



Home Gardening

Bulletin 116
of the
Agricultural Extension Service, The Ohio State University

CONTENTS

Classes of Vegetable Growing.....	3
Vegetables Provide Vitamins.....	4
Soils for Vegetable Gardening.....	5
Soil Building Program.....	6
Seed Bed Preparation.....	7
Choosing Vegetable Seeds.....	8
Viability of Seeds.....	9
Planting Vegetables.....	9
Garden Plans.....	10
Companion and Succession Cropping.....	11
Protection for the Garden.....	11
Cultivation.....	12
Irrigation.....	13
Vegetable Storage.....	14
Harvesting and Marketing.....	14
Suggested Plan for Farm Garden.....	15
Planting Table.....	16, 17, 18
Suggested Plan for a Small Garden.....	18
Perennial Crops.....	19
Potherbs or Greens.....	21
Salad Crops.....	22
Cole Crops.....	24
Root Crops.....	27
Bulb Crops.....	29
Potato Crops.....	30
Beans and Peas.....	31
Solanaceous Fruits.....	33
Vine Crops.....	33
Sweet Corn.....	35

BULLETIN 116
MARCH, 1931

THE OHIO STATE UNIVERSITY AND THE UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING
AGRICULTURAL EXTENSION SERVICE, H. C. RAMSOWER, Director, Columbus
FREE—Cooperative Agricultural Extension Work—Acts of May 8 and June 30, 1914.

Home Gardening

By E. R. LANCASHIRE

Specialist in Vegetable Gardening, The Ohio State University

Vegetable gardening offers unusual opportunities to a large number of people in Ohio. The vegetable growing business is divided into five classes: (1) market gardening, (2) vegetable forcing, (3) truck gardening, (4) growing vegetables for canning factories, and (5) home gardening.

Market Gardening.—The market gardener grows a large variety of vegetables for a local market. Generally such a grower plans on having a continuous supply of salable vegetables. He is a specialist in succession and companion cropping.

Vegetable Forcing.—The greenhouse operator produces vegetables out of their normal season. There are more than 600 acres of greenhouses in Ohio.

Truck Gardening.—The production of vegetables on a large scale for a distant market is classified as truck gardening. For example in Washington County, Ohio, a single grower may have 50,000 tomato plants or 100,000 cabbage plants, or both, and his market might be Pittsburgh, Pennsylvania, or New York City.

Growing Vegetables for Canning.—Growing vegetables for canning factories in Ohio is an important phase of vegetable gardening. General farmers contract with a canning company to plant a definite acreage of one or more kinds of vegetables. The price per ton of vegetables is usually specified in advance of planting time.

Home Gardening.—The home gardener plans his work much as does the market gardener. The home garden should furnish a good supply of fresh vegetables and also produce a supply for canning and for storage. It is with this class of gardening that this bulletin is chiefly concerned. Farm gardens, city or backyard gardens, community gardens, vocational student and Four-H Club gardens are included in the home garden classification.

Fresh vegetables are an important item in the family budget. When they are produced in the home garden, vegetables can be harvested as needed and when the garden is carefully planned these vegetables can be harvested at their best edible stage.

So valuable are home gardens that they might well be given more attention. Home gardening is universally considered as a woman's work, yet a well planned and properly managed garden only one-fifth acre in size can produce vegetables equivalent in value to a 10-acre field of wheat.

The importance of vegetables in the diet is realized by most people. Vegetables are one of the few products of the farm which are today being consumed in larger amounts per capita. The food value of vegetables, supplemented by their color and attractiveness when prepared for the table, makes them popular in every home.

VEGETABLES PROVIDE VITAMINS

Including vegetables in the diet is a pleasant and economical way of providing many of the vitamins necessary to a normal, healthy body development. Vitamins A, B, and C are found in vegetables, and if the choice of vegetables is correctly made, certain diseases can be prevented.



Fig. 1.—Vine ripened tomatoes are excellent sources of vitamins A, B, and C.

Vitamin A is found in green lettuce, yellow sweet corn, green asparagus, and other vegetables. The green and yellow vegetables are much richer in vitamin A than white colored vegetables of the same kind. For example, green leaf lettuce is much richer in vitamin A than white head lettuce leaves. Vitamin A is important in building strong, normal body tissues and in increasing resistance to bacterial infection.

Vitamin B is a factor in the maintenance of a good appetite, growth, reproduction, lactation, proper functioning of the digestive tract, and resistance to bacterial infection. Green asparagus and tomato concentrate are excellent sources of vitamin B.

Vitamin C is necessary to prevent the disease known as scurvy. Lack of stamina, stiff joints, sore gums, and loosening of the teeth are characteristic of scurvy. Raw cabbage, green cabbage leaves, or white cabbage leaves are very good sources of vitamin C. Head lettuce, green leaf lettuce, or bleached lettuce leaves are also excellent sources of vitamin C. Green peppers and raw, vine ripened tomatoes are also important sources of vitamin C.

The following table indicates the value of the more important vitamin carrying vegetables: x indicates that the vitamin is contained by the vegetable; xx indicates that the vegetable is a *good* source of the vitamin; xxx indicates that the vegetable is an *excellent* source of the vitamin.

NAME OF VEGETABLE	VITAMIN A	VITAMIN B	VITAMIN C
Muskmelon	xx	xx	xx
Asparagus, cooked or canned ..	xx		
Asparagus, green, raw	xx	xxx	
Beans, String, cooked or canned		x to xx	
Beans, String, raw	xx	xx	xx
Cabbage, head, raw	x	xx	xxx
Cabbage, head, cooked	x	xx	x
Carrots, young, raw	xxx	xx	xx
Lettuce, head	x to xx	xx	xxx
Lettuce, leaves, green	xxx	xx	xxx
Peas, green, canned or cooked .	xx	x to xx	xx
Peppers, green	xx	xx	xxx
Potatoes, baked	x	xx	x to xx
Potatoes, boiled 15 minutes ...	x	xx	xx
Rutabagas, raw	x	xx	xxx
Sauerkraut	x	x	x to xx
Spinach, canned or cooked	xxx	x	x to xx
Spinach, raw	xxx	xx	xxx
Tomato concentrate	xxx	xxx	xxx
Tomatoes, ripe, canned	xx	xx	xx to xxx
Tomatoes, vine ripened, raw ...	xx	xx	xxx
Turnips, greens, cooked	xxx	xx	— to x
Turnips, white	— to x	xx	xx

SOILS FOR VEGETABLE GARDENING

A good garden soil should be well drained and abundantly supplied with organic matter. A deep, mellow loam is preferred. For early crops and for root crops a sandy loam is best, but a silt loam is better able to retain moisture, and so for crops which may encounter dry weather conditions, the heavier loam is preferred.

A southern or southeastern exposure is preferable for most vegetable crops. Such an exposure is especially valuable for early

crops like asparagus, spinach, or lettuce. Good air drainage is an asset to any garden. Air drainage aids in warding off light frosts.

The soil of a vegetable garden should be about neutral in its reaction. Testing soil for acidity is a service which is performed by the Ohio State University without cost to the gardener. Garden soils should be tested for acidity about once every three years. If manure is applied in large amounts each year the soil is usually neutral in reaction. Finely ground limestone or hydrated lime can be applied to correct an acid soil condition. Since there is danger in applying too much lime it is best to follow the recommendations furnished by Ohio State University for each sample of soil tested.

Vegetables grow very slowly on even the best garden soils if such soils are shaded by trees, high shrubs, fences, or buildings. The best yield and the highest quality of vegetables are produced when the garden is free from the competition of trees and shrubs, and from the shade produced by buildings, fences or other objects.

SOIL BUILDING PROGRAMS

Rotations and Cover Crops.—The rotation of garden sites is advisable wherever it is possible. Sweet clover or some other legume crop could then be grown in the rotation. Such a practice would help to build up and maintain a high state of fertility and organic matter content in the garden soil. Cover crops of rye planted in the garden even as late as November 1 will make some growth during the late fall and will grow rapidly the following spring. Rye cover crops aid in retaining soil fertility; they catch and hold soil moisture and they add organic matter to the garden soil.

Use of Manures and Fertilizers.—Manure has always been used in building up garden soils. Annual fall applications of 25 tons of horse or cattle manure per acre are practical. The best way to use poultry manure is as a top dressing for leafy vegetable crops such as cabbage, lettuce, or spinach. Fresh poultry manure contains 20 pounds of nitrogen per ton. One or two tons of poultry manure per acre can be used for each top dressing of leafy vegetable crops.

Heavy soils are greatly improved physically by additions of large amounts of manures. Sandy soils are also greatly benefited. Manures plus 20 per cent superphosphate at the rate of 75 pounds for each ton of manure used will meet the fertilizer needs of most vegetables. Poultry manure (1 to 2 tons per acre) or commercial nitrogen carriers (200 to 300 pounds per acre) can be used to supply extra amounts of nitrogen to leafy vegetables. Complete instructions for fertilizing vegetables are given in a circular issued by the Ohio State University.

Commercial fertilizers should be mixed thoroughly with the soil to prevent their coming in direct contact with vegetable seeds, because when this happens the seeds will usually be killed. Commercial fertilizers are most efficient when they are worked well down into the soil. The phosphorus and potash contained in a complete commercial fertilizer combine with other chemicals in the soil and remain fixed until released and taken up by plant roots. Available forms of nitrogen can move up or down with the water in the soil.

A 4-12-4 complete commercial fertilizer applied broadcast at the rate of 1000 pounds per acre just before the garden is planted



Fig. 2.—A vegetable garden in a high state of fertility and well supplied with water produces luxuriantly.

is practical for most vegetables growing on silty or sandy loam soils. The commercial fertilizer is used in addition to the soil building program already suggested.

SEEDBED PREPARATION

Plowing.—Seedbed preparation begins with plowing. Plowing loosens the soil and covers organic materials such as crop residues and manures. To secure the maximum benefits of plowing, the furrows should be of a uniform width and depth. The surface of the garden will be level, and all crop residues and manures will be completely covered when good plowing is done. Eight inches is usually a satisfactory depth for garden plowing.

The preferred time for plowing under crop residues and animal manures is in the fall. Fall plowing is beneficial on well drained, silt loam soils. Freezing and thawing during the winter and spring loosens the soil and improves its physical condition. An extra early and thoroughly prepared seedbed is usually obtainable if the plowing is done in the fall. A fall plowed garden soil can be fitted for planting as early in the spring as the upper 3 inches of the surface soil are dry enough to work.

Soils which run together when fall plowed, land that is too hilly, or soils which are subject to blowing will necessarily be spring plowed. Sweet clover sod is spring plowed as soon as every bud on the crowns has made some growth; the second year's growth will be about 6 inches high at that time.

Disc harrows are often used to stir the surface soil just before plowing a dry, medium to heavy soil late in the spring.

Preparing the Seedbed.—A well prepared seedbed is firm underneath and mellow on the surface. For vegetable crops the best results are obtained when the soil is so finely divided that it can be firmly pressed about the seeds. When moist, warm soil is forced into direct contact with the seeds a quick, strong germination usually results.

Disc harrows are used in seedbed preparation to break up clods and fill in holes at the bottom of the furrows on late plowed land.

Cultipackers are of value in breaking surface clods and in firming the middle and lower parts of garden soils which have been plowed late in the spring. Fall plowed and early spring plowed ground is usually firmed by rains and by freezing and thawing.

A spring tooth harrow or a disc harrow is used to loosen the surface of fall plowed soils. An extra fine, level seedbed can be made by using a "meeker" harrow.

CHOOSING VEGETABLE SEEDS

Ordering vegetable seeds is nearly always an interesting job. The seedsman is continually introducing new varieties of vegetables. The buying of seeds can be made a pleasant task by sending for a half dozen or more reliable catalogs and making selections directly from the seedsmen. Many of the catalogs are illustrated with colored pictures of vegetables which are so realistic as to reawaken the ambition of even the least interested of gardeners. The early seed orders receive first choice of good seed supplies. It seldom pays to delay the seed order.

The selection of varieties is always an important factor in studying the seedman's catalog. The varieties found to be best adapted, at present, for Ohio conditions are listed on pages 19 to 35, with detailed cultural directions for each vegetable. Fewer varieties and more kinds of vegetables are needed in the vegetable gardens of Ohio. The higher priced seed is frequently the cheapest due to increased yields and improved quality of the vegetables produced.

The gardener may have seeds left over from the previous season. In such a case it is advisable to test the seed for germination. One hundred seeds placed between two moist blotters and kept there for a few days in a warm room will sprout if the moisture is maintained. They can then be examined for vigor and percentage of germination. The length of time seeds may be expected to retain their vitality is as follows:

Length of Viability of Seeds

Vegetable	Years	Vegetable	Years
Asparagus	2	Mustard	2
Bean	3	Okra	5
Beet	6	Onion	2
Cabbage	5	Parsley	3
Carrot	4	Parsnip	2
Cauliflower	5	Pea	3
Celery	8	Pepper	4
Corn, sweet	2	Pumpkin	5
Cress	5	Radish	5
Cucumber	10	Rhubarb	3
Eggplant	6	Salsify	2
Endive	10	Spinach	5
Kale	5	Squash	5
Kohlrabi	5	Tomato	4
Leek	5	Turnip	5
Muskmelon	5	Watermelon	5

PLANTING VEGETABLES

Vegetables are easily cultivated when planted in straight rows. Straight rows can be made by stretching a string about 6 inches above the row and opening a furrow of the desired width and depth just beneath the string. If the string is properly placed and if it is not touched by the furrow opening tool, each row should be fairly straight.

Sowing the Seed.—The proper depths for drilling seed, the correct planting dates, the amount of seed required to plant 100 feet of row, together with practical spacing distances for both

horse and hand tilled gardens are given in the planting tables, pages 15 to 18. The approximate days required for each vegetable to reach edible maturity and the probable yield per 100 feet of row are also listed in the planting tables. This information is given for vegetable crops which are started under glass as well as for the crops which are seeded directly in the garden.

The smaller the seed the nearer the surface it needs to be planted. For best results a moist soil is necessary at planting time. Early and late plantings need to be shallower than those made during the mid-season. Plantings in heavy soils should be nearer the surface than in light soils. After the seeds are placed in the drill row at the proper depth and interval, they are covered and the soil is firmed. The drier the garden soil, the more pressure will be needed to bring the soil and seed into close contact.

Transplanting.—Sweet corn, cucumbers, melons, and beans, if transplanted, need special care. If they are started on inverted sods and moved intact to the garden, little loss occurs. Cabbage, sweet potatoes, cauliflower, lettuce, onions, celery, eggplant, tomatoes, and peppers are easily lifted from the plant beds and transplanted in the garden. The requirements of successful transplanting are: (1) keep sunlight away from the roots; (2) keep the roots moist and the tops dry while the plants are out of the ground; (3) press moist soil firmly around the plant roots; (4) keep as much soil on the roots as possible; (5) transplant during cloudy weather or late in the afternoon.

Complete information about plant growing in hotbeds and coldframes is contained in Ohio State University Bulletin 103, "Growing Vegetable Plants."

GARDEN PLANS

Every garden should be planned on paper before it is planted. A good plan is of value in estimating the amount of seed needed, and if such a plan is improved each year so as to better meet the owner's needs, it will help him to plant the garden quickly and efficiently. Guesswork is largely eliminated by using the planting tables when making a garden plan.

A gardener can arrange the time and rate of planting each vegetable so as to provide a continuous supply for consumption, throughout the growing season, and also for storage and canning purposes. Sample garden plans are given in this bulletin for both the large and the small type of garden (see pages 15 to 18).

In making a plan of the garden, it is best to use a sheet of heavy paper about 2 by 3 feet in size. Such a plan is not easily

misplaced and it will last throughout the season. The plan should also include an estimate of the amount of seed needed. The planting tables indicate the amounts of seed needed per 100 feet of row for each vegetable.

If the garden is large enough to use horse drawn cultivators, the rows ought to be 28 inches or more apart. If the work is all to be done by hand, the rows can be much closer together.

The garden is so planned that every available space is producing during the entire growing season. A thin seeding of radish is made in the row of parsley and parsnips. Squash and pumpkins are planted with the sweet corn. As soon as an early season crop matures it is followed with another crop.

COMPANION AND SUCCESSION CROPPING

The growing of vegetables in small gardens frequently requires the use of succession and companion cropping in order to increase the volume of production. Companion cropping is the planting of two crops about the same time without allowing sufficient space for more than one of them to mature. One of the vegetables matures before the other is large enough to require all the room. Succession cropping means the planting of a vegetable crop in a place in the garden which has already produced one crop. Market gardeners are able to grow three and even four short season crops in succession on the same field during a single season.

Examples of Companion Cropping.—Radish in same row with parsley or turnips; squash with early sweet corn; early head lettuce between plants in rows of early cabbage; and radish between rows of beans.

Examples of Succession Cropping.—Beets following early peas; radishes followed by staked tomatoes, and after the tomatoes are harvested there may still be time to grow a crop of spinach.

PROTECTION FOR THE GARDEN

A natural windbreak which is far enough removed from the garden so as to cause very little shading and so as to compete as little as possible for soil nutrients or moisture is a real advantage. Such a windbreak, to be most efficient, should be located between the garden and the direction from which the prevailing winds come.

Mulch paper is another form of protecting the garden. The use of mulch paper has been satisfactory when properly used. A heavy grade of paper is needed for best results. Some have used paper lined fertilizer sacks with excellent results. Tar paper should

never be used, as it kills the vegetables. When mulch paper is used, it is important to make sure that the soil is well settled and smooth before the paper is laid, otherwise depressions will occur in the paper at a later date.

Two ways of planting are used in connection with paper mulch. In one, the plants are set in the soil through holes made in the mulch paper. In the other the seeds are drilled in openings left between the rows of paper. The use of paper eliminates weeding between rows, enables the soil underneath the paper to warm up faster than cultivated soil, and aids in storing and conserving soil moisture.

One of the troublesome features of using the paper mulch is the difficulty of holding it on the soil. The use of wire staples is sometimes successful. They are made from 24-inch lengths of wire. Six-inch legs are bent on each end of the wire and they are pushed through the paper and into the soil. The most satisfactory method of preventing the paper from tearing is to cover the edges with soil.

If a gardener uses straw for a mulching material, it is important to wait until the soil is warm before it is applied. The straw should be loose when applied. A layer of straw 8 to 12 inches deep when first put on will later settle to a 3- or 4-inch layer. Mulches applied in this way are used successfully on such crops as late potatoes or any other late row crop, but the job of applying the straw and that of harvesting a crop growing under a straw mulch is costly.

Protection from insects and diseases is fully described in Ohio State University Bulletin 76, "The Control of Garden Insects and Diseases." Vegetable growers should know how to control insects and diseases. Controlling insects and diseases in the garden is frequently a matter of prevention rather than of cure.

CULTIVATION

Cultivation begins with plowing. Plowing loosens the soil and covers crop residues and organic fertilizers and weeds. Fall plowing plus thorough seedbed preparation reduces the amount of cultivation necessary after the crops are planted.

The most economical time to cultivate the garden soil is before the crops are planted. A few additional disc harrow workings will make the seedbed finer and will reduce the weed population to a minimum.

Soil cracking and crusting make cultivations necessary. Soil cracks permit excessive evaporation of water from the soil, and soil

crusts prevent aeration and may keep seedling plants from pushing through the surface soil.

The garden should be cultivated as often as is necessary to control weeds, to cover up soil cracks or to break up soil crusts. These three objects can be accomplished most efficiently by using the "knife blade" type of cultivator (see Fig. 3). The "sweep" or "knife blade" is most efficient because, if used often enough, weeds, soil cracks, and soil crusts can be removed with the minimum of labor and root pruning.



Fig. 3.—Cultivating with a "sweep" or "knife blade" type of cultivator is more efficient than with deep tillage tools.

Shallow, level cultivation is the rule in a vegetable garden. Deep cultivation causes severe root pruning and results in reduced yields. The time to stop cultivating is when the tools used are injuring the top growth of the vegetables. Hand hoes can be used after other cultivators begin to injure the foliage.

TYPES OF IRRIGATION

There are three types of irrigation which can be used in the vegetable garden. They are: overhead irrigation, sub-irrigation, and surface (furrow) irrigation.

Of the three, surface irrigation is the most economical. It is adapted to level, well drained soil. Sub-surface irrigation by means of tile lines is frequently practical, especially if the subsoil is not too open and porous. The same tile lines used for soil drainage can be used for sub-irrigation by closing the outlet and filling the lines with water. The overhead system of irrigation most resembles rainfall and can be used any place it is installed. This system of irrigation is likely to spread leaf spot diseases on such crops as celery.

For optimum vegetable growth the soil should receive one acre-inch of water each week. More frequent irrigation is inefficient. Irrigation is a practical crop insurance and may repay the vegetable grower in one dry season. When water is available as needed the gardener can be sure of prompt seed germination at all times, the growth of vegetables will be rapid and the quality of the best.

VEGETABLE STORAGE

Storing vegetables is cheaper than canning them if they are to be consumed during their natural storage period. It is easier to store vegetables than it is to can them, but with some vegetables the quality is better if they are canned.

Special late plantings of vegetables are made for winter storage. Crops to be stored should mature as late as possible so that they can go into storage in a nearly perfect condition. Only sound, high quality vegetables are worth storing.

Beets, carrots, cabbage, parsnips, potatoes, winter radish, rutabagas, salsify, and turnips may be stored in a cool, well-drained, frost proof cellar that has a moist atmosphere. The moisture keeps these crops from shriveling.

Celery and endive are dug with a little soil on their roots and are set in a cool, well ventilated shed or cellar. The soil is watered lightly from time to time, but the leaves and stalks are kept dry.

Onions require a cool, dry place for storage. Sometimes the attic is used for onion storage.

Sweet potatoes, pumpkins, and squashes keep best in a warm, dry place such as a shelf near the furnace. Plenty of ventilation is needed also.

HARVESTING AND MARKETING

A vegetable is at its best for a very short time and it should be harvested when it is in such a condition. All vegetables consumed, canned, stored, or sold should be of the highest quality. Old, diseased, or otherwise damaged vegetables are discarded.

A SUGGESTED PLAN FOR THE FARM GARDEN (Size 80.5 by 100 Feet)

Planting date	Main crop	Planting date	Succession crop	Width of row, inches
March 20-31	Lettuce 5' Peas 95'	June 15-30	Beans, bush snap 100'	30
March 20-31	Peas 200' (two rows)	June 15-30	Sweet corn 200' (2 rows)	30
March 20-31	Lettuce 20' Spinach 80'	June 1-15	Beans, bush lima 100'	30
March 20-31	Beets 40' Carrots 40' Kohl-Rabi 20'	June 15-30	Carrots 100'	30
March 20-31	Head Lettuce 20' Early Cabbage 80'	July 1-15	Celery 100'	30
March 20-31	Onions 100' (sets)	Sept. 1-10	Spinach 50' Radish 50'	30
March 20-31	Potatoes 100'	July 1-15	Head Lettuce 50' Endive 50'	30
March 20-31	Potatoes 100'	July 1-15	Cabbage 100'	30
March 20-31	Potatoes 100'	July 15-30	Beets 100'	30
15 March 20-31	Parsnips 100' (Mark row with radish)			30
April 15-30	Spinach N. Z. 80' Swiss Chard 20'			30
May 10-25	Potatoes 600' (six rows)			30
May 15-31	Beans, bush snaps 50' Beans, bush lima 50'	August 10-20	Turnips 100'	30
May 15-31	Muskmelon 70' Watermelon 30'			60
May 15-31	Peppers 40' Cucumbers 60'			48
May 15-31	Sweet Potatoes 200' (two rows)			30
May 15-31	Tomatoes 100'			48
May 15-July 1	Sweet corn 600' (six rows). Plant first third of each row with Whipple's White; second third with Golden Bantam, and last third with Country Gentleman. Hills of pumpkin and squash can be planted in sweet corn.			30

NOTE: These planting dates are for normal seasons in central Ohio.

PLANTING TABLE—VEGETABLES SEEDED DIRECTLY IN THE GARDEN

VEGETABLE	When to plant	Depth in inches	Seed per 100 feet	Days to Maturity	Spacing (inches between plants)		Yield per 100 ft. of row
					Horse tools	Hand tools	
ASPARAGUS PLANTS	April	6-8	60 crowns	730	20 x 60	20 x 48	30 lbs.
BEANS, BUSH SNAP	May 1 to Aug. 1	½-2	1 pound	40-60	3 x 30	3 x 24	50 lbs.
BEANS, GREEN SHELL	May 1 to July 1	½-2	1½ pound	90-100	3 x 30	3 x 24	50 lbs.
BEANS, DRY SHELL	May 15 to June 1	½-2	1 pound	90-100	3 x 30	3 x 24	50 lbs.
BEANS, BUSH LIMA	May 20 to June 10	½-2	1 pound	60-75	6 x 30	6 x 24	40 lbs.
BEANS, POLE SNAP	May 15 to June 1	½-2	½ pound	50-75	24 x 48	24 x 36	60 lbs.
BEANS, POLE LIMA	May 20 to June 1	½-2	¾ pound	70-100	24 x 48	24 x 36	50 lbs.
BEETS	April 1 to Aug. 1	1-2	2 oz.	40-55	3 x 30	3 x 18	100 lbs.
CABBAGE, CHINESE	July 20	¼	1 oz.	80-90	15 x 30	15 x 24	80 heads
CARROTS	April 1 to July 15	¼-½	1 oz.	55-75	3 x 30	3 x 18	100 lbs.
CHARD, SWISS	April 1	1-2	1 oz.	50-60	8 x 30	8 x 24	100 lbs.
CHICORY, WITLOOF	May 15	¼-½	½ oz.	120-130	5 x 30	5 x 18	240 roots
CORN, SWEET	May 1 to July 1	1-2	4 oz.	60-90	12 x 30	12 x 24	100 ears
CUCUMBER	May 10 to June 1	1-2	½ oz.	50-70	12 x 60	12 x 48	150 lbs.
ENDIVE	August 1	½-1	1 oz.	90-100	18 x 30	18 x 18	50 lbs.
HORSERADISH	April 1	2	70 roots	140-180	12 x 30	12 x 24	100 roots
KALE	August 1	½	¼ oz.	50-70	18 x 30	18 x 18	50 lbs.
KOHL-RABI	April 1 and Aug. 1	½	¼ oz.	50-70	4 x 30	4 x 18	100 lbs.
LETTUCE	April 1 to Aug. 1	¼	½ oz.	70-90	6 x 30	6 x 18	50 lbs.
MUSKMELON	May 15	1-2	½ oz.	70-100	12 x 60	12 x 48	50 fruits

PLANTING TABLE—VEGETABLES SEEDED DIRECTLY IN THE GARDEN (Continued)

VEGETABLE	When to plant	Depth in inches	Seed per 100 feet	Days to Maturity	Spacing (inches) between plants		Yield per 100 ft. of row
					Horse tools	Hand tools	
ONIONS, SEED	April 1	½-1	1 oz.	110-150	3 x 30	3 x 18	75 lbs.
ONIONS, SET	April 1	1-2	2 lbs.	100-140	3 x 30	3 x 18	100 lbs.
ONIONS, GREEN	April 1	1-2	3 lbs.	30-40	1 x 30	1 x 18	1200 plants
PARSLEY	April 1	⅜-¼	¼ oz.	55-60	6 x 30	6 x 18	50 lbs.
PARSNIPS	April 1	½-1	½ oz.	130-140	3 x 30	3 x 24	100 lbs.
PEAS	April 1 and Aug. 1	2-3	1-2 lbs	50-60	1 x 30	1 x 18	40 lbs.
POTATOES, EARLY	April 1	3-4	10 lbs.	90-110	9 x 30	9 x 24	75 lbs.
POTATO, LATE	May 15	3-4	9 lbs.	110-140	12 x 30	12 x 24	100 lbs.
PUMPKIN, BUSH	May 15	1-2	1 oz.	60-90	12 x 48	12 x 36	100 fruits
PUMPKIN, VINE	May 20	1-2	½ oz.	90-110	12 x 72	12 x 60	100 fruits
RADISH	April 1 and Aug. 1	½-1	1 oz.	25-35	1 x 30	1 x 18	1200 radish
RHUBARB	April 1	2-3	50 roots	365	24 x 60	24 x 36	100 lbs.
RUTABAGA	July 1	½-1	¼ oz.	100-120	6 x 30	6 x 24	150 lbs.
SALSIFY	April 1	½-1	1 oz.	140-150	2 x 30	2 x 18	75 lbs.
SPINACH	April 1 and Sept. 1	1-2	1 oz.	40-50	2 x 30	2 x 18	50 lbs.
SPINACH, N. ZEALAND	April 1	1-2	1 oz.	60-80	15 x 30	15 x 24	75 lbs.
SQUASH	May 15	1-2	½ oz.	60-125	12 x 60	12 x 60	100 fruits
TURNIP	April 1 and Aug. 1	¼-½	½ oz.	50-60	3 x 30	3 x 18	100 lbs.
WATERMELON	May 20	1-2	1 oz.	110-130	96 x 96	96 x 96	25 fruits

NOTE: The planting dates are for normal seasons in central Ohio.

A SUGGESTED PLAN FOR A SMALL GARDEN (Size 21.7' x 25')

Planting date	MAIN CROP			Planting date	SUCCESSION CROP	
	Vegetables		Width of row, inches		Vegetables	
Mar. 20-31	Head Lettuce 5'	Early Cabbage 20'	24	June 15-30	Late Carrots 25'	24
Mar. 20-31	Early Potatoes 25'		24	July 1-15	Late Beets 25'	24
Mar. 20-31	Early Potatoes 25'		24	July 1-15	Late Cabbage 25'	24
Mar. 20-31	Onions (sets) 25'		18	June 15-30	Sweet Corn 25'	27
Mar. 20-31	Carrots 25'		18	June 15-30	Sweet Corn 25'	27
Mar. 20-31	Kohl-rabi 25'		18	June 1-10	Beans, bush lima 25'	18
Mar. 20-31	Beets 20'	Radish 5'	18	May 15-31	Beans, bush snap 25'	18
Mar. 20-31	Spinach 20'	Leaf Lettuce 5'	18	May 25-30	Staked Tomatoes 25'	36
Mar. 20-31	Peas 25'		18	None	None	24
Mar. 20-31	Peas 25'		18	None	None	36
April 1-15	Swiss Chard 22'	Parsley 3'	24	None	None	24
Mar. 20-31	Asparagus 20'	Rhubarb 5'	36	None	None	36

NOTE: Planting dates are for normal seasons in central Ohio. Mark rows of parsley and carrots with thin seedings of radish.

PLANTING TABLE—VEGETABLE PLANTS STARTED UNDER GLASS

VEGETABLE	Sow seed in hotbed	Move plants to coldframe	Spacing in coldframe	Set plants in garden	Spacing in garden (inches)		Yield per 100 ft. of row
					Horse tools	Hand tools	
EARLY CABBAGE	Feb. 20	March 1	2" x 2"	April 1	15 x 30	15 x 24	100 lbs.
LATE CABBAGE	May 10	June 1	3" x 3"	July 1	18 x 30	18 x 24	175 lbs.
CAULIFLOWER	May 30	None	None	July 15	24 x 30	24 x 24	45 heads
EARLY CELERY	Feb. 1	March 1	2" x 2"	April 20	6 x 30	6 x 24	200 plants
LATE CELERY	April 15	May 15	2" x 2"	July 15	6 x 30	6 x 24	200 plants
TOMATOES	March 20	April 10	4" x 6"	May 15	18 x 48	18 x 36	200 lbs.
PEPPERS	March 20	April 10	2" x 2"	May 15	18 x 36	18 x 24	120 peppers
HEAD LETTUCE	Feb. 20	March 1	2" x 2"	April 1	15 x 30	15 x 24	60 heads
SWEET POTATO	April 10	None	None	May 20	12 x 36	12 x 30	100 lbs.
BROCCOLI	May 20	June 10	3" x 3"	July 15	24 x 30	24 x 24	45 heads

NOTE: The planting dates are for normal seasons in central Ohio. Tomatoes set 18 inches apart in the row should be pruned and tied to stakes.

PERENNIAL CROPS

ASPAGUS.—The Mary Washington variety of asparagus is at present the best to plant. It produces large rust resistant stalks and high quality spears.

Soil and Seed Requirements.—A deep, sandy, silt loam soil, well supplied with organic matter and about neutral in reaction, is excellent for asparagus. Asparagus roots need a well aerated soil with the water table 4 to 5 feet below the surface. Only 1-year-old asparagus roots should be planted. Good roots can be purchased from reliable seedsmen or they can be grown by the gardener.

Asparagus seed from rust free, high yielding plants can be purchased or grown at home. If the seed is grown in the garden, as soon as the berries are red the stalks are cut and hung up for two or three weeks, so that the seed can ripen thoroughly. The berries are then removed from the stalks. The seed is saved by crushing the berries and washing the pulp with water. The heaviest seeds settle to the bottom. These can then be dried on a screen. The heavier the seed, the better plant it will produce. Asparagus seed is viable for only a year or two, and it should be stored in a cool place.

Asparagus seed is sown in the garden very early in the spring. Soaking the seeds for four days in water at a temperature of 75°F. will speed up germination. The water should be changed twice to prevent spoilage by fermentation. The seeds are planted 3 inches apart in the row. It is sown in moist, fertile soil in drills 15 inches apart and is covered with 1 inch of soil.

Fertilizers.—A 4-12-4 fertilizer is applied broadcast at the rate of 1000 pounds per acre and worked deeply into the soil just before the seed is sown. The organic matter in the seedbed needs to be well decayed and abundant at the time the seeds are sown.

As soon as the young plants begin to grow, 200 pounds per acre of nitrate of soda should be applied on the surface of the soil between the rows.

Between 1000 and 2000 pounds of a 6-8-6 fertilizer should be applied just before the end of the cutting season. The fertilizer should be worked into the soil between the rows, since application directly over the rows would injure the plants.

Propagating Bed.—The propagation bed is kept free from weeds. A very light seeding of radish in the row will aid in cultivation by marking the rows until the asparagus plants are large enough to see. In the late fall a covering of straw is put on the bed for winter protection. The following spring the roots are dug. The biggest of them are replanted as soon as possible without unnecessary exposure to the sun or wind. The crowns of the roots selected for planting should have large, well distributed buds. The vigor of the asparagus plant during its first year in the permanent bed determines its success or failure in later years.

Preparing the Permanent Bed.—The soil for the permanent bed needs special attention since the bed is expected to produce over a 15- to 20-year period. The fertility of the soil can be increased by turning under an alfalfa sod. Soybeans followed by a winter crop of rye could also be included in the soil improvement program. Such a program increases the organic matter supply, reduces weed troubles, and makes extra early seedbed preparation possible. Ten loads per acre of manure can be turned under with the alfalfa and ten more with the soybeans. Ten additional loads of well rotted manure

could profitably be disked in with the rye. The soil used for asparagus should have a reaction of between pH 6.50 and 7.50.

Setting out the Plants.—Early in the spring a double moldboard plow is used to open the furrows for asparagus planting. A good wide furrow is needed so as to permit the natural spreading of the plant roots. On sandy soil the crowns of the plants should be about 8 inches from the surface level. On silt loams and clay loams this depth should be about 6 inches.

Twenty inches between plants in the row and 5 feet between rows is the best spacing for new plantings. The crowns of the plants are at first covered 2 inches deep. As the season advances the trench is gradually filled.

Growing the Crop.—Weed control throughout the growing season plus a sound fertilizer program will be absolutely necessary. A good cutting of spears plus the removal of the tops after they are killed by frost will take 160 pounds of nitrogen, 80 pounds of phosphorus, and 200 pounds of potash from each acre. An application of 16 tons of manure per acre, or its equivalent in commercial fertilizer, will offset this drain on the fertility of the soil.

Salt is of questionable value to asparagus as a fertilizer.

Two-year-old asparagus beds can be harvested for two or three weeks. After the second year the harvest period ends July 1. Extending the cutting season a week or two beyond this date reduces the amount of food stored in the roots for the next year's crop. The spears can be broken off at the surface of the soil or they can be cut with a knife just below the surface of ground. Careful harvesting is needed to prevent injury to spears not yet above the ground. The less soil there is over the crowns during the cutting period the easier it will be for the spears to grow to marketable size.

Asparagus is very perishable and the spears should be marketed quickly. Holding them in a cool place with the trimmed ends of the bunches standing in cool water is helpful. Crooked spears frequently result when the tender shoots encounter stones, undecayed stalks, or even very cold surface soil in their upward growth. It is advisable to remove and burn the tops during the winter after they have been killed by frost.

RHUBARB.—Both rhubarb and asparagus are perennial crops which most home gardens contain. A very few rhubarb plants are usually sufficient to supply the average family. Any surplus of rhubarb plants could be used in the forcing of a winter crop as described in the paragraph on "Forcing Rhubarb."

Rhubarb should have the same seedbed preparation as described for asparagus. A deep, well pulverized, neutral soil, well drained and supplied with liberal amounts of organic matter, is needed.

Organic matter can be added each fall by applying 20 tons of manure per acre. If manure is scarce the same fertilizing program used for asparagus is recommended. Rhubarb starts its spring growth from reserve food stored in the roots.

The varieties recommended are Linnaeus and Victoria. To start a new planting, strong, healthy roots are dug up and divided into several pieces having one or two strong buds each.

Early spring plantings of these root divisions are made in rows 3 to 5 feet apart with 2 to 3 feet between pieces in the row. A layer of soil 2 to 3 inches deep is placed over the root pieces. The Victoria variety is a vigorous plant and needs more space than does the high quality, pink stalked Linnaeus variety.

Clean cultivation is needed for rhubarb. All seed stalks are broken off as soon as they appear, since they use up food supplies which should be stored in the roots. A new planting is needed every five or six years.

Only the largest stalks are pulled in harvesting rhubarb. The leaf blades are trimmed off to prevent wilting of the stalks after they are harvested. Stalks are not pulled during the first two years in new plantings. A 4- to 5-week harvest period is used the third year and after that an 8-week harvest season is practical where the stalks show sufficient vigor.

Forcing Rhubarb.—Strong, vigorous 2-year-old roots are dug in the fall after the tops are killed by frost. They are allowed to freeze thoroughly, after which they are stored in a cool cellar until three or four weeks before the forced rhubarb is wanted. They are then placed close together on the floor of a darkened room having a temperature of 60°F. A layer of sand,



Fig. 4.—A greater variety of vegetables are needed in Ohio gardens. There are 32 kinds of vegetables growing in this garden.

ashes, or garden soil is then put over them and they are watered thoroughly. Stalks of good size may be harvested in about three weeks after forcing begins. The harvest period lasts four or five weeks for each bed, after which the roots are thrown away.

POTHERBS OR GREENS

SPINACH.—Spinach is very sensitive to acid soil and should be grown only on nearly neutral soil. Spinach goes to seed in warm weather. It should be planted just as soon as the ground can be prepared in the spring. Early spinach should not follow late beets in the rotation.

Fall crops of spinach should be planted with blight resistant Virginia Savoy. Long-Standing Bloomsdale Savoy, King of Denmark, and Juliana are good early spring varieties of spinach. The crop is sown either broadcast or

in drills. Spinach is a quick maturing crop, requiring about 40 days from seeding to harvesting. The entire plant is harvested at one cutting.

New Zealand Spinach.—New Zealand spinach differs considerably from true spinach. It stands hot weather well; it can be harvested continually throughout the growing season, and the plants are branching and spreading in their habit of growth. The tips of the branches are cut off and used. The yields produced are large and the edible parts are very palatable. The plants are not as procumbent as spinach plants are, so there is less soil on the leaves.

SWISS CHARD.—This vegetable belongs to the beet family. Swiss chard is a good hot weather vegetable to use as greens. The cultural methods for this crop are the same as for beets. The larger outer leaves are removed, and if too many are not taken at one time the plants will continue to bear until late fall. The leaves are cooked as greens and the large mid-ribs of the leaves can be used as are asparagus spears. The plants should stand 6 inches apart in the row. The Lucullus is the recommended variety.

KALE.—This crop requires a well drained and fertile soil. In the Ohio river section, this vegetable is planted about August 10. It is harvested early the next spring. Two or three cuttings are made. Nitrate of soda is applied at the time the kale begins to grow in the early spring; a second application is given 10 days later. The rate used is 150 to 200 pounds per acre.

Kale belongs to the cabbage family, and is a cool season crop which does not do well after hot weather arrives. When seeded in rows 18 to 30 inches apart the plants should be thinned to stand 10 inches apart in the row. The variety to plant is the Dwarf Scotch Curled.

MUSTARD.—White mustard is also grown in the Ohio river section as a fall crop. The culture of this vegetable is similar to that of kale. Fordhook Fancy is a good variety. It produces a large, light green, long standing plant.

SALAD CROPS

CELERY.—This crop can be produced only on moist, well drained and fertile soil. A muck soil or a soil well supplied with organic matter is essential for the successful culture of celery.

From 800 to 1200 pounds of a 4-12-4 fertilizer is recommended on all soils except mucks and peats. For the mucks and peat a 3-9-18 is advised. A nitrogen side dressing is usually profitable and can be applied as often as needed until the plants are almost half grown. The rate of application is 150 to 200 pounds per acre for nitrate of soda.

Early celery is set out about May 15 and late celery July 1. Well grown plants should be used (see Ohio Extension bulletin, 103). A fall crop is the most profitable in Ohio. The length of the growing season necessary to produce celery is 105 to 125 days. Early celery is checked by hot weather in July and August.

Celery is blanched with boards, paper, or soil. Excluding light from the growing leaf stalks prevents the formation of chlorophyll, and that which is there at the time of blanching will gradually disappear. Boards 12 inches wide can be used. They are held in position by wire or wooden cross pieces.

Banking the late celery with soil is begun early in September. The earth is gradually worked against the celery plants. This results in a gradual shutting out of light and at the same time induces an upright and compact growth of the plants.

In late October and early November the celery plants are placed in storage. The roots are allowed to remain on the plants; the foliage should be dry when they are moved to the storage and while they are in it; only the smallest amount of trimming should be done at this time.

The plants are set in an upright position, close together, and with the roots in moist soil. The celery storage is well ventilated, cold, and dark. Any watering necessary to keep the soil moist is done by applying it directly to the soil. The foliage is never watered. The plants grow slowly while in such a storage and food stored in the celery stalks is transplanted to the new, tender, crisp, heart growth. The leaves of the celery plants held in storage need air circulation to remove the moisture of condensation.

The Giant Pascal and the Emperor are very high quality varieties of the green type of celery. The Giant Pascal is a late celery which keeps well. It is used for the production of celery hearts. Golden Plume is an early variety which is especially suited to a home garden.

LETTUCE.—Moisture supply and soil fertility are important factors in growing lettuce. Cool weather is also needed to assure a good crop. Well rotted manure or green manure crops should be turned under to increase the organic matter supply. Superphosphate, 20 per cent, is used at the rate of 75 pounds for each ton of manure. In addition 1000 pounds per acre of a 4-12-4 fertilizer is drilled in just previous to seeding. On muck soils a 3-9-18 fertilizer is used. A meeker smoothing harrow or a plank drag will leave the well pulverized seedbed in the smooth, level condition necessary to successful lettuce seeding.

Lettuce plants for the head lettuce crop or for the leaf lettuce crop can be started under glass (see Ohio Extension bulletin, 103). Well grown plants set out in light soil prepared as described above will do well in Ohio. It is important to have such plants set out very early. The earlier the ground can be prepared the sooner the plants can be set out and the better the transplanted crop will be. A 15-inch spacing in the row for head lettuce and an 8-inch spacing for transplanted leaf lettuce is advisable.

Transplanted head lettuce or leaf lettuce crops may be profitably sidedressed with nitrate of soda in the early spring. Applications of 200 pounds per acre at two-week intervals until plants are half grown is the rule. During the first half of their development they need plenty of water.

Cultivation of the lettuce crop requires more than ordinary care because the root system is very small. Very shallow, level cultivation is required and this should be often enough to remove all weed competition. "Sweep" or "knife blade" types of cultivators which cut the weeds off just below the surface of the soil are the best kind.

The best head lettuce for Ohio is the New York variety. From 80 to 90 days of cool growing weather are needed to mature a crop. Black Seeded Simpson is an excellent variety of the loose leaf type and matures in about 70 days. Lettuce may also be grown as a fall crop.

ENDIVE.—This fall salad crop is grown much the same as is lettuce. Seed is sown in July or August and later blocked out or thinned to 8 inches between plants in the row. It is a cool weather vegetable, and if used as a spring crop should be started very early. The Green Curled variety is recommended.

Blanching is necessary to reduce the bitter flavor of endive as well as to make the foliage more tender. This requires three weeks or more in cool

weather. It is accomplished by tying the spreading outer leaves together. The central leaves will turn attractively white and bright provided they are kept dry and not allowed to rot.

CHICORY.—Whitloof chicory is a salad plant which is becoming more important in Ohio. Roots of chicory are plowed out late in the fall (October 15) and used to produce a winter forcing salad crop. Tender, crisp heads of chicory can be forced as needed during the winter.

The roots are grown as are those of parsnips. Seed is sown about May 15 in rows 18 to 30 inches apart. The plants are thinned to stand 5 inches apart in the row. Deep, mellow soil is desirable, but whitloof chicory may be grown successfully in any good garden soil.

The roots are trimmed to equal length by clipping off the lower ends. The plow can be set so as to cut roots to a uniform length of 6 to 7 inches. Shorter roots do not always produce satisfactory heads. All side roots are removed and the tops are cut back to 1 inch from the crown of the root. If the heart is cut away the roots are no good for forcing and if there is too much of the leaves left the heads are loosely formed.

The roots are then stored in a cool, well ventilated place for two or three days. After this short drying period they are placed in cool storage for three weeks. Frost protection is essential.

They are then planted. Trenches, boxes, and other places are used. A box is laid on its side and a 1-inch layer of sandy loam soil is spread. The trimmed roots are placed closely together on this layer of soil. The box is tightly packed with alternate layers of soil and roots, and is then turned back to its normal position and the roots are moderately watered. A second box with bottom removed is placed on top of the planted box and nailed there. An 8-inch layer of loose, sandy, loam soil is applied over the crowns of the roots. This soil should be screened free from foreign materials such as sticks and stones. The 8-inch layer of soil is kept dry and the box is stored in a cool place until three or four weeks before the salad crop is wanted. It is then removed to a warmer place having a temperature of about 60°F. Solid heads will develop when the method described here is used.

PARSLEY.—Seed of this garden herb is slow to germinate and is best started in the hotbed and later transplanted to the garden. Soaking the seed in water for five or six hours is practical. It can also be seeded with the early radish or in rows by itself directly in the garden. The variety Moss Curled is preferred.

Weeds are removed from competition with young parsley plants by level, shallow cultivation. The plants should be 6 to 8 inches apart in the row. Parsley can be held over winter in a hotbed.

Turnip rooted parsley is grown for its roots as are carrots. The leaves of this kind of parsley are good for drying and for flavoring.

COLE CROPS

CABBAGE.—Early cabbage plants produce mature heads during late June and early July if they are set in the field about April 1 to 10. Early cabbage is spaced 15 inches by 30 inches. Plants for the early cabbage crop should be properly grown (see Ohio Extension bulletin, 103). A deep, fertile, sandy loam soil is excellent for early cabbage.

The Jersey Wakefield and the Golden Acre are good early varieties of cabbage. The Glory is a kraut cabbage. The Danish Ballhead is a good keeping, late cabbage. Marion Market, Wisconsin All Seasons, and Wisconsin Hollander No. 8 are yellows-resistant varieties. Mammoth Rock Red is a late, purple variety and Drumhead Savoy is a good quality of the crinkled type variety.

Late cabbage plants are set in the garden about July 1. They require 18 inches between plants in 30-inch rows. The crop matures in October and early November. Late cabbage responds well to moisture and fertile soil. In recent fertilizer tests it was found that cabbage needs plenty of phosphorus in the soil. The same fertilizer recommendations made for celery are used for cabbage.

Cabbage plants are set by machine or by hand. The plant roots should be set firmly in contact with moist soil. Experiments show that large young plants produce much bigger crops than do smaller plants of the same age. It therefore pays to select out the biggest plants, and where enough plants are available the small ones can be discarded.

Cabbage roots grow close to the surface of the soil. Shallow cultivations just frequent enough to prevent weed growth should be given. Scraping the weeds between the plants in the row with a sharpened hoe is all that is necessary to keep them down.

CAULIFLOWER.—Fertile soil and plenty of moisture are needed for cauliflower. The cauliflower will not head in warm weather. On this account only fall crops are successful, as a rule. Cauliflower heads best during

October in Ohio. From 110 to 120 days are required to mature this crop. The culture of cauliflower is similar to that for late cabbage. As soon as the head begins to form the leaves are tied together. Parting the leaves to examine the plant for marketable heads should be carefully done from the north side of the plant. This will prevent undue light injury. In warm weather heads reach maturity rapidly, whereas late in October more time is required. Using colored tying strings aids in the locating of ripening heads. A different color is used

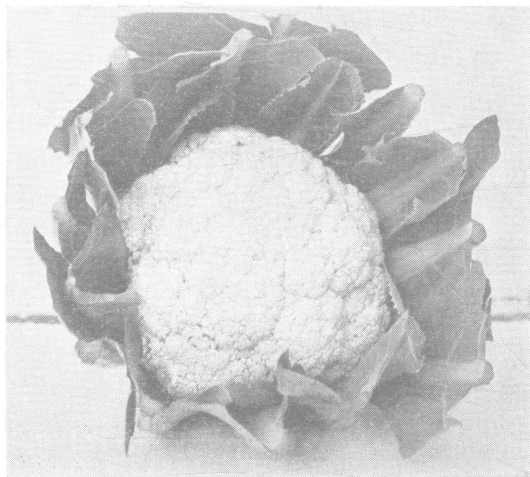


Fig. 5.—A head of cauliflower grown in Ohio. The fall crop is the easiest to grow.

with each day's tying operations. Early Snowball is an early, round, white headed variety.

Broccoli (sprouting) has some of the characteristics of cauliflower but the head is not grown in the dark and is therefore green in color. After the head on the main stalk is cut off, smaller heads develop from the axis of

leaves. The variety recommended is Italian Green Sprouting. The sprouts should be cut before the flowers open. This vegetable requires a cool season and 130 to 150 days are needed to mature the crop. Maturing a crop in the late fall is preferred to growing an early crop. Broccoli is set in the garden about June 1.

BRUSSELS SPROUTS.—This vegetable requires a longer season than does late cabbage. It is otherwise handled in much the same way. Just before freezing weather sets in, the elongated stems of brussels sprouts are cut off at the surface of the ground. These stalks are packed in an upright position and close together in a cool storage. Alternate freezing and thawing damages the sprouts but light continuous freezes do little if any harm. The sprouts can be used any time during the winter. At least three months are required to mature a crop. It is a difficult crop to grow in Ohio. The Long Island Improved is a dependable, dwarf variety.



Fig. 6.—Cauliflower plants are tied up as shown in the illustration just as soon as the heads begin to form.

KOHL-RABI.—Kohl-rabi differs from the other cole crops in that it can be planted in succession beginning in early April and ending the first part of August. If seeded directly in the row the plants should be thinned to 4 inches. Succession plantings are important, because the edible fleshy stems are only succulent and tender while very small (2 to 3 inches in diameter). The same cultivation and fertilization used for cabbage is needed for kohlrabi. A quick growth is essential for a quality product. The preferred variety is the White Vienna.

CHINESE CABBAGE.—Cauliflower culture methods do well for Chinese cabbage. Seed can be sown in the garden about August 20 and thinned to 15 inches in the row. There are two types; one is a tall growing plant pro-

ducing a head 12 inches or more in length (Pe-Tsai), and the other is a shorter plant and produces a more compact head (Wong Bok). The crop cannot be grown in the spring.

ROOT CROPS

BEETS.—The garden beet can be matured in fifty days. The soil should be deep, friable, and well supplied with organic matter. Special work is needed in the preparation of root crop seedbeds, since the seeds are planted directly in the row. The same methods used in preparing the celery seedbed for planting would be very acceptable for root crops.

Well rotted manure used for beets and other root crops will cause less weed competition than fresh barnyard manure. The use of 20 per cent superphosphate at the rate of 75 pounds for each ton of manure applied is the first step in the fertilizer program. Both the manure and the superphosphate should be plowed under in the fall where possible and practical. If enough manure is applied (10 loads or more per acre) no other fertilizer may be needed. Root crops need more potash than many other vegetable crops.

Beets and other root crops are of high quality only when they are grown rapidly and without checking the growth at any time. On this account the additional use of 500 to 1000 pounds of fertilizer per acre may be profitable. Ohio Extension leaflet, "Fertilizers for Vegetable Crops" gives complete recommendations.

Early beets can be planted as soon as the soil can be prepared properly. A sandy loam soil is fine for the early crop. Succession plantings can be made up to July 15. The seed should be sown 1 or 2 inches apart, and later thinned to 3 inches between plants.

For real early beets the seeds can be planted in a hotbed about three or four weeks before they are to be transplanted to the garden. They are set out four or five days after the usual time for sowing seeds in the garden and are usually ready to harvest twelve to fifteen days ahead of the regular crop. This is a commercial practice in some states.

The cultivation of root crops is very important. The root system is not large, and clean, level, shallow cultivation is needed to control weeds and to keep the surface soil loose and free from soil cracks. The "knife blade" or "sweep" type of cultivator is preferred over all others.

Crosby Egyptian is a good early variety. The Early Wonder is also a good early variety. The Detroit Dark Red is a high quality, late beet. For the home garden the Long Season or the Winter Keeper are preferred varieties.

CARROTS.—The carrot is planted, thinned, cultivated, and fertilized as is the beet. Carrot seed germinates slowly and the rows can be marked with a very light sowing of radish seed. Carrot seed is smaller than beet seed and it is important to have the surface of the seedbed smooth and well pulverized. From fifty-five to sixty days are necessary to grow a crop of carrots.

The Nantes is the highest quality carrot that is known. Chantenay and Danvers are also good varieties.

PARSNIPS.—The parsnip is a long season crop requiring 130 days to reach marketable size. The roots are poorly shaped when grown in shallow, cloddy seedbeds; a deep, fertile soil is needed for a good root development. Soils which form crusts easily are likely to prevent the slowly germinating seedlings

from ever reaching the surface. The culture of this crop is otherwise the same as for beets and carrots. Radishes are used to mark the rows.

Parsnips are hardy and can be allowed to remain in the ground all winter. Freezing improves the flavor of parsnips. Early Short French and Hollow Crown are recommended varieties. The Early Short French is a good home garden variety.

SALSIFY.—“Vegetable oyster,” as salsify is sometimes called, is also a long season crop. The culture of salsify is almost the same as for parsnips. It can be left in the garden all winter. Sandwich Island is an excellent variety.

TURNIPS.—Success in growing turnips lies in preparing the seedbed so that there will be an abundance of moisture stored in the soil at the time the seed is sown (July 20 to August 10). Turning under a sweet clover crop in late May, and summer fallowing until planting time, will usually accomplish the desired result. Ten or more loads of manure per acre if well distributed throughout the surface soil will help to hold moisture in the soil. Manure applied late in the spring should first be composted to kill any weed seeds present. Superphosphate should be used with the manure at the rate of 75 pounds of 20 per cent goods for each ton of manure.

Turnips should be planted $\frac{1}{2}$ inch deep in drills 15 to 30 inches apart. Two pounds of seed will plant an acre. The plants should be thinned to stand 3 inches apart in the row. A comparison of broadcast seeding with drilling shows 1000 bushels per acre against 500 bushels per acre in favor of drilling the seed. For yields like these the very highest quality of seed is necessary.

Turnip seed germinates quickly and the plants are up in a few days. The crop is ready to harvest in sixty days from time of seeding. At that time the turnips should be $2\frac{1}{2}$ inches in diameter. Fast growing turnips, maturing in cool weather, are usually of good quality. A deep, fertile, loam soil is ideal for turnips. Purple Top White Milan and Purple Top White Globe are recommended varieties.

RUTABAGA.—A month longer growing season is required for the rutabaga than for the turnip. Cooler growing weather is necessary also. On this account the rutabaga can be grown well only in northern Ohio. Irrigation would be a valuable aid even in northern Ohio. The Improved Long Island rutabaga is an accepted variety.

RADISH.—Radish sown on sandy soil early in the spring can be ready to pull in about twenty-five days. A light friable soil is best for early radish. For summer radish a heavier and cooler soil is preferred. The culture is the same as for other root crops except the thinning is 1 inch between plants.

This crop can usually be grown as a companion crop between the rows of slower maturing vegetables. The larger the radish seed the sooner the plants come up and the earlier they mature, as is the case with sweet corn and cabbage seeds as well as many others.

There are spring, summer, and winter varieties. The Scarlet Globe is a fine early spring variety. White Icicle takes longer to mature (thirty to thirty-five days) and is a good, long rooted spring variety. Strasburg is a summer radish of value. The White Chinese is a winter radish.

HORSE-RADISH.—A deep, fertile, moist, highly organic soil is ideal for horse-radish production. Plenty of manure and superphosphate should be

applied and plowed under in the fall for this crop. Ten tons of manure and 750 pounds of 20 per cent superphosphate per acre should meet all fertilizer requirements.

Root cuttings from the previous year's crop are planted in a slanting position, with the upper end of the cutting 2 inches below the level surface of the soil. These cuttings are trimmed off square on the upper end and slanting on lower end. It is important to plant them correctly. Twelve inches is the spacing in the rows. The crop is started very early and is dug after the tops are killed in the fall. In digging horse-radish, all side roots must be taken from the soil because they will grow the next season if they are not removed. The Maliner Kren and the Bohemian varieties are both recommended.

BULB CROPS

ONIONS.—Onions are hardy and grow best in cool seasons. A good crop from sets is easier to grow than one from seeds. The sets should be from $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, and if possible they should be held at 32° F. from the time they are harvested until they are planted. Small sets produce weak plants, and sets larger than $\frac{3}{4}$ inch are likely to produce seed stalks instead of edible bulbs.

Sets are planted 1 inch deep and 1 inch apart for use as green onions. A 3-inch spacing is used for bulb production. The time for planting sets is just as soon as the field can be made ready. The sets of Egyptian, winter or perennial onion, and potato onion are very hardy and can be planted in a new bed in early August for the spring crop of long, thick necked, green onions.

The sets of the Egyptian crop are produced on top of the plant during July. Onion sets for growing small bulb, green onions or for mature bulb crops can be grown by sowing onion seed of the desired variety at the rate of 1 ounce per 25 feet of row about May 15. The plants are so crowded that they mature early. After pulling the onions and drying them thoroughly they are placed in storage.

Onion seed should be sown in a shallow drill very early (about April 1). Mature bulbs from seed require the same spacing per plant as do sets (3 inches). Onion plants about 8 weeks old are transplanted in the garden early in April for the Bermuda crop. A 4-inch spacing in the row is used.

Soil for onions should be fertile, mellow, and loose. Soils which form crusts are to be avoided unless they are planted with sets. Large amounts of organic matter in the soil are essential.

Level, shallow cultivation is required to control weeds and keep the surface soil loose and free from soil cracks. Hand weeding between plants in the row is necessary. Here again the knife blade or "sweep" type of cultivator is preferred.

As soon as the tops break over naturally, the plants are pulled, dried in windrows, topped, and stored. "Thick-necked" or "bottle-necked" onions are not stored because they will not keep.

The Ebenezer is a good keeping, flattened, yellow onion. The Ohio Yellow Globe is a flattened, globe shaped, good keeping variety. Sweet Spanish is a large, round, mild, good keeping onion. Potato (multiplier) and Egyptian (top set) are recommended varieties.

LEEK.—This crop is grown for its blanched stem and for its leaves. Seed is planted early and the plants are thinned to 4 inches in the row. If plants are used instead of seeds they should be started in hotbeds. The seed is sown six to eight weeks before the leek is transplanted. —Blanched leek is produced by banking soil around the stems of the plants. The Large American Flag is a large, long, straight variety of leek.

POTATO CROPS

IRISH POTATO.—Potato growing in Ohio is fully discussed in Ohio Extension bulletin 86. It is doubtful if the vegetable gardener should attempt the production of potatoes unless all the recommendations of this bulletin can be followed.

Briefly, potato production consists of planting 1 ounce, chunky, square cut seed pieces in moist, well prepared soil 4 inches below the level surface of



Fig. 7.—Commercial fertilizer is profitable for vegetable crops. A yield increase of 100 bushels of potatoes per acre was obtained on this Miami County farm.

the garden. The spacing in the row is 9 inches for the early crop and 12 inches for the late potatoes, with 30 inches between the rows.

Green manure crops and barnyard manures are needed to build up the organic matter of the soil. Clean, shallow, level cultivation is used.

High pressure spraying (300 to 400 pounds) with 3 nozzles to the row is absolutely necessary. A 4-6-50 Bordeaux is used. Five sprays is the minimum number of applications for the early potatoes and 8 sprays for the late crop. Two pounds of calcium arsenate for each 50 gallons of Bordeaux are added if flea beetles or other chewing insects are present.

Certified potato seed should be used. Irish Cobbler potatoes are preferred for the early crop with the Early Ohio as a second choice. Irish Cobblers are the best yielders of the early potatoes. Russet Rurals are the preferred late potato, with White Rurals a second choice. The early potatoes are planted as soon as the soil is workable and the late potatoes are planted the first part of May.

SWEET POTATO.—The sweet potato plant is tender and needs a long frost-free growing season (120 days in the field). The crop is drought-resistant. A well drained, sandy loam soil with a heavier subsoil is ideal for sweet potatoes. Any good soil will produce a fair crop. Ridging the soil is not necessary if the soil is loose and well drained. A 4-10-6 applied broadcast at the rate of 1000 pounds per acre would meet the fertilizer needs of the sweet potato on light soils. Manures are not used on sweet potatoes, since their use is likely to result in excessive vine growth.

Slips are produced from sweet potatoes sprouted in a hotbed. All sweet potatoes should be disinfected before they are bedded. A 4-inch layer of a sandy loam soil over a 6-inch layer of fermenting manure is a satisfactory place on which to grow sweet potato slips. The sweet potatoes are placed close together on this bed but without touching each other. A 2-inch layer of the same kind of soil is placed on top of the roots and the bed is thoroughly watered. When the plants come up a second thin layer of sandy loam is applied to aid in developing a good root system. At a uniform temperature of 70°F. the plants will be ready for pulling in about six weeks' time. Higher temperatures are not desirable. The beds should be kept well ventilated and watered.

When all danger of frost is gone the plants are pulled. It is best to avoid walking on the beds as this will injure the second pulling of plants.

The only cultivation required is for the purpose of weed control and for breaking up soil crusts and filling in soil cracks. Moving the vines or pruning them is injurious.

Digging begins with the arrival of the first hard frost. The crop is plowed out at once with a "middle buster" and the rows which are not so harvested should have the vines cut away. Injury to the roots must be avoided if they are to be stored.

The yellow Jersey variety of sweet potato is a dry, mealy, golden colored variety. The Nancy Hall is a sweet potato preferred by those who like a moist type.

YAMS.—Yams are not related to sweet potatoes in any way. The yam is a tuber and the sweet potato is a root. The yam is propagated in much the same way as is the Irish potato. The yam is a monocot, whereas the sweet potato is a dicot.

BEANS AND PEAS

KIDNEY BEAN.—The common bean is grown for its edible yellow or green pods, which are snapped off by hand before they are full grown and while the seeds are small. The development of stringless varieties in recent years has been a great boost for this crop. If the lower pods are allowed to mature and turn yellow the crop can be harvested as shell beans. The plants are then cut off and dried in the field for several days. The beans are later removed from the pods by special bean threshers.

The varieties of beans recommended for Ohio are:

Yellow Pod Snap—Webber Wax, Valentine Wax, Pencil Pod Black Wax.

Green Pod Snap—Stringless Refugee and Giant Stringless.

Pole Green Pod Snap—Kentucky Wonder and White Creaseback.

Pole Wax Pod Snap—Kentucky Wonder Wax and Golden Cluster Wax.

Pole Lima—Early Leviathan and King of the Garden.

Bush Lima—Ford-hook and Burpee's Improved Bush.

Green Shell Beans—French.

Green Shell Pole—Horticultural Pole.

Dry Shell or Field—Michigan Robust Pea (a disease-resistant "Navy" bean)

White Kidney (a large, white, kidney shaped bean) Well's Red Kidney (a disease-resistant red, kidney-shaped bean).

A sandy loam soil best meets the requirements of early beans. Silt loams are preferred for later planting. Soils which do not form crusts readily are best. Good drainage is also required. On sandy loams and light silt loams a 4-12-4 applied broadcast at the rate of 500 pounds per acre is satisfactory. Manure and superphosphate will also meet the fertilizer needs of beans. In this case 5 tons of manure and 400 pounds of 20 per cent superphosphate are enough to apply; heavier applications may cause too much vine growth.

Beans are planted after danger of frost is over unless the gardener can afford to stand the loss of such plantings as may be made earlier. Seed should be planted in rows and later thinned to stand 2 to 3 inches between plants in the row for the dwarf types. The pole beans are planted in hills four feet by 4 feet with 5 seeds per hill.

Very shallow cultivation should be depended on for weed control. Deep soil working will destroy some of the roots which are near the surface. Cultivation is given only when the plants are dry. Harvesting follows this same rule. To work beans while the leaves are wet aids in spreading disease.

LIMA BEAN.—Lima beans need more time to mature than the common bean. It is also more tender and is planted a few days later than the common bean. Four months of frost free weather are needed for the successful production of lima beans.

Lima beans are thinned to 6 inches between plants in the row. They are harvested by hand when the seeds are nearly full-grown and before the pods turn yellow. Dry lima beans are harvested as are dry common beans.

PEAS.—Peas and beans do well on the same kinds of soils. The same fertilizer program is used for both crops. The same cultivation requirements fit both crops; otherwise the two crops are quite different. The pea is planted as early as the soil can be prepared. When drilled in rows the best way is to place the seeds an inch apart in a deep furrow 2 inches wide. In Ohio early planting is very important, since the pea does best in cool weather. Fall planted peas sown August 1 sometimes mature a crop.

Deep, thorough soil preparation is essential. Fall plowing is better than spring plowing, since it permits earlier planting. The seed is covered 2 to 4 inches deep, depending upon the soil and moisture supply.

Laxton's Progress is the earliest of the large podded, dwarf plant type of peas. The Little Marvel is an early dwarf variety of excellent quality and it is productive. The Improved Stratagem is a mid season dwarf variety. The Alderman is a late, tall growing variety.

SOLANACEOUS FRUITS

TOMATOES.—Tomatoes will grow on any fertile, well drained soil. The best fertilizer treatment would be the plowing under of 10 tons of manure and 750 pounds of 20 per cent superphosphate per acre sometime previous to January 1.

Good plants are absolutely essential. They should be healthy, stalky, about 7 inches high and six weeks old at the time they are set in the field. The more roots are moved with the plants the less they are checked. Ohio Extension bulletin 103 contains complete plant growing instructions.

The Bonny Best tomato is preferred for the home garden. It is an early variety, round, smooth, red, and productive. The Marglobe is a wilt-resistant, mid-season variety. It is large, deep-fruited and red. The Early Detroit is an early, round, pink, or purple variety. The Globe is a purple, mid-season, deep-fruited variety. The Early Stone and the Greater Baltimore are mid-season to late, red tomatoes used for canning.

Where space is limited or where real early tomatoes are wanted in large quantity, the plants are set 18 inches apart in rows 4 feet apart and are pruned to a single stem. Each plant is tied loosely to a stake about 5½ feet long which is driven into the ground either before or after the plants are set in the field. To prune a plant the axillary shoots are pinched out as soon as they appear. When plants are not staked they are set 4 feet apart each way.

The time of setting tomatoes is as soon as all danger of frost is over. Late setting results in lower yields.

EGGPLANT.—Eggplant is a hot weather crop and is started in a hotbed. Plants are set out in the garden on June 1. The spacing is 24 inches between plants in the row. The culture of this crop is otherwise like that of the tomato. The Black Beauty is an early, medium sized, dark purple, productive variety.

PEPPER.—The spacing is 18 inches between plants. The culture of this crop is otherwise the same as for eggplant. The Early Giant and the Oshkosh are mild varieties of peppers. The California Wonder is a midseason to late, large, very thick fleshed, red, mild pepper. The small Cayenne is fiery hot, small, and pointed. The Hungarian Wax is semi-hot, medium sized, and yellow.

VINE CROPS

CUCUMBER.—The vine crops will not cross pollinate in the field. Melons which taste like pumpkins are usually the product of a diseased vine. The vine crops are heat-loving plants and prefer a sandy soil. Manure is more important as a fertilizer for vine crops than it is for any other group of vegetables. Experiments by the Ohio Agricultural Station show that a ton of manure is equivalent to five dollars' worth of commercial fertilizer for the vine crops. The same experiment shows manure to be worth three dollars a ton for tomatoes, ninety cents a ton for cabbage, and only sixty cents a ton for sweet corn. Each ton of manure used should be supplemented with 75 pounds of 20 per cent superphosphate. The manure should be well rotted when the vine crops are planted. Green manures can be substituted for

barnyard manure. Everything possible should be done to assure a fast growing vine crop. Slow growth seriously interferes with production.

Cucumbers are planted in drills and blocked out later to one plant per foot of row. This blocking is done when the vines begin to run. Seed is covered $\frac{1}{2}$ inch deep. Cultivation should be light and frequent until the vines cover the ground. Unless young cucumbers are picked off as soon as they are 3 or 4 inches long the crop will be small. For slicing, the cucumbers should be removed before they show yellow color.

The earliest slicing cucumber is the Early White Spine. Early Fortune is a longer, darker, but later variety than the Early White Spine. Boston Pickling is recommended for pickles.



Fig. 8.—Early maturing varieties of watermelons can be successfully grown in Ohio.

WATERMELON.—Early maturing varieties of watermelon can be grown in Ohio. The watermelon crop is handled as is the muskmelon, the only difference being that it requires a longer season and more room. Four months of frost-free growing weather is needed.

Watermelon seed is planted 10 to 15 in hills 8 by 8 feet apart. They can also be drilled and blocked out 2 feet between plants when the vines begin to run. The recommended varieties are Harris' Earliest and Halbert Honey.

PUMPKIN.—The same culture used in growing watermelons may be used for pumpkins. Since they are somewhat harder than melons, it is safe to sow the seed earlier. The fruit stalk of a pumpkin is hard. Small Sugar and Winter Luxury are recommended varieties. The Table Queen is a new variety which is of unusual merit. It is small, productive, bakes well and is a good keeper.

SQUASH.—Squash are grown as are pumpkins. The bush types are planted 4 by 4 feet, the running types 8 by 8 feet. The fruit stalk of a squash is soft, spongy, and cylindrical. The Hubbard squash are highly preferred.



Fig. 9.—High quality muskmelons can be grown in Ohio gardens if insects and diseases are controlled. (See Ohio bulletin 76.)

MUSKMELON.—Bright clear weather at ripening time is conducive to high quality in melons, provided the vines are healthy (see Ohio Extension bulletin 76). A sandy loam soil is preferred for melons, but a good silt loam is satisfactory. Both soils should be fertilized and prepared as in the case of cucumbers.

Four-week-old melon plants grown in veneer bands or on inverted sods may be set in the field after the soil is warmed up well and all damage of frost is over. Seed is also sown directly in the field. The spacing is the same as for the cucumbers.

The culture of the muskmelon crop is the same as for cucumbers. A melon is ripe in the "full-slip" stage. The stem separates easily from the melon at this time.

The Golden Champlain is a home garden muskmelon worthy of trial. It is early and the flesh is salmon colored. Bender's Surprise, Tip-Top and Hearts of Gold are recommended varieties.

SWEET CORN

Any fertile soil should produce good sweet corn. The planting distance for the small eared varieties is 10 inches by 30 inches; for the large eared varieties the spacing is 10 inches by 34 inches. The first planting is made as early as April 20. The last safe date for planting sweet corn is July 1.

Sweet corn should always be planted in "blocks" of three or more rows to insure good pollination and well filled ears. Large, plump kernels will come up sooner and mature the crop five to six days earlier than smaller kernels of the same seed. Suckering does not pay usually.

Five varieties of sweet corn which are highly recommended include:

Whipples Early White—Early, large-eared white.

Whipples Early Yellow—Early, large-eared yellow.

Golden Bantam—Midseason, 8 rowed, high quality.

Country Gentleman—Late, excellent quality.

Narrow grain Evergreen—Late, white, large ear.

Bulletins for Vegetable Growers

Extension Bulletins and Circulars

Extension Bulletin 86, Potato Growing in Ohio
Extension Bulletin 76, Control of Garden Insects and Diseases
Extension Bulletin 75, Mexican Bean Beetle
Extension Bulletin 103, Growing Vegetable Plants
Extension Bulletin 109, Rhubarb Culture
Extension Bulletin 110, Vegetable Forcing in Ohio
Extension Bulletin 114, Tomatoes for Canning
Fertilizers for Vegetable Crops
Correspondence Courses

The bulletins and circulars mentioned above and prepared especially for Ohio growers may be had by writing to the Publications Department, College of Agriculture, the Ohio State University, Columbus, Ohio.

The following bulletins may be secured from the Ohio Agricultural Experiment Station, Wooster, Ohio.

Ohio Experiment Station Bulletins

Bulletin 408, Chemical Fertilizers for Greenhouse Lettuce
Bulletin 447, Paper Mulch for the Vegetable Garden
Bulletin 399, Relation of Weather to the Dates of Planting Potatoes in Northern Ohio
Bulletin 430, The Normal Multiple Sprouting of Potatoes
Bulletin 432, Ohio Potato Diseases
Bulletin 420, Fertilizers for Early Cabbage, Tomatoes, Cucumbers, and Sweet Corn
Bulletin 433, Farmers Produce Markets in Ohio

The College of Agriculture and the Experiment Station are your institutions. Call on them when wanting help.