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Vegetable Growing in Missouri



Fig. 1.—View of a cabbage experimental plot, horticultural grounds,
Missouri College of Agriculture, Columbia, Mo.

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Fig. 2.—Three steps in preparing the garden: (above) applying a heavy coat of manure in fall; (center) plowing under manure in late fall; (below) disking into proper condition before planting, early spring. From Mo. Agr. Exp. Sta. Bul. 193.

Vegetable Growing in Missouri

J. T. QUINN AND T. J. TALBERT

“Let the garden, then, have its due meed of honour, and let not things, because they are common, enjoy for that the less share of our consideration—and the more so, as we find that from it men of the very highest rank have been content to borrow their surnames even; thus in the Valerian family, for instance, the Lactuini have not thought themselves disgraced by taking their name from the lettuce. Perhaps, too, our labours and research may contribute some slight recommendation to this our subject; although, with Virgil, we are ready to admit how difficult it is, by language however elevated, to ennoble a subject that is so unassuming in itself.” From Pliny’s Natural History, written about 3000 years ago.

Practically all of the common vegetables and truck crops reach their highest development in Missouri. The geographical position of the State makes it possible to grow successfully the vegetables of both the far north and the south. The great diversity of the soils gives the growers an opportunity to exercise choice as to the kinds best adapted to their particular needs and requirements.

The home vegetable garden may be made an important asset to the farm, suburban, or city dweller. Moreover, it offers one of the most valuable means of effecting savings in the family budget. Too many persons make excuses for not raising vegetables and truck crops. It is often considered a trivial matter, and some believe that they can better afford to buy the vegetables needed than to go to the trouble of producing them. The tendency, however, is to not purchase fresh vegetables daily but to do without them and to substitute the more expensive and less wholesome canned or preserved products.

Profits from Vegetable Garden

A well kept garden will yield very profitable returns for the time and labor expended. Experiments conducted by the Missouri Agricultural Experiment Station from 1919 to 1921 inclusive from a garden containing one-fourth of an acre gave an annual net return of \$134.14. This garden paid \$1.79 an hour for the labor required. The net returns from another garden containing one-twentieth of an acre was \$47.28 and for the labor expended this garden paid \$1.63 per hour.

Vegetables as Food

Vegetables also are important from the standpoint of health and growth. Recent investigations have shown that they contain an abun-

dance of mineral salts not found so plentifully in other foods. Growth and health producing substances known as vitamins are found in ample amounts in most of our common vegetables.

Purpose of Vegetable Garden

The growing of a vegetable garden may be justified for the following reasons: (1) It can be made to furnish an adequate supply of fresh vegetables from early spring until late autumn, and in addition, all that are required for canning, preserving, and storage for winter use. (2) It supplies vegetables of high quality. (3) Intelligently planned and carried out, the work becomes a source of education and inspiration instead of drudgery and a disappointment. (4) It is a paying proposition in dollars and cents.

Care of Soil

In the preparation of the soil, thorough, deep plowing in the fall or early winter is generally advisable. The seed bed should be mellow, deep, rich, well aired, and well drained for best results. Weeds should not be allowed to get a start. Once the garden or truck patch becomes infested with weeds it may often be more expensive to clean them out than the crop is worth. Frequent, thorough cultivation is necessary. If the top surface of the soil is stirred as soon as it will do to work after rains, trouble seldom will be experienced with weeds. Moisture also will be conserved by preventing the ground from cracking. Timely and frequent cultivations will tend to make gardening and trucking not only profitable, but a real pleasure.

Fertilizers

Barnyard manure is the best general garden and truck crop fertilizer. It furnishes the essential plant foods and tends to make the soil more friable, porous, and easily worked. It acts like a sponge in holding water in the soil when the plant roots are feeding, thus rendering the land more drought resistant. Commercial fertilizers, however, are often needed and when properly used with or without manure are very valuable in securing profitable yields and high quality.

For the farm garden where economy of space is not essential one-third or one-fourth of the land may be planted to some green manure crop and be turned under late in the fall. A plan for smaller gardens is to sow cowpeas or soybeans following the early vegetables. Green manure crops will add organic matter to the soil and greatly improve its physical condition.

For the average small backyard garden green manuring crops are impractical. Under such conditions stable manure must be depended upon. Heavy applications of manure should be applied in the fall or light applications of well rotted manure may be made in the spring. When ap-

plied in the fall, a covering of two inches over the entire garden is none too much. It should be plowed or spaded under soon after it is applied. Sheep and poultry manures are also very good fertilizers for the garden, but are so concentrated that they should be used only as very light applications in the fall or as a light top dressing in the spring after the crop has been planted.

Many gardeners find it almost impossible to grow root crops where continued heavy applications of barnyard manures have been made. This is usually due to the addition of an excess of nitrogen without the addition of other plant foods to make a balanced fertilizer necessary for proper plant development. The great amount of nitrogen furnished by the manure favors leaf and vine extension instead of root growth. However, such crops as lettuce, chard, and cabbage will do very well under such conditions. For root crops like potatoes, parsnips carrots, and turnips root growth is desired and superphosphate (acid phosphate)* or a complete commercial fertilizer such as a 3-12-4 should be used alone or with the barnyard manure. Three hundred pounds of superphosphate used with ten tons of barnyard manure per acre should give very good results on all root crops, or a complete fertilizer such as a 3-12-4 applied at the rate of 400 to 600 pounds per acre may be used. The commercial fertilizers may be applied broadcast, but in general better results will be had from sowing the fertilizer in the row, mixing it well with the soil before either plants or seeds are planted. This is necessary because seeds, roots, or tops of plants may be injured by coming in direct contact with the concentrated fertilizer. Four pounds per square rod broadcast before planting, or three pounds per hundred feet of row applied in the drill, are recommended applications for small areas.

It is often advisable to use some nitrogenous fertilizer such as ammonium sulphate or sodium nitrate alone. These fertilizers will be found useful in forcing a quick growth of such leafy crops as cabbage, lettuce, spinach, and chard. They may be applied as top dressings around the plants or in a solution using one pound of either ammonium sulphate or sodium nitrate to 25 gallons of water. Care should be taken to see that only light applications of these nitrogenous fertilizers are made and that they do not come in contact with the tender leaves or stems of the plant. From 100 to 150 pounds per acre is sufficient when used in the dry form. Ammonium sulphate or sodium nitrate should not be used on such crops as potatoes, carrots, and beets unless combined with phosphorous and potash as in the case of the recommended 3-12-4 complete commercial fertilizer.

Gardeners often ask about the use of common salt as a fertilizer. The question no doubt arises from the fact that a few home gardeners

*The newer term *superphosphate* is used throughout this circular to designate the material formerly known as *acid phosphate*

use it on their asparagus beds. Salt may appear helpful in a few instances, but as a general rule it is of very little value even on asparagus beds. It is often decidedly injurious both directly to the plant and from the after effects on the soil.

Ground limestone is especially valuable after plowing under a green manure crop, applying it broadcast at the rate of 15 pounds per square rod. It is better, however, not to apply lime to soil which is soon to be planted to Irish potatoes, since lime tends to make soil conditions more favorable for the growth of the disease organism causing potato scab.

The gardener and trucker will generally secure more satisfactory results on a small area, well fertilized, intensively cultivated and cared for than on a larger area which cannot be properly handled.

Watering the Garden

During dry periods of spring and summer, growers often make the mistake of lightly sprinkling the garden every day. This practice destroys the dust mulch and causes the soil to bake and a crust to form on top. Such watering generally does more harm than good to the plants. It would be much better to water once a week and thoroughly wet the soil than to sprinkle the surface soil daily. Cultivation should follow irrigation as soon as the soil will do to stir. This is just as important as watering, as it conserves moisture, aerates the soil and promotes the growth of the vegetables.

Good Seed

Good seed is perhaps the most important factor connected with the vegetable and trucking business. A farmer may have the best of soil, have all the tools and labor necessary for the highest production, and yet his efforts will be a failure if his seed is not what it should be. Many growers fail altogether or produce low yields because they buy cheap seed. The best seed is always the cheapest regardless of price. It is usually a good practice to buy seed from men or firms who are well known and who are reliable.

The Control of Insects

The gardener and trucker who knows how to prevent or control the various insect pests injurious to vegetables and truck crops is generally successful. Almost everyone who attempts to grow a crop knows about when to plant and something regarding cultivation and fertilization, but it is too often true that too little or nothing is known about the control of injurious insect and plant diseases.

Methods Used.—The insects are combated in various ways, by spraying (liquids and dusts), crop rotation, growing resistant varieties, adding chemicals to the soil, mechanical barriers, planting early or late,

and by adopting farm and garden practices which are unfavorable to the development of the pests.

Divided into Two Classes.—Insects may be divided roughly into two great classes on the basis of their mouth parts and habits of feeding: first, the chewing or biting type, which actually eat the stems, leaves, and fruits of plants; and second, the sucking type which with a long sucking beak draws out the plant juices. The potato beetle is a good example of a biting and chewing insect, while the plant louse or aphid represents a sucking type. Advantage of this natural division is taken in controlling insects.

Kill Biting Insects with Poison Spray.—It is usually possible to kill insects that bite and chew by dusting or spraying arsenical poisons over the infested plants. The insects are thus forced to feed upon poison, and death results. Stomach poisons like arsenate of lead are used. It is necessary to cover the plants thoroughly with such poisons because in many cases the insect may seek, and feed upon the parts of the plants not covered by the poison dust or liquid spray.

For Sucking Insects Use Contact Sprays.—It is practically impossible to poison the sucking insects because they can insert their sucking beaks into the tissues of the plant, draw out the juices beneath the surface without taking any of the arsenical poisons. For the sucking type of insects, therefore, a contact spray or dust must be used. The solution, or dust kills the insects by coming in contact with their bodies, smothering, corroding, burning, and penetrating their living tissues. Only those insects which are actually hit by the spray or dust will be killed, hence the importance of thorough spraying and dusting.

The Control of Diseases

Combating Fungous Diseases.—Fungous diseases are not generally as harmful to vegetables and truck crops as insects yet they deserve attention. Where a poison as arsenate of lead is used to destroy biting insects, it is often advisable to use with it a fungicide like bordeaux. The combination spray, may therefore, control both fungous diseases and insects.

A protective spray or dust applied as a covering on the susceptible plant parts kills the fungous spores alighting on the coating before they have an opportunity to cause infection. In all spraying operations, it is important that all susceptible parts of the plant be kept thoroughly covered and that the new growth be sprayed often enough to prevent the germination of fungous spores and later injury.

There are certain other diseases like the various kinds of blight and wilt which are caused by bacteria. As a rule these are not affected directly by spraying. Consequently the grower must adopt cultural practices,

crop rotations, use resistant varieties, and other methods suited to the control or prevention of the particular malady. Physiological or constitutional troubles are also common with some vegetable crops and here again sprays have no more than an indirect beneficial effect. The remedy in many instances consists of a better understanding of the nutritional requirements of the plants. This serves to emphasize the fact that good culture tends to produce strong, vigorous plants which are generally more resistant to attacks of both diseases and insects.

Spraying and Dusting Equipment

Spraying on an extensive scale may be done with a power sprayer, barrel and pump sprayer, or a small traction sprayer. Effective work may also be done on small areas with the knapsack sprayer, the bucket pump, the hand atomizer, and other contrivances or devices arranged for liquid sprays or for blowing and distributing a dust spray. Delays caused by inferior or insufficient equipment may mean heavy financial losses.

Dust as well as liquid spraying outfits may be used with good results. These are prepared for blowing and distributing the dust over infested plants. Power and traction dusters are in use for large acreages but most growers for small plantings use the hand outfits which may be procured from most hardware stores at a small cost. Effective dusting may be made over a small area by using a talcum powder can, a tin can in the bottom of which a few holes have been made, or a porous cloth bag may be used.

The apparatus should be adapted to the size of the garden or truck crop to be covered. Where the apple orchard is being sprayed with the power or barrel and pump sprayer, the same equipment can usually be used to spray the garden or truck patch. Where diseases and insects are a real problem, that is very difficult to control, liquid sprays generally give better results than dust sprays.

Small Spraying Outfits.—The hand atomizers, bucket pumps, knapsack pumps, and compressed air pumps may be used effectively in spraying small trees, shrubs, and garden plants. They are not suited however for spraying extensive plantings and the results generally obtained by using such equipment will not be satisfactory.

Barrel Pumps.—Truck patches of from 4 to 5 acres may be sprayed efficiently with a good type of barrel pump sprayer. Every outfit of this kind should be equipped with a good agitator to keep the spray solution well mixed and a strainer at the bottom of the pump to prevent clogging the nozzles with particles of dirt and other foreign matter.

Tank Pumps.—With plantings of from 5 to 10 acres a double acting tank pump will be much more satisfactory than a barrel pump. Such a pump will maintain sufficient pressure for good work and since the tank

may have a capacity of 100 to 150 gallons considerable time is saved in refilling. This is especially true where the crop is some distance from the water supply.

Power Sprayers.—Operations covering from 10 to 25 or 30 acres can be most economically and efficiently sprayed with a gasoline power sprayer. Since a continuous high pressure is desired in order to obtain the best results in spraying, the gasoline power sprayer comes nearer meeting the requirements than any other type of power outfit.

Spraying Materials

Arsenate of Lead.—In the spray schedules the quantities given refer to the dry form, although the paste form of arsenate of lead may be used. For all practical purposes, one form is as effective as the other. Since the arsenate of lead paste is 50% water, use twice the amount recommended for the dry form. Most growers now prefer to use the dry lead arsenate because it is not changed when containers are opened and it is easier to store and handle. For the control of most chewing insects that affect vegetables, dry arsenate of lead should be used at the rate of 2 pounds to each 50 gallons of water. For dusting use dry arsenate of lead at the rate of 1 pound to 10 to 12 pounds of airslacked lime. Many home gardeners still use paris green as an insecticide. Better control may be had from arsenate of lead because it sticks to the foliage better than paris green and is less likely to do injury by burning.

Nicotine Sulphate.—This material is a tobacco product and may be purchased from companies dealing in spraying materials. It is generally used to control plant lice or aphids. Since the cost is very high, nicotine sulphate should not be used unless there is a real need. In spraying vegetables and truck crops to control plant lice, it is generally used at the rate of $\frac{3}{4}$ pint to 100 gallons of either water or bordeaux spray. For smaller quantities full directions may be found on the containers.

Nicotine Dust.—For a number of years many growers in Missouri have been using a nicotine dust for the control of such insects as the striped cucumber beetle and plant lice. The dusts may be procured with varying percentages of nicotine, also, with different percentages of an arsenical poison. When used for the control of the cucumber beetle, the dust should contain not less than 4 per cent pure nicotine in addition to 10 per cent of an arsenical poison. When only plant lice (aphids) are present a 2 per cent pure nicotine mixture, without an arsenical should control this insect.

Dusts may be applied by using a home made duster such as a cheesecloth bag, a perforated tin can, or one of the many small mechanical dusters now offered on the market. To be most effective nicotine dusts should be applied on a warm day between 10 a. m. and 3 p. m. and at

a time when there is little wind. Under such conditions 3 pounds of dust will be required to dust an acre of young watermelon plants and from 5 to 8 pounds per acre for muskmelon plants.

Poison Bran Mash

- Dry arsenate of lead
- or
- Paris green
- } ½ pound
- Wheat bran, 10 pounds
- Molasses, 2 quarts
- Oranges or lemons, 2 fruits
- Water, 1½ gallons

The bran and paris green should be mixed together dry in a tub or half-barrel. To the water add the juice and pulp (after it has been cut or ground up) of the oranges or the lemons. Then add the syrup or molasses and stir. Finally add the water containing the syrup and fruit to the poison bran and stir the whole mixture thoroughly, after which it is ready for use. A damp, coarse, crumbly mash is desired. The material should not be sloppy. For best results, make up and use at once.

This mixture should cover from two to three acres if sown broadcast like wheat or oats. It is one of the best poison baits known for insects and it is very effective against grasshoppers, army worms, and cut worms. For grasshoppers, spread broadcast early in the morning when the hoppers are feeding. For cut worms or army worms, spread broadcast near the injured plants late in the evenings.

Bordeaux Mixture

Where only a small quantity of bordeaux is desired, it often may be best to purchase the prepared product although a small quantity of bordeaux may be made without difficulty. In using prepared spraying chemicals, it is very important that the grower follow carefully the directions given on the containers.

If as much as 50 gallons of bordeaux is needed, better results will generally be secured by making the spray mixture on the farm. The following formula and method of preparation has given satisfactory results in Missouri:

- Blue-vitriol (copper sulphate)..... 3 pounds
- Stone lime..... 4 pounds
- or
- Hydrated lime..... 6 pounds
- Water..... 50 gallons

Only the highest grade of lime should be used. Since metal containers are corroded by copper solutions or bordeaux they should not be used in mixing or storing.

Making Stock Solutions.—The number of pounds of copper sulphate needed may be placed in a gunny sack or cloth bag and hung in a barrel or keg of water so that it is just below the surface of the water. This should be done a day or two before the spray is needed for use. When the copper sulphate is dissolved add sufficient water to make 1 gallon for each pound used. This is known and referred to hereafter as the copper sulphate stock solution.

If hydrated lime is used, the copper sulphate stock solution is the only one needed. The amount of hydrated lime required for each barrel or tank should be mixed with a little water and stirred into a thin paste, after which it is ready to be poured through the strainer into the spray barrel or tank.

Where stone lime is used, slake the required amount in just enough water to make a thin paste. Stir and mix thoroughly after which add sufficient water to give 1 gallon for each pound of lime used. This is known and referred to hereafter as the lime stock solution.

The stock solution of copper sulphate will keep for several weeks without deterioration if evaporation is prevented. The lime stock solution deteriorates unless kept in air-tight containers. Where evaporation does occur, water should be added before using to bring the dilution up to 1 pound to each gallon.

Mixing.—According to the above formula, 3 gallons of the copper sulphate stock solution and 4 gallons of the lime stock solution, or 6 pounds of the hydrate lime made into a thin paste will be required for each 50 gallons of bordeaux to be made. Fill the spray tank about two-thirds full of water and start the agitator. Pour through the strainer 3 gallons of the copper sulphate stock solution for every 50 gallons of spray. Add 4 gallons of the lime stock solution or 6 pounds of hydrated lime made into a thin paste for every 50 gallons of spray. Then add the required amount of arsenate of lead and enough water to bring the volume up to the required amount. Since bordeaux deteriorates rapidly, the mixture should be used soon after making.

Dust Versus Liquid Sprays

Extensive experiments and observations have been carried on by several state experiment stations to determine the relative merits of dust sprays as compared to liquid sprays. Some of the advantages of the dust spray may be enumerated as follows: (1) More acres may be sprayed in a given time. (2) On rough, hilly land, the dust sprayer and materials are more convenient to use. (3) Time is saved in loading the dusting machine and preparing the spray.

Some of the advantages for the liquid spray may be listed as follows: (1) Where the diseases are serious, practically all investigators and growers agree that the liquid spray is much more efficient than the

dust spray. (2) The cost per acre for materials is usually higher for dusting than for spraying, although the total cost is generally about the same. (3) In fields where insect pests are serious, better control is usually secured by the use of liquid sprays.

Hotbeds and Coldframes

The hotbed and coldframe should be located on a well drained plot of ground. If possible they should face the south and be protected on the north by buildings, a board fence, or a wind break of trees. It is also important that the forcing structures be located close to the water supply and garden. For the back yard garden, one corner of the lot would be a good location.

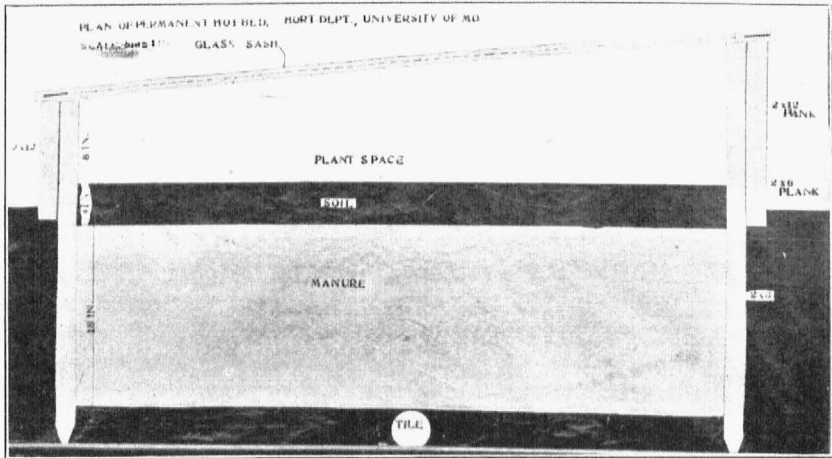


Fig. 3.—Cross section showing the construction of permanent hotbed.

The hotbed is used for starting plants very early in the season. The coldframe is used for starting plants later in the spring and for the purpose of “hardening off” vegetables which have been started in the hotbed. The hotbed may be heated from fermenting manure, or by pipes carrying steam or hot water. The coldframe receives its only heat from the sun. In some sections of Missouri the flue heated hotbed is used, especially in the growing of sweet potato slips. Permanent hotbeds have three parts, a pit, frame, and covering. The pit should be dug the size of the proposed hotbed, and from one to two feet deep. The frame may be made of wood, concrete, brick, stone, or hollow building tile, but two inch planks treated with some preservative is the most common material used. One side of the frame should be about six inches higher

than the other. The end walls are built slantingly to give the proper slope to the side walls, on which is placed the standard sash or other covering used.

For Central Missouri the hotbed should be prepared about February 15, to be of use in starting most of our vegetable seeds. It is very important that it be properly constructed, and the manure be well prepared.

The preparation of the manure to be used in the hotbed should begin about ten days before the time the hotbed is to be used. Fresh horse manure containing straw or leaves about equal to $\frac{1}{3}$ its total bulk has been found to be the most satisfactory heating material. The manure should be piled in a compact heap. As soon as fermentation begins, it should be forked over and repiled. When the entire heap seems to be

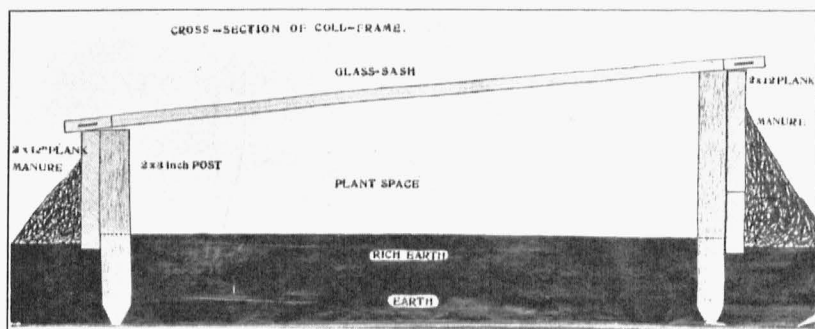


Fig. 4.—Cross section showing construction of coldframe.

heated thoroughly it is ready to be placed in the pit of the hotbed. The manure should be thoroughly tramped, especially in the corners and near edges. Soil should be placed on top of the manure. When plants are to be grown in flats, and the flats placed in the hotbed, 2 inches of soil is sufficient, but when plants are to be transplanted directly into the bed at least 4 inches of soil should be used. As soon as the soil is in place, the sash is placed on the frame and the heating allowed to continue until it has reached about 90°F, at which time seed may be sown. If seed is to be sown in flats, they should be well watered and placed in the hotbed. When plants are large enough they may be transplanted to the hotbed or coldframe.

The ventilating of the hotbed is very important. To keep the temperature constant requires a considerable amount of attention. The amount of ventilation will depend on outside weather conditions. For

the early spring the amount of ventilation may be very little while as the season advances, the sash may be removed from the frame on warm sunny days. For the last week or ten days before the plants are to be set in the field, it is well to leave the sash off the frame both day and night if the weather is favorable. This will harden the plants and the number lost from exposure after being set in the field will be reduced.

The soil should be thoroughly wet just after sowing the seed or transplanting the plants. The amount of subsequent watering required will depend on weather conditions. A good watering every ten days to two weeks is usually sufficient during the cool days of March while later in the spring, it may be necessary to apply water every two or three days. Do not apply water unless the soil shows signs of drying out. When watering do not sprinkle, but wet thoroughly.

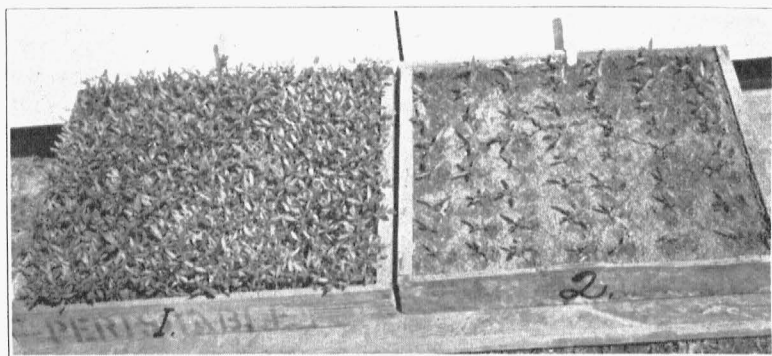


Fig. 5.—Seed flat 1 shows tomato plants grown from seed, and 2 shows the proper spacing of the same plants in transplanting.

Starting the Plants

Every gardener should have a hotbed or small greenhouse in which to start early plants. A three or four sash hotbed may be so managed as to supply enough plants of such crops as cabbage, tomatoes, and peppers for the average small garden. Seed may be sown in rows directly in the hotbed and later transplanted or they may be sown in small boxes or flats. The use of boxes or flats will be found very convenient because of the ease with which they may be watered and moved about. When planted in flats seed may be sown in rows or broadcasted and later transplanted to other flats. At planting time these flats may be taken directly to the garden or field and the plants removed with very little disturbance to the roots.

The use of paper pots, paper bands, wood veneer bands, clay pots and composition pots has become a general practice in many of our commercial vegetable sections. The containers have many advantages,

but the principal one is the possibility of early crops through their use. Plants or seeds may be planted directly into these containers in the hot-beds or greenhouse very early in the spring and later transplanted in the field with little or no "set back" from the transplanting operation. Care should be taken to see that the pots or bands are large enough to allow for normal development of the roots during the time they are growing in the container. A 3 to 4 inch pot or band will be found satisfactory for such plants as tomatoes, peppers, eggplant, and cauliflower. The 4 to 5 inch size will be found more satisfactory for watermelons, muskmelons, and cucumbers.

Arrangement of the Garden

To obtain the best results from a garden, it is necessary to have in mind a definite idea concerning its arrangement. This is especially true when the garden space is limited, and every foot must be made to produce in a systematic manner if the home is to be supplied with vegetables throughout the year.

For convenience, we may divide vegetables into three groups: the perennial crops, long season crops, and short season crops. All perennial vegetables such as asparagus, rhubarb, and horseradish should be placed to one side of the garden, where they will not interfere with the plowing or general plan of other crops. Long season crops, such as parsnips and tomatoes should be placed together. The short season crops such as lettuce, radishes, and peas when grouped together may be easily followed by another crop. A grouping of vegetables which may aid in the arrangement of the garden is suggested.

CROPS OCCUPYING THE GROUND ALL SEASON

Asparagus	Beans, pole lima	Okra	Peppers
Rhubarb	Chard	Onion (from seed)	Pumpkins
Horseradish	Cucumbers	Parsley	Salsify
Beans, pole snap	Eggplant	Parsnips	Squash
Muskmelons	Sweet Potatoes	Watermelons	

CROPS OCCUPYING THE GROUND FOR ONLY A PART OF THE SEASON AND MAY BE FOLLOWED

BY OTHERS

Beans, bush	Carrots	Kale	Onions (sets)
Beets	Cauliflower	Kohlrabi	Peas
Cabbage	Corn (early)	Lettuce	Potatoes
Radishes	Spinach	Turnips	

LATE CROPS WHICH MAY FOLLOW OTHERS

Beans, bush	Cabbage (Chinese)	Celery	Potatoes (late)
Beets	Carrots	Kale	Radishes
Cabbage (late)	Corn	Lettuce	Spinach
Turnips			

Succession Crops

To get maximum returns from a vegetable garden it is necessary to have the land growing a crop the greater part of the season. This is made possible by either following an early cool crop with a warm season crop or by repeating the same crop. It is possible to have a continuous supply of either radishes or lettuce by replanting as soon as the crop matures. A very good example of succession cropping is early lettuce, followed by tomatoes and a fall crop of spinach. These three crops occupy the soil from early spring until late fall. In selecting succession crops, vegetables of the same family should not follow one another. This precaution will aid greatly in controlling those insects and diseases which attack crops of the same family. There are many combinations which may be worked out by referring to the grouping of vegetables under "Arrangement in the Garden."

Companion Crops

The growing of two or more vegetables on the same ground at the same time is known as companion cropping. This method is especially well adapted to the small garden, where space is limited, but is generally not followed in the farm garden. In companion cropping the longer season vegetable is planted its regular distances, and then interplanted either in the row or between the rows with some other quick maturing short season crop.

A good example is the planting of radishes, lettuce, or onion sets between rows of cabbage. Squash and pumpkins may be planted as a companion crop in the sweet corn planting. Many more examples might be given which would especially apply to the small garden of limited area. When sufficient space is available it will be found better to plant the vegetables in long rows and allow space enough between the rows to use horse cultivation.

What Size Garden?

The question is often asked, "What vegetable and how much of each vegetable shall I plant?" This is difficult to answer for the likes and dislikes of individuals differ. In some instances a family's liking for a certain vegetable will require a large planting, while another family may omit the crop from their garden. There are, however, certain staple vegetables which are grown in most gardens. The table on page 17 will give an approximate idea of the crops to plant and the amount usually required for the average family.

TABLE 1.—The following is a suggested garden which may be made to provide fresh, canned, and stored vegetables for an average family of five.

Feet of row	Crop grown	Variety	Date of Planting	Planting distance in inches		Seed or plants for 100 ft. of row
				In row	Between rows	
150	Asparagus	Mary Washington	April	18	48	66 plants
60	Rhubarb	Victoria	April	48	48	25 plants
800	Potatoes, early	Irish Cob.	Mar.15-Apr.15	15	36	6 lbs.
200	Onions	(Sets)	Feb.&March	3	24	3 pts.
50	*Radishes	Icicle, Wh. Tip	Mar.Apr.May	1	24	1 oz.
100	Spinach	Bloomsdale	Mar. or Sept.	3-4	24	1 oz.
50	*Lettuce	Grand Rapids	Mar. Apr.May	4-6	24	½ oz.
300	*Peas, early	Alaska	Feb. Mar. Apr.	1	24	1-2 pts.
200	Cabbage	Copenhagen	Mar'15-Apr.15	15	30	80 plants
50	Beets, early	Crosbys Egypt.	Apr. 1-15.	2-3	30	2 oz.
100	Beets, late	Detroit D.Red	Apr.	3-4	30	2 oz.
200	Onions (seed)	SouthportGlobe	Apr. 1-10	2-3	24	1 oz.
100	*Carrots	Chantenay	Mar. Apr.	2-3	30	¼ oz.
100	Parsnips	Guernsey	Feb. Mar.	2-4	30	¼ oz.
50	Swiss Chard	Lucullus	April	6-8	30	1 oz.
300	*Beans, snap	Stringless				
		Greenpod	May	3	30	1 qt.
200	*Sweet corn, ea.	Gold Bantam	Apr.10-June 1	18	36	¼ pt.
300	Sweet corn, late	Evergreen	May 1, June 15	18	36	¼ pt.
400	Sweet potato	Nancy Hall	May	15	36	80 plants
50	Peppers	Ruby King	May	18	36	66 plants
100	Tomato, early	Bonny Best	May	36	48	33 plants
300	Tomato, late	Stone or Mar-globe	May 1, June15	40	48	30 plants
75	Cucumber	White Spine				
		Davis Perfect	May	48	48	¼ oz.
25	Summer Squash	White Bush	May	36	48	¼ oz.

*Make succession plantings

Succession Crops to follow the above

400	Turnips	Globe or Strap Leaf	After Potato August	2-4	24	¼ oz.
50	Radish	Icicle Wh. Tip	After lettuce June-Sept.	1	24	1 oz.
50	Lettuce, leaf	Grand Rapids	After radish June-Sept.	4-6	24	¼ oz.
100	Winter Squash	Hubbard	After peas, June	72	72	2 oz.
100	Chinese Cabbage	Pe-Tsai	After spinach, August	8	24	½ oz.
500	Pole beans	Ky. Wonder in corn	May-June	30-36	36	1 pt.
300	Spinach	Bloomsdale	After beans Sept.	3-4	24	1 oz.
200	Snap beans	Stringless				
		Greenpod	After cabbage July	3	30	1 qt.

TABLE II.—PLANTING TABLE

Crop	Seed per 100 ft. of row		Planting distance between rows. (inches)		Depth to plant in inches	Distance in row inches	Plant Seed		Trans-plant to field	Days required to mature from seed	Approx. yield per 100 ft. row
	Seed	Plants	Horse Cul.	Hand Cul.			in open field	in hotbed			
Asparagus roots	-----	60-80	42-48	42-48	8-10	15-20	-----	-----	March 15 April 15	3 years	50 lbs.
Beans, Bush	1 qt.	-----	30-36	18-24	1-1½	4-6	April 15 June 15	-----	-----	45-65	2 bu.
Beans, Bush Lima	1 qt.	-----	30-36	18-30	1-2	4-6	May 20 June 10	-----	-----	50-70	2 bu.
Beans, pole	¾ pt.	-----	36-48	36	1-2	36-48	May 15 June 15	-----	-----	45-65	2½ bu.
Beans, Pole Lima	¾ pt.	-----	36-48	36	1-2	36-48	May 20 June 10	-----	-----	65-80	2½ bu.
Beets	2 oz.	-----	24-36	12-18	1	2-3	Apr. 1* June 15	Feb. 15	-----	60-110	2½ bus.
Brussels Sprouts	¼ oz.	66	36	20-28	¼-½	18-24	-----	Feb. 1 Feb. 15	March 20 April 1	90-110	30 qt.
Cabbage, Early	¼ oz.	65-80	24-35	20-28	¼-½	15-18	-----	Feb. 1 Feb. 15	March 20 April 10	90-120	200 lbs.
Cabbage, Late	¼ oz.	50-65	36-42	24-32	½	24-30	June 1	-----	July 10	100-135	250 lbs.
Cabbage, Chinese	½ oz.	80-100	24-28	18-24	½	12-15	July 1 July 15	Feb. 1 Feb. 15	March 20	80-100	85 heads
Carrots	½ oz.	-----	21-28	12-18	½	2-3	Mar. 15* May 1	-----	-----	60-120	1½ bu.
Cauliflower	¼ oz.	65-80	36-42	24-30	½	18-24	-----	Feb. 1 Feb. 15	March 20 April 1	100-120	60 heads
Celeriac	¼ oz.	200	36	24	¾	6	-----	Feb. 15	April 1	125	100 lbs.
Celery	¼ oz.	200	36-48	20-24	¾	4-8	-----	Feb. 15 Apr. 1†	April 15 June 15†	120-150	200 stalks
Chard, Swiss	1 oz.	-----	24-30	15-18	1	6-8	April 1	-----	-----	50-120	50 lbs
Corn, Sweet	½ pt.	35-65	36-42	30-36	1-2	18-24	April 15* June 15	Apr. 1†	May 1	75-90	4 doz. ears
Cucumber	½ oz.	20-25	48-60	48-60	1	48-72	May 10 June 15	Apr. 1†	May 10	90-130	200
Eggplant	¼ oz.	25-50	30-36	24	½	18-24	-----	Mar. 1	May 20	150-160	125 fruits
Endive	½ oz.	75-100	24-28	14-18	½-1	8-12	April 10	-----	-----	60-90	65 plants
Horseradish roots	-----	70	30-36	24-30	3-4	14-20	-----	-----	April 1	120-140	65-70 r'ts
Kale	¼ oz.	80-100	24-30	15-24	½-1	12-24	Apr. 1* Aug. 15†	-----	-----	90-100	60 bu.
Kohl-rabi	¼ oz.	120-150	24-28	15-24	½	4-8	-----	Feb. 1 Feb. 15	March 20 April 1	60-90	2 bu.
Leek	½ oz.	-----	24-28	12-18	1	4-6	Mar. 20 April 1	-----	-----	140-180	300 stalks
Lettuce	½ oz.	100-300	24-28	12-15	½	4-12	Mar. 15* Aug. 1	Feb. 15	March 20	60-95	25-50 lbs.

Crop	Seed per 100 ft. of row		Planting Distance between rows. (inches)		Depth to plant in inches	Distance in row inches	Plant Seed		Trans-plant to field	Days required to mature from seed	Approx. yield per 100 ft. row
	Seed	Plants	Horse Cul.	Hand Cul.			in open field	in hotbed			
Muskmelon	½ oz.	20-25	48-60	48-60	1	60-72	May 10	Apr. 1 †	May 15	90-120	90-110 melons
Mustard	¼ oz.	-----	24-28	12-15	¼	2-3	Mar. 20*	-----	-----	60-90	2½-3 bu.
Okra	1 oz.	40-50	30-36	30-36	1	18-24	Sept. 1 May 1	-----	-----	90-140	900-1000 pods
Onion Seed	1 oz.	-----	24-28	12-15	½-1	2-3	April 1	Feb. 1	April 15	140-160	1½-2 bu.
Onion Set	2 qt.	-----	24-28	12-15	1	2-3	-----	-----	March 20	45-75	120 bunches
Onion, Bermuda	1 oz.	600	28-36	12-15	1	2-3	-----	Jan. 15	April 1 April 10	130-150	100 bunches
Parsley	¼ oz.	120-200	28-36	12-18	¾	3-6	Apr. 15	-----	-----	90-100	90 bunches
Parsnips	½ oz.	-----	28-36	18-24	½-1	3-5	April 1 May 1	-----	-----	140-160	2 bu.
Peas	1-2pt.	36-48	30-36	2	1-2	2-3	Mar. 15 Apr. 15	-----	-----	75-100	2 bu. in pods
Pepper	¼ oz.	65-80	30-36	24-28	¼	15-20	-----	Mar. 1	May 15	140-160	2 bu.
Potato, Irish	5-8 lb	-----	28-36	12-18	3-4	12-18	Mar. 20 June 20 †	-----	-----	120-140	3 bu.
Potato, Sweet	-----	65-75	36-48	36-48	3-4	14-18	-----	Apr. 1	May 10 June 10	140-150	3 bu.
Pumpkin	½ oz.	12-15	8-12	8-12	1	84-108	May 15	-----	-----	90-120	75 pumpkin
Radish	1 oz.	-----	24-36	12-18	½-1	1½-2	Mar. 15* Sept. 15	-----	-----	30-65	100 bunches
Rhubarb Plants	-----	33	36-60	36-60	2-3	36-60	-----	-----	April 1	365	250-300 stalks
Salsify	1 oz.	-----	30-36	18-24	½-1	2-4	April 1 May 1	-----	-----	140-160	600 roots
Spinach	1 oz.	-----	30-36	12-18	1	2-4	Mar. 15* Sept 10 †	-----	-----	60-80	3 bu.
Spinach, N. Zealand.	1 oz.	-----	30-36	30-36	1	12-18	Apr. 15 June 15	-----	-----	60-150	75-100 lbs.
Squash, Summer	½ oz.	20-40	36-48	36-48	1	36-48	May 10	April 1	May 15	60-65	125 squash
Squash, Winter	½ oz.	15-35	84-108	84-108	1	84	June 1	-----	-----	125-140	75 squash
Tomatoes	¼ oz.	25-35	36-60	36-48	¼	36-48	-----	Mar. 10	May 10 June 1	150-170	4 bu.
Turnips	½ oz.	-----	24-36	18-24	¼-½	-----	March 20 Aug. 1 †	-----	-----	60-80	2 bu.
Watermelon	1 oz.	30	96-144	96-144	1	84-108	May 10 June 10	Apr. 1 †	May 15	100-130	40 melons

The dates in this table are approximate and for Central Missouri conditions.
 *Make succession plantings every 4 weeks.
 †Planting date for fall crop
 ‡Started in paper bands or pots in hotbed.

Vegetable Varieties for Missouri

ASPARAGUS	CABBAGE—yellows-resis- tant	KALE
Mary Washington	Marion Market—early	Dwarf Scotch
Palmetto	Wisconsin Hollander No. 8—late	
BEANS		KOHL-RABI
Longfellow	CARROTS	White Vienna
Valentine	Chantenay	LETTUCE—leaf
Burpee's Stringless	Ox Heart	Grand Rapids
Green Pod	Danver's Half-long	
Bountiful	CAULIFLOWER	LETTUCE—head
Kentucky Wonder	Early Snowball	Iceberg
BEANS, LIMA	CELERY	New York Wonderful
Burpee's Bush Lima	Golden S. B.	May King
King of the Garden (pole lima)	Easy Blanching	Big Boston
	Winter Queen	
BEETS	Giant Pascal	MUSKMELON
Crosby's Egyptian	CHARD	Rocky Ford
Detroit Dark Red	Lucullus	Hearts of Gold
Edmund's Blood Turnip		Pollock 10-25
	CORN, SWEET	Hale's Best
CABBAGE—early	Golden Bantam	Tip Top
Copenhagen Market	Stowell's Evergreen	MUSTARD
Golden Acre	Vanguard	Giant Curled
Early Jersey Wakefield	Country Gentleman	OKRA
	CUCUMBERS	White Velvet
CABBAGE—late	Davis Perfect	ONIONS
Late Flat Dutch	White Spine (forcing)	Southport Globe
Danish Ballhead	Early Fortune	Yellow Prizetaker
	White Spine	Pearl (pickle)
CABBAGE—Chinese	Improved Long Green	ONIONS—Bermuda
Wong Bok	EGGPLANT	Crystal White Wax
Pe-Tsai	Black Beauty.	Yellow Bermuda

PARSNIPS	RADISHES	SWEET POTATOES
Hollow Crown-	White Icicle	Nancy Hall
Guernsey	Scarlet Turnip	Porto Rico
	(white tips)	Yellow Jersey
PARSLEY	Early Saxa (forcing)	Rose Jersey
	Rose Chinese (winter)	
Moss Curled		TOMATOES
Double Curled	RHUBARB	
	Victoria	Bonny Best
PEAS	Linnaeus	Earliana
		Globe
Alaska		Marglobe
Gradus	SALSIFY	Stone
Thomas Laxton-		
	Mammoth Sandwich	Bloomsdale
	Island	Greater Baltimore
PEPPERS	SPINACH	TOMATOES—wilt-resistant
Ruby King		Marglobe (red)
Chinese Giant	Bloomsdale	Marvelosa (pink)
	Victoria	
POTATOES—early	New Zealand	TURNIPS
Irish Cobbler	SQUASH—summer	Purple Top white Globe
Early Ohio		Purple Top Strap Leaf
Bliss Triumph	White Bush	Early Milan
	Summer Crookneck	Early White Flat Dutch
POTATOES—late	Des Moines	WATERMELONS—for ship-
		ment
	SQUASH—winter	
Rural		Tom Watson
Green Mountain	Chicago Warded	Irish Gray
Peachblow	Hubbard	Thermond Gray
PUMPKINS	Golden Hubbard	WATERMELONS—Local
		market
Connecticut Field		Kleckley's Sweet
Small Sugar Pie		
Winter Luxury		Halbert's Honey

Asparagus

This is a crop that should be grown in every home garden. Being one of the earliest fresh vegetables it is usually in great demand. Asparagus is a perennial, and with proper care, may be made to produce profitably for 10 to 15 years. Asparagus will thrive on most any well drained soil; however, for maximum production, a sandy loam soil of high fertility is considered best. Plantings may be started from seed or

roots. For the average gardener one-year-old roots purchased from seedmen are likely to be most satisfactory. When seed is to be used it should be planted in "nursery" rows, 2 feet apart, and about 3 inches apart in the row. One-year roots from this planting, after being graded and selected may be planted in the permanent location.

Asparagus roots may be planted in the spring as early as the ground will work well. Furrows about 8 inches deep should be opened, allowing 4 feet between the rows. The one-year-old crowns are then placed 18 inches apart in the row, care being taken to see that the roots are well spread and not placed in the furrow in a matted condition. The crowns are at first covered with from 2 to 3 inches of soil; then, as the plant grows, the soil should be gradually worked in around the shoot until the crown is about 6 inches below the surface of the soil.

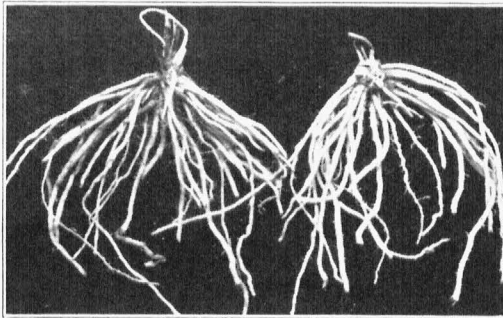


Fig. 6.—Vigorous, healthy one-year-old asparagus crowns. Use crowns like these in starting a planting.

Cultivation of the asparagus plants consists of keeping the soil in the best possible condition, both from the standpoint of killing weeds and the conservation of moisture. During the first season it is possible to grow other low-growing vegetables between the rows. Such crops as lettuce, radishes, cabbage, bush beans, or other short season crops will be found suitable.

Level culture is the most common method for the home garden, however, by slightly ridging the rows in the early spring, a lighter colored shoot may be grown. Ridging is especially desirable with older plantings, since the crowns gradually grow toward the surface, making ridging necessary if shoots of the desired length and quality are to be had.

Cutting of shoots should be delayed until the third year, as earlier cutting will greatly hinder the development of the crowns for further production. Immediately after the last cutting is made the ridges should

be worked down and cultivation continued for the remainder of the season. At this time heavy application of barnyard manure should be made. In addition to the manure some high grade commercial fertilizer, such as a 3-12-4, may be applied broadcast at from 500 to 600 pounds per acre. The cultivation and fertilization of the asparagus, after cutting has been discontinued, will determine to a great extent the quality and quantity of the shoots produced for the next season.

Although there are a number of varieties of asparagus, most of the recent plantings are being made from the Mary Washington variety. This variety is a sturdy grower, productive, and is resistant to asparagus rust. It will be found suitable for either the home garden or in a commercial planting.



Fig. 7.—Harrowing down asparagus ridges after cutting has been discontinued. Ridging as shown will produce a very good quality of asparagus.

The common asparagus beetle is perhaps the most common insect affecting asparagus. Both the adult beetle and the larva attack the shoots and leafy tops of the plants. The adult beetles stay under cover during the winter, and come out during the first warm days of spring. Three or four generations are produced each year. Dusting or spraying with arsenate of lead is the principal control.

Beans

Beans are a warm-season crop and should not be planted until all danger of frost is past. For convenience two divisions or classes are made, the common garden or kidney bean, and the lima bean. These again may be divided into bush and pole varieties. The common garden or bush bean is the one generally grown in Missouri. Planting should be

made about May first for the summer crop and as late as August first for the fall crop.

Burpee's Green Pod Stringless is one of the best varieties of bush beans. Burpee's Bush Lima is also one of the best varieties of Lima beans for Missouri conditions. The pole lima is grown in many of the trucking sections, while the pole kidney bean is used to a considerable extent for both home garden and market garden purposes. The Kentucky Wonder, kidney-type bean, is one of the best pole varieties for either the early or late crop. Beans may be made to yield profitable returns, although midseason beans are never as profitable as either the early or late crop.

Bush beans are usually planted in drills 3 feet apart, planting the seed about 1 inch deep and from 3 to 5 inches apart in the row. Pole beans are generally planted in hills 3 or 4 feet apart each way, using poles for supports. It is also possible to plant pole beans in drills, using some form of woven wire for support.

Beans, like many other vegetables, prefer a well-drained sandy loam fertile soil. Some such commercial fertilizer as a 3-12-4 applied in the row at the rate of from 400 to 500 pounds per acre should give profitable returns.

Stored beans are often attacked by the common bean weevil. To control, fumigate with carbon bisulphide using $\frac{1}{2}$ ounce to about 35 pounds of seed. The gas should be kept with the seed, in a tight container, from 24 to 36 hours.

Beets

The beet is one of our most common root crops. It is found in most all home gardens and is grown extensively as a truck crop in our market garden sections. Although it is a cool-season vegetable, it is possible to have beets from early spring until late fall. Beets may be planted about April 15 for the early crop, while June first is the date of planting for the fall crop and for storage. The most common method of seeding is to sow the seed rather heavy at first, and later thin the plants to stand from 3 to 4 inches in the row. The thinnings may be used as greens or by delaying thinning a few days, the thinnings may be used as small beets.

The three principal varieties of beets which are well adapted to Missouri conditions are: for early, Crosby's Egyptian, and for the medium or late crop, Detroit Dark Red and Improved Blood Turnip. Beets for winter use should be harvested before the ground freezes and stored in out-door pits or cellars.

Brussels Sprouts

Brussels sprouts, a member of the cabbage family, are a cool-season crop and its cultural requirements are the same as for late cabbage or cauliflower. Each plant produces a large number of small buds or heads

which are borne in the axils of the leaves. As the small buds develop, the leaves should be broken off to afford more room for the growth of the small heads. Although not grown extensively in this state, it is possible to produce a crop by sowing seed about May 10, and transplanting to the field about June 20. This will bring the development of the buds or heads during the cool fall months. The half-dwarf is the type most commonly used and best adapted to Missouri conditions.

Cabbage

Cabbage is one of the most important cool season vegetable crops. Both the early and late crop are grown to a great extent in the home garden, while only the early crop is grown on a commercial scale in Missouri. The production of late cabbage in large quantities has not proven profitable, due to unfavorable weather conditions in later summer. To be successful with the early crop it is necessary to use stocky, well-hardened plants which should be ready for the field as soon as the ground will work.

Seeds should be sown in a hotbed or greenhouse about February first. For the hotbed, plant the seed in rows 4 or 5 inches apart. After the plants have reached a height of $1\frac{1}{2}$ to 2 inches, transplant to stand 2 inches apart in the row and 4 inches between rows. If greenhouse space is available the seed may be sown in flats. (See Fig. 5.)

Time of Setting.—Under average conditions in Central Missouri well hardened cabbage plants may be set in the field about March 20. For the late crop, seed should be planted about April 20. The plants may be transplanted once before being set in the field, which should be done about June 10. Plants for the early crop are usually set in the field early enough to insure maturing of the heads before hot, dry summer weather is due. Field setting the late crop in June will bring the head-forming period during the cool fall months. Plants are usually set 18 inches apart in the row and 3 feet apart between the rows.

Fertilizers.—Cabbage is considered a heavy feeder and requires a very fertile, well drained soil for its best development. Heavy applications of well rotted barnyard manure and the use of a high-grade complete fertilizer will give increased returns. On soils high in fertility where heavy applications of barnyard manure have been made, superphosphate (acid phosphate) at 400 pounds per acre will prove profitable. On a medium to fertile soil, where only small amounts of manure have been applied, a 3-12-4 fertilizer applied at the rate of 500 to 600 pounds per acre will give an increased yield.

Varieties.—There are a number of varieties of cabbage that do well under Missouri conditions. For the early crop, Copenhagen Market, Early Jersey Wakefeld, and Golden Acre are recommended. The

Copenhagen Market is a firm round-headed sort, averaging about 5 pounds per head, and is preferred on some markets to the pointed head of the Wakefield varieties. Danish Ball Head and Late Flat Dutch are the varieties recommended for a late crop, which is principally for the home garden and storage. Other late varieties, like Wisconsin Hollander No. 8 and Burgener's Disease-Resistant, have shown marked resistance to cabbage yellows.

Diseases.—The most serious disease of cabbage in Missouri is cabbage yellows (*Fusarium conglutinans*). Cabbage plants may become infected with cabbage yellows in the seed bed or may become infected from being planted in soil in which the organism causing the disease is present. The first symptoms are a yellowing and dropping of the leaves, which finally die and drop from the plant. The organism causing this disease lives in the soil from year to year. Soil once infected should not be planted to cabbage more than once in six or seven years. The only practicable means of control are to grow cabbage on disease-free soil, or on soil that is known to have had no cabbage grown on it for a number of years, or use yellows-resistant varieties.

Insects.—The insect pests most common on cabbage are the cabbage worms and plant lice. The cabbage worm and other chewing insects can be controlled by either dusting or spraying the infested plants with arsenate of lead. (See pages 9-10.) The plant lice are combated by dusting with a nicotine preparation or by spraying with nicotine sulphate. (See page 9.) For good results, it is important that both dust and liquid sprays be made up carefully according to directions and that they be applied thoroughly.

Chinese Cabbage

Chinese Cabbage is a popular salad plant which is being grown in many home gardens. It is a cool-season crop like other members of the cabbage family.

The early crop may be handled in the same manner as ordinary cabbage, starting the plants under glass and transplanting to the field as early as possible. The usual planting distance is 24 inches between rows and from 12 to 15 inches in the row.

For the fall crop, seed may be sown in the garden the latter part of July in Central Missouri, or it may be sowed directly in the field and later thinned to the desired distances. When Chinese Cabbage is well-headed, the inner leaves are white, tender, and especially adapted for salads.

The most important insect attacking the Chinese Cabbage is the plant louse. This may be controlled by spraying with a nicotine sulphate solution or by dusting with a nicotine dust. (See page 9.)

The two strains generally grown are Pe-Tsai and Wong Bok, both of which are satisfactory for Missouri conditions.

Carrots

Carrots are one of our very important root crops and require approximately the same culture as the beet. Tender roots may be had throughout the growing season by making successive plantings. Roots should be dug and stored in pits or cellars before freezing weather.

The three principal varieties are: Chantenay, Danvers Half-long and Ox Heart.

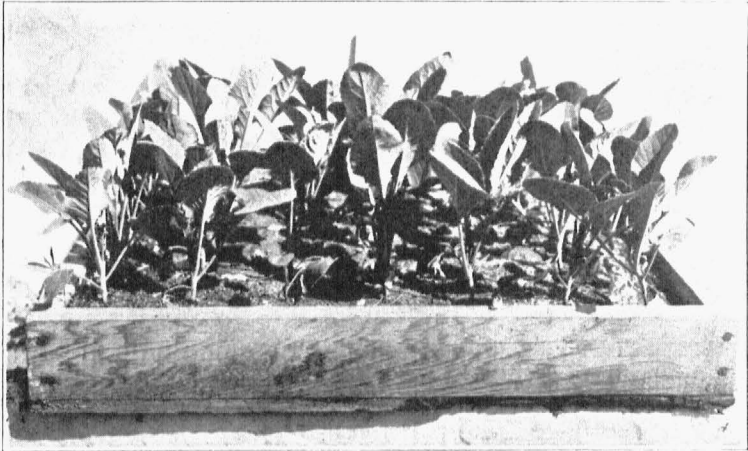


Fig. 8.—Flat showing well hardened, stocky, healthy cauliflower plants ready for early spring transplanting.

Cauliflower

This crop requires approximately the same cultural practices as cabbage. It is, however, more difficult to grow and for that reason is not found in many home gardens. Cauliflower must be grown during the cool spring or fall. The spring crop seems to be the more easily grown. Great care should be taken to see that only the best seed is planted and after the plants have started to keep them growing without a check until matured. Allowing the plants to become stunted in the seed flat or hot-bed is sure to lessen the chances for a successful crop.

The pure white color of the cauliflower may be retained by tying the outer leaves together at their tips. The length of time required for blanching will be from five days to two weeks, depending on weather conditions. The variety Early Snowball has given the best results under Missouri conditions. Cauliflower is attacked by many of the insects and diseases that affect cabbage.

Celeriac

Celeriac is a turnip-rooted celery, which is grown to a very limited extent and used mostly for the flavoring of soups and other vegetables. The crop is handled in much the same manner as celery, except blanching is not practiced. The roots will withstand considerable freezing; however, for best results they should be harvested before hard freezing and stored in a root cellar, trench, or pit.

Celery

Every home garden should include this crop. Celery is not grown so extensively as a commercial crop in this state, though production of this crop is steadily increasing on some of the muck land and well-drained sandy loam soils of Southeast Missouri.

Celery is a cool-season crop. It is a heavy feeder and requires a great deal of water for its development. This, however, does not mean that poorly drained soils will produce good celery for this is not the case. In Missouri we have celery growing divided into the early crop and the late crop.

The early crop is for summer use. The Golden Self-blanching or easy blanching varieties are the ones most commonly used. The seed should be sown in a greenhouse or in a hotbed during the early part of February. Care should be taken since celery seed is usually very slow to germinate, and takes considerable time to produce a sizable plant for transplanting to the field. As soon as the second pair of leaves form, the small plants should be transplanted from the flats or beds to other flats or beds placing the plants about two inches each way. This method will give stocky plants with a thick compact root system, which will transplant easily. By April 10 these plants should be from 3 to 5 inches high and may be transplanted to the field any time from April 15 to May 10, or after danger of frost has passed. The plants should be set 6 inches apart in the row with the rows 3 feet apart. Blanching of the early crop should be carried on by drawing boards up closely along side the plants for a period of two or three weeks before using or marketing.

The late crop of celery matures late in the fall or just before frost. The varieties best adapted for the late crop are Winter Queen and Giant Pascal. Seed should be sown about April 1 under central and southern Missouri conditions. A coldframe will usually give sufficient protection for starting seed of the late crop. The plants should be handled in the same manner as suggested for the early crop.

The plants should be transplanted to the field some time between June 15 and July 1, depending on weather conditions. Set about 8 inches apart in the row, leaving from 4 to 5 feet between the rows. This added space between the rows for the late crop is necessary because late

celery is blanched by drawing earth from the row middles toward the plants, gradually banking the celery with earth until only the tips of the plants protrude. In addition to the above methods of blanching, it is possible to blanch by wrapping each individual plant with paper. Many home gardeners prefer to use a combination of boards and earth for blanching the late crop.

As stated before, celery is a heavy feeder and stable manure seems to be one of the best fertilizers one can use for this crop. On the muck soils of Southeast Missouri it is necessary to use more potash than is usually required for other types in this state, therefore, a fertilizer like 0-10-10 should be used. Nitrogen is not needed with equal amounts of phosphorus and potash. For sandy loam soils or similar types, a 3-12-4 is recommended. This fertilizer should be applied at the rate of about 600 pounds per acre. Application in the row before transplanting to the field is generally best.

The crop may be harvested when the plants have reached the proper size and are well blanched. In harvesting, the roots are cut a short distance below the surface of the soil leaving a small amount of the root attached.

Celery grown as an early crop is hardly ever used for storing. The late crop may be carried over in storage until the holiday season or later. It may be protected for some time in the original row by covering the tops with straw or leaves. Storing in trenches is the most common method. The trench should be about 18 inches wide and from 15 to 18 inches deep. Not more than two inches of the tops of the celery should extend above the level of the ground. Boards are then placed over the tops of the celery plants and as hard freezing weather comes on, hay or straw may be used for further protection. Celery must be taken from the field to storage, however, before hard freezing temperatures effect the plants.

Under Missouri conditions the plants are very often attacked by either the late or early blight. Early blight appears as yellowish green spots on the leaf. These spots spread until the leaves turn yellow and die. Warm, damp weather is especially favorable for this malady.

Late blight usually is found affecting the late crop, however it often appears in early summer. It is characterized by irregular brown spots and gives the plant an appearance of having been burned. This disease is often the cause of soft rot in storage. Both of the above blights may be controlled by using a 3-4-50 solution of bordeaux spray. It is well to spray the seedlings in the seed bed or hotbed at least once before transplanting in the field. Three sprays applied at intervals of about 10-12 days will usually control this disease during unfavorable seasons.

Chard

Chard, or Swiss Chard, is a member of the beet family. It is grown for its thick broad leaves which are used as greens. It is one of the best plants to grow for summer greens under Missouri conditions, since it withstands the hot summer weather. Its cultural requirements are similar to those of the beet. In harvesting the large outer leaves are removed. If the crown of the plant is not injured, it will continue to grow from early summer until late fall. Lucullus, a variety having large green leaves is the type most grown.

Corn, Sweet

Sweet corn can be grown very profitably in all sections of Missouri. Any good field corn land will produce good sweet corn. This crop is tender to frost and should not be planted until the soil has become warm. Only high-grade seed should be used, and this may be home grown seed if there is no chance of cross-pollination with field corn or pop corn. Where such crossing occurs, the quality of the next year's crop would be affected.

The seed may be planted the same as for field corn, except some of the earlier and dwarfer varieties may be planted closer. Though many different varieties of sweet corn are offered by seedmen, Golden Bantam, Stowell's Evergreen, Vanguard, and Country Gentleman will do very well in furnishing a continuous supply of corn throughout the season. Many gardeners prefer to have a continuous supply of one variety. This may be accomplished by making successive plantings to July 10, the date of last planting. Shallow cultivation is best for sweet corn, if the seed bed has been properly prepared.

Sweet corn is sweetest and of the best table quality when the kernels are fully developed but still in the dough stage. The shortest possible time should elapse between harvesting and cooking, since the sugar content decreases rapidly after the ear has been removed from the stalk.

Sweet corn is attacked by the smut disease so common to field corn. The corn ear worm is also a serious pest in the southern section of the State. Sanitary measures and crop rotation are the best methods for controlling disease and insects in sweet corn.

Cucumbers

The cucumber is a warm-season vegetable and may be grown on any well drained soil, however, a sandy loam is preferred for the early crop. There are many varieties which can be successfully grown in Missouri, however, the following are recommended: Davis Perfect, White Spine, Early Fortune, and Improved Long Green. When a smaller type cucumber is wanted, the Chicago Pickling and Boston Pickling may be used.

For very early cucumbers, seed may be sown in paper pots, or berry boxes and later transplanted to the field. It is important that great care be taken in transplanting the crop since cucumbers, like many of the vine crops, will not withstand having their roots disturbed. When planted directly in the soil, from six to eight seed should be used, later thinning three plants to the hill. The hills are usually placed 5 feet each way, which will allow for cultivation until the vines are almost mature.

When manure is placed in the hill it should be well rotted and thoroughly mixed with the soil. Superphosphate in combination with barnyard manure will give increased returns. When manure is not available a complete fertilizer as 3-12-4 may be used at the rate of 200 to 250 pounds per acre. For each hill this will amount to about a small handful of fertilizer.

The greatest difficulty in the growing of cucumbers is the lack of ability to control diseases and insects.

Diseases.—Of the many diseases, bacterial wilt and mosaic are likely to do the most damage. Bacterial wilt causes the young plants to dry up and die within a few days after being attacked. Destroying diseased plants and practicing clean culture will aid in the control of the malady. The most important treatment, however, consists of the proper control of the striped cucumber beetle, which carries the disease from plant to plant. Mosaic often referred to as “white pickle” causes a mottling of the leaves and a stunting of the fruit. Controls for this trouble are the same as for bacterial wilt.

Insects.—The two most troublesome insects of the cucumber are the striped cucumber beetle and the melon aphid or plant louse. The adult cucumber beetle is striped with yellow and black and it is about two-fifths of an inch long. While the beetles usually confine their attack to the leaves and stems, the larvae feed upon the tender roots of the same plants. Although not so noticeable, perhaps the greatest damage is from the small white larvae which bore into the stems and roots of the young plant. The beetle may be controlled by dusting at intervals of seven days, also after every rain, using a nicotine dust (see page 9), or a mixture of 1 pound of arsenate of lead to 10 to 15 pounds of air-slaked lime. (See pages 9 and 10.) With any preparation for controlling the beetle it is necessary to keep the vines thoroughly covered with the dust or spray.

The melon aphid or louse injures the plant by sucking the juices from the plant tissues. This insect can be controlled by dusting with a nicotine dust (page 9), or spraying with a nicotine sulphate solution (page 9). Since the melon aphid is found on the under side of the leaves, it

is necessary that both dusting or spraying be done in a very thorough manner, in order to hit and completely cover every insect.

Eggplant

The eggplant, a member of the same family as the tomato, is a warm season crop. It requires a high temperature and a long growing season for best development. Its cultural requirements are the same as for the tomato. Seed should be sown in a greenhouse or hotbed about March 15. Where only a few plants are needed it is advisable to grow them in paper pots or clay pots. It is very important that the plants be kept growing and not allowed to become stunted. Black Beauty is the recommended variety.



Fig. 9.—Plant and fruit of eggplant. Note the flea beetle injury in the form of small holes in the leaves.

The eggplant flea-beetle is the most serious eggplant pest and is especially destructive to young plants. This insect is a small back beetle and injures the plants by eating small holes in the leaves. Spraying the young plants every 10 to 14 days with a 3-4-50 bordeaux mixture to which has been added three pounds of arsenate of lead, or keeping the plants covered with a dust of 1 part of arsenate of lead to 10 of air-slaked lime will control this pest.

Endive

Endive is grown as a late fall salad crop and is much in demand on the market in many of our large cities. In addition to its use for salads it

is extensively used in the flavoring of soups and stews. For early planting sow seed about April 10, for a late crop a planting should be made the first week in August. The seeds should be sown in drills from 15 to 18 inches apart in the row. Endives require approximately the same cultural practices as lettuce. Blanching of the late crop is a common practice when it is to be used for salads. The outer leaves are tied together at the top and the crop harvested when the inner leaves are blanched. The curled leaf type is the one most grown. The most common varieties are Green Curled and White Curled.

Horseradish

Horseradish is grown in many home gardens where it is often allowed to develop as an uncultivated perennial root crop. It is, however, a highly specialized field crop as grown in the commercial section of St. Louis county, Missouri. A relish made from the grated roots is very popular.

A deep, fertile, mellow, well drained soil is essential for the profitable production of horseradish. It is propagated from root pieces called "sets". These are usually cut into lengths of about 12 to 14 inches and about one half inch in diameter. In the commercial districts the "sets" are planted in shallow furrows in a slanting position, with the upper end of the "set" within 1 or 2 inches of the surface of the soil when covered. The "sets" are placed 18 inches apart in the row and from 30 to 36 inches between rows. The crop of roots can be stored in a pit or root cellar. In either method of storage ventilation is necessary or heating will result. When grown as a garden crop the roots may be left in the ground and dug as needed. For the home garden a 10-foot row of horseradish should produce abundance for the average family.

Kale

Kale, a member of the cabbage family, is grown for its leaves which are used as greens. It may be grown as an early or a late fall crop. Seed should be sown in rows, from 15 to 30 inches apart. After the plants have become well established they should be thinned to stand 8 inches apart in the row. In harvesting, the leaves may be removed at intervals or the entire plant may be cut off near the ground.

Dwarf Scotch is the recommended variety.

Kohl-Rabi

Kohl-Rabi, a member of the cabbage family, produces a turnip-shaped stem above the ground. It has a flavor much like that of cabbage or turnips. The cultural practices are essentially the same as those for cabbage. The plants may be set from 6 to 8 inches in the row and from 18 to 30 inches between the rows. The crop should be harvested before

the edible portion becomes pithy and stringy. The most satisfactory size is from 2 to 3 inches in diameter.

White Vienna is the recommended variety.

Leek

Leek is a member of the onion family. It is used as an onion substitute and its cultural requirements are the same as for the onion. It is propagated from seed sown early in the spring in rows 12 to 15 inches apart and the plants are thinned to stand six inches apart in the row. Blanching of the fleshy leaf parts is sometimes practiced by gradually working the soil up to the plant. The American Flag is the variety usually grown.

Lettuce

Lettuce is one of our main cool-season salad crops. It is easy to grow but does not reach perfection unless the weather is cool and the soil fertile and moist.

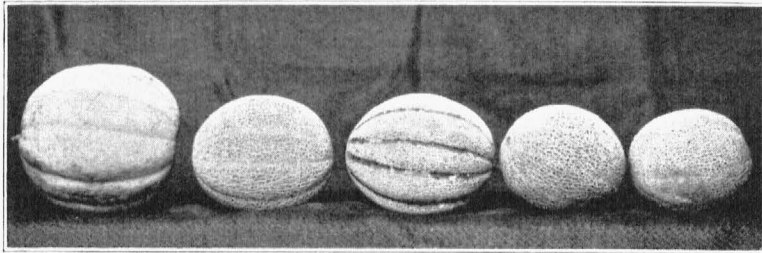


Fig. 10.—Muskmelon varieties adapted to Missouri. From left to right: Tip Top, Hales Best, Burrells' Gem, Pollock 10-25, and Rocky Ford.

Lettuce may be grown as either a spring or fall crop. For the spring crop sow as early as the soil will work. For the home garden, successive plantings every two weeks should be made until warm weather. For the late crop seed should be planted the first week in August. Lettuce is often sown in beds, though more satisfactory results may be had from planting in rows, later thinning the plants to stand from 4 to 6 inches in the row.

Leaf lettuce is the type most grown, though it is possible to produce fairly solid heads of some varieties of head lettuce, if the seed is sown very early in the spring and weather conditions remain cool and moist throughout the growing season.

Varieties recommended are: Grand Rapids for leaf lettuce, May King, Iceberg, and New York Wonderful for head lettuce.

Muskmelon

Although the muskmelon prefers a sandy loam soil it can be successfully grown on many types of soil, provided they are in a fair state of fertility and well drained.

Muskmelons, commonly referred to as cantaloupes, require approximately the same fertilizer applications and cultural practices as the cucumber. Recommended varieties are: for the home garden or for local market Hearts of Gold, Tip Top, and Rockyford; for shipping, Pollock and Hale's Best.

The striped cucumber beetle and the melon aphid are the two most troublesome insects of the muskmelon. The diseases of most importance are wilt and bacterial leaf spot. The controls for both insects and diseases of the muskmelon will be found discussed under cucumbers.

Mustard

White mustard is extensively grown in the home gardens and market gardening sections of the State. It is grown as both a spring and fall crop. For succession, sow every two weeks from April until September. With a small amount of irrigation during the dry summer months, mustard "greens" may be had from early spring until late fall. Seed is sown in drills 12 to 15 inches apart and thinned as needed for table use. Giant Curled is the recommended variety. Black mustard is grown mostly for its seed from which the condiment, commercial mustard, is made. Black Mustard is not produced to any extent in Missouri.

Okra

Okra, also known as gumbo, has been grown for many years in the southern states. It is valued for its seed pods which are used in soups and stews. The pods may be threaded on a string and placed in a dry cool place where they will be available for soups or stews during the winter months. The pods should be harvested while they are still quite tender and before the seeds have started to harden.

Okra, though drought-resistant, requires a long growing season. The seed should be sown about May first. Plant in rows 3 feet apart and thin the plants to stand about 18 inches in the row.

White Velvet is the recommended variety.

Onion

Onions are a hardy crop, easily grown. No garden would be complete without this very important bulb crop. There are three methods of propagating onions. From seed sown directly in the row where the crop is to grow; by sowing seed in a hotbed or greenhouse and later transplanting to the field; and by planting onion sets. Planting the seed directly in the field is the method followed by commercial growers and home gardeners who grow onions for storage. For the small garden the use

of "sets" is recommended. For the home garden the very early green onions may be had by planting the multiplier or potato onion in the fall, covering with a light mulch for winter protection.

The plant requires a deep, rich, well drained soil. Unless naturally fertile, the soil should be prepared by growing green manure crops and applying barnyard manure. Three hundred pounds of superphosphate in combination with barnyard manure or the application of 600 pounds of a complete fertilizer as a 3-12-4, will yield profitable returns. The best varieties for Missouri conditions are the Yellow Prizetaker and Southport Globe. It is well to grow both varieties, using the Yellow Prize-taker and Southport Yellow Globe for the production of yellow onions and the Southport White Globe for the white. The latter sort is very productive. The demand for the red onion is not as great as for the other colors.

The seeds should be sown as early as the soil will work in the spring. Approximately 4 pounds of seed are required to plant an acre. The seed should be put in with a garden drill, dropping it about $\frac{1}{2}$ inch apart and allowing 18 inches between the rows. When the onions become well established and have made bulbs about $\frac{1}{2}$ inch in diameter, they should be thinned to stand 3 to 4 inches apart in the row. A few radish seed planted with the onions will aid as a guide for the first cultivations. Continuous cultivation is very important for weeds should never be allowed to get a start. Frequent shallow cultivation is recommended. Some hand weeding in the row is necessary, especially when thinning the onions.

The bulbs should be harvested as soon as the onions have matured and the tops have wilted down. The keeping qualities of the onions in storage will depend to a great extent on how they have been handled and cured at the time of harvesting. They should be handled carefully and not bruised. The onions should be pulled by hand and placed in small windrows to cure, after which the tops are removed, the bulbs placed in crates and stored. Onions grown from seed will keep longer in storage than those grown from "sets". Onions in storage require a low temperature and dry atmosphere. A dry, cool, airy attic is a good place to store onions for home use.

The onion plant is commonly attacked by small sucking insects, known as thrips, causing the onion leaves to become streaked and spotted. These insects may be controlled by spraying with a nicotine sulphate solution. (See page 9.)

Onion (Bermuda)

The Bermuda type of onion is grown to a considerable extent in Missouri. The shape of this onion is much flatter and the flavor milder than any of the common onion types.

The three varieties of the Bermuda onion best known are the Crystal White Wax, the Yellow Bermuda (often called the White Bermuda) and the Red Bermuda. The Yellow Bermuda is the principal commercial crop in the southern states, and is also better adapted to Missouri conditions. The Crystal White Wax is grown to some extent commercially, but is found mostly in the small home garden.

Nearly all of the Bermuda onion acreage in Missouri is being grown from plants shipped in from the southern states. Texas furnishes most of these plants. The Bermuda plants are grown in the Southern States under conditions much more favorable than the hotbed method in Missouri would be. The Crystal White Wax plants are usually quoted somewhat higher than either the yellow or red varieties.

As stated above, the production of plants in Missouri is very little practiced and, due to the great number of growers who are not familiar with the management of a hotbed, the production of onion plants should be at first on a very small scale.

With average conditions, it requires approximately 80 days to produce young Bermuda onion plants about the size of a lead pencil and from 4 to 5 inches long after being trimmed. Figuring March 20 to April 1 as a possible date for setting in the field, the seed would have to be sown in the hotbed about the middle of January. The hotbed should be prepared as for any other crop. The seed should be planted about $\frac{1}{4}$ of an inch deep, in rows from 3 to 6 inches apart, and given a thorough watering. If the seeds are healthy, they should show through the soil in from 6 to 8 days. From 2 to $2\frac{1}{2}$ pounds of seed will furnish plants for an acre. An acre requires approximately 60,000 plants, depending on the spacing in the row and between rows.

Strong healthy plants are very essential if the crop is to be a success. A plant of good size is one about the size of a lead pencil, from 4 to 6 inches in length, and fairly straight. The plants are usually shipped in bunches of 100 each, and packed in paper cartons, baskets or crates, depending on the number ordered. Only healthy stock plants should be used. Weak plants should be discarded, as they are not profitable.

Onions are a cool-season crop, and should be planted in the spring as soon as all danger of freezing weather is past. The Bermuda onion will withstand light freezes and frosts. For central Missouri the plants should be set in the field about March 20 to April 1 while for Southern Missouri, it may be possible to plant from one to two weeks earlier.

The tops of the plants should be cut back about one half of their length and their fibrous roots cut back to about $\frac{1}{2}$ inch in length. When plants are purchased from plant growers the trimming of tops and roots is done at the time of bunching.

When setting in the field, plants are placed from 4 to 6 inches apart in the row, and the width of the rows will be determined by the type of cultivation to be used and the fertility of the soil. The rows may be spaced 18 inches or more apart for horse cultivation, and from 12 to 18 inches when hand cultivation is to be used.

The setting of the plants in the field is done by hand. Rows may be opened with a small one-shovel garden plow and plants set in the furrow or the plants may be set out by means of a small pointed stick or "dibble". For commercial plantings many growers use home-made "markers" which mark out a number of rows at a time. The plants should be placed upright in the furrow and from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in depth, depending on the length. The harvesting and storage requirements of the Bermuda onion are the same as for the common onions.

Parsley

Parsley, one of the most important garden herbs is grown in most home gardens for use in flavoring and garnishing. The seed should be planted very early in the spring in rows 12 to 14 inches apart, later thinning the plants to stand about 4 inches in the row. Plants may also be started under glass and later transplanted to the field. They should be transplanted quite young or before the taproot becomes too long. Plants will continue to produce leaves throughout the summer and fall. Parsley can be successfully grown in a hotbed or cool greenhouse through the winter months. There are two types, the curled and the plain-leaved. The varieties most grown are the Moss Curled and Double Curled.

Parsnip

A deep sandy loam soil is considered best for the production and proper development of the parsnip. The seed should be sown early in a well-prepared seed bed. A few radish seed planted with the parsnip seed will aid in marking the row, since the parsnip is slow to germinate.

Unlike most root crops, the parsnip root is improved by freezing. The roots may be left in the ground and dug as they are needed; however, it will be found more convenient, especially when the soil is frozen if the roots are harvested and stored in a trench or pit.

The Hollow Crown and Guernsey varieties are suitable for both the home garden and commercial plantings.

Peas

In Missouri peas are grown as an early spring crop. The very early varieties are of the dwarf type while the taller growing sorts are usually later. Peas are very hardy and can, therefore, be planted earlier than most of the other cool-season vegetables.

For a succession of green peas plantings should be made every ten days until May 1. Plantings should be made of both early and late

varieties. Seeds are usually planted in drill from 18 inches to 3 feet apart, depending on the variety. Thinned plants should stand about 3 inches apart in the row. The dwarf type usually grows without supports, while a trellis or support is necessary for the taller growing sorts.

Recommended varieties are as follows: for a smooth early variety, Alaska. For the later wrinkled varieties, Gradus and Thomas Laxton. The pea plant is often troubled by aphids or plant lice. These may be controlled by using a nicotine dust or spraying with a nicotine sulphate solution. (See page 9.)

Peppers

The pepper, a member of the same family, as the tomato, is a popular and easily grown vegetable. Its cultural requirements are much the same as for the tomato. The seed should be started in a hotbed or greenhouse and well hardened plants are set in the field after all danger of frost is past. The plants are usually set from 18 inches to 2 feet in the row and from 30 to 36 inches between rows. The large sweet peppers used for salads, pickling and cooking are now found in most home gardens and in all commercial trucking sections. The Ruby King, Chinese Giant and World Beater are the recommended varieties. The Red Cayenne is a long slender variety of the hot type and is used for flavoring.

Potatoes (Irish)

While the potato may be grown on a wide range of soils, maximum yields and most profitable returns are generally obtained on soils that are loose and friable, well drained, and contain a liberal amount of plant food. Soil lacking in plant food can be improved easily through the application of barnyard manure, green manures and commercial fertilizers.

The varieties of Irish potatoes recommended are the Irish Cobbler, Early Ohio, and Bliss Triumph for the early crop and the Rural New Yorker and Peach Blow for the late crop. The Irish Cobbler is in general considered the best potato for Missouri. It is of good quality, matures early, and usually outyields other varieties. The greatest objection to the Early Ohio is its tendency to produce a large percentage of "knobby" potatoes and growth cracks during unfavorable seasons. The Peach Blow is well adapted as a late crop for the home farm garden. It produces fair yields and keeps especially well in storage.

Most of the commercial growers in Missouri are using northern grown certified seed, but there is still a large acreage being planted annually with home grown potatoes. The principal objection of northern seed among some growers has been its cost. The first cost to the grower may be higher for northern grown seed, but the increased returns will more than offset the additional price. The inferiority of the home grown

seed is not only shown in low yields but especially in the large percentage of cull potatoes. It is very evident, and is known from experience by many growers, that profitable yields cannot be obtained from the continued use of home grown seed.

The large amount of northern seed potatoes used by Missouri and other Central and Southern States has caused a number of the Northern States to give particular attention to the production of a special crop for this trade. This special crop is in the form of certified seed. Certified seed is the outcome of the production of potatoes under a state inspection service. To be able to qualify as a producer of certified seed, a grower

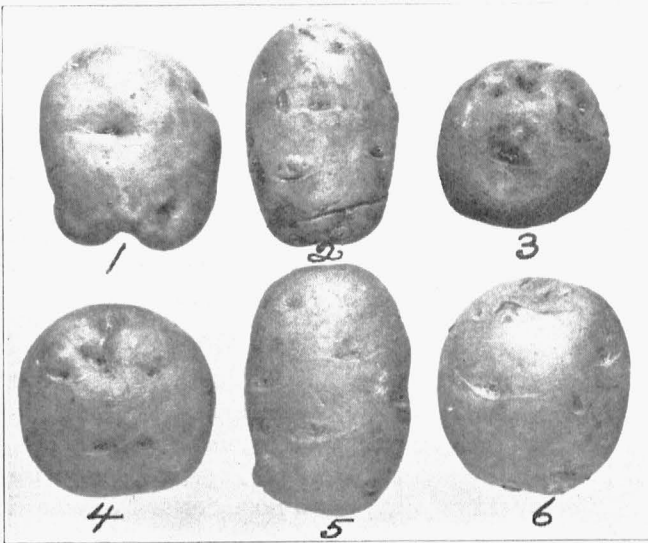


Fig. 11.—Three early and three late varieties of Irish potatoes suited to Missouri conditions. 1. Irish Cobbler. 2. Early Ohio. 3. Bliss Triumph. 4. Russet Rural. 5. Green Mountain. 6. Rural New Yorker. (White Rural).

must have at least two field inspections during the growing season and one bin inspection. The field inspections are for the purpose of detecting varietal mixture, and such diseases as rhizoctonia, mosaic, black-leg, spindle-tuber, curly-dwarf, leaf-roll, or others that show up on the plants in the field. The bin inspection is for the purpose of determining whether diseased tubers are present and the character of the grade. If the inspector finds the potatoes conform to the requirements for certification for his particular state, he issues certificates and inspection tags. The certified potatoes are then sacked and sealed with the official tags.

Only well shaped, disease-free potatoes should be used for seed purposes. Each seed piece should contain one or more healthy eyes and

average from 1½ to 2 ounces in weight. In general, blocky seed pieces are to be preferred to wedge-shaped pieces. The blocky seed pieces will work much better in the automatic planters than will thin or ill-shaped pieces. The potatoes should be planted soon after they are cut; if this is impossible they should be spread out in a cool dry place until planting time. If cut potatoes are stored in bags or piled to any appreciable depth, heating may take place and the vitality of the seed reduced.

Where the acreage of potatoes to be planted is large, it is often necessary to cut a considerable quantity of seed before planting operations start. Under such conditions the seed pieces may be dusted with sulphur or gypsum. Either of these materials will tend to decrease the amount of



Fig. 12.—Front and back of the official tag, with seal, as used on all bags of Minnesota certified seed potatoes. All Northern grown certified seed potatoes will have similar official tags. Different states have various forms.

water lost through the cut surfaces, thereby preventing to some extent the shriveling of the seed piece.

The amount of seed required per acre will vary with the variety, size of potatoes used for seed, and planting distances. The Irish Cobbler, having fewer eyes than the Early Ohio, will usually require a few more bushels per acre. The commercial growers in Missouri plant from 12 to 18 bushels per acre.

The date of planting will vary with the weather conditions, but in general there seems to be a definite relation between date of planting and yield. It is known that climate is one of the limiting factors for potato production.

The potato likes a cool, moist soil for its best development. To have such conditions through the greater part of the growing season, it is necessary to plant as soon after the middle of March as the weather will permit. The potato should pass its critical period, namely, when blossoming and setting tubers, during the latter part of May or the first of June. If this period comes during the hot days of late June and early July, low yields will usually result.

The depth of planting will vary to some extent with the type of soil. Light sandy loam soils will warm up quicker, and therefore planting can be deeper on these than on the heavier types of soil. For the average potato soil in Missouri 3 to 3½ inches is the proper planting depth. Care should be taken to see that the seed pieces are planted deep enough so that when the ridge of soil thrown up by the planter is removed by cultivation, the seed pieces will still be at the proper depth.

The distance for planting potatoes in Missouri will vary from 32 to 40 inches between the rows and from 8 to 15 inches in the row. The most common practice is to plant 12 inches in the row and 36 inches between the rows.

A large part of the cultivation of the potato field should be done just after the plants begin to show above the ground. About the time the potatoes are breaking through the soil, the ridge should be worked down with a section harrow, going diagonal across the field to keep the harrow on the ridges at all times. This is one of the important cultivations, for if the soil is well worked at this time, most of the small weeds which have started will be killed and subsequent cultivations will be easier and more effective. The next cultivation consists in stirring the soil between the rows and close to the ridges to a depth of 5 to 7 inches. Each succeeding cultivation should gradually become shallower. Continued deep cultivation close to the plants would destroy many of the roots which are close to the surface. The first one or two cultivations may be done with an ordinary one-row corn cultivator, while for succeeding cultivations a cultivator with many small shovels may be used.

The number of cultivations will be regulated by weather conditions. Like other crops, the soil should be stirred as soon after a rain as the land will work, in order to prevent baking or cracking. The last cultivation should be just before the plants show full bloom. At this time a low ridge should be thrown to the potatoes, care being taken not to form too much of a ridge which would cause the soil to dry out more rapidly and result in a decrease in yield.

Although it is customary to discontinue cultivation just before blooming, it is often necessary during a wet season to continue shallow cultivation between the rows to keep down weeds. The same may be true

during dry seasons when the shallow stirring of the soil between the rows will keep down weeds and grass and aid in conserving moisture.

Potato Diseases.—The potato grower has to deal with three types of potato diseases; those which are carried within the tuber, such as mosaic; those usually carried on the surface of the tuber, as common scab; and those that affect the foliage of the plant.

The three different methods for controlling these three types of diseases are: the use of certified seed and crop rotations, seed treatment using corrosive sublimate or hot formaldehyde, and spraying the plants in the field with bordeaux mixture.

The more important tuber-borne diseases in Missouri are: Rhizoctonia, common scab, black-leg, wilt, mosaic and spindle-tuber. The only foliage trouble of importance is tip-burn (hopper burn). The blights which affect the foliage are seldom serious.

Seed Treatment.—Seed treatment consists of disinfecting the potato tuber in such a way that all disease organisms carried on the surface of the tuber will be killed. It should be understood that internal diseases of the potato such as mosaic and wilt cannot be controlled by seed treatment. Tubers showing signs of any of the internal diseases when the potatoes are being cut, should be discarded. All treating should be done before the tubers are cut. Badly sprouted potatoes should not be treated, because of possible injury to the tender sprouts.

The two methods recommended are the cold corrosive sublimate method and the hot formaldehyde method. For the farmer who plants only a few bushels of seed, the corrosive sublimate method is the more practical. For the commercial grower who treats large quantities of seed, the hot formaldehyde method should be used. Both methods are effective if properly performed in controlling the common surface borne disease of the tuber.

CORROSIVE SUBLIMATE METHOD.—Metal tanks or tubs should not be used as such containers will be corroded and the solution weakened. When only a few bushels are to be treated a wooden barrel may be employed. In mixing the solution, 4 ounces of corrosive sublimate should be used to each 30 gallons of water. As corrosive sublimate dissolves slowly in cold water, it should first be dissolved in a glass jar of hot water and then poured into the 30 gallons of water. The temperature of the water should be approximately 60°F. The potatoes must be immersed in this solution for 1½ hours and then allowed to dry before cutting. The seed may be treated in crates or sacks using the same sacks each time since some sacks tend to weaken the solution. Never place the treated potatoes in sacks which have not been disinfected. When the solution is to be used over a number of times, it should be strengthened by adding ½ pound of corrosive sublimate and enough water to bring it up to the

original volume after each four bushels have been treated. After treating 12 to 16 bushels in this manner the entire solution should be emptied where stock cannot reach it and a new solution prepared. Corrosive sublimate (bichloride of mercury) is a POISON, if taken internally, but will not injure the hands.

HOT FORMALDEHYDE METHOD.—This method consists in treating the seed for four minutes in a solution of 1 pint of liquid commercial 40 per cent formaldehyde to each 15 gallons of water at a temperature of from 122° to 124°F. When this method is practiced the potatoes are usually treated in the original sacks. Wooden or metal tanks may be



Fig. 13.—A stalk of an Irish potato plant showing typical injury from the Colorado Potato Beetle (common potato bug). Note the adult and larva stage.

used for this purpose. The temperature of the liquid can be maintained by passing steam from a stationary or steam traction engine boiler through a coil of 1 or 1- $\frac{1}{4}$ inch pipe near the bottom of the tank. False bottoms for the tanks should be used to keep the hot pipes from direct contact with the potatoes. For treating smaller quantities of seed, smaller tanks may be used with oil or gas burners supplying the heat. It is necessary that the solution be kept at the proper temperature and a good grade Fahrenheit thermometer should be used for this purpose.

Potato Insects.—Although there are not a great many insects which attack the potato, it is nevertheless absolutely necessary that the insects be controlled if profitable yields are to be obtained.

COLORADO POTATO BEETLE.—This is the most serious potato insect in Missouri. Most of the injury is done by the leaf eating larvae. Since this is a chewing insect, the control must be in the form of a stomach poison. Arsenate of lead may be applied as a dust or as a spray. When a spray is applied, use 1½ pounds of powdered arsenate of lead to 50 gallons of water. When applied as a dust, use 1 part of powdered arsenate of lead to 10 parts of air-slaked or hydrated lime.

LEAF HOPPER.—This is a small active, pale green, leaf-sucking insect which causes what is known as “tip-burn”. It can be controlled by thorough spraying at intervals of 10 to 14 days using 3-4-50 bordeaux.

WHITE GRUB.—The white grub which is the larvae of the common June bug, causes considerable loss by eating holes in the surface of the tubers, and thus decreasing their market value. The insect is most troublesome on new land or on fields having been in sod the previous year. It is better to follow sod or new land with some cultivated field crop before planting to potatoes. Considerable injury may be expected when potatoes are planted in sod or new land after the first breaking.

BLISTER BEETLE.—These insects are often called the old fashioned potato beetles. They move about in large numbers and can do a great deal of damage to a potato field in a single day. Driving from the field with the aid of brush, or by using 3 pounds of arsenate of lead to 50 gallons of water or bordeaux have proven to be the most effective method of control.

FLEA BEETLE.—The damage from these little beetles is often overlooked, but they are responsible for the small round holes in the potato leaf. The adult is a bright, black, hard shelled insect about one-twentieth of an inch long. The adult beetles overwinter in trash, emerging in the early part of summer. Thorough spraying with bordeaux mixture and arsenate of lead will control the flea beetle.

Although experiments at this station have shown that increases in yield may be had from the use of bordeaux, the practice is not general in Missouri. The general absence of the two leaf diseases, early blight and late blight, from Missouri is probably the reason that spraying with bordeaux is not practiced more. Bordeaux, to be effective against either diseases or insects, must be applied at the proper intervals and sprayed on the plant in such a way that the entire leaf, both upper and lower surfaces, will be thoroughly covered.

Pumpkins

The climatic and cultural requirements of the pumpkin are almost identical with those of the squash. After the soil has become warm, from 6 to 8 seed should be planted in each hill, covering with one inch

of soil. When the plants are well established they are usually thinned to four in the hill. If pumpkins are to be planted in the corn field, 3 to 4 seed may be dropped in every fourth hill of corn.

Of the large type, Connecticut Field is the variety most grown. Small Sugar and Winter Luxury are popular varieties of medium size.

Some of the most troublesome insects affecting the pumpkin are discussed under cucumbers. (See page 31.) The common squash bug is often a serious pest on both pumpkins and squash. The picking of the adults by hand, the destruction of the egg masses found on the under side of the leaves and the burning of all old vines and litter near the field in the fall are the principal methods of control. A large percentage of the young bugs or nymphs may be killed by spraying with nicotine sulphate. (See page 9.)

For storing, the pumpkins should be harvested with the stem attached. When placed in a well ventilated storage room with a temperature of approximately 50 degrees, pumpkins may be kept until spring.

Radishes

Radishes are our quickest maturing vegetable. They have long been a favorite for the home garden and within the last few years have become of considerable commercial importance as a field crop in Southeast Missouri. In general a sandy loam is preferred, as this type of soil warms up much quicker in the early spring than the heavier types.

The best spring radishes, for garden or hotbed culture, are the round red sorts. Some recommended varieties are, Early Scarlet Globe, Early Scarlet Turnip, White Tipped and Saxa. These varieties are very early and will mature in approximately 30 days from seeding. Successive plantings of the above varieties should be made from March 10 to May 1. After May 1st it is well to plant such varieties as White Icicle and White Strasburg.

Winter radishes, although not as commonly grown as the early summer type, may be easily produced either for fresh radishes or stored for winter use. The winter radish may be had in all shapes and colors but the Long Black Spanish and the Rose Chinese are the varieties recommended.

The early radishes may be sown between rows of slower maturing crops. Broadcast in beds or plant in drills 10 to 12 inches apart. The plants are thinned by pulling as they become of edible size. For market the roots are pulled, washed and bunched with the tops on. From the commercial sections they are iced and shipped in crates or baskets to keep them fresh until they reach market. Due to their very short season of growth, very little trouble is usually experienced from diseases or

insects. However, the turnip louse may be troublesome but can be controlled by dusting with nicotine or spraying with nicotine sulphate. (See page 9.)

Rhubarb

Rhubarb, often referred to as "pie plant" is one of our most important perennial vegetable crops. It is primarily a cool-season plant, and is available very early in the spring when the supply of many other vegetables is limited. For the home garden where only a few plants are needed to supply the family, rhubarb should be placed to one side of the garden with such perennial crops as asparagus and horseradish.

Rhubarb is not particular as to soil type, but may be grown on any fertile well drained soil. Since rhubarb is considered a gross feeder it should have heavy application of barnyard manure. This is usually applied in the fall or winter and worked into the soil the following spring.

The most common method of propagation is by divisions of the root clumps. Roots may be cut into as many divisions as there are healthy eyes or buds. Each division must have at least one eye, but it is better to have two or three buds to each division. Only strong growing plants from fields known to be free from disease, should be used in new plantings.

The roots are usually planted early in the spring in rows 4 to 6 feet apart and from 3 to 5 feet apart in the row, depending on the variety used. After opening a furrow the rhubarb roots are spread out and the crown covered with not more than 3 inches of soil. Clean cultivation to keep down weeds and maintain a soil mulch generally gives best yields.

For best results the newly planted rhubarb roots should be allowed to grow for two seasons before any crop is harvested. For the third year the harvest period, depending on the growth that has been made, should not extend over four weeks. Beginning with the fourth year the harvest season may be lengthened to from 8 to 10 weeks. In harvesting the stalks are pulled, not cut nor broken off, above the surface of the ground. The stubs of stalks left after cutting or breaking serve as a possible source of infections for the crown rot organisms, which are doing considerable damage in both commercial fields and home gardens. After the cutting season, seed stalks growing up from the center of the crown will make their appearance. These should be removed since they are using plant food which is being stored in the roots for early growth the following spring.

The seed catalogues list a number of varieties of rhubarb, of which the two most important are Victoria and Linnaeus.

The use of disease-free roots on disease-free soil and clean culture are the principal methods of controlling diseases and insects of this crop.

Rhubarb Forcing.—Rhubarb is one of our principal forcing crops. In some sections of the State, especially around our larger cities, the forcing of rhubarb is an established industry. Under commercial conditions the forcing of this crop is usually in especially built houses, under greenhouse benches or in hotbeds. For the small gardener the hotbed, a cellar, or the basement of a dwelling is adapted to the forcing of this crop. In fact, any enclosure that may be darkened and a temperature from 45° to 55° maintained, may be used for this purpose.

After the first good freeze, but before the soil freezes solid, the roots should be dug and left exposed to hard freezing weather for a few days. The freezing of the roots will break their rest period and make them suitable for forcing. If not wanted for immediate use, the roots, after freezing may be piled in the field and covered with leaves or straw. In this manner roots may be had as they are wanted for forcing.

The roots are placed where they are to be forced, putting them as close together as possible and filling in around them and the crowns with garden soil. They should then be given a thorough watering. Soil is not essential, but any material such as sand or coal ashes, that will retain moisture will give good results. Stalks of good size may be had in from 20 to 25 days after forcing commences. Roots will usually continue to produce shoots for from four to five weeks after which they should be discarded. It is easily possible for the home gardener to have a continuous supply of fresh forced rhubarb from early winter until the first field rhubarb appears in the spring.

Salsify

Salsify is being grown in many home and farm gardens, principally for its value in the flavoring of soups and stews. It is often referred to as oyster plant, because of the similarity in flavor. Its cultural requirements are the same as for parsnips.

Spinach

Spinach is a cool-season vegetable. It will not withstand the hot summer months and is therefore grown as either an early spring or late fall crop. A very fertile soil is necessary for the production of spinach. Light yields and plants of poor quality may be expected from soils of low fertility. Seed may be sown broadcast or in drills. When sown broadcast it will require about 20 pounds per acre. When planted in drills from 12 to 14 inches apart, approximately 15 pounds of seed will be required per acre. For Central Missouri two crops are grown. The spring crop is planted as early as the ground will work and the fall crop should be planted from August 20 to Sept. 10. In South Missouri where spinach does not winter kill, a winter crop may be planted from September 20

to October 5. In the commercial sections of St. Louis County the following rotations are used—

SPRING		SUMMER		FALL
Spinach	followed by	Tomatoes	followed by	Spinach
Spinach	followed by	Cantaloupe	followed by	Spinach
Spinach	followed by	Beans	followed by	Spinach
Lettuce	followed by	Beets	followed by	Spinach

In harvesting, the entire plant is cut off just above the ground and the dead leaves removed. It is then packed in hampers, bushel baskets or barrels. Bloomsdale is the recommended variety for both the home garden and market garden. New Zealand spinach is a hot-weather plant, especially adapted to the home garden as a source of summer greens.

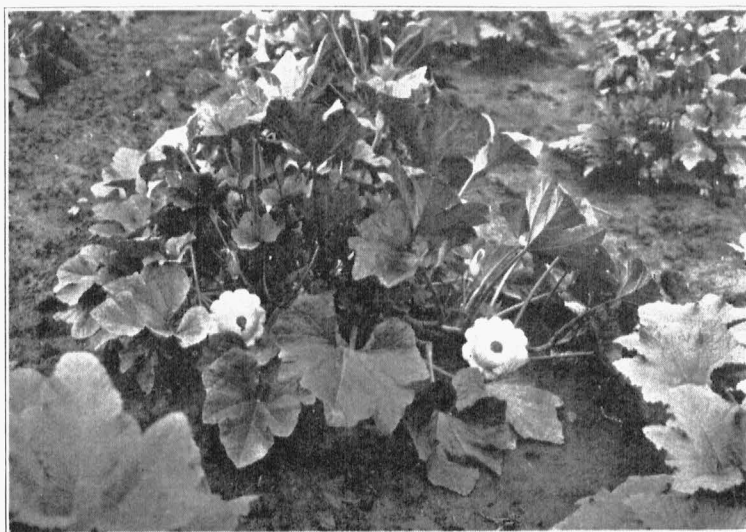


Fig. 14.—A healthy, well grown White Bush summer squash. The fruit represents the size best adapted for home use and market demands.

Spinach is often attacked by plant lice or aphids which will do considerable damage if not controlled while the plants are small. These insects can be controlled by applying a nicotine dust. (See page 9.)

Squash

Squash should be grown in every garden. Seed should be planted after all danger of frost is past. Varieties of the summer type are usually planted in hills 4 to 6 feet apart, while the more sturdy winter varieties may be planted in hills 8 to 10 feet apart each way. From 6 to 8 seed should be planted in each hill, later thinning to three strong plants.

Of the summer varieties the White Bush Scalloped (also known as Patty Pan) and the Mammoth Summer Crookneck will be found suited to Missouri conditions. The White Bush Scalloped variety is used when about half grown. If left to maturity, the fruit becomes strong and of poor flavor. Of the winter varieties Hubbard strains are the best. The Blue Hubbard, Warded Hubbard, and Golden Hubbard are perhaps the best known.

The winter varieties can be kept in storage if placed in a well ventilated room or dry cellar at a temperature around 50°F. Many of the pests that attack the squash also affect other vine crops. Insects with their controls are discussed under cucumbers. (Page 31.)

Sweet Potato

Every farm and home garden in Missouri should have a few short rows of sweet potatoes. Three hundred plants occupying 400 feet of row should produce approximately 10 bushels or sufficient quantity to supply the average family from early fall until late spring.

An ordinary hotbed is used for starting the plants. After placing about three inches of soil on the manure in the hotbed, about 2 inches of clean sand should be placed on the soil. The sweet potato roots are placed on the sand, spacing the roots so that they do not touch one another. After the roots are in place, they should be covered with from 2 to 3 inches of clean sand. The bed should be kept moderately warm and moist. With proper management of the hotbed, plants or slips from 4 to 5 inches tall, will be ready for the "hardening off" process in about five weeks after placing the roots in the sand. The sweet potato bed should be started about six weeks before the first transplanting to the field, which must not be until all danger of frost is past. After the first crop of sprouts or "slips" are removed for transplanting, the bed should be well watered and the sash replaced. This will produce a second crop of plants from the same roots. One bushel of small to medium sized tubers will require about 20 square feet of hotbed space and should produce about 3000 plants or enough for about one-third of an acre. Only the best disease-free roots should be used for the production of sweet potato plants. Certified sweet potatoes are now sold in many sections of Missouri. When only a few rows of sweet potatoes are to be planted it is usually cheaper to buy them from a professional plant grower. Plants should be set in slightly ridged rows, from 30 to 36 inches apart and about 15 inches apart in the row. To allow for maturity, plants should be in the field by June 10 under Central Missouri conditions. During the early part of the season, good, clean cultivation should be practiced, working the soil toward the row. The varieties recommended for Missouri are the Nancy Hall, Porto Rico, Yellow Jersey, and Red Jersey. The Nancy Hall is

grown to a greater extent than any other variety. This is a sweet juicy type, stores well and is adapted to Missouri conditions. The Yellow Jersey is of the dry mealy type and is preferred by many.

The keeping qualities of the sweet potato roots in storage will depend to a great extent on the care with which the potatoes are handled during harvest. The roots should be dug soon after the vines have been browned or discolored by frost. The frosting of the vines will not injure the roots, but the roots should be dug before a heavy freeze. After harvesting the roots should be stored in a well ventilated room at a temperature of about 80°F. for about two weeks. This is known as "curing". After the curing process, the temperature should be held for best results around 55°F. Most house basements with a furnace, or any dry fairly warm room are suited to the storing of sweet potatoes.

Tomatoes

The tomato is one of the most important vegetable crops in Missouri. It is one of the most dependable crops for either the farm or home garden. The tomato is not particular as to soil type, but a fertile sandy loam soil will prove more satisfactory than the heavier types of soil.

Seed should be purchased from a reliable seedsman who is known for his production of high-grade seed, or the grower should save the seed from his own crop. The saving of home seed is a simple procedure. With the desirable type of plant in mind, stakes should be placed near such plants as seem to conform to the ideal type. This should be done about the time the plants are ripening their first fruit. If the plants staked continue to bear fruit of the type desired and seem to be resistant to diseases as the season advances, they should be the source of your seed. Only fruit for seed of the type desired should be saved from the staked plants. By following this method of seed selection year after year it is possible to build up a very desirable strain.

The variety that seems the best adapted to the grower's conditions is the one which should be grown. For the home garden the selection of an early and a late variety will not only supply early tomatoes, but the later variety will furnish tomatoes for fall canning. For the market gardener where earliness is the main factor, such early varieties as Bonny Best, Earliana and Globe are satisfactory. In the canning sections of South and Southwest Missouri, a medium late, sturdy growing variety with large smooth fruit is desirable. Such varieties as the Stone, Greater Baltimore and Marglobe are recommended. Due to the prevalence of wilt in Missouri it is advisable always to include one of the following wilt resistant varieties in the garden: Marvana, an early red tomato, Marvelosa a medium-season pink tomato much like the Ponderosa, but smoother, and Marglobe a main-season red tomato, resembling the Globe except in color.

Plant Growing.—The production of well grown healthy plants is essential to the production of a profitable tomato crop. Where the plants are to be grown for the production of early fruit, as in the case of the home garden, and market garden, the hotbed method is used. The coldframe and open bed method are used almost exclusively by cannery growers, as the need for early fruit is not so important as in the case of the market gardener, and the cost of production is much less.

THE HOTBED METHOD.—For Central Missouri the seed should be sown in the hotbed about March 15. This will allow ample time for the production of a strong healthy plant to be set in the field about May 10. The most common method is to sow the seed directly in the hotbed in rows about 4 inches apart. When the plants are about 3 inches high they may be picked off and transplanted to stand 3 inches apart in a hotbed or coldframe.

THE COLDFRAME METHOD.—This method is much the same as the hotbed method except that the seed is sown later, usually the first week in April. Very often an ordinary sash is replaced with paraffin or oil treated cloth, this having been found to be just as efficient and much cheaper.

THE OPEN BED METHOD.—This is the method most used in many of the cannery sections of the state. Seed is sown in the open without protection. The plants should be thinned so as to allow room for proper development. The aim of the grower is to produce healthy, stocky, well grown plants for setting in the field at as low a cost as possible. Plants grown in this way are usually much later than the hotbed or coldframe plants, but are early enough for the cannery crop.



Fig. 15.—A well grown tomato plant in a 4-inch veneer band. Plants grown in this manner are especially desirable for the production of early tomatoes.

Transplanting.—The transplanting of seedling plants at least once before setting in the field should be practiced whenever possible. Plants handled in this way will be strong and vigorous and will not be subject to the check that is often incurred when plants are taken directly from the seed bed. Under home garden or market conditions, where a greenhouse is used for starting plants, the most common method is to transplant from the seed flat to other flats, placing the plants from 1½ to 3 inches apart. Paper pots or dirt bands ranging in size from 3 to 6 inches are being used especially for the very early tomatoes. Due to the fact

that most of the paper used in paper bands or pots decompose quite rapidly, it is unnecessary to remove the pot or band when setting the plant in the field.

Setting in the Field.—Tomato plants should not be set in the field until all danger of frost is past. This is usually about the first week in May for Central Missouri. Very little is gained and more often a loss is incurred by setting out plants before the frost-free date. Setting the plants in the field is done mostly by hand, except in some of the canning sections, where the horse-drawn transplanter is used to some extent. When only a few plants are to be set out, a hoe or spade will serve the purpose. When larger amounts are to be planted, a furrow, its depth depending on the size of plants, should be opened. The plants are placed in the furrow at the desired distance and the soil packed firmly about them. The depth of setting will depend upon the size of the plant. Short, vigorous plants need to be set about 4 inches deep while larger plants may have to be set from 6 to 8 inches deep. In any case shallow planting should be avoided. The plant bed should be thoroughly soaked with water before removing the plants so that as much soil as possible will adhere to the roots.

The setting of the plants in the field should be done when conditions are most favorable. Setting on cloudy days or late in the afternoon will help the plants to become established.

PLANTING DISTANCE.—The planting distance will vary with the fertility of the soil, variety grown and method of culture. Large growing varieties such as the Greater Baltimore will require more space than smaller growing varieties. For the home garden, plants may be placed as close as 3 feet by 3 feet. Under field conditions on a soil of high fertility the minimum distance should be 3 by 5 feet.

Cultivation.—Cultivation should begin soon after the plants are set in the field. This will loosen the soil that has become packed during the transplanting operations. The cultivator can also be used in pulling the soil up around the plant. The first cultivation should stir the soil to a good depth, each succeeding cultivation becoming shallower. Prevailing weather conditions will have much to do with the number of the cultivations required. However, thorough cultivations of the tomato field during the early part of the season will have much to do with the success of the crop.

Mulching.—It has been found profitable for the home or market gardener to mulch tomatoes with straw, clean grass or other materials. On a large area the expense would be too great to justify mulching. Mulching is especially profitable during dry periods as it conserves moisture and seems to lessen the amount of blossom-end rot which is so common during dry seasons. The mulch also keeps the vines and fruit

from coming in contact with the soil, thereby reducing the amount of diseased and spoiled fruit.

Staking and Pruning.—In many home gardens and with a few market gardeners the staking and pruning of tomatoes is a common procedure. Many advantages and disadvantages are claimed for this method. Where the garden area is limited more tomato plants may be set in a given space; also the amount of spoiled fruit due to the contact with the soil may be lessened. Again, plants staked and pruned are more exposed to the sun's rays and thus the amount of sun scald on both stem and fruit is increased. Under average conditions experiments at this station have shown that staking and pruning increase the percentage of early fruit but in most cases showed a decrease in total yield.

Fertilizers.—Phosphorus seems to be the most important fertilizer element for tomato production on Missouri soils. It can be applied either as superphosphate or in a high grade mixed fertilizer. On soils where considerable barnyard manure has been used, superphosphate at the rate of 150 to 200 pounds per acre will give increased yields. On soils of only medium fertility, a 3-12-4 or a 3-12-6 complete fertilizer at the rate of 400 pounds per acre is recommended. The fertilizer should be applied in the row before setting the plants.

Tomato Diseases.—**TOMATO WILT.**—This is one of the most destructive tomato diseases in Missouri. It has been reported not only from the commercial canning sections of the Ozarks, but from many home and market gardens throughout the state. In many communities the soil has become so thoroughly infected with the wilt organism that it is almost impossible to produce a crop of tomatoes from common "stock" seed. The disease attacks tomato plants in all stages of development. Very often seedlings which are planted in "sick soil" in the seed bed do not show signs of the disease until after they have been transferred to the field.

Tomato wilt is caused by a fungus known as *Fusarium lycopersici* (Sacc.) It is a soil organism living over in the soil from year to year and attacking the plant by entering through the root system.

Where plants have become infected in the seed bed, the disease often kills the young plants before they are moved to the field. However, where healthy plants are used in an infected field, the disease usually does not appear until midsummer, or about the time the first fruits are ripening.

The start of the disease is indicated by the upward rolling of the leaves followed by a gradual yellowing and wilting until the plant dies. Cross-sections of the stem of the diseased plant in the advanced stages

will show a discoloration in the form of a ring. This is especially noticeable in the main stem of the plant.

Since tomato wilt is caused by a fungus which lives in the soil from year to year, the application of sprays on the plant will be of no use. Control measures must consist of some form of soil treatment, rotation of the crop or the use of resistant varieties. Soil treatment may be practiced under greenhouse or plant bed conditions, but as yet no practical means has been devised for the treatment of soil under field conditions. The rotation of the crop, that is, not growing tomatoes on the same field more than once in six or seven years is perhaps the most practical method and should be practiced where land is available. However, this is not always possible, especially with the small gardener; so he must either rely on resistant varieties or discontinue growing tomatoes. (See varieties.)

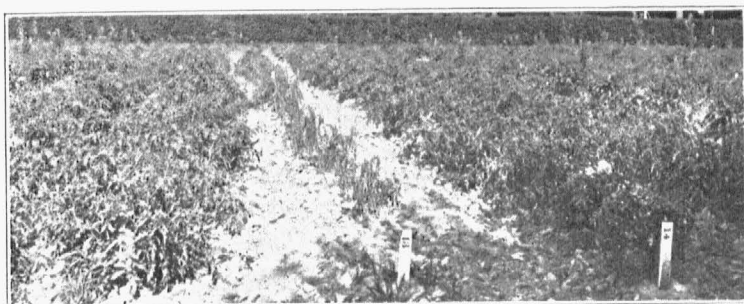


Fig. 16.—Tomatoes grown on soil infected with the wilt disease. Row 13 in center shows an ordinary variety dying of wilt infection. Note resistant variety growing on either side.

LEAF SPOT.—This disease (*Septoria Lycopersici*) is a very common fungous disease of the foliage, and is present to some extent in most tomato fields. The spores of the fungus causing this disease are spread by wind, rain, insects and animals, which make it all the more difficult to control, due to its methods of dissemination. The disease attacks the lower leaves first and may be distinguished by its dark-colored, water-soaked spots. These small spots grow in size, causing the affected leaves to turn yellow, and finally die. Like many other fungous diseases, this one is especially destructive in damp weather.

This disease is known to live over the winter on old tomato leaves and vines and is one of the main sources of infection to the young plants in the spring. The burning of the old vines and deep fall plowing seems to help in reducing spring infection. From observations at this Station and from experiments from other stations it is known that leaf spot may be controlled by the use of bordeaux 3-4-50. (See page 10.) The first

application should be applied to the plants in the plant bed. If plants are well sprayed in the plant bed it may not be necessary to apply other sprays.

Tomato Insects.—**TOMATO WORM.**—This is the large greenish worm commonly called the tobacco worm. They may be controlled by the use of 1½ pounds of powdered arsenate of lead to 50 gallons of water or bordeaux. The arsenate of lead may be combined with the bordeaux, when this spray is being used for any of the fungous diseases. Equal parts of air-slaked lime and dry arsenate of lead dusted on the infested plants should destroy the worms.

FRUIT WORM.—During some seasons this insect is very destructive. The worms bore into the green and ripening fruit, and are especially destructive on the half-grown green fruit. When picked, all affected tomatoes should be destroyed, as this will help eliminate later broods. The use of a few rows of sweet corn, planted near the tomato field has proven successful as a trap crop. The wormy corn should be gathered and destroyed. Deep fall plowing during late fall or early winter should help in controlling the insect on infested land as the pupa stage of the insect passes the winter in the soil. The arsenical sprays applied for other insects may also be helpful.

BLISTER BEETLES.—These insects are often called the old fashioned potato beetles. They move about in large numbers and can do a great deal of damage to a tomato field in a short time. Driving from the field with the aid of brush or by making heavy applications of arsenate of lead have proven to be the most effective methods of control.

CUT WORM.—These worms are responsible for the loss of many of the newly set plants. The best remedy is the use of a poisoned bait (See page 8.) It should be sown broadcast along the rows. Apply late in the evening just before dark in order that it may be in a moistened condition when the worms come out to feed.

Turnips

The turnip is a cool-season vegetable. It may be grown as a spring or fall crop. For the spring crop the seed should be sown either in drills or broadcast as soon as the soil will work. For the late or fall crop seed should be planted the later part of July. The white-fleshed type is the one most grown for the home or farm garden. The varieties recommended are: Purple Top White Globe, Early Milan, Early White Flat Dutch and Purple Top Strap Leaf. Turnips from the fall crop may be stored in pits or cellars.

Watermelons

Watermelons can be grown on most any well-drained, fertile soil. A sandy loam soil of high fertility is perhaps the best type.

The Kleckley's Sweet and Halbert's Honey are considered among the best varieties for the home garden. The flavor of these melons is excellent, but having a thin rind will not stand shipping. For commercial production where shipping is followed the Tom Watson, Thurmond Grey, and Irish Grey are the leading varieties in Missouri.

By planting the watermelon seed in paper bands, veneer bands, berry boxes or other containers, in a hotbed or coldframe, about four weeks before time for setting in the field the harvesting season may be advanced often as much as two weeks. This method is practiced by some small home and market gardens in Missouri, while in some states it is a regular practice for the commercial growers. The containers are placed



Fig. 17.—Irish Grey watermelons, and healthy vines the result of good seed, crop rotation, and insect disease and control.

in a hotbed or coldframe, filled with soil and from two to three seeds placed in each container. After the plants are up two or three inches they are thinned out to one strong plant. When transplanted to the field great care must be taken to see that the roots are not disturbed to any great extent. When paper bands or veneer bands are used the plants can be taken from the hotbed or coldframe with a flat spade or hand trowel. On being transplanted the bands can be lifted from around the plant after it has been placed in its final position in the soil.

Under field conditions the land is usually laid off so that the hills will come 8 or 10 feet by 10 feet apart. After the fertilizer has been placed in the hills and mixed with the soil from four to six seed are

planted in each hill, later thinning to one or two strong plants. For the best melons the plant should be pruned to produce from 2 to 4 melons per hill. This is not a common commercial practice, but will be found to be very profitable. Keep down all weeds throughout the growing season and give frequent shallow culture following rains until the vine growth prevents further working of the soil.

Well rotted barnyard manure has been found to be the best fertilizer obtainable for watermelons. However, it is not always possible to obtain manure, in which case we must depend upon such commercial fertilizers as a 3-12-4 or a 2-12-2. Two methods may be followed in using commercial fertilizer. It may be applied at the rate of 200 to 250 pounds per acre, scattered in the hill and mixed with the soil before planting the seed. The method which is generally recommended is to mix the fertilizer in the hill just before planting, at the rate of 100 pounds per acre, later applying a top dressing just after the vines start to "run", at the rate of 100 pounds per acre scattered around the hills and worked into the soil. Good results may be obtained by using superphosphate in combination with well rotted barnyard manure, placing the manure in the hill as usual and using the superphosphate at the rate of about 150 pounds per acre.

For insects attacking watermelons, see insects on cucumbers (page 31).

Two of the most common diseases that we have in the Missouri fields, are watermelon wilt and anthracnose. Watermelon wilt is caused from a fungus which attacks only watermelons. It attacks the plants by entering the small roots, blocking up the water vessels to such an extent that the plant wilts and dies. The organism is known to live over in the soil from 5 to 7 years. To control this disease, melons should not be grown on the same field more than once in 6 to 7 years. The rotation of the crop, that is planting on disease free soil, is the only practical method of control. Spraying will not control this disease.

Watermelon anthracnose is one of the most common melon diseases. It attacks the leaf, vine, and fruit. It can be distinguished by the ir-



Fig. 18.—Dusting watermelons for the control of the striped cucumber beetle. Note the bellows type knapsack duster.

regular grayish colored spots which first appear on the leaves, causing them to die. This disease is responsible for the grayish sunken areas on the fruit often referred as to "melon pox". Anthracnose may be controlled by spraying with bordeaux mixture. The number of sprays will depend upon weather conditions. During damp, cool seasons spraying should start in the early part of the growing season. During droughty seasons spraying may be delayed until 2 or 3 weeks before ripening. The standard 3-4-50 formula of bordeaux mixture should be used. (See page 10.)

The damage from field mice is especially heavy in the commercial melon sections and they often do considerable damage in the small garden. A poison may be prepared and used with good results as follows:

1 oz. strychnine	3 pints water	4 tablespoons syrup
1 tablespoon starch	1 tablespoon soda	16 quarts wheat

Make a thin, clear starch paste, free from lumps. Use about a half cup of cold water, to break down the starch, then add $\frac{1}{2}$ pint of boiling water, and if necessary cook until the desired starch mucilage is obtained. Flour may be substituted for the laundry starch if more convenient. Reduce the soda to a soft consistency with cold water, and the strychnine with warm water. Stir these two into the starch paste, add the syrup and pour the mixture over the grain. The grain should be thoroughly mixed until all grains are evenly coated. This bait may be stored and kept indefinitely. When it becomes so dry that the poison rubs off it can be restuck with a fresh mixture of starch and soda. It should be



Fig. 19.—Traction power sprayer used in spraying watermelons.

plainly labeled POISON. This poison bait should be placed in wide mouth jars, in special built boxes or under boards, located about the field or garden so as to be accessible to mice. Such "poison stations" will prevent the poisoning of birds and other animals.

Vegetable Storage

Many of our vegetables, especially the root crops can be satisfactorily kept in storage until late spring. Vegetables to be stored should be planted at a time when they will be properly matured by fall. Too often early planted carrots, beets, and other root crops are placed in storage. Such vegetables are often over mature and will be coarse and unpalatable.

An outside root cellar is one of the best types of storage for such crop as beets, carrots, parsnips, potatoes, salsify, and turnips. When a cellar is not available the above crops including cabbage may be stored in outdoor pits.

The making of a storage pit is a very simple procedure. Select a well drained location, removing all the soil to a depth of from 6 to 8 inches. Place a 6 to 8 inch layer of straw in the pit to keep the stored product from coming in direct contact with the soil. If large quantities are to be stored in this way, the pile should be narrow and not piled over five feet deep. Openings 4 to 6 inches square and about 10 to 12 feet apart, should be left in the top for ventilation. These should generally be left open, but when the temperature is low it may be well to close them with burlap sacks or other material. The vegetables should not be placed in the pit until late fall or until the days have become fairly cool. The first covering should be of coarse straw or hay. As freezing weather approaches, soil should be placed over the straw. It is a good plan not to put all the soil on at one time, but to cover at intervals so that the stored vegetables are covered with a ten inch layer of soil before severe freezing weather arrives.

The outside storage cellar is to be much preferred to the storage pit. If the storing of a quantity of vegetables is a yearly practice, it will pay to construct a permanent storage cellar.

Small quantities of such root crops as beets, carrots, parsnips, and turnips may be kept, for a considerable length of time, in a cool basement. They should be placed in boxes or baskets and covered with damp sand or soil. Only sound, disease free vegetables should be placed in storage. (See discussion of individual vegetables for specific storage recommendations.)

Garden Herbs

Many home gardeners include in their plantings such garden herbs as dill, sage, peppermint, spearmint, catnip, hoarhound, and tansy.

These herbs are not unlike our vegetables in that they thrive on any well drained fertile soil. With the exception of dill, all of the above herbs are perennial. Dill may be planted in drills early in the spring and harvested in late summer, at which time it may be used for the purpose wanted. The perennial crops will continue to produce from year to year and may be propagated by the division of the root clumps.

The tops of the above plants are usually cut when in full growth, tied in bundles, and placed in a dry, cool place to cure.

Ginseng

Ginseng may be grown from seeds or roots. The seed usually ripen in early fall and should be planted immediately after harvesting. When propagated from roots they may be purchased from seedmen or dug from the woods and planted in early spring. It thrives best in a deep, well drained, mellow soil containing a very large amount of leaf mould. The soil should never be allowed to dry out and should be kept mulched with an inch or two of well rotted leaf mold.

For the first year or two the young seedlings may be grown in narrow drills. However, for final development the plants should stand at least one foot apart each way.

Ginseng will thrive only under shade. It may be grown in the woods or under lath screens. Movable lath screens, which can be removed on cloudy days or toward evening for the purpose of weeding the plants, will be found very convenient. They may be supported on a frame from 18 to 24 inches above the ground, or they may be placed high enough on poles to allow a man to work underneath. The supporting walls should also be lathed.

When the roots are four years old they are of marketable size and should be dug and thoroughly dried. Such roots usually lose about two-thirds of their weight in the drying process. Prices are always quoted for the dry weight. Seeds, when bought, usually cost from 8 to 15 cents each, while the roots vary from 15 to 50 cents each, depending on their age. The price paid for the dried product varies with the demand, size, and condition of the product.

There are concerns advertising frequently in horticultural papers, who are nursery growers of drug plants and from whom the stock can be purchased if it cannot be found in the woods.

Golden Seal Culture

Golden Seal, sometimes listed by seedmen under its botanical name, *Hydrastis canadensis*, is a plant which, like ginseng, grows wild in the cool, moist, fertile, but well drained soils of many wooded sections in South Missouri. Under cultivation these natural conditions should be

duplicated by working the soil deep and getting it well filled with old, well-rotted manure or natural leaf mold. By raising it a few inches higher than the surrounding land good drainage may be secured. A lath screen should be used for shade, having the openings between the laths the width of a lath itself so as to shut out a part of the direct sunlight. Seeds of young plants should be set 1 foot apart each way and mulched with leaf mold from the woods to prevent drying out. The roots of the plant are dried and sold to druggists.

The wild supply of Golden Seal is no longer very abundant and here and there are a few people succeeding in growing it on a commercial scale. The plant needs such special care and special conditions for growth that many who try fail to grow it successfully. It is probable that if any large proportion of those who attempt to grow it, should succeed, the market would be overstocked. It is a very special enterprise, in which it is not expected that any large number of people will succeed.

Summary

Begin planning in early fall for gardening next spring. Fall plowing of the garden is essential in the preparation of the seedbed and the production of early vegetables.

Use the best seed obtainable. Poor seed is expensive at any price.

Sturdy, healthy, well hardened plants that have been transplanted at least once, are far superior to ordinary unhardened plants.

Use suggested varieties best adapted to your individual needs and market demands.

Early and late vegetables are usually more profitable than mid-season crops.

Maintain the soil fertility of your garden and truck crop land by the use of green manures, barnyard manure, and proper crop rotation.

Commercial fertilizer applied according to recommendations will usually give paying increases in earliness, quality, and yield.

Prepare for the control of insects by having on hand spraying and dusting equipment together with such insecticides as arsenate of lead, nicotine dust, and nicotine sulphate.

Most of the common diseases of vegetables may be controlled by the timely application of bordeaux, by seed treatment, or through the use of disease resistant varieties.

Practice clean gardening. Burn or otherwise destroy all cull fruits, old vines, stems, trash and litter about the garden or truck field. Keep fence rows free from weeds. Such precautions will aid in the control of insects and diseases.

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