaving the spaces as uniform as possible. When thinning the rows of seedlings in the garden the best plants should be allowed to remain, but due consideration should be given to the matter of proper spacing. Failure to thin plants properly will invariably result in the production of an inferior crop.

There is a tendency for some gardeners to leave the plants of carrots, onions, and similar vegetables too thick, or to defer the thinning too long, with the intention of making use of the thinnings. Usually this is a serious error, except in the case of beets, which can be used quite young for greens. The crowded

seedlings do not reach edible size as soon as they would if not crowded; and the removal of part of the crowded plants when they are wanted for the table is likely to seriously disturb and impair the growth of those which remain. A better plan is to make at least a preliminary thinning as early as possible, leaving the plants perhaps twice as thick as they are eventually to stand; and then to pull out every other plant after they reach edible size. This method of thinning is especially adapted to beets, carrots, lettuce and onions. The other root crops, like parsnips and salsify, should be thinned to the full distance at the first thinning.—(U. Wis. Cir. 16; F. B. 255.)

TRANSPLANTING.

At the North, where the growing season is short, it is necessary to transplant several of the garden crops in order to secure strong plants that will mature within the limits of the growing season. In the Southern States the season is longer, and transplanting, while desirable, may not be necessary, as many crops that must be started indoors at the North can be planted in the garden where they are to remain. Transplanting should be done as soon as the seedlings are large enough to handle, and again when the plants begin to crowd one another. Aside from producing more uniform and hardy plants, the transplanting process has several other very marked influences. Certain crops which are grown for their straight roots are often injured by having their roots bent or broken in transplanting. On the other hand, such plants as celery, which at first have a straight root and are grown for their tops, are greatly benefited by transplanting. In all cases transplanting has a tendency to increase the number of small roots, and these are the main dependence of the plant at the time it is set in the open ground.

A large number of garden crops, including melons, cucumbers, and beans, do not transplant readily from the seed bed to the open ground, and some special means for handling the plants must be employed where extra early planting is desired. A common practice among gardeners is to fill pint or quart berry boxes with good soil and plant a single hill in each box.

Another method is to cut sods into pieces about 2 inches thick and 6 inches square and place them, root side upward, on the greenhouse bench or in the hotbed, the hills being planted in the

loamy soil held in place by the roots of the grass. When the weather becomes sufficiently warm, and it is desired to set the plants in the garden, the berry boxes or pieces of sod are placed on a flat tray and carried to the place where the planting is to be done. Holes of sufficient size and depth are dug and the boxes or sods are simply buried at the points where it is desired to have the hills of plants. The boxes should be placed a little below the surface and fine earth worked in around the plants. If it is thought desirable, the bottoms of the boxes may be cut away when set in the garden.

SETTING IN THE OPEN GROUND.

A few hours before removing plants from the seed bed or plant bed they should be well watered and the water allowed to soak into the soil. This will insure a portion of the soil adhering to the roots and prevent the plants from wilting. If the plants have been properly thinned or transplanted it is often possible to run a knife or trowel between them, thus cutting the soil into cubes that are transferred with them to the garden. Where the soil does not adhere to the roots of the plants it is well to puddle them. In the process of puddling, a hole is dug in the earth near the plant bed, or a large pail may be used for the purpose, and a thin slime, consisting of clay, cow manure, and water, is prepared. The plants are taken in small bunches and their roots thoroughly coated with this mixture by dipping them up and down in the puddle a few times. Puddling insures a coating of moist earth over the entire root system of the plant, prevents the air from reaching the rootlets while on the way to the garden, and aids in securing direct contact between the roots and the soil.

Previous to setting out plants, the land should be worked over and put in good condition, and everything should be ready for quick operations when a suitable time arrives. The rows should be measured off, but it is well to defer making the furrows or digging the holes until ready to plant, in order to have the soil fresh. The time best suited for transferring plants from the plant bed to the open ground is when there is considerable moisture in the air and clouds obscure the sun, and if the plants can be set before a shower there will be no difficulty in getting them to grow. During seasons when there is very little rain at planting time, or in irrigated regions, evening is the best time to set the plants. It is possible to set plants in quite dry soil, provided the roots are puddled and the

earth well packed about them. When water is used in setting plants it should be applied after the hole has been partially filled, and the moist earth should then be covered with dry soil to prevent baking. Where water is available for irrigation it will be sufficient to puddle the roots and then irrigate after the plants are all in place. Plants should be set a trifle deeper in the garden than they were in the plant bed. The majority of plants require to be set upright, and where the dibble is used for planting care should be taken that the soil is well pressed around the roots and no air spaces left.

PRECAUTIONS TO AVOID ATTACKS OF INSECTS AND DISEASES.

In the control of insects and diseases that infest garden crops it is often possible to accomplish a great amount of good by careful sanitary management. In the autumn, after the crops have been harvested, or as fast as any crop is disposed of, any refuse that remains should be gathered and placed in the compost heap, or burned if diseased or infested with insects. Several of the garden insects find protection during the winter under boards and any loose material that may remain in the garden. Dead vines or leaves of plants are frequently covered with spores of diseases that affect those crops during the growing season, and these should be burned, as they possess very little fertilizing value.

PROTECTION OF PLANTS.

Some plants require protection from the direct rays of the sun in summer or from cold in winter, and there are many that need special protection while they are quite small. Seedlings of many of the garden crops are unable to force their way through the crust formed on the soil after heavy rains, and it is necessary either to break the crust with a steel rake or soften it by watering.

In parts of the country where the sunshine is extremely hot during a part of the summer, some plants, especially those that are grown for salad purposes, are benefited by shading. Shading is often used in the care of small plants when they are first transplanted.

Where boards are available they can be used for protecting plants that have been set in rows in the garden by placing them on

the south side of the row at an angle that will cast a shadow over the plants, and holding them in place by short stakes driven in the ground. Laths, wooden slats, cotton cloth, or shaded sash are frequently used to protect plant beds from the heat of summer.

For protecting plants from cold in winter several kinds of materials are used, such as boards, cloth, pine boughs, straw, manure, or leaves. There are a number of crops of a tropical nature that may be grown far north, provided they are properly protected during the winter.

Several of the annual crops can be matured much earlier in the spring if they are planted in the autumn and protected during the winter. Plants of this kind can often be protected by means of boards set at an angle on the north side of the row instead of on the south. A mulch of manure, straw, or leaves forms a good protection, but care should be taken that the mulch does not contain seeds of any kind or serious trouble will attend the further cultivation of the crop. Plants are like animals in that they require air, and care should be exercised in putting on the winter covering not to smother them. Coarse, loose materials are better for a winter covering than fine, easily compacted substances.—(F. B. 255.)

HARVESTING, PACKING AND SHIPPING.

As a rule the crop should be harvested just before it reaches maturity. The time for this depends somewhat upon the distance from the market and the method of shipment. Remember that it costs just as much freight for a package of poor goods as for the best, and while there is a market for good produce, poor stuff not only does not bring good prices, but reacts upon the superior article, reducing its price. It is, therefore, poor policy to ship inferior goods. Inspect and assort rigorously, retaining all doubtful product for canning, or to be otherwise disposed of. Better lose it entirely than send it to market to undermine the good. Learn what kind of package the market you are selling in prefers. Provide that package, and pack the goods securely and honestly. Be sure the package is full. Not only is this more honest, but your produce will arrive upon the market in better condition if this is done. Have the goods in each package as near the same size as possible, and as near the same degree of ripeness. Do not make the error of placing the best on top. Remember that every package is examined by the buyer until he learns whether you are honest or not, and this

practice fools no one, and only serves to make the buyer wary of your goods. Pack neatly in a neat clean package. Nail it up securely, stencil your name and post office, and the name of the consignee upon it, and ship as promptly, and by the most direct route possible. Notify the consignee promptly of the shipment in order that he may know it is on the way, and have a chance to provide for its reception and disposal. The shipment of perishable goods by freight in refrigerator cars is preferable. Very early in the season ventilated cars may give satisfaction. Except with a few packages of very early vegetables or fruits, express shipments will not, as a rule, be found profitable. Not only will the charges be four or five fold, but the packages are handled so often, and so roughly, that they invariably reach their destination in poor condition. Besides this, there is no assurance as to the temperature being kept low, and a low temperature, while in transit, is essential to the arrival of your produce upon the market in good condition.

Careful selection, packing and shipping cannot be too strongly urged. Upon the intelligence and care with which this is done, depends, largely, the success of the shipper. Remember that after leaving your hands, and before reaching the consumer, these perishable goods are subjected to their greatest ordeal, and too much care cannot be given to make this test as light as possible. A proper understanding of this by the shipper would save many a disappointment, and many a hard word for the consignee. Of course, all else being equal, it is much safer and more satisfactory to sell on the track. However, this is not always possible, nor is it always advisable when possible. It would be unjust to demand or to expect the buyer to pay you the net price of the big city market for your goods at your home town.

In buying from you there, he takes the risk of transportation, of the fluctuations of the market, and pays all selling charges, and it is but just and right that he should be allowed a fair margin for these risks. On the other hand, human nature is the same the world over, and unless you watch Mr. Buyer closely, you will find he shows a decided tendency to make this margin unnecessarily large. To sell on track, intelligently and advantageously, therefore, you must make a close study of the market conditions. It is not enough to know what stuff sold for last week. You should know what it sold for the day before, and what the conditions of supply and demand are. Is the crop a large one? Is the movement to your market large or light? Is the demand brisk or dull? Is your railroad

service efficient? All these questions should be considered, and unless the farmer recognizes that the disposal of his crop is a business, and adopts business methods, he is sure to come to grief. In order to do this, it is necessary to have some reliable source of information. For this purpose, select some reliable commission house, and if necessary, pay them to furnish you daily market reports by wire during the shipping season. Do not begrudge the little money these telegrams will cost, for they will frequently save you many a dollar, even on one carload.—(La. St. U. & A. & M. Col. 81.)

CANNING VEGETABLES IN THE HOME.

One of the many problems that confront the American housewife is the supply of vegetables for her table during the winter months. "What can I have for dinner today?" is a question often heard. Since the advent of the modern greenhouse and the forcing of vegetables under glass, fresh vegetables can usually be found at any time in the markets of the large cities. But the cost of forcing vegetables or growing them out of season is and will continue to be very great. This makes the price so high as almost to prohibit their use by people of moderate means, except as a luxury. A healthful diet, however, must include vegetables, and therefore the housewife turns to canned goods as the only alternative. These are sometimes poor substitutes for the fresh article, especially the cheaper commercial grades, which necessarily lack the delicate flavor of the fresh vegetable. There is practically no danger, however, from contamination with tin or other metals providing the containers are made of proper materials and handled carefully. In some cases the proper care is not taken in packing vegetables for market. The decayed and refuse portions are not so carefully removed as they should be and the requisite degree of cleanliness is not observed in their packing. Happily, however, such carelessness is not general.

Every housewife may run a miniature canning factory in her own kitchen, and on the farm this is especially economical and desirable, the economy being less pronounced in the case of city dwellers, who must buy their fruits and vegetables. Enough vegetables annually go to waste from the average farm garden to supply the table during the entire winter. But usually the farmer's wife cans her tomatoes, preserves her fruits, and leaves her most

wholesome and nutritious vegetables to decay in the field, under the impression that it is impossible to keep them. This is a great mistake. It is just as easy to keep corn or string beans as it is to keep tomatoes, if you know how.

Sterilization.—The great secret of canning or preserving lies in complete sterilization. The air we breathe, the water we drink, all fruits and vegetables, are teeming with minute forms of life which we call bacteria, or molds, or germs. These germs are practically the sole cause of decomposition or rotting. The exclusion of air from canned articles, which was formerly supposed to be so important, is unnecessary provided the air is sterile or free from germs. The exclusion of air is necessary only because in excluding it we exclude the germ. In other words, air which has been sterilized or freed from germs by heat or mechanical means can be passed continuously over canned articles without affecting them in the least. If a glass bottle is filled with some vegetable which ordinarily spoils very rapidly—for instance, string beans—and, instead of a cork, it is stoppered with a thick plug of raw cotton and heated until all germ life is destroyed, the beans will keep indefinitely. The air can readily pass in and out of the bottle through the plug of cotton, while the germs from the outside air cannot pass through, but are caught and held in its meshes. This shows that the germs and their spores or seeds are the only causes of spoilage that we have to deal with in canning.

Germs which cause decay may be divided into three classes—yeasts, molds and bacteria. All three of these are themselves plants of a very low order, and all attack other plants of a higher order in somewhat the same way. Every housewife is familiar with the yeast plant and its habits. It thrives in substances containing sugar, which it decomposes or breaks up into carbonic acid and alcohol. This fact is made use of in bread making, as well as in the manufacture of distilled spirits. Yeasts are easily killed, so they can be left out of consideration in canning vegetables. Molds, like yeasts, thrive in mixtures containing sugar, as well as in acid vegetables, such as the tomato, where neither yeasts nor bacteria readily grow. Although more resistant to heat than yeasts, they are usually killed at the temperature of boiling water. As a general rule, molds are likely to attack jellies and preserves and are not concerned with the spoiling of canned vegetables. The spoiling of vegetables is due primarily to bacteria.

The reproduction of bacteria is brought about by one of two processes. The germ either divides itself into two parts, making two bacteria where one existed before, or else reproduces itself by means of spores. These spores may be compared with seeds of an ordinary plant, and they present the chief difficulty in canning vegetables. While the parent bacteria may be readily killed at the temperature of boiling water, the seeds retain their vitality for a long time even at that temperature, and upon cooling will germinate, and the newly formed bacteria will begin their destructive work. Therefore it is necessary, in order to completely sterilize a vegetable, to heat it to the boiling point of water and keep it at that temperature for about one hour, upon two or three successive days, or else keep it at the temperature of boiling water for a long period of time—about five hours. The process of boiling upon successive days is the one that is always employed in scientific work and is much to be preferred. The boiling on the first day kills all the molds and practically all of the bacteria, but does not kill the spores or seeds.

As soon as the jar cools these seeds germinate and a fresh crop of bacteria begin work upon the vegetables. The boiling upon the second day kills this crop of bacteria before they have had time to develop spores. The boiling upon the third day is not always necessary, but is advisable in order to be sure that the sterilization is complete. Among scientists this is called fractional sterilization, and this principle constitutes the whole secret of canning. If the housewife will only bear this in mind she will be able with a little ingenuity to can any meat, fruit, or vegetable.

Exclusion of the Air.—Even after sterilization is complete the work is not yet done. The spores of bacteria are so light that they float about in the air and settle upon almost everything. The air is alive with them. A bubble of air no larger than a pea may contain hundreds of them. Therefore it is necessary after sterilizing a jar of vegetables to exclude carefully all outside air. If one bacterium or one of its spores should get in and find a resting place, in the course of a few days the contents of the jar would spoil. This is why the exclusion of air is an important factor, not because the air itself does any damage but because of the ever-present bacteria.

All of this may seem new fashioned and unnecessary to some housekeepers. Persons have quite often heard it said: "My grandmother never did this, and she was the most successful

woman at canning that I ever knew." Possibly so, but it must be remembered that grandmother made her preserves—delicious they were, too—and canned her tomatoes, but did not attempt to keep the most nutritious and most delicately flavored vegetables, such as lima beans, string beans, okra, asparagus, or even corn.

So-Called "Preserving Powders."—There are a great many brands of so-called "preserving powders" on the market. These are sold not only under advertised trade names but by druggists and peddlers everywhere. In the directions for use the housewife is told to fill the jar with the fruit or vegetable to be canned, to cover with water, and to add a teaspoonful of the powder. It is true that these powders may prevent the decay of the fruit or vegetable, but they also encourage uncleanly, careless work, and in the hands of inexperienced persons may be dangerous. While with small doses the influence may not be apparent in an adult in normal health, with a child or an invalid the effect may be of a serious nature. The proper way to sterilize is by means of heat, and as this can be done very easily and cheaply the use of chemical preservatives in canning is not to be recommended.

Kinds of Jars.—The first requisite for successful canning is a good jar. Glass is the most satisfactory. Tin is more or less soluble in the juices of fruits and vegetables. Even the most improved styles of tin cans which are lacquered on the inside to prevent the juice from coming in contact with the tin are open to this objection. While the amount of tin dissolved under these conditions is very small, enough does come through the lacquer and into the contents of the can to be detected in an ordinary analysis. While the small amount of tin may not be injurious, it gives an undesirable color to many canned articles. Tin cans can not readily be used a second time, while glass with proper care will last indefinitely.

There are a great many kinds of glass jars on the market, many of them possessing certain distinct points of advantage. The ordinary screw-top jar is the one in most common use. Although cheap in price, these jars are the most expensive in the long run. The tops last only a few years and, being cheaply made, the breakage is usually greater than that of a better grade of jar. The tops also furnish an excellent hiding place for germs, which makes sterilization very difficult.

The most satisfactory jar is the one which has a rubber ring and glass top, held in place by a simple wire spring. There are several brands of these jars on the market, so no difficulty should be experienced in obtaining them. Vegetables often spoil after being sterilized because of defective rubbers. It is poor economy to buy cheap rubbers or to use them a second time. As a general rule black rubbers are more durable than white ones.

Buy a good grade of jar. The best quality usually retails at from a dollar to a dollar and twenty-five cents a dozen. The initial expense may be, therefore, somewhat high, but with proper care they should last many years. The annual breakage should be less than 3 per cent on the average. In selecting a jar always give preference to those having wide mouths. In canning whole fruit or vegetables and in cleaning the jars the wide mouth will be found to be decidedly preferable.

Containers for Sterilizing.—A tin clothes boiler with a false bottom made of wire netting cut to fit may be used as a container for sterilizing. The netting is made of medium-sized galvanized wire (No. 16) with one-half inch mesh. A false bottom is absolutely necessary, as the jars will break if set flat upon the bottom of the boiler. Narrow strips of wood, straw, or almost anything of this nature may be used for the purpose, but the wire gauze is clean and convenient.

There are several varieties of patent steamers or steam cookers in common use. These have either one or two doors and hold a dozen or more quart jars. They are ideal for canning, but they are somewhat expensive and can be easily dispensed with. A common ham boiler or clothes boiler with a tight-fitting cover will answer every purpose.—(F. B. 359.)

Selection and Preparation of Vegetables.—The first step in successful canning is the selection and preparation of the vegetables. Never attempt to can any vegetable that has matured and commenced to harden or one that has begun to decay. As a general rule, young vegetables are superior in flavor and texture to the more mature ones. This is especially true of string beans, okra, and asparagus. Vegetables are better if gathered in the early morning while the dew is still on them. If it is impossible to can them immediately, do not allow them to wither, but put them in cold water, or in a cold, damp place and keep them crisp until you

are ready for them. Do your canning in a well-swept and well-dusted room. This will tend to reduce the number of spores floating about and lessen the chances of inoculation.

STORING.

The assortment of vegetables which can be made available for winter use is much larger than is ordinarily supposed. No less than thirty distinct kinds of vegetables can be preserved for winter use by proper methods of storing, canning, and pickling. Of these, at least twenty may be kept in the fresh state, without canning or pickling. Besides the staple crop, potatoes, the list includes the root crops (beets, carrots, horse-radish, parsnips, winter radish, ruta-baga, salsify, turnips), kohl-rabi, cabbage, celery, leeks, chicory, parsley, onions, dry beans, pumpkins, squashes and sweet potatoes. The vegetables most commonly canned are rhubarb, tomatoes, corn, peas and string beans; those commonly preserved by pickling are cauliflower, cucumbers (both green and ripe), citron, green peppers and green tomatoes.

When vegetables are to be canned or pickled, it is not usually necessary to grow them especially for that purpose, except to make sure that a suitable variety is planted in sufficient quantity. When the vegetables have reached the right stage of maturity and the supply is abundant, part of the crop is simply canned or pickled without special regard to the particular time in the season it may be done. However, with vegetables to be preserved in the fresh state for winter use it is essential that they be planted at such a time that they will reach the right stage of development at the proper season for storing. This means that in the case of some of the crops they will be planted considerably later than if designed for summer use, since the product is of better quality if not allowed to continue growth after reaching the desired stage of development, and this stage should not be reached before the arrival of the storage season. Since most vegetables usually keep best if put into storage comparatively late, it should be the aim of the gardener to mature the vegetables for winter use as late in the season as he can, and yet have them harvested before they are injured by cold.

Of the vegetables stored for winter, some require entirely different conditions in storage than do others, so that attempts to store all vegetables under the same conditions would result only in

failure. In order that the root crops may be stored without wilting, rotting or starting into growth, they must be kept cool, fairly moist, and away from contact with circulating air. Cabbage may be successfully stored under the same conditions. Onions must be kept at a low temperature, but differ from the root crops in that they must be in a dry atmosphere and have free circulation of air. In a moist atmosphere, under high temperature, they would either rot or sprout. Vegetables that are expected to continue growth while in storage, such as celery, leeks, Brussels sprouts, chicory and parsley, must be planted in dirt and the roots kept moist. Air should circulate freely about the tops, and the temperature must be low. On the other hand, sweet potatoes, pumpkins and squashes demand a high temperature and dry atmosphere, with free circulation of air.

The conditions of storage favorable to the different crops are secured in various ways. Market gardeners use outdoor pits or specially constructed cellars for their root crops, cabbage and celery. Onions are commercially stored in slatted crates piled in tiers in frost-proof houses provided with means for ventilation so that the temperature can be maintained at slightly above freezing. Sweet potatoes and squashes are also stored in specially constructed houses, in which the temperature can be controlled; but since a high temperature is demanded for these crops, artificial heat is usually employed. Circulation of air about these products in storage is facilitated by the use of slatted bins, and allowing ample space between the bins and the side walls of the building.

For home use the root crops and cabbage can best be stored in outdoor pits for late winter use, and in the cellar for use early in the season. The chief objection usually urged against storing root crops in the cellar is that they are likely to wilt. This difficulty can be obviated by packing the roots in boxes with alternate layers of earth or sand, and placing the boxes in the coolest part of the cellar. The earth will absorb any odors in case the vegetables should start to decay, and thus avoid endangering the health of the family. Cabbage can be stored in the same way if the roots and outer leaves are removed and merely the heads are packed in boxes or barrels of earth.

Cabbage intended for late winter use, however, will keep better in an outdoor pit than in a cellar. The same is true of parsnips, salsify, horse-radish and some of the other root crops. Except

where the ground is especially well drained, the pits are usually made entirely above ground. For storing cabbage in this manner, the plants are pulled with the roots and leaves on, and placed upside-down in regular order on a level piece of ground. Usually three plants are placed side by side, with two above, and this arrangement repeated so that the final result is a long, low pile of cabbage showing five plants in a cross section. Earth is piled against and over this array of cabbage until the plants, including the roots, are entirely covered. In a severe climate, a layer of manure may be added when cold weather arrives.

For storing parsnips, salsify and horse-radish, which are uninjured by freezing, the roots may be placed in a pile on the ground and covered with about six inches of earth. The advantage of storing in this manner, instead of allowing the roots to remain where they grew, is the saving in time of digging, when a few roots are wanted during the winter. It is much easier to open the pit when the ground is frozen than to dig roots from the garden with a pick. In fact, the difficulty of digging almost precludes the use of these crops in midwinter unless they are more accessible than in the place where they grew.

Beets, carrots, turnips, ruta-bagas, kohl-rabi and Irish potatoes can also be stored in outdoor pits, but they must be covered sufficiently to prevent freezing. One of the best ways of handling these crops is to place them in a conical pile and cover first with six or eight inches of hay or straw, then with earth to a similar depth. If extremely cold weather is expected, a layer of manure should be placed outside of the earth. In getting vegetables from pits of this kind in midwinter, the manure is removed slightly from one side of the pit near the bottom and a hole about a foot square chopped through the frozen earth with an old ax. Sufficient hay is then pulled out by means of an iron hook, to enable a person to thrust his arm into the opening and reach the vegetables.—(U. Ill. 154.)

EARLY PLANTS IN HOTBEDS.

The most common method of starting early plants in the North is by means of a hotbed. The hotbed consists of an inclosure covered with sash and supplied with some form of heat, usually fermenting stable manure, to keep the plants warm and in a growing condition. As a rule, the hotbed should not be placed

within the garden inclosure, but near some frequently used path or building where it can receive attention without interfering with other work. The hotbed should always face to the south, and the south side of either a dwelling, barn, tight board fence, hedge, or anything affording a similar protection, will furnish a good location. The hotbed should be started in February or early in March, in order that such plants as the tomato and early cabbage may be well grown in time to plant in the open ground. There are two or three forms of hotbeds that are worthy of use.

A temporary hotbed, such as would ordinarily be employed on the farm, is easily constructed by the use of manure from the horse stable as a means of furnishing the heat. Select a well-drained location, where the bed will be sheltered, shake out the manure into a broad, flat heap, and thoroughly compact it by tramping. The manure heap should be 8 or 9 feet wide, 18 to 24 inches deep when compacted, and of any desired length, according to the number of sash to be employed. The manure for hotbed purposes should contain sufficient litter, such as leaves or straw, to prevent its packing soggy, and should spring slightly when trodden upon. After the manure has been properly tramped and leveled, the frames to support the sash are placed in position facing toward the south. These frames are generally made to carry 4 standard hotbed sash, and the front board should be 4 to 6 inches lower than the back, in order that water will drain from the glass. Three to five inches of good garden loam or specially prepared soil is spread evenly over the area inclosed by the frame, the sash put on, and the bed allowed to heat. At first the temperature of the bed will run quite high, but no seeds should be planted until the soil temperature falls to 80° F., which will be in about three days. In most farmhouses enough heat is wasted throughout the winter to sustain a small hothouse to say nothing of a hotbed.

Hotbeds having more or less permanence may be so constructed as to be heated either with fermenting manure, a stove, a brick flue, or by means of radiating pipes supplied with steam or hot water from a dwelling or other heating plant. For a permanent bed in which fermenting manure is to supply the heat, a pit 24 to 30 inches in depth should be provided. The sides and ends of the pit may be supported by brick walls or by a lining of 2-inch plank held in place by stakes.

Standard hotbed sash are 3 by 6 feet in size, and are usually constructed of white pine or cypress. As a rule, hotbed sash can be purchased cheaper than they can be made locally, and are on sale by seedsmen and dealers in garden supplies. In the colder parts of the country, in addition to glazed sash either board shutters, straw mats, burlap, or old carpet will be required as a covering during cold nights. It is also desirable to have a supply of straw or loose manure on hand to throw over the bed in case of extremely cold weather.

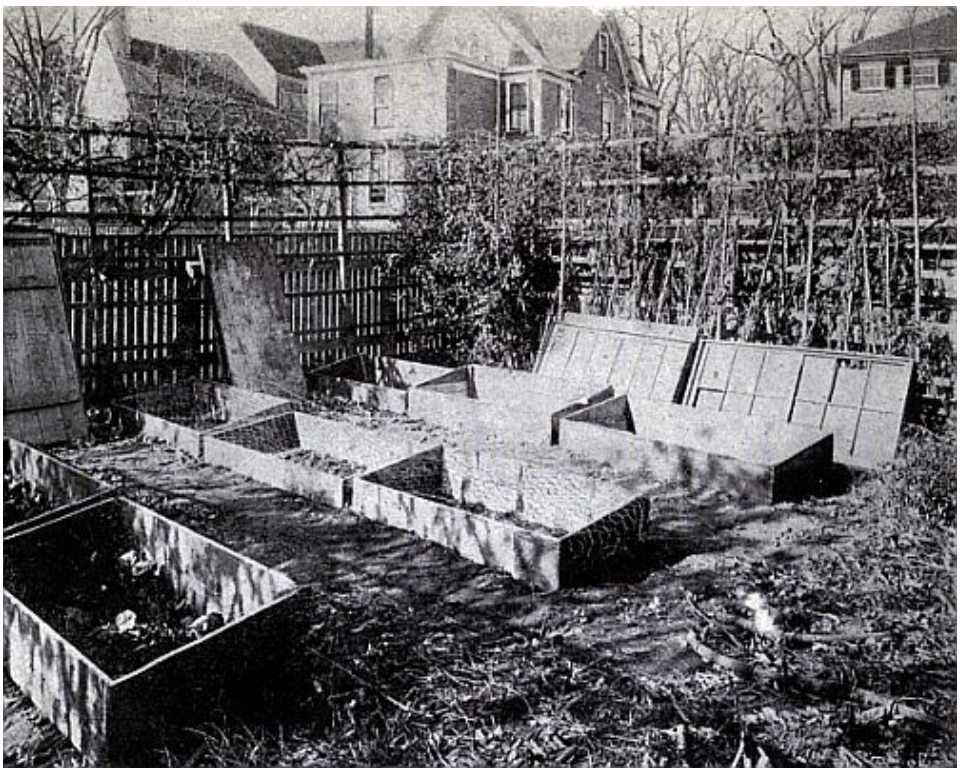
During bright days the hotbed will heat very quickly from the sunshine on the glass and it will be necessary to ventilate during the early morning by slightly raising the sash on the opposite side from the wind. Care should be taken in ventilating to protect the plants from a draft of cold air. Toward evening the sash should be closed in order that the bed may become sufficiently warm before nightfall. Hotbeds should be watered on bright days and in the morning only. Watering in the evening or on cloudy days will have a tendency to chill the bed and increase the danger from freezing. After watering, the bed should be well ventilated to dry the foliage of the plants and the surface of the soil and prevent the plants being lost by damping-off fungus or mildew.

HANDLING OF PLANTS.

Successful transplanting of indoor-grown plants to the garden or field depends largely upon their proper treatment during the two weeks preceding the time of their removal. Spindling and tender plants will not withstand the exposure of the open ground so well as sturdy, well-grown plants, such as may be secured by proper handling.

Plants grown in a house, hotbed, or cold frame will require to be hardened off before planting in the garden. By the process of hardening off, the plants are gradually acclimated to the effects of the sun and wind so that they will stand transplanting to the open ground. Hardening off is usually accomplished by ventilating freely and by reducing the amount of water applied to the plant bed. The plant bed should not become so dry that the plants will wilt or be seriously checked in their growth. After a few days it will be possible to leave the plants uncovered during the entire day and on mild nights. By the time the plants are required for setting in the garden they should be thoroughly acclimated to outdoor

conditions and can be transplanted with but few losses.—(F. B. 255; U. Mo. Col. Ag. & Mech. Arts 33; N. La. 81; Kan. St. Ag. Col. 70; S. Dak. 47; U. Idaho 17.)



TEMPORARY HOTBEDS IN A CITY BACK YARD

FRAMES USED IN TRUCK GROWING.

Intensive gardening under sash or cloth covers has become one of the most popular and, in certain localities where the conditions are suitable, one of the most profitable lines of outdoor work. The trucker and the market gardener of the present day have been compelled by keen competition and a constantly increasing demand for high-grade products out of season to provide special facilities for increasing and improving the product, as well as to take advantage of every favorable natural condition. Many localities are especially favored with an abundance of sunshine at all seasons of the year, and at the same time their climate, due to the influence of large streams or near-by bodies of water, is mild and free from extremes of temperature. In such localities it would be possible to grow lettuce, radishes, and similar crops during the entire winter without protection were it not for a few cold days and nights. A very slight covering or the application of a small amount of heat will, as a rule, carry the plants through in good condition. This industry may readily be combined with regular truck farming,

as it furnishes remunerative employment during the winter months. A comparatively small area is necessary for the frames, but several times that acreage of land should be available, so that the site of the frames may be changed every few years to safeguard against diseases and insect injuries.

Cloth-Covered Frames.—The type of frame or bed varies with the different localities and is ordinarily no more elaborate or expensive than is necessary to protect the crops. In North Carolina and South Carolina the type of frame generally used is that having for the sides two lines of 12-inch boards set on edge and held in place by means of stakes driven into the ground. The covering of cheap unbleached muslin is supported on strips of wood 1 inch thick and 2½ or 3 inches wide, which are raised in the center by being carried over the top of a stake; the ends are held down by nailing to the sides of the bed. Most of these frames are temporary and are taken apart and stored during the summer months. Before placing the frames in position in the autumn the soil is plowed, thoroughly fitted, and given a liberal dressing of well-rotted stable manure and commercial fertilizers. The placing of the boards will cause some trampling of the bed, and before putting in the ends and nailing on the rafters or strips to support the cloth it is desirable to loosen the soil again by means of a harrow or cultivator. The stakes for supporting the cross strips or rafters are then driven through the center and the strips nailed in place at intervals of 4 feet. The ends are inclosed by means of 12-inch boards, and the bed is then ready for the cloth cover. The cloth is first stitched, with the strips running lengthwise of the bed, into one great sheet large enough to cover the entire bed. This sheet is fastened on the north side of the frame by nailing over it plastering laths or similar strips of wood. The cloth should not be fastened to the top edge of the board but on the side, 1 or 2 inches below the top. For fastening the sheet on the south side of the frame short loops of string or cloth are attached to its edge and these are looped over nails driven into the side of the bed.

Sash-Covered Frames.—In the tidewater region of Virginia the frames are covered with hotbed sash. The climate of Norfolk is a little too severe for the use of cloth except for early autumn and spring crops. A number of growers in the vicinity of Norfolk handle sash-covered frames occupying as much as 3, 4, or 5 acres each season. For the sides and ends of these frames the same class of cheap lumber as for the cloth-covered frames is used.

Heated Frames.—Farther north, near Chicago, St. Louis, Cleveland, Detroit, Baltimore, Philadelphia, Cincinnati, New York, and Boston, sash-covered frames are extensively used for growing early vegetables. This work is practically the same as that found at Norfolk, except that the frames are constructed over an excavation which is filled with fermenting manure to provide heat. Where manure-heated beds are extensively used for growing early vegetables a long, shallow pit is opened, the manure is trodden in, and 12-inch boards are fastened to stakes to form the sides. The board on the north side is raised a little higher than the one on the south side in order to form a slope for the glass. A few strips are nailed across the bed to prevent the sides from coming in by the pressure of the manure or soil that is banked on the outside, and the sash simply rest on the sides without any guide or supporting strips between them. Straw mats and board shutters are employed as a protection for the sash during cold weather.

Temperature of Frames.—The temperature at which the air of the beds should be carried will depend entirely upon the crop being grown. Thermometers should be placed at intervals in the beds, as it is not safe to judge the temperature by personal sensation. If lettuce, parsley, or radishes are growing in the beds, the temperature should not go above 70° F. before ventilation is given; on the other hand, if the frames are filled with cucumbers, eggplant, or peppers, the temperature may run 8 or 10 degrees higher. It should be borne in mind that any covering, whether cloth or sash, will exclude a part of the light, and every precaution is necessary to prevent the plants becoming "drawn." The safest plan is to keep the temperature a trifle low and thus retain the plants in a strong, thrifty condition. Where tender plants are being grown under cloth there is greater danger of injury from keeping them covered too tightly than from exposure to moderate cold.

SHOWING VEGETABLES GROWING IN HOTBED

VENTILATION.

Open-Air.—In the care of cloth-covered frames the covers are left off during bright weather and the plants subjected to open-air conditions. When there is danger of cold the covers are put on at night, and during unfavorable weather they are frequently left on during the day. While the cloth covers conserve the heat, they at the same time exclude the sunlight, and if they are kept on too great a portion of the time the crops will become drawn and spindling. With sash-covered frames the matter of ventilation is of prime importance. The glass admits and holds the heat of the sun's rays, and during bright weather it is necessary to open the frames quite early in the morning. Ventilation is accomplished by propping up one end or one side of the sash on a notched stick. The rule to be followed is to ventilate on the side away from the wind, so that the wind will blow over the opening and not into the bed.

Protection of Frames.—The area occupied by the frames is often surrounded by a high board fence or a hedge of evergreens to break the force of the wind. If a large area is devoted to frames it is sometimes subdivided by numerous cross fences to break up air currents and lessen the force of storms. Where no heat is applied to

the frames the control over temperature will not be great except in the prevention of too high temperature by means of ventilation during bright weather. In many instances straw and burlap mats are kept ready at hand for throwing over sash-covered frames to prevent loss from freezing, but this would not be practicable on a large scale. Sometimes the glass is covered by shoveling one-half or three-fourths of an inch of soil over it, but this involves considerable labor and frequently results in the breakage of a great deal of glass. It is possible to ward off frost by the use of a number of orchard heaters in the frame yard. These heaters burn kerosene or crude oil and give off both heat and a smudge which will prevent injury from a reasonable degree of cold.

Crops Grown in Frames.—The crops most commonly grown in frames are lettuce, radishes, cucumbers, garden beets, parsley, eggplant, peppers, and snap beans. The crops grown in the sash-covered frames do not differ materially from those grown under cloth. In the spring, however, many growers devote their beds almost entirely to cucumbers and eggplant instead of to lettuce and radishes. To the southward the cloth covers are sufficient to protect the more hardy crops throughout the winter. To the northward the hardy crops may be grown under sash in midwinter, and those requiring more heat are grown in the spring.

Marketing Crops Grown in Frames.—Crops grown in frames are usually superior in quality and appearance to those grown in the open and should be given more care in handling and marketing. The cost of production is somewhat higher than for outdoor crops, and it is essential that they be put up in neat packages in order to bring the highest market price. The more successful growers give the work of gathering, grading, and packing the crop their closest personal attention and use only clean, attractive packages for handling and shipping.

The packages employed for handling the frame products are generally the same as those used for marketing outdoor vegetables, of the same kinds. In a few instances a distinctive package has been employed. The use of special shipping packages that would give the frame-grown produce special recognition on the markets would be a decided advantage to the grower.—(F. B. 460.)

SOIL AND FERTILIZERS.

The greater portion of the work with frames is conducted on light or sandy loam soils which are naturally well drained and adapted to intensive trucking. The original soil is usually employed, but when necessary rich soil is hauled and placed in the beds. The first essential is good drainage, and if the land is not naturally well drained it should be tiled or provided with numerous open ditches to carry off the water. The surface of the soil should be graded and all depressions filled in and leveled. For best results the land should be subjected to two or three years of preparation by manuring and planting to leguminous crops.

The presence of plenty of organic matter in the soil is very important, especially where large quantities of commercial fertilizers are to be used. This organic matter may be added in the form of stable manure, but more satisfactory results will be obtained where leguminous crops are included in the preparatory treatment. For green manure nothing is better than cowpeas as a summer crop and crimson clover as a winter crop. The crimson clover should be turned under about the time it comes into full bloom in the spring, the land planted to cowpeas, and the resulting crop plowed under or mowed for hay during the month of August in ample time to prepare the land for frame work during the autumn. When heavy crops of green manure are turned under it is essential that lime be used to improve the mechanical condition and to sweeten the soil; a dressing of 1,000 pounds to the acre should be sufficient.

Large quantities of stable manure are used in growing crops in frames, sometimes as much as 30 to 60 cartloads to the acre. The manure is generally spread in a broad, flat pile to compost before it is applied to the soil on which frames are to be located. Where manure is employed for heating the beds it may afterwards be mixed with the soil for the growing of subsequent crops. Poultry and sheep manure is excellent fertilizer for frame work, but the quantity obtainable is very small. In the application of natural manures of all kinds it is essential that the manure should be fine; that it be what is termed "short" manure.

WATERING CROPS.

To insure success in the cultivation of plants in frames it is necessary to provide some means of applying water to the soil. Occasionally the supply of water can be obtained from the system

of some city, but more often it must be pumped from a well or stream and stored for use in an elevated tank. Watering is generally done during the late afternoon, but should be completed early enough to permit the foliage to become reasonably dry before closing the frames for the night. If the plants are young and very tender it will be important to avoid too great a degree of moisture. Serious losses from "damping-off" often result from excessive moisture, especially at night, when evaporation is not so rapid as during the day. Many gardeners make the mistake of watering too often and not doing the work thoroughly. Under ordinary conditions twice a week will be often enough to apply water, and in winter, when evaporation is at its lowest point, once a week will be sufficient. In watering the sash-covered frames it is necessary either to remove the sash or to prop them up high enough to permit working under them. As a rule the sash are taken off early in the morning of a bright day, the soil is stirred, sometimes a little fertilizer is added, later in the day the bed is watered, and toward night the sash are replaced.

ANISE.

This is an annual. Leaves used as a garnish. The seeds are the source of Anise oil. This plant grows well and gives a good yield of seed. Seeds should be soaked over night in warm water and sown thickly.—(U. Idaho 10.)

ARTICHOKE, GLOBE.

This plant requires a deep, rich sandy loam, with a liberal supply of well-rotted manure, is best suited for growing artichokes. Plant the seeds as soon as the soil is warm in the spring, and when the plants have formed three or four leaves they may be transplanted to rows 3 feet apart and 2 feet apart in the row. The plants do not produce until the second season, and in cold localities some form of covering will be necessary during the winter. This crop is not suited for cultivation north of the line of zero temperature. After the bed is once established the plants may be reset each year by using the side shoots from the base of the old plants. If not reset the bed will continue to produce for several years, but the burs will not be so large as from new plants. The bur, or flower bud, is the part used, and the burs should be gathered before the blossom part appears. If they are removed and

no seed is allowed to form, the plants will continue to produce until the end of the season.

ARTICHOKE, JERUSALEM.

This useful and productive plant will grow in any good garden soil, and should be planted three to four feet apart each way, with three or four small tubers in a hill. If large tubers are used for planting they should be cut the same as Irish potatoes. Plant as soon as the ground becomes warm in the spring and cultivate as for corn. A pint of tubers cut to eyes will plant about thirty hills. The tubers will be ready for use in October, but may remain in the ground and be dug at any time during the winter.—(F. B. 255; U. Idaho 10.)

ASPARAGUS.

This valuable plant was formerly a luxury on the tables of the rich, but is now during the season a vegetable seen daily upon the tables of people of moderate or even small incomes. It is also frequently recommended as an article of diet for the sick and convalescent. To the asparagus grower there are two methods by which plants can be secured, (1) by purchasing or saving the seed from which to raise them, and (2) by purchasing the plants from either a seedsman or some grower. Taking the second method, as being the quickest way to start a bed as well as the most easily disposed of, it is suggested that roots over two years old be rejected, and only one-year-old roots selected if a sufficient number can be secured, as the latter are much better and will in the course of a few years produce more and larger spears to the plant and yield profitable crops for a longer period. It is best to deal with reliable firms; they will be more likely to supply plants of both the kind and age desired.

Seed.—Only reliable seedsmen should be trusted, or the seed should be procured from some neighbor who has the desired variety and has taken proper care in producing and saving the seed, if the first plan is to be followed. If one already has an asparagus bed of the desired sort, producing fine spears, and of the proper age (8 to 12 years old) for seed production, it is always best to save seed from it for new plantings. The growing of one's own plants is preferable, both because of the extra year intervening

between the determination to plant and the actual setting out of the bed, thereby permitting the soil of the proposed bed to be put in a better and more friable condition, and because, good seed having been secured and proper care given to the young plants, a more satisfactory supply of the young roots is obtained. That there are objections to growing one's own seed is undoubtedly true, but there are also compensating advantages, and if proper care is exercised it will pay the grower to raise his own seed (from beds which are satisfactory) even if seed can be bought in the open market for much less than the trouble of attending to the home grown may cost. If, however, a grower is unwilling or unable to exercise the necessary care in the production of seed, he would do much better not to attempt it, but depend upon some reliable dealer, studiously avoiding those whose claims to patronage are based upon cheapness of stock. Good seed are worth good money; poor seed should not be accepted under any conditions.

Soil.—Asparagus will grow on most soils, and will yield large crops upon stiff soils; but for the purpose of the grower for market, a light sandy soil of fair fertility is much to be preferred, both because of the earliness with which it produces marketable spears and the ease with which it is cultivated. A soil on which water stands after rain, or under which the standing subsurface water is near the surface, into which the roots are liable to penetrate, is to be avoided. Of course, such a soil, if otherwise suitable, can be made fit by a thorough system of under drainage, since an occasional overflow, or even a submergence of the beds for several days, is not necessarily injurious if the drainage, either natural or artificial, is good. The soil should be free of roots, stones, or any trash that will not readily disintegrate or that will interfere with the growth of the spears. A rather stiff but naturally well-drained soil which produces early and fine asparagus, notwithstanding the fact that it is full of large gravel, some of the stones being twice the size of a man's fist.

Shade.—Fruit or other trees or high shrubs must not be allowed in the asparagus bed, because of the shade they throw over the beds and because their roots make heavy drafts upon the soil. Nor should high trees, hedges, hills, or buildings be so near as to throw a shadow upon the beds, because all the sunshine obtainable is needed to bring the spears quickly to the surface. The land should be protected from the north or east (or from the direction of the prevalent winds) and so slope that the full benefit

of the sunshine will be obtained during the whole day. Freedom from weeds is very desirable, even more so than great fertility, for the latter can be produced by the heavy manuring which the future cultivation will require; and to the end that weeds may be few, it is well that for a year or two previous to planting the land should have been occupied by some hoed crop, such as potatoes, beets, cabbages, etc.

Cultivation.—In the late fall or early winter the selected area, should be a light sandy loam as described above, needs to be deeply plowed, and if the subsoil is not already of an open and porous nature, through which surface water will readily drain and the roots easily penetrate, a subsoil plow should follow, breaking the soil to the depth of at least 15 inches. After harrowing the field, a good compost of well-rotted horse, cow, sheep, or other manure should be spread broadcast and left to the action of the weather until as early in the spring as the ground is in condition to be worked, when the manure should be plowed in, the surface carefully harrowed, and the soil put in a light and friable condition.

As early in the spring as the condition of the ground will permit work to be done—when it is dry enough to bear plowing and the soil will break up fine—rows should be marked off 4 to 6 feet apart and opened up with a large plow, going a sufficient number of times to make a furrow from 8 to 12 inches deep. Loose soil that the plow does not throw up should be taken up with a shovel or wide-bladed hoe. It is in these furrows that the crowns are to be set, the distance to be left between plants varying, according to the opinion of the grower, from 18 inches to 5 feet.

Planting.—Rows should be run north and south, so that the full benefit of the sunshine will be secured. If the rows run east and west, they will be shaded by the ridges in early spring, when the sun is low in the south, and later in the season they will be completely shaded on one side by the tall foliage. This delays sprouting in the spring, and prevents the best development of the plants at all times. Of course, any conditions, such as the slope of the land, etc., which make it inadvisable to run the rows north and south must be considered, but southeast to northwest or northeast to southwest is better than due east or west, or, in short, the natural conditions permitting, the course should be as far from east and west as possible. This is especially important to those who ridge

the rows to produce white asparagus. Early in the spring of each year, after the plants are old enough to cut, there must be a ridge made over the rows to blanch the shoots, if white asparagus is to be cut; and once ridging is not sufficient, but after the spears begin to appear the ridges will need renewing every week or ten days during the cutting season, as the rains beat them down and the sun bakes a crust upon the top. The grower of green asparagus has about the same work, less the ridging and plowing down. As it is necessary to keep down all weeds, some hoeing may be necessary as supplementary to a free use of the 1-horse cultivator. After the cutting season, a cutaway harrow run twice diagonally across the rows loosens up the soil and destroys a vast number of weeds without injury to the crowns, although some spears may be broken off.

Brush.—The bushes should be cut as soon as the berries are fully colored, as the growth will be sufficiently matured so that no injury will be done the roots by removing the tops, thus avoiding a further drain upon the roots to mature the seed, and preventing the dropping of seed, followed by the springing up of innumerable young asparagus plants.

All brush should be promptly collected and burned, that there may be no lodging places for insects and diseases. In case the fields were not leveled, harrowed, and manured at the close of the cutting season, now is a convenient time to perform this work, although if the soil is rather too moist it is well to leave the surface firm, that the winter rains may run off rather than penetrate to the already too damp subsoil around the roots.

Manuring.—In nothing relating to asparagus has there been a greater change than in the practice of manuring. Formerly it was thought necessary to place large quantities of manure in the bottom of the deep trenches in which the young plants were set out in order that sufficient fertility might be present for several years for the roots, as after the plants were once planted there would be no further opportunity to apply the manure in such an advantageous place; it was also considered necessary to use much manure every autumn to bank the beds in order that the crowns should not be injured by the winter's frost. These applications, especially that given prior to planting the young crowns, made the outlay so great, and that for so many years before any return

would be received from the bed, that only small plantings were possible to those who were without considerable capital.

Although asparagus is still heavily manured, the amount now used is much less than was formerly supposed to be necessary, only about double the quantity ordinarily used upon root crops, such as potatoes, beets, etc. It is not a good practice to put manure in the bottom of the trenches or furrows when setting out the crowns, because it is demonstrated to be rather a waste of manure than otherwise, and besides the roots of asparagus thrive better when resting upon a more compact soil; nor is it necessary that the soil should contain great amounts of humus or be in an extremely fertile condition when the plants are first put out, since by the present system of top dressing a moderately fertile soil soon becomes exceedingly rich and equal to the demands which the plants make upon it. Considerable improvement is produced in the mechanical condition of the soil by the use of stable manure upon beds. By the addition of humus, porous sandy soil is made somewhat more binding and its ability to take up and retain moisture thereby increased; while, on the other hand, cold, heavy soils are made warmer and more porous.

All organic manures are suitable for use on the beds; but care must be exercised in the use of any of these lest they be too hot and injure the plants, especially if applied directly to the roots and immediately over the crowns. Where the young shoots come up through it, fresh, hot manure is likely to produce rust or to render the shoots unsightly and thus injure their sale. Especially is this true in light, sandy soils.

The time of applying manure on beds, and the position where it should be placed, are of some importance. In the use of stable manure, both writers upon the subject and growers actually engaged in producing asparagus for the market almost unanimously state that "in the autumn, after the stalks have matured and have been cut, manure should be applied on top of the rows." Some give the caution not to put it just over the crowns, lest the shoots next spring be injured by contact with it. This plan of top dressing beds during the autumn or early winter is gradually giving way to the more rational mode of top dressing in the spring and summer. It was believed that autumn dressing strengthened the roots and enabled them to throw up stronger shoots during the following spring. This is a mistake.

It is during the growth of the stalks after the cutting season is over that the crowns form the buds from which the spears of next season spring, and it is probable that it is principally during this period that the roots assimilate and store up the material which produce these spears. This being true, the plant food added to the soil and becoming available after the cessation of vegetation in the autumn can have little, if any, effect upon the spears which are cut for market the following spring; it first becomes of use to the plant after the crop has been cut and the stalks are allowed to grow. In the use of hot, or fresh, manure it may be that the winter season is none too long to permit the fertilizing elements to become available and well distributed throughout the soil, but if well-rotted manure is used there is danger of the fertility being leached out of the soils by the rains and melted snows of winter.

Those growers who apply a liberal dressing of stable manure or fertilizer immediately after the cutting season supply the required nourishment to the plants at the time they most need it and can most profitably utilize it in the production of spears. Manure thus applied will also act as a mulch, preventing the growth of weeds, keeping the soil light and cool, and preserving the moisture intact. It should not be made on top of the row. This suggestion the writer wishes to emphasize.

Manuring in November in many cases does more harm than good, as the mass of manure causes many roots to decay, and those which do survive are weak and only produce small spears. It would be much better to rely upon liberal supplies of food through the growing season than to give manure when the bushes are cut, as at the former period the roots can more readily absorb the food given. By feeding in spring and summer the crowns are built up for the next season's supply of grass. The roots of the asparagus are perhaps always active, but much less so in winter than at any other season, and they will obtain as much nutriment from the soil as they can then use. If heavily covered with manure sunshine is excluded, growth is checked, and the roots have to fight hard for existence at a time when they are none too strong.

In the culture of green spears the manure is best utilized by broadcasting, this application to be followed by a thorough harrowing of the field. When white asparagus has been cut, either manuring in the trench between the ridges before disturbing them or harrowing down the ridges and then manuring broadcast is

perhaps the most rational way. As between manuring in the row and between the rows, the latter should be selected as the evidently advisable one by which the feeding roots of the plants are most easily reached. Placing the manure in the row only reaches those feeding roots which are to be found about midway between the crowns, as just around the crowns are nothing but storage roots, besides it is not desirable to place manure too close to the crowns, but manuring between the rows puts the manure right where the summer rains can carry the fertility directly down into the (as it were) open mouths of the feeding roots.

Green Crop.—If green asparagus is desired, the stalks need be cut only so far beneath the surface as to furnish a 9 or 10 inch spear, the major part of which, say 6 inches or more, will be green, and of course above ground. If white asparagus is sought for, the rows will have been ridged from 10 to 15 inches above the crowns, and the spears must be cut as soon as they show at, and before they peep above, the surface. This means cutting 9 or 10 inches below the surface. To accomplish this, long chisel-like knives of various shapes are used.

Cutting should be done at least every day, and when vegetation is rapid twice each day will be necessary for white asparagus, and is often desirable when the green sort is being cut.

Harvesting and Marketing.—Asparagus is one of the earliest vegetables, especially if the roots are near to the surface or the soil above them has been temporarily removed so that the rays of the sun can easily penetrate to them. Some varieties are earlier than others, and this difference in time of appearance varies from a day or two to several weeks. For instance, the Early Argenteuil is about ten days earlier than the ordinary asparagus grown in the same locality, and the Late Argenteuil at least ten days later; so that there would be nearly three weeks between the Early and Late Argenteuil. Among the ordinary varieties, however, there is only a short period between the earliest and the latest.—(F. B. 61, 255; U. Cal. 165; U. Mo. 43; U. Kans. 70; U. Miss. 1905.)

BEANS.

Kinds.—For convenience in reference and for discussion, beans may be divided into two general groups—"field" and "garden" beans—which are by no means distinctly separate either

in appearance or in characteristics. Each of these groups can again be divided into bush and pole beans. Bush beans of the field type are recognized, for commercial purposes, under three well-marked types, known as Kidney, Marrow, and Pea beans, each of which may be subdivided into two groups, colored and white. The garden beans, like the field beans, may be divided into bush and pole types; these again into Kidneys and Limas, the term "Kidney" in this case including all of the common garden beans whether of one type or another, and this group may again be divided into wax and green pod. The same subdivision may also be recorded under pole beans, as is suggested in the following classification:

- Field beans
  - Bush
    - Kidney — Colored; White
    - Marrow — Colored; White
    - Pea — Colored; White
  - Pole or corn hill. White or colored.
- Garden beans
  - Bush
    - Kidney — Green Pod; Wax
    - Lima — Green Pod; Wax
  - Pole
    - Kidney — Green Pod; Wax
    - Lima — Green Pod; Wax
    - Runner (Scarlet Runner).

Soil.—While clay loams or soils overlying limestone are most desirable, sandy and even gravelly loams may be used, but these latter soils should contain more or less humus and the gravelly soil should not be too coarse. Beans may be grown on heavy clay soils but the surface or underground drainage, or both, must be good and special attention must also be given cultural methods to produce a fine, mellow seed bed. Muck soils or those with a superabundance of humus are not suitable as they tend to produce vines at the expense of the seed. It is also true that this crop will not thrive on low, wet, poorly drained soils. Beans seem to produce good crops on soils somewhat deficient in nitrogen when well supplied with potash and phosphorus. Contrary to a somewhat prevalent notion, beans will not produce well on very poor soils, but require a fair degree of fertility.

Seed.—Care should be exercised in the selection of beans for seed. None but the best hand-picked beans should be used for planting, as the success of the crop is quite largely dependent on the vitality of the seed.

Tilth.—Since the bean is a warm-season crop and can not safely be planted until after danger from killing frost has passed, the preparation

of the soil for field beans should be deferred until the vegetation covering the area has made considerable growth, so that it may be as completely destroyed as possible during the operations of plowing, harrowing, and fitting the land for the reception of the seed. The short-season character of the bean crop enables the land to be occupied during the winter months by some cover crop, such as wheat or rye, and if the same land is used year after year for the production of beans, the turning under of winter cover crops furnishes an important means by which the store of organic matter in the soil can be maintained, a consideration of great moment in sections chiefly dependent upon commercial fertilizers as a source for available plant food.

After the land has attained proper dryness in the spring it should be plowed from 6 to 8 inches in depth, and immediately compacted and harrowed, so as to prevent the loss of moisture. The surface of the seed bed should be made smooth and fine, so that the drill or planter can be economically used upon it. If dry weather follows at this season of the year, a good practice is, immediately preceding the planting of the crop, to run a heavy land roller over the area, particularly if the planting is done with an ordinary grain drill. If the planting is done with a planter similar to the ordinary corn planter and the land has been rolled previously, it is advisable to go over it with a spike-tooth harrow or some other type of smoothing harrow after the crop has been planted, in order that the land may not possess a compacted condition from the substratum to the surface.

Planting.—Growers have found that it is better to postpone planting the crop until as late in the season as is practicable and yet be able to safely harvest the crop before the vines are injured by fall frost. The late planted crop has the advantage of escaping the most serious attacks of the bean rust. While there are undoubtedly varieties which are more or less resistant to this trouble, yet the general practice of late planting has been found to be of decided advantage. In planting the field crop the distance between the rows varies from 28 to 36 inches, according to the implements used in harvesting the crop, 30 inches being a very satisfactory and not an unusual distance for placing the rows. The seeds are so scattered as to fall from 2 to 4 inches apart in the row. The ideal distance would be undoubtedly 6 inches, if it were possible to obtain a perfect stand of plants at this distance. For distributing the seed in the row at these distances a bean planter or a check row corn planter may be set to drop the seeds in drills. A common practice is to use an ordinary grain drill and stop a sufficient number of tubes to enable two or three rows of beans to be planted at the proper distance apart without the necessity of purchasing a special implement.

Quantity of Seed.—The quantity required to plant an acre of beans varies with the size of the beans; that is, a half-bushel of small Pea beans is sufficient to plant an acre of ground, while a bushel of Red Kidney beans is hardly sufficient to plant an acre when the seed is distributed in the ordinary fashion in drills rather than in hills. In planting beans of the Pea and Marrow types the quantity of seed varies from one-half to a bushel per acre, depending upon the quality of the beans and upon the preferences of the planter. For Kidney beans the quantity varies from a bushel to as much as six pecks per acre. Ordinarily, with rows 30 inches apart, a bushel is a sufficient quantity for seeding an acre.

Depth of Planting.—The depth at which beans should be planted is determined by the character of the soil and the season of the year at which they are planted. In heavy, retentive soils planting should be made comparatively shallow, as the peculiar habit of growth of the bean is such that it can not readily reach the surface if planted deep in such soils. Upon light soils and early in the season, planting can be made quite deep. Three inches is not too deep upon such soils, but an inch and a half or 2 inches is the maximum depth for planting upon retentive soils. All things considered, a satisfactory depth for planting beans is about 1½ inches.

Cultivation.—Like all other hoe crops field beans require frequent, shallow cultivation. The stirring of the soil for the purpose of holding the weeds in check and preserving a soil mulch over the area occupied by the growing crop, is the important factor to be considered in culture. At the last cultivation the plants may be slightly hilled; that is, the soil may be thrown toward the plants with small wings. This has the advantage of leaving the plants on a slight ridge, which facilitates the work of harvesting when such work is done by mechanical means. In the cultivation of beans it is traditional that they should not be cultivated when the dew is on the vines. This undoubtedly has a slight foundation for the reason that moisture is a conveyor of spores of disease and might have a tendency to distribute them more widely than would be the case if moisture were allowed to dry off the leaves without being disturbed.

Harvesting.—For many years the handling of hoe crops, such as field beans, upon an extensive scale was impossible because of the great amount of hand labor necessary to gather the crop. Within recent years, however, labor-saving devices have been invented so that now the once laborious practice of hand-pulling individual plants can be done away with by the use of a bean harvester. After the plants are thrown together by the harvester it is customary for men with ordinary pitchforks, either 2 or 3 tined, to follow the harvester and place the beans in small heaps to cure for several days before storing them in barns or sheds for thrashing. In some instances, where the work is done upon a very extensive scale

and where the loss from shelling is not considered sufficient to justify the employment of hand labor for bunching the beans with forks, an ordinary horserake is employed for the purpose. Where the beans are to remain for a longer period and to become more thoroughly cured in the field and where the work of harvesting is done entirely by hand, the crop is frequently placed in shocks which are built about a pole 4 or 5 feet in height, both ends of which have been sharpened and one end firmly placed in the ground. A small quantity of straw, grass, or other material is placed around the base of the stake, and the beans as they are pulled are piled around the pole until a compact miniature stack about 4 or 5 feet high is formed. The curing process in any case is carried far enough to prevent the vines molding after storing them in the barn prior to thrashing. If the vines are thoroughly ripened in the field before harvesting, they can be stored in from two to three days if the weather is satisfactory. If, however, the vines have some green leaves upon them and the pods are not thoroughly dry, the period for curing in the field is of necessity much longer than with thoroughly ripened plants.

Storage.—After the crop has been properly cured in the field it is customary to store the beans in barn lofts or in sheds until the weather has become quite cool before the work of thrashing is done. In some instances, however, if the beans are thoroughly field cured they may be thrashed in the field; but ordinarily, in those regions where beans are extensively grown, weather conditions will not permit of their being cured and left in the field a sufficient period to enable the entire work of harvesting and thrashing to be carried on in the open.

Care Necessary.—All operations connected with the harvesting and field management of beans should be done as carefully as possible, in order to avoid injury to the plants while in the growing condition and to prevent shelling the beans after they have ripened. Most varieties of beans shell more or less easily after the pods have become thoroughly matured. Most extensive growers of beans consider the loss by shelling resulting from the use of labor-saving machinery of less money value than the added cost of carrying on all operations by hand in the most careful way. In other words, the loss from the use of labor-saving machinery is not sufficient to justify the return to hand labor in the care and management of the crop.

Threshing.—Beans are now threshed by a special machine or beaner which has been instrumental in materially increasing the acreage of beans grown. These machines are usually introduced into localities where beans are grown commercially and offered for hire on a plan similar to that used by grain threshers.

Cleaning and Grading.—While the farm operations in connection with the preparation of field beans for market usually cease with the

thrashing of the crop, the cleaning and grading of the product is a very important item and requires much hand work. Besides the removal of sticks and straws from the grain by the use of the fan, the beans are passed through a machine which is provided with a broad, slow-moving belt placed at such an angle that split beans and peas, dirt, and stones which are not removed by the fan adhere to the belt and are thrown out, while the smooth, perfect seeds fall back into another receptacle and are thus separated from the dirt and broken seeds. After this the beans are usually subjected to a third operation, which consists in removing by hand all broken and discolored seeds, as well as foreign matter, which were not removed in the other operations.

Garden Beans.—The type as well as the variety of garden bean to be grown is determined by the purpose for which it is to be used. If it is to be used as a snap or string bean for early market, quick-maturing green or wax-podded varieties are selected. If for canning purposes, a different variety is selected, which may have either green or wax pods, while as a rule green beans which are required late in the season for table use belong to the pole type. For early beans, however, the bush type is the one most commonly used.

Fertilizers.—While beans are quick-growing and early-maturing plants requiring an abundance of available plant food in the soil, yet, because of their family relations, being legumes, they make the soil better for having been grown upon it. They are nitrogen-gathering plants, and for this reason require only a small percentage of this element in any fertilizer used upon them. While heavy applications of fertilizers containing nitrogen, phosphoric acid, and potash are used by truck growers in the production of beans, as a rule such fertilizers should be relatively richer in phosphoric acid and potash than in nitrogen. The production of garden beans for snap or string beans, however, demands a larger percentage of immediately available nitrogen than does the production of field beans for the dry grain, as in the former case the crop occupies the land a shorter time and therefore gives it less opportunity to provide itself with a supply of nitrogen from the atmosphere. The fertilizer, if used in the form of commercial fertilizer, may be distributed broadcast over the area occupied by the crop with a grain drill or a fertilizer distributer, or it may be scattered along the row at the time the seeds are sown by one of the many types of seed drill having a fertilizer attachment.

Planting.—Garden beans, like field beans, may be planted either in hills or in drills. The customary practice, however, is to plant the seeds in drills so that they shall fall 2 or 4 inches apart in rows far enough apart to admit of cultivation with either one or two horse implements. Because of their peculiar habit of germination—the elongation of the

part between the root and the seed leaves, called the hypocotyl—the seed leaves or cotyledons are lifted out of the soil. A large expenditure of energy on the part of the plant is necessary to accomplish this, and the more compacted the soil and the deeper the seed is planted the more time and energy are required in accomplishing this result. It is evident, therefore, that the shallower the beans can be planted without retarding satisfactory germination, the better. Upon thoroughly fine and compacted soils the seeds are planted from 1½ to 2 inches deep. Shallower planting does not as a rule give as satisfactory germination as planting within the range above mentioned. While garden beans are planted in extensive areas, they are, nevertheless, frequently used as a catch crop between other plants, such as squashes and cucumbers. The bean, being a quick-growing plant, matures its crop and is out of the way before the entire area is demanded by the companion crop.

Harvesting.—From the nature of the product the harvesting of garden beans for use as string or snap beans must necessarily be done by hand. Their extensive culture is therefore restricted to areas in which an abundant labor supply which can be commanded at short notice is available. After the beans are picked they are carried to a convenient sorting table, either in the open or under shelter, where they are looked over, all diseased and broken beans rejected, and the baskets uniformly filled and shaken down preparatory to covering them for shipment.

LIMA BEANS.

Under the name of Lima beans two distinct types are now recognized: Pole Limas and dwarf, or bush, Limas. Lima beans are of very great commercial value, but are not sufficiently appreciated as a table food because it is not generally known that in a dry state they can be used in practically the same manner as are the common beans. In reality they are richer and more delicate in flavor than the common beans, and can be used in as many different ways. The virtues of these types as green beans need only a passing mention, and their value as an accompaniment of corn in succotash is well known to every consumer of canned goods.

Planting.—The common method of handling the Lima bean in the climate of the northern tier of States, outside of the irrigated belt, is to plant from three to five beans in hills 18 to 36 inches apart, with the rows 3½ to 4 feet apart, and after all danger from cold and from insect enemies is past the beans are thinned to about three plants to the hill. As the beans are exceedingly tender, it is necessary to delay planting in the open until about a week or ten days after the time for planting the common garden beans. After the second cultivation, when the tendency to climb has manifested itself, the plantation is supplied with poles from

5 to 6 feet high, or with a trellis running from end to end of the row, which may be made by stretching two or three wires lengthwise of the row and weaving between them strands of ordinary wool twine. If the trellis is employed the beans can be planted in practically continuous rows, so that they stand about a foot apart. Toward the northern limit for cultivating this crop, one is fortunate if one-half to two-thirds of the pods which set upon the plants mature the seed. Farther south the crop is proportionally heavier.

In California and in other irrigated regions where there are well-marked wet and dry seasons, the dry season, accompanied by heavy fogs, occurring during the summer months, it is possible to cultivate Lima beans somewhat as follows: Upon moderately rich, somewhat sandy valley land, cultivation can be carried out by planting the beans as soon as all danger from rains has ceased and the plantation will remain dry except for irrigation. If there has not been sufficient winter rain to thoroughly moisten the land it should be well watered and allowed to dry to a good cultural condition before planting. Seed can then be planted in hills about 3½ or 4 feet apart each way, or in drills, the beans scattered about a foot apart in rows 4 feet apart. After the beans have germinated it may be necessary to cultivate them once or twice with a sweep of some type, to destroy any weeds which may have sprung up from the moist ground. All moisture should be withheld and a dust mulch over the surface preserved by running a sweep over the plantation once or twice more, and then the vines should be allowed to take possession of the territory. This obviates the necessity of using poles, and the crop can grow to maturity under these conditions without irrigation, without cultivation, and without poles.

At harvest time a root cutter is passed under the lines of the rows, severing the roots of the plants, and after the plants have dried and become somewhat cured they are thrown into convenient heaps for loading on wagons and are allowed to remain in these heaps until near the approach of the rainy season. Then they are carried to the thrashing floors, where they are beaten out by the tramping of animals or by driving over the heap a device somewhat similar to the ordinary cutaway harrow.

The dwarf Lima beans, because of their habit of growth, are planted and cultivated practically the same as are field beans. They are slightly hardier than pole Limas, and for that reason toward the northern limit of the range of this crop can be planted somewhat earlier in the season than the pole Limas.—(F. B. 289; U. Mich. 259; S. C. E. S. 10; S. Dak. E. S. 47, 91; Iowa E. S. 47; Miss. E. S. 131.)

BEETS.

The red garden beet may be grown in any good soil, but rich, sandy loam will give the best results. Sow the seeds in the spring as soon as danger of frost has passed. Beets should be planted in drills 12 to 18 inches apart, and when the plants are well up they should be thinned to 4 or 5 inches in the row. If desirable to plant in rows 3 feet apart for horse cultivation, the seeds may be sown in a double drill with 6 inches between, leaving 30 inches for cultivation. Two ounces of beet seed are required to plant 100 feet of row, or 5 pounds to the acre. As a rule each seed ball contains more than one seed, and this accounts for beets coming up very thickly. The seed should be covered to a depth of about 1 inch. For a succession of young beets during the summer, plantings should be made every four or five weeks during the spring months. Beets intended for winter storage should not be sown until late in the summer, the crop being harvested and stored in the same manner as turnips. Sugar beets are often substituted for the ordinary garden beet, especially for winter use.

A soil that is well adapted to growing the usual vegetables will be found good for this one. It may be slightly heavier than that for the crops that are grown for their foliage, as lettuce. A good cabbage soil will be found of about the right consistency. Wet or soggy land will not raise a crop. Plow deep and prepare the ground well; the seedlings are quite small and need considerable coaxing before they will make a good start. Use plenty of fertilizer of some well prepared kind. Rough or undecomposed material should not be used. A sprinkling of powdered nitrate soda as a top dressing when the plants are one-third grown will produce a rapid growth. In applying, be careful not to apply so as to touch the foliage, unless during a rain. It is not profitable to transplant beets; it may be done on a small scale, but it is too expensive to practice on a large scale.

Varieties.—According to shape of the root one may divide beets into two classes, viz., Long Rooted and Globular. If color is made the basis of classification you have red, white and yellow kinds. Extra Early Blood Turnip, Eclipse and Extra Early Egyptian are good varieties to grow for market. The first named is probably the best; the last named has the disadvantage of becoming stringy if it matures during a long, dry spell, or if allowed to stand too long. The deep red varieties are preferred in the markets, and those that are turnip shaped sell better than the long.

Marketing.—The usual method is to use barrels or large boxes; this is a clumsy way, and one not calculated to bring the best price. The usual vegetable crate will be found handy and desirable.

In districts where there are pickling factories, and near large cities, small beets, with greens, are raised with profit, but these can not be shipped to a distant market. For a distant market gather tops and all;

carry to the packing-house; remove the tops with a sharp knife, leaving about an inch of the leaf-stalk on the beet. Remove the dirt, and pack in vegetable crates. The leaves put in a compost heap will pay for the trouble of hauling, or they can be fed to domestic animals with profit. The beet itself makes one of the best feeds for milch cows, and is excellent for other domestic animals.—(F. B. 225; N. C. A. E. S. 132; Fla. E. S. 31; U. Idaho 10; N. H. Col. 99, 125; N. J. A. Col. Rpt. 1900.)

BORAGE.

The leaves are used for flavoring.

BROCCOLI.

Broccoli is simply a variety of cauliflower that is more commonly grown for fall use, as it is rather more hardy than the true cauliflower. Lee's Sprouting Broccoli is a branching sort that is esteemed in some places. There is a great deal of misunderstanding regarding the Cauliflower and Broccoli. Both are the same in their general make up and growth, both producing heads in the same manner and to the casual observer are taken one for the other. The difference is that Cauliflower is a more tender variety and therefore will not stand a very low temperature. The seed is sown in early spring and will produce heads during the summer. The Broccoli will stand a temperature as low as 25 without much injury to the plant. The seed is sown in the spring, the plants set out in June or early part of July and continue to grow until the spring following, some varieties producing heads at intervals during winter and up to as late as May. Attention needs to be directed during the winter to such plants as are about to produce heads. These should have the outer leaves turned over the head to protect it from frost to which it is very susceptible. The seed may be sown and the plants treated in every way as for the cabbage. They thrive well in a deep, rich soil. Much better results would be had if more attention were given to the matter of deep cultivation, that is, in deep spading or plowing of the ground. Manure that has been well composted should be used plentifully and plowed in deep. By so doing the roots of the plants are encouraged to penetrate deep into the soil where they can find moisture as well as food. The shallow plowing in of manure has the tendency to keep the feeding roots of plants near the surface and will therefore soon dry out and turn blue, and when once the plants are stricken with the blues no further growth will be made and they might as well be discarded.—(Oreg. E. S. 74; N. C. E. S. 132.)

BRUSSELS SPROUTS.

This crop is closely related to cabbage and cauliflower. Instead of a single head, Brussels sprouts form a large number of small heads in the axils of the leaves. As the heads begin to crowd, the leaves should be broken from the stem of the plant to give them more room. A few leaves should be left at the top of the stem where the new heads are being formed. Brussels sprouts are more hardy than cabbage, and in mild climates may remain in the open ground all winter, the heads being removed as desired. For winter use in cold localities, take up plants that are well laden with heads and set them close together in a pit, cold frame, or cellar, with a little soil around the roots. The uses of Brussels sprouts are similar to those of cabbage, but they are considered to be of a superior flavor. They require the same treatment as cabbage. The soil must be rich and requires considerable moisture. The small sprouts must grow rapidly or they will be tough. Sow the seed in hotbed and transplant, or scatter seed in hills and thin. The plants must have plenty of room. Rows should be thirty inches apart and the plants not closer than two feet.—(F. B. 255; U. Idaho E. S. 10; Cornell U. E. S. 292.)

CABBAGE.

Cabbage is one of the most universally cultivated of the garden plants. Although it is one of the coarser vegetables it finds a place in the home garden as well as in the market garden and truck farm. In some sections of the United States it is extensively grown as a farm crop. Early cabbage is practically all consumed as a green vegetable. The late crop, on the other hand, is handled as a fresh vegetable, as a storage crop, and for the manufacture of sauerkraut. It is always in demand, and under present conditions is always available, either as the product of a southern truck farm or a northern farm, garden, or storage house. The group of cultivated plants which has been derived from the wild cabbage presents a greater diversity of form than that derived from any other single ancestral type.

Wild cabbage is a robust-growing broad-leaved plant enjoying the low, moist areas near the seacoast of southern Europe. The most closely allied form now in cultivation is the collard. The wide variation in the group is illustrated by the diversity of form shown in collards, kale, tree cabbage, marrow kale, cauliflower, and Brussels sprouts. It is almost beyond the bounds of reason to believe that all these forms have been derived from a common parentage, yet such is the fact.

Seed.—In no truck crop does the character of the seed count for more than in cabbage. It is very essential that the crop come to marketable maturity early, that the heads be uniform in size and character, and that they mature so that the whole crop can be harvested at two cuttings. The small saving made by the purchase of cheap or

inferior seed is usually paid for a hundred times over in the lessened value of the crop. A grower can not afford to risk his crop for so small a saving. The best seed that can be obtained is none too good, and anything short of this is not good business. Without highly viable seed of a good strain, true to type, the best results can not be expected. For early spring cabbage in the South, sow the seeds in an outdoor bed and transplant to the garden before January 1. In the North, plant the seeds in a hotbed during February and set the plants in the open ground as early as the soil can be worked. For a late crop in the North, plant the seeds in a bed in the open ground in May or June and transplant to the garden in July. Early cabbages require a rich, warm soil in order that they may mature early. For late cabbages the soil should be heavier and more retentive of moisture and not so rich as for the early crop, as the heads are liable to burst. Cabbages should be set in rows 30 to 36 inches apart and 14 to 18 inches apart in the row. Where the plants are set out in the autumn and allowed to remain in the ground over winter, they are usually placed on top of ridges.

Soil.—The soil for cabbage must necessarily vary in different localities. In one area it may be of an alluvial character, while in another it may be sedentary, and in still another it may be characteristic glacial drift. The fact that cabbage grows well in all these soils indicates its adaptation to a wide range of conditions. The main thing with cabbage is an abundant supply of immediately available plant food. Market gardeners rely chiefly upon stable manure for their supply of plant food.

Cultivation.—Among market gardeners it is a common expression that "cabbage should be hoed every day." Perhaps no other crop responds more quickly to good cultivation and an ample food supply. This is undoubtedly the explanation of the above quoted expression. In cultivating cabbage the work should be frequent and thorough, but the cultivation should not be deep. The aim should be to destroy all competing weeds and to maintain a loose, friable layer of soil about 2 inches deep over the surface of the area devoted to cabbage.

Storage.—Early cabbage must be used soon after it has formed solid heads, as it will not keep during hot weather. Late cabbage may be buried in pits or stored in cellars or specially constructed houses. The usual method of storing cabbage is to dig a trench about 18 inches deep and 3 feet wide and set the cabbage upright, with the heads close together and the roots bedded in soil. As cold weather comes on, the heads are covered slightly with straw and then 3 or 4 inches of earth put on. Slight freezing does not injure cabbage, but it should not be subjected to repeated freezing and thawing. If stored in a cellar or building, the heads are generally cut from the stems and stored on slatted

shelves or in shallow bins. While in storage, cabbage should be well ventilated and kept as cool as possible without freezing.

Varieties.—The varieties of cabbage used in the trucking section are practically limited to the Wakefield type. There are two strains of this type of cabbage now extensively employed: The true Jersey Wakefield, with its small, acutely pointed tip and very firm, tender flesh of high quality, and the Charleston Wakefield, which is broader, somewhat flatter, more obtusely pointed, and slightly more angular in cross section than the Jersey type. The varieties which may be used for field cultivation depend upon the purpose for which the cabbage is intended. If for sauerkraut or for immediate consumption, the Flat Dutch type from American-grown seed is extensively employed in the eastern part of the United States. In the irrigated section of Colorado, in the vicinity of Greeley, where cabbage is grown for sauerkraut, a variety known as Scotch Cross is almost universally grown. If the cabbage is intended for storage the Danish Ball Head from imported seed is almost exclusively used.—(F. B. 255, 433; Colo. E. S. 143; Md. Ag. Col. E. S. 133; Tex. E. S. 52, 69; Ga. E. S. 91; Kans. E. S. 70; S. Dak. E. S. 91.)

CALABASH[1]

The increasing popularity of calabash pipes made from the fruits of a South African calabash, or gourd, has aroused a widespread interest in the growing of this vine.

Calabash pipes made from imported South African gourds have been the fashion in England for some time and are now coming into vogue in America. These pipes are formed from the crooked necks of a large gourd (*Lagenaria vulgaris*) belonging to the well-known group of plants which includes the cucumber, the melons, and the squashes. Pipes made from the imported gourds are expensive, American dealers usually charging $3 to $12 apiece for them. They are the lightest pipes made for their size, are graceful in shape, color like meerschaums, and are delightful smokers. Unlike the cheap pipes which are turned out by machinery, no two of these calabash pipes are alike. In this lies much of their charm. In this, likewise, lies their cost, for, unlike the great mass of pipes turned out by machinery, the crook of the calabash varies so that each mouthpiece must be made to fit it and each lining of meerschaum or plaster of Paris must be specially adapted. In our land of labor-saving machinery and expensive hand labor this is what makes the pipes costly.

The vine forms a very satisfactory cover for unsightly brush heaps or fences, though its rather rank odor might prove objectionable if used for an arbor too near the dwelling. To grow the vine for the sake of its gourds is where the chief interest lies, however, and to do this well it

should not be trained on a trellis, but allowed to trail over the ground. If the fruits are allowed to lie on the ground they form their crooked necks quite naturally without assistance, and while not all of them by any means make suitable necks for pipes a good proportion do. It seems to induce a more perfect neck to stand the gourds up when half grown so that they rest on their big ends. Unless care is exercised in doing this the necks snap off, for they are extremely brittle even when fully grown. It is only when almost mature that they become hard and then they are indeed almost unbreakable.

Much could doubtless be done to perfect the methods of culture, insuring perhaps a greater percentage of properly crooked necks and more perfect surfaces. It could not be seen that inheritance plays any material part in this matter of percentage of crooks. If left to themselves the majority will crook their necks, but some few will remain quite straight, and this on the same vine with perfectly formed crooks. The gourds should be left as long as possible on the vines to thoroughly thicken their shells. If picked green the shell will be no thicker than stiff cardboard and in drying it is very liable to crack. Frost will injure the gourds if they are left on the vines too long.—(B. P. I. Cir. 41.)

CANTALOUPE.

Cantaloupe growing, as developed since its origin near Rockyford, Colorado, in 1885, requires unusual judgment and cultural skill on the part of the farmer. Co-operative organization and good business management are also essential, for only by these means can the crop be properly timed and prepared for shipment, and necessary arrangements made with transportation and selling agencies.

Seed.—Seed should be most carefully selected with reference to flavor and appearance of the fruit; to good shipping characters, including small cavities and heavy netting; and to a tendency to produce melons of standard size. Early strains are desired for some situations; but in Arizona rust resistance is not a necessary character as this class of diseases is little to be feared under the arid conditions. Seed should be purchased only from most reliable sources. Rockyford growers are at present the principal means of supply.

Soil.—Experience has proven that a sandy loam is the soil best suited for cantaloupes, and that its condition of tilth and the available fertility are the prime essentials in bringing cantaloupes to quick maturity. The secret of getting soil in that ashy, mellow condition so desirable for cantaloupes is largely one of experience, for hardly two farms can be handled the same. In general, there must be moisture in the soil over winter to get the disintegrating effect of frost, and plowing

should not be done until the ground is dry enough to pulverize mellow. Barnyard manure has long been the means of supplying fertility to force cantaloupes to early maturity. Old alfalfa ground is most excellent for cantaloupe culture. Bermuda sod plowed up and exposed to the sun without irrigation the preceding summer makes excellent cantaloupe ground, the intensive cultivation necessary serving both to benefit the crop and to restrain this formidable weed.

Planting.—The first requisite aside from moisture for a good start is warm weather, as cantaloupe seed cannot germinate when the ground is cold and freezing; and if perchance the days are warm enough to germinate the seed that is planted in March or April, the cold nights that are sure to follow will offset the advantage of early planting. If there is a secret in getting early cantaloupes it is in growing the crop from start to finish with a uniform unchecked growth; the cantaloupe does not seem to have the power to rally from a check in growth or an injury from an insect and still makes its normal development. The back-set not only cuts off the production of early cantaloupes but seriously affects the size and quality of the melon. There are numerous instances where unfavorable conditions of growth have produced a large quantity of pony melons, while under more favorably growing conditions the same seed and soil have yielded standard sized cantaloupes. One of the first signs of promise for early cantaloupes is a quick germination and rapid development of large cotyledons. Seed that germinates slowly with small, yellow appearing seed leaves has never made early cantaloupes.

Irrigation.—Moisture for the cantaloupe hill is generally supplied by the irrigation furrow. It should always reach the seed or plant by soaking through the soil. Irrigation should never be allowed to over-soak or flood the ground, as the soil will then become hard and not permit a good growth. The relation of irrigation to an early set of cantaloupes is a somewhat mooted question. There are growers who argue the use of frequent irrigations during the setting period to secure a good set, and there are others who prefer to keep the vines rather dry and even letting them show the need of water before they will irrigate during the setting stage. There have been results that seemed to support both theories, yet close observation would not warrant following either plan to an extreme, but rather a medium course of supplying enough moisture for an even, healthy growth, which seems to be the essential condition all the way through. An excess of irrigation during the hot weather in July will doubtless tend to grow vines at the expense of early fruit; but the most disastrous result of too much water—having the ground so soaked that the surface is nearly all wet, and affording the moist, dewy condition which is favorable to its development—is in the development of rust. The rust problem is a serious one in cantaloupe culture in Colorado. Controlling it by proper application of irrigation is only a palliative

measure, yet a marked contrast is often seen in two portions of a field; one over-irrigated, and the other comparatively dry, aside from the moisture necessary to the growth of the vines. Rainy weather and dewy nights afford the proper conditions for the growth of the rust spore, and while the farmer cannot change climatic conditions, yet by careful attention in the application of water, having the rows well ditched, and with adequate waste laterals to prevent over-soaking and flooding, the surface of the ground will dry rapidly after a rain or an irrigation. Thus the dews at night will be less, and in a measure alleviate the effects of rust.—(U. Ariz. Cir. 77; Ag. Col. Colo. 62, 85, 95 and 108.)

CARDOON.

The cardoon is a thistle-like plant, very similar in appearance to the Globe artichoke, but is grown as an annual. The seeds are sown in early spring in a hotbed or cold frame and the plants transplanted later to the open ground. The cardoon should be planted in rows 3 feet apart and 18 inches apart in the row on rich soil, where it can secure plenty of moisture and make rapid growth. Toward autumn the leaves are drawn together and the center blanched in the same manner as endive. If intended for winter use, the leaves are not blanched in the garden, but the plants are lifted with considerable earth adhering to the roots and stored closely in a dark pit or cellar to blanch. The blanched leaf stems are used for making salads, soups, and stews.—(F. B. 255.)

CARROT.

The culture of the carrot is practically the same as the parsnip, except that carrots are not thinned so much and are allowed to grow almost as thickly as planted. Carrots should be dug in the autumn and stored the same as parsnips or turnips. Any surplus can be fed sparingly to horses, mules or cattle. The roots of the carrot are used at all times of the year, mostly in soups, but they may be boiled and served with butter or creamed. Carrots are planted in rows 16 inches apart and the plants thinned out to 4 inches in the row. Chantenay is an excellent table carrot of medium size and dark orange color, slightly tapering and abruptly terminating with a short, fine taproot. The flesh is orange colored, brittle, juicy and mild flavored. What it lacks in size it makes up in quality and good shape. Scarlet Intermediate, somewhat larger than Chantenay, is of good size for table use. In shape more tapering and with a longer taproot. It is dark orange colored; flavor and quality good. Flesh is quite brittle and orange colored with a white center. To these two are added two varieties principally grown for stock feed, similar varieties being grown for table use in many parts of Europe, and more especially those of the White Belgian variety. Both varieties are of slender shape,

1½ to 2 inches in diameter, holding their size well, although averaging 12 inches in length, 3 to 4 inches of which grows above ground and which as a consequence is colored light green on the outside. White Belgian is the sweeter of the two, and while the flesh is somewhat coarse, the flavor of it, when well stewed and mashed, is sweeter and not unlike that of the parsnip. Victoria, the other variety, is of the same texture, fairly sweet and with a more pronounced carrot flavor, the flesh instead of white, being light orange colored. This vegetable can be grown to perfection in Porto Rico almost any time of the year. It prefers a rich loam and grows very well on a heavy clay which is not too wet, but a light sandy soil is not well adapted to it. For fertilizer, stable manure will do when nothing else is available, but a commercial fertilizer, rich in potash and phosphoric acid, is much to be preferred for this crop.—F. B. 255, 295; Mich. E. S. 20; N. C. E. S. 132; U. Idaho E. S. 10; P. R. A. E. S. 7.

CAULIFLOWER.

This plant requires a very rich, moist soil. Land that will produce only a fair crop of cabbage is unfit for cauliflower. If the land is very rich and well fertilized it may be reasonably expected that the returns from the crop of cauliflower will more than repay the cost of putting the land in good condition.

Seed.—No more important element enters into the success of the cauliflower crop than the quality of the seed and to the seed alone is often due the difference between success and failure, profit and loss. The best seed that can be secured is the cheapest at any reasonable price, and it should always be obtained from a well-known, reputable seedsman.

Seed-bed.—This should be carefully prepared. The soil should be enriched with a liberal application of commercial fertilizer, or thoroughly decomposed stable manure. After the fertilizer is applied it should be thoroughly worked in to a depth of three or four inches. From a few days to two weeks should elapse before the seed is sown for there is great danger in planting seed too soon after applying commercial fertilizer as the seed is likely to be destroyed by the action of the mineral substance unless it has been dissolved and thoroughly incorporated with the soil. The time between the application of the fertilizer and the sowing of the seed will depend upon the amount of rainfall and it is often better to wet down the seed-bed each day for four or five days before planting and not to depend upon the uncertain rainfall. The rows should be about three inches apart. In six or seven days the young plants should begin to appear and the ground between the drills should be cultivated. Do not allow the soil to dry out as the cauliflower plant from seed to head should never be checked. Neither should the bed be kept

too wet, else there is danger of "damping off." The bed should be carefully watched and if the disease does break out it may be checked by removing the diseased plants, working the soil, scattering dry sand and sulphur along the rows and withholding water until the surface soil becomes dry. It might be pointed out here that about six months must be allowed from the sowing of the seed until the crop matures.

Transplanting.—The plants should not be allowed to remain long in the seed rows. If left too long they will soon crowd and become weak and spindling. When they have reached the height of one inch, they should be pricked off and set in another portion of the bed. They may be set in rows four inches apart with the plants one and a half to two inches apart in the rows. Here they should remain until ready for the field. If care has been exercised all the way through, the plants will be short, stocky and vigorous. By the time they are four or five inches high or when the leaves have lapped they are ready for the field. It is not best to let them get too large, because there is often a delay of a few days in order to obtain good climatic conditions for setting out. If left too long in the seed bed, greater care must be exercised in transplanting, else the plants may suffer a severe check and will button or break irregularly instead of forming smooth well shaped heads.

Soils and Preparation.—Work should be started on the ground at least a month before the plants are set out. The cauliflower is a deep rooted plant, consequently the soil should be prepared deeply. It is not advisable to turn under the good surface soil and to obviate this ground may be plowed shallow and then stirred and opened with a bull-tongue to a depth of seven or eight inches. After this the surface should be cultivated to a depth of two or three inches. Give thorough preparation by frequent cultivation before the fertilizer is applied, preparatory to setting out the plants.

Setting Out.—It is best that the plants be set out either just before or immediately after a rain, but if this can not be done they should be set out late in the evening and watered, giving each plant about a quart of water. A cloudy day is much preferable to a clear one and if the day on which the plants are set out is followed by cloudy weather, so much the better. The ground should be leveled or smoothed over, for which purpose a roller or float may be used. After this the ground may be marked off. Two markers should be constructed, one with the teeth three feet apart, the other with the teeth two feet apart. These may be made of wood after the pattern of an ordinary garden rake. In place of a marker a line may be used or the ground may be checked off with a light hand plow. Only a limited number of plants should be removed from the seed-bed at one time. The leaves should be cut back about one-half or one-third, using for the purpose a large pair of shears. Sprinkle the plants

with water as soon as removed from the bed, place in a shallow box or basket and keep them shaded from the sun.

Cultivation and Care.—The field should be frequently cultivated and the ground should be scarified at least every week and after every rainfall. The best tool for cultivating is an ordinary cultivator and the ground should not be worked to a greater depth than two and one-half or three inches. This will preserve a surface mulch of dry earth and prevent loss of moisture by evaporation. As soon as the heads commence to form the leaves should be drawn together at the top and loosely tied near their tips with a piece of cord or twine. Rafia makes a good substitute for twine and is preferable because there is less danger of cutting the leaves. The practice of breaking down the leaves over the head has been tried, but found not quite so satisfactory. If the heads are left uncovered they become yellow through the action of the sun and rain but when the leaves are drawn together and tied, they bleach out pure white, and curd-like.

Gathering.—Cauliflower may be cut before it is mature, but the flavor is not so well developed as it is when the heads are full grown. For winter shipment heads from four to six inches in diameter are of a desirable size and the market will take them fully as well or better than large ones. The field should be picked over at least every two or three days during the season, though heads will remain in good condition for nearly a week if the weather be cold. Examine the head by separating the leaves on the side. As soon as the head is well rounded up in the center and developed so as to force the leaves outward, and assumes a grained appearance, it will be found to be fully matured. The heads should be cut, preferably, when dry. If moist they are likely to decay in transit. The best time of day is the afternoon if they are intended for long distance shipment. About an inch of stem should be left on the head and three rows of leaves. After cutting, the heads should be carefully placed in a wagon and carried to the packing house or on dry pleasant days packing may be done in the field.

Packing.—The package recommended for general use is the ordinary lettuce basket. Before packing, the leaves should be cut back to stubs. Each head should be carefully wrapped in a large sheet of white glazed paper. The baskets should be packed snug and tight without bruising the heads, and only those of uniform size should be placed in each basket. Never place different sizes in the same package and always discard inferior or injured heads; the compost heap is the place for them. —(F. B. 255; Fla. E. S. 59; Tex. E. S. 57; Cornell U. E. S. 292.)

CELERIAC.

This vegetable, which is also known as turnip-rooted celery, or knot celery, is closely related to our ordinary celery, being indeed a cultural variety of the same original plant grown under conditions which have developed the root rather than the stalk. In Europe it is by far the most common form of celery, but has never been extensively cultivated in the United States, though it is found in the larger markets. The roots are white and more or less globular in shape, closely resembling turnips in appearance. This vegetable deserves to be more widely known, being extremely hardy and of easy cultivation. It is mostly used for flavoring soups, except by the Germans who use it in the same manner as potatoes for potato salad. Planted 7 or 8 inches apart and 3 feet between the rows it will yield abundantly, and succeed best where celery will. The edible portion develops into a bulbous root weighing 4 to 6 ounces when trimmed, and these bulbs when properly packed away in the cellar will keep almost until spring. Where the ground but slightly freezes, the plants may be safely left unharvested for spring use.—(F. B. 255, 295; Mich. E. S. 20.)

CELERY.

The ideal climatic conditions for the production of celery are bright sunshine, pure air, cool nights, and a well-distributed rainfall of about 8 inches during the growing period in the field or garden.

Soils.—In the production of celery for domestic use, a rich, mellow, sandy loam will give the best results. The soil of the seed bed should contain plenty of leaf mold and should be passed through a sieve having not less than six meshes to the inch. The soil of the transplanting bed need not be sifted so fine, and some well-rotted barnyard manure should replace a part of the leaf mold; in other respects it should be the same as that of the seed bed. Any fertile, well-drained soil will grow celery, but a loose, sandy loam is preferable. If nothing but clay soil is available, it may be made to produce good celery by the liberal application of well-rotted barnyard manure. On clay soils there is likely to be injury caused by the soil becoming washed into the hearts of the plants while they are yet small.

Fertilizers.—For the production of the home supply of celery there is no fertilizer that is so satisfactory as well-rotted barnyard manure. In many localities the supply of manure is limited, and it may be necessary to depend almost entirely upon commercial fertilizers. If fresh stable manure is used, it should be plowed under in the autumn. If the manure is well rotted, it may be plowed under early in the spring or used as a top-dressing a short time before planting in order to bring the manure to the surface. From 10 to 20 tons of manure to the acre should be applied each year that the land is planted to celery. The application of lime will

improve most soils. Following the use of stable manure an application of 1,000 pounds of ground quicklime as a top dressing will be beneficial. Soils that are liable to leach during the winter can be held by planting to rye and the crop turned under quite early in the spring. When applied to clay soils the lime has a tendency to lighten them, and sandy soils are rendered more retentive of moisture by the addition of lime. An application of 500 to 800 pounds of common salt to the acre is considered desirable by some growers. Celery will take up a limited quantity of salt, and its flavor is improved thereby.

One to 2 tons of high-grade fertilizer to the acre may be profitably applied on most soils in addition to the stable manure and lime. As a rule, the quick-acting fertilizers are used, and a mixture suitable for growing celery should contain about 6 per cent of nitrogen, 5 per cent of available phosphoric acid, and 10 per cent of potash.

Time and Method of Plowing.—As a rule the land should be plowed several weeks before planting. At the North it is desirable to plow the celery land in the autumn and allow the soil to lie exposed to the action of frost during the winter. At the South it will be necessary to plow but a short time before planting. The plowing should be very thorough, and in most cases with a somewhat heavier plow than that generally used for other crops.

Smoothing and Pulverizing.—A few days before the land is required for planting, the surface should be cut with a disk or cutting harrow, followed by such tools as are necessary to pulverize the soil to a depth of 5 or 6 inches. Just before planting, the land should either be rolled or gone over with a float, or drag, made by nailing together planks or scantlings, in order to secure an even surface for planting.

Marking Rows.—The rows in which the celery plants are to be set should not be marked until a short time before planting, in order that the soil may remain fresh. A marking device similar to the ordinary corn marker may be used, but some form of roller with a number of projecting pegs to form holes in which to set the plants is desirable. A device of this character can be constructed by replacing the wheel of an ordinary wheelbarrow with a roller having a series of pegs.

Selection of Seed.—The first and most important consideration when preparing to grow a crop of celery is the securing of good seed, not merely seed of which a large percentage will germinate, but that having strength and vigor sufficient to give the seedling a good start. As the seeds of celery are very small, it is necessary that only a small percentage of the number usually sown should actually grow in order to secure an abundance of plants; but as low germination and the necessary

vigor are seldom both to be found in the same packet of seed that seed which has a high percentage of germination is preferable.

Sowing for an Early Crop.—For sowing seed during the early part of the season, the plan best suited to the requirements of the farmer or amateur grower of celery is to secure a wooden flat or tray about 16 by 24 inches in size and 3 inches deep, with several small holes in the bottom for drainage. After filling with sifted soil level it off even with the top, and either shake down the soil or press it down by means of a board before the seeds are sown. Either sow in drills 2 inches apart or scatter broadcast, and cover the seed by sprinkling through a fine sieve a very small quantity of leaf mold or sand. This tray can be placed in the window of a moderately warm room in the dwelling, and the soil should be watered by sprinkling very lightly as often as necessary to keep the surface from showing dryness, but the soil should not become waterlogged.

Sowing for a Late Crop.—The method now in use by most large growers is to prepare a tract of land by pulverizing with horse tools and then raking by hand, after which the seed is sown broadcast by means of a wheelbarrow grass-seed drill. The soil is sometimes pressed down with a plank after the seeds are scattered, but some growers maintain that there is a decided advantage in leaving the soil slightly uneven, as the seeds fall into the shaded places and are protected from the direct rays of the sun. The seed will become sufficiently covered by rains or by watering. Should more than 20 per cent of the seed usually sown germinate, it is necessary to thin out to prevent overcrowding, with its attendant injury. To prevent the surface of the soil becoming too dry, it may be necessary to partially shade the young plants during the warm days of early summer, but the shading should never be so dense as to cause them to become "drawn."

Transplanting.—In case the grower adopts the plan of transplanting twice, the seedlings will be ready for the first handling in from four to six weeks from the time the seed is sown. The seedlings may be transplanted to trays or to beds in the open ground. This transplanting answers two purposes: (1) The seedling plant of celery has a straight root, or taproot, which is broken in transplanting, causing a large mass of fibrous roots to be formed. In the case of a plant allowed to remain in the seed bed until planting-out time this taproot has gone far down into the soil and the plant has formed very few side roots; consequently it suffers a great shock in the process of planting in the field, and a large number of plants will need to be replaced. (2) When transplanting twice is practiced there is no necessity for thinning, and a more uniform lot of plants is obtained. Two handlings can not be recommended when celery

is grown on a large scale, as the cost of labor is too great. It is better to have a surplus of plants and to renew those that fail.

Watering.—When the seed bed is prepared, the soil of which it is composed should contain as much moisture as possible and yet be in good condition to handle. After sowing and covering the seeds the bed should be sprinkled lightly. During the period between seeding and the appearance of the plants the bed should be watered only as often as it shows indications of dryness; however, the surface should never become dry. During the first few days a moist cloth may be spread over the surface of the seed bed in order to conserve the moisture, but this covering should be removed before the seedlings begin to appear. After the plants are up, care should be taken not to water too heavily, as the seedlings are liable to "damp off"; but the ground should never become so dry as to check their growth. Celery requires the most water while making its greatest growth, which occurs late in the summer. As the crop approaches maturity the water should be applied sparingly, and it should be withheld altogether for some time before blanching. Among the methods of applying the water, the most simple and usually the most desirable practice, especially where the surface of the soil is even, is to run the water along the rows by means of small furrows, 8 or 10 inches distant on either side of the row. This method is well adapted to use on a gentle slope with the rows running up and down the incline. When the water is sprinkled over the entire surface it should be done late in the day, so that the soil may, during the night, absorb the moisture and prevent a crust being formed, as would be the case were the water applied under the direct heat of the sun.

Growing Without Irrigation.—For a home supply of celery it is often possible to select a rather moist but well-drained piece of land whereon it may be grown without artificial watering. In this case the plants should be set while the atmosphere is filled with moisture, preferably between gentle showers, and the moisture afterwards retained in the soil by frequent shallow cultivation or by the application of a mulch around the plants. This method can not be followed in climates where irrigation is necessary for the production of crops, but is applicable in regions that have an ordinary rainfall during the growing season.

Planting.—For domestic use, where plenty of land is available, it will be found most economical to plant in single or double rows 4, 5 or 6 feet apart, with the plants 5 or 6 inches apart in the row. If the space is limited, solid beds about 5 feet wide will be found suitable, with the plants set 7 or 8 inches apart each way. By planting in rows the crop may be worked with a horse cultivator or a wheel hoe and the banking more easily done, and thus the cost of production is lessened. With the solid-bed system the work must all be done by hand. If possible, the

planting should be done when the soil is rather moist and the atmospheric conditions suitable to the subsistence of the plants until the roots can again furnish sufficient moisture to supply them. The bed should be thoroughly watered a few hours before the plants are removed, and a knife or trowel should be run between the plants so that they may be lifted with a clump of earth and with most of their roots attached.

Mulching.—In muck soils it will not be found necessary to mulch the ground around the plants after setting, but some kind of a covering is desirable on sandy and clay soils. As soon as the plants are in position and before any water is applied, cover the ground for a distance of 8 or 10 inches on either side with any finely divided material that will shade the top of the soil and prevent a crust being formed after watering; half-rotted manure is preferable for this, as it aids the growth by its fertilizing qualities. Good celery can be grown on clay upland with but one watering—at the time of planting—provided that plenty of mulch is applied as soon as the plants are set. The roots of celery, after it is once transplanted, run close to the surface, and the mulch will protect them from the heat of the sun. Among materials that may be used for a mulch may be mentioned pine needles, leaves of any kind, straw, cornstalks run through the cutter, clippings from the lawn, etc., none of which, however, are as good as barnyard manure. Have the material to be used as a mulch near at hand, and as the plants are set cover the soil around them to a depth of 2 inches, bringing the mulching material up close to the plant, but being careful to allow none to get into the heart. Apply the mulch before watering, if possible.

Where celery is planted in single rows and mulched it will only be necessary to maintain shallow cultivation between the rows, not allowing the cultivator teeth to come nearer the plants than the edge of the mulch. Where no mulch is used the cultivation may be carried a little closer to the plants, but should be very shallow, and at no time should deep cultivation be practiced, as the roots are to be found very near the surface of the soil. If a mulch is used no hand cultivation will be required, either along the side or between the plants in the row, except to pull any weeds that may spring up. Where no mulch is used it will be necessary lightly to stir the surface with a wheel hoe or iron rake, to prevent a crust being formed after each rain or watering. Keep the surface of the soil smooth and in no case allow lumps of earth to remain near the plants.

Blanching.—In its original wild state the stems of celery are tough, full of woody strands, of a rank flavor, and green in color, being similar to the outside stems or trimmings of our present varieties. The object of blanching is to secure leafstalks free from woody strands, crisp and

tender, and without the rank flavor found in those that are green. Of the cultivated plant there are two classes of varieties, the large-growing, or giant, and the dwarf sorts. These are again divided into those which must be blanched by excluding all the light and those which are in a measure self-blanching. Of the former the Giant Pascal variety is a type, and of the latter the Golden Self-Blanching variety is a good illustration.

Blanching is accomplished by the same general method that is employed for destroying the coloring matter in any plant tissue, that is, by excluding the light and allowing the growth to proceed in the dark. The particular method to be adopted must be determined largely by the time when the crop is to be used. If for early use or marketing, the blanching must be completed where the plants are grown; but if the celery be for winter use the blanching may take place after the crop has been removed from the field and placed in storage. In fact, it is best to blanch as little as possible before storing when the product is to be kept until late, as the keeping qualities are better while it is unblanched. When planting for early use it is necessary to choose one of the self-blanching varieties, such as may be conveniently blanched by the use of boards or other similar means.

For early blanching on a small scale, such as would be employed on the farm or in the garden of the amateur horticulturist, there are several methods. One of the most common is by means of boards placed on edge along each side of the row.

After the boards are in position it is a good plan to run a celery hiller between the rows and to throw a little soil against the lower edges of the boards to close any openings that may result from the uneven surface of the soil.

Two or three weeks' time will be required to complete the blanching of the early varieties, and the boards must be kept in position until the crop is removed from the ground, after which they may be used again two or three times during the season. If the celery is allowed to remain in the boards too long after it has reached a marketable stage, it loses in weight and flavor and is liable to be injured or even destroyed by the attacks of blight. This is especially true during the earlier part of the season, when the weather is warm. At the end of the season the boards should be piled flat, with strips inserted at every fourth or fifth course, and the whole pile roofed over to shed off rain; treated in this manner they will last from ten to twelve years.

Perhaps the most satisfactory way of blanching early celery on a small scale is by means of ordinary farm drain tiles of about 4 inches inside diameter, placed over the plants after they have become almost fully grown. To facilitate the work of placing the tiles over the plants,

some of the outside leaves should be pulled away and the main part of the plant loosely tied together by means of a soft string, or, better, with what is known as paper twine, being a string made by twisting a strip of soft paper. This string will lose its strength as soon as it becomes wet, and will offer no resistance to the further growth of the plant. If the common, unglazed tiles are used the evaporation from their surface has a tendency to keep the plant cool during the heat of the day, and a very crisp and tender product is the result. This method of blanching is desirable also on account of its cleanliness, as celery treated in this way will need very little washing before marketing.

The most common method for blanching celery on a small scale is that of banking with soil, and it is by this means that the finest flavor can be obtained. Where the plants are set in single rows the soil can often be partially thrown up by means of a plow, or, better, by a celery hiller. Before the plow or banking machine is used a small quantity of dirt must be placed around the plants by hand to hold them in position while the earth is being thrown around them. This may also be accomplished by tying up the plants with paper twine, as previously recommended for use in connection with tiles.

Storing.—The plan usually adopted where but a small quantity of celery is to be stored for winter use is to bank up with earth and cover the plants where grown. Place enough earth around the base of the plants to hold them in good form, and then allow them to remain without any further banking as long as there is not danger of a hard frost. Celery may be safely stored in cellars provided the temperature is kept low and plenty of ventilation maintained. The warmth and dampness of the ordinary cellar have a tendency to cause the celery to decay, but these conditions can frequently be overcome. Celery will readily absorb any odor that may be present in the atmosphere of the storage place, and care should be taken to provide sanitary conditions. When storing in a cellar, the plants should have most of their roots attached, and a bed of moist sand in which to set them should be provided.

CELERY BANKED WITH EARTH TO BLANCH IT

Preparing Celery for Market.—In preparing it from the rows where grown, it is not necessary to remove the entire root from the earth, but it may be cut off just below the surface of the soil by means of a stiff knife. Remove the outside leaves and trim the root evenly, pack in boxes, and load on the wagon for removal to the washing house. The blanching boards should not be removed till necessary, and the trimmed celery must not be allowed to lie exposed to the sun or wind for any length of time. It is well also to have a piece of canvas to protect the celery while it is on the wagon on the way to the washing house. In marketing from the trenches the process is practically the same as from the rows, except that the celery is already loosened from the soil and the roots can be removed more easily. Upon reaching the washing room the celery is placed upon a rack consisting of wooden slats over a large trough and subjected to a spray of cold water to cool it and to remove the adhering soil. After washing, it is allowed to drain; then it is tied in bunches of 12 or more plants each, according to the size. The bunches are packed 6 in a box for first-grade celery and 8 or 9 for second or third grades. These boxes should be practically air-tight, and a lining of paper should be placed in them before packing the celery, or each bunch should be wrapped separately. The celery should be nearly dry before it is placed in the boxes, and throughout the entire handling must be kept as cool as possible.

Sanitary Conditions.—It is essential that the celery should be washed in pure water to prevent the transmission of disease germs. Any germ, such as that producing typhoid fever, which is found in contaminated water, is readily carried to the digestive system of the consumer, and may or may not produce an attack of the disease,

according to the strength of the person to resist it. The washhouse and its surroundings should be kept clean and free from any decomposing materials. Shippers and dealers alike lose sight of the fact that the edible portion of celery is constantly being exposed to the contaminating effects of dirty wagons, unclean cars, and dusty markets. Many persons have discontinued the use of celery on account of the unclean condition in which it is served. This statement holds good for all vegetables that are served in the raw state, but it is especially applicable to celery.

Estimates of Returns.—Anyone contemplating making a start in celery growing will do well to first investigate the market prospects, and unless satisfactory shipping arrangements can be made beforehand the crop should be planted only on a small scale for one or two years, until a local trade can be established. It is fair to estimate a return of 1,500 dozen from 1 acre; and this should bring 25 cents per dozen, at the lowest average estimate; this will yield a gross income of $375 to the acre, leaving a net balance of $125 to cover the interest on the investment and the profit. As a matter of fact, the growers who are making a success of celery raising—and many are doing so—receive a net profit of $100 an acre over and above the interest on the investment. On the other hand, hundreds of acres are grown annually which do not much more than pay expenses, but this is due to the fact that the soil has become exhausted and the product is consequently undersized and inferior.—(F. B. 255, 282; Cornell E. S. 132; Colo. E. S. 144.)

CETEWAYO, OR ZULU, POTATOES.

The Cetewayo, or Zulu, potato, a wild variety of *Solanum tuberosum* found in Africa, is sometimes grown as a garden vegetable for its flavor and novelty. It has practically the same percentage composition as the ordinary potato. When cooked, the flesh is purple in color, but when brought in contact with vinegar, as in salads, it turns red.—(F. B. 295.)

THE CHAYOTE.

The chayote suggests the cucumber rather than any other of the cultivated plants of the same family, but is a larger and more vigorous plant, climbing widely by means of numerous branched tendrils. When grown under ordinary garden conditions the cultural requirements of the chayote may be said to be two in number: (1) A somewhat sheltered situation and (2) something to climb upon. While the vine will not refuse to grow without these advantages, the results will not be satisfactory. Like many climbing plants, the chayote is very susceptible to injury from the wind, while, unlike many Cucurbitaceae, it does not seem to take kindly to creeping upon the ground, at least in the Tropics. In the

different parts of the world the chayote has been found to grow upon a great variety of soils, though it is generally considered to thrive best in a loose sandy or loamy substratum, providing sufficient humus or other fertilizing material be at hand. Although it has been found possible to secure plants from the seed when planted alone, or even from the embryo when carefully extracted from its seed coats, it is the universal practice to plant the entire fruit. The fruit should be gathered before fully matured, because of the tendency to germinate. It is like the cucumber, edible at any stage of growth, and may be picked when large enough. The chayote is a good shipper and may be shipped in bulk in vegetable crates, wrapped and well packed; cold storage will not be necessary.—(Dept. Ag., Div. of Botany 28; P. Rico A. E. S. 7).

CHERVIL.

Under the name of chervil two distinct plants, known as salad chervil and the turnip-rooted chervil, are cultivated. The seeds of the salad chervil are sown in spring and the crop will thrive on any good garden soil. The seeds of the turnip-rooted chervil should be sown in the early autumn, but they will not germinate until the following spring. The edible part of this plant is the root, which somewhat resembles the carrot and is used in the same manner. The leaves are used the same as parsley for garnishing and in flavoring soups.—(F. B. 255.)

CHICORY.

Chicory is grown for two or three purposes. The root of this plant is the common adulterant of coffee, and large quantities are used for this purpose. The commercial growing of chicory is confined to a few sections, as the crop will not thrive on every kind of soil. A deep, rich loam, without excessive amounts of clay or sand, is desirable, and soil that is not too rich in nitrogenous matter is best suited to the production of roots. The roots are frequently placed in soil under a greenhouse bench or in a warm cellar and covered with a foot or more of straw, or with a light covering of straw and then several inches of warm manure. Under this covering the leaves will be formed in a solid head, which is known on the market as witloof. Chicory has run wild in some parts of the country and is considered a bad weed. The handsome blue flowers, which are borne the second season, are very attractive. As a pot herb chicory is used like spinach, but the leaves should be boiled in two waters to remove the bitter taste. As a salad the roots are dug in the autumn and planted in cellars or under a greenhouse bench, where they produce an abundance of blanched leaves, which are eaten raw. The blanched leaves are also boiled and used as greens.—(F.B. 255; U. Idaho E. S. 10.)

CHILE.

The chile is used in many different ways and it is quite an important article of food among the Spanish speaking population in the Southwest and in Mexico. It is eaten both in the green and ripe state. It may be grown on ridges or in level plats. The former method is the more common in New Mexico. In the spring after the ground has been plowed and leveled (the plowing of the land can be done in the fall or winter) and just a little before planting the ridges are made. These ridges may vary in height from 8 to 12 inches. It is better to irrigate the ridges before planting, though this is not always done. The object of irrigating before planting is to get the water mark on the side of the ridges and to settle the newly plowed soil somewhat. As soon as the soil is dry enough so it can be worked, which is generally from four to seven days, the seed is planted usually on one side of the ridge and just above the water mark. The seed is planted by hand in hills about every two feet in the row. The chile does not stand freezing weather, though it will stand a little more cold than tomatoes. For the convenience of intending chile growers the following table which gives the number of hills per acre at different distances has been prepared:

Distance.				Number of Hills per Acre.
3½	feet between rows	× 2	feet in the row	6222
3½	feet between rows	× 2½	feet in the row	4978
4	feet between rows	× 2	feet in the row	5445
4	feet between rows	× 2½	feet in the row	4356

Planting.—The seed is planted on the side of the ridge, when the ridge method is practiced. The southern exposure of the ridge is always preferable since this is usually warmer and the germination, other factors being uniform, is quicker. If level culture is practiced there is no choice of exposure. Whatever method of planting is followed care should be taken not to bury the seed too deeply. As a general thing the seed should not be deeper than three-fourths of an inch to an inch and a half. Shallower planting, if the moisture is kept normal, will give quicker and better germination. More seed is required per acre when the planting is done by hand on the ridges than when it is drilled with a garden drill in plats.

Thinning.—Chile started from seed planted in the field must be thinned to one or three plants to the hill. When the chile has been thinned out properly the plant or plants in the hill branch out considerably and produce a heavier and better crop. If too many plants are left to the hill there is a marked tendency for the plants to grow too tall and more or less top heavy. The chile is thinned out when about 3 to

5 inches high. If a good germination takes place it is more difficult to thin the chile, because there are more small plants to the hill to be pulled out. Care should be had in selecting the strongest plants in the hill and in injuring as little as possible the roots of those which remain. While the common way of growing chile is to plant the seed out in the field in the spring, it can also be grown by starting the plants in cold frames early in the season and transplanting to the field as soon as danger of frost is over.

Irrigation.—After the irrigations to get the crop started have been given, the frequency of the subsequent irrigations depends upon the weather and soil conditions, and for that reason no specific statement can be made just when and how often the chile should be irrigated. One thing, however, is important to keep in mind, and that is that the chile plant keeps bearing as long as it is growing. If the growth should be checked by the lack of irrigation the plant stops bearing and the blossoms and the very small pods are likely to drop off. The grower himself should study his local conditions and decide for himself when and how much to irrigate. While the chile plant resists considerable drought, at the same time, it should not be allowed to suffer from the lack of irrigation. When the chile is grown on ridges the space between the ridges should be allowed to fill with water almost up to the plant. If the water is simply turned in and allowed to rush down the furrow to the other end the ridges will remain practically dry, necessitating frequent irrigations to keep the plants from suffering. In irrigating the chile on ridges always aim to hold the water long enough in the furrow for the ridges to get fairly well soaked through. In the level plat the irrigation is more simple and the soil around each hill gets wet sufficiently while the water is running down to the end of the plat. When the plats are quite long and are made up of a series of squares as soon as each square is filled with water the border, dividing that square from the next one, is cut and the water rushes into the next square which is treated the same as the one before.—(N. Mex. Col. Ag. and Mech. Arts 67.)

CHIVE.

This is a small onion-like plant having flat, hollow leaves which are used for flavoring soups. The chive rarely forms seeds, and it is propagated by the bulbs, which grow in clusters. The leaves may be cut freely and are soon replaced by others.—(F. B. 255; S. Dak. E. S. 68.)

CITRON.

The citron is a type of watermelon with solid flesh which is used for preserves and sweet pickles. The rind of the watermelon is frequently

substituted for citron. The cultivation of the citron is the same as for the watermelon.—(F. B. 255; U. Idaho E. S. 10.)

COLLARDS.

The culture and uses of collards are the same as for cabbage and kale. Collards withstand the heat better than either cabbage or kale, and a type known as Georgia collards is highly esteemed in the Southern States. Collards do not form a true head, but instead a loose rosette of leaves, which, when blanched, are very tender and of delicate flavor.—(F. B. 255; U. Idaho E. S. 10; P. Rico A. E. S. 7.)

CORN SALAD.

Corn salad is also known as lamb's-lettuce and fetticus. Sow the seed during the early spring in drills 14 to 18 inches apart and cultivate the same as for lettuce or mustard. For an extra early crop the seed may be planted during the autumn and the plants covered lightly during the winter. In the Southern States the covering will not be necessary and the plants will be ready for use during February and March. The leaves are frequently used in their natural green state, but they may be blanched by covering the rows with anything that will exclude the light. Corn salad is used as a salad in place of lettuce, or mixed with lettuce or water cress. The flavor of corn salad is very mild, and it is improved by mixing with some other salad plant for use. It is also boiled with mustard for greens. —(F. B. 255.)

CRESS.

Under the name of cress there are two forms, the water cress and the upland cress. The upland cress, sometimes called peppergrass, is easily grown from seed sown in drills a foot apart. As the plants last but a short time, it will be necessary to make a sowing every few days if a continuous supply is desired.

Water cress can be grown all the year in small open ditches containing running spring water. It is best and most easily produced in water from rather warm springs in limestone regions. A sufficient supply for family use can be grown in a small spring-fed brook, and the plants may be started either from small pieces of plants or from seed. Cress is used in salads, to which it imparts a pleasant pungency.—(F. B. 255; U. Idaho E. S. 10; P. Rico A. E. S. 7.)

CUCUMBERS.

Soil.—The soil best adapted to the cultivation of cucumbers in the open is a light sandy loam, one which responds quickly to temperature and fertilizer. Such soils are prepared early in the season and thrown into gentle undulations, so as to produce slight ridges upon which to plant the seed to insure good surface drainage.

Fertilizers.—The soil for cucumbers should be made very rich by the annual application of heavy dressings of stable manure to be incorporated with the soil. During the time it is not occupied by cucumbers or lettuce, cowpeas are frequently grown upon the area and turned under prior to planting a fall crop of lettuce. In addition to this, liberal applications of a fertilizer carrying a considerable percentage of nitrogen are employed.

Planting.—There are almost as many methods of planting cucumbers as there are growers. Some plant in hills the standard distance of 6 feet apart each way; others plant in hills 6 feet apart in one direction and 2 or 3 feet apart in the row, while others plant in drills or broad belts 6 feet apart and chop out the plants to stand about a foot apart in the row after all danger from insect depredation has ceased. The methods which seem most economical under the conditions at hand will of course be adopted by the grower. In outdoor culture the cucumber is frequently used as a companion crop to other crops, like beans. Beans being of rapid growth come on quickly and form a partial protection or wind-break for the young cucumber plants. When arranged in this way, cucumbers are planted in drills or in hills 6 feet apart and a row of beans is placed between two rows of cucumbers, a method which insures a very complete and satisfactory use of the ground. The quick maturity of the beans allows them to be harvested and entirely removed from the area before it is required for the cucumbers.

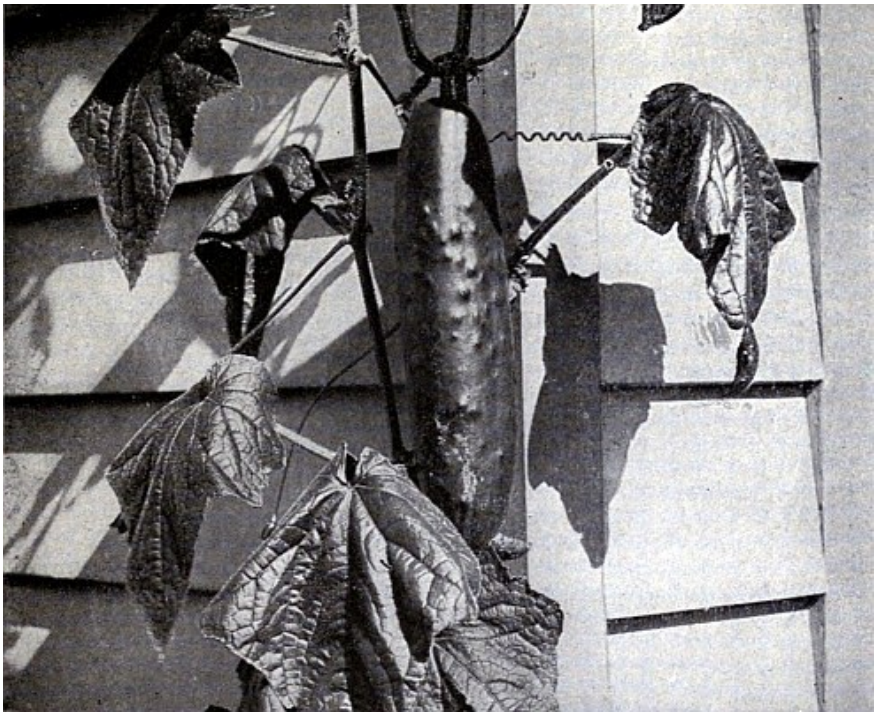
Harvesting.—Cucumbers intended for pickling purposes are harvested when they have attained a length of from 2½ to 5 inches. Because such cucumbers are bought by weight it will readily be seen that the small-sized pickles are less profitable to the grower than the larger ones, and in order to secure them before they have attained an unsalable size it is necessary that the picking be repeated at frequent intervals, as cucumbers grow rapidly and a delay of twenty-four to forty-eight hours in harvesting would render many of them unsalable. It is therefore necessary to have regular intervals to harvest certain areas of the patch and to continue this routine throughout the bearing season. Another point which is of prime importance in the management of the cucumber patch is that none of the fruits be allowed to come to maturity. The ripening process, which means the development and maturing of the seeds, produces a heavy strain upon the growing plant, the life and yield of the plant being in proportion to the number of fruits which are

allowed to ripen. If no fruits are allowed to come to maturity the plants will remain green and in an active vegetative condition longer and will produce a much larger aggregate number of fruits.

Dill Pickles.—Dill pickles, which are much prized and command the highest price among pickles, can be made from fresh cucumbers as they come from the vines, or from vat stock which has been carried for some time at the salting station.

Cucumbers Grown in Cold Frames for Market.—Soil for use in cold frames should be a well-enriched sandy loam of the type of the usual sandy loam. If it can be dark in color, this is an advantage. If normally light, the color can be changed by the addition of muck or by incorporating well-decomposed stable manure with the surface soil. A dark color is of some advantage in helping to raise the temperature in the frames under the glass.

Watering.—Since the glazed sash prevent the soil beneath them being moistened by natural means—that is, by rain or dew—it is necessary that means be provided for watering or irrigating the plants. This can be done by arranging pipes upon the surface of the ground or at a convenient height overhead, so as not to interfere with cultivation, from which water can be drawn to sprinkle the surface of the beds at desired intervals and as the plants may require. The work of watering should, however, be very carefully done. The same general precautions necessary for the care of plants in cold frames should be observed—that is, to do the watering in the morning on bright days only, when air can be admitted and when the sun will soon dry the moisture from the leaves of the plants. In this way much can be done to protect the plants from injury from such diseases as the damping-off fungus and mildew.



JAPANESE CLIMBING CUCUMBER NEARLY SIX FEET FROM THE GROUND

WELL-GROWN CUCUMBERS

Ventilation.—Besides the precautions to be observed in watering plants in cold frames, extreme care is necessary to give the plants sufficient air to keep them in a healthy condition. If the atmosphere is allowed to become close and very hot, the plants will be weakened and thus rendered more susceptible to the attacks of plant diseases.

Forcing Cucumbers Under Glass.—Forcing is a technical term used by gardeners to designate the growing of plants out of their normal season under an artificial environment. The cucumber is one of the few garden plants which lend themselves to this manner of cultivation in addition to their more extensive cultivation in the open ground. Under the stimulus of forcing work, two distinct types of cucumbers have been developed. These are recognized in the trade as the English type and the American type. The English type is purely a product of forcing-house conditions, as the climate of England is not congenial to the growth and development of the cucumber in the open. The American type of cucumber is primarily a product of field conditions, and the few varieties which have been developed to meet the requirements of the forcing house are simply modifications of the existing field or outdoor forms. The English type of cucumber is a long, cylindrical, uniformly green fruit, with few seeds and a very fleshy seed cavity; in fact, the normal seed cavity of the forced cucumber is almost entirely wanting. The triangular shape characteristic of the normal outdoor cucumber has been lost, and the cylindrical outline almost perfected. There is considerable difference in the size and length of the various English varieties of cucumbers. The American type of cucumber is primarily grown in the field, the product to be used either for pickling or for slicing. Forcing cucumbers in America is confined to those varieties which produce large fruits suitable for slicing. Only three or four of the better and larger field varieties are adapted to this purpose. Notable among these is the White Spine, the Arlington White Spine being the variety which has been especially developed for forcing. The Long Green, or a modification of it, is also sometimes used, but aside from these two varieties there are few that ever find their way into the forcing house. Such varieties as the Boston Pickling, Chicago Pickling, and the cluster varieties in general are not adapted to forcing purposes. The forcing of cucumbers presupposes that an adequate forcing house or greenhouse is at hand for such work. The chief desideratum in a forcing house for cucumbers is a maximum amount of light, sufficient headroom, and adequate radiation to maintain a temperature varying from 65° to 85° F. The amount of radiation will, of course, depend upon the style of heating employed, whether steam or hot water, and upon the location of the greenhouse, whether at the north or the south; the outside temperature determining to a considerable extent the amount of radiation required in the house to maintain a given degree of heat.

Propagation.—There are a number of methods of propagation followed by successful cucumber growers, all of which have some advantages. Three of the more common practices are as follows: (1) To plant the seeds of cucumbers in the soil of the bench where the plants are to grow and mature; (2) to plant the seeds of the cucumbers in 3-inch or 4-inch pots filled about half full of soil and after the seeds have

germinated and the hypocotyl or stem of the seedling has elongated to fill the pots well up to the seed leaves with soil; and (3) to plant the seeds in cups similar to those used for harvesting strawberries, except that the cups for this purpose are usually made of Georgia pine. In the first case, where the seeds are planted directly in the soil on the benches, cucumbers are usually employed as a crop to follow lettuce, seeds being planted in the lettuce benches before the crop is entirely removed, heads of lettuce being taken out at proper distances to allow for the correct spacing of the cucumber plants, and the seeds of cucumbers planted in the areas so left. In the other two cases the rearing of the plants for forcing purposes can be carried on in a small house especially designed for this purpose or in a general propagating house, thus obviating the necessity of heating and maintaining normal conditions in the growing house during the period previous to which the plants begin to run.

Planting on the Benches.—As soon as the plants show well-developed runners and are 10 to 12 inches long they should be placed in their permanent position upon the greenhouse benches. Plants grown in pots must be carefully removed from these receptacles to the bench, but those grown in the wooden cups above referred to can be planted, cup and all, in the soil of the bench. The utmost care should be exercised to keep the plants of the cucumber growing rapidly at all times. If cucumbers receive a severe check or are placed under conditions which are not entirely congenial to them, they are liable to become dwarfed and stunted, and as soon as vigorous growth ceases they become the prey of the melon aphis, mildew, and other pests and diseases which are so annoying to growers of cucumbers under artificial conditions.

Distance to Plant.—After the plants have attained a height of 10 or 12 inches and are in a vigorous growing condition they should be placed about 15 or 18 inches apart in single rows upon the side benches of the greenhouse, which are normally 3½ feet wide, or if planted on 8-foot benches they should be planted about 10 or 12 inches from the edge of the bench and 15 to 18 inches apart and parallel with the edge of the bench. In the broad benches, where more than a double row can be carried, plants can be set about 18 inches apart and in rows about 2 feet apart. A satisfactory plan for an 8-foot bench will be a row parallel with and 10 inches from each edge of the bench and a double row 18 inches apart through the middle of the bench. It is well, however, to allow as much space as possible. The cucumber is a rank-growing plant and many side branches will develop if sufficient space is allowed.

Training the Plants.—As soon as the plants show a tendency to run they should be trained so as to keep them from becoming unduly tangled and in order to fill all the space upon the trellis. Galvanized wires No. 16 can be run lengthwise of the house and stapled to the supports, which

should be placed about 6 feet apart. Upon side benches which are elevated it will be necessary to train the cucumbers to the framework of the greenhouse. For this purpose screw eyes about 8 inches in length can be placed in the sash bars at intervals of 4 or 5 feet and the parallel wires to which the vines are to be tied stretched 12 inches apart lengthwise of the house through these screw eyes and firmly fastened at the ends. The vines should then be loosely tied to the supporting wires with raffia or soft cotton yarn. When the fruits become heavy, as in the case of the English varieties, it will become necessary to truss them to prevent their weight breaking the vines. Heavy fruits will cause the supporting wires or bands of raffia to break or girdle the vines unless they are supported independently. The American varieties seldom attain sufficient size to require this precaution. Fruits of these varieties as soon as they are 8 to 10 inches in length and 2 inches in diameter are harvested for market. The vines are usually sufficiently strong to withstand the weight of fruit of this size.

Pollination.—The cucumber, like the other members of the gourd family to which it belongs, bears two kinds of blossoms on widely separated parts of the plant. The staminate or nonfruit-bearing flower is the first to appear and is in general borne near the base of the plant. The pistillate blossom with the embryo cucumbers at its base appears later and is borne near the extremity of the newly forming and rapidly growing shoots. Since these flowers are normally produced in this way, it is necessary that a transfer of pollen be made from the staminate to the pistillate flowers throughout the agency of insects or by other artificial means. Under greenhouse conditions and at the time of year that the cucumber is forced it is necessary to provide for pollination. In small establishments this work can be done by hand. The staminate blossoms are removed, the petals turned back so as to allow the anthers to project, and the pencil thus produced is then thrust into the cup of the pistillate flower in such a way as to distribute pollen upon the stigma of the pistillate flower. In large establishments where hand pollination is out of the question a colony of honey bees is placed in each house to accomplish the work.—(F. B. 254, 255; Mass. Ag. Col. E. S. 87; Iowa Ag. Col. E. S. 47.)

DANDELION.

Sow the seed of dandelion in spring in drills 18 inches apart, covering it one-half inch deep. Thin the plants to about 12 inches apart and give good clean cultivation throughout the summer. In the colder parts of the country it may be desirable to mulch slightly during the winter to prevent the plants heaving out of the soil. Early the following spring the plants will be ready for use as greens, but they are greatly

improved if blanched by setting two boards in the forms of an inverted letter V over the row. The blanching not only makes the leaves more tender but destroys a part of the bitter taste. Dandelion greens should be boiled in two waters to remove the bitterness.—(F. B. 255-68; S. Dak. 68; U. Id. E. S. 10.)

DILL.

Grown as fennel which it greatly resembles, both being well known herbs used for flavoring pickles, and both being of unsurpassed hardiness.—(Mich. E. S. 20.)

EGG PLANT.

This delicious vegetable is not so much cultivated in our gardens as it should be. This has arisen largely from the difficulty of getting the plants from seed in the open ground. If you have no greenhouse, hotbed, nor frame, it will be best to buy the plants at setting-time from some one who grows them early in pots. Plants pulled from a bed are seldom worth planting, as the egg plant is slow to recover from a serious check.

Kind of Soil.—A sandy loam will be found excellent soil; this should be well drained and have a moist subsoil. Land that has been drained, if all other conditions are proper, will make an excellent field. This plant is a deep feeder, so that the land should be plowed as deeply as possible. A new field should not be taken, while one might succeed, the chances are not so good as on an old and well-tried piece of land. Be sure that all rubbish and matter that could interfere with cultivation has been removed. Fertilize the field broadcast; there is little or no danger of the plants failing to get the food if it is in the soil. The best way is to apply the fertilizer just before plowing the field, and then apply a smaller amount where the plants are to stand; work the fertilizer in well a week or two before setting out. Lay the land off into rows four feet apart, and set the plants three or four feet apart in the row. At convenient distances a row may be skipped to make a road to gather the crop. After the crop has been planted there is little or no use for a hoe; the plow can and ought to do the work. No weeds should be allowed to show more than the seed leaves, and the ground should be kept mellow enough to let a person sink nearly to the ankles in dry times. When the fertilizer has been applied properly the roots will seek the deeper soil, and the ordinary horse cultivator will not reach them at all. Eggplant raising pays best under high cultivation. By replenishing the fertilizer, plants may be kept in bearing until frost kills them in the fall, but it will be found more profitable to renew the field, if a summer or fall crop is

desired.—(U. Id. E. S. 10; N. C. E. S. 132; Fla. E. S. 31; F. B. 255; Iowa E. S. 47.)

ENDIVE.

The endive is a form of chicory. Sow the seeds thinly in drills, and when the plants are well established thin to 8 inches. Water and cultivate thoroughly in order that a good growth of leaves may be made. When the leaves are 6 to 8 inches in length draw them together and tie them so the heart will blanch. The leaves should not be tied up while wet or decay will follow. The heads should be used as soon as blanched. For winter use sow the seeds rather late and remove the plants, with a ball of earth adhering to the roots, to a cellar or cold frame, and blanch during the winter as required for use. Endive is used as a salad at times of the year when lettuce and similar crops are out of season.—(F. B. 255; U. Id. E. S. 10; S. Dak. E. S. 68.)

FENNEL.

Cultivated for the sweet aromatic foliage and fruit is an herb used for flavoring pickles.—(Mich. E. S. 20.)

GARLIC.

Garlic is closely allied to the onion, but will remain in the ground from one year to another if undisturbed. Garlic is planted by setting the small bulbs, or cloves, either in the autumn or early spring. The culture is practically the same as for the onion. The bulbs are used for flavoring purposes.—(F. B. 255.)

GINGER.

Ginger, the underground root stock of *Zingiber officinale*, is perhaps most commonly used dry as a spice, though the fresh root or green ginger is common in autumn, being used in pickle making, preserving, and in other ways. The young and tender ends of the branching root or rhizome, called ginger buds, are the most delicate portion as regards both texture and flavor. Large quantities of ginger root are preserved in rich sugar syrup, the round stone jars of "Canton ginger" being an old-fashioned confection which is still much prized. The crystallized or candied ginger is even more common and is frequently served as a sweetmeat, and is also used in making deserts of various sorts.—(F. B. 295.)

HERBS.

To this group belong a number of plants hardly recognized as vegetables in the common use of the term, yet of sufficient importance to entitle them to a corner in the family garden. The herb garden or "patch" is too often considered a worthless gift or fashion handed down from grandmother's day. In every well ordered garden there should be a few of the common herbs. The same conditions concerning care, cultivation, etc., will answer for all. The site selected should be out of the way so that it may not be disturbed. As the bed is to be permanent it should be made fertile and cultivated deeply. In sowing classify according to whether they are annuals or perennials. The plants may be grown from seed but whenever possible, propagation by root division is much more easy and certain. In autumn before frost the leaves and stems of those desired for winter use should be gathered, tied in small bunches and hung up to dry in an airy room. Where the seed is desired, it should be allowed to ripen and harvested.—(U. Id. E. S. 10; S. Dak. E. S. 68; N. C. E. S. 132.)

ICE PLANT.

This plant (*Mesembryanthemum cristallinum*) gets its name from the crystalline ice-like covering of the leaves. In hot countries the leaves are used as a salad or boiled the same as spinach.—(S. Dak. E. S. 68.)

HORSE-RADISH.

This plant will thrive best in a deep, rich soil, where there is plenty of moisture. The rows should be 3 feet apart and the plants 12 to 18 inches apart in the row. Tops cut from large roots or pieces of small roots are used for planting. A comparatively few hills of horse-radish will be sufficient for family use, and the roots required for starting can be secured of seedsmen for 25 or 30 cents a dozen. This crop will require no particular cultivation except to keep down the weeds, and is inclined to become a weed itself if not controlled. The large fleshy roots are prepared for use by peeling and grating. The grated root is treated with a little salt and vinegar and served as a relish with meats, oysters, etc. The roots should be dug during the winter or early spring before the leaves start. After being treated with salt and vinegar the grated root may be bottled for summer use. As this has always been considered strictly a cold-weather plant, is would seem useless to try to grow it in Porto Rico, but, as it gave very favorable results at this station, it can no doubt be produced for local consumption. It is practically unknown in Porto Rico, but most people acquire a taste for it, and foreigners, who are used to it in their native country, will find it very gratifying that they can grow it here. In the North it thrives in any soil from a light sand to a heavy clay, but prefers a medium heavy loam. Here it grows luxuriantly in heavy

clay but may not do so well in sand. It is planted from cuttings of the lateral roots, which should be from 4 to 6 inches long and planted at a distance of 12 to 15 inches in rows 24 to 30 inches apart. Root cuttings can be obtained either in spring or fall from any seed firm, and these should be planted when received. The roots can be dug when large enough for use or can be left in the ground until wanted.—(F. B. 255: U. Id. E. S. 10; P. Rico E. S. 7.)

KALE, OR BORECOLE.

There are a large number of forms of kale, and these are thought by some to be the original type of the cabbage. Kale does not form a head and has convoluted leaves and thick leaf stems. It is cultivated the same as cabbage, but may be set somewhat closer. This crop is very hardy and will live through the winter in the open ground in localities where freezing it not too severe. The flavor of kale is improved by frost. Kale is used for greens during the winter, and as a substitute for cabbage.—(F. B. 255; N. Car. E. S. 132; U. Id. E. S. 10.)

KOHL-RABI.

Kohl-rabi belongs to the same class as cabbage and cauliflower, but presents a marked variation from either. It is, perhaps, half-way between the cabbage and turnip, in that its edible part consists of the swollen stem of the plant. For an early crop, plant and cultivate the same as for early cabbage. For a late crop or for all seasons in the South the seed may be sown in drills where the crop is to be grown and thinned to about 8 inches apart in the row. The rows should be from 18 to 36 inches apart, according to the kind of cultivation employed. The fleshy stems should be used while they are young and quite tender. Prepare kohl-rabi for the table in the same manner as turnips, which it very much resembles when cooked.—(F. B. 255; U. Id. E. S. 10; Mich. E. S. 20; N. C. E. S. 132; La. E. S. 90.)

LEEK.

This plant belongs to the same class as does the onion, but requires somewhat different treatment. Leeks can be grown on any good garden soil and are usually sown in a shallow trench. The plants should be thinned to stand about 4 inches apart in the row and the cultivation should be similar to that for onions. After the plants have attained almost full size the earth is drawn around them to the height of 6 or 8 inches to blanch the fleshy stem. The leek does not form a true bulb like the onion, but the stem is uniformly thick throughout. Leeks are marketed in bunches like young onions, and they may be stored the same as celery

for winter. Leeks are used for flavoring purposes and are boiled and served with a cream dressing the same as young onions.—(N. Car. E. S. 132; La. E. S. 90; F. B. 255.)

LETTUCE.

This crop attains its best development in a rich sandy loam in which there is plenty of organic matter. Lettuce thrives best during the early spring or late autumn and will not withstand the heat of summer. In order that the leaves may be crisp and tender, it is necessary to force the growth. The usual method of growing lettuce for home use is to sow the seeds broadcast in a bed and remove the leaves from the plants as rapidly as they become large enough for use. A much better method is either to thin or transplant the seedlings and allow the plants to form rather compact heads and then cut the entire plant for use. In the Southern States the seeds may be sown during the autumn and the plants allowed to remain in the ground over winter. At the North the seeds may be sown in a hotbed or cold frame and the seedlings transplanted to the open ground, or the seeding may be in rows in the garden and the plants thinned to 5 or 6 inches in the row. Lettuce may be grown in rows about 12 inches apart. In order to produce crisp and tender lettuce during the summer months, it may be necessary to provide some form of partial shading.—(F. B. 255; N. Y. E. S. 208; N. Car. E. S. 147; Tenn. E. S. 2; Purdue Ind. E. S. 66 and 84; Kas. E. S. 70.)

LLEREN (*Calathea allouya*).

This vegetable, although cultivated in Porto Rico for a long time, is not extensively known. The plant at a cursory glance resembles a canna. The edible tubers, which are formed in great profusion, can be eaten boiled like potatoes; but, unlike potatoes, they do not become soft, but appear hard and crisp after prolonged boiling. Lleren somewhat resembles boiled sweet corn in taste, and most people pronounce it delicious without needing to acquire a taste for it. The best soil for lleren is a rich, moist, well-drained loam, which is usually benefited by an application of wood ashes or sulphate of potash; an excess of nitrogen causes the production of large tops and few tubers. The stools or roots immediately adhering to stalks are the parts used for propagating; the tubers will not germinate. Lleren should be planted at intervals of 2 feet in rows 4 feet apart, and cultivated like any other vegetable. It requires ten to fifteen months to mature tubers, which are ¾ to 1 inch in diameter, and may be harvested at any time when large enough, but can be left in the ground for a long time without spoiling. It is a good shipper and if introduced into the northern market it would soon create a demand.—(P. Rico E. S. 7.)

MARTYNIA (*Unicorn Plant*).

The curious, long beaked fruit is used for pickles. The plants are quite hardy and ornamental, the fruit being no less conspicuous for its odd shape than the large wax-like flowers of whitish color with purple and yellow spots.—(Mich. E. S. 20.)

MELON—MUSK.

Soil and Location.—The soil for muskmelons must be well drained and contain an abundance of humus and readily available plant food. If these conditions are met, it matters little what the particular type of soil may be. A knoll or ridge sloping gently to the south and protected by timber on the north and west furnishes an ideal site for melons. Such a location will usually produce earlier melons than a north or west slope and is better than a level area because the soil dries out more quickly after a rain, thus permitting more timely tillage in a wet season, and resulting in the production of melons of better flavor. It is only in dry seasons that low, flat land, unless thoroughly tile-drained, produces good melons. The condition of the soil in reference to its supply of humus has a marked influence upon the welfare of the melon crop. Because of its abundance of humus, newly cleared timber land is well adapted to melon culture, but is difficult to work on account of the stumps and roots. Land slightly deficient in humus can be put in condition for growing melons by plowing under a clover sod, or a crop of cowpeas or rye, or a coat of manure applied broadcast. If melons are to be grown as one of the crops in a regular rotation, they should constitute the crop immediately following the leguminous crop designed to add humus and nitrogen to the soil. In regions where winter wheat and clover are grown, a rotation of wheat, clover and melons is highly satisfactory. Another good rotation would be: oats, clover, melons, corn. In regions where clover does not thrive and wheat and oats are not grown, a rotation of corn, cowpeas, and melons may be employed, or the rotation extended by seeding to grass after the melons are harvested. Even with careful attention to rotation and the incorporation of humus by plowing under catch crops or manure, ordinary farm land—including good corn land—is not sufficiently rich to produce a satisfactory crop of melons without the use of fertilizing material in the hills. It is only on garden soil that has been made exceedingly rich by repeated applications of manure, that it is wise to attempt to grow melons without special treatment of the hills.

Manure for the Hills.—The manure for use in the melon hills is ricked up in the fall in long low piles, about eight feet wide and two or three feet deep. The sides of the pile are made as nearly perpendicular as

possible and the top is flattened so that rains will soak in instead of running off. Sometimes a layer of dirt about three inches deep is placed on top of the manure to help retain the moisture. Early in the spring, work is commenced on the manure to put it in condition for use. The pile must be cut down and the manure turned and mixed until it is thoroughly decomposed and of fine texture. Formerly this work was done by hand with a fork, and entailed a large amount of labor. Now some of the large growers do all this turning of the manure with a disk and plow. The pile is worked three or four times at intervals of one or two weeks.

Time of Planting.—The melon is a warm season crop, and unless the soil is warm and the weather favorable the seeds will not germinate nor the plants grow. It is therefore usually unwise to plant in advance of the normal season in the hope of securing an early crop. Occasionally, such plantings do well, but usually the stand is poor, necessitating much replanting, and the early plants which do survive are likely to be so badly stunted by reason of the cool weather that they do not mature their crop much in advance of the later plantings which have had the benefit of warm weather from the start.

Preparations for Planting.—Melon ground should be plowed early in the spring, or replowed if it was broken in the fall. After plowing, it should be thoroughly pulverized by the use of a disk or harrow, or both, and then kept in good, friable condition by occasional working until planting time arrives. Shortly before planting is to begin, the field should be furrowed out both ways with a single-shovel plow or a one-horse turning plow. The furrows should be about six inches deep, and as far apart as the hills are to be placed. On some soils melon vines make only a moderate growth and the hills may be planted as close as four feet apart each way; but on rich soil, where they make a stronger growth, they should be at least five by five, and in some cases six by six. After the land is furrowed out the rotted manure is applied at the intersections of the furrows. From a quart to a half-peck of manure is used for each hill, depending upon the quality of the manure and also the quantity available. The manure is dropped into the bottom of the furrow, and either mixed thoroughly with the soil there, and covered with a layer of pure soil in which to plant the seed, or is merely covered with the soil without any mixing. The latter method seems to give fully as good results as the former, especially when a small quantity of manure is used, and is a great saving of labor. In either case, especial care should be taken to compact the soil over the manure so that when the seed is planted it will not suffer from lack of moisture by reason of any vacant air space in or about the mass of manure. Sometimes the manure is covered with soil by merely plowing a furrow on each side of the furrow containing the manure, but unless the soil is in exceedingly fine

condition, this method is not as satisfactory as using a hoe and giving each hill individual attention. In making the hill, some planters compact the soil with the hoe, while others use the feet. When ready for planting, the hill should be practically level with the general surface of the field. If too low, the hill will become water-soaked in case of rain and the seeds or plants injured; if too high, there is likely to be insufficient moisture to insure proper germination and growth.

Planting the Seed.—If the hills have been made more than a few minutes before the seed is dropped, the top layer of dry soil should be scraped aside with a hoe so that the seed may be placed in immediate contact with moist soil. The area thus prepared for planting the seed should be at least six inches across, and should be smooth and level. From ten to fifteen seeds should be scattered uniformly over this area, and covered with about half an inch of fine, moist soil. This should be firmed with the back of the hoe and then covered with a sprinkle of loose dirt to serve as a mulch. If a heavy rain packs the top of soil and a crust is formed before the plant appears, it is wise to go over the field and carefully break the crust over each hill by means of a garden rake. The method of preparing the hills and planting the seed described above applies to field rather than garden conditions and to soils of medium rather than excessive fertility. In a market garden where the soil is exceedingly rich as a result of repeated manuring for onions or cabbage, and is in fine tilth, it is a common practice to sow the melon seed in drills six to eight feet apart, by means of a garden seed drill. This is done without any special preparation of the soil where the plants are to stand, or application of fertilizing material other than manure applied broadcast before plowing.

Thinning.—While ten to fifteen seeds are planted per hill for the sake of insuring a full stand, only two, or at most three, plants are left to make the crop. Thinning is usually deferred until the plants have become fully established, and the struggle against the striped beetle is nearly over. However, the plants must be thinned before they begin to crowd badly, or those which are to remain will be stunted in growth. Usually the thinning is completed by the time the plants have four rough leaves. If the seed has been well scattered in planting, so that each plant stands apart by itself, the superfluous plants may be pulled with the fingers, but extreme care must be taken to avoid disturbing the roots of the remaining plants. Sometimes the plants are cut off with a knife or shears, instead of being pulled, and thus all danger of disturbing the roots is avoided. If the seeds have been sown with a drill as in market gardening practice, the plants are usually thinned to one in a place at distances of two to two and one-half feet in the row.

Transplanting.—Since it is impossible to increase the earliness of the crop to any great extent by early planting in the field, growers have adopted the transplanting method. This makes it possible to plant the seed three or four weeks earlier than would otherwise be feasible, and to grow the plants under controlled conditions of temperature and moisture during their most critical period. It also simplifies the matter of protection from striped beetles. The main objections to this method are the expense for sash, and the difficulties attending the transplanting. A melon plant will not survive transplanting if the root system is disturbed. For this reason the seed is sown on inverted sod, in pots or in dirt bands. The dirt bands are used almost exclusively by commercial growers. These are thin strips of wood veneer, three inches wide and eighteen inches long, scored at intervals of four inches so that they can be bent without breaking. When folded ready for use, each band resembles a small strawberry box without the bottom. These bands are placed close together in a hotbed and filled level full with fine, rich soil. With a block of wood shaped for the purpose, the soil within the bands is pressed until it is ½ to ¾ inch below the top of the band. If only part of the dirt is put in at first, and is pressed down firmly, then the rest of the dirt put on and pressed, the soil in the band will be more compact throughout and will hold together better in the transplanting than if the dirt were pressed only once. Unless the soil used was very moist, the bed is then thoroughly watered. Next, three seeds are placed in each band. These are covered with fine, loose soil deep enough to fill the band. This soil is not firmed. The hotbed for melon plants should have full exposure to light and be maintained at a high temperature—about 85 degrees F. during the day and 65 to 70 degrees at night. As much ventilation should be given as the weather will permit, and care exercised to avoid overwatering. As soon as the plants are well started, they are thinned to two in a band by cutting off the extra plant with a sharp knife. When the plants are about four weeks old from the planting of seed they will be in the right condition for transplanting to the field. They are then compact, stocky plants with about four rough leaves. If allowed to remain longer in the bed they begin to stretch for light and are of little value for planting, for the long naked stems, unable to support themselves and unaccustomed to direct sunlight, would easily be sun-burned, and the plants seriously checked if not killed outright.

Cultivation.—Whether the melons are transplanted from a hotbed or grown from seed planted in the field, the tillage of the crop should begin as soon as the plants can be seen. In the case of transplanted plants, this will be the same day that they are set in the field. The early tillage should be deep, and as close to the plant as it is feasible to run the cultivator. The object of this deep tillage is to establish a deep root system so that the plants will not suffer so severely from dry weather later in the season. In the case of a field planted crop it is not feasible to

cultivate so close to the plants early in the season because of the danger of tearing out the little plants. For this deep tillage a one-horse five-shovel cultivator, often weighted with a rock, is the tool most commonly used. It is customary to follow this with a "boat" or a 14-tooth cultivator to more fully pulverize the soil. Tillage is usually given after each rain or at least once each week so that the soil is maintained in a loose friable condition. In addition to the cultivation with a horse, much hand hoeing is required close about the plants. Any crust forming after a rain, is broken, and fresh, moist soil drawn up about the plant. Crab grass and weeds appearing in the hill are removed by hand. Most growers cease tillage and lay-by the crop as soon as the vines have run enough to interfere with the cultivator. The experience of a few growers who have turned the vines and kept them in windows so that tillage could be continued until the picking season opened, indicates that a departure from the old method is likely to insure better development of the melons and a longer picking season, though the first fruits may not ripen so early. There is another distinct advantage in this turning of the vines, in that the gathering of the crop is greatly facilitated and there is no injury to the vines from tramping.

Seed.—No matter what variety of melon is grown, it is extremely important that pure seed be planted if good melons are to be produced. The melon deteriorates very rapidly under careless methods of seed selection. None but the very choicest specimens of the desired type, from productive vines, should be selected for seed. It is unsafe to cut seed from a field in which more than one variety of melon is grown; for seed from such a field would likely be very badly mixed, and the product undesirable for market. If a grower has sale for all his good melons, it may be cheaper for him to purchase his seed than to save it. But here again there is danger of procuring inferior seed, for much of the melon seed on the market is cut without careful selection, in order to meet the demand for cheap seed. Even cull melons are used to supply this demand. Such seed is expensive at any price. The difference in the cost of good seed and poor seed is insignificant when compared with the advantages to be derived from the use of seed which can be depended upon to produce melons of a given type.

Picking.—There is considerable difference of opinion as to the exact stage of maturity at which melons should be picked for shipment. If allowed to become too ripe before picking, they become soft by the time they reach the market, and often must be sacrificed in order to effect an immediate sale. If picked too green, the melons reach market in firm condition, but are lacking in flavor, and are not desired by the best trade. It is a nice point to pick melons at such a degree of ripeness that they will reach the market in firm condition, and yet possess the requisite flavor. The farther from market the melons are produced, the less mature

they must be when picked. Furthermore, the rapidity of softening after picking varies with the temperature to which the melons are subjected. The cooler they can be kept after picking, the longer they can be allowed to remain on the vines and the better flavor they will have. It is, therefore, essential that the melons be placed in the shade as soon as possible after picking, and be kept shaded until they are loaded into the car. For the same reason, riper melons can be shipped under the refrigeration than in ventilated cars. It is also true that melons shipped during excessively hot weather, unless under refrigeration, will soften more rapidly than those shipped during cooler weather. The condition of the vines and the rapidity of ripening of the melons in the field will also have a bearing upon the stage of maturity at which they should be picked. Early in the shipping season, when the vines are in full vigor and the melons ripening slowly, the fruits may safely be left upon the vines until more mature than would be safe later in the season when the plants have become somewhat weakened, or, by reason of excessive heat, the melons are ripening very rapidly. Melons should not be picked at the same degree of maturity under different conditions of ripening, methods of transportation, and distances from market.

While it is true that no rule can be given for picking melons that will apply under all conditions, and that the grower must exercise judgment in reference to each day's picking, the ideal will be attained when the conditions are such that the melons will reach the market in the best condition if picked as soon as the fruit will part readily from the stem when the latter is pressed with the thumb or finger. There is a tendency among some growers to pick considerably before this point has been reached, in order to run no risk of the melons becoming soft in transit. In fact, some growers make a practice of picking the melons before a crack appears about the stem or any change of color takes place, even on the under side of the fruit.

Market Demands.—While various types of muskmelon may be disposed of upon a local market, there are certain types which are recognized as standards in the large city markets; and it is seldom wise to attempt to force upon a general market a variety not recognized as a standard in that particular market. In the Chicago market the sorts most in demand are the Netted Gem, or Rocky Ford type, and the Osage.—(Ill. E. S. 124, 139; F. B. 255; S. Dak. E. S. 67; N. Hamp. E. S. 70, 96; N. Y. E. S. 200; N. Mex. E. S. 63.)

MELON—WATERMELON.

The cultivation of the watermelon is practically the same as for the muskmelon, except that the plants grow larger and require more room for development than those of the muskmelon. Watermelons require that

the soil should contain a larger percentage of sand than muskmelons, and that the land should be quite rich. Watermelons should be planted 10 feet each way between the hills, or in drills 10 feet apart and thinned to 3 feet apart in the drills. The watermelon seedlings must be protected from the cucumber beetle until the foliage becomes toughened. Watermelons readily group themselves into six classes based upon the color or characteristics of the skin or external appearance. It does not necessarily follow that in the proposed classification the fruit of each variety will all be of the same form to which it is referred; for, as every melon grower knows, the fruits in each hill vary more or less; but if everything is normal and favorable for their development the characteristic form or that typifying the variety will predominate. The larger the experience of the grower, the easier it is for him to understand these various types. In order to get the true type of each variety, it is important that the seeds be secured directly from the seedsman who first introduced them thus avoiding complications or errors.—(F. B. 255; N. H. E. S. 86; Ind. E. S. 123; N. Mex. E. S. 63; S. Dak. E. S. 67.)

I. Light Green Class
- Sweet Heart Type (oval shape)
- (medium shape) Monarch Type, (Long shape)

II. Medium Green Class
- Icing Type, (oval shape)
- (medium shape) Jackson Type, (long shape)

III. Dark Green Class
- Black Spanish Type (oval shape)
- (medium shape) Boss Type, (long shape)

IV. Light Striped Class	Kolb's Gem Type, (oval shape) Cuban Queen Type, (medium shape) Rattlesnake Type, (long shape)
V. Dull Striped Class	Pride of Georgia Type, (oval shape) Christmas Type, (medium shape) Favorite Type, (long shape)
VI. Mottled Green Class	Nabob Type, (oval shape) Phinney Type, (medium long shape)

MUSTARD.

Almost any good soil will produce a crop of mustard. The basal leaves of mustard are used for greens, and as the plants require but a short time to reach the proper stage for use frequent sowings should be made. Sow the seeds thickly in drills as early as possible in the spring, or for late use sow the seeds in September or October. The forms of white mustard, of which the leaves are often curled and frilled, are generally used. Mustard greens are cooked like spinach.—(F. B. 255; Mich. E. S. 20; La. E. S. 90.)

NASTURTIUM.

The hardiness and unsurpassed beauty of this plant should make it a favorite near every home. The seed pods just before beginning to ripen make a delicious flavoring for pickles.—(Mich. E. S. 20; S. Dak. E. S. 68.)

NEW ZEALAND SPINACH.

The plant known as New Zealand spinach is not a true spinach, but grows much larger and should be planted in rows 3 feet apart, with the plants 12 to 18 inches apart in the row. Some difficulty may be experienced in getting the seeds to germinate, and they should be soaked one or two hours in hot water before planting. New Zealand spinach is satisfactory for growing in warm climates, as it withstands heat better than the ordinary spinach. The fleshy leaves and tender stems are cooked the same as spinach.

OKRA (*Gumbo*).

This plant may be grown throughout the greater portion of the United States, but only one crop can be produced during a season in the northern part of the country. In the region around New Orleans successive plantings are made and a constant supply is maintained. The plant is of a tropical nature and will not endure frost, but the pods begin to be produced very soon after the plants start into rapid growth and continue to form for several weeks, especially if all pods are removed while young and no seeds allowed to ripen upon the plants.

Soil and Its Preparation.—The soil upon which okra can be most successfully grown is a rich mellow loam, plowed rather deeply and well worked over with pulverizing tools. After the seedlings become established and the roots get a firm hold of the soil, the growth is very rapid and a large amount of available plant food, especially of a nitrogenous nature, is required. Quick-acting commercial fertilizers may be applied in moderate quantities, but these should be well mixed with the soil. The same conditions that will produce good cotton or corn will be found suitable for the production of okra.

Planting the Seed.—Throughout the Northern States planting should be done as early as possible in spring, or as soon as the soil is warm enough for the planting of general garden seeds. In the Southern States, where a continuous supply is desired, successive seedings of four or five weeks apart should be made. Plant in rows 3½ feet apart for the dwarf types, and 4½ feet for the larger-growing varieties. Scatter the seeds in drills, or plant loosely in hills, as with corn, and cover to a depth of 1 or 2 inches, according to the compactness and moisture content of the soil. The seeds may be planted with any good seed drill, but when placed in hills they should be separated 3 or 4 inches to allow space for the development of the stems. If the soil is reasonably warm, germination will take place within a few days, but should there be a heavy rainfall in the mean time the soil should be lightly cultivated between the rows and the crust broken over the seed by means of an iron rake.

Cultivation.—As soon as the plants are well established they may be thinned to three or four in a hill, or, if grown in drills, to 12 or 14 inches for the dwarf and 18 to 24 inches for the larger growing varieties. Where vacant places occur from failure in germination they may be filled in by transplanting. Cultivate as in the case of corn or cotton, keeping the ground well stirred and the surface soil loose, especially while the plants are small. After the leaves begin to shade the ground, very little cultivation is necessary except to keep the land free from weeds. A poor soil and insufficient moisture will yield pods of inferior size and quality, and irrigation may often be desirable in order to produce a marketable crop. Okra is sometimes grown as a mixed crop with cotton, the okra being removed before the cotton begins to mature; but this practice is not to be recommended, as both crops draw heavily upon the nitrogenous matter of the soil. The okra plants will usually continue to grow until late in the season, but after a time the pods are not so large or tender as those produced earlier in the season. As the pod is the only part of the plant ordinarily used for food, it is desirable to secure a rapid and continuous growth in order to produce the greatest quantity of marketable pods.

Gathering and Marketing.—As soon as the plants begin to set fruit the pods should be gathered each day, preferably in the evening. The flower opens during the night or early morning and fades after a few hours. The pollen must be transferred during the early morning, and the pod thus formed will usually be ready for gathering during the latter part of the following day, although the time required to produce a marketable pod varies according to the age of the plant and the conditions under which it is grown. The pods should always be gathered, irrespective of size, while they are still soft and before the seeds are half grown.—(F. B. 232.)

Cultivation for Seed.—If okra is to be grown for seed alone, only one variety should be planted, or if more than one variety is grown each should be separated from the other by at least one-fourth mile to prevent mixing. When several varieties of okra are grown near each other no seed should be saved except that produced by the method of bagging and hand pollination. To secure seed in this way is a rather simple matter when only a small quantity is required, as the pods formed on a single day when the plants are at their best will produce enough seed. The bags should be tied over the flower buds in the evening and the pollen transferred early the following day. Replace the bags immediately, as an insect or the wind may at any moment bring to the flower the pollen of another variety. After going over all the flowers of a variety it is well to return to the first three or four and repollinate them in order that they may receive pollen from different individual flowers of the same variety and to insure perfect fertilization. Before beginning upon another variety

the brush used for transferring the pollen should be thoroughly cleaned. If a brush is not available, use a portion of a young leaf, folded together between the thumb and finger, to convey the pollen. This improvised brush should be discarded and a new one adopted for each variety. The bags need remain only during the day on which the pollen is transferred and may be replaced by a tag to mark the pod. The seed should remain on the plant until fully ripe.

The common bumblebee is a frequent visitor to the flowers of the okra, and a single bee was on one morning observed to pollinate over 500 flowers, comprising more than 50 separate samples. In this instance practically every flower in the field was visited and pollinated, although no pollen had previously been transferred. This observation demonstrated the necessity of great care to prevent cross-pollination. Our variety tests with okra have shown that seed growers have not always succeeded in keeping the varieties separate, and as a result there has been a gradual blending together of all the sorts. In many of the samples all the sorts usually grown are represented.

Uses.—The principal use of okra is in soups and various culinary preparations in which meats form an important factor, as in the so-called gumbo soups, to which the young pods impart an excellent flavor, besides giving a pleasant mucilaginous consistency. The young seeds are occasionally cooked in the same way as green peas, and the very young and tender pods are boiled and served as a salad with French dressing. Both the stem and the mature pod contain a fibre which is employed in the manufacture of paper. No copper, brass, or iron cooking vessels should be employed in preparing okra, as the metal will be absorbed and the pods discolored or even rendered poisonous. The cooking should be done in agate, porcelain, or earthen ware.—(F. B. 232.)

Varieties.—There are three general types of okra, viz., tall green, dwarf green, and lady finger. Each of these is again divided according to the length and color of the pods, making in all six classes or varieties, namely, tall green, long pod; tall green, short pod; dwarf green, long pod; dwarf green, short pod; lady finger, white pod; and lady finger, green pod. All variations from these are merely the results of mixtures, no true crosses or hybrids being formed. These mixtures are easily separated and referred to the parent type, and a little attention to roguing and selection is necessary in order to keep the varieties pure. It is essential that the parietal strain should be pure in order that a uniform and marketable lot of pods may be produced.—(F. B. 232, 255; U. Id. E. S. 10.)

ONIONS.

The onion is exceptional in that it will thrive under a very wide range of climatic and soil conditions. There is perhaps no extended area in the United States, except the mountainous regions, where the onion can not be successfully grown. For best results a temperate climate without great extremes of heat and cold should be selected. Onion culture is rarely profitable in regions where the climate does not change or has no definite seasons of heat and cold or wet and dry. Naturally the onion does best under rather cool conditions, with plenty of moisture during its early stages, but requires a reasonable degree of heat, together with dryness of both soil and atmosphere, for its proper ripening.

Soils.—The essential requirements of a soil upon which to grow onions profitably are a high state of fertility, good mechanical condition in order that the crop may be easily worked, sufficient drainage, and freedom from weeds. If a soil has the proper mechanical properties—that is, if it contains sufficient sand and humus to be easily worked, is retentive of moisture and fertilizers, and is capable of drainage—all other requirements can be met. As a general rule new land is not adapted to onion growing until it has been worked one or two years with other crops. Onions should follow some crop that has been kept under the hoe and free from weeds the previous season. Corn, beans, and potatoes are suitable crops with which to precede onions. Muck and sandy soils may in some cases be brought to a suitable condition for onions the first season, but the fitting will have to be very thoroughly performed. The land should be plowed in the autumn, then replowed in the spring, after which numerous harrowings and doubtless some hand work will be required to get the soil in suitable shape. If necessary to manure the land heavily before planting to onions, it will be desirable to plant to some farm crop one season, then apply the manure during the autumn in order to give it time to become incorporated with the soil. Owing to the value of good onion land it would not be advisable to devote it to general farm crops for any extended period, although corn is frequently planted and oats or rye are sometimes used in the North. Cowpeas may be of great service in bringing new land into shape for planting to onions.

Preparation of the Soil.—Assuming that the land intended for planting to onions is capable of being brought to a good mechanical condition, fertile, well drained, and reasonably free from weed seeds, the first step in the production of the crop will be to plow moderately deep, then harrow, disk, roll, and drag until the soil is smooth and mellow to a depth of 4 or 5 inches. On soils that are naturally well drained and where surface water can not accumulate, the plowing may be done in large blocks, but where the opposite conditions are found or irrigation is practiced it may be necessary to plow the land in narrow beds. In the case of insufficient drainage it will be desirable to throw the soil together into beds, leaving a double furrow between each bed to carry

off surplus water. Where the flooding system of irrigation is practiced the beds must be leveled and a system of ditches and ridges provided for distributing and controlling the water.

Crop Rotation.—Onions should not be planted on the same piece of land year after year, and some system of crop rotation should be maintained. Care should be taken, however, to use crops in the rotation that will not be exhaustive of the high fertility necessary in the onion land. During the years when the land is not devoted to onions it can be planted to some truck crop that will give a return that will justify the application of large quantities of fertilizers, or, better to a leguminous crop to be turned under as green manure. Continuous cropping with onions will cause the land to become infested with both disease and insect enemies that will sooner or later injure the crop to such an extent as to render it unprofitable.

Fertilizers.—As the onion is an intensive crop and yields great quantities of marketable bulbs for the area planted, the grower is justified in manuring heavily. It would be difficult indeed to make the soil too rich for onions, provided the manures are thoroughly incorporated with the soil. A heavy application of fresh raw manure just before planting would have an injurious effect, but where the manure is well rotted and uniformly applied there is nothing to be feared.

Animal Manures.—There is perhaps no fertilizer so well adapted to the production of onions as plenty of clean, well-composted stable manure, and the quantity and frequency of application will depend upon the nature of the land under cultivation. All stable manure used on onion land should be well composted before use and then spread upon the land several months before planting to onions. In the Northern States the manure may be applied during the autumn and well disked into the soil. The land can then be allowed to lie in the rough state and exposed to the action of frost during the winter, or it can be smoothed and seeded to rye, in which case it will be necessary to replow during the early springtime. Large quantities of fresh manure applied to onion land just before planting will have a tendency to produce an overgrowth of tops at the expense of the bulbs. This is especially true on irrigated lands and soils that are naturally moist.

Commercial Fertilizers.—Where there is an abundance of humus matter in the soil the onion crop will be greatly benefited by moderate applications of high-grade commercial fertilizers. Many growers follow the practice of applying only a part of the fertilizer at planting time, reserving the balance to be put on as a top-dressing at some time during the period of cultivation. This plan is especially desirable where onions are grown during the winter, as the application of highly nitrogenous fertilizers in the autumn is liable to promote a soft growth that will be

injured by cold. If the fertilizer is not put on until cold weather is over, the crop may be forced without danger of injury. For this purpose only those fertilizers of a very available form will answer.

Planting and Thinning.—Experienced growers are frequently able by using extreme care in regulating the drills to distribute onion seed in rows where the crop is to mature so that little thinning will be necessary. Thinning is generally left until the time of the first hand weeding, when all thick bunches along the rows are thinned to a uniform stand of eight or ten plants to the foot. It is always well, however, to allow for considerable loss of plants, and unless the plants are so thick as to actually crowd, thinning will not be necessary.

Transplanting.—The transplanting process, often spoken of as the "new onion culture," is merely a modification of the regular seeding method. The objects gained by transplanting are an earlier crop, a uniform stand, and bulbs of more regular size. Where a small area is to be grown, the transplanting process is the ideal method, but for large acreages and where labor is difficult to obtain, this would not be practical. After transplanting, the seedlings will require rain or watering in order that they may start, and for this reason the transplanting process is practically limited to areas where some form of irrigation is available. In growing onions by the transplanting method the seed is sown in greenhouses, hotbeds, cold frames, or specially prepared beds at the rate of 3½ or 4 pounds for each acre to be planted. When the seedlings are grown under cover, they are given the necessary attention regarding watering and ventilation and kept growing quite rapidly until near the time for setting them in the open ground. As planting time approaches, the seedlings are "hardened" or prepared for transplanting by increased ventilation and exposure and by withholding water. When ready to transplant, the seedlings should be somewhat smaller than a lead pencil and rather stocky. The plants are lifted from the seed bed and the roots and tops both trimmed somewhat.

Methods of Tillage.—The cultural requirements of the onion are frequent shallow stirring of the soil and freedom from weeds. The feeding roots of the onion run close to the surface of the soil and should not be disturbed by deep cultivation. Sometimes a heavy rain immediately after seeding will so pack the surface that the seedlings can not break through. Under such circumstances it will be necessary to slightly break the surface by means of a steel rake or a rake-like attachment on a cultivator. As soon as the plants are up and the rows can be followed the cultivator should be started to loosen the soil, which is always more or less compacted during seeding. It is well-nigh impossible to produce a crop of onions without some hand weeding. During favorable seasons the strictly hand work may be reduced to but

one or two weedings, but a greater number will be necessary during rainy seasons. The work of hand weeding may be facilitated by the use of some of the small hand tools designed for the purpose. Among these tools might be mentioned the onion hoe, the hand weeder, and the thinning or weeding hook.

Irrigation.—Outside of the areas where irrigation methods are depended upon for the production of general crops it is not customary to use artificial watering in the growing of onions.

Harvesting.—In the North the bulbs are allowed to become as ripe as possible before removing them from the soil. Growers prefer that the tops ripen down and shrivel and that the outer skin of the bulbs be dry before they are pulled. To the southward, where the onions are not cured so thoroughly, they are often pulled about the time that the tops begin to break and fall. The ripening process may often be hastened by rolling a very light roller or a barrel over the tops to break them down. This process is frequently spoken of as "barreling." Where the bulbs are practically upon the surface they may be pulled by hand and thrown in windrows consisting of eight or ten onion rows. If the onion bulbs are considerably covered with soil it will be necessary to employ a one-horse plow or a cultivator with a sweep attached for lifting them. In any case it will be necessary to gather them from the soil by hand. After lying in the windrows for several days and being stirred occasionally with wooden rakes they are gone over and the tops removed either by twisting or cutting with ordinary sheep shears. In cases where very bright color is important as with fancy White Globe onions, and this would be injured by exposure to the sun and rain, the bulbs are cured in long, narrow, low ricks formed by two rows of onions laid with the bulbs regularly to the center, tops to the outside, the rows a few inches apart at the bottom of the rick but coming together at the top, and the top of the rick covered by straw or boards to shed the rain. As the tops are removed the bulbs are generally placed in crates for drying. In some sections onion-topping machines are employed, the bulbs being hauled from the field to a central location and run through the topper. These machines remove the tops, grade the bulbs, and deliver them into the crates or bags. If crates are not employed for curing, the bulbs are allowed to lie in the windrows for some time, and are then either put into sacks or hauled to slat cribs, where they complete the curing process. Too long exposure to hot sunshine will injure the bulbs. Where the bulbs are extremely dry at the time of their removal from the soil, they may be allowed to lie in the windrows for a few days only, and then sorted and cleaned in the field ready for packing and marketing.

Storage.—In order that onions should keep well when stored they must be well ripened and thoroughly cured. Those that are immature,

soft, or "thick necks" should never be placed in storage but sold as soon as gathered for whatever price they will bring. Good storage onions will rattle almost like blocks of wood when poured from one crate to another. In order that the bulbs may remain bright and of attractive appearance they should not be allowed to lie exposed to the weather, but should be hauled and stored in open sheds just as soon as they may safely be placed in one-bushel crates. After the bulbs have remained in drying sheds or cribs for several weeks they will be ready for screening and removal to the storehouse. In handling onions it is the rule to pass them over a screen each time they are moved, as in this way the loose skins are removed and any soft or decaying bulbs may be sorted out. The essentials for the successful storage of onions are plenty of ventilation, storing in small quantities, a comparatively low temperature, dryness, and safety from actual freezing. Any building wherein the above conditions may be secured will answer.

Marketing.—Large quantities of onions are sold and shipped direct from the fields where they are grown. A part of the crop is held in temporary storage until late autumn or early winter. During recent years the winter storage of onions has become of great importance and the finest stock is held for late winter deliveries. The Bermuda crop from the southwestern part of the country comes upon the market during April and May, so that most of the storage onions are disposed of before that time. In marketing onions the first essential is to properly grade and clean the bulbs, in order that they may present an attractive appearance when offered for sale. Ordinarily the bulbs are separated into three grades—primes, seconds, and picklers. The primes include all those of 1¼ inches, in diameter and larger, and the seconds consist of those from ¾ inch to 1¼ inches in diameter, while all those that will pass through a ¾-inch screen are sold for pickling purposes. The grading is generally done in the field during the cleaning process, but as onions shrink considerably while in storage it is necessary to regrade before placing upon the market.

Weight of Onions.—The legal weight of onions per bushel varies somewhat in different States, but 56 pounds of dry onions are generally considered a standard bushel.

Important Commercial Varieties.—The varieties of onions that have distinctively yellow, white, and red skins and are of the globular type are of greatest commercial importance. Among the varieties that belong to the yellow globe class are the Prizetaker, Yellow Danvers, Yellow Globe, Danvers, Southport Yellow Globe, and Ohio Yellow Globe. The principal white varieties are Southport White Globe, New Queen, Italian Tripoli, Silver Skin, and White Silver King. Among the more important red sorts are Red Globe, Red Wethersfield, and Australian Brown. The

principal Bermuda varieties are Red Bermuda, White Bermuda and Crystal Wax. The Bermuda onions are all of the more or less flat type. The red coloration of the Bermuda onion is not distinctive like that of the Red Wethersfield or Red Globe varieties, but is lighter in color. The famous Denia onion is somewhat of the Prizetaker type, is light yellow in color, grows to a large size, and is mild in flavor. In the selection of varieties for any particular locality the soil conditions and market requirements should both be considered. Those adapted to the muck soils are the yellow and red sorts. For alluvial and prairie soils the red and brown varieties are to be preferred, while all kinds do well on the sandy loams and light soils. A cleaner, better grade of white onions can generally be produced on light or sandy soils than on muck or clay loams. Those of the Bermuda, Spanish, and Egyptian types flourish on the deep, rich alluvial soils of the river bottoms and delta regions. Certain of our markets show a decided preference for onions belonging to a particular type. The red and brown varieties find ready sale on the markets of the Middle West, while onions of the yellow and white varieties are preferred in the eastern cities. Onions will withstand long-distance shipment, those of the Red Globe type being generally more subject to injury than the yellow and brown sorts. Some of the white varieties also have a thin skin and are easily injured. It should be the aim of every grower to employ varieties that will withstand handling and at the same time find ready sale on the market. Other types of onions are top onions, multipliers, garlic, and leeks, which are planted to some extent for marketing purposes.

Bermuda Onions.—The production of Bermuda onions in the United States is a comparatively new industry and has thus far been undertaken mainly in Texas and California. Soils of a silty or alluvial nature are suited to the production of Bermuda onions, and those containing considerable sand are most desirable. The Bermuda requires a very rich soil for the best results, and this can only be obtained by first selecting a good soil and then manuring heavily. The Bermuda onion as grown in this country is a winter crop; therefore, mild climatic conditions are required. While the plants would withstand considerable freezing, their growth is seriously checked by cold weather, and the crop will not mature in time for the early market if grown to the northward. The cultural methods employed in the growing of Bermuda onions are essentially the same as those for ordinary onions. As the greater portion of the crop is grown in a region which has no regular rainfall, irrigation methods are employed almost universally. The greater part of the crop is grown by the transplanting process and a great amount of hand labor is required. Bermuda onions are harvested as early as possible, generally before the tops have become fully ripened. Phenomenal yields of 34,000 and 35,000 pounds of Bermuda onions are frequently made on an acre of land, but this is far above the general average, which is in the

neighborhood of 10,000 or 12,000 pounds to the acre. Many fields, especially when planted for the first time, do not yield as much as 10,000 pounds to the acre. On land that has been heavily manured and planted to onions for several years the yield averages about 16,000 pounds. The best Bermuda-onion farms are valued at $300 to $500 an acre. In order to prove profitable, the growing of Bermuda onions should be conducted on a comparatively large scale. The necessary land and irrigation facilities will require the initial outlay of from $10,000 to $30,000, and the running expenses are quite heavy. Labor can be secured at a low price, but is correspondingly inefficient and often not to be had in sufficient quantities. Furthermore, the markets are now pretty well supplied with Bermuda onions, and persons who desire to engage in their production are advised to investigate every phase of the industry before embarking too heavily in it. The expansion of the Bermuda-onion industry is limited by the facts that a large supply of bulbs can be grown on a comparatively small area, that the distance to market is great, that the product is perishable, and that the markets will consume only a limited quantity at the prices at which the crop can be sold with profit.

Green Onions for Bunching.—Another phase of onion culture that is of considerable importance in certain localities is the production of young bunching onions for the early spring trade. In several sections along the South Atlantic coast the growing of this class of onions is quite an enterprise. Many persons who are engaged in other lines of work follow the practice of growing a small area of bunching onions as a side issue. The varieties known as multipliers and top onions are generally employed for this purpose; however, bunching onions are sometimes grown from ordinary sets, from inferior and damaged large onions, and from seed. The multipliers and top onions are the only kinds adapted for this work on a large scale. For growing bunching onions the bulbs or sets are planted during the autumn either in beds or in rows 12 or 14 inches apart with the bulbs quite close in the rows. The bulbs will start growing within a short time and make more or less growth during the winter. As soon as the weather becomes warm during the first months of spring the onions make a rapid growth and are ready for marketing about the time peach trees begin to bloom. In marketing this class of onions the young shoots are pulled, the roots trimmed, and the outside peeled off, leaving the stem white and clean. The onions are then tied in small bunches by means of a soft white string, the tops trimmed slightly, and the bunches packed in crates or baskets for shipment or sale on the local market. This phase of the onion industry is limited to small plantings and is well suited to the needs of the general market garden. During the springtime and early summer large quantities of ordinary young onions are pulled when the bulb is about the size of a fifty-cent piece, the roots and tops are trimmed, and they are then bunched and

sold for stewing purposes. So far as known, this class of onions is not shipped to any great extent, but is sold mainly on local markets.

Home Production of Onion Seed.—The bulbs, or "mother bulbs," as they are commonly called, for the production of onion seed should be grown in the same manner as those intended for marketing, except that more care should be taken throughout. Some seed growers prefer to use 6 pounds of seed to an acre for the production of seed bulbs instead of 4 pounds, as ordinarily used in growing for market, in order that the bulbs may crowd and not become too large. The planting, culture, and harvesting of the bulbs are practically the same as for first-class marketable stock. Onion-seed growing is a two-year process and two crops are constantly to be cared for. After growing the bulbs the first summer they must be stored over winter and replanted the following spring for the production of seed. Meantime the crop for the next year's planting must be coming on in order to have a crop of seed every year. The first requisite for the growing of the best seed is a clear-cut ideal of the exact shape, form, color, and general characteristics sought in the variety being grown. The second requisite is the growing of seed from bulbs of that exact type for the greatest possible number of generations. Two selections should be made, the first to include but a small number of the very finest and most ideal bulbs from which to produce the stock seed to be used the following year for the growing of the seed bulbs, and the second to include the bulbs from which to grow the supply of seed for the market. By keeping the very best stock separate and using the product for propagation the entire strain will be gradually improved. Bulbs a trifle below the ideal market size, or about 1½ to 2 inches in diameter, are the most profitable for seed production.

Bulbs that are to be used for seed productions should be allowed to become thoroughly ripe in the field. After pulling they should be stored in crates under a roof where they will have plenty of ventilation and be protected from sun and rain. Before freezing weather begins the onions should be graded and removed to a house where both ventilation and temperature can be controlled. The temperature of the storage house should at no time be so low as to cause the bulbs to become frosted. A temperature of 32° F. for a short period will do no harm, but should not be allowed to continue. If the bulbs become frosted, heated, or sweated in storage they will sprout before planting time and be greatly injured for seed purposes. In general, the storage conditions should be the same as for marketable onions.

The proper time to gather the seed is when the inside of the grain has reached the dough stage. Onion seed assumes its black color very early; in fact, before it has passed the watery stage and formed milk in the grain. This change of color is no indication of ripeness and very often

deceives the inexperienced grower. The heads should be harvested just before the first-formed seed begins to shatter in handling.

Curing the Seed Heads.—Any building having a tight floor and in which a free circulation of air can be maintained will serve as a curing place for onion seed. In localities where rains do not occur during the curing period the seed heads are frequently dried on sheets of canvas stretched over frames or spread upon the ground. For curing the seed in houses, wire-bottomed racks or trays placed one above the other are generally employed. As the seed is stirred from time to time during the curing process considerable of it will be shattered and fall upon the tray below or finally upon the floor. The main essentials in the curing of onion seed are to spread the heads very thinly, not over two heads in depth, and to give free ventilation. Even at a depth of 3 inches in the trays it will be necessary to stir them very often, especially during damp weather.

Thrashing and Cleaning the Seed.—The date for gathering the seed depends upon the locality and climate, but as a rule this will be about midsummer. The thrashing and cleaning of the seed are often deferred until quite late in the autumn, except where the curing is done in the open air. Where large quantities of seed are produced the thrashing is done with machines similar to regular grain thrashers, but when grown on a small scale the seed is removed by beating with a flail.

After the seed has been thrashed, there is still considerable danger of its heating or molding if left in too great bulk. The usual practice is to run it through a fanning mill to remove the dust and small particles of the heads or chaff that are broken up in thrashing. In former years the method of cleaning was to place the seed in a tank of water the heavy seed settling to the bottom of the tank while the chaff and lighter portions could be floated off. This process is no longer used to any great extent, owing to the improvement in cleaning machinery, and the danger of injuring the seed by the water. After the seed is fanned and most of the foreign matter removed, it should be spread thinly on the floor or canvas and stirred from time to time. About the only test that can be applied in order to detect moisture in the seed is that of feeling it with the hand, and anyone experienced in the handling of seed will soon become expert at determining when it is safe to bag it ready for storage or shipment.

Production of Seed for Onion-Set Growing.—Frequently the seed for onion-set growing is produced from bulbs selected from the sets themselves; in other words, the bulbs or mother bulbs are the overgrown sets. Owing to the great quantity of seed employed in set growing it is desirable to secure it cheaply, and the bulbs selected from the sets, being small, will produce a larger quantity of seed per bushel from mother

bulbs than when grown in the usual manner. The stock seed bulbs should, however, be well matured, small necked, uniform in size, and selected according to an ideal shape. Onion seed from undersized bulbs is not so desirable, even for set growing, as that from standard bulbs. The length of time that onion seed will retain its vitality depends largely upon maturity and climatic conditions. Well-matured seed will always keep better than poorly ripened and inferior seed. Under ordinary conditions onion seed loses its vitality very rapidly after the second year, especially if stored in a damp climate. It will often pay to ship the seed to a dry climate for storage.

Production of Onion Sets.—The term "set," as applied to the onion, indicates a small, undersized bulb which, when replanted in the ground, will produce a large onion. This method of producing onions is perhaps the oldest and now the most universally employed for the growing of small areas of onions in the garden where an early crop is desired. The common method of producing sets is to plant a large quantity of seed on a small area of rather rich land and thus procure a great number of bulbs that are undersized, owing to crowding and lack of plant food. The greater number of these bulbs do not attain sufficient size or maturity to produce seed the following season and are really plants in which the process of growth has been arrested. The climatic conditions governing the production of onion sets are practically the same as those for standard onions, although it is not necessary to plant quite so early in the spring. As the essential feature of growing onion sets is the crowding together of the plants in the rows, a large quantity of seed is required to plant an acre. The quantity of seed required varies with the different localities. The ideal onion set is almost globular in shape and a trifle less than half an inch in diameter. The color should be bright and the surface free from smut or spots. The term "pickler" is applied to the onion just above sets in size, or, in other words, one-half to three-fourths of an inch in diameter. The term "boiler," or "stewer," is applied to the size next larger than picklers, which are too small for sale as standard onions, or from three-fourths of an inch to 1¼ inches in diameter.

Varieties Used for Sets.—Seed of almost any variety of onion may be used for the production of sets, but a greater demand exists for the distinctly yellow, white, and red colors. In the trade the sets are recognized by their color rather than by actual varietal names. The demand for the yellow and the white sets is greater than for the red, and those of the globular type are generally preferred.

Onion sets are sometimes grown from left-over seed, in which case a large number of varieties may be included. In the principal set-growing districts, where the seed has been locally grown for many years, the varieties are more or less distinct from those of seedsmen's catalogues.

—(F. B. 255, 354, 434; Ariz. E. S. Cir. 75; Colo. E. S. 81, Cir. 5; N. Mex. E. S. 52, 74; Oreg. E. S. 74; N. Y. E. S. 206; U. Id. E. S. 22; N. Dak. E. S. 12; S. Dak. 47; Mich. E. S. 6; Kans. E. S. 70.)

PARSLEY.

After soaking the seeds of parsley for a few hours in warm water, they may be sown in the same manner as celery seed and the plants transplanted to the open ground. At the North, parsley will live over winter in a cold frame or pit, and in the South it will thrive in the open ground during the winter, but it can not withstand the heat of summer. The plants should be set in rows 12 inches apart and every 4 inches in the row. The leaves of parsley are used for garnishings around meats and for flavoring soups.—(F. B. 255, 295; N. Car. E. S. 132; U. Id. E. S. 10.)

PARSNIP.

Sow the seeds of parsnip as early as convenient in the spring in drills 18 inches to 3 feet apart. Thin the plants to stand 3 inches apart in the rows. The parsnip requires a rich soil and frequent cultivation. The roots can be dug late in the fall and stored in cellars or pits, or allowed to remain where grown and dug as required for use. It is considered best to allow the roots to become frozen in the ground, as the freezing improves their flavor. As soon as the roots begin to grow the following spring they will no longer be fit for use. All roots not used during the winter should be dug and removed from the garden, as they will produce seed the second season and become of a weedy nature. When the parsnip has been allowed to run wild the root is considered to be poisonous.—(F. B. 255, 295; Mich. E. S. 20; U. Id. E. S. 10; N. Car. E. S. 132.)

PEAS.

Garden peas require a rather rich and friable soil with good drainage in order that the first plantings may be made early in the spring. Fertilizers that are high in nitrogenous matter should not be applied to the land immediately before planting, as they will have a tendency to produce too great growth of vines at the expense of pods. Land that has been well manured the previous year will be found satisfactory without additional fertilizer. A sandy loam is to be preferred for growing peas, but a good crop may be produced on clay soils; however, the pods will be a few days later in forming. Peas are easily grown and form one of the most palatable of garden products. For the best results peas should be planted in the bottom of a furrow 6 inches in depth and the seeds covered with not more than 2 or 3 inches of soil. If the soil is heavy the covering should be less than 2 inches. After the plants attain a height of

4 or 5 inches the soil should be worked in around them until the trench is filled. The rows for peas should be 3 feet apart for the dwarf sorts and 4 feet apart for the tall kinds. A pint of seed will plant about 100 feet of single row. Many growers follow the practice of planting in a double row with a 6-inch space between. The double-row method is especially adapted for the varieties that require some form of support, as a trellis can be placed between the two rows. Brush stuck in the ground will answer for a support for the peas to climb upon. Three-foot poultry netting makes a desirable trellis. If peas are planted for autumn use, the earliest varieties should be employed. The first plantings should be of such varieties as Alaska or Gradus, which make a small but quick growth, and may or may not be provided with supports. The dwarf sorts like American Wonder come on later, require very little care, and produce peas of fine quality. The tall-growing sorts of the Telephone type are desirable for still later use on account of their large production and excellent quality. Sugar peas have tender pods and if gathered very young the pods may be eaten in the same manner as snap beans. In order to maintain a continuous supply of fresh peas, plantings should be made every ten days or two weeks during the spring months, beginning as soon as the ground can be worked. In the extreme South peas may be grown during the entire winter.—(F. B. 255; N. C. E. S. 132; Mich. E. S. 20, 190; S. Dak. E. S. 85, 91; Del. E. S. 41; Colo. E. S. 172.)

PEPPERS.

Plant the seed of peppers in a hotbed, and transplant to the open ground as soon as it is warm, or sow the seeds in the garden after all danger of frost is past. When grown in the garden the plants should be in rows 3 feet apart and 15 to 18 inches apart in the row. The plants require about the same treatment as the tomato. Peppers are divided into two classes—the sweet varieties, which are eaten as vegetables, and the pickling varieties, which are used for pickles or dried and powdered, in which form they are much used in Mexico. Of the sweet peppers the varieties Sweet Mountain, Ruby King, and Large Bell are good standard varieties; and of the pickling peppers, the Cayennes and Chilies are largely used. The pickling varieties are all more or less pungent and should never be prepared with bare hands, because the burning sensation is very difficult to eliminate.—(F. B. 255; B. P. I. 6; P. Rico 7; Iowa, E. S. 47; N. C. E. S. 132.)

PHYSALIS.

The physalis is also known as the ground-cherry or husk-tomato. Sow the seed in a hotbed or cold frame and transplant to the garden after danger of frost is past, or the seeds may be sown in the row where the

plants are to remain and thinned to 12 or 18 inches. No particular care is required except to keep them free from weeds. There are a large number of varieties of the physalis, and the fruits vary in size and color. The variety commonly used in gardens produces a bright-yellow fruit, which is about the size of an ordinary cherry. Toward fall the fruits will drop to the ground and will be protected for some time by their husks. If gathered and placed in a cool place the fruits will keep for a long time. The physalis will self-sow and may become a weed, but it is easily controlled. A few of the volunteer plants may be lifted in the spring and placed in rows instead of making a special sowing of seed. Ten plants will produce all the husk-tomatoes desired by the average family. The fruits are excellent for making preserves and marmalade.—(F. B. 255; S. Dak. E. S. 68.)

POTATO.

The term "potato," when not modified by an adjective, suggests to the mind of an American the so-called potato (*Solanum tuberosum*). When the name is modified by the word "sweet," reference is made to a different plant, belonging to the morning-glory family and known botanically as *Ipomoea batatas*. Attention is here directed entirely to the Irish potato.

Soil and Rotation.—The potato is grown in every State and Territory, and naturally on a great variety of soils. Indeed, it has been grown on nearly every class of soils, but this fact does not minimize the importance of selecting for the potato the kind of soil best adapted to it. The ideal soil for this crop should be one so light as to offer no great resistance to the enlargement of the tubers, so supplied with organic matter as to be rather moist without being wet, and so rich as to furnish an unfailing supply of fertilizing ingredients. A rich, sandy loam abundantly supplied with organic matter and naturally well drained is preferable. Stiffer soils may be rendered suitable for the potato by drainage and by the incorporation of farm manures; or better, by plowing under green crops. Very heavy clay should be avoided if the farm contains any lighter soil. Recently cleared ground suits the potato. Sandy soils, if not too subject to drought, may be fitted for this plant by the addition of organic matter. It is claimed that potatoes grown on sandy land are of better quality than those grown on stiffer soil.

The potato requires a rich soil, but even more important than natural fertility is a proper mechanical condition of the soil. Artificial fertilizers may be substituted in part for natural fertility, but they are effective only when the soil is in such a condition as to furnish a constant supply of water. The potato should have the best soil on the farm, since it is more exacting in this respect than the other staple crops and since the product

of an acre is generally of greater value. The success of the potato is largely dependent on the crops preceding it in the rotation. If clover, cowpeas, or other leguminous plant is grown just preceding potatoes, its stubble furnishes organic matter and adds to the store of available nitrogen in the soil. Corn after sod frequently precedes potatoes, and this is generally regarded as the best rotation.

Rye is sometimes sown in late summer or fall and plowed under so as to lighten a heavy soil. Buckwheat and other plants have also been used for the same purpose. On light soils and in rather mild climates, crimson clover for green manuring may advantageously take the place of rye where early planting of potatoes is not specially desirable. One year, or at most two years, is as long as a field should be devoted to continuous potato culture, although this crop is sometimes grown for more than two years in succession on the same land. This latter course taxes heavily the fertility of the soil and necessitates liberal manuring; moreover it involves considerable risk of injury from fungous diseases, especially from potato scab. A clean crop of potatoes can not, as a rule, be grown on land which in the preceding year produced scabby tubers. The germs of the disease once in the soil must be starved out by growing on the infected field other crops, such as grass or grain, for several years. In certain localities in the central part of the United States and elsewhere the following three years' rotation has given highly satisfactory results on farms where potatoes are extensively grown; Fall wheat, in which clover is seeded in the spring; second year, clover, plowed under in fall or winter; and third year, potatoes. In some localities the uncertainty in obtaining a catch of clover renders this rotation inexpedient.

Detailed directions for the preparation of one class of soils would not apply to others, hence it can only be said that preparation should be deep and thorough, and that unnecessary compacting of the soil should be avoided. Plowing can scarcely be too deep, provided that much of the subsoil is not brought to the surface; when practicable, the depth should be gradually increased from year to year. Though the tubers are usually formed within 6 inches of the surface of the ground, the roots feed deeper. Practical experience, as well as the extent of the distribution of potato roots in the soil, emphasize the importance of deep and thorough preparation of the soil for this crop. Whether fall plowing is advisable depends on a variety of local considerations. In general in a mild climate fall plowing of light land exposes it to leaching; on the other hand, fall plowing is sometimes necessary, as, for example, when a field is badly infested with injurious insects.

Fertilizing.—The potato requires liberal manuring. Barnyard manure usually affords a large increase in the crop, for not only does it supply

nitrogen, phosphoric acid, and potash, but it improves the mechanical conditions of the soil. However, its direct application to the potato affords conditions favorable to potato diseases, and thus injures the quality of the crop. For this reason the best practice is to apply barnyard manure to corn or grass the year before the potatoes are grown. If it is considered necessary to apply it directly to the potato crop it should first be well rotted.

If for several years before potatoes are planted the land has been properly manured with farm manures, or with green crops plowed under, commercial fertilizers can be advantageously used on most soils. Generally, a complete fertilizer should be used—i. e., one which contains nitrogen, phosphoric acid, and potash. The farmer is justified in supplying all three of these fertilizing ingredients, unless by previous tests he has learned that on his soil a certain one of them can be safely omitted. Of nitrogenous fertilizers, one of the best for potatoes is the quick-acting nitrate of soda. Of phosphatic fertilizers, superphosphate is preferred. Among potash fertilizers the sulphate of potash has been found to afford a better quality of potato than kainit and muriate of potash. Ashes, are extensively and effectively used to supply potash to potatoes.

As little farmyard manure is available in the Southern States where the early crop of potatoes is chiefly produced, this seldom enters as a factor in the production of the crop. Commercial fertilizers of a nature especially adapted to the potato crop form the chief reliance of the growers. A fertilizer carrying 3 to 4 per cent of nitrogen, 6 to 8 per cent of phosphoric acid, and 8 to 10 per cent of potash is used at the rate of 500 to 1,500 pounds to the acre, depending upon the crop which is to follow the potato crop and the liberality of the grower. The fertilizer may be applied broadcast if put on at the rate of 1,000 pounds or more to the acre. When less than 1,000 pounds to the acre are used it is almost universally applied along the line of the row, a furrow being opened for the reception of the fertilizer; which is scattered by hand or by a distributor which can be used to fertilize several rows at a time. After the fertilizer has been distributed, a cultivator is run along the line of the rows to incorporate the fertilizer with the soil in order to prevent its coming in contact with the seed when planted. Sometimes the furrow is refilled and reopened prior to the planting of the seed, so as to incorporate the fertilizer more completely with the soil. Still another plan is to open the furrow, distribute about one-half the quantity of fertilizer to be used in the bottom, incorporate it with the soil, plant the potatoes, partially cover them, and scatter the remainder of the application on the seed bed above the seed.

Planting.—The rows should be laid off as close together as practicable without interfering with horse cultivation. Generally the seed pieces should be dropped in furrows made in the level field and not on ridges. However, low ridges are advantageous for an early crop and on poorly drained land. In covering the seed pieces, whether they are planted flat or on ridges, it is well to leave a small, sharp ridge marking the line of the row. In some localities, however, where excessive moisture is not feared, the opening furrows are only partially filled after planting, leaving a depression along the row to be filled by the use of the smoothing harrow or other implement. In planting late in the season this course is sometimes advisable. The pieces may be dropped by hand in the open furrow, or a potato planter may be used, dropping and covering the seed pieces at one operation. There are several potato planters that do very satisfactory work, but their cost restricts their use to those who plant a large acreage in potatoes or to cases where several farmers can use one together. Their more extended use is perhaps desirable, since they save a considerable amount of labor and enable the potato grower to take full advantage of even a brief period of favorable weather at planting time regardless of scarcity of labor. In the preparation of the ground and in planting, the earth along the line of the row should be compacted as little as possible consistent with thorough work, and hence the team should be made to walk between the rows whenever possible instead of along the drill. There is a simple potato coverer constructed somewhat like a triangular snowplow, with the wide end forward and a portion of the point or apex cut away so as to leave a narrow opening at the rear. No special implement, however, is required for this purpose.

Planting Machines.—Planting potatoes by hand on any large scale is out of the question on account of the expense. The large potato grower can of course afford the most modern machinery. In a community of small potato growers it is possible for them to own machinery jointly, and thus avoid any large expense to the individual farmer. The two most expensive machines connected with potato growing are the planter and the digger. A word of caution about the type of planter is perhaps desirable. There are some planters which pick up the seed potatoes by means of a prong or fork which breaks the skin of the tuber. This exposes the potato to any germs of potato diseases which may be present in the soil. Furthermore, it carries any germ disease that may be on some of the seed potatoes to others. There are planters which pick up the potatoes in such a way as not to break the skin. This point is especially important in planting whole seed. In planting cut seed there is still the danger of transferring the disease from one piece of potato to another. Whatever planter may be used, some one should ride on the machine in order to see that it works regularly, so as to give as nearly a perfect stand as possible. The improved planters of today open the furrow, drop the seed, cover it, firm the dirt over the seed, and mark the next furrow.

Such a planter is drawn by two horses. Experiments with potatoes planted in rows all the way from 36 to 42 inches apart indicate that the best distance depends upon the seasonal conditions and type of soil; it is a problem for each grower to solve for himself. The distance apart the potatoes should be planted in the row also depends so much upon the variety, the fertility of the soil, the availability of water, etc., that each farmer must determine this from his own experience.

Time of Planting.—Each community is the best judge of the proper date for planting. Where potatoes are grown for the early market the aim is to plant as early as possible, without subjecting the young plants to severe cold. The crop should be planted at such a date as to bring the stage of growth during which the tubers are rapidly developing at a time when there is ordinarily an adequate supply of moisture. The month when dry weather is most certain varies with the locality, and each potato grower should so time his planting as to be least affected by drought. Where the growing season is long the crop that is to be stored over winter should be planted very late, so that it may remain in the ground until cool weather. On the other hand, where the season is short, late varieties should be planted in time to ripen before frost.

Depth of Planting.—The Toots of a young potato plant grow, not directly from the seed piece, but from the underground joints or nodes of the stem. From these underground nodes also grow the short stems which bear the tubers at their extremities. Hence the seed pieces should be placed deep enough in the soil to permit several of these joints to form below the surface, so as to afford room for an ample supply of roots and tuber-bearing stems to grow. Many experiments have been made to ascertain the best depth for planting. The results, with some exceptions, favor planting not less than 4 inches deep. The favorable effects of deep planting were especially marked on well-prepared, friable soil and in dry seasons. Very deep planting is open to objection because of the increased labor of harvesting and the danger of a deficient stand when weather conditions are unfavorable. Very shallow planting reduces the yield and injures the quality of the crop.

Growing Seed Potatoes Under Mulch.—The Nebraska Experiment Station reported an interesting comparison of the value for seed purposes of potatoes grown under mulch with those grown with ordinary cultivation under like conditions, which indicates that the mulch method offers a convenient and practical means of producing good home-grown seeds under Nebraska conditions. The theory of the method and the results obtained in the comparative tests are thus stated: Potatoes are a cool-weather crop. It is because of this that they succeed so well in the far north. Moreover, potatoes require for their best development fairly uniform conditions, especially as regards soil moisture and soil

temperature. This being the case, why should not potatoes grown under a litter mulch be especially well developed and therefore make strong seed? The soil beneath a mulch not only has a moderately low temperature during summer, but its temperature is also exceptionally uniform, varying not more than a degree or two between day and night and only a few degrees from day to day. The soil moisture beneath a good mulch is also more abundant and much more nearly uniform in amount than in case of bare ground, even though the latter is given good tillage.

The value for seed purposes of tubers grown under a litter mulch has been tested during two seasons at the experiment station. In 1904 a plat of potatoes was mulched with straw and an adjoining plat was given careful cultivation. The soil of the two plats was practically uniform and the seed planted on the two plats was taken from the same lot of tubers. Seed was saved from the mulched and cultivated plats separately, kept under the same conditions during winter, planted on adjoining plats in the spring of 1905, and given identical cultivation during the summer. In 1906 the experiment was repeated with seed grown in mulched and in cultivated ground the year before. The same precautions were observed as in the first test. Uniform seed was used to start with in 1905. The seed saved from the mulched and from the cultivated plats was taken as it came, without selection, and was kept over winter under the same conditions. Both kinds of seed were cut in the same way, planted in the same way, on adjoining plats, and treated alike as regards tillage, spraying, etc. Under these conditions any constant differences in yield between the two plats must be ascribed to the effect of the methods of culture employed the previous season. The yields obtained from the mulched and from the cultivated seed were as follows: Cultivated seed, 384 pounds in 1905; mulched seed, 563 pounds in 1905; cultivated seed, 123 pounds in 1906; mulched seed, 174 pounds in 1906.

The use of seed that had been grown under a mulch the preceding year increased the yield of potatoes 47 per cent in 1905 and 41 per cent in 1906. If further tests confirm the results reported here, it would seem that mulching might be used for the production of high-grade seed potatoes at home. Moreover, mulching usually results in increased yields if properly handled. Mulching potatoes on a large scale is of course impracticable, but most farmers could easily mulch enough of their potato field to produce the seed that they would require the following year, and in doing so they would not necessarily increase the cost of production per bushel.

Time to Cut Seed Potatoes.—At least three American experiment stations have conducted tests to learn the effect of cutting seed potatoes several days or weeks in advance of planting. The results varied

somewhat according to the length of time that the cut sets remained unplanted, but on the whole indicated no marked difference in productiveness between planting freshly cut pieces and those that had been cut for a week or less. The investigations of Kraus and of Wollny in Germany led to the conclusion that a slight wilting of the seed pieces increased the yield on moist soils and in wet seasons, but reduced it on soils not retentive of water and in dry seasons. On the whole it appears that the storing of cut pieces for several days, which sometimes becomes necessary, is attended with no great disadvantages. Of course due care should be taken in such instances to prevent heating, and it may be well to dust the cuttings with gypsum (land plaster) to prevent excessive wilting.

Seed End v. Stem End.—When potatoes are cut in half through their smaller diameter there is a seed or bud end more or less crowded with eyes and a stem or butt end on which there are few eyes. Experiments to determine the relative values of cuttings from the stem end and from the seed end of the tuber have been numerous. The majority of these showed that the yield was greater when the seed end was used. The superior productiveness of the seed end as compared with the stem end was maintained, whether the halves of the potatoes, the thirds, or smaller cuttings were employed.

Effect of sprouting.—The growth of sprouts before planting is made at the expense of the tubers from which they draw their support. Hence if these shoots are rubbed off before planting there is a total loss of the nutriment contained in them. Moreover, numerous weak shoots grow from the injured eye. To prevent these evil consequences of premature sprouting, seed potatoes are stored in a dark, dry, cool place. In spite of all precautions the tubers sometimes sprout; but when practicable only potatoes that have not sprouted should be selected for planting. If the eyes appear dormant in spring, seed potatoes may be exposed to the light and warmth for a few days before planting so as to promote germination and prompt growth. If long exposed, sprouts will form and careful cutting and planting by hand become necessary, so as to avoid breaking of these sprouts.

Quantity of Seed Potatoes per Acre.—A bushel of potatoes (60 pounds) may contain 240 quarter-pound tubers. When the seed pieces are planted a foot apart in 3-foot rows an acre requires 14,520 sets. When tubers averaging 4 ounces are employed an acre requires at these distances 60 bushels for planting whole potatoes, 30 bushels when halves are used, and 15 bushels when quarters are planted. In a number of tests the amount of seed cut to 2 eyes, spaced 1 by 3 feet, averaged 13 bushels per acre, the usual range being from 10 to 14 bushels. In 18 experiments with many varieties the average amount of seed cut to

single eyes was at these distances 6.3 bushels per acre, the usual range being from 5 to 7 bushels, though the varieties with large tubers bearing few eyes required considerably more seed.

Size of Seed Pieces.—In the size of the seed piece planted the practice of different farmers varies widely, some advocating a liberal use of seed and others claiming equally good results from small cuttings. To aid in settling this question the State agricultural experiment stations have made numerous tests of seed pieces of different sizes. Taken separately these experiments show certain amount of divergence in results, as might naturally be expected of tests conducted under widely different conditions. However, the majority of these tests, and especially the figures expressing the average results of all available American experiments, may be safely taken as indications of what the farmer, under ordinary conditions, will generally, but not always obtain. The effect of size of seed pieces on yield of crop will be treated here under three distinct heads: (1) On the total yield; (2) on the gross yield of salable potatoes, and (3) on the net yield of salable potatoes, i. e., after deducting the amount of seed planted.

Effect on Total Yield.—In making up the averages below it was found practicable to use the results of 19 tests of single eyes *v.* 2-eye pieces, 4 tests of 2-eye cuttings *v.* quarters, 17 comparisons of quarters and halves, and 44 tests of halves *v.* whole potatoes. The results of other experiments less completely reported were used for the purpose of corroboration. The following table shows the *average* results of these tests, including potatoes of all sizes:

	Bushels.	Per cent.
Excess from use of—		
2-eye pieces over 1-eye pieces	26	21
Quarters over 2-eye pieces	15	16
Halves over quarters	24	18
Whole tubers over halves	31	18

If there are compared all the total yields with the total yield produced by single eyes there appears an increase of 21 per cent for 2-eye pieces, 41 per cent for quarters, 67 per cent for halves, and 96 per cent for entire tubers. The total yield resulting from planting whole potatoes is practically double that obtained by planting single eyes. Thus far there is considered only the total yield, i. e., large and small potatoes, and it is found that the total yield increases somewhat uniformly as the size of the seed piece is increased. The farmer and gardener, however, have to consider other factors than the total yield, for a heavy crop may consist very largely of tubers too small for the market, or the great expenditures for seed when large pieces are planted may more than counterbalance the increased yield. Before noting the gross and net yields of large or salable tubers, resulting from seed pieces of different sizes, it is well to consider the causes inducing a somewhat regular increase in total yield accompanying the use of larger seed pieces.

Several causes operate to increase the yield when large seed pieces are planted. The larger the cutting the greater generally the number of eyes and the number of stalks. The young shoot, before it develops a strong system of feeding roots, is dependent for nutriment on the material stored up in the seed piece; hence the more abundant this supply the more vigorous the growth of the plant and this increased luxuriance is not confined to the early stages of growth, but is marked throughout the growing season. Investigation has shown that severing the connection between the seed piece and the growing vine, even after the latter is thoroughly rooted, reduces the yield of potatoes. The danger of partial or entire failure resulting from an imperfect stand is much greater with small cuttings than with large seed pieces. The small pieces with extensive cut surfaces are liable to perish should the season be unfavorable, either through excessive moisture or drought. The sprouts from small cuttings being weaker reach the

surface with difficulty, or fail entirely on soil not properly prepared.

Effect on Gross Salable Yield.—By averaging the results of the experiments referred to above, it is found that the actual increase in the potatoes of salable size due to using larger seed pieces was as follows, every increase in the size of the seed pieces being followed by an increased gross salable yield:

	Bushels.	Per cent.
Excess from use of—		
2-eye pieces over 1-eye pieces	23	21
Quarters over 2-eye pieces	10	15
Halves over quarters	15	15
Whole tubers over halves	14	10

Effect on Net Salable Crop.—Before concluding that the largest seed pieces are the most profitable it becomes necessary to deduct from the crop the amount of seed planted. It is plain that the increased amount of seed potatoes required when larger pieces are used may more than counterbalance the increase in yield obtained. The true test of profit is the market value of the crop produced, less the cost of seed planted. Should the quantity of seed potatoes used be subtracted from the total yield of large and small potatoes or from the salable crop? If small or unsalable seed potatoes are planted, then the former course is the proper one, but since large or medium tubers (either entire or cut) are generally selected for seed purposes, it seems best to subtract the seed from the salable crop, thus ascertaining the net salable yield. The following table shows the actual average results for the net salable yield; that is, the crop after deducting the small potatoes and the seed used:

	Bushels.	Per cent.
Excess from use of—		
2-eye pieces over 1-eye pieces	15.0	14
Quarters over 2-eye pieces	7.0	15
Halves over quarters	5.0	6
Halves over whole tubers	8.5	8

The amount of the net salable crop rose with the increase in the size of the cutting employed, but when the whole potato was

planted the figures declined on account of the large amount of seed potatoes which had to be deducted. The above figures indicate a very slight advantage in planting halves rather than quarters when the price of seed and crop produced are the same. As a matter of fact, spring prices are usually somewhat higher than fall prices. A high price for seed potatoes may make it profitable to plant smaller pieces (as, for example, quarters) than would be economical where seed and crop command the same price per bushel.

Amount of Seed Potatoes.—In the following diagram 100 represents the total yield from planting single eyes. The figures may be read as bushels per acre, if it is constantly borne in mind that there are being considered soils of such character as to average 100 bushels of large and small potatoes per acre when planted with 1-eye pieces. The first group answers the question, "What size of seed piece generally affords the largest yield of large and small potatoes?" The second group answers the query: "What size of seed piece generally gives the greatest yield exclusive of small potatoes?" The third group offers an answer to a still more important question: "What size of seed piece generally produces the largest yield after deducting both the small potatoes and the amount of seed planted?"

Yield from planting different seed pieces, assuming 100 as the total yield from single eyes.

RELATIVE TOTAL YIELD.

1 eye.....	100	————————————
2 eyes.....	121	————————————————
Quarters.....	141	————————————————————
Halves.....	167	————————————————————————
Wholes.....	196	————————————————————————————

RELATIVE GROSS SALABLE YIELD.

1 eye.....	87	————————————
2 eyes.....	105	————————————————
Quarters.....	123	————————————————————
Halves.....	142	————————————————————————
Wholes.....	157	————————————————————————————

RELATIVE NET SALABLE YIELD.

1 eye.....	83
2 eyes.....	95
Quarters.....	109
Halves.....	115
Wholes.....	107

Taking as the correct measure of profit the yield of salable potatoes less the amount of seed used, there is seen by the third section of the diagram that with seed and crop at the same price per bushel it was more profitable in these tests to plant halves than smaller cuttings and whole potatoes. If there be taken account of the yield of small potatoes the advantage of large seed pieces is even greater than the figures in the last section of the diagram would indicate, for the yield of small potatoes is greater with large than with small seed pieces. Where large quantities of small potatoes can be profitably utilized, as, for example, as seed for the second crop, the potato planter may therefore use quite large seed pieces with advantage. On the other hand, the higher price of potatoes in spring rather than in fall is an argument in favor of planting quarters rather than halves or whole tubers. A number of investigators have noted that large seed pieces (either large cuttings or entire potatoes) afford an earlier crop than very small cuttings, a matter of much interest to growers of early potatoes. However, some growers have reported that uncut potatoes germinate more slowly than large cuttings. Most of those who raise potatoes for the early market use large cuttings rather than whole potatoes.

In this connection it may he said that the seed-end half gives an earlier crop than the other half. This suggests the expediency of cutting a potato lengthwise when halves or quarters are to be planted, thus securing on each piece one or more of the eyes which germinate first. Another advantage of cutting lengthwise is that it insures a more even distribution of the eyes on the several pieces. Of course this system is not practicable when very small cuttings are to be made from long, slender potatoes, since the large amount of exposed surface would render the long pieces susceptible to injury both from moisture and dryness.

If it is desired to cut the potato into small pieces the operator should begin at the stem end, and the pieces should be cut in a

compact shape, and of as nearly equal size as is practicable without leaving any piece entirely devoid of eyes. There are special implements for cutting potatoes, and their use is reported as enabling a man to cut four or five times as many bushels of seed per day as by hand. The character of the work is said to be satisfactory. No definite rule can be given as to the best size of seed piece, for this depends somewhat on the distance between the hills and on the character of the soil and season. Another important factor in determining the proper amount of seed is variety. Some varieties are able to produce a crop almost as large from small cuttings as from large pieces.

Size of Seed Tubers.—A study of more than a hundred experiments testing the relative values of large, medium, and small uncut tubers confirms the general law that an increase in the weight of seed planted affords an increase in the total crop. The yield of salable potatoes increases less rapidly than the total yield. With whole potatoes as seed the salable yield reached its extreme upward limit in one test when tubers weighing about half a pound were planted; in another when those weighing 4½ ounces were employed. The limit of profitable increase was reached with tubers weighing 4½ and 3 ounces respectively. The size of seed tubers selected becomes a matter of importance when they are to be cut, for we have seen that the heavier the cutting the larger the total yield, and seed tubers for cutting should be of such size that their halves, quarters, or other divisions shall not be extremely small.

Small Potatoes for Planting.—Whether or not to use uncut small potatoes for seed is an important question on which farmers are divided. Some present the plausible argument that the use of undersized potatoes results in degeneration. If this claim is based on the results of experience it should determine practice, but if the conclusion is simply a generalization based on the fact that large seed usually give best results the reasoning is defective, and the question remains open. The potato tuber is not a seed, but an underground stem, and the relations existing between seeds and their progeny do not necessarily exist between a tuber and its descendants. Others hold that potatoes just below marketable size, if shapely and sufficiently mature, may be used without serious deterioration, and that for economic reasons their use is especially desirable, because if not planted or used at home they must be lost

or fed to stock, for which purpose their value is usually smaller than the market price.

The result of tests at a number of experiment stations have uniformly indicated that small tubers uncut can be used for seed purposes without detriment to the succeeding crop. It may still be urged, however, that the choice of small seed year after year will result in degeneration. On this question the information is meager, but two experiments, extending over four and eight years, respectively, have been reported in which no degeneration resulting from the continued use of small potatoes from the preceding crop was apparent. Although the evidence seems fairly conclusive that small uncut seed potatoes may sometimes be used with profit, it cannot be advised that small seed tubers be selected year after year from a crop which has been grown from small potatoes. Potatoes of irregular shape and injured tubers should be rejected as unfit for planting.

Number of Eyes and Weight per Set.—Many potato growers cut tubers into pieces containing one, two, or more eyes, laying greater stress on the number of eyes than on the size of the cutting. Extensive experiments at the Indiana station and elsewhere prove that of the two factors, number of eyes and weight of piece, the latter is the more important. Of course it is desirable that each piece, whether large or small, should contain at least one eye, and it has been generally profitable for it to be of such size as to contain at least several eyes; but whether it has one or many eyes it is important that the seed piece be heavy enough to furnish abundant nutriment to the shoots which spring from it. A single eye may give rise to several stalks, for each eye is a compound bud or cluster of buds. An eye can be bisected, and each half may then grow successfully if it is not a victim to dryness or decay, to which its exposed condition subjects it.

In one series of experiments it was found that the number of stalks growing in a hill was less dependent on the number of eyes than on the size of the seed piece, whether cut or entire. In general, as the number of eyes per piece increased each eye became less prolific in sending up stalks, so that there was less crowding of stalks where large seed pieces with many eyes were used than would be expected from the large number of eyes planted. After numerous experiments touching on almost every aspect of this subject the investigator advised that tubers be cut so

as to make each piece of a constant size or weight, whatever the number of eyes that might fall to its share.

Cuttings per Hill.—A custom not uncommon among those who plant small cuttings is to drop two pieces in each hill. They usually get a larger yield by so doing than by planting single pieces, the increase generally, though not always, being sufficient to pay for the excess of seed. This does not prove the practice profitable, for better results may be secured by planting a single piece weighing as much as the combined weight of the two pieces which would have been dropped in one hill. Thus the labor of cutting is considerably reduced and, what is more important, larger pieces improve the chances of getting a good stand in an unfavorable season, because they have less exposed surface than two small pieces of equivalent weight, hence are less liable to dry out excessively when drought follows planting. They are also better able to resist rotting if wet weather prevails.

Stalks per Hill.—The most common objection urged against planting large seed pieces is, next to the expense, the danger of having the hills so crowded with stalks, and consequently with tubers, that a large proportion of the potatoes never develop to marketable size. This objection is probably valid for entire tubers, and also for halves planted very close in the row. The evidence available does not permit us to conclude that in the case of quarters used as seed there results any injurious crowding, and it may be questioned whether halves give rise to this trouble when planted under favorable conditions and at considerable distance apart. The number of stalks that can be advantageously grown in each hill varies greatly with variety, season, soil, and distance apart.

Distance Between Plants.—In deciding on the proper distance at which to plant potatoes it is necessary to take into consideration the size of the seed piece that is to be employed. In general, small seed pieces should be planted close and the distance allotted to each hill should be greater as the weight of the piece is increased. Close planting for small cuttings is best attained, not by narrowing the row to less than about 2½ or 3 feet (for if the distance is much less horse cultivation becomes difficult), but by planting the seed pieces close together in the row. To frame a general rule giving best distances for seed pieces of different sizes is plainly impossible, for the distance at which the largest yields is

obtained depends also on the variety, the season, the soil, and the fertilizers. However, the results of some of the investigations covering this matter afford help in deciding on the proper distance under varying conditions. It has been shown that if very small cuttings are used, and if the soil is fertile, the distance can be reduced to 6 or 9 inches without sacrificing the yield, provided the season happens to be favorable, but this is not generally advisable.

On rich soil cuttings of considerable size can be advantageously planted as close as 12 inches. Checking effects a saving of labor in cultivation, and also in planting and harvesting, when these latter operations are performed by hand; hence expensive labor and the absence of machines for planting and harvesting the crop are conditions in favor of checking. For planting in checks a variety can be chosen which makes a large growth of vines and which forms many tubers in each hill, thus more completely utilizing the space at its disposal than could a variety with small vines and few tubers. In checking there is danger on rich soil that some of the tubers may grow to an objectionable size. Potato growers in attempting to obtain a phenomenal yield, as in contests for prizes, almost universally plant in drills rather than in hills, and place the seed pieces from 8 to 15 inches apart. The advocates of planting in drills claim that by this method a larger yield can be obtained, and experience seems to confirm the correctness of this view. The few experiments that have been made on this question are not entirely conclusive, though the majority of them favor drills. Although no fixed rule regarding distance of planting can be given, the following general considerations are widely applicable:

(1) For maximum yield of salable potatoes plant in rows as narrow as can be conveniently cultivated.

(2) Crowd small seed pieces close together in the row, increasing the distance with every increase in the size of the seed piece; avoid on the one hand such close planting as to greatly reduce the average weight of the tubers, and on the other such wide spacing as to leave any considerable portion of the soil unshaded by the full-grown vines.

(3) As a rule, the richer the land the less the required distance between sets.

(4) Varieties with strong growth of vines or which set many tubers in a hill should have greater distance between plants than is necessary with less vigorous varieties.

Cultivation.—Soon after planting, and again just as the young plants are beginning to appear above ground, the field should be harrowed, inclining the teeth of the harrow backward. This is a cheap method of cultivation, since a wide space is covered. It is also effective in destroying small weeds, in leveling the ridges left in planting, in preventing the formation of a surface crust, and in keeping the land covered with a mulch of dry earth, thus conserving moisture within the soil below. Subsequent cultivation should be frequent so as to accomplish these same ends. Almost any pattern of cultivator may be used, provided it is made to do shallow work. However, if the ground has become packed the first cultivation may be deeper. Experience and exact experiments generally favor flat or nearly flat cultivation. Excessive hilling during cultivation intensifies the injurious effects of dry weather. It also results in breaking many of the feeding roots between the rows. The frequent use of the cultivator should be substituted as far as possible for hoeing. If a severe frost is apprehended soon after the plants come up, the tops should be covered by throwing a furrow to each row.

Mulching.—While mulching with hay, straw, leaves, or other litter frequently increases the yield and is specially valuable in tiding over a season of drought, it is not generally practicable on farms where potatoes are grown on a large scale. Its place is in the garden rather than in the field. It is a substitute for cultivation, and it is generally cheaper to maintain a soil mulch by frequent cultivation than to apply litter. If a mulch is employed, it can be applied over the entire surface or in the furrow above the seed pieces, or between the rows. Mulching in the furrow is not commended by the results of tests in Colorado, Louisiana, and Michigan. In striving for a large yield, with little regard to cost, or to insure against drought, mulching is useful.

Material intended to serve as a mulch should first be exposed to the weather, so as to cause the sprouting of any seed it may contain. It is better to apply a mulch after potato plants have made some growth, as an earlier application may result in smothering some plants and in injury from late frosts.

Harvesting and Storing.—The death of the vines is the signal for digging the main crop. For the early market potato growers do not wait for this, but are governed by the size of the tubers. As long as any portion of the vine is green the tubers can continue to grow. In gardens very early potatoes are sometimes obtained by carefully removing a few of the larger tubers from the growing plant, replacing the soil and allowing the smaller potatoes to continue growing ("grabbing"). The large amount of labor required prohibits "grabbing" except when early potatoes are selling at a price very much higher than can be expected from the later crop.

In harvesting a large area a high-priced potato digger is frequently used; hand digging with a four-tined fork is probably the best method on small areas, though many make use of a potato hoe or of a plow. Careful handling always pays, and extreme carefulness is necessary, especially with the early crop, to prevent injury to the tender skin of the immature potatoes. In harvesting, as well as in storage, potatoes should be exposed to light as little as possible. In storing potatoes a low temperature is required. The potato tuber is uninjured by a temperature of 33° F., and one authority gives the freezing temperature of potatoes 30.2° F. Warmth favors sprouting, which injures potatoes both for planting and eating.

Most of the farmers have potato houses or cellars constructed for storing their stock and holding the unsold portion of the crop through even the coldest weather until they can market it. Some growers, especially those near town, depend on the warehouses of the dealers alongside the railroad tracks. The common type of storehouse on the farm is a cellar walled up with concrete or stonework, about 8 or 9 feet deep, with a low wooden roof above it, giving a considerable space for the storage of tools, barrels, etc., on the floor above the cellar portion. These cellars are usually built on the side of a hill, so that the potatoes are unloaded down through the floor in the fall and taken out at a lower doorway during the winter.

Photo by Verne Morton, Groton, N. Y.
THOROUGH CULTIVATION OF THE GROWING CROP IS AN ESSENTIAL OF SUCCESSFUL POTATO RAISING

Grading.—The grading of early potatoes is quite as important as the grading of fruits. Large and small tubers should not be mixed in the same barrel. The pickers should be taught to gather the large and merchantable tubers in one basket and the small or seed potatoes in another, and these if placed upon the market should go in separate receptacles and be clearly marked so as to represent the grade. If a mechanical sorter is used this work will be more effectively accomplished than if left to the pickers. The type of grader usually used is similar to that employed in some sections for grading apples and peaches, although the common type of potato grader is a rotary screen which separates the earth from the tubers and allows the small tubers to fall through the large meshes of the screen before reaching the general outlet which carries away those of merchantable size. The objection to a mechanical grader of this type is that it bruises the immature tubers and renders them somewhat less attractive than when not so handled and probably also shortens the length of time they can be safely held on the market.

Marketing.—The perishable nature of the immature potato renders it necessary to place it upon the market in such quantities only as will admit of immediate consumption. Producers in regions where the growing of early potatoes has been extensively developed appreciate this and have provided for this condition by organizing shippers' associations through which the crop is graded, often trade-marked, and distributed chiefly in carload lots. The officers of the association being in constant telegraphic communication with the various markets are thus informed regarding the most satisfactory destination for every consignment which may be necessary. It is the purpose of these associations, however, to conduct their business in such a way that the product can be sold f. o. b. shipping point instead of by consignment, and the best organized associations are usually able to do this.

The great advantage of such a system of selling is that it enables the brokers in a small city or town to buy direct from the producer instead of through another city broker. It enables the consumer to obtain fresh products, as they are shipped direct from the point of production to the place of consumption. The plan carries other benefits which are of great moment to the producer. He is enabled to sell in carload lots at shipping point, thus saving to himself the cost of transportation, which ranges from 7 to 15 per cent of the gross selling price. The exchange secures a much wider distribution of the crop, with the result that overstocked markets are much less likely than under the consignment system. Transportation companies provide better service, and claims are more promptly settled through the exchange than in the case of individuals. This plan enables the producer to be his own salesman. It transfers the distributing point from the city to the field, where it should be. It brings the market to the fields instead of the product to the market. The exchange becomes the farmer's commission house, and it is much easier to keep informed regarding the transactions of a home association than of a foreign concern.

Varieties.—The following are among the most widely known varieties: *Early*, Early Ohio, Early Rose, Beauty of Hebron, and Triumph. *Medium and late*, Burbank, Rural New Yorker No. 2, Empire State, Mammoth Pearl, White Star, and Dakota Red. These are standard varieties, and though not necessarily the best, they seem to have given general satisfaction.

Second-Crop Potatoes for Seed at the South.—Within recent years there has been a marked increase in the use of second crop potatoes for seed throughout the southern potato-growing sections. This crop is frequently grown on the same land from which the first crop of potatoes was harvested. In most instances, however, it follows beans or cucumbers, as the seed for this second potato crop is not usually planted until July or August. The seed for this crop is, as a rule, saved from the early crop, the small tubers being stored in a well-ventilated shed, where they are protected from the direct action of the sun and from storms until about ten days or two weeks before the time of planting, when they are spread thinly upon the ground and lightly covered with straw or litter to partially protect them from the sun. Under these conditions the tubers quickly "green" and all those suitable for seed will develop sprouts. As soon as the sprouts are visible, and before they are large enough to be rubbed off in handling, the potatoes are ready to plant. The product of this planting gives a crop of partially matured tubers which are held over winter for spring planting. This practice gives excellent results in many localities and is found to be more economical than the purchase of northern-grown seed. To what extent it is safe to follow this practice without renewing the seed from the North by the use of fully matured tubers has not been determined. Those following the method should carefully observe the quality and yield of the crop for the purpose of determining whether or not it is deteriorating under this treatment. In general, it is believed that it will be within the limits of good practice to secure every second or third year enough northern-grown seed to supply seed for the second crop; in fact, some of the most successful growers of potatoes who use second-crop seed get enough northern-grown seed each year to supply planting material for the second crop. In this practice it will be economy to err on the side of safety and obtain fresh seed frequently from reliable northern sources. In a majority of instances it is found that second-crop home-grown seed is slower to germinate and later in maturity than northern-grown seed, and as quick development is an important element in the crop at the South, growers are urged to consider this point carefully.

Held-over Seed.—The consensus of opinion is that in southern localities it is impracticable to keep early potatoes from harvest time to the next season's planting period. The conclusions of those

who have given this problem careful study are that the exposure of the tubers to the sun at harvest time is the chief factor in determining their keeping qualities. In other words, it is possible to keep potatoes in the extreme South from season to season provided the tubers are not exposed to the sun after being dug. They should be immediately carried to a protected place where there is ample ventilation and where they will receive only diffused light, such as a cyclone or other cellar, or the basement of a house, or even where brush protection will prevent the sun shining directly upon them. It is, of course, necessary that the tubers be well matured before being dug and that they be the product of disease-free plants. Plants killed by blight yield tubers which seldom keep well even under the most favorable conditions.

Methods of Securing Extra-Early Potatoes.—One of the most important factors having an influence on the profitableness of market garden crops is that of earliness. A difference of two or three days or a week in placing a crop on the market often makes the difference between profit and loss, and the prices obtained for extra-early crops have stimulated cultural experiments with every kind of fruit and vegetables. Some interesting results along this line with potatoes have recently been reported by the Kansas and Rhode Island stations. At the Kansas Station seed tubers of four different varieties of medium-sized potatoes were placed in shallow boxes with the seed ends up in February. They were packed in sand, leaving the upper fourth of the tubers exposed, and the boxes were placed in a room with rather subdued light, having a temperature of 50° to 60° F. Vigorous sprouts soon pushed from the exposed eyes. The whole potatoes were planted in furrows in March in the same position they occupied in the boxes. The same varieties of potatoes taken from a storage cellar were planted in parallel rows. The sand-sprouted potatoes took the lead from the start in vigor and strength of top and produced potatoes the first of June, a week earlier than the storage-cellar potatoes. At the final digging they showed better potatoes and gave a 10 per cent larger total yield. In other experiments part of the potatoes was treated the same as in the first test, except that the sand was kept moistened, and the other part was placed in open boxes and kept in a light room having a temperature of 50° F. The tubers placed in sand developed strong sprouts and nearly all rooted. When planted in the field they outstripped both the

tubers sprouted in open boxes and the storage-cellar tubers in vigor of growth. The tubers started in the open boxes gave earlier yields than were obtained from the storage-cellar tubers, but not as early as the tubers sprouted in moist sand. The tubers sprouted in moist sand produced table potatoes from 7 to 10 days earlier than the storage-cellar seed.

At the Rhode Island Station medium-sized whole potatoes sprouted on racks, in a fairly warm and light room, gave a 27 per cent better yield at the first digging than potatoes kept in a cold cellar until planting time; and this was increased to 40 per cent at the final digging. The percentage of large tubers was also greater at each digging with the sprouted tubers. The results of these experiments are suggestive. The handling of seed potatoes in such manner as to secure strong, stocky sprouts before the tubers are planted out is shown to be an important factor in increasing both the earliness and the total yield of the crop. By planting only well-sprouted seed, a full stand is assured.

One of the objections to this method of growing potatoes is the large amount of space required for exposing the tubers to the light for sprouting. This objection has been overcome in part by the use of trays and racks. At the Rhode Island Station the rack used held 9 trays. Each tray was 3¾ feet long and 1½ feet wide, and would hold about 1 bushel of potatoes when spread out in a single layer for sprouting. The bottoms of the trays were made of pieces of lath placed about 1 inch apart. Nine trays were placed in a rack over each other, leaving about 9 inches of space between each tray. This method of arrangement has the advantage of securing a very uniform distribution of light, heat, and air for all the trays. It greatly facilitates the handling of the potatoes and lessens the danger of breaking off the sprouts and transferring to the field for planting.

Another method of securing early potatoes in Rhode Island on a commercial scale is that of sprouting tubers in a cold frame and planting out as soon as danger of frost is past. The tubers are cut into pieces, not smaller than an English walnut, after rejecting the two or three eyes nearest the stem end, which have been found to start late. The pieces are placed side by side in the bed, skin side upward, and covered about 4 inches deep with fine, rich earth. Their growth can be controlled by proper regulation of the cold-frame sash. At planting time the tubers, the sprouts of which

should be just breaking the surface of the soil, are carefully lifted with manure forks, separated by hand, and placed in well-fertilized rows, and entirely covered with soil; or, if danger of frost is past, they are placed with the apex of the sprout just at the surface of the soil. About 216 square feet of cold frame is required to sprout sufficient potatoes to plant an acre in 30 to 32 inch rows, 12 inches apart. Eight men can transplant an acre in a day.

On the Island of Jersey, where early potatoes are raised in large quantities for the London market, the potatoes destined for seed are placed side by side in shallow boxes and stored, as soon as cold weather sets in, in a light and well-sheltered loft or shed, out of danger of frost. The position of the boxes is changed from time to time so that the sprouts will be of equal length and strength at the planting season. Medium-sized tubers selected from the best of the crop and allowed to lie in the field in the fall until they become greenish are used.

Potatoes on Western Irrigated Farms.—With thorough cultivation, for potatoes planted the first of May, irrigation is seldom necessary until July. Generally speaking irrigation water is cold and it is highly important not to irrigate too frequently, since the water not only causes the soil to run together but lowers the temperature to a point that is not favorable to the growth of potatoes. Irrigation water is applied only when the condition of the plants indicates that they are in need of water, as by darkening of the foliage. Or one may dig down in the hill and press a handful of soil in the hand; if it fails to retain its form, irrigation is needed. Care should be taken not to wait until the ground is too dry, because one can not cover the whole field of potatoes in one day's irrigation, and some are likely to suffer for water before being reached. Experience shows that if potatoes are grown as rapidly as possible, so as to become strong and well established early in the season, they withstand the maximum of unfavorable weather conditions later on, when the hot dry winds becomes a menace to the crop.

When the time for irrigation arrives, a V-shaped trench half-way between the rows should be opened in alternate middles with an 8 or 10 inch lister plow; that is, a narrow plow with a double mold-board which throws the dirt each way. In these furrows the irrigation water is run so that the soil will not become solidified by flooding, and the necessary amount of water may be properly

distributed. For the second irrigation furrows are opened in the middles that were not opened at the first irrigation, and this alternation is continued for succeeding irrigations. At the head of each field is a feeder ditch from which the water is admitted to these irrigation furrows between the rows. It is essential that the right quantity of water be used, and that it be uniformly distributed. Cultivation should commence as soon after irrigation as the soil will permit so as to insure rapid and uniform growth without check. This will not only result in the production of smooth, uniform tubers of attractive appearance, which are always in demand at high prices, but will also result in large, profitable yields and at the same time keep the soil in good mechanical condition for future crops. Do not irrigate after August 10, so as to give fifty or sixty days for ripening in dry earth.

There is no line of farming in the irrigated districts that gives such marvelous profits as that of scientific potato production. With scientific knowledge which can certainly be acquired by experiments in supplying perfectly balanced plant food and maintaining soil fertility, the scientific principles of which are similar to those used by every successful breeder in feeding and fitting prize-winning stock; and with the proper proportions of plant foods—phosphates, nitrogen, and potash—in the soil as found in many parts of the West; and by the use of clover and alfalfa, there is no reason for those who contemplate engaging in the potato industry to fear the outcome. Too much stress can not be put upon the value and importance of livestock in keeping up favorable soil conditions, as no country now known has been continuously successful in crop production without the use of manures from the feeding of forage and grain crops.

Varieties.—Years of experience have demonstrated that comparatively few varieties of potatoes are really adapted to western or mountain conditions. Among the early varieties none has been so universally successful as the Early Ohio. This potato is of fine quality and uniform in size and shape, though not a heavy yielder. Another good potato, though not so early, is the Rose Seedling. For a medium to late variety, the Dalmeny Challenge, a Scotch variety, is being used quite extensively on the western slope of Colorado. For later varieties, the White Pearl and Rural New York No. 2 are more extensively used at Greeley, in

the San Luis Valley, and in the Uncompahgre Valley; and the Perfect Peachblow is the favorite in the upper Grand Valley.

PUMPKIN.

The true pumpkin is hardly to be considered as a garden crop, and, as a rule, should be planted among the field corn. Plant where the hills of corn are missing and cultivate with the corn. However, some of the better sorts of pie pumpkins should be grown in the garden for cooking purposes, because they are productive and much superior in quality to the common field pumpkins.—(F. B. 255; Mich E. S. 20, 190.)

RADISH.

The radish is quite hardy and may be grown throughout the winter in hotbeds at the North, in cold frames in the latitudes of Washington, and in the open ground in the South. For the home garden the seed should be sown in the open ground as soon as the soil is moderately warm. Plant in drills 12 to 18 inches apart, and as soon as the plants are up thin them slightly to prevent crowding. Radishes require to be grown on a quick, rich soil, and some of the earlier sorts can be matured in two to three weeks after planting. If the radishes grow slowly they will have a pungent flavor and will not be fit for table use. For a constant supply successive plantings should be made every two weeks, as the roots lose their crispness and delicate flavor if allowed to remain long in the open ground. As a rule a large percentage of radish seed will grow, and it is often possible by careful sowing to avoid the necessity of thinning, the first radishes being pulled as soon as they are of sufficient size for table use, thus making room for those that are a little later. Radishes will not endure hot weather and are suited to early spring and late autumn planting. There are a number of varieties of winter radishes, the seed of which may be planted the latter part of summer and the roots pulled and stored for winter use. These roots should remain in the ground as long as possible without frosting and should then be dug and stored the same as turnips. This type of radish will not compare with the earlier summer varieties, which may be easily grown in a hotbed or cold frame during the winter. One ounce of radish seed is sufficient to plant 100 feet of row, and when grown

on a large scale 10 to 12 pounds of seed will be required to the acre.—(F. B. 255, 295; U. Id. E. S. 10; Mich. E. S. 20; N. Car. E. S. 132.)

RHUBARB (PIE PLANT).

The soil for rhubarb should be deep, and there is little danger of having it too rich. Like asparagus the seedling plants of rhubarb can be grown and transplanted. Ten to twelve good hills are sufficient to produce all the rhubarb required by the average family, and these are most easily established by planting pieces of roots taken from another bed. Good roots may be secured from dealers and seedsmen at about $1.50 a dozen. The old hills may be divided in the early spring or late fall by digging away the earth on one side and cutting the hill in two with a sharp spade, the part removed being used to establish a new hill. The usual method of planting rhubarb is to set the plants in a single row along the garden fence, and the hills should be about 4 feet apart. If more than one row is planted the hills should be 3½ or 4 feet each way. The thick leaf stems are the part used, and none should be pulled from the plants the first year after setting. Rhubarb should receive the same treatment during winter as asparagus, and the plants should never be allowed to ripen seed. The roots may be brought into the greenhouse, pit, cold frame, or cellar during the winter and forced. Rhubarb does not thrive in warm climates. The use of rhubarb is principally during the early spring for making pies and sauces, and the stems may be canned for winter use.—(F. B. 255; N. Car. E. S. 132; U. Id. E. S. 10.)

RUTA-BAGA (SWEDES).

The culture of the ruta-baga is the same as for the turnip, except that the former requires more room and a longer period for its growth. The roots are quite hardy and will withstand considerable frost. The ruta-baga is used like the turnip, and also for stock feed. Two pounds of seed are required for one acre.—(F. B. 255; Mich. E. S. 6.)

SALSIFY (VEGETABLE OYSTER).

Sow seeds of salsify during the spring in the same manner as for parsnips or carrots. At the South, a sowing may be made in summer to produce roots for winter use. One ounce of seed is required to plant 100 feet of row, and on a large scale 10 pounds to the acre. After the plants are well established they should be thinned sufficiently to prevent their crowding. The cultivation should be the same as for parsnips or carrots, and frequent use of a wheel hoe will avoid the necessity for hand weeding. Salsify may be dug in the autumn and stored or allowed to remain in the ground during the winter, as its treatment is the same as for parsnips. Salsify is a biennial, and if the roots are not dug before the second season they will throw up stems and produce seed. It is of a weedy nature and care should be taken that it does not run wild by seeding freely. Salsify is deserving of more general cultivation, as it is one of the more desirable of the root crops for the garden. The uses of salsify are similar to those of the parsnip, and when boiled and afterwards coated with rolled crackers and fried in butter it has a decided oyster flavor, from which the name vegetable oyster is derived.—(F. B. 255, 295; N. Car. E. S. 132; Idaho E. S. 10.)

SCOLYMUS.

Scolymus is a vegetable with spiny, thistle-like leaves, from Spain, with roots much like a small parsnip and keeping equally well in winter.—(S. Dak. E. S. 68.)

SKIRRET.

This is called "Zuckerwurzel" (Sugar root) in Germany. The plump, fleshy roots are sweet and used boiled during winter, the same as Salsify.—(S. Dak. E. S. 68.)

SORREL.

This plant resembles the weed "sour dock" of the fields. The leaves are large, tender and juicy, very broad and often 10 inches long, retaining the pleasant acid flavor of the original weed. Much prized in France where it is cultivated as a spring vegetable and used singly or mixed with spinach.—(Mich. E. S. 20; U. Idaho E. S. 10.)

SPINACH.

Spinach thrives in a rather cool climate and attains its best development in the Middle South, where it can be grown in the open ground during the winter. Large areas are grown near Norfolk, Va., cuttings being made at anytime during the winter when the fields are not frozen or covered with snow. When the weather moderates in the early spring the plants make a new growth, and a large crop of early greens is available. North of the latitude of Norfolk, spinach can be planted in the autumn and carried over winter by mulching with straw or leaves. Sow the seeds in drills 1 foot apart at the rate of 1 ounce to 100 feet of row or 10 to 12 pounds to the acre. To produce good spinach, a rich loam which will give the plants a quick growth is required. As ordinarily grown, it occupies the land during the autumn and winter only and does not interfere with summer cultivation. It is an easily grown garden crop, and there is, perhaps, no other of its kind that will give as good satisfaction. Three or four ounces of seed, planted in the autumn after a summer crop has been harvested from the land, will produce an abundance of greens for the average family during the late autumn and early spring. In gathering spinach the entire plant is removed rather than merely cutting off the leaves. The larger plants are selected first, and the smaller or later ones are thus given room to develop. No thinning is required if this plan of harvesting is practiced.—(F. B. 255; Mich. E. S. 20; U. Id. E. S. 10; N. C. E. S. 132.)

SQUASH.

There are two types of the squash, the bush varieties, which may be planted in hills 4 or 5 feet apart each way, and the running varieties, which will require from 8 to 16 feet for their development. Squashes may properly be grown in the garden, as 3 or 4 hills will produce all that are required for family use. They require practically the same soil and cultural methods as the muskmelon. A number of varieties are used during the summer in the same manner as vegetable marrow, but squashes are principally used during the winter, in much the same way as pumpkins, to which they are superior in many respects. Squashes are also used extensively for pie purposes. The varieties known as Hubbard and Boston Marrow are most commonly grown.

Squashes, like pumpkins, should be handled carefully to avoid bruising, and should be stored in a moderately warm but well ventilated room.—(F. B. 255; Mich. E. S. 190; S. Dak. E. S. 42, 68.)

STACHYS.

This vegetable, known to the botanists as *Stachys sieboldi*, has been introduced into America from Japan and has a number of different names, such as Japanese potato, Chinese artichoke, chorogi, etc., but the name stachys seems to have been adopted as the common one in this country. The plant is a small perennial belonging to the mint family and produces just below the ground a multitude of small, white, crisp edible tubers, varying from an inch to two and one-half inches in length, and about one-half an inch in thickness and marked by irregular spiral rings, which give them a corkscrew-like appearance.

Stachys has been tested at the New York (Cornell) and a number of the other agricultural experiment stations, and proved so easy of cultivation and pleasant in taste (the flavor resembling artichokes) that the vegetable has made many friends and is now procurable at the markets in most of our larger cities. The agreeable quality is in considerable measure due to the crispness of the tubers, and as this disappears when they are exposed to the air they should be stored in sand or sawdust. They are ready for use when the plant dies down in the autumn, though they may be easily carried over the winter and are prepared for the table like potatoes or other vegetables, or may be eaten raw like radishes.—(F. B. 295.)

SWEET BASIL.

The leaves are used for flavoring purposes.

SWEET CORN.

Plant sweet corn as soon as the soil is warm in the spring, and make successive plantings every two weeks until July, or the same result can be attained to some extent by a careful selection of early, medium, and late varieties. Plant the seeds in drills 3 feet apart and thin to a single stalk every 10 to 14 inches, or plant 5 to

6 seeds in hills 3 feet apart each way, and thin out to 3 to 5 stalks in a hill. Cover the seeds about 2 inches deep. Cultivate frequently and keep down all weeds, removing suckers from around the base of the stalk.

Sweet corn should be planted on rich land, and the method of cultivation is practically the same as for field corn, but should be more thorough. There are a number of good early varieties, and for a midsummer and late sort there is none better than Stowell's Ever-green.—(F. B. 255; N. J. E. S. 199; S. Dak. E. S. 91.)

SWEET MARJORAM.

Leaves and ends of shoots used for seasoning.

SWEET POTATO.

Owing to the tropical nature of the sweet potato it naturally thrives best in the South Atlantic and Gulf Coast States, but it may be grown for home use as far north as southern New York and westward along that latitude to the Rocky Mountains. The climatic requirements for the production of sweet potatoes on a commercial scale are (1) a growing period of at least four and half months without frost, (2) warm nights and abundant sunshine during the day, and (3) a moderate rainfall during the growing period. Where irrigation is depended upon for the supply of moisture, the greatest quantity of water should be applied between the time the plants are set in the field and the time when the vines practically cover the ground. If too much water is applied during the latter part of the season the result may be an abundant growth of vine and a small yield of stringy potatoes. For some time before harvesting the crop the water should be withheld altogether, in order that the roots may ripen properly.

Soil.—Sweet potatoes thrive on a moderately fertile sandy loam which does not contain an excess of organic matter. They are frequently grown upon almost pure sand, especially where the subsoil is a yellow clay. Soils containing considerable calcium or underlain with limestone are well adapted to the growing of the crop. The sweet potato is exceptional in that a fairly good crop can be grown upon soils that are too poor for the production of the majority of farm crops. Sweet potatoes yield a fair crop on the

"worn-out" tobacco and cotton lands of the South, especially when used in a rotation including some leguminous crop for increasing the humus in the soil. Like many other crops, the sweet potato thrives on newly cleared land, but the crop should not be planted continuously in the same place. With the sweet potato, as with other crops, rotation is the keynote of success.

Good drainage is essential, the original idea of planting upon high ridges being for the purpose of securing better drainage. The surface soil should extend to a depth of 6 or 8 inches, and the subsoil should be of such a nature that it will carry off excessive moisture without leaching away the fertilizers applied to the land. Too great a depth of loose surface soil or an alluvial soil having no subsoil will produce long, irregular potatoes that are undesirable for marketing. Planting upon land having a loose, sandy surface soil underlain by a well-drained clay subsoil will tend to produce the type of rather thick, spindle-formed potato that commands the highest price. The depth of plowing is a prominent factor in the preparation of land for sweet potatoes, and on soils of too great depth before the subsoil is reached very shallow plowing should be practiced, leaving the soil firm beneath, against which the roots must force their way. If the surface soil is of insufficient depth, it should be gradually increased by plowing a little deeper each year or by subsoiling in the furrow behind the regular turning plow.

Fertilizers.—The root portion of the plant is the part having the greatest value, though the foliage and vines have some value as food for certain kinds of stock. It has been found that an excessive amount of organic matter in the soil will frequently produce an abundant growth of vines at the expense of the roots. It has also been noted that the potatoes will be small and the yield unsatisfactory on soils that do not contain sufficient organic matter to produce a fair growth of vine. The use of stable manure as a fertilizer for sweet potatoes is recommended on lands that are deficient in organic matter. Heavy applications of fresh manure shortly before planting the land to sweet potatoes will stimulate not only the growth of weeds but also of the vines at the expense of the roots. Well-rotted stable manure may be used at the rate of 10 to 15 carloads to the acre, spread broadcast or beneath the ridges and harrowed into the soil, but it is always well to apply the manure with the crop grown the previous season. By this

method the manure will become thoroughly incorporated with the soil and become somewhat reduced before the sweet potatoes are planted upon the land. Stable manure will be found most beneficial on worn-out soils, but on the more fertile soils its use should be restricted and the method of application carefully studied.

The sweet potato is one of the few crops that thrive equally as well (or better) upon commercial fertilizers as upon stable manure. A fertilizer for use on the majority of sweet potato lands should contain 3 to 6 per cent of nitrogen, 6 or 7 per cent of phosphoric acid, and 8 to 10 per cent of potash. Every grower should make a study of the requirements of his soil and apply the fertilizer that will give the best results. Many growers purchase the ingredients and mix their own special fertilizers, or use a standard fertilizer as a base and increase the percentage of certain elements by adding high-grade elementary ingredients. Some soils require that certain elements should be in a more available form than others; in the case of nitrogen it is often desirable to have a portion of that contained in the fertilizer quickly available and the remainder more slowly in order to feed the plants throughout the season. A mixture adapted to the growing of sweet potatoes on most soils may be made by combining the following:

200 pounds of high-grade sulphate of ammonia, 25 per cent pure.

200 pounds of dried blood, or 300 pounds of fish scrap.

1,200 pounds of acid phosphate, 11 per cent pure.

400 pounds of high-grade muriate of potash, 50 per cent pure.

The quantity of fertilizer that may be profitably applied will be governed entirely by local conditions. Many growers do not depend upon commercial fertilizers, but merely apply from 200 to 300 pounds to each acre as a supplement to the organic matter and natural fertility of the soil. Others apply from 300 to 1,000 pounds, according to the condition of the soil, while a few growers use a ton to the acre. The general rule is to apply the fertilizer in the row where the crop is to be grown, but where large quantities are used it should be distributed at least ten days before planting and thoroughly incorporated with the soil. An application of 1,000 pounds of high-grade fertilizer placed in the row at

planting time has been known to injure seriously or kill the plants. For the best results the fertilizer should be applied at least ten days before planting, or a portion of the fertilizer may be applied a month or more in advance and the remainder at the time of preparing the land for planting. Hardwood ashes are desirable for use on sweet potato land and may be applied at the rate of from 1,200 to 2,000 pounds to the acre. The value of wood ashes depends upon how much they have become leached, but hardwood ashes should contain from 6 to 8 per cent of available potash. Wood ashes also contain considerable lime.

Where large quantities of any green crop are plowed into the soil there is a tendency to sourness, and occasional applications of from 1 to 2 tons of lime to the acre are beneficial. The presence of an abundance of lime in soils devoted to the growing of sweet potatoes hastens the maturity of the crop and increases the yield. On poor soils the lime and potash work together to produce potatoes of uniform size and shape, but on rich or alluvial soils the tendency is toward the production of over-large and irregular roots. The lime should be applied the previous season, or at least the autumn before planting the land to sweet potatoes.

Propagation of Plants.—The more common varieties of the sweet potato have for a great many years been propagated by cuttings, or sets, taken either from the potatoes themselves or from growing vines, and as a result the plants have ceased to flower and produce seed. The greater portion of the commercial crop is grown from sets, or "draws," produced by sprouting medium-sized potatoes in a warm bed of soil.

Where only a small area of sweet potatoes is to be grown for home use, the necessary plants can generally be secured from some one who makes a business of growing them. If an acre or more is to be planted it will in most cases be more economical to prepare a bed and grow the plants. The method of starting the plants will depend upon the locality and the acreage to be planted, the essentials being a bed of warm earth and a covering to protect the young plants during the early springtime.

Selection of Seed.—The potatoes that are to serve as seed from which to grow the plants for the next season's crop should always be selected at the time of digging and housing the crop. For seed purposes it is the custom to select the medium or

undersized potatoes, such as are too small for marketing. Those potatoes that will pass through a 2-inch ring or can be circled by the thumb and first finger of a man having a hand of average size are used for seed purposes.

The seed potatoes should be uniform in size and of the shape desired in the following year's crop. The seed should be free from cuts, bruises, decay, or disease of any kind. Throughout the handling of the seed potatoes they should not receive any treatment that would break eggs. The seed should always be handled and kept separate from the regular crop. The oftener the seed is handled the greater the danger of decay, and it should not be sorted over until everything is ready for bedding. The best seed is grown from cuttings taken from the regular plants after they have begun to form vines. These cuttings produce large numbers of medium or small-sized potatoes that are free from diseases and adapted for use as seed the following year.

Hotbeds.—Toward the northern part of the area over which sweet potatoes are grown it is necessary to start the plants in a hotbed in order that the length of season may be sufficient to mature the crop. The roots that are too small for marketing are used for seed, and these are bedded close together in the hotbed and covered with about 2 inches of sand or fine soil, such as leaf mold. The seed should be bedded about five or six weeks before it will be safe to set the plants in the open ground, which is usually about May 15 or May 20. Toward the last the hotbed should be ventilated very freely in order to harden off the plants.

Drawing the Sets.—As a general rule sweet potato plants are set in the field shortly after a rain. In order to avoid delay in planting, the hands should begin to get out the sets as soon as the rain ceases falling and place them in crates or baskets ready for transportation to the field. The sets are not all produced at once, and only those that have formed good roots are "drawn," the others being left until later. In drawing the sets the seed potato is held down with one hand while the plants are removed with the thumb and finger of the other hand. It often happens that five or six plants will cling together at the base, and these should be separated in order to avoid loss of time in the field. The roots should all be kept in one direction, and if the tops are long or irregular they may be trimmed off even by means of a knife. While drawing the sets it is a good plan to have at hand a large

pail or tub containing water to which there has been added a quantity of clay and cow manure which has been stirred until it forms a thin slime. As the plants are pulled from the bed they are taken in small bunches and their roots dipped into this mixture. This process, termed "puddling," covers the roots with a coating which not only prevents their becoming dry in handling but insures a direct contact with the soil when they are planted in the field or garden. After removing the sets that are ready, the bed should be watered to settle the soil where it has become disturbed and then left for the younger plants to develop.

Packing for Shipment.—In preparing sweet potato plants for shipment or for sale, they are "drawn" from the bed and tied in bunches of 100 each with soft string. Sweet potato plants will not withstand excessive moisture and should always be packed while the tops are dry. A little damp moss or paper may be placed in the crate or basket and the roots bedded in it, but the tops should remain dry and have free ventilation. If the roots of sweet potato plants are carefully puddled without the mixture coming in contact with the tops, they will keep in good condition for a week or ten days.

Preparation of Land.—The character of soil devoted to sweet potato culture is generally quite easy to prepare. In preparing land for planting to sweet potatoes the plowing and fitting are practically the same as for corn. It should be borne in mind, however, that the work necessary for thorough preparation will be well repaid by the increased ease in handling the crop later. It is always desirable that a crop like sweet potatoes be grown as a part of the regular farm rotation. In the northern portion of the sweet-potato-growing area the crop will occupy the land the entire growing season, and a three or four year rotation should be practiced. Where the climate will permit, a crop of early snap beans, peas, or cabbage may precede the sweet potatoes, but in any case the land should not be planted to sweet potatoes oftener than once every three years. A good rotation is to devote the land to corn one year, sowing crimson clover in the alleys between the rows at the time the corn is given the last cultivation. During the following spring the crimson clover should be turned under and sweet potatoes planted; then in the autumn, after the potatoes are harvested, the land may be plowed, fitted and sown to rye or winter oats with plenty of grass seed. In this way a crop of grain

may be obtained during the time that the grass is becoming established. Allow the land to remain in grass one or two years and then repeat the rotation. Where corn is followed by sweet potatoes in the rotation, stable manure should be applied while fitting the land for the corn, and commercial fertilizers should be applied with the sweet potato crop.

The usual depth of plowing in preparing land for corn will prove satisfactory for sweet potatoes. The fact that sweet potatoes are not planted in the field until quite late in the spring makes it possible for the grower to select a time when conditions are favorable for the preparation of the land. Plowing may be deferred until the soil has become sufficiently dry to break up fine and mellow. It is important that the land should be harrowed within a few hours after plowing; further fitting may be deferred until later, and if the soil is inclined to be lumpy the work of pulverizing may best be done shortly after a shower and while the lumps are mellow. When the primary work of preparation is finished, the soil should be mellow to a depth of 6 or 7 inches and the surface smooth and even. Subsequent handling of the soil preparatory to planting will depend upon whether ridge or level culture is to be followed.

Preparation for Planting.—After plowing and fitting the land it is generally allowed to lie several days before being put in shape for planting. If level culture is to be practiced, the only thing necessary will be to run the harrow over the soil once and then mark in both directions at the desired distances for planting. The marking is generally done with either a one-horse plow, a flat-soled marker, or a disk marker. The disk marker is well adapted to this work, as it throws up a slight ridge which furnishes fresh earth in which to plant. Some growers who practice level culture mark the ground with a small one-horse plow and throw up a slight ridge upon which to plant; behind the plow a roller is used to compress this ridge to a low, flat elevation. Where the more universal ridge method of planting is employed the soil is thrown up by means of a turning plow or a disk machine. The ridges should be made at least one week before planting, in order that the soil may become settled and compact. The majority of sweet-potato growers make the ridges whenever the land is in good condition to work and then either roll or drag the tops just ahead of the planters.

Setting the Plants.—The success of the crop depends largely upon the way in which the plants start after being removed from the bed and set in the field or garden. Practical growers always plan to set the plants during a "season" or period when the conditions are suitable to a quick start into growth, either just before a rain or as soon afterward as the soil can be worked. The method of setting will depend entirely upon local conditions and the acreage to be grown, the essential features, however, being to get the roots in contact with moist earth and the soil firmly pressed about the plants. The use of water around the roots of the plants is desirable under most circumstances, as it not only moistens the soil but assists in settling it about the roots. A large quantity of water is not necessary, one-half pint to each plant being generally considered sufficient.

Where level culture is practiced, the plants are set from 24 to 30 inches apart in each direction. On the eastern shore of Virginia the greater portion of the crop is planted 24 inches apart each way, requiring about 11,000 plants to an acre. By planting 30 inches apart each way, only about 7,000 plants are required to set one acre. Where the crop is grown on ridges it is customary to have the ridges from 36 to 42 inches apart from center to center and to place the plants 14 to 18 inches apart in the row. By this method an acre will require from 8,000 to 12,500 plants. An acre of good sweet potato land will readily support 9,000 to 11,000 plants, and the number most commonly planted by the several methods will fall within these figures.

Cultivation.—The methods of handling a crop of sweet potatoes do not differ materially from those employed with ordinary farm and garden crops. Within a few days after planting, a sweep or one-horse plow should be run in the alleys to break out the strip of earth left in ridging. The loose earth in the alleys should be worked toward the rows until a broad, flat ridge is formed upon which a small-tooth cultivator can be run quite close to the plants. After each rain or irrigation the soil should receive a shallow cultivation, and during dry weather frequent cultivations are necessary in order to retain moisture. About two hand hoeings are generally necessary in order to keep the rows free from weeds and the soil loose around the plants. As hand labor is expensive, it should be the aim to perform the greater part of the work by means of horse tools. Where sweet potatoes are planted in check

rows and worked in both directions the hand work required will be reduced to a minimum, but a certain amount of hoeing is always necessary. When the vines begin to interfere with further cultivation the crop may be "laid by," i. e., given a final working in which the soil is drawn well up over the ridges and the vines then allowed to take full possession of the land. To do this it is often necessary to turn the vines first to one side of the row and then to the other by means of a stick or a wooden rake. After "laying by," very little attention is required until time for harvesting the crop.

Harvesting.—The harvesting and marketing of sweet potatoes direct from the field begins about the middle of August and continues until the crop is all disposed of or placed in storage for winter marketing. During the early part of the harvesting season the yield is light, but as a rule the prices paid are good. The supply for home use and those potatoes that are to be kept in storage should not be dug until just before frost. In the localities where frosts do not occur until quite late in the season the sweet potatoes ripen and the vines show a slight tinge of yellow when ready for handling.

Effect of frost.—The foliage of the sweet potato is very tender and is easily injured by frost. A light frosting of the leaves will do no harm, but should the vines become frozen before digging they should be cut away to prevent the frozen sap passing down to the roots and injuring them. Where there is a heavy yield of potatoes the soil is frequently cracked or the ends of the potatoes protrude above ground and are liable to injury from severe frost.

If on account of rainy weather or for any other cause the potatoes can not be dug before frost or immediately afterwards, the vines should be cut away and the potatoes removed at the first opportunity. If cold weather continues it may be necessary to draw a little extra soil over the hills to protect the potatoes, or the vines may be piled in a ridge over the row. A very slight frosting of the potatoes will cause them to decay within a short time after being placed in storage.

It is desirable that the soil should be comparatively dry at the time of harvesting sweet potatoes, and bright, drying weather is essential to the proper handling of the crop. Sweet potatoes differ from Irish potatoes in that they are not so easily injured by

sunlight. However, they should not be exposed for any length of time if the sunshine is very warm. During the handling in the field it should be the purpose to remove all soil and surface moisture from the potatoes. Sweet potatoes should not lie exposed upon the surface of the ground during the night.

Grading and Packing.—In sorting sweet potatoes preparatory to packing, about four grades are recognized, as fancy, primes, seconds and culls. Those packed as fancy include only the most select, both in size and shape. The primes include all those adapted to general first-class trade, while the seconds include the smaller and more irregular stock which goes to a lower priced trade. The culls are not marketed unless good stock is exceedingly scarce, and as a rule are used for feeding to hogs. Sweet potatoes are usually shipped in barrels holding eleven pecks each. Some markets require that the barrels be faced and headed, while for others the tops are slightly rounded and covered with burlap. Small lots of extra-fancy sweet potatoes are sometimes shipped in one-bushel crates having raised tops; also in patent folding crates. Throughout the process of handling care must be exercised to see that the sweet potatoes do not become bruised, for upon this their shipping and keeping qualities greatly depend.

Storage.—Unlike most perishable products, the sweet potato requires warmth and a dry atmosphere while in storage. The method of storing will depend both upon the locality and the quantity of potatoes to be cared for. The temperature and conditions of a rather cool living room are admirably adapted for keeping sweet potatoes intended for home use in the North, while in the South they may be placed in pits or stored in outdoor cellars. The home supply may be placed in crates and stored in a loft over the kitchen part of the dwelling. Sweet potatoes should not be stored in bags or in barrels without ventilation.

The seed stock for planting the following year should be selected and stored separately in a small bin. As the potatoes are separated into their respective grades they are put into baskets and carried to the bins. Some growers prefer to do the grading in the field, but this necessitates the employment of a larger percentage of expert labor and delays the work of getting the potatoes hauled to the storehouse. Women and children can pick up the potatoes in the field, and two or three experienced men can do the sorting and

grading at the house in a much shorter time and in a more satisfactory manner.

Before starting to fill a bin, 2 or 3 inches of dry pine needles, straw, or chaff should be placed upon the floor. Beginning at the back of the bin the potatoes are piled to a depth of 30 or 40 inches until the entire floor space is covered and a number of slats are required to be placed across the doorway opening. A few grain bags filled with straw should be placed upon the potatoes at intervals from front to back of the bin, and upon these planks on which the men may walk while carrying in the next layer of potatoes may be laid. In this way a bin may be filled to a depth of 8 or 9 feet by about three layers. By dumping them in layers the potatoes have an opportunity to become thoroughly dry before a new layer is placed over them.

Temperature and Ventilation of Storage Houses.—Two or three days before beginning to bring in the potatoes, the storage house should be thoroughly cleaned and the heating appliance put in working order and started, in order to have the house both warm and dry when the crop comes in. Throughout the time of storing and for about ten days after the potatoes are all in the bins a temperature of 85° or 90° F. should be maintained in the house, with plenty of ventilation. This constitutes what is known as the sweating or curing process, and the keeping qualities of the potatoes depend upon the thoroughness with which this part of the work is done. Wood-burning stoves are frequently employed for heating sweet potato storage houses, but a hot-water boiler with coils of pipes along the walls of the building is very satisfactory.

After the crop is all in and thoroughly cured, the temperature of the storage house should be gradually lowered and may vary between 55° and 65° F., but considerable ventilation should be maintained. Sweet potatoes should be handled very carefully and as few times as possible, the essentials to good keeping being a reasonable degree of warmth, a dry atmosphere, and careful handling. Great care should be taken with the seed for the next year's planting to see that it is carefully handled and properly stored. While a temperature of 80° or 85° F. is required to properly start the seed into growth in the spring, a higher temperature during a long period of time in storage is liable to injure or even kill the buds. Potatoes intended for seed should not be stored in too great quantities, and where but a small supply is

needed they can often be kept buried in dry sand after having first been thoroughly cured. The sand used for this purpose should be baked to insure the driving off of moisture, and may be placed around the potatoes while slightly warm. In controlling the ventilation of the storage house during the winter months, outside air should be admitted only when quite dry and when its temperature is lower than that of the air in the storage house. If warm, moist air is admitted considerable moisture will be deposited upon the potatoes, thus injuring their keeping qualities.

Loss from Shrinkage in Storage.—Under proper storage conditions sweet potatoes will shrink from 6 to 10 per cent, but the loss in weight will be greater if the temperature of the house is carried too high. If the potatoes are not mature when dug from the field the loss from shrinkage may be as much as 15 per cent, and immature stock should be marketed early in the winter.

Marketing During Winter Months.—For marketing from outside pits it is desirable to have the quantity stored in one pit small enough to permit of all being removed at one time. The potatoes may be removed from outdoor cellars as desired. In marketing from heated storage houses the potatoes should not be disturbed until they are barreled or crated, and then they should be placed directly upon the market and sold without delay. When shipping during cold weather the barrels should at least be lined with paper, and a covering of heavy brown paper over the outside of the barrels will form a safeguard. If the potatoes are shipped in carload lots during the winter the cars should be either of the regular refrigerator type or felt lined.

Varieties.—Of the large number of varieties of the sweet potato there are not more than ten that are now of great commercial importance in the United States. For the markets that require a dry, mealy-fleshed potato those varieties belonging to the Jersey group are suitable. For the southern trade and where a moist-fleshed potato is desired those commonly designated as yams are in demand. Among the Jerseys that are extensively grown are the Big-Stem Jersey, the Yellow Jersey and the Red Jersey. The principal varieties of the yam group are the Southern Queen, the Pumpkin Yam, the Georgia, the Florida, and the Red Bermuda. Of the varieties mentioned there are a large number of special strains, known under many local names. In the selection of varieties for home use one must be governed largely by locality.

As a rule those of the Jersey group will thrive farther north than those of the so-called yam types. For market purposes the particular variety or strain grown in the vicinity should first be selected, and afterward other varieties may be experimented with in a small way.—(F. B. 255, 295, 324; Tuskegee E. S. 2, 10, 17; Ariz. E. S. 86; N. Mex. E. S. 70; S. Car. E. S. 5, 136; S. Dak. E. S. 91.)

SWISS CHARD.

The part eaten is not the root, but the midrib of the leaf which is prepared much the same as asparagus. The flavor is distinct from that of the ordinary beet root. Give the same culture as required for beets. The soil should be richer. In the fall cover with straw. This will aid an early growth and help blanch the stems. This is a very valuable plant and should be cultivated more extensively.

THYME.

The leaves are used for seasoning, and a tea is also made therefrom for nervous headache.

TOMATOES.

Because of the tropical origin of the tomato it requires a long season for its growth and development, and on this account it is necessary in the Northern States, in order to secure paying crops, to resort to methods which lengthen the growing season. It is much easier for the gardener to accomplish this while the plant is small than when it is large, and because early fruits are as a rule more valuable than late ones it is of advantage to the gardener to secure his crop as early in the season as practicable. The season is, therefore, lengthened at the beginning rather than at the end. This is accomplished by sowing seeds in hotbeds or greenhouses several weeks in advance of the time when they could be safely planted in the open.

The Tomato as a Field Crop at the North.—East of the Mississippi River and north of the latitude of Washington, D. C., the tomato is handled as an annual, the seeds being sown in hotbeds about the middle of March. The young plants, as soon as

they have developed their first true leaves, are transplanted to stand about 2 inches apart each way and are allowed to develop in these quarters until they have attained a height of from 4 to 6 inches and the leaves begin to crowd considerably. They are then transplanted to pots, 3 or 4 inches in diameter.

Training Plants to Stakes.—For earliest returns it is desirable to train forced plants to a single stem by tying them to a stake 4 or 5 feet in height. These stakes should be driven firmly into the ground beside the plants and the plants carefully tied to them to prevent whipping and to keep the fruits off the ground. All side shoots should be kept pinched out and only the central leading stem allowed to develop to bring larger results. If the plants are to be trained in this way they can be set from 18 inches to 2 feet apart in the row, and about 3½ to 4 feet between the rows.

Training Plants on Frames.—Another plan sometimes followed in the training of tomatoes is to place a flaring frame, about 18 inches square at the base and 24 inches square at the top over the plants before they begin to spread. The shoots as they become heavy with fruit fall over against the sides of the rack and are prevented from coming in contact with the earth. For a kitchen garden where but few plants are grown this is a very satisfactory plan. The plants can be set somewhat closer than is the case where no supports are provided. For commercial plantations, however, the cost of the frames is prohibitive. The common commercial practice is to place the plants about 4 feet apart each way in check rows so as to allow them to be cultivated in both directions. Under intensive cultivation in a small garden, however, the first method, that of tying the vines to stakes, will be found very satisfactory.

Where tomatoes are grown on a large scale and where the product brings only a small price per bushel, expensive methods of handling and training can not be profitably followed. The common practice in growing tomatoes for the general market and for canning purposes in localities north of New York City is to sow the seed very thinly in a hotbed about March 15 and allow the plants to grow slowly without transplanting them until they can be put in the field about June 1. The plants, even with the most careful attention, when grown under these conditions will become long and thin stemmed, with a small tuft of leaves at the top.

Setting the Plants.—Plants more than a foot high which have been grown under these conditions should be treated somewhat as follows: Instead of attempting to set the plant deeply and maintain it in an upright position, remove all except three or four of the top-most leaves about the growing point. Dig a shallow trench along the row—a trench 3 or 4 inches deep—slightly sloping from a deep point at one end to the surface of the ground at the other. Place the bare stem of the tomato and the root in this trench, with the root in the deepest portion, cover the stem throughout its length with fresh soil, and pack this firmly. Under these conditions the plant will take root throughout the length of the buried stem, and in a short time the added root system which is thus given the plant will force it into vigorous growth. Plants of this character which are to be grown on an extensive scale are never trained. They are allowed to grow at will, and the fruits are gathered as they ripen without special attention to keep them off the ground or otherwise to care for them.

Length of Season.—The season of fruit production is longer in the higher than in the lower latitudes. This is a rather interesting and unexpected condition. Normally one would expect to find that the tomato would begin maturing its fruit earlier and would continue bearing longer in the latitude of the city of Washington than it would in the latitude of Boston; but this is not the case. Tomatoes in the latitude of Washington and south of this point come into bearing, quickly produce a heavy flush of fruit, and then refuse to do more, and in order to have a continuous supply throughout the season it is necessary for market gardeners and truckers to plant seeds in succession so as to keep up a continuous supply.

Fertilizers.—Since the tomato is grown exclusively for its fruit, those fertilizers which induce a large growth of plant and foliage are not desirable in the production of this crop. Soils vary greatly in regard to the quantity of available plant food they contain. The use of a fertilizer is determined largely by the character, mechanical condition, and composition of the soil. If a soil is deficient in all the essential elements of plant food—nitrogen, potash, and phosphoric acid—the application of any one or even two of them will not materially influence the yield of the crop. On the other hand, on soils deficient only in potash or phosphoric acid, or both, little would be gained by adding

nitrogen, which is already in excess, to the other element or elements to be applied. Economy of operation, as well as the general effect upon the soil, must also be considered. This may be influenced by the character of the season, but should be based on the increased yield and increased net receipts of the crop.

As a general rule, readily soluble, "quick-acting" fertilizers which produce an early growth and early ripening of the crop are most desirable. Heavy dressings of stable manure tend to produce too much vine, and are seldom or never employed. If stable manure is used it is at a moderate rate, usually not more than one or two shovelfuls to a plant. This, if well decomposed and thoroughly incorporated with the soil, is very stimulating to the young plant and consequently very beneficial. Any fertilizer used should be applied, in part at least, at the time the plants are transplanted to the field.

Cultivation.—As soon as the young seedling plants from the hotbed or greenhouse are transferred to the field they should be given clean cultivation with implements which stir the surface of the soil but do not produce ridges or furrows. When the plants are set in check rows 4 feet apart each way it is possible in field culture to keep the plantation almost free from weeds by the use of horse hoes. If, however, the plants are set so that cultivation can be carried on only in one direction, hand hoeing will be necessary to keep down weeds between the plants in the row. Where land is not expensive, and where labor costs heavily, the cost of producing a crop of tomatoes can be decidedly lessened by planting in check rows and carrying on the cultivation by horsepower.

The grower should bear in mind, however, that the object of cultivation is not merely to kill weeds. The destruction of weeds is an important factor and in itself sufficient to justify clean culture, but the preservation of a soil mulch for the purpose of husbanding the moisture of the soil during periods of drought is of even greater value. With care in the choice of implements both results can be attained with the same expenditure of labor.

Harvesting and Marketing.—The fruits should be gathered two or three times a week if the tomato is grown as a truck crop. When used for canning purposes the harvesting periods need not be quite so close, and when the fruits are to be shipped some

distance they should be gathered as soon as partially colored, instead of allowing them to become colored on the vine. The fruit of the tomato is velvet green up to the time the ripening process begins, and at this stage, if the products are to be shipped long distances, the fruits should be harvested. For home markets, however, the fruits should be allowed to ripen upon the plant.

In harvesting, none except sound fruits of a similar stage of maturity should be harvested and packed in any one receptacle. Leaky fruits and deformed fruits should be rejected. In packing tomatoes for the market, those that are symmetrical in form and uniform in size and of a like degree of ripeness should be selected for filling any one receptacle.

Varieties for the North.—There are a large number of sorts of tomatoes, each one possessing some points of merit or difference which distinguish it from all others. These differences enable the intelligent cultivator to select sorts for special purposes, as well as for special soils and climates. The varying demands of the markets and the different soil and climatic conditions presented in the various sections of the United States where the tomato is grown can only be satisfied by a variety list as variable as are the conditions.

Early ripening sorts are frequently irregular in shape, have comparatively thin walls, large seed cavities, and numerous seeds. The fruit is apt to color and ripen unevenly, remaining green around the stem, or to contain a hard green core. Later-ripening sorts, while not all superior to the others, have as a rule thicker and firmer walls, smaller seed cavities, and few seeds.

The most highly developed varieties now make few seeds and ripen evenly. These characteristics of the fruits are important factors in determining their fitness for special purposes. Medium-sized, smooth, spherical fruits, which ripen evenly and have small seed cavities and thick walls are especially suited to long-distance shipment. These qualities should enter into every sort selected to the greatest possible degree consistent with earliness, lateness, heavy yield, or any other special quality which gives the variety a marked commercial advantage. The following list is made up of varieties possessing some markedly distinct character, such as earliness, great size, purple, red, or yellow color, dwarf habit, etc.:

Early Ripening Varieties.—Sparks' Earliana, Atlantic Prize, Early Freedom.

Large-Fruited Varieties.—Ponderosa, Beefsteak.

Purple-Fruited Varieties.—Beauty, Acme, Imperial.

Red-Fruited Varieties.—Favorite (late), Honor Bright, Matchless, Stone, Royal Red, New Jersey.

Yellow-Fruited Varieties.—Golden Queen, Lemon Blush.

Dwarf or Tree Types.—Dwarf Champion, Station Upright Tree, Aristocrat.

Potato-Leaf Types.—Livingston's Potato-Leaf, Mikado, Turner's Hybrid.

The Tomato as a Field Crop at the South.—Commercial tomato growing in the Southern States is almost exclusively confined to the production of tomatoes at a season when they can not be grown at the North, except in greenhouses. On this account the commercial production of this crop is restricted to areas where there is very little, if any, freezing during the winter months.

Time of Planting.—At the extreme southern limit of the commercial cultivation of this crop in Florida the plants are grown so as to be ready for setting in the open about December 1. The date of seed sowing advances as the cultivation of the crop progresses northward, so that in northern Florida the seeds are sown early in January and the young plants placed in the field in March. Where frost conditions do not form barriers against the production of seedling plants in the open, the seed beds for the young plants are prepared in some sheltered situation where partial shade can be given and where the seed bed can be frequently watered. The young plants, as soon as they have attained the proper size—that is, from 6 to 10 inches in height—are transferred to the field in practically the same manner as are the hotbed-grown plants produced for general field culture at the North, and except for a specially early crop they are not transplanted or potted. The young seedlings in the cold frame will require careful attention in the way of watering and ventilation; otherwise many plants will be lost by damping off or from sun-

scorching during bright days unless the sash are lifted or entirely removed.

Yield.—The yield of fruit in the South, under the conditions mentioned, is much less than it is in regions having the long growing periods characteristic of higher latitudes. Yields vary from 75 to 250 bushels to the acre, but the high price obtained for the fruits which are thus produced at a season when the sole competition comes from the products of northern greenhouses renders the crop, when well handled, very remunerative.

Soil.—The soil which is preferred for the production of this crop is one which contains a comparatively high percentage of sand. In this region sandy loam or a sandy soil is preferred to bottom land for the cultivation of tomatoes. An area with a gentle slope to the south is considered more desirable than that with other exposure. If a wind-break can be secured along the north and west sides of the area very early crops can frequently be preserved through a wind-storm when the temperature, while not low enough to freeze the plants, will, when accompanied by a high wind, chill and destroy them.

Varieties for the South.—In the South, where the tomato is handled as a short-season crop, certain varieties are found to give best results in certain districts. Along the Atlantic seaboard the growers of tomatoes use such sorts as Beauty, Stone, Perfection, Aristocrat, and Paragon. In the truck regions of eastern Texas the Dwarf Champion is perhaps more universally grown than any other variety, but in this same region the Success is found to be a more profitable late-season or fall crop than the Champion.

Forcing Tomatoes.—In the forcing of plants, which means the growing of a plant out of its natural season and in an artificial environment, the first requirement for success is a properly constructed protective structure or greenhouse. Because of the tropical nature of the tomato more than ordinary provisions must be made in order to meet the demands of this crop. In the forcing of most vegetables a lower temperature and benches without bottom heat are satisfactory, but with the tomato the house must be piped so as to maintain a minimum temperature of 65 degrees F., and the benches should be so constructed as to admit of applying bottom heat.

Type of Greenhouse.—The type of house that is generally employed for the forcing of tomatoes is the even-span or a three-fourths span house. If the even-span house is used it is preferable to have the ridge running north and south; if the three-fourths span house is employed it is best to have the long side sloping toward the south. The tomato when grown in the forcing house, because of its long fruiting season and the fact that its clusters of fruit are borne one above the other, requires a considerable amount of head room. Low houses are therefore not desirable in the production of this crop. The side walls of a house designed for the forcing of tomatoes should be at least 4 feet in height, and the distance from the top of the middle bench to the ridge of the house should be at least 10 feet.

Soil.—The soil for the production of this crop should be well decomposed loam, made, if possible, from sods from an old pasture, the soil of which is a rather light clay loam or a heavy sandy loam. With this should be incorporated about one-fourth its bulk of well-rotted stable manure, preferably cow manure. By composting these two materials for from four to six months before they are required for use a very satisfactory soil for the forcing of tomatoes will result. Care should be exercised to allow the soil that is used for forcing tomatoes to be frozen each year. The depth of soil required for the successful growth of tomatoes is considerably more than that employed for roses, although the temperature and other requirements are very similar to those demanded by the rose. While 4 or 5 inches of soil are adequate to produce a crop of roses, the soil for tomatoes should be at least 6 or 8 inches in depth; 8 inches is preferable. It is not well to allow the soil to remain in the greenhouse longer than a single season. It becomes somewhat exhausted and is likely to become infested with injurious forms of life, particularly nematodes, which cause root-knots upon the tomato plants, thus defeating the work of the gardener. This trouble, however, can be easily overcome by subjecting the soil to freezing.

Seedling Plants.—Two types of plants are used for forcing purposes—seedling plants and cutting plants. The former are, of course, seedlings grown from seed especially sown for the purpose of raising plants to be grown in a greenhouse. It is customary in the latitude of New York and northward to sow the seed for a forcing crop of tomatoes in the month of August. The

young seedling plants, as soon as they develop the first true leaves, are then transplanted from the seed bed to small pots, preferably 3-inch pots. They are planted deeply at this time and are kept growing rapidly but not sufficiently to produce a soft, succulent growth. As soon as the 3-inch pots are filled with roots the plants are shifted to 4-inch pots, and when the plants have attained a height of 12 or 15 inches, and have developed their first blossoms, they are usually placed on the benches of the greenhouse, where they are to produce their crop. The plants are then set 15 or 18 inches apart each way in a soil prepared as previously described.

Cutting Plants.—Cuttings should be taken from strong, healthy, vigorous-growing plants in the field, and placed in the cutting bed about the last of August, where they will quickly take root. As soon as the roots have developed to a length of from one-half to 1 inch the young plants are shifted to 3 or 4 inch pots, where they are allowed to develop until the blossom buds are well formed or the blossoms have expanded, when they should be planted on the bench where they are to mature their crop, in like manner as noted for seedling plants.

Pollination.—In the field, where the tomato plants are exposed to the action of wind and to the visits of insects, no special attention is necessary in order to secure the pollination of the flowers and the setting of the fruits. Under the conditions existing in a greenhouse, however, it is necessary to artificially pollinate the flowers of the tomato; otherwise only a very small percentage of fruits will set and the object of the work will be defeated. It is therefore necessary to allow the temperature of the house to become quite high in the middle of the day on bright sunshiny days while the plants are in bloom, and to pass through the house at this time with a little stick, 18 inches or 2 feet in length, with which to strike the supporting strings or wires and thus to set the plants in motion and liberate the pollen and cause it to fertilize the flowers. A more satisfactory way, however, is to use a watch glass, 1¼ or 1-12 inches in diameter, embedded in putty, at the end of a handle composed of a light material, preferably white pine, which shall be 12 or 18 inches long. Grasp this spatula in the left hand and, with a light pine stick of equal length in the right hand, pass through the house, tapping each open flower lightly with the wand, at the same time holding the

watch glass under the flowers to catch the pollen. Before removing the watch glass from this position lift it sufficiently to cause the stigma of the flower to dip into the pollen contained in the glass. By carefully going through the house from day to day during the blooming period nearly 90 per cent of the blossoms which develop can be caused to set. During dark, cloudy, stormy weather, however, a smaller percentage of plants will be fertilized than during bright, comparatively dry weather. The conditions in the greenhouse can not be modified so as to entirely overcome the adverse conditions existing on the outside, although with care much can be done in this direction.

Manuring.—It is desirable to keep plants of the tomato which are designed for forcing growing at a moderately rapid rate throughout the whole forcing period. Growth should be strong and robust at all times, yet slow enough to produce close-jointed plants which bear their fruit clusters at near intervals. There is considerable difference in varieties of tomatoes in this respect, and those which naturally bear their fruit clusters close together should be selected for forcing purposes. The manuring of the plants should, therefore, take a form which will be conducive to this strong, vigorous growth, yet not sufficiently heavy to produce plants which run to wood at the expense of fruit bearing.

Ventilating and Watering.—If careful attention is given to keeping the plants in a healthy condition by never allowing them to suffer from overwatering or from becoming too dry, and if sufficient ventilation is given without allowing draughts of cold air upon the plants, much can be done to prevent the development of mildew. If the plants are to be sprayed it should be done once a week or once in ten days, and then only in the mornings of bright days. Ordinarily, however, the atmosphere of the house should be kept dry rather than moist, as a very moist atmosphere is liable to produce a soft, succulent growth, which brings on a disease known to gardeners as œdema. This, however, can be prevented by care in keeping the house rather dry. The temperature of the house, too, should not be allowed to fluctuate through too wide a range. The night temperature for tomatoes should range between 65° and 68° F., while the day temperature should run from 70° to 80° F.

Varieties for Forcing.—The comparatively limited use of tomatoes for forcing purposes in this country has not resulted in

the development of many sorts especially suited for this purpose. The Lorillard is the one American sort which is now almost exclusively confined to this use, and it is perhaps more generally cultivated in forcing houses than any other single variety.

The Tomato as a Field Crop for Canneries.—Owing to the fact that in canned tomatoes it is difficult for the average consumer to note any deficiencies in the appearance of the original fruit, many labor under the delusion that any variety will answer for this purpose. This is a mistaken idea, as quality in canned goods is now an important factor, and it is quite as necessary that a good quality of product should be used for canning as for growing for the early or general market, although from the field side it is natural that tonnage should be a primary consideration.

In the matter of varieties, as in the case of early tomatoes, too much dependence should not be placed upon the name or upon the fact that a neighboring farmer secures good results from a given variety. There are so many variations in the character of soils, even in the same locality, which exert an influence upon the size and quality of crop that the best variety is usually one that is, in part at least, developed by the individual grower. The main point is to select varieties that produce large, smooth, solid fruits, which do not remain green or crack on the shaded side near the stem. Those which possess size as their chief characteristic are frequently of poor quality, as they are likely to possess large seed cavities and to ripen unevenly.

The conditions in some sections are such as to prevent the canners from making as much distinction between good and poor varieties as they would like. Canneries are in a measure obliged to receive all that come, unless they can control absolutely the land upon which the crop is grown. The variation in the quality of the crops of different farmers will make a difference of from 25 to 40 cans on a ton of fruit, or from 6 to 10 per cent—a very considerable item. In good seasons and with good fruit 400 cans may be regarded as the maximum number to be derived from a ton, though late in the season, and with poor varieties, as already stated, the pack from a ton is very much less. The interests of the grower and the canner are really identical in this regard. An improvement in the quality of the fruit will result in an improvement of the canned product and a consequent increase in

the price of both the raw and manufactured products. Less expense is involved in growing suitable plants for cannery purposes than for other crops. This is due to the fact that earliness is not so important a factor as it is in the market garden crop.

Fertilizing and Cultivating the Soil.—In manuring and fertilizing, the character of the crop and the season of its growth should be remembered. Hence, recommendations that were made for an early crop do not apply in all cases except perhaps on the poorer classes of soils. In the first place, the plants are not put in the soil until summer, when the conditions are most favorable for the rapid change of organic forms of nitrogen into nitrates, and thus, if the soil has been manured or is naturally rich in vegetable matter, the additional application of nitrogen in immediately available forms is not so important. In the second place, the object of the growth is not early maturity, but the largest yield of mature fruit.

Setting and Cultivating the Plants.—The plants should be set from 4 to 4½ feet apart each way and cultivation should begin immediately. The first cultivation should be deep, in order to conserve the moisture, and each subsequent cultivation shallower, in order not to destroy the roots, which will fill the soil as soon as the plants reach maturity. The crop in good seasons should begin to ripen in August, and picking will continue from that time until the last of September.

Cost, Yield, and Value of Crop.—The cost of production per acre is much less for fruit for canning than in the case of early tomatoes, the chief difference being in the production of the plants. The several items may be classified as follows:

Cost of growing an acre of tomatoes for canning:

Plants	$ 2.00
Manures and fertilizers	8.00
Preparation of land, setting plants and cultivation	8.00
Picking and carting	10.00
Total	$ 28.00

The yield, as in the case of the early tomatoes, varies widely, ranging from 5 to as high as 20 tons per acre, even 30 tons per

acre having been reported in exceptional cases, although the average for a series of years on average land will probably be under 8 tons. Where all conditions are carefully observed, 20-ton yields are frequently obtained, and at the prices received at the cannery, ranging from $5 to $7.50 per ton, according to the locality, the crop is a fairly good one and the net profits are quite as large as for other field crops.

TURNIPS.

A great variety of turnips is grown throughout temperate climates, some of which being coarse in texture are used as food for farm animals while other varieties are raised as table vegetables. There is considerable variation in the color, flavor, and composition of the turnip, the yellow-fleshed sorts as a group being commonly distinguished from the white by the name "Swedes" or "ruta-bagas." In the summer the early white varieties are usually preferred in spite of the fact that they are more watery, while in winter the yellow turnips are more commonly used.

The turnip requires a rich soil, and may be grown either as an early or a late crop. For an early crop, sow the seeds in drills 12 to 18 inches apart as early in the spring as the condition of the soil will permit. Two pounds of seed are required to plant an acre. After the plants appear, thin to about 3 inches. The roots will be ready for use before hot weather. For late turnips the seeds are usually sown broadcast on land from which some early crop has been removed, generally during July or August, but later in the South. Turnips are quite hardy, and the roots need not be gathered until after several frosts. Turnips may be stored in a cellar or buried in a pit outside. Before storing, the tops should be removed.—(F. B. 255, 295; U. Id. E. S. 10; Mich. E. S. 20.)

VEGETABLE MARROW.

The so-called vegetable marrows are a valuable product and closely allied to the pumpkin, both as to species and habit of growth, the principal difference being that the vegetable marrows are used while quite young and tender, and may be baked and served very much the same as sweet potatoes. The vegetable marrows should receive thorough cultivation in order that a tender product may be secured, and should be gathered while the outside

skin is still so tender that it may easily be broken by the finger nail. The flesh is either boiled and mashed or baked in the oven and served with butter while hot.—(F. B. 255; Oreg. E. S. B. 74.)

Quantity of Seeds or Number of Plants Required for a Row 100 Feet in Length, with Distances to Plant, Times for Planting, and Period Required for Production of Crop.

Brackets indicate that a late or second crop may be planted the same season.

Kind of vegetable.	Seeds or plants required for 100 feet of row.	Distance for plants to stand ——			Depth of planting.	Time of planting in open ground.		Ready for use after planting.
		Rows apart.		Plants apart in rows.		South	North	
		Horse cultivation.	Hand cultivation.					
Artichoke, Globe	½ ounce	3 to 4 ft.	2 to 3 ft.	2 to 3 ft.	1 to 2 in.	Spring	Early spring	15 months.
Artichoke, Jerusalem	2 qts. tubers	3 to 4 ft.	1 to 2 ft.	1 to 2 ft.	2 to 3 in.	Spring	Early spring	6 to 8 months.
Asparagus, seed	1 ounce	30 to 36 in.	1 to 2 ft.	3 to 5 in.	1 to 2 in.	Autumn or early spring	Early spring	3 to 4 years.
Asparagus, plants	60 to 80 plants	3 to 5 ft.	12 to 24 in.	15 to 20 in.	3 to 5 in.	Autumn or early spring	Early spring	1 to 3 years.
Beans, bush	1 pint	30 to 36 in.	18 to 24 in.	5 or 8 to ft.	½ to 2 in.	February to April.		
						[August to September.]	April to July	40 to 65 days.
Beans, pole	½ pint	3 to 4 ft.	3 to 4 ft.	3 to 4 ft.	1 to 2 in.	Late spring	May and June	50 to 80 days.
Beets	2 ounces	24 to 36 in.	12 to 18 in.	5 or 6 to ft.	1 to 2 in.	February to April.		
						[August to September.]	April to August	60 to 80 days.
Brussels sprouts	¼ ounce	30 to 36 in.	24 to 30 in.	16 to 24 in.	½ in.	January to July	May and June	90 to 120 days.
Cabbage, early	¼ ounce	30 to 36 in.	24 to 30 in.	12 to 18 in.	½ in.	October to December	March and April.	

							(Start in hotbed during February)	90 to 130 days.
Cabbage, late	¼ ounce	30 to 40 in.	24 to 36 in.	16 to 24 in.	½ in.	June and July	May and June	90 to 120 days.
Cardoon	½ ounce	3 ft.	2 ft.	12 to 18 in.	1 to 2 in.	Early spring	April and May	5 to 6 months.
Carrot	1 ounce	30 to 36 in.	18 to 24 in.	6 or 7 to ft.	½ in.	March and April.		
						[September]	April to June	75 to 110 days.
Cauliflower	¼ ounce	30 to 36 in.	24 to 30 in.	14 to 18 in.	½ in.	January and February.	April to June.	
						[June]	(Start in hotbed during February or March)	100 to 130 days.
Celeriac	¼ ounce	30 to 36 in.	18 to 24 in.	4 or 5 to ft.	½ in.	Late spring	May and June.	
							(Start in cold frame during April)	100 to 150 days.
Celery	¼ ounce	3 to 6 ft.	18 to 36 in.	4 to 8 in.	½ in.	August to October	May and June. (Start in hotbed or cold frame during March or April)	120 to 150 days.
Chervil	1 ounce	30 to 36 in.	18 to 24 in.	3 or 4 to ft.	1 in.	Autumn	Autumn	1 year.
Chicory	¼ ounce	30 to 36 in.	18 to 24 in.	4 or 5 to ft.	½ in.	March and April	May and June	5 to 6 months.
Citron	1 ounce	8 to 10 ft.	8 to 10 ft.	8 to 10 ft.	1 to 2 in.	March and April	May and June	100 to 130 days.
Collards	¼ ounce	30 to 36 in.	24 to 30 in.	14 to 18 in.	½ in.	May and June	Late spring	100 to 120 days.
Corn salad	2 ounces	30 in.	12 to 18 in.	5 or 6 to ft.	½ to 1 in.	January and February.		

						[September and October]	March to September	60 days.
Corn, sweet	¼ pint	36 to 42 in.	30 to 36 in.	30 to 36 in.	1 to 2 in.	February to April	May to July	60 to 100 days.
Cress, upland	½ ounce	30 in.	12 to 18 in.	4 or 5 to ft.	½ to 1 in.	January and February.	March to May	
						(Autumn)	[September]	30 to 40 days.
Cress, water	½ ounce	Broadcast			On surface	Early spring	April to September	60 to 70 days.
Cucumber	½ ounce	4 to 6 ft.	4 to 6 ft.	4 to 6 ft.	1 to 2 in.	February and March.		
						[September]	April to July	60 to 80 days.
Dandelion	¼ ounce	30 in.	18 to 24 in.	8 to 12 in.	½ in.	Early spring or autumns	Early spring	6 to 12 months.
Eggplant	¼ ounce	30 to 36 in.	24 to 30 in.	18 to 24 in.	½ to 1 in.	February to April	April and May. (Start in hotbed during March)	100 to 140 days.
Endive	1 ounce	30 in.	18 in.	8 to 12 in.	½ to 1 in.	February to April	April [July]	90 to 180 days.
Horse-radish	70 roots	30 to 40 in.	24 to 30 in.	14 to 20 in.	3 to 4 in.	Early spring	Early spring	1 to 2 years
Kale or borecole	¼ ounce	30 to 36 in.	18 to 24 in.	18 to 24 in.	½ in.	October to February	August and September.	
							[March and April]	90 to 120 days.
Kohl-rabi	¼ ounce	30 to 36 in.	18 to 24 in.	4 to 8 in.	½ in.	September to March	March to May	60 to 80 days.
Leek	½ ounce	30 to 36 in.	14 to 20 in.	4 to 8 in	1 in.	May to September	March to May	60 to 80 days.
Lettuce	½ ounce	30 in	12 to 18 in.	4 to 6 in	½ in.	September to March	March to September	120 to 180 days.
Melon, muskmelon	½ ounce	6 to 8 ft.	6 to 8 ft.	Hills 6 ft.	1 to 2 in.	February to April	April to June (Start early plants in hotbed during March)	120 to 150 days.
Melon, watermelon	1 ounce	8 to 12 ft.	8 to 12 ft.	Hills 10 ft.	1 to 2 in.	March to May	May and June	100 to 120 days.
Mustard	¼ ounce	30 to 36 in.	12 to 18 in.	4 or 5 to ft.	¼ in.	Autumn or early spring	March to May. [September]	60 to 90 days.

New Zealand spinach	1 ounce	36 in.	24 to 36 in.	12 to 18 in.	1 to 2 in.	Early Spring	Early spring	60 to 100 days.
Okra, or gumbo	2 ounces	4 to 5 ft.	3 to 4 ft.	24 to 30 in.	1 to 2 in.	February to April	May and June	80 to 140 days.
Onion, seed	1 ounce	24 to 36 in.	12 to 18 in.	4 or 5 to ft.	½ to 1 in.	October to March	April and May	130 to 150 days.
Onion, sets	1 qt. of sets.	24 to 36 in.	12 to 18 in.	4 or 5 to ft.	1 to 2 in.	Early spring	Autumn and February to May	90 to 120 days.
Parsley	¼ ounce	24 to 36 in.	12 to 18 in.	3 to 6 in.	1/8 in.	September to May	September and early spring	90 to 120 days.
Parsnip	½ ounce	30 to 36 in.	18 to 24 in.	5 or 6 to ft.	½ to 1 in.		April and May	125 to 160 days.
Peas	1 to 2 pints.	3 to 4 ft.	30 to 36 in.	15 to ft.	2 to 3 in.	September to April	March to June	40 to 80 days.
Pepper	½ ounce	30 to 36 in.	18 to 24 in.	15 to 18 in.	½ in.	Early spring	May and June (Start early plants in hotbed during March)	100 to 140 days.
Physalis	½ ounce	30 to 36 in.	18 to 24 in.	18 to 24 in.	½ in.	March to May	May and June	130 to 160 days.
Potato, Irish	5 lbs. (or 9 bu. per acre)	30 to 36 in.	24 to 36 in.	14 to 18 in.	4 in.	January to April	March to June	80 to 140 days.
Potato, sweet	3 lbs. (or 75 slips)	3 to 5 ft.	3 to 5 ft.	14 in.	3 in.	April and May	May and June (Start plants in hotbed during April)	140 to 160 days.
Pumpkin	½ ounce	8 to 12 ft.	8 to 12 ft.	Hills 8 to 12 ft.	1 to 2 in.	April and May	May to July	100 to 140 days.
Radish	1 ounce	24 to 36 in.	12 to 18 in.	8 to 12 to	½ to 1 in.	September to April	March to September	20 to 40 days.

				ft				
Rhubarb, seed	½ ounce	36 in.	30 to 36 in.	6 to 8 in.	½ to 1 in.		Early Spring	2 to 4 years.
Rhubarb, plants	33 plants	3 to 5 ft.	3 to 5 ft.	3 ft.	2 to 3 in.		Autumn or early spring	1 to 3 years.
Ruta-baga	¼ ounce	30 to 36 in.	18 to 24 in.	6 to 8 in.	½ to 1 in.	August and September	May and June	60 to 80 days.
Salsify	1 ounce	30 to 36 in.	18 to 24 in.	2 to 4 in.	½ to 1 in.		Early spring	120 to 180 days.
Spinach	1 ounce	30 to 36 in.	12 to 18 in.	7 or 8 to ft.	1 to 2 in.	September to February	September or very early spring	30 to 60 days.
Squash, bush	½ ounce	3 to 4 ft.	3 to 4 ft.	Hills 3 to 4 ft.	1 to 2 in.	Spring	April to June	60 to 80 days.
Squash, late	½ ounce	7 to 10 ft.	7 to 10 ft.	Hills 7 to 9 ft.	1 to 2 in.	Spring	April to June	120 to 180 days.
Tomato	½ ounce	3 to 5 ft.	3 to 4 ft.	3 ft.	½ to 1 in.	December to March	May and June (Start early plants in hotbed during February and March)	100 to 140 days.
Turnip	½ ounce	24 to 36 in	18 to 24 in	6 or 7 to ft	¼ to ½ in	August to October	April. [July]	60 to 80 days.
Vegetable marrow	½ ounce	8 to 12 ft.	8 to 12 ft.	Hills 8 to 9 ft.	1 to 2 in.	Spring	April to June	110 to 140 days.

Average Composition of Succulent Roots.

Kind of vegetable.	Refuse	Edible portion						
		Water	Protein	Carbohydrates		Grade	Ash	Fuel value per pound
				Fat	Sugar			
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Calories
Beets, fresh	7.0	87.5	1.6	0.1	8.8	0.9	1.1	215
Beets, cooked	....	88.6	2.3	.1	7.4	....	1.6	185
Celeriac	20.0	84.1	1.5	.4	11.8	1.4	.8	285
Carrots, fresh	20.0	88.2	1.1	.4	8.2	1.1	1.0	210
Carrots, desiccated	....	3.5	7.7	.6	80.3	....	4.9	1,790
Parsnips	20.0	83.0	1.6	.5	11.0	2.5	1.4	300
Salsify "Oyster plant"	25.0	85.4	4.3	.3	6.8	2.0	1.2	250
Black salsify	20.0	80.4	1.0	.5	17.1	2.3	1.0	390
Radishes	....	91.8	1.3	.1	5.1	.7	.1	135
Turnips, white	10.0	89.6	1.3	.2	6.8	1.3	.8	160
Turnips, yellow (ruta-bagas)	10.0	88.9	1.3	.2	7.3	1.2	1.1	185
Kohl-rabi	20.0	91.1	2.0	.1	4.2	1.3	1.3	145
Onions	30.0	87.6	1.6	.3	9.1	.8	.6	225
Garlic	....	64.7	6.8	.1	27.9	.8	1.5	650
Potatoes	20.0	78.3	2.2	.1	18.0	.4	1.0	375

(Authorities consulted in the Chapter on Vegetable Garden. —Colo. Ag. Col. E. S.; U. Ill. A. E. S.; U. Idaho A. E.; Purdue U. A. E. S.; N. H. Col. A. E. S.; Mich. St. A. E. S.; Mass. Ag. Col.

E. S.; Ohio Ag. E. S.; S. C. A. E. S.; Okla. A. E. S.; Texas A. E. S.; Va. A. E. S.; W. Va. U. A. E. S.; Cornell U. A. E. S.; R. I. Col. of Ag. and Mech. Arts E. S.; N. C. Col. of Ag. and Mech. Arts; N. Y. A. E. S.; U. Tenn. A. E. S.; Pa. St. Col. A. E. S.; Mich. St. Ag. Col. A. E. S.; S. Dak. A. E. S.; U. Wyo. E. S.; B. P. I.; Kans. St. Ag. Col. E. S.; N. J. A. E. S.; Tuskegee Normal & Industrial Inst. E. S.; S. S. E. S. Clemson Ag. Col.; N. Mex. Col. of Ag. and Mech. Arts E. S.; Fla. A. E. S.; Iowa Ag. Col. E. S.; U. Minn. A. E. S.; U. Nevada A. E. S.; N. Dak. E. S.; Oreg. A. E. S.; Del. Col. A. E. S.; Ark. Ag. Col. E. S.; U. Nebr. A. E. S.; Ga. E. S.; Md. A. E. S.; Miss. Ag. E. S. The entire article on Vegetable Garden was taken bodily from the best portions of the above bulletins, etc.)

THE COUNTRY LIFE PRESS

GARDEN CITY, N. Y.

[1] See page 321, for illustration.

Transcriber's Note: For reasons of clarity the illustration labels and tables have been moved to the end of the paragraph.

The illustration of a Calabash as referenced in the footnote on page 51 was not included in this publication, being a reprint of a section from "The Farmer's Cyclopedia". The illustration can be found on page 321 of "Farmers' Cyclopedia Abridged Agricultural Records Volume IV Grass, Hay, Grains, Vegetables" published by Doubleday, Page & Company, 1914, available on The Internet Archive at: archive.org/stream/farmerscyclopedi04gardiala#page/320/mode/2up.

The following changes have been made:
Page 5 The word 'in' was repeated and deleted.
Page 26 havings is now having.
Page 54 to is now too.
Page 64 tumber is now number.
Page 68 maturty is now maturity.
Page 70 conditons is now conditions.
Page 75 flshy is now fleshy.
Page 78 bettles is now beetles.
Page 88 The word 'as' was repeated and deleted.
Page 101 cutlivated is now cultivated.
Page 116 necessisity is now necessity.
Page 81 toughtened is now toughened.

*** END OF THE PROJECT GUTENBERG EBOOK THE VEGETABLE GARDEN: WHAT, WHEN, AND HOW TO PLANT ***

THE FULL PROJECT GUTENBERG™ LICENSE

To protect the Project Gutenberg™ mission of promoting the free distribution of electronic works, by using or distributing this work (or any other work associated in any way with the phrase “Project Gutenberg”), you agree to comply with all the terms of the Full Project Gutenberg License available with this file or online at www.gutenberg.org/license.

Section 1. General Terms of Use and Redistributing Project Gutenberg electronic works

1.A. By reading or using any part of this Project Gutenberg electronic work, you indicate that you have read, understand, agree to and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy all copies of Project Gutenberg electronic works in your possession. If you paid a fee for obtaining a copy of or access to a Project Gutenberg electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. “Project Gutenberg” is a registered trademark. It may only be used on or associated in any way with an electronic work by people who agree to be bound by the terms of this agreement. There are a few things that you can do with most Project Gutenberg electronic works even without complying with the full terms of this agreement. See paragraph 1.C below. There are a lot of things you can do with Project Gutenberg electronic works if you follow the terms of this agreement and help preserve free future access to Project Gutenberg electronic works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation (“the Foundation” or PGLAF), owns a compilation copyright in the collection of Project Gutenberg electronic works. Nearly all the individual works in the collection are in the public domain

in the United States. If an individual work is unprotected by copyright law in the United States and you are located in the United States, we do not claim a right to prevent you from copying, distributing, performing, displaying or creating derivative works based on the work as long as all references to Project Gutenberg are removed. Of course, we hope that you will support the Project Gutenberg mission of promoting free access to electronic works by freely sharing Project Gutenberg works in compliance with the terms of this agreement for keeping the Project Gutenberg name associated with the work. You can easily comply with the terms of this agreement by keeping this work in the same format with its attached full Project Gutenberg License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also govern what you can do with this work. Copyright laws in most countries are in a constant state of change. If you are outside the United States, check the laws of your country in addition to the terms of this agreement before downloading, copying, displaying, performing, distributing or creating derivative works based on this work or any other Project Gutenberg work. The Foundation makes no representations concerning the copyright status of any work in any country other than the United States.

1.E. Unless you have removed all references to Project Gutenberg:

1.E.1. The following sentence, with active links to, or other immediate access to, the full Project Gutenberg License must appear prominently whenever any copy of a Project Gutenberg work (any work on which the phrase “Project Gutenberg” appears, or with which the phrase “Project Gutenberg” is associated) is accessed, displayed, performed, viewed, copied or distributed:

> This eBook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may

copy it, give it away or re-use it under the terms of the Project Gutenberg™ License included with this eBook or online at www.gutenberg.org. If you are not located in the United States, you will have to check the laws of the country where you are located before using this eBook.

1.E.2. If an individual Project Gutenberg electronic work is derived from texts not protected by U.S. copyright law (does not contain a notice indicating that it is posted with permission of the copyright holder), the work can be copied and distributed to anyone in the United States without paying any fees or charges. If you are redistributing or providing access to a work with the phrase “Project Gutenberg” associated with or appearing on the work, you must comply either with the requirements of paragraphs 1.E.1 through 1.E.7 or obtain permission for the use of the work and the Project Gutenberg trademark as set forth in paragraphs 1.E.8 or 1.E.9.

1.E.3. If an individual Project Gutenberg electronic work is posted with the permission of the copyright holder, your use and distribution must comply with both paragraphs 1.E.1 through 1.E.7 and any additional terms imposed by the copyright holder. Additional terms will be linked to the Project Gutenberg License for all works posted with the permission of the copyright holder found at the beginning of this work.

1.E.4. Do not unlink or detach or remove the full Project Gutenberg License terms from this work, or any files containing a part of this work or any other work associated with Project Gutenberg.

1.E.5. Do not copy, display, perform, distribute or redistribute this electronic work, or any part of this electronic work, without prominently displaying the sentence set forth in paragraph 1.E.1 with active links or immediate access to the full terms of the Project Gutenberg License.

1.E.6. You may convert to and distribute this work in any binary, compressed, marked up, nonproprietary or proprietary form, including any word processing or hypertext form. However, if you provide access to or distribute copies of a

Project Gutenberg work in a format other than “Plain Vanilla ASCII” or other format used in the official version posted on the official Project Gutenberg website (www.gutenberg.org), you must, at no additional cost, fee or expense to the user, provide a copy, a means of exporting a copy, or a means of obtaining a copy upon request, of the work in its original “Plain Vanilla ASCII” or other form. Any alternate format must include the full Project Gutenberg License as specified in paragraph 1.E.1.

1.E.7. Do not charge a fee for access to, viewing, displaying, performing, copying or distributing any Project Gutenberg works unless you comply with paragraph 1.E.8 or 1.E.9.

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg electronic works provided that:

- You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, “Information about donations to the Project Gutenberg Literary Archive Foundation.”

- You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg™ License. You must require such a user to return or destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg™ works.

- You provide, in accordance with paragraph 1.F.3, a full refund of any money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.

- You comply with all other terms of this agreement for free distribution of Project Gutenberg™ works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg™ electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from the Project Gutenberg Literary Archive Foundation, the manager of the Project Gutenberg™ trademark. Contact the Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable effort to identify, do copyright research on, transcribe and proofread works not protected by U.S. copyright law in creating the Project Gutenberg™ collection. Despite these efforts, Project Gutenberg™ electronic works, and the medium on which they may be stored, may contain "Defects," such as, but not limited to, incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the "Right of Replacement or Refund" described in paragraph 1.F.3, the Project Gutenberg Literary Archive Foundation, the owner of the Project Gutenberg™ trademark, and any other party distributing a Project Gutenberg™ electronic work under this agreement, disclaim all liability to you for damages, costs and expenses, including legal fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE PROVIDED IN PARAGRAPH 1.F.3. YOU

AGREE THAT THE FOUNDATION, THE TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER THIS AGREEMENT WILL NOT BE LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a defect in this electronic work within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending a written explanation to the person you received the work from. If you received the work on a physical medium, you must return the medium with your written explanation. The person or entity that provided you with the defective work may elect to provide a replacement copy in lieu of a refund. If you received the work electronically, the person or entity providing it to you may choose to give you a second opportunity to receive the work electronically in lieu of a refund. If the second copy is also defective, you may demand a refund in writing without further opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth in paragraph 1.F.3, this work is provided to you ‘AS-IS’, WITH NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied warranties or the exclusion or limitation of certain types of damages. If any disclaimer or limitation set forth in this agreement violates the law of the state applicable to this agreement, the agreement shall be interpreted to make the maximum disclaimer or limitation permitted by the applicable state law. The invalidity or unenforceability of any provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the trademark owner, any agent or employee of the Foundation, anyone providing copies of Project Gutenberg™ electronic works in accordance with this agreement, and any volunteers associated with the production, promotion and distribution of Project Gutenberg™ electronic works, harmless from all liability, costs and expenses, including legal fees, that arise directly or indirectly from any of the following which you do or cause to occur: (a) distribution of this or any Project Gutenberg work, (b) alteration, modification, or additions or deletions to any Project Gutenberg work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg

Project Gutenberg is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the assistance they need are critical to reaching Project Gutenberg's goals and ensuring that the Project Gutenberg collection will remain freely available for generations to come. In 2001, the Project Gutenberg Literary Archive Foundation was created to provide a secure and permanent future for Project Gutenberg and future generations. To learn more about the Project Gutenberg Literary Archive Foundation and how your efforts and donations can help, see Sections 3 and 4 and the Foundation information page at www.gutenberg.org.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non-profit 501(c)(3) educational corporation organized under the laws of the state of Mississippi and granted tax exempt status

by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's business office is located at 41 Watchung Plaza #516, Montclair NJ 07042, USA, +1 (862) 621-9288. Email contact links and up to date contact information can be found at the Foundation's website and official page at www.gutenberg.org/contact

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg™ depends upon and cannot survive without widespread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be freely distributed in machine-readable form accessible by the widest array of equipment including outdated equipment. Many small donations ($1 to $5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up with these requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit www.gutenberg.org/donate.

While we cannot and do not solicit contributions from states where we have not met the solicitation requirements, we know of no prohibition against accepting unsolicited donations from donors in such states who approach us with offers to donate.

International donations are gratefully accepted, but we cannot make any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg web pages for current donation methods and addresses. Donations are accepted in a number of other ways including checks, online payments and credit card donations. To donate, please visit: www.gutenberg.org/donate.

Section 5. General Information About Project Gutenberg electronic works

Professor Michael S. Hart was the originator of the Project Gutenberg concept of a library of electronic works that could be freely shared with anyone. For forty years, he produced and distributed Project Gutenberg eBooks with only a loose network of volunteer support.

Project Gutenberg eBooks are often created from several printed editions, all of which are confirmed as not protected by copyright in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our website which has the main PG search facility: www.gutenberg.org.

This website includes information about Project Gutenberg, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.