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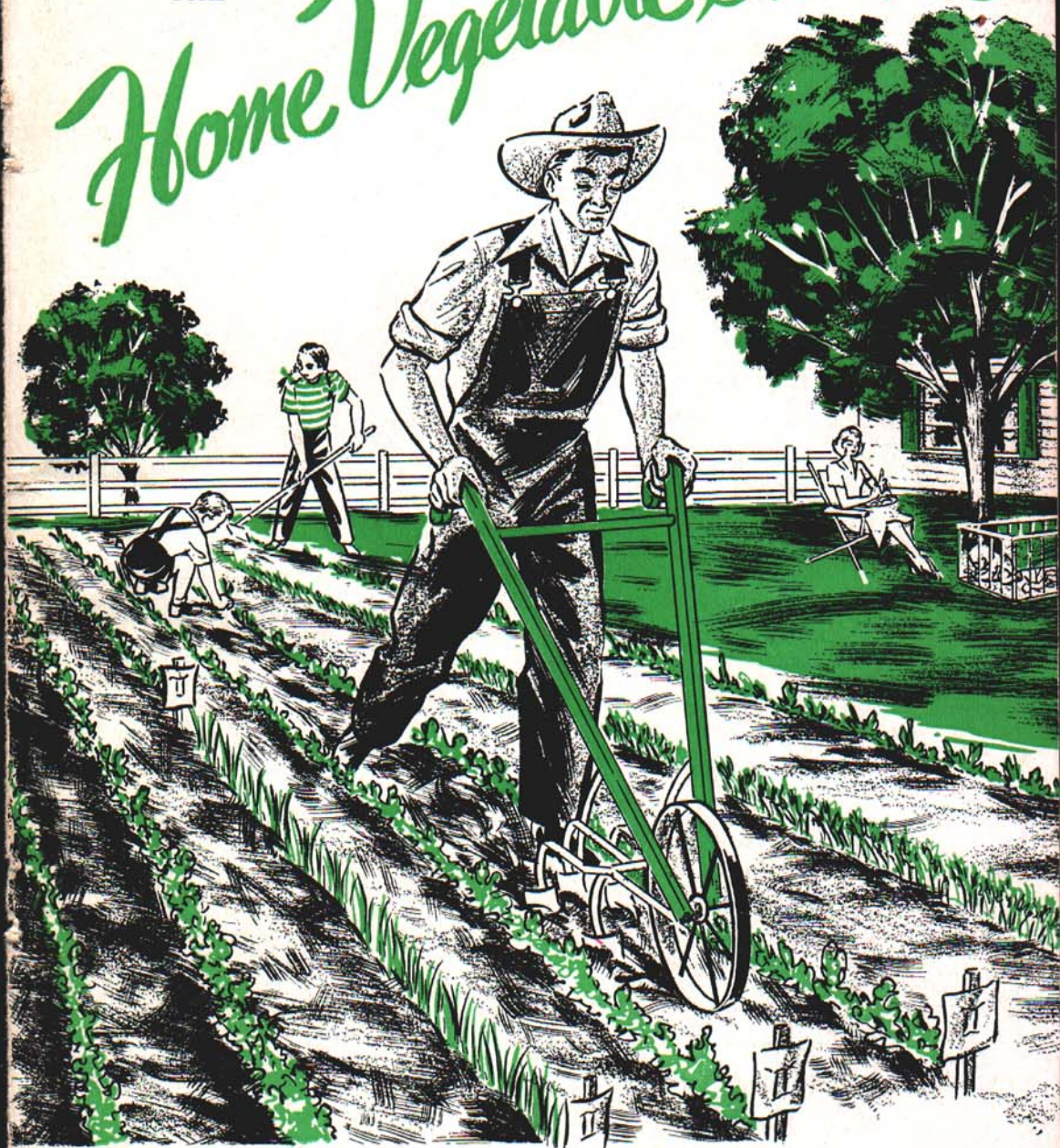
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The Home Vegetable Garden
Michigan State University Extension Service
Horticulture, Botany and Plant Pathology, Entomology, Farm Crops, Soil Science
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THE Home Vegetable Garden



MICHIGAN STATE COLLEGE
COOPERATIVE EXTENSION SERVICE
EAST LANSING

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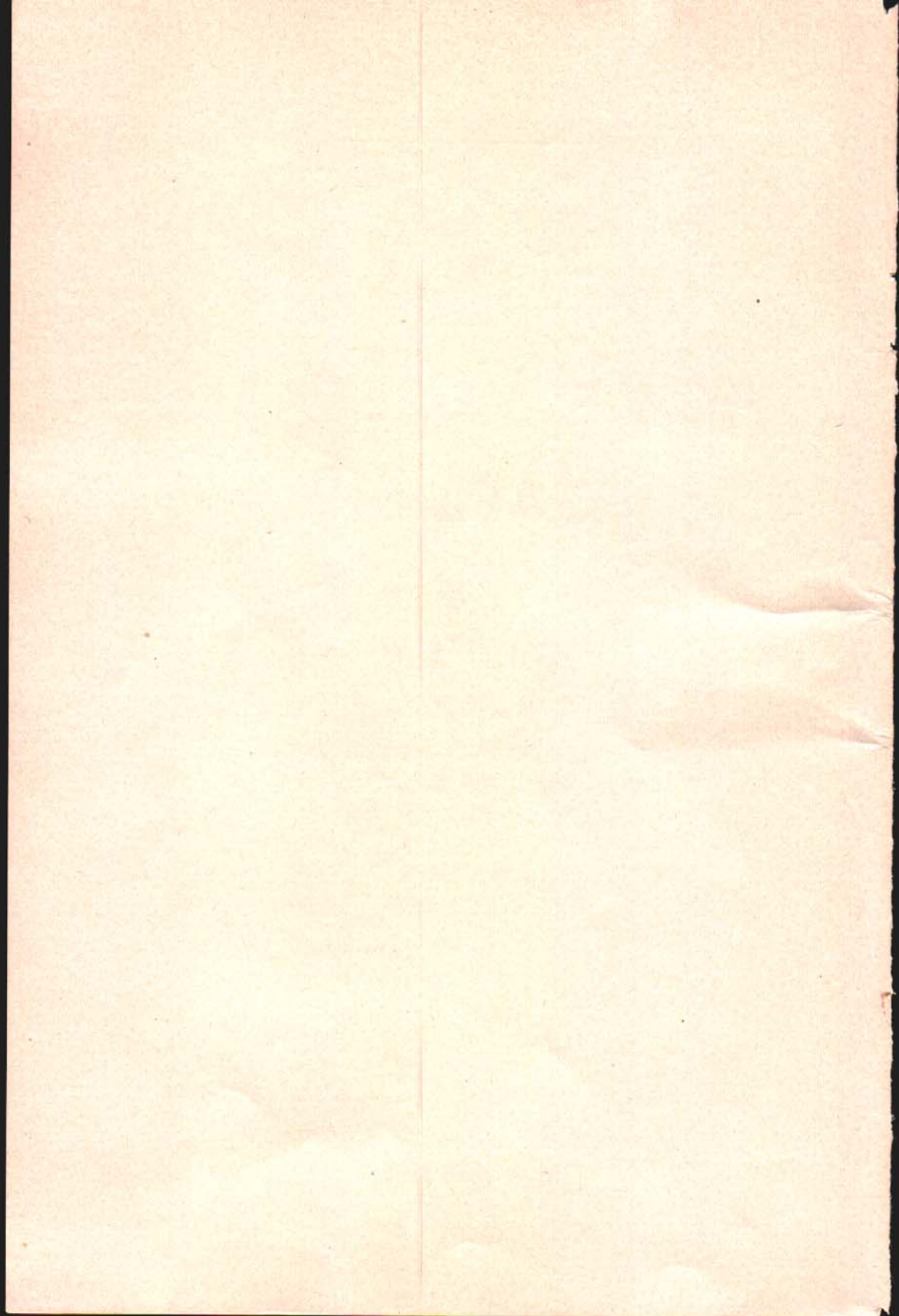
The HOME VEGETABLE GARDEN

Prepared by the

*DEPARTMENTS OF HORTICULTURE, BOTANY
AND PLANT PATHOLOGY, ENTOMOLOGY,
FARM CROPS and SOIL SCIENCE*

MICHIGAN STATE COLLEGE
COOPERATIVE EXTENSION SERVICE

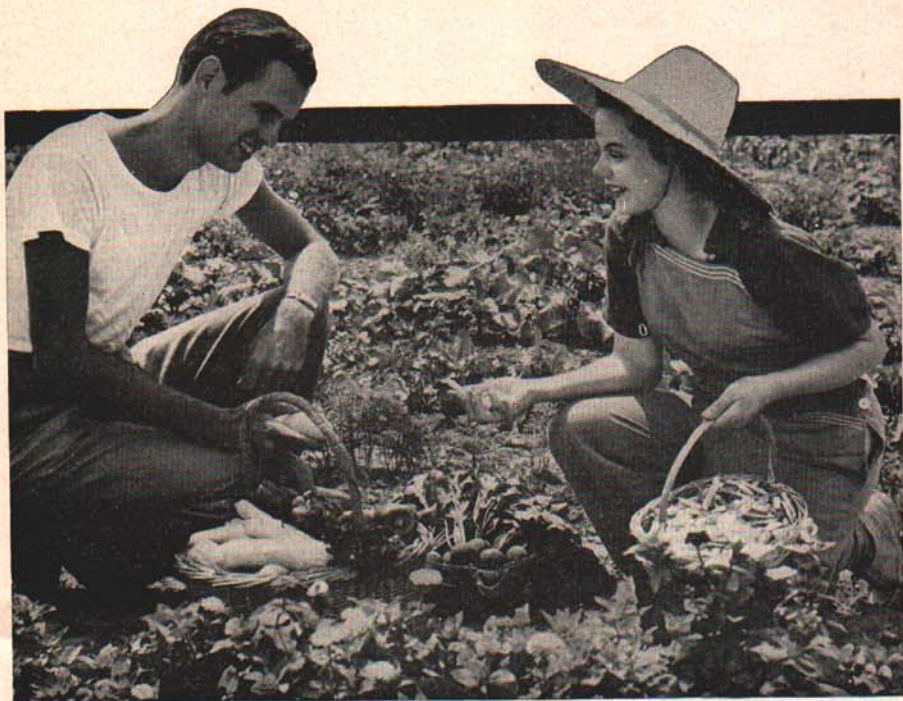
EAST LANSING



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Photograph: Ferry-Morse Seed Company

Fig. 1. The home vegetable garden provides both nutritious food and healthful exercise for the entire family.

The Home Vegetable Garden

Prepared by the DEPARTMENTS OF HORTICULTURE, BOTANY AND PLANT PATHOLOGY, ENTOMOLOGY, FARM CROPS, and SOIL SCIENCE

Gardening has assumed an important part in the American way of life. It has become important from the standpoint of producing nutritious and delicious food, because of the healthful recreation and exercise that it provides, and because it is one way families can stretch their food budgets. American housewives have learned that vegetables are never more tempting to waning appetites than when picked fresh from the garden and served to the family in the shortest possible time. How to provide the vegetables the family most prefers to eat is the purpose of this bulletin.

PLANNING THE GARDEN

In planning the home garden, many factors should be considered so as to insure maximum production from the land available.

During the winter months a plan of the garden should be prepared on paper, showing the location of each crop, the amount to be planted on each date, late crops that are to follow early ones, and companion crops that are to be planted together in the same area. In this way the greatest amount can be produced with the least effort, and the land used more efficiently.

A LARGE GARDEN

If the size of the garden is not limited by the amount of land available, it should be determined by the size of the family, their likes and dislikes, and the amount of each crop that can be consumed — fresh, frozen, canned or stored — throughout the year. Grow the things your family likes. Personal likes and dislikes will play an important part in deciding what to include in your garden and in determining the amount of each crop grown.

Variations in individual food habits and in the productivity of different

TABLE 1—Grow and can this amount for each member of your family

Crop	This Amount*	Should Produce†	Of Which, Can or Freeze
Snap Beans.....	50 feet	3 pecks	10 pints
Corn.....	100 feet	72 ears	12 pints
Tomatoes.....	50 feet	2 bushels	30 quarts‡
Greens.....	35 feet	20 pounds	5 pints
Broccoli.....	15 feet	15 pounds	8 pints
Lima Beans.....	50 feet	½ bushel unshelled	4 pints
Peas.....	100 feet	1 bushel	6 pints

Grow and store this amount for each member of your family

Crop	This Amount*	Should Produce†	Of Which, Store
Beets.....	25 feet	½ bushel	¼ bushel
Cabbage.....	35 feet	15 heads	10 heads
Carrots.....	35 feet	¾ bushel	⅓ bushel
Onions (dry).....	30 feet	½ bushel	¼ bushel
Potatoes.....	175 feet	3½ bushels	2½ bushels
Turnips or Rutabagas..	20 feet	⅓ bushel	¼ bushel

*The number of feet indicated is the total for all plantings of each crop, i.e., if three plantings of snap beans are made, the figure given is the total for all three.

†This includes the quantity used fresh as well as that canned or stored.

‡Includes juice and canned tomatoes. This quantity is recommended where citrus fruits may be unavailable. If plenty of oranges and grapefruit are available, this quantity could be reduced.

gardens make it impossible to provide an accurate list of every family's requirements. But Table 1 indicates the approximate number of feet of row necessary to produce enough of each crop for each adult member of the family for fresh use, and for freezing, canning or storing for use throughout the winter.

In addition to the vegetables liked best by the family, some of the less-known but highly nutritious kinds should be grown to establish a keener liking for them. Home-grown vegetables of this type frequently are more acceptable, particularly to children, than purchased ones, and the family may learn to like them in this way.

GARDENS OF LIMITED SIZE

If the garden area is limited, plant a balanced garden of those vegetables which will produce the greatest return in terms of nutrients per pound, production per square foot, and the number of hours of labor required to produce the crop.

The following list is suggested for the small garden:

Beans	Carrots	Spinach
Beets	Chard	Peppers
Broccoli	Lettuce	Radishes
Cabbage	Onions	Tomatoes (Staked)
Peas (if planted before May 1, and followed by later crops)		Turnips

Sweet corn is one of the borderline crops. Owing to the high quality of freshly harvested corn, nearly every gardener wants to include it in his plan. The amount of food value produced per square foot, however, is small compared with some of the other crops, and there is hardly room for it in a garden smaller than 25 by 50 feet. Although potatoes, lima beans, cucumbers, and squash are highly desirable, they require a considerable amount of space and, therefore, are usually limited to larger gardens.

Grow vegetables that are suited to your soil and to your local climatic conditions.

The amount of land available, the tools available, whether the land is to be cultivated by horse, tractor or by hand, and the amount of time that can be spent in it should all be considered when planning a garden. It is better to plant a smaller garden and take good care of it than to have a large one poorly planned and cultivated.

No one plan will suit the needs of any large number of families. The plans submitted here are typical ones, however, that will fit in many cases. If they do not seem to fit your conditions they may be modified accordingly.

When making your garden plan, follow these simple suggestions:

1. Arrange the crops that are to be planted first along one end of the garden.

2. Plant perennial crops such as asparagus, rhubarb and berries along one side of the garden.
3. Group together crops that will be harvested early so that after harvest the space may be used for later plantings.
4. Wherever possible, plant tall growing crops to the north or west of lower growing crops to avoid shading.
5. Include several kinds of vegetables — but choose them carefully.
6. If space permits, plant enough of each crop for freezing, canning and storing as well as for fresh use during the summer (see Table 1).
7. Allow ample space between rows for convenient cultivation, depending upon the type of tool to be used.
8. Don't plant too much of any one crop at one time, particularly radish, lettuce, kohlrabi, spinach and chard. Study the production records in the planting chart on pages 28-30.

THREE PRACTICAL PLANS

Plan I

PLAN I is for the city backyard garden, small but efficient. This 25-by-50-foot garden should produce all of the vegetables for canning, storing and fresh use — exclusive of potatoes and corn — necessary for two persons. It will require an average of one-half hour's work a day to obtain maximum production. To increase the production of this small garden, plant cucumbers and pole beans along the back fence, or on the trellis against the garage. Plan succession plantings carefully to assure crops in late summer and fall.

Since it is designed to produce the greatest variety and quantity of food per square foot, only 1 row of potatoes and 2 half-rows of corn are included for fresh use. To produce a year's supply of potatoes would require approximately 14 more rows, and to produce corn for fresh use and canning would require 6 to 8 rows more. Winter squash, pumpkins and melons have not been included because of the relatively large amount of space these vegetables would require.

Despite the fact that they do not produce as much food in a small area as many other vegetables, peas are included in this plan because they occupy the space only during the early part of the season and the entire area is devoted to later crops. Unless planted no later than the first week in May, however, peas cannot be included because they will not be harvested in time to plant the later crops.

A 25-BY-50-FOOT GARDEN

Radish (1)	Onions (1)		
	Lettuce (1)	(Carrots*) (5)	Onion Sets or Plants (1)
	Spinach (1)		
	Beets (1)	(Carrots*) (5)	
	Peas (1)	(Spinach*) (July Planting)	
	Peas (1)	(Beets*) (5)	
	Peas (1)	(Late Cabbage Plants*) (5)	
	Peas (1)	(Late Cabbage Plants*) (5)	
	Peas (1)	(Late Broccoli Plants*) (5)	
	Peas (1)	(Late Beans*) (5)	
Early Potatoes (1)	Fall Lettuce and Radishes (July Planting)		
	Chard (1)		
Radish (2)	Lettuce (2)	(Late Beans*) (5)	Parsnips (2)
	Early Cabbage Plants (2)		
	Carrots (2)	(Spinach*) (July Planting)	
	Early Beans (3)		
Sweet Corn (4)	Beans (4)		
Sweet Corn (4)	Beans (4)		
Interplant Radish (3)	Tomatoes (4)		
Interplant Lettuce (3)	Tomatoes (4)		
	Tomatoes (4)		
	Tomatoes (4)		
	Tomatoes (4)		
	Cucumbers† (4)		

Rows
18 in.
ApartRows
24 in.
ApartRows
4 ft.
Apart

*Those crops listed in parenthesis would be planted after the other crops had matured. To make this succession possible, peas must be planted before May 1.

†On fence or garage trellis as suggested on previous page.

The figures in parenthesis indicate planting dates as follows:

- (1) Very early—as soon as the soil can be worked. (3) 20 days after No. 1 planting.
 (2) 10 days after No. 1 planting. (4) As soon as danger of frost is past.
 (5) Late June planting—for fall.

Plan II

PLAN II is for the vacant-lot gardener. It requires a 50-by-100-foot area, with rows spaced 2 feet apart for small vegetables and 3 feet apart for the larger crops. If peas can be sown early they may be followed with late plantings of cabbage, beets, spinach, turnips, beans or other late crops as indicated. Such a garden should supply a family of three adults or two adults and two children with most essential vegetables, including corn and possibly enough potatoes, for the entire year. The care of it will require an average of less than an hour a day.

Plan III

PLAN III is a complete farm garden, with rows spaced far enough apart for farm equipment. Since the farmer usually has more land to use than time to spare, succession cropping and interplanting are not recommended. Late plantings for fall crops should not be overlooked, however. This plot should

A 50-BY-100-FOOT GARDEN

.....	Onions (1)			
.....	Lettuce (1)	(Carrots*) (5)	Spinach (1)	
.....	Beets (1)	(Turnips*) (5)		
.....	Peas (1)	(Beets*) (5)		
.....	Peas (1)	(Late Cabbage*) (Set Plants) (5)		
.....	Peas (1)	(Late Cabbage*) (Set Plants) (5)		
.....	Peas (1)	(Late Broccoli*) (Set Plants) (5)		
.....	Peas (1)	(Late Beans*) (5)		Rows
.....	Peas (1)	(Late Beans*) (5)		Apart
.....	(Early Beans) (3)	Early Carrots (1)	(Spinach*) (July Planting)	
.....	Early Cabbage (2)			
.....	Chard (2)			
(Interplant Radish) (2)	Parsnips (2)	Parsley (2)		
Fall Lettuce and Radish (6)	Early Potatoes (1)			
.....	Potatoes (2)			
.....	Potatoes (2)			Rows
.....	Potatoes (2)			30 in.
.....	Potatoes (2)			Apart
.....	Potatoes (2)			
.....	Potatoes (2)			
.....	Early Beans (3)			Rows
.....	Midseason Beans (4)			2 ft.
.....	Lima Beans (4)			Apart
.....	Lima Beans (4)			
Eggplant (4)	Peppers (4)			
.....	Cucumbers (4)	4 Hills Summer Squash (4)		Rows
.....	Tomatoes (4)			4 ft.
.....	Tomatoes (4)			Apart
.....	Tomatoes (4)			
.....	Corn (4)			
.....	Corn (4)			Rows
.....	Corn (4)			30 in.
.....	Corn (4)			Apart
.....	Rutabagas (5)			
.....	Late Carrots (5)			Rows
.....	Asparagus (1)	6 Hills Rhubarb (1)		5 ft.
.....	Asparagus (1)			Apart

*Crops listed in parenthesis would be planted after the other crop has matured. Peas must be planted by May 1 to make this succession possible.

The figures in parentheses indicate planting dates as follows:

- | | |
|---|---|
| (1) Very early—as soon as the soil can be worked. | (4) As soon as danger of frost is past. |
| (2) 10 days after No. 1 planting. | (5) Late June planting—for fall. |
| (3) 20 days after No. 1 planting. | (6) Early August planting for fall use. |

produce enough vegetables for a family of five for one year. The care of it would require approximately 92 hours, or an average of about one hour a day during the growing season with horse-drawn or mechanical equipment.

Minor crops in the garden such as parsley, chives, witloof chicory, endive, salsify and brussels sprouts can be included in the garden according to the gardener's preference.

A 120-BY-150-FOOT GARDEN

(Distance between rows may depend upon type of cultivator to be used. Most gardeners using horse-drawn or power cultivators prefer to space all rows the same distance apart.)

Asparagus.....		Rows 5 ft. Apart
	Bramble Fruits.....	
	Bramble Fruits.....	Rows 1-3 ft. Apart
Rhubarb.....	Strawberries.....	
	Strawberries.....	
Strawberries.....		Rows 3 ft. Apart
Strawberries.....		
	Onion Seed (1).....	Rows 4 ft. Apart
Onions (1).....	Early Carrots (1).....	
Peas (1).....	Spinach (1).....	Rows 5 ft. Apart
Peas (1).....	Radish (1) Lettuce (1).....	
Peas (1).....	Chard (1) Parsley (1).....	Rows 3 ft. Apart
Early Cabbage Plants (2).....	Lettuce (2) (6)..... Broccoli and Cauliflower (2).....	
Spinach (2) & (6).....	Late Cabbage (5) (Plants).....	Rows 4 ft. Apart
Midseason Cabbage Plants (3).....	Beets (2)..... Parsnips (2).....	
Early Green Beans (3).....	Early Sweet Corn (3).....	Rows 5 ft. Apart
Midseason Green Beans (4).....	Early Sweet Corn (3).....	
Midseason Green Beans (4).....	Late Sweet Corn (4).....	Rows 3 ft. Apart
Late Green Beans (5).....	Late Sweet Corn (4).....	
Late Green Beans (5).....	Late Sweet Corn (4).....	Rows 4 ft. Apart
Early Tomatoes (4).....	Canning Tomatoes (4).....	
	Canning Tomatoes (4).....	Rows 5 ft. Apart
	Cucumbers (4)..... Carrots (5).....	
Beets (5).....	Cucumbers (4)..... Turnips (5) (6).....	Rows 3 ft. Apart
	Winter Squash or Summer Squash (4).....	
	Winter Squash or Summer Squash (4).....	Rows 3 ft. Apart
	Pumpkin (4).....	
	Potatoes (2).....	Rows 3 ft. Apart
	Potatoes (2).....	
	Potatoes (2).....	Rows 3 ft. Apart
	Potatoes (2).....	
	Potatoes (2).....	Rows 3 ft. Apart
	Potatoes (2).....	
	Potatoes (2).....	Rows 3 ft. Apart
	Potatoes (2).....	
	Potatoes (2).....	Rows 3 ft. Apart
	Potatoes (2).....	

Numbers in parenthesis indicate planting dates as follows:

- | | |
|---|--|
| (1) Very early—as soon as the soil can be worked. | (4) As soon as danger of frost is past. |
| (2) 10 days after No. 1 planting. | (5) Late June planting—for fall. |
| (3) 20 days after No. 1 planting. | (6) Early August planting—for fall and winter storage. |

GARDEN CALENDAR

*To Remind You of Some of the Things To Be Done
Each Month in Your Garden*

Sowing and planting dates given are based on conditions at East Lansing. Adjust these dates by comparing the average date of the last killing frost in the spring and the first in the fall for your community with those indicated for Ingham County on the weather maps (pages 25 and 27).

January

Make your garden plan. Check your tools. Repair hose, sprayers, dusters, flats, etc. See that tools are dry and have a light coating of oil on all metal parts to prevent rust. Check the vegetables in the basement storage—destroy rotted ones

February

Order seeds. Get manure for the hotbed, or check electric heating cables if these are used for heat.

February 1 - February 10: Sow seed of celery indoors.

February 15 - March 1: Sow seed of onions, head lettuce indoors.
(If sown in hotbeds, delay until March.)

Check fertilizer and insecticide needs and buy quantities needed.

March

Treat seed to be sown indoors with fungicide. Sterilize your seed soil if possible. Start the hotbed.

March 1 - March 15: Sow seed of cabbage and broccoli indoors.

March 15 - April 1: Sow tomatoes, peppers, eggplant and cauliflower seeds indoors. Seed onions and head lettuce in hotbeds. Transplant and space plants grown from seed sown in February. Move all seed flats to hotbeds as soon as plants are up.

Clean up the debris, leaves and grass for at least 10 feet from the outer edge of the garden to avoid stalk borers. Be sure that all corn stalks are burned or buried to get rid of corn borers.

April

Spade or plow the garden.

Transplant and space in other flats those plants grown from seed sown in March.

Treat seeds with Arasan or Phygon before sowing.

Sow outdoors *as early as weather permits*: peas, onions, head lettuce, kohlrabi, spinach, carrots, beets, chard, parsnips, salsify, leaf lettuce, and radish. Set strawberry plants.

April 15 - April 30: Set out plants of head lettuce, early cabbage, onions, and broccoli. Cut and treat seed potatoes. Plant early potatoes. Dust with 5% DDT to prevent cabbage maggot on cabbage and cauliflower.

April 21 - May 1: Sow seeds of watermelon, muskmelon, cucumber, summer squash in strawberry boxes or plant-bands, in hotbeds or coldframes, to provide early crops. Set out plants of cauliflower.

May (After danger of frost)

Plant corn, beans, second plantings of radishes, leaf lettuce. Set out plants of tomatoes, peppers, eggplant, celery. Plant late potatoes. Thin and weed crops sown in April that need it at this time. Cultivate frequently. Cut asparagus. Spray or dust tomatoes, peppers, eggplant, and celery with copper and rotenone for leaf blight and flea beetle.

June

June 1 - June 5: Sow seeds of late cabbage, broccoli, cauliflower, brussels sprouts, for fall crops. Treat seeds with Arasan or Phygon. Make second sowing of corn and beans. Sow lima beans, soybeans, and pole beans. Sow seed or set plants of pumpkins, squash, melons, cucumbers.

Thin plants that need it. Stop cutting asparagus about June 20. Apply manure and fertilizer to asparagus.

About June 25, set out plants of late cabbage, cauliflower, broccoli and brussels sprouts. Make third sowing of beans, second sowing of beets and carrots. Sow rutabagas, kale, Chinese cabbage and endive for fall crops. Shade transplants after setting until well established. Stake pole beans and tomatoes.

Inspect undersides of bean leaves for Mexican bean beetle and spray or dust with rotenone when they appear. Be sure to cover undersides of leaves with insecticides. Spray or dust potatoes once a week with fixed copper for blight. Add 1 ounce 25% DDT to 2 gallons fixed copper for spray to control potato beetles. Prepared dusts containing fixed copper and DDT may be used instead of sprays.

Spray or dust corn with DDT for corn borer 5 times at 5-day intervals, starting June 10. Pull and destroy wilted cucumber vines to reduce spread of bacterial wilt.

July

Tie up cauliflower when heads are 1 to 3 inches across. Remove pea vines. To control corn earworms, add white mineral oil to DDT sprays when

first silks appear. Beans may be planted until July 10 in southern Michigan. Mulch tomato plants with straw or leaves. Seed turnips.

Dust or spray squash, cucumbers, muskmelon with mixture of fixed copper and calcium arsenate or fixed copper and rotenone. Cover joints of squash vines with soil to encourage rooting at each node. Pick and destroy tomato worms.

August

Sow radishes, lettuce, kohlrabi, spinach, and turnips for fall crops. If early cabbage starts splitting, twist heads a half to three-quarters turn to disturb roots. Harvest early potatoes.

Continue covering nodes of squash for squash vine borer. Watch for second brood of Mexican bean beetles — dust or spray with rotenone. Dust or spray cabbage, cauliflower and broccoli with rotenone to control cabbage worms as soon as white butterflies appear.

September

Harvest and dry shell beans. Cover tomato plants on frosty nights. Pick green-mature ones before freezing. Pot 2 or 3 plants of parsley and chives for winter use. Thoroughly clean the storage room and if possible fumigate it. Pick pumpkins and squash before hard frosts occur. Blanch endive. Strawberries can be set early this month.

Spray or dust broccoli, cabbage and brussels sprouts frequently with rotenone or nicotine for aphids. Pepper plants can be pulled and hung in the basement before freezing.

Pull onions as soon as tops die down. If they don't die down, break them over to mature the onions. Rye sown in vacant spots in the garden in early September will be 4 to 5 inches high by winter, and can be spaded under in spring to add organic matter.

October

Dig late potatoes. Dig carrots, beets, turnips, rutabagas, and salsify as late as possible, but before ground freezes. Pull late cabbage, celery and Chinese cabbage before freezing weather and replant in storage pit.

Do your fall plowing or spading. Plow or spade under debris, leaves, etc.

November

Dig chicory for winter forcing. Dig 5 or 6 rhubarb plants for winter forcing. Lay clumps on top of ground. Cover slightly with soil and allow them to remain there until they have frozen in December. Thoroughly clean and oil all tools, sprayers, and dusters and store in a dry place for the winter. Pull brussels sprouts and reset close together where they can be covered

with straw. They can be used at least until Thanksgiving. Dig parsnips and salsify to store for winter use. Those for spring use may be left in the ground.

December

Place chicory roots in boxes for forcing. Check over vegetables in basement storage. Destroy any that are spoiling. Take in rhubarb and start forcing it late in the month (*see rhubarb, page 85*).

SUCCESSION PLANTING

To be assured of a continuous supply of garden-fresh vegetables throughout the entire season, successive plantings of many crops must be made. Three or four small plantings of lettuce and radishes may be made at weekly intervals in early spring, and an additional one or two plantings in the fall. At least three plantings of corn and beans can be made between the date of the last killing frost and the last safe date indicated for your community on the weather maps. Cool-season crops, such as head lettuce, spinach, and peas, may be planted very early — and again in late summer for a fall crop.

At least two plantings of carrots, beets, and cabbage should be made — one early in the spring for summer use; another late in June for fall storage.

The following crops can be sown to follow each other in the garden, the later crops being planted after the early ones are harvested. Early lettuce, spinach, radishes may be followed by beans, beets and corn. Early peas may be followed by late storage carrots, beets, late cabbage or turnips. Beans, carrots, peas or beets may be followed by late turnips. Chinese cabbage, winter radishes and late turnips or late spinach can be planted after early beans, peas or early corn are harvested.

Study the planting and harvesting calendar for other combinations.

The planting chart (pages 28-30) indicates approximate planting dates for early and late crops of the more important vegetables. By studying it you can select crops that can follow each other. This chart is based on conditions at East Lansing. Adjust your planting dates by comparing the average dates of the last killing frost in the spring and the first in the fall for your community with those given for Ingham County as shown on the weather maps.

Through careful planning and companion cropping, production from the small garden can be greatly increased. Provided the soil is properly fertilized and water is available, frequently two or three crops can be grown in the same area: for instance, crops that mature quickly can be planted between the rows or in the rows with crops that occupy the space during the entire season. Lettuce and cabbage are often set alternately in the row, with radishes planted between the rows. The radishes and lettuce are out of the way before the cabbage needs the space.

Squash or pumpkins can be planted in early corn, if the corn is spaced

at least 3 feet between rows and single plants spaced 18 inches or more apart in the row. The stalks should be removed as soon as the corn matures, so as to make room for the squash.

In small gardens early beans, lettuce, radishes, or spinach may be planted between rows to be planted later in the spring to tomatoes, eggplant, late cabbage and melons.

Early peas may be planted between the rows being saved for later planting of tomatoes.

Radishes may be mixed with parsnip or carrot seed and sown in the same row. Since parsnips germinate slowly the radishes will help to mark the row and mature before the parsnips need the extra room.

While succession and companion cropping is recommended for the small garden, the practice makes heavy demands on the soil. Two crops cannot be successfully grown on the same land unless plenty of water is available, liberal amounts of fertilizer are used, and the best cultural practices employed.

THE GARDEN SOIL

A suitable soil is one of the primary factors in a successful garden. Sandy loams, loams, silt loams, and clay loams are satisfactory soil classes for garden purposes when well managed, although well-drained loams are preferred. It frequently happens, however, that there is little choice in the selection of a garden site and one must use the vacant lot or back yard which is available. Heavy clays and very sandy soils should be avoided if possible, but even these soils can be converted into acceptable gardens if there is not too much shade, or too many roots of trees or of other large perennials competing with the vegetables for moisture and plant nutrients.

If heavy, clayey soils must be used, they may be permanently improved by putting on a 3-inch layer of coarse sand, followed by some 3 inches of granular peat or rotted manure. Mix the two thoroughly into the top 3 or 4 inches of clay by plowing, spading, disking, or rototilling.

Very sandy soils warm up early in the spring and are easy to cultivate even when somewhat wet or dry, but do not hold much moisture and are deficient in plant nutrients. They will produce satisfactory gardens if fertilized and manured abundantly, and irrigated freely. For permanent improvement very sandy soils should be covered with 4 to 8 inches of loam surface soil, or by incorporating 2 inches of clay and 4 inches of peat or rotted manure into the top 3 or 4 inches of sand by plowing, spading, disking, or rototilling.

Adequate drainage is another essential of a good garden soil. If water stands on the soil for some length of time after a rain, drainage is needed. With a satisfactory outlet, drainage may be accomplished by tile lines or by means of shallow surface ditches. Tile drainage is preferred for a permanent garden since it provides for better soil aeration, deeper penetration of plant roots, earlier planting, and a better physical condition of the surface soil.

ORGANIC MATTER

Soils which contain a good supply of organic matter are more easily tilled and more productive than soils lacking this essential ingredient. Organic matter improves the physical condition of both sand and clay soils, supplies food and energy for soil bacteria, and acts as a storehouse for nitrogen and other plant nutrients which become available to the plants as the organic matter decomposes in the soil. Organic matter acts like a sponge, absorbing water when rainfall is plentiful and holding it to be used during dry weather. The action of organic matter is that of a binder, helping to hold and stabilize light sandy soils, and helping to make heavy, clayey soils more friable and more easily tilled. Soils which otherwise tend to bake and form hard crusts through which seedlings are unable to come up, crumble and break up into a granular structure when well supplied with organic matter.

Well-rotted barnyard manure or stable manure is the best source of organic matter for gardens. For best results it should be spread at the rate of one-half ton per 1000 square feet of area, before the soil is plowed or spaded, whether the soil is plowed in the fall or spring. Where the garden is large enough to use tractor or horse-drawn equipment, manure may be spread after the garden has been plowed and then disked into the surface.

Artificial manure can be made from straw, leaves, grass clippings, and waste plant material from the garden, provided it is free from disease and insect pests. Put down a layer of the material one foot thick over an area 6 by 6 feet. Sprinkle over this 5 pounds of fine lime and 20 pounds of 12-6-6 fertilizer and spray with water until thoroughly moistened. Add successive layers in the same way until the pile is about 5 feet high. When the pile is completed it should be straight-sided, and concave or saucer-shaped on top. The pile will decompose into manure, equal to good stable manure, in several months. The time required for decomposition will depend on the time of year. Usually synthetic manure is made early in the season and a year previous to using.

Shredded peat, granular muck, and sewage sludge may be used as substitutes for manure. Apply at least one ton of sewage sludge or 1 yard peat or muck to the 1000 square feet. Many mucks and peats are strongly acid, but the effect of these on soil reaction will be temporary and will not cause any damage.

Green manure crops offer another good way to build up the organic-matter content of garden soils. Rye can be planted in the garden about September 1, in areas from which the vegetables have been harvested and between the rows of late crops. The rye will make a growth of 6 to 8 inches in the fall, make a good winter cover crop, and tend to make the soil dry enough to work earlier in the season. It can be plowed or spaded under whenever the soil is fit to be worked in the spring.

Buckwheat, mixed Sudan grass and soybeans, mixed oats and field peas,

sweet clover, and in the southern counties cowpeas, are very good summer green manure crops. These can be used if the garden area is larger than is needed for the growing of the yearly supply of vegetables. They should be planted late in the spring. When they have reached a height of 2 to 3 feet, and before the seeds have matured, they can be disked down to kill the plants, leaving a plant mulch on the surface to prevent erosion losses during the winter. Plow under in the spring. An alternative procedure is to plow under the summer annual in late August, fit the seedbed and plant rye about September 1. Plow under the rye in the spring and fit the garden in the usual way.

Oats and peas may be seeded in the early spring to be plowed or spaded under in late June and followed immediately by a crop of buckwheat or soybeans.

Sweet clover, if planted in the spring on soils well supplied with lime, makes an excellent green manure crop. Plow it under the following spring after it has made 6 to 8 inches of growth.

Fertilize the leguminous green manure crop such as sweet clover with 10 to 15 pounds of superphosphate (0-20-0) fertilizer per 1000 square feet on heavy loam, silt loam, and clay loam soils. Use 0-20-20 fertilizer on light loam and sandy loam soils. Fertilize buckwheat, oats, and rye with 3-12-12 or 4-16-8.

All non-legumes such as rye, buckwheat, oats, and Sudan grass, should be top-dressed, either during their growing period or when incorporated with the soil, with one pound of actual nitrogen per 1,000 square feet of area. (One pound of nitrogen would be supplied by 5 pounds of ammonium sulfate, 3 pounds of ammonium nitrate, or 2 pounds of urea.)

SOIL REACTION AND USE OF LIME

Vegetables grow best on soils that are only slightly acid in reaction. Proper applications of lime made to acid soils will increase very materially the production of most vegetables. Too much lime in the soil may be just as bad as too little. Apply liming materials only if the soil test indicates a need. If the soil is thought to be acid, take a sample to the county agricultural agent or agricultural teacher to be tested before applying lime. The results of the test likely will be expressed in terms of "pH" or hydrogen-ion concentration. A pH reading of 7 indicates a neutral soil. The lower the pH, the more acid the soil. A reaction below pH 6 indicates a need for lime. The kind of liming materials to be used depends upon the location of the garden and the materials available in the community.

The amount to apply depends upon the reaction of the soil, type of soil, and the kind of liming materials used. County agricultural agents will advise the amount of lime to apply if needed.

The liming material should be spread evenly over the garden before

plowing or spading. If the plowing has already been completed, however, it may be applied afterward and worked into the soil thoroughly by hoeing, raking, or harrowing.

FERTILIZERS

All materials applied to the soil to furnish plants with nutrient elements, except animal manures and other organic wastes, are called "commercial fertilizers". The nutrient elements most likely to be needed in garden soils are nitrogen, phosphorus, and potassium. These nutrients are always given in this order in the analysis shown on the fertilizer bag. For example, a "4-16-4" is a fertilizer containing 4 percent of available nitrogen (N); 16 percent phosphorus, expressed as phosphate (P_2O_5); and 4 percent potassium, expressed as potash (K_2O).

Other chemical elements are needed by plants, but these are usually present in the soil; or they can be supplied in the fertilizer if desired. In some gardens, particularly in urban areas in Michigan, soils may be very alkaline due to the high lime-content in water used for irrigation. In such cases it may be necessary to use fertilizer with boron and manganese added. On the other hand, gardens on farms and soils that are not irrigated may be so strongly acid that lime is needed to correct acidity and supply sufficient calcium and magnesium, as recommended in the preceding section.

Commercial fertilizers should be used in gardens to supply an abundance of mineral nutrients, so as to insure the production of satisfactory crops of high quality. Manure is an excellent source of organic matter for garden soils, and usually is a good source of nitrogen and potassium — but is low in phosphorus. Nutrients from manure are more slowly available than in commercial fertilizers. The high availability of nutrients, especially nitrogen, in commercial fertilizer is very important in vegetable growing. Even when manure is used on the garden it is desirable to apply a commercial fertilizer containing some nitrogen and a high percentage of phosphate.

Fertilizers are available with a wide variation in the amounts of nitrogen, phosphate, and potash. Most commercial grades show no specified amounts of minor elements. A few trade-name products are now available that contain small amounts of the various minor elements. The kind of fertilizer to use on a garden will depend on the soil type and the previous treatment of the soil. In the commercial production of vegetables, soil tests can be made, usually through the county agricultural agent's office, and specific recommendations based on these tests can be made.¹

In home gardens where many kinds of vegetables are grown in a small area, under intensive culture, it becomes necessary to suggest practices that

¹A copy of Bulletin No. 159, "Fertilizer Recommendations," can be obtained from the office of the local county agricultural agent or by writing the Bulletin Office, Michigan State College, East Lansing.

are widely adapted and will be satisfactory for the crops that have large nutrient requirements, but will not be injurious to those with the lowest needs. It is possible to use too much fertilizer and thus injure crops.

Light soils, sandy and sandy loams in Michigan are frequently low in potash; fertilizer for vegetables grown on these soils should contain a high percent of potash. For satisfactory production, heavy soils, clays and clay loams usually require more phosphorus and less potassium. Fertilizers containing some nitrogen should be applied to both light and heavy soils.

Muck soils generally are high in nitrogen — except during wet, cool weather of spring — but lack phosphorus, and are usually very low in potassium. With these facts in mind, the following kinds and amounts of fertilizer or fertilizers with a similar analysis are recommended.

Light or heavy soils that have

been heavily manured . . .	0-20-0	25 lbs. per 1000 sq. feet
Light soils	4-16-16	40 lbs. per 1000 sq. feet
Heavy soils	4-16-8	40 lbs. per 1000 sq. feet
Muck soils	3-9-18	40 lbs. per 1000 sq. feet

MINOR ELEMENTS IN GARDEN SOILS

Garden soils may be deficient in manganese and/or boron for certain crops. Such deficiencies are not likely to occur when the pH is less than 6.5. Where the pH is higher than 6.5 manganese sulfate may be needed for beans, peas, and beets. A deficiency of manganese shows up as a fading of the green color in the leaves. The fading or yellowing occurs uniformly over the entire leaf, with the veins remaining green. An application of 2 pounds of manganese sulfate per 1,000 square feet is recommended on slightly acid and alkaline soils, pH 6.5 or higher (muck soils with pH 6.0).

Where the soil is neutral or alkaline in reaction — pH 7.0 or higher (muck soils pH 6.0) — borax is likely to be needed for spinach, beets, cabbage, cauliflower, broccoli, brussels sprouts, lettuce, turnips, rutabagas, and celery. The most noticeable symptoms of boron deficiency are black corky areas in the flesh of beets; rough cankers on the outside of beets; blackened small center leaves in the case of head lettuce; internal stem browning in cabbage, and cauliflower; and small deformed center leaves on spinach, and cracking of celery petioles.

The best insurance against a deficiency of boron on neutral and alkaline soils is to apply common borax. Arrange the garden so that the above-mentioned crops are together in one section. Apply common borax at the rate of 6 ounces per 1,000 square feet. *Borax should never be applied for beans or peas.* And if used where crops other than those listed as susceptible to boron deficiency are grown, use no more than 2 ounces per 1,000 square feet of area.

Copper deficiencies develop on muck soils that are more acid than pH 6.0. Applications of $\frac{1}{2}$ pound of copper sulfate per 1,000 square feet of garden on these soils are required for good vegetable production.

Borax, manganese sulfate, and copper sulfate, where needed, may be mixed with the fertilizer since it is very difficult to spread these small amounts uniformly.

METHODS OF FERTILIZER APPLICATION

Fertilizer may be applied in various ways with good results. Two-thirds to three-fourths of it may be broadcast before plowing or spading so that it becomes mixed with the soil to the depth to which the soil is worked. Since this is the region in which the roots grow most densely, it is an excellent place to have the fertilizer. The remainder should be applied in bands on both sides of the row, about 1 to 2 inches from the seed or roots of newly set transplants and 1 to 2 inches below the seed.

Many new garden seeders have fertilizer attachments which place the fertilizer in bands in this way, or fertilizer may be applied by hand in trenches along side the seed row prior to seeding. The fertilizer should not come into direct contact with the seed or plants.

SUPPLEMENTAL NITROGEN

Nitrogen deficiency² in crops is usually evidenced by a general yellowing of the entire plant, and by slow growth. If nitrogen deficiency is indicated by symptoms, sidedress the crop with one pound of nitrogen per 1,000 square feet. One pound of nitrogen is the amount contained in either of the following: (a) 5 pounds ammonium sulfate; (b) 3 pounds ammonium nitrate; or (c) a little over 2 pounds Nu-Green. Early peas, sweet corn, and leafy crops such as cabbage, cauliflower, celery and the greens usually benefit from nitrogen sidedressing.

STARTER SOLUTIONS

An all-soluble fertilizer high in phosphorus should be added to the water used in transplanting vegetable plants. This mixture of water and fertilizer is commonly termed a "starter solution". It may be applied to plants several times, at intervals of 2 to 3 days, beginning a week to 10 days before transplanting as well as in the transplanting solution. Starter solutions composed in large part of all-soluble phosphate may exhibit a pronounced influence on early growth and yields, regardless of other fertilizer treatment or natural soil productivity. The importance of available fertilizer, particularly phos-

²Crop nutrient deficiencies are fully described and many of them shown in colored photographs in Michigan Experiment Station Special Bulletin 353, "Nutrient Deficiencies Diagnosed by Plant Symptoms, Tissue Tests and Soil Tests." This bulletin may be secured from the Bulletin Office, Michigan State College, East Lansing, Michigan.

phorus in close proximity to the root systems of newly set plants, cannot be overemphasized. Phosphorus hastens maturity. It stimulates rapid early growth. The regeneration of roots lost in transplanting is hastened. Bud, flower, and fruit growth is increased.

In the usually cool, late spring in Michigan, soils release little or no phosphorus to young transplants with limited root systems. Absorption of phosphorus by the roots is greatly reduced. Thus growth and fruiting are delayed until the weather becomes warmer. Sufficient soluble plant food close to the roots will assist in promoting good growth of transplants, even in cool weather. This is the basis for using starter solutions.

All-soluble, dry-mix fertilizers high in phosphorus³ are best for preparing starter solutions. Usual recommendations consist of adding 1 to 1½ ounces of the dry but soluble fertilizer to one gallon of water, or 3 to 5 pounds to 50 gallons of water. One half to one pint of the solution is applied around the roots of each plant at the time of transplanting. Results equally as effective may be obtained if plants in bands or pots are thoroughly watered with the starter solution before transplanting.

TILLAGE

Coarse-textured soils, such as sands and sandy loams, which are well supplied with organic matter seldom present any tillage problems since they can be plowed, spaded and cultivated when somewhat wet or dry without harming their physical condition. These soils can be fitted for early planting, as they warm up early in the spring. If planted at the proper depth, even the smallest seeds can emerge from such soils without difficulty.

Fine-textured soils, such as silt loams and clay loams, present more of a tillage problem as they cannot be plowed, spaded, or cultivated when too wet or too dry without forming hard clods which are difficult to pulverize. Such soils should be plowed only when they will crumble into coarse granules. If they stick to the shoes or spade or plow, they are too wet to work. Immediately after plowing or spading in the spring they should be rolled and harrowed or hoed and raked. In spading small gardens it is well to use a spading fork. Turn over the soil so as to cover manure or vegetable debris, and then strike each forkful with the back of the fork to pulverize the soil. Fall plowing or spading of very heavy soils permits much pulverization through freezing and thawing, wetting and drying, and also permits of earlier planting in the spring.

Much can be done to control weeds in the garden before planting. Allow the weed seeds to germinate and produce an inch or two of growth, then cultivate and destroy them. Repeat this operation until time to plant that

³Approximately equal parts by weight of di-ammonium and mono-potassium phosphates provide an excellent dry-mixture for preparing a starter solution. This combination gives an analysis of 10-52-17 and such formulations or similar ones are available under the trade names of Take-Hold, Bonro, Armour's All-Soluble, etc.

part of the garden. If the garden is infested with quack grass, allow grass to grow until about 6 inches tall. Then spray with Maleic Hydrazide at 4-6 lb. per acre. $\frac{1}{2}$ lb. Maleic Hydrazide is sufficient to spray a garden 50 x 100 feet. The sprayed area must be plowed or spaded within 4 to 6 days after spraying for an effective kill. Gardens may be planted safely immediately after plowing.

TCA may also be used to control quack grass. One pound of TCA to two gallons of water is enough to spray an area 25 x 25 feet. A small garden sprayer of any sort may be used. Complete coverage of the grass is needed for best results. The sprayer should be cleaned thoroughly because TCA tends to corrode metals, and if the sprayer is used for other purposes, it should be rinsed several times with water. For best results apply this material in the fall (October or November).

Seedlings of vegetable crops such as carrots, lettuce, radishes, beans, cucumbers, onions, and parsley often have difficulty emerging through heavy clayey soils. In small home gardens this difficulty can be overcome in the following manner. With a hoe-handle, or other tool, mark out the row to the proper depth for planting. After dropping the seed, fill the seed row level with either sand, granulated muck, well rotted manure, or compost. The covering should then be firmed by using the back of the hoe or rake.

SOIL CONDITIONERS

Fine-textured soils not well supplied with organic matter are likely to develop a crusty surface, especially after heavy rains, which impede the emergence of small seedlings. Fine sandy loams, silt loams, clay loams, and clayey soils are the kinds most likely to be affected. Soil conditioners have been found to be quite effective in preventing this crust formation and the seedling emergence greatly improved where they have been used. There are two kinds on the market, the dry powder and the liquid forms. Apply the soil conditioner to the surface of the soil after the seeds have been planted. Mix with the surface $\frac{1}{4}$ inch by raking lightly with a fine-toothed steel garden rake, taking care to rake in same direction as the rows and not across them.

The dry powder may be dusted on the soil or mixed with screened dry soil and broadcast. The liquid can be sprayed on the surface or applied with a sprinkling can. For the most economical use of the soil conditioners, they can be applied in a band 3 or 4 inches wide directly over the seed row. No benefits have resulted from the use of soil conditioners where transplants are to be placed. Organic matter of all kinds, including leaves, garden refuse and manure, should be incorporated with the soil when available. It is an excellent natural soil conditioner.

MOISTURE CONTROL

Gardens not equipped for irrigation must rely on rainfall for their moisture supply. The moisture-holding capacity of garden soils can be appreciably increased by building up their organic matter content. Rain penetrates into soils that are well supplied with organic matter more readily than into soils with low organic matter content. The amount of runoff is reduced and the amount retained in the soil increased for crop use.

Mulches can be used to a good advantage in gardens which have been worked sufficiently to kill weeds. A mulch not only helps to prevent the surface soil from drying and cracking, but also helps keep the vegetables, especially tomatoes, clean. Straw, grass, shavings, sawdust, and hay may be used. Extra nitrogen may be needed where mulch materials are used.

It is best, where irrigation is available, to soak the soil thoroughly during dry seasons rather than to sprinkle the garden frequently. The sprinklers used for irrigation should apply the water only as fast as it can be absorbed by the soil, and the sprinkler should be allowed to operate in one place until the soil has been soaked to a depth of at least 6 inches. Water penetration into sandy soils is much faster than into clayey soils, therefore, the water can be applied at a much faster rate for a shorter period of time. However, irrigation will need to be repeated more frequently than on finer textured soils. Water should be applied slowly and for a much longer time on the finer textured soils. With fine-textured clayey soils which tend to bake and crack, it is desirable to cultivate or hoe when the surface soil has dried sufficiently after irrigation.

The foregoing system of garden irrigation tends to produce deep-rooted crops which are better able to withstand drought and therefore produce better vegetables. Frequent light sprinkling, on the other hand, which wets only a shallow depth of the top soil tends to produce shallow-rooted, poor quality crops. It is better not to irrigate at all than to irrigate unwisely.

The gardener who sows seed in hot, dry weather may have to hand-sprinkle the surface soil at frequent intervals in order to insure germination and give the seedlings a good start. Hand-sprinkling at other times almost invariably does more harm than good.

Water may be applied by an automatic sprinkler, or by removing the nozzle and allowing the water to run from the hose onto a flat board or stone, thus preventing washing. Shallow furrows running along the plant rows distribute the water where it is most needed and can be arranged to cover large areas at one setting.

Canvas hose is very satisfactory on most soils. Water is applied through a porous 2- to 3-inch canvas hose, which is laid along the row. It is fastened to a garden hose at one end and sealed at the other. The water is then turned on until the canvas hose becomes turgid, then the water pressure is

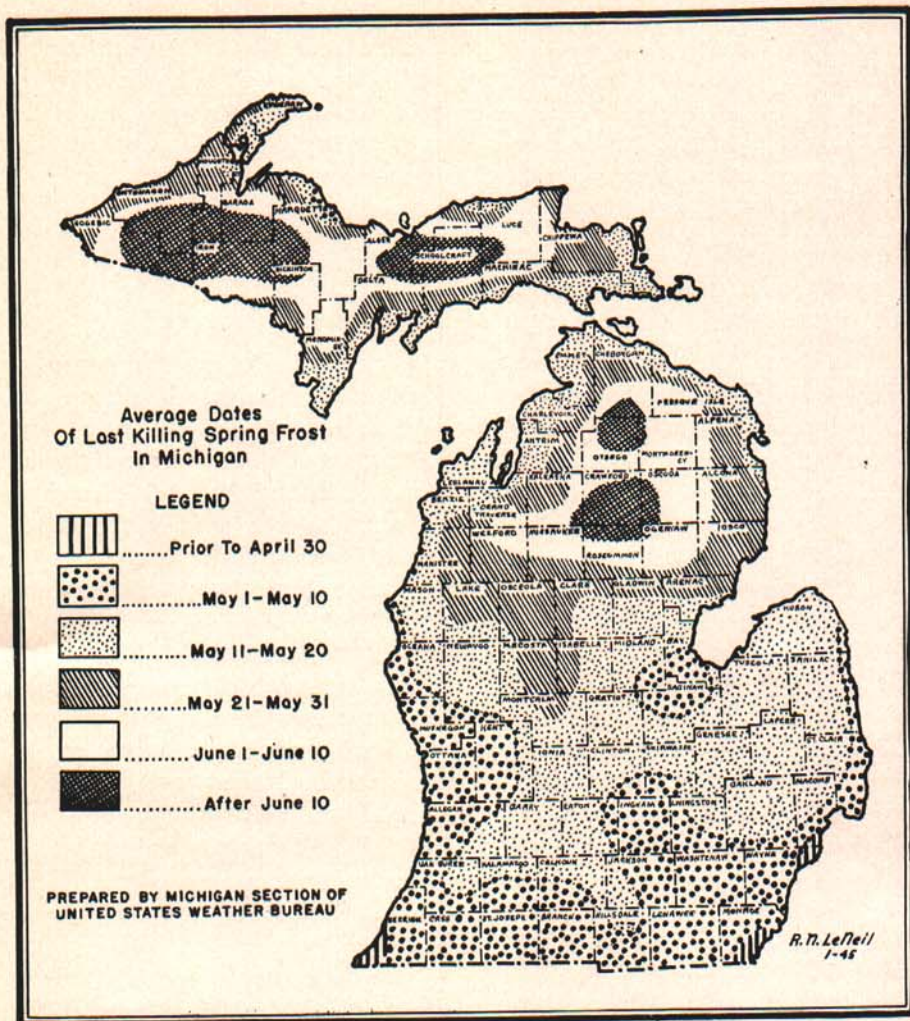


Fig. 2. Weather map showing average dates of last killing frost in the spring in Michigan.

turned down so that only enough is entering the canvas hose to keep it turgid. The water seeps out through the pores and slowly penetrates the soil.

On the farm garden where water under pressure is not available, furrow irrigation may be used. Water can then be pumped from a creek, well or dugout reservoir.

Regardless of the method of irrigating when water is applied, the soil should be thoroughly soaked to a depth of 5 to 6 inches. The ground should not dry out after such a wetting for at least a week. When it does, give it another thorough soaking.

During the early part of the season, rain and artificial irrigation may be followed by cultivation as soon as the soil is dry enough to work. Stirring the soil will kill the weeds that would otherwise start to grow after the application of water. Cultivation also prevents baking and on some soils helps conserve moisture. Overhead irrigation washes off fungicides and insecticides. It is best to apply these materials after sprinkling.

FROST DATA FOR MICHIGAN

A glance at the weather maps (Figs. 2 and 3) will give you some indication of the dates on which various crops may be planted. The first map (Fig. 2) indicates the average date of the last killing frost in the spring in the various areas in Michigan. It should be remembered that these are *average* dates and to be safe, tender crops like tomatoes and peppers should not be planted out until about a week or so later than the date given for your community, unless some type of plant protector is used or the plants can be covered when a later frost is expected. Hardy crops such as cabbage, broccoli, onion plants, etc., can usually be set out 3 to 4 weeks earlier than the date indicated for the last killing frost.

The second map (Fig. 3) indicates the approximate date of the average first killing frost in the fall. Use this map as a guide in determining the safe planting dates for fall crops. A few more days should be allowed for the maturing of such tender crops as beans so that a crop can be harvested. It should be remembered, too, that dry weather in midsummer sometimes delays the germination of seeds sown at that time, and that the plants develop more slowly in the cool weather of late fall.

STARTING EARLY PLANTS

Most home gardeners purchase their vegetable plants from a greenhouse or a reliable dealer since it is very difficult to grow satisfactory plants indoors. Some gardeners prefer to start their own plants, to be sure of having varieties they want or for the pleasure of growing them. This can be done if hotbed (Fig. 4) or greenhouse space is available.

Seed is usually sown in flats or shallow boxes 3"-3½" deep. A fine grade of vermiculite or expanded mica is an excellent material in which to start seed. Clean sand is also satisfactory. Sow seed in rows marked across the flat, dropping 6 to 8 seed per inch. Cover seed in sand to a depth equal to 2 to 3 times the diameter of the seed. In vermiculite cover to a depth 4 to 5 times the diameter. Caution must be used to avoid covering too deeply very fine seed, such as celery. Mark all rows with labels as they are seeded.

After seeding, water the flats carefully with a fine spray. Covering flats with burlap, cloth or paper will help to retain moisture while seed are germi-

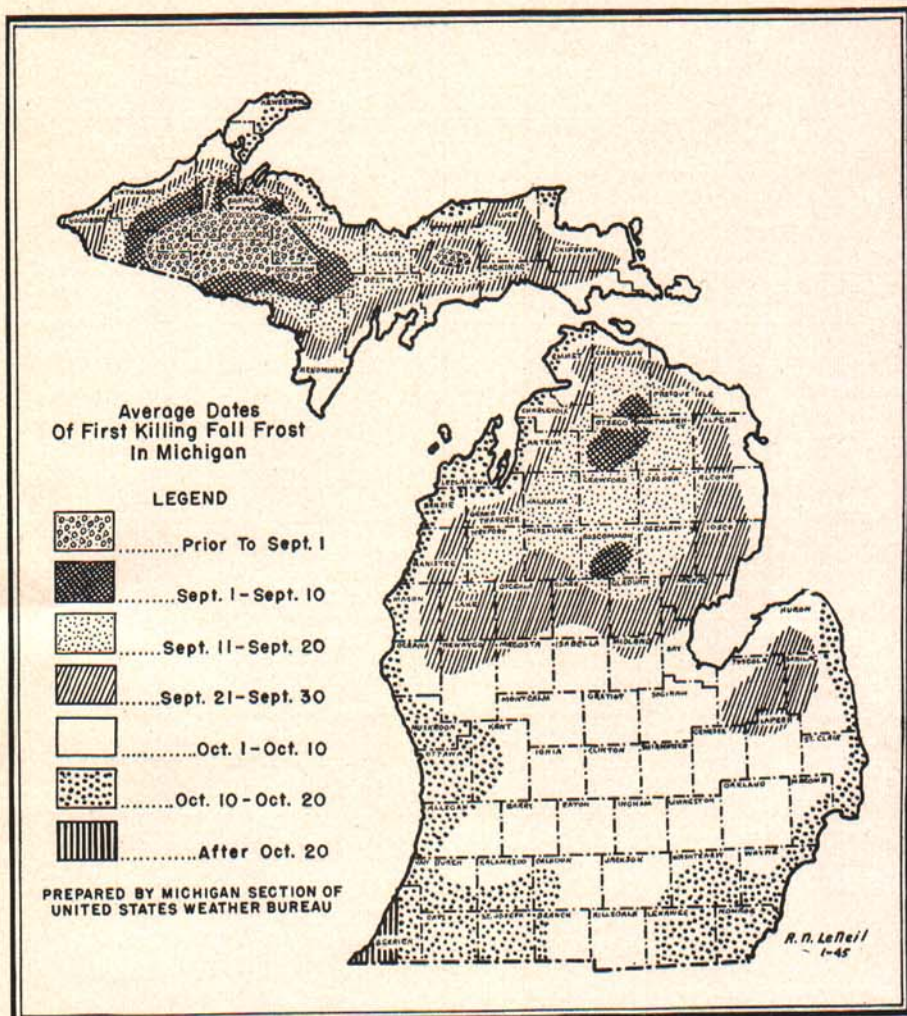


Fig. 3. Weather map showing average dates of first killing frost in the fall in Michigan.

nating. Remove covers as soon as first seedlings begin to germinate to prevent seedlings from becoming spindling.

Most vegetable seeds will germinate satisfactorily if flats are held at 75°-80° F. After seedlings appear, the temperature should be reduced to about 70° F. Growing seedlings must have good ventilation to prevent losses from fungus diseases.

When the seedlings are large enough to handle, transplant them to pots, plant bands or to other flats, allowing more space per plant. Flats or pots

PLANTING CHART

Vegetable	Amount Per Person	Estimated Production	Amount of Seed to Plant That Amount	Last Planting Date*	Days to Maturity	Depth to Plant (inches)	Distance Between Rows (inches)	Thin to	Planting Time†	Planting Date Indoors	Plant for Storage
Asparagus.....	20'	6 lb.	12 plants		2-3 yrs.	6-8	60	18-24"	1		
Snap Beans (early).....	15'	7 lb.	½ lb.		51-70 d'ys.	1-2	18-24	3-4"	3		
Snap Beans (midseason).....	15'	7 lb.	½ lb.		52-70 d'ys.	1-2	18-24	3-4"	4		
Snap Beans (late).....	15'	7 lb.	½ lb.	7/15	52-70 d'ys.	1-2	18-24	3-4"	5		
Pole Beans.....	15'	10 lb.	½ lb.	6/15	65	1-2	72	4-6"	3		
Lima Beans.....	50'	4 lb. shelled	½ lb.	6/1	65-88	1-2	24-30	6-8"	4		
Soybeans.....	50'	8 lb. shelled	¼ lb.	6/1	90-95	1-2	24	4-6"	4		
Beets (early).....	10'	10 lb.	½ oz.		50-55	½-1	18-24	2-3"	1		
Beets (late).....	15'	15 lb.	½ oz.	7/10	55-75	½-1	18-24	2-3"	5		6/25-7/10
Broccoli.....	25'	10 lb.	12 plants	6/25	60-80	Plants	30-36	24"	1-5	2/15-3/1	
Brussels Sprouts.....	25'	8 lb.	15 plants	6/10	90-100	Plants	24-30	18-24"	2-5	3/1-5/15	
Cabbage (early and midseason)...	12'	6 heads	6 plants		60-75	Plants	24-30	15-24"	1-2	2/15-3/1	
Cabbage (late).....	20'	9 heads	10 plants	6/25	80-100	Plants	24-30	15-24"	5		6/20
Chinese Cabbage.....	10'	12 heads	¼ pkt.	8/5	70	½	24-36	10-12"	5-6		
Carrots (early).....	10'	10 lb.	½ pkt.		70	½-1	18-24	1-3"	1		
Carrots (late).....	25'	25 lb.	1 pkt.	6/25	75	½-1	18-24	1-3"	5		6/25
Cauliflower (early).....	5'	3 heads	3 plants		55-65	Plants	30-36	18-24"	2	3/15-4/1	
Cauliflower (late).....	12'	5 heads	6 plants	6/25	55-65	Plants	30-36	18-24"	5	5/15	
Celeriac.....	10'	6 lb.	¼ pkt.		120	½	30	6"	2		

Celery (early).....	5'	10 stalks	10 plants		85-100	Plants	30-36	4-8"	2	1/25-2/10
Celery (late).....	10'	20 stalks	20 plants	6/10	85-100	Plants	30-36	4-8"	4	
Chicory.....	10'	5 lb.	½ pkt.	6/15	125-150	½	24	4-6"	2	
Chives.....	5'	3 lb.	½ pkt.	6/15		½	12-18	8-10"	1	
Collards.....	25'	20 lb.	½ pkt.	6/15	80	½	24-30	6-8"	2	3/15
Sweet Corn (early).....	25'	20 ears	½ lb.		65-98	2-2½	30-36	8-12"	3	
Sweet Corn (midseason).....	25'	20 ears	½ lb.		65-90	2-2½	30-36	10-12"	4	
Sweet Corn (late).....	50'	40 ears	¼ lb.	7/5	65-90	2-2½	30-36	10-12"	5	
Cucumbers.....	10'	6 lb.	½ pkt	6/25	50-80	1-2	48-72	12-24"	4-5	4/21-5/1
Eggplant.....	6'	12 fruits	3 plants	6/1	80-90	Plants	30-36	24-30"	4	3/15-4/1
Endive.....	6'	10 heads	10 plants	7/10	90-120	½	12-18	8-12"	1-5	
Kale.....	6'	6 heads	6 plants	7/15	50-80	½-1	18-24	8-15"	6	
Kohlrabi.....	12'	24 stems	24 plants	7/15	60-80	1-1½	18-24	4-8"	1-5	3/15-4/1
Leeks.....	10'	30	1 pkt.		110	½	15-18	1-2"	Sept.	3/15
Leaf Lettuce (3 plantings).....	5'	2½ lb.	1 pkt.	8/1	60-90	¼-½	6-12	6-12"	1-3-6	
Head Lettuce (3 plantings).....	15'	15 heads	18 plants	7/10	70-80	¼-½	15-18	8-15"	1-2-6	2/15/4-1
Muskmelon.....	16'	18 fruits	½ pkt.	6/1	85-120	1-2	48-84	3'-6"	4	4/21-5/1
Mustard.....	10'	5 lb.	¼ pkt.	8/10	35	½	18-24	1"	3	
Okra.....	8'	5 lb.	¼ pkt.		55-65	½	36	12-15"	4	
Onions (plants) or	30'	25 lb.	120 plants	5/15	90	Plants	12-18	2-3"	1	
(seeds).....	30'	25 lb.	1 pkt.	5/15	130	½	12-18	2-3"	1	2/20-3/1

*Planting dates are based on conditions at East Lansing. Adjust these dates to suit local conditions by comparing the average date of the first killing frost in the fall in your community with that in Ingham County as given on Weather Map No. 2.
 †(1) As soon as the ground can be worked.
 (2)—10 days after No. 1 planting.
 (3)—20 days after No. 1 planting.
 (4)—After all danger of frost is over.
 (5)—Late June for fall crops.
 (6)—July for fall crop.

PLANTING CHART (Continued)

Vegetable	Amount Per Person	Estimated Production	Amount of Seed to Plant That Amount	Last Planting Date*	Days to Maturity	Depth to Plant (inches)	Distance Between Rows (inches)	Thin to	Planting Time†	Planting Date Indoors	Plant for Storage
Onions (sets).....	10'	5 lb.	½ pkt.		100-120	½	12-18	2-3"	1		
Parsley.....	3 pl.		3 plants	6/10	65-85	¼-½	12-18	6"	1		
Parsnips.....	15'	15 lb.	½ pkt.	6/1	120-170	½	24	3-4"	2		5/1
Peas.....	100'	28 lb.	1 lb.	7/20	45-70	1-2	18-24	2-3"	1		
Peppers.....	10'	6 lb.	6 plants	6/1	65-75	Plants	18-24	14-18"	4	3/15-4/1	
Pumpkins.....	3 hills	30 lb.	½ pkt.	5/20	90-110	½	72-96	72-96"	4		
Radish (4 plantings).....	12'	8 lb.	1 pkt.	8/25	30-65	½	6-12	1-2"	1-3-6		
Rhubarb.....	9'	8 lb.	3 plants		2 yrs.	Plants	48	36-48"	1		
Rutabaga.....	15'	15 lb.	½ pkt.	7/1	80-100	½	18-24	6-10"	5		6/25
Salsify.....	15'	15 lb.	½ pkt.	5/15	140-150	½	15-18	3-4"	2		4/15
Spinach (early).....	10'	5 lb.	½ oz.		45-60	¼-½	12-18	3-6"	1-2		
Spinach (late).....	10'	5 lb.	½ oz.	8/10	45-60	¼-½	12-18	3-6"	6		
Summer Squash.....	6'	12 fruits	2 plants	6/15	60-80	1-1½	36-48	36-48"	4	4/21-5/1	
Winter Squash.....	12'	5 fruits	3 plants	6/1	90-120	1-1½	60-72	48-60"	4		5/20
Swiss Chard.....	8'	7 lb.	¼ pkt.	6/10	75-100	½	18-24	6-8"	2		
Tomato.....	40'	2 bu.	10 plants	6/1	70-100	Plants	36-48	36-60"	4	3/15-4/1	
Turnip.....	20'	20 lb.	½ pkt.	7/15	60-90	1-1½	18-24	4-6"	6		
Watermelon.....	15'	4 melons	½ oz.	5/20	100-130	1-2	72-96	72-96"	4	4/21-5/1	

*Planting dates are based on conditions at East Lansing. Adjust these dates to suit local conditions by comparing the average date of the first killing frost in the fall in your community with that in Ingham County as given on Weather Map No. 2.

†(1) As soon as the ground can be worked.

(3)—20 days after No. 1 planting.

(6)—July for fall crop.

(2)—10 days after No. 1 planting.

(5)—Late June for fall crops.



Fig. 4. A hotbed heated through a basement window.

should be filled with a soil mixture consisting of 2 parts garden loam or compost, 1 part peat moss, 1 part sand, 1 teacup complete fertilizer mixed and screened through a $\frac{1}{2}$ inch screen. Firm and level the soil in the flats. Be sure the soil in the pots and bands is well firmed before setting plants.

In transplanting, open a small hole in the soil with a stick or forefinger. Insert the seedling, with all the roots that can be kept intact, in the hole almost down to the seed leaves. Firm the soil well around the root and stem of the plant and water carefully. Shade during the first 48 hours after transplanting. Space lettuce, cabbage, cauliflower, broccoli, brussels sprouts 2 inches apart each way in the flat. Tomatoes, peppers, and eggplant should be transplanted into 3- to 4-inch plant bands, or into clay pots.

Sow celery indoors about February 1 to 10; onions and head lettuce, February 15 to March 1; cabbage and broccoli, March 1 to 15; tomatoes, peppers, eggplant, and cauliflower, March 15 to April 1; brussels sprouts⁴,

⁴Brussels sprouts and cauliflower may be sown directly out of doors in May for fall crops.

April 1 to 15, and again May 15; muskmelon⁵, watermelon, cucumber, summer squash, April 21 to May 1.

When transplanting them to the garden, the seedlings should be dug out of the flat carefully to avoid breaking the roots and the soil should be kept on them as well as possible. The soil should be watered 2 to 3 hours before the plants are dug so that it will adhere to the roots better, and so that the plants will have a chance to take up plenty of moisture and become turgid before transplanting.

PLANTING — SOWING THE SEED

It is desirable to plant in a freshly prepared seedbed; otherwise the weeds are likely to come up before the plants. Keep the ground worked where late sowings are to be made to prevent weeds from starting.

PLANT IN STRAIGHT ROWS — This will increase the attractiveness of your garden and make cultivation, insect control and harvesting easier. Use stakes, string and a yardstick. Follow your previously prepared plan. Shallow furrows, suitable for small seed, can be made by drawing the hoe handle along the line. (Fig. 5.) For deeper furrows, use a wheel-hoe or the corner of the hoe-blade.

⁵If muskmelon, watermelon, cucumber and summer squash are sown indoors, the seed should be sown directly in plant-bands, pots or strawberry boxes. They do not transplant well from flats.



Fig. 5. Make straight seed rows with a rake or hoe handle.



Fig. 6. For more uniform distribution, pour seed into palm of left hand; then distribute it with fingers of right hand.

PLANT AT PROPER DEPTH — In moist soil, cover small seeds such as spinach and lettuce with $\frac{1}{4}$ inch of soil. Medium-sized seeds, such as those of carrots and parsnips, are covered to a depth of $\frac{1}{2}$ inch. Large seeds such as those of peas, beans and corn should be covered with about an inch of soil. In light soils or when moisture is deficient, as it is likely to be in mid-summer, plant somewhat deeper.

SPACE SEEDS PROPERLY IN THE ROW — Plants that crowd do not develop properly. They also require more labor in thinning which may, unless carefully done when the plants are still small, damage those left. The seed can be distributed more evenly by pouring it out of the package into the palm of the left hand, then taking a pinch between the thumb and first finger of the right hand, and spreading it by rolling it out between the fingers. (Fig. 6.) Follow the planting directions on most seed packages. Mix some dry pulverized soil with small seeds, then spread them in the row with your fingers.

MARK ROWS — Some gardeners plant radishes thinly in rows with onions, parsnips, beets and salsify. The radishes germinate quickly and mark the rows. They mature early and are harvested before they compete seriously with the companion crops.

FIRM SOIL AFTER PLANTING — This practice packs the soil particles around the seed and hastens germination. It may be easily and quickly done with your hands or by light tamping with rake held upright.

TRANSPLANTING TO THE GARDEN

Unless great care is taken when transplanting vegetable plants, they may be so stunted that they will never fully recover and production will be materially reduced. The gardener who takes the following precautions will be well repaid for his trouble:

1. Seedlings should not be allowed to get too big before being transplanted.
2. Water the soil thoroughly before removing the plants, so that the soil will adhere to the roots.
3. Cut through the soil between the plants with a trowel or large knife about one week prior to transplanting.
4. Remove the plants carefully, so as to keep the soil around the roots.
5. Do transplanting on a cloudy day or in the evening if possible.
6. In hot weather shade the plants with paper cones, or shingles or boards driven into the ground on the south and windward sides. Wind will wilt seedlings as badly as sun.
7. Dig the hole large enough to accommodate the roots without crowding.
8. Set the seedlings of cabbage, cauliflower, kohlrabi, onions, eggplant, and peppers slightly deeper than they were in the flat. While good stalky plants should be used, if tomato plants have grown tall and spindling before transplanting, set them on an angle in a trench. They will root out along the stem. Lettuce and celery should be planted with the crowns just at the surface.
9. After setting the plant, fill the hole half-full of soil, then fill it the rest of the way with water. After the water and soil have settled, fill what remains of the hole with soil.
10. Firm the soil thoroughly around the roots when transplanting to exclude the air and conserve moisture.
11. A starter solution can be made by dissolving 1 ounce of an all-soluble, complete fertilizer high in phosphorus in a gallon of water. Apply it to such plants as cabbage, tomato, pepper and eggplant at the rate of 1 cupful to each plant as it is set in the garden to speed up recovery.
12. If dry weather follows transplanting, water the young plants thoroughly at least once a week. If the sun comes out bright, rake in some dry soil around the plants to keep that which has been soaked from baking.

PLANT PROTECTORS

Hot-caps and other types of plant protectors — such as hat-shaped, especially treated paper plant covers; or even paper or cloth cones covering single plants or entire rows — serve to protect the transplanted plants from wind, sun, and cold in early spring. By using such protectors, it is frequently possible to set plants in the open a week or two before it would be safe to do so otherwise. The added protection will also enable the plant to establish itself better and hasten its early growth. If paper cones are used, it is well to punch a small hole in the top to provide for the escape of moist air, especially after the weather starts to warm up.

Some growers place hot-caps over the seeds of melons, squash and similar tender crops to hasten their germination.

The use of plant protectors in the northern part of the state is highly desirable. They frequently hasten the crop just enough to mature it before fall frosts.

TOOLS AND THEIR CARE

For the small garden, only a very limited number of tools are necessary. A spading fork or spade, rake, hoe, hand cultivator, planting line, measuring stick, trowel, and a good sprayer or duster are all that are necessary in a garden of 2,500 square feet or less. In a large garden a wheel hoe or cultivator is a big help. In farm gardens a wheel seeder may be desirable.

High-quality tools, properly cared for and well sharpened, will make for much easier gardening. After use, shovels and hoes should be cleaned thoroughly and rubbed with an oily rag before being put away. If they have become rusty, soak them in kerosene, then polish with emery cloth and a wire brush. Hoes and spades can best be sharpened with a 10-inch file. Place the hoe handle in a vise or lean it against something to hold it steady, then file at an angle, against the cutting edge of the hoe, to produce a sharp edge at the front or inside. Never sharpen a hoe to a V-edge, for such an edge will cause the hoe to pull out of the ground. A spade, on the other hand, should be sharpened to a V-edge.

Sprayers should be emptied and cleaned thoroughly with water after each use. The leather plunger should be soaked with light oil twice or three times during the season. Use powdered graphite instead of oil on the rubber plungers in dusters.

CULTIVATION

Once the seed is in the ground, cultivation is one of the most important garden jobs.

Proper cultivation loosens the topsoil and permits the rain to soak in so that none of it is lost. It preserves moisture by killing weeds which if

allowed to grow, would rob the crops of both moisture and plant food. It aerates the soil so that beneficial bacteria will have favorable conditions in which to work. It improves the general appearance of the garden. (Fig. 7.)

Unless the soil is too wet to be worked, begin cultivation as soon as the rows of plants can be recognized, even though weeds have not yet appeared. Cultivate as often as necessary to keep weeds under control. Weeds are easily killed while they are small. If allowed to grow, they not only damage the plants but their control becomes a tiresome back-breaking job, and crops are more likely to be disturbed when weeds are pulled. As the season progresses, the cultivator should be set shallower and care should be taken not to get too close to the rows to avoid disturbing the plant roots.

In the farm garden, the work can best be done with either horse-drawn or power tools; in the medium-sized garden, with a wheel-hoe; in the small garden, with a hoe, hand-rake or weeder. Between-the-row cultivation should be supplemented by hand-weeding in the rows. Cultivate only the surface soil (as shallow as possible and still control weeds). Deep cultivation is harder work, injures plant roots, and dries out the soil.



Fig. 7. Shallow cultivation conserves moisture by eliminating weeds. Loose surface soil permits all of the rainwater to soak in.

THINNING

Thinning the seedlings in the row is one of the most important of garden operations. It is difficult to sow small seeds thinly enough to permit the plants to make their best development. The Planting Chart (page 28-30) gives the proper distances for plants to stand in the row after thinning.

Thinning should be done while plants are small and when the soil is moist, so they can be pulled out easily without injuring those that are left. Turnips, rutabagas and other root crops should be thinned before their taproots become fleshy. Onions from seeds and radishes can be left in the ground until those that are thinned out are large enough to eat.

Pull surplus beet plants when they are 4 to 5 inches tall and use for greens. Plants thinned from the turnip row may also be used for greens.

Carrots should be thinned first when they are 2 to 3 inches tall, so as to stand about 1 inch apart. They can then be left to develop until large enough to be eaten, when alternate plants can be pulled and used, leaving more room for those that are left.

SUPPORTING TALL-GROWING PLANTS

Some of the taller growing plants and vine crops will need a support of some kind to hold them erect.

To support pole beans and other similar plants, set 6-foot posts every 12-15 feet in the row and drive stakes about 12 feet from either end of the row. Stretch wire between the posts at top and bottom, extending the top wire beyond the end poles and fastening it to the stakes to serve as guy wires. Weave string between the top and bottom wires to support the plants.

Shorter plants such as peas can be supported in the same way, using 3- to 4-foot poles. If available, cut brush stuck in the ground along the row will serve as a satisfactory support for such crops.

Whether to stake tomatoes is a considerably argued question. Usually it is not necessary in Michigan if the soil under the plants is mulched with straw or grass clippings at the time that the plants start to vine out. This will keep the fruits off the ground and prevent rotting; it will also help to maintain an even soil moisture. If grass clippings are used, not more than an inch should be applied at a time.

If the tomato plants are to be staked, use stakes 1½ inches in diameter and 6 feet long. Drive the stakes before the plants are set. Space them about 24 inches apart in rows 3 feet apart. As the plant starts to grow, remove the small side branches as they appear so only one, or at most two, stems are allowed to develop. Don't remove the leaves on the main stem.

Although it is possible, with proper care, to produce more perfect fruits and to get an earlier crop if they are staked, the production per square-foot is less than when they are allowed to run.

CONTROLLING INSECTS

The owner of a home garden is obliged to contend with noxious insects without expensive machinery and without the privilege of crop rotation. A spray rig capable of delivering a spray at several hundred pounds pressure would be out of place in the small garden, but such a spray rig is essential for the control of several of the worst pests. The small garden is usually surrounded by weedy ground or by ordinary grass sod in which many pests thrive. The recommendations given here are not adapted to the growing of crops in large fields, and the doses recommended in the case of contact insecticides are increased to compensate for the lack of pressure with which they are applied. Those desiring a more comprehensive discussion on garden insects should consult Michigan State College Extension Bulletin E-312, "Insect and Disease Control on Vegetable Crops."⁶ No attempt has been made to include more than a few of the common pests in this discussion.

INSECTICIDES

There are plenty of garden insecticides for sale, but rotenone, pyrethrum, arsenicals, nicotine and other standbys still do the job satisfactorily.

Cryolite-containing insecticides in some cases will serve in place of arsenicals, but they do not mix with alkalis such as bordeaux mixture nor do they stick well.

These killing agents are suggested for control of insects in the garden.

CALCIUM ARSENATE⁷ — Calcium arsenate is commonly used as a dust in gardens against leaf-eating insects. It is mixed at the rate of 5 parts of arsenate to 95 parts of fresh hydrated lime or gypsum. After the two have been thoroughly stirred they may be applied with a manufactured duster or shaken onto the plant through a coarse cloth. The chemical is a *violent poison* and should never be used on plants like lettuce, Swiss chard, spinach, cauliflower, or similar plants where the tops are used for food.

DDT — Dusts and sprays containing DDT may cause residues. Some of the squash family are injured by DDT. Generally speaking, leafy vegetables should not be treated with DDT because it will not come off. It is for the above reasons that no general recommendation of DDT is made.

In cases where experience is sufficient, suggestions are made on the following pages for the use of DDT dusts and wettable powder sprays.

ROTENONE⁸ — Dusts containing derris or rotenone and sprays or dusts made from these products kill insects, but are comparatively harmless to human beings or warm-blooded animals. There are so many brands of

⁶This bulletin may be obtained without charge from your county extension office, or from the Bulletin Office, Michigan State College, East Lansing.

⁷Lead arsenate is often used instead of calcium arsenate.

⁸Rotenone-containing plant products are prepared from derris, cube, timbo, hiairi, barbasco.

rotenone-containing insecticides upon the market that it is impossible to give general directions; hence, the user must follow manufacturer's directions. A $\frac{1}{2}$ - or $\frac{3}{4}$ -percent rotenone dust is commonly used, but 1-percent rotenone is better, particularly for corn borer.

Rotenone preparations act slowly as a general rule, 48 to 72 hours commonly elapsing before the greatest kill is evident. Rotenone is most effective at temperatures above 70° F.

Ground derris containing 4-percent rotenone, when used at the rate of 1 pound in 20 gallons of spray with 1 pound of thoroughly dissolved mild soap, is an effective insecticide.

NICOTINE, usually sold as 40-percent nicotine sulfate, is commonly used as a spray against aphids or plant lice. It is always more effective if used in soapy water, or with some other spreader.

When dilutions are given on insecticide or fungicide containers in proportions—such as 1-100, 1-200, 1-300, 1-400, 1-500, 1-600, 1-800—the proper amount of killing agent for a given amount of spray can be found by tracing to the right from the dilution column in Table 3 to the column indicating the quantity of spray desired.

THE MOST COMMON GARDEN INSECTS

General feeding insects such as cutworms, wireworms, and white grubs attack all kinds of plants and must be considered in all gardening.

CUTWORMS are the larvæ of moths. They are thick-bodied and appear early in the season with enormous appetites. They are called cutworms because they commonly cut plants at or near the ground level. Cutworms work at night and are especially troublesome on all "set" plants such as tomato, cabbage, etc., particularly when they are first placed in the garden.

Cutworms may be controlled by dusting the ground around the plants with 5% DDT or by the use of poison bait. Baits may be purchased at stores handling gardeners' supplies or they can be made at home. Detailed

TABLE 3—Proportional dilutions for small quantities of spray*

DILUTION	QUANTITY OF SPRAY			
	5 Gallons	3 Gallons	1 Gallon	1 Quart
1-200.....	6 T.	4 T.	4 t.	1 t.
1-300.....	5 T.	3 T.	1 T.	1 t.
1-400.....	3 T.	2 T.	2 t.	$\frac{1}{2}$ t.
1-500.....	2½ T.	5 t.	1½ t.	$\frac{1}{2}$ -½ t.
1-600.....	2 T.	4 t.	1¼ t.	$\frac{1}{4}$ -½ t.
1-800.....	5 t.	3 t.	1 t.	$\frac{1}{4}$ t.

*Differences in bulkiness are responsible for seeming contradictions in dosage.

information on preparation and use of poison baits can be found in Bulletin E-312, "Insect and Disease Control on Vegetable Crops."

WIREWORMS resemble small, brown lengths of wire. They frequently attack many vegetable crops. No chemical treatment is dependable. Avoid infested land if possible. Land which has been in sod for several years is a favorite place for wireworms. If you have to use wireworm-infested land make sure that soil reaction and drainage are correct, and avoid planting root crops, especially potatoes. (See Bulletin E-312 for further details on wireworm control.)

WHITE GRUBS are another serious garden pest best treated by avoidance. White grubs are most commonly encountered in land recently in grass. They are white, heavy-bodied larvæ, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long with brown heads, incapable of straightening themselves. White grubs feed on the roots of plants and are especially troublesome on corn and potatoes. Beans, peas, tomatoes, beets, chard, and cole crops are troubled less than corn or potatoes.

Proper preparation of infested land to reduce damage by white grubs requires several diskings, or deep cultivations. Little else can be done. After 1 or 2 years cultivation, white grubs commonly disappear because the adult June beetles seldom deposit eggs except in grassy areas.




Fig. 8. White grub, larva of the June beetle.



Fig. 9. Cutworm feeding inside of onion bulb.





A CHECK LIST OF GARDEN INSECTS AND DISEASES

Vegetable	Disease Control		Insect Control	Illustration
	Disease	Seed and Field Treatment		
Beans, snap (45)*	Bacterial Blights Anthracnose Mosaic	Use blight-tolerant strains as: Improved Kidney Wax; Round Pod Kidney Wax Refugee Do not cultivate or pick them when plants are wet Use resistant varieties such as Rival, Ranger, Topcrop, Con-tender, Puregold Wax	Mexican bean beetle	 Mexican Bean Beetle
			Leafhoppers	
Beans, lima (50)	Seed decay	Dust seed with Captan or Arasan	Aphids	Nicotine
			Leafhoppers	5% DDT Dust
Beets (50)	Damping-off	Dust seed with Captan, Arasan, or Phygon	Beetles	Rotenone dust
			Cutworms	Poison bait
Broccoli Brussels Sprouts Cabbage Cauliflower (51) (52) (53) (50)	Damping-off Yellows	Dust dry seed with Arasan Use yellows-resistant strains of Cabbage (Wis. Golden Acre, Resistant Detroit, Marion Market, Wis. Ball-head). Do not use copper fungicides on this group of plants.	Aphids	Nicotine
			Cabbage worms	Rotenone dust
Carrots (57)	Damping-off	Dust seed with Captan, Arasan, or Phygon	Flea beetles	Never use arsenicals on cauliflower or broccoli, use calcium arsenate and gypsum on cabbage only.
			Maggots	Tar paper disks 5% DDT or 5% Chlordane Dust while plants are small.
			Carrot rust fly	Mid-season crop avoids fly

*NOTE: For complete descriptions of these diseases and insects see the discussion under each crop. Numbers refer to page on which complete description appears.



A CHECK LIST OF GARDEN INSECTS AND DISEASES (Continued)

Vegetable	Disease Control		Insect	Insect Control		Illustration
	Disease	Seed and Field Treatment		Control		
Corn, sweet (65)*	Seedling root rot	Dust seed with Captan, Arasan, or Spergon	Corn borer Corn ear worm	Rotenone 1% dust or 5% DDT dust Dust with 5% DDT	 Cucumber Beetle	
Cucumber (68)	Damping-off Wilt Mosaic	Dust seed with Captan, Phygon, or Arasan Control beetles and aphids	Aphids Cucumber beetles	Nicotine Rotenone dust Calcium arsenate-gypsum or 5% methoxychlor. Dust while plants are small.	 Flea Beetle	
Eggplant (70)	Damping-off Fruit spot	Dust dry seed with Captan, Phygon, or Arasan Spray with fixed copper fungicide if necessary	Flea beetles	Rotenone dust Bordeaux or fixed copper fungicides plus calcium ar- senate, or 5% DDT dust	 Onion Maggot	
Lettuce (72)	Damping-off Tip burn Drop	Dust seed with Captan, Phy- gon, Arasan Three or four years rotation on well drained soil	Leafhoppers	Pyrethrum, 1/10 of 1% Pyrethrins	 Aphid	
Onions (75)	Downy mildew Smudge	Good air and soil drainage Yellow and red varieties are resistant	Onion maggot	¼ pint dormant oil in 1 gal. water. Pour along row. Do not spill oil on plant. OR Rotenone or 5% chlordane dust. Repeat every 5 days for 6 treatments.		

Peas, green (78)	Damping-off	Dust seed with Captan, Phygon, or Arasan	Aphids Weevils	Rotenone dust 5% DDT dust
Potatoes (81)	Scurf Scab Early Blight Late Blight	Plant certified seed Spray or dust when plants are 4 inches tall and repeat at intervals of 10 days with a fixed copper material; follow manufacturer's directions	Potato beetle Flea beetles Leaf hopper	5% DDT dust 3%) or 5% DDT dust
Rutabagas (85)	Few diseases in home garden cause damage		Maggots	Rotenone. Methoxychlor, 5% dust. 1 pt. dormant oil in one gal. water. Pour along row. Do not spill oil on plants.
Spinach (86)	Damping-off	Dust seed with Arasan, or Phygon	Cabbage worms	Rotenone dust
Squash (87)	Few diseases in home garden cause damage	Dust seed with Arasan, or Phygon	Aphids Cucumber beetles Squash bugs	Rotenone dust Gypsum plus calcium arsenate. Rotenone. Trap adult bugs under shingles and hand-pick. Destroy eggs. Nicotine kills young bugs. Cover bugs 1 inch deep with soil.
Tomato (88)	Damping-off Leaf spots	Dust seed with Captan, Arasan, or Phygon Spray or dust with fixed copper materials or Zineb	Tomato Hornworm Cutworms	Lead arsenate or 5% DDD (TDE) dust Hand-pick Paper collars Poison bait, or DDT dust



Potato Beetle



Maggot



Squash Bug



Tomato Hornworm

*NOTE: For complete descriptions of these diseases and insects see the discussion under each crop. Numbers refer to page on which complete description appears.

KEEPING PLANTS HEALTHY

It is better to prevent diseases than to try to cure them. The following simple suggestions will help materially to avoid the more common plant diseases.

1. Rotate the crops within your garden.
2. Grow disease-resistant varieties.
3. Use treated seed if possible.
4. Sow thinly — thin properly.
5. Provide good drainage.
6. Stay out of the garden when the plants are wet. (This particularly applies to beans.)
7. Spray or dust with fixed copper or Zineb each week during the growing season.
8. Keep insects under control.

SEED TREATMENTS TO PREVENT SEED DECAY AND DAMPING-OFF

Arasan, Phygon, Captan, and Cuprocid are effective in controlling seed-borne diseases, such as damping-off or seedling rot. Follow the manufacturer's recommendations as printed on the container. Treated seed should not be used for human food nor fed to poultry or livestock.

SPRAYS AND DUSTS FOR FUNGOUS DISEASES OF THE LEAVES

FIXED COPPER FUNGICIDES — Fixed copper fungicides may be used in place of bordeaux mixture and copper-lime dusts. They do not require the addition of lime. These materials can be purchased in powder form (to be diluted in water) from dealers in spray materials. Follow the manufacturer's directions.

COMMERCIALY PREPARED COPPER DUSTS — Commercially prepared copper dusts also may be used instead of sprays. These should be used according to the manufacturer's directions. They may be obtained from the dealers who handle spray materials.

CULTURAL DIRECTIONS FOR VEGETABLE CROPS

ASPARAGUS

RECOMMENDED VARIETY: Mary Washington

A row of asparagus 100 feet long (50 plants) will supply the needs of the average family both for fresh use and for freezing or canning.

Asparagus needs a well-drained location where water will not stand during the spring. For best results, the soil should be spaded to a depth of 12 to 15 inches and a good application of manure worked in. Dig a trench about 6 inches deep and 6-8 inches wide; set the plants 18 to 24 inches apart in this trench. Spread the roots out carefully, then cover them with about 1½ inches of soil. After the first shoots have emerged, gradually fill the trench level-full.

Edible spears should not be cut the same year the plants are set, and not more than two or three spears should be cut per plant the second spring. The third spring the spears can be cut for a short period of approximately 3 weeks, whereas, during the following years harvesting may continue until late June. After the tops have been killed by frost, they may be cut and added to the compost pile. In order to compensate for this loss of organic matter, well-rotted manure and a complete fertilizer should be applied the following spring, at the rate of 3 to 4 pounds per 100 square feet.

Asparagus is harvested by cutting with a knife or by snapping. This latter method involves grasping the tip of the spear with the thumb, index, and third fingers, and pushing forward until the spear breaks. Asparagus is harvested when 6 to 8 inches in height. If stalks are not to be used immediately, set them cut-end down in a pan of water in a cool place.

Insects

The *asparagus beetle* chews the shoots just as they appear and also lays small brown eggs on them. A rotenone dust or spray is the proper treatment for the spears. Trap plants every 10 feet or so are sometimes left and thoroughly treated with insecticide. The fern growth can be sprayed or dusted with either DDT or rotenone.

Diseases

Rust is the most common disease of asparagus. Small pustules filled with a reddish or black dust are found on the needles and twigs of the plant. Disk under or remove all asparagus debris from planting along with any infected plant parts. Burn the material if it is not disked under, or placed in compost pile.

BEANS (SNAP)

RECOMMENDED VARIETIES:

Bush Green: Rival; Top Crop; Contender (oval pod)

Pole Green: Kentucky Wonder

Wax: Pencil Pod; Kidney Wax; Puregold

For freezing: All of the foregoing varieties are recommended for freezing.

Snap beans should not be planted until the soil has become warm and the danger of frost is past. They can be planted at 10-day to 2-week intervals

thereafter until about July 15 (in the vicinity of Lansing), to provide continuous production. For green use, the pods should be picked while they are young and succulent, before the seeds have started to mature. They should be picked frequently to keep the plants producing freely.

Sow the seed 2 inches apart in rows 2 feet apart. Do not place commercial fertilizer under the seed when sowing but rather, sow the seed in the row, then open small trenches about 2 inches from the row on either side and apply the fertilizer in these trenches at the rate of 1 pound for each 30 feet of row.

Pole beans are increasing in popularity among Michigan gardeners. They are very desirable for small gardens, because they can be grown on trellises or frames and their production per square foot of ground area occupied is greater than for bush beans.

They may be sown in rows spaced 6 feet apart, and thinned to stand 4 to 6 inches apart in the row. Or they may be planted in hills spaced 3 feet apart in triangular formation, so that the vines can be supported on poles tied together at the top and with the base of the poles stuck in the ground, one in each hill. If they are planted in rows, the vines may be supported by brush or tied up as described under the section on "supporting plants."

Insects

BEAN MAGGOT — Probably the most serious pest of beans in Michigan is the bean maggot, which works upon the plants as they come to the surface.



Fig. 10. Very young bean plants attacked by bean maggots.

(Fig. 10.) This insect is especially troublesome in wet seasons. Control can be brought about through cultural practices, and it is usually sufficient to observe the following precautions: Use well-rotted manure rather than fresh manure; see that the soil is well compacted, and if the season is wet, plant the beans less than an inch deep. During a dry season, maggots are not likely to appear, and after the beans get nicely started the danger from the maggot is over for the season. Reseeding immediately after damage usually gives a good stand. Treating seed with Lindane before planting has helped to control this insect.

BEAN WEEVIL — This insect passes the winter in dried beans, usually in cavities scooped out in the seeds. When spring comes, if such beans are planted, the beetles will feed on the young bean plants until the pods are formed, after which eggs are laid in holes chewed by the female in the pod. (Fig. 11.) The minute grubs that come from these eggs scatter themselves through the cavity in the pod and eat their way to the inside of the seeds.



Fig. 11. Eggs of bean weevil (enlarged 50 times) and adult bean weevils (enlarged 9 times).

- Here they continue to feed, becoming finally about one-eighth of an inch long. The pupal stage is passed in the larval cells and it is usually as larvæ or pupæ that they go into storage when the beans are harvested.

They continue to breed in the dried seeds and are usually carried to the field at planting time. No buggy or weevily seeds should ever be planted without first fumigating them, for it is in this way that the weevils survive. A good way to store a small amount of seed beans from season to season is in dry, air-slaked lime, used at the rate of 1 pound of lime to 2 pounds of beans.

MEXICAN BEAN BEETLE — Mexican bean beetles are frequently troublesome on snap beans. Both larvæ and adults attack the bean plant, feeding

freely on the pods, stems and leaves. These insects work on garden beans, cow-peas, soybeans, and beggar tick, and may eat alfalfa, clover, vetch, and field beans.

Mexican bean beetles have never been much of a pest on field beans. Like many other serious garden pests, the insects pass the winter as adults on the ground, hidden away under trash and rubbish. The adults are one-fourth inch long and range from yellow to a copper-brown color. Each wing-cover is marked by eight small black spots. The Mexican bean beetle attacks beans shortly after they come up, and lays eggs on the under surfaces of the leaves. (Fig. 12.) The eggs are laid in clumps and are yellowish in color. From these eggs hatch yellow, spiny larvæ which reach a length of one-third of an inch or more. Each bears upon its back six rows of black-tipped spines.

In the case of garden beans, it is sufficient to spray or dust with one of the many brands of pyrethrum or rotenone insecticides now on the market. These sprays or dusts should be repeated every 10 days when necessary and continued as long as the insects are present. It is essential to direct the sprays or dusts so as to cover the under surfaces of the leaves. Use sprays according to manufacturers' recommendations. Rotenone dust, $\frac{3}{4}$ of 1 percent, is the proper strength to get results in controlling this pest. A $\frac{2}{10}$ of 1-percent pyrethrins dust will accomplish the same purpose. DDT is not as effective as rotenone on Mexican bean beetles.

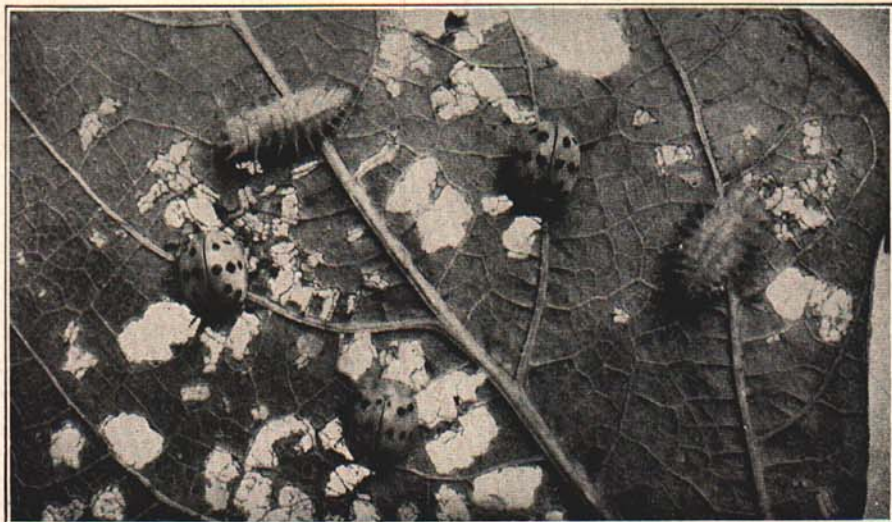


Fig. 12. Larvae and adults of Mexican bean beetle, with their work. Natural size (from bureau of Entomology, U.S.D.A.).

Diseases

Anthracnose and *bacterial blights* are the most serious diseases of snap and dry beans. Both diseases are carried in or on the seed. The anthracnose first appears as a reddish brown spot on the seed leaf, followed by similarly colored lesions on the veins of the leaf. Circular or irregular dark red to almost black spots with lighter centers are formed on the pods. Bacterial blights also appear first on the seed leaves as a yellowish brown blotch. On the leaves, small water-soaked areas are formed. These later dry out and break away. In a small garden, infected plants may be pulled and burned. These diseases are spread by splashing rain and cultivating while the plants are wet. Do not pick or cultivate beans while they are wet from rain or dew. Plant clean seed showing no discolored spots.

Mosaic is another important disease of beans which is seed borne. Use mosaic resistant varieties such as Rival, Ranger, and Topcrop.

BEANS (EDIBLE SOY)

RECOMMENDED VARIETIES:

Bansei
Giant Green

Edible soybeans, because of their high food content, are becoming more popular in Michigan gardens.

The seeds should be sown after danger of frost is past in the spring. They respond well to fertilizer applications and will grow on most soils. The plants grow to a height of about 2 feet. Soybeans can be used while still green if picked after they have filled out well. They also may be preserved by canning or in the frozen food locker at this stage, or they may be allowed to mature on the plant and stored dry for winter use. The green beans can be shelled out more easily by placing the pods in boiling water for a minute or two before shelling. The dried pods can be placed in a cloth bag, then stepped on until the pods are thoroughly broken up. They are then placed in a tub of water. The beans will sink and the debris will float out. The shelled beans should then be thoroughly dried before storing for the winter.

Insects

See Snap Beans, page 46.

Diseases

Generally disease-free.

BEANS (LIMA)**RECOMMENDED VARIETIES:**

Peerless
Bixby
Fordhook 242

Cultural conditons for lima beans, both bush and pole, are much the same as for snap beans. To insure good germination, the seeds should not be sown until the ground has become warm — usually after May 20 in central Michigan. Usually only one planting is made since the beans require a long season to mature. The beans can be harvested as green limas when they have reached their maximum size but before they have started to turn white. Those that are not used in this stage can be allowed to mature on the plant and used as dry beans.

Insects

See Snap Beans, page 46.

Diseases

In wet years, *downy mildew* may affect this crop. Leaves and pods are covered with the white downy growth of the fungus. Spraying with a fixed copper material 4-100 (50-percent metallic copper content) when infection first becomes evident will help hold the disease in check.

Dusting the seed with Phygon or Arasan will prevent rotting of the seed in wet soils.

BEETS**RECOMMENDED VARIETIES:**

Detroit Dark Red
Crosby Egyptian

Beets are valuable not only for their fleshy roots but also for their tops, which can be used for greens. They may be sown very early since the plants will withstand light frosts. To provide beets of an optimum size all summer and for winter storage, three or four plantings should be made, the last one being about July 10 in central Michigan. The seed balls contain more than one seed, and more than one plant usually develops from each so-called seed. As the plants develop they should be thinned to stand about 3 inches apart in the row. The thinnings can be used for beet greens. The plants require an abundant supply of plant food and soil moisture and a

deep well-prepared seedbed. Difficulty may be encountered in germinating mid-summer sowings. Seed should be sown in slightly deeper trenches at that time and the seedbed should be kept moist if possible. Covering with papers, boards or cloth will help to conserve the moisture and speed germination.

Insects

Usually beets are not attacked by many insects. A few caterpillars and leaf-eating insects, that can usually be controlled by hand-picking if the leaves are to be used for greens, are about the only insect pests. Later in the season an arsenical dust can be used for controlling these pests. It may be necessary to spray with nicotine occasionally for the control of plant lice.

Diseases

Damping-off and *root rot* of seedlings occur frequently during wet weather. Treating the seed with Arasan, or Phygon will largely prevent these diseases.

Leaf spot appears first as circular reddish purple spots which soon become lighter in color. Spraying or dusting the foliage with fixed copper when the spots first appear will hold the disease in check. This disease also affects swiss chard. Wash leaves thoroughly to remove spray material before using beet tops for greens.

BROCCOLI

RECOMMENDED VARIETIES:

- Italian Green Sprouting (Early strain)
- DeCicco
- Green Mountain.

Broccoli, recently introduced from Italy, has become one of our most popular vegetables. It is rated as an excellent source of those vitamins associated with green plant parts and it also has a high mineral content. Broccoli is a close relative of cauliflower but produces rather loose, dark green heads. It is easily grown and stands heat and drouth much better than cauliflower. After the main head is cut, smaller heads are produced for a period of 8 to 10 weeks at the terminals of the side branches. The culture is similar to cabbage. The young plants may be started in a hot-bed for an early crop, and for a fall crop 5 or 6 seeds may be sown in May, in hills 18 inches apart and in rows 3 feet apart. As the seedlings grow they should be thinned to one plant per hill.

The head, which is made up of a compact grouping of green flower buds, should be cut when it is well formed but before the buds start to open. Four or five inches of the stem can be cut with the head (Fig. 13) but if the stems are thick they should be split lengthwise before cooking so that they will cook as rapidly as the head.

Insects

See *Cabbage*, page 54.

Diseases

Dust dry seed with Arasan to prevent damping off.



Fig. 13. Cut about 4 inches of stem with the broccoli head.

BRUSSELS SPROUTS

RECOMMENDED VARIETIES:

Catskill

Long Island Improved

Brussels sprouts are closely related to cabbage, but instead of developing one large terminal head they produce a number of small heads about the size of a walnut in the axils of the leaves along the main stem of the plant. The culture is similar to that of late cabbage. Plants may be set in June or seed may be planted directly in the garden as suggested for broccoli. The lower sprouts are harvested as soon as they are large enough. The lower leaves may be removed to allow more room for the sprouts to develop as they start to crowd on the stem; however, the top leaves should not be removed. Late in the fall before hard freezing weather sets in, pull the plants, place them close together and cover with straw for protection

from hard freezing. The plants may be taken out and the sprouts broken off anytime during the winter.

Insects

Like broccoli, brussels sprouts are subject to cabbage lice which require rigorous control practice. (Fig. 14.)

See Cabbage, page 54.

Diseases

Dust dry seed with Arasan to prevent damping off.



Fig. 14. Dust brussels sprouts with rotenone to control aphids.

CABBAGE

RECOMMENDED VARIETIES:

In many areas the yellows disease causes serious losses in cabbage. Yellows-resistant varieties should be grown in such areas.

TYPE	YELLOWS-SUSCEPTIBLE	YELLOWS-RESISTANT
<i>Early:</i>	Golden Acre	Wisconsin Golden Acre Resistant Detroit
<i>Second Early:</i>	Bonanza Copenhagen Market	Marion Market
<i>Midseason:</i>	Glory	Globe
<i>Late (Storage):</i>	Hollander	Imp. Wisconsin Ballhead
<i>Red:</i>	Mammoth Rock Red	Red Hollander
<i>Curled:</i>	Chieftain Savoy	

Planting Dates — For early plants, seed should be sown indoors in late February or March, or plants can be purchased and set out in late April or early May. Plants from seed sown out of doors in April will mature heads in midseason. If cabbage is wanted for storing, seed should be sown in a seed row in the garden in early June and the plants transplanted to their permanent location in late June. Or seed can be sown thinly in the row where they are to remain, then thinned to 24 inches apart.

Cultural Suggestions — Since most home gardeners can use only two or three heads of cabbage a week, it is advisable to plant a few plants of each of several varieties for the early crop to lengthen the maturity season. An early variety followed by a larger planting of Bonanza will provide cabbage through most of the summer. Bonanza stands without splitting much longer than most cabbage varieties. Quality cabbage can be grown only in a very fertile soil. In addition to the manure and fertilizer applied at planting time, two side-dressings of a nitrate fertilizer made at monthly intervals after transplanting will improve the quality.

If spaced 24 inches apart, early lettuce can be planted between the plants since it will be harvested before the cabbage needs the extra room.

Insects

CABBAGE MAGGOT — Cabbage, cauliflower, and radish as well as other related plants are attacked by the cabbage maggot which works early in the season before the plants attain much size. The standard treatment for cabbage maggot is to moisten the soil around the roots with a solution of bichloride of mercury, sometimes called corrosive sublimate. The solution is made by dissolving 1 ounce of the poison in hot water and then diluting to 8 gallons with cold water. Half a teacupful of this solution should be poured about the stem of each cabbage or cauliflower plant at the time of setting out, or within a day or two thereafter.

It should be constantly borne in mind that corrosive sublimate is an extremely violent poison — dangerous to all who handle it. It has the property of combining with metals, so that neither the solution nor the crystals should be allowed to come in contact with metal containers. The solution should be made in a wooden or stoneware or glass vessel. An enamelware dipper should be used in making the applications.

In case of poisoning by this material, send for a doctor immediately.

Chlordane, 5% dust, may be used also for control of cabbage maggot. Apply around the stalk when plant is first set out; repeat at least once in 7 days. Avoid using where root vegetables are to be grown within 3 years.

Figure 15 shows the tar paper disk method of combating cabbage maggot.

CUTWORMS — See page 39.

CABBAGE WORMS — These worms are likely to appear before the season is over. (Fig. 16.) The best treatment for cabbage worms is the use



Fig. 15. Tar paper disk in place for maggot protection.

of rotenone or pyrethrum dust. A 5% calcium arsenate or DDT dust is sometimes used for this same purpose but it should be kept in mind that such poisons leave a residue; neither should be used after the heads have formed.

Cabbage worms sometimes attack cauliflower and broccoli. Under no circumstances should poison ever be put on these crops. DDT dust may be used while the plants are small. Rotenone and pyrethrum are the safest to use on these two crops.

CABBAGE LICE OR APHIDS — These insects appear late in the season and, although they sometimes present an alarming appearance, nevertheless, they are seldom troublesome unless present in very great numbers. They can be readily killed by spraying with 3 tablespoonsful of nicotine sulfate in 3 gallons of water in which 2 ounces of soap has been dissolved; or by use of nicotine dust, pyrethrum dust, or rotenone dust.

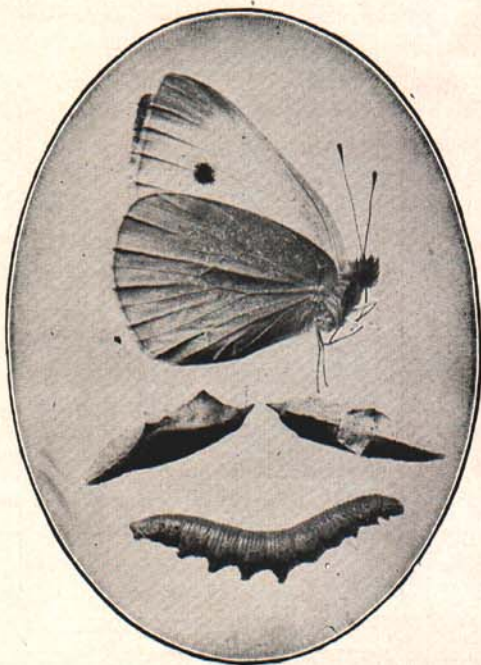


Fig. 16. Imported cabbage worm larva, pupae and adult (slightly enlarged).

Diseases

Black rot, yellows, black leg, and club root are important diseases of cabbage, cauliflower and other plants of this family.

Black rot is a bacterial disease carried on the seed. This disease appears on the young leaf as a V-shaped wilted area. Later the area enlarges and the veins turn black. With severe infection, the entire leaf turns yellow and falls. When the vein of an infected leaf is cut across, the black water bundles are readily seen. Treat seed as for control of black leg.

Cabbage yellows is a disease carried in the soil and in the young plants when set in the field. The appearance of diseased plants is similar to those affected with black rot. Infected seedlings are yellow and wilt rapidly. In older plants, the sickly yellow color persists and dwarfing results. The lower leaves usually drop first followed by those next higher on the plant until often only a few top leaves or the small undersized head remains. On cutting across a diseased stem, the brown water bundles are evident.

The control of this disease lies in growing resistant varieties. Such varieties as Jersey Queen, Yellows Resistant Golden Acre, Resistant Detroit, Globe, Marion Market, All Head Select, Wisconsin All Seasons, Wisconsin Ballhead, and Wisconsin Hollander No. 8 are resistant to the disease. (See Recommended Varieties on page 53.)

Black leg first appears on the seedling as a small light brown canker at the base of the stem which may be girdled. Similar spots may appear on the leaves. Later, within these spots, very small black dots appear. These are the fruiting bodies of the causal fungus. Badly diseased plants often wilt and die. Girdling of the stem late in the season may cause the headed plant to fall over.

The fungus causing black leg and blackrot lives within and upon the seed. Many seed companies now treat cabbage seed to control these diseases. Buy only treated seed or seed known to be from disease free areas of the Pacific Northwest.

Club root is also known as finger-and-toe disease because of the characteristic swelling of the roots. Such roots are gray or dirty yellow in color. Large swellings on the roots may cause the plants to wilt rapidly, especially during hot days. Often, the plants recover partially at least during the night. Usually, affected plants die or if they live, are weak and do not produce heads. There is no satisfactory control if disease is present.

The individual control methods for the diseases of cabbage and cauliflower given are applicable to those who grow their own plants. For those who purchase plants, the selection of vigorous seedlings of normal color with roots, stems and leaves free from swellings, cankers or spots affords an effective means of controlling the diseases above described.

The fungus causing club root lives in the soil for 8 years or longer. Do not plant cabbage or related plants in soil that has produced club root plants.

CARROTS

RECOMMENDED VARIETIES:

Nantes

Imperator

Supreme Half Long

Gold Spike

Varieties for Storing — Nantes, Supreme Half Long

Carrots do best on a light, well-drained soil. The roots are likely to be poorly shaped and unsatisfactory on heavy, wet soils. Germination is sometimes difficult, particularly on midsummer plantings when the weather is hot and dry. The seedlings are very delicate and they grow slowly when young. If the soil has a tendency to bake on the surface, cover the seeds with a mixture of half soil and half peat moss or leaf mold. A mixture of sand and peat or leaf mold may also be used. Keep the soil over the seeds uniformly moist until the plants are well established.

Two or three sowings are usually made, one very early in the spring, another after danger of frost is over, and a third in late June for storage. Carrots are at their best if pulled while still small, not more than an inch in diameter at the crown. For storage, however, larger carrots are preferred since those less than an inch in diameter are more likely to shrivel.

Seed should be sown thinly and the plants thinned to stand 2 inches apart. This thinning can be delayed until the roots are about the thickness of your little finger, when the thinnings can be eaten or canned (Fig. 17).



Fig. 17. Thin carrots when the thinnings are large enough to be eaten.

Although carrots can be preserved in the frozen food locker, this method is not usually recommended since they can be quite easily stored in pits or vegetable storage rooms.

Insects

Generally insect-free in most sections of the state.

Diseases

Leaf Blight. In the garden, carrots and parsnips are often affected with leaf blight in seasons of heavy rainfall. The disease appears as small gray-brown to black spots on the leaves or the leaves may turn yellow. Spraying the tops with fixed copper when the disease first appears, and repeating at intervals of 10 days, will hold the blight in check.

Bacterial soft rot may attack carrot and parsnip roots while in the ground. This disease also occurs in storage. The root disintegrates into a soft, mushy, or slimy mass with the outer covering or epidermis often remaining intact. This disease also affects radish, cabbage, cauliflower, eggplant, rhubarb, muskmelon, turnip, tomato, rutabaga, and other vegetables. Complete control of the disease in the garden is seldom possible. It may be greatly reduced by care in cultivation to avoid injury.

If the roots are to be stored, the storage house should be well cleaned, including floor, walls, and ceiling and sprayed with a solution of copper sulfate (1 pound copper sulfate dissolved in 5 gallons of water). The roots after digging should be dried in the sun and sorted to remove any that are broken, bruised or diseased. The temperature of the storage should be kept as nearly 32° F. as possible, and good ventilation provided.

Fig. 18. When the heads are 1 to 2 inches across, tie up leaves of cauliflower to blanch.



CAULIFLOWER

RECOMMENDED VARIETIES:

Snowdrift, White Mountain or Snowball X: Early Snowball (Fig. 19)

For freezing: Both varieties are suitable.

The soil and fertilizer requirements for cauliflower are about the same as for cabbage. This crop is not so hardy, however, and where it is to be grown as a spring crop, it cannot be planted as early as cabbage.

Cauliflower does not do well in a dry, hot atmosphere, and in most cases it would be more profitable to grow it as a fall crop. Plants can be set into the garden about the first of July, so as to bring them into bearing the last part of September when the weather is likely to be cool and moist.

It is necessary to protect the heads of cauliflower from sun and rain and also for the blanching process. This is done by drawing the leaves up over the heads as soon as they begin to form. (Fig. 18.) The leaves may be held in place by tying them with string or raffia. The length of time necessary to blanch the heads depends upon the weather. During hot dry weather 3 or 4 days will be sufficient, while in cold weather 8 to 14 days may be required.



Photo courtesy Ferry-Morse Seed Company

Fig. 19. Snowdrift cauliflower (synonymous with White Mountain and Snowball X).

Insects

See Cabbage, page 54.

See Cutworms, page 39.

NEVER USE ARSENICAL OR DDT INSECTICIDES ON CAULIFLOWER.

Diseases

See Cabbage Diseases, page 56.

CHINESE CABBAGE

VARIETIES RECOMMENDED: Chihli; Michihli

Chinese cabbage, sometimes called "celery cabbage," is definitely a cool-season crop. It is seldom satisfactory when sown in the spring, but produces very good heads if sown in late July so that they may mature during the cool short days of fall.

The plants are thinned to stand about 10 to 12 inches apart in the row, with rows spaced 3 feet apart. They do not have to be tied up in order to make them head.

The heads are used chiefly as a vegetable salad, although the midribs of the leaves can be cut out and creamed like asparagus. The outer leaves should be removed and only the tender, blanched center leaves used.

Insects

Comparatively insect-free. *See Cutworms, page 39.*

Diseases

Usually not attacked by disease organisms.

SWISS CHARD

RECOMMENDED VARIETIES:

Lucullus, Large Ribbed Green, Rhubarb Chard.

For freezing: The varieties listed are satisfactory.

Because of the fact that it continues to produce throughout the summer, some gardeners prefer chard to spinach. It belongs to the beet family but does not produce an enlarged root, so it is used only as a green. A row 20 feet long will produce plenty of chard both for fresh use and for canning or freezing for the average family of 5.

The seed can be sown very early in the spring in rows 18 to 24 inches apart. Thin the plants to stand 12 inches apart in the row. The first leaves

will be ready to eat in about 60 days and, by keeping the outer leaves cut (Fig. 20), the plants will continue to produce high-quality greens throughout the summer and fall.



The midrib of the leaf can be cut out and cooked separately as you would celery, or the entire leaf can be cooked as a green.

Insects

Comparatively insect-free. See *Spinach*, page 86.

Diseases

Ordinarily disease-free.

Fig. 20. Cut the outer leaves of swiss chard while they are still young.

CELERICAC

RECOMMENDED VARIETY: Giant Prague

Celeriac, the so-called turnip-rooted celery, produces a globe-shaped, turnip-like root at or above the surface of the ground. It has a celery-like flavor. Only the enlarged roots are eaten. These can be stored for winter use as you would other root crops. They can be used for flavoring soups, in salads, or cooked like parsnips.

This crop is usually seeded directly in the garden very early in the spring and the plants thinned to stand about 6 inches apart in rows 30 inches apart.

Insects

Comparatively insect-free.

Diseases

See Celery (below).

CELERY**RECOMMENDED VARIETIES:**

Green Types: Tall Summer Pascal (Early); Utah 15 (Late)

Golden Types: Cornell # 19 (Late)

Celery does best on muck soils or very rich loams containing a high percentage of organic matter. On very light soils or very heavy clay soils, celery cannot be successfully grown. It is best suited to a climate with warm days, cool nights, and an abundance of sunlight. Unless the soil is very rich, a trench 12 to 15 inches deep should be dug, partially filled with well-rotted manure, and then covered with soil. The plants (which have to be started inside in February) are then set into this soil. It is very important that this crop have an abundance of soil moisture available at all times, and, since the root system is quite shallow, irrigation is required.

Although self-blanching types which need not be blanched may be grown, the quality even of these varieties is improved by excluding light and air from the stalks for a short time before harvesting. Blanching is usually accomplished by means of boards fastened on both sides of the row, or by wrapping each plant in heavy paper bands. Celery can be blanched very satisfactorily however, by merely hilling soil up around the stalks as they grow. Care should be taken not to get dirt into the center of the stalk.

Insects

Comparatively insect-free. *See Cutworms, page 39.*

Diseases

Celery may be affected with two *leaf spot* diseases. These may be controlled by thorough spraying with 4-100 (50% metallic copper content) fixed copper, or by dusting with 20-80 copper lime or fixed copper dusts.

CHICORY

Witloof chicory or French endive (Fig. 21) is a new crop for most Michigan gardeners. It is most commonly used during the wintertime when the large roots which were produced during the summer are taken into the basement and forced into growth. At that time they produce a growth somewhat resembling a small head of romaine lettuce. This growth is then cut off and used.

Chicory does best in a deep, friable, rich soil. It is sown in late spring or early summer and thinned to stand 4 to 6 inches apart in the row. The young leaves can be used for greens when they are about 6 inches long, or the roots can be grown for winter forcing. After the tops have been killed by freezing weather, the roots are dug and stored at a temperature of 33-40° F. until they are wanted for forcing. They are then placed upright and close together in a box of moist soil with the top of the soil just level with the tops of the roots. They are then covered over with about 6 to 8 inches of sand, which is kept moist throughout the forcing period. They should be placed in a temperature of 55-60° F. until the leaves push up through the surface of the sand. The heads are then cut and used.

Insects

Comparatively insect-free.

Diseases

Usually disease-free



Fig. 21. Witloof chicory or French endive. Right, untrimmed. Left, ready for use.

CHIVES

Chives are hardy perennials resembling small green onions and having a mild onion-like flavor. They can be grown from seed, sown early in the spring, or the clumps that develop can be divided into 10 or 12 parts and replanted in early spring. The plants should be spaced about a foot apart in the row. A new row should be planted every three or four years for best results. The clumps can be dug up and potted, then grown indoors for winter use.

Insects

See Onions.

Diseases

See Onions.

COLLARDS

RECOMMENDED VARIETY: Georgia

Although collards are much more popular in the South than in Michigan, they can be grown very successfully here. They resemble tall-growing cabbage or kale, except that they produce a large growth of leaves instead of a head. They require the same growing conditions as cabbage but will withstand the heat better. An early crop can be started indoors in early March, then transplanted to the garden in early May. The later crop can be sown directly into the garden in rows 3 feet apart in early June. The seedlings should be thinned to about 6 or 8 inches in the row. As they start to crowd, they can then be thinned again and the plants that are pulled out will be big enough to use. The entire stalk of those plants that are thinned out should be cut off below the crown. As the other plants mature, the rosette may be cut off and used or the older leaves may be used as they mature, leaving the younger, upper ones to develop.

Insects

See Cabbage, page 54 and Cutworms, page 39.

Diseases

See Cabbage, page 56.

SWEET CORN

RECOMMENDED VARIETIES:

Early: Seneca Dawn, North Star

Midseason: Carmelcross, Tendergold

Late: Golden Cross, Seneca Chief, Iochief

Although the return in food value produced per square foot is less for corn than for many other crops, most gardeners insist on growing it — for corn is only at its best when eaten within a very short time after harvesting.

A succession of corn may be obtained by planting varieties which ripen at different times, or by planting one variety at 10-day or 2-week intervals from the time it is safe to plant until about the first week in July (in the vicinity of East Lansing).

Corn may be planted in rows spaced 3 feet apart, with the plants thinned to 8-12 inches apart in the row. Or it may be planted in hills spaced 3 feet apart each way. Five to seven seeds are dropped in each hill; the seedlings are then thinned to three to a hill when 4 or 5 inches tall.

Since corn is dependent upon the wind for pollination, at least 2 short rows of each crop should be planted rather than one long one. Removing the suckers from sweet corn is not necessary and, as a matter of fact, this practice has proved to be harmful when done after the plants have started to tassel.

In the small garden, squash or pumpkins are sometimes planted in with the early corn to conserve space. This practice proves satisfactory only when the soil is sufficiently well fertilized and sufficient water is available. In a dry season, however, both crops will be inferior. The corn should be cut as soon as it matures to prevent its competing with the squash for water, fertilizer, and sunlight.

Most hybrid-corn varieties which are becoming increasingly popular in Michigan mature their crop over a relatively short period; consequently,



Fig. 22. Thin sweet corn to three plants to the hill.

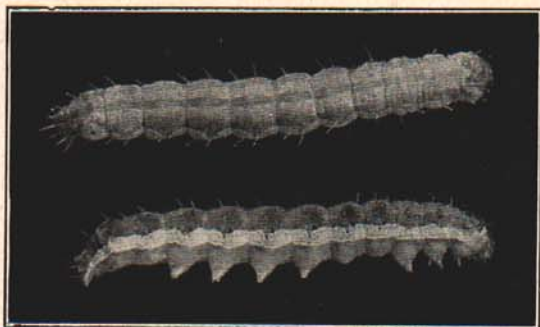


Fig. 23. Corn earworms.

in the home garden, smaller, more frequent plantings should be made so the corn can all be used as it matures, and so that harvesting can be extended throughout the season. Some seed houses offer collections of mixed hybrid corn. This prolongs the season but may result in less uniform crops.

Insects

EUROPEAN CORN BORER — The European corn borer is a moth, which produces a small, grayish or tan larva usually an inch or less in length. (Fig. 24.) The larva tunnels in the stalks of corn and other fleshy-stemmed plants. It passes the winter in last year's cornstalks and under rubbish on the ground. It is impossible to control this pest once it gets into the plant.

Corn borer on sweet corn can be profitably controlled by dusting or spraying with rotenone. Five dustings are necessary, using 1 percent rotenone dust at 5 day intervals, beginning not later than June 10 or when the growing whorl is 10 inches high in normal seasons. Five dustings of 5% DDT dust at 7-day intervals gives control equal to that from rotenone. Sprays of 1½ pounds of 50% DDT per 100 gallons have also given good results when applied 4 or 5 times. Good control is also possible by use of factory-processed nicotine ben-
 tonite dusts. Sprays of 4 pounds derris or cube (4% rotenone) per 100 gallons of spray have also given good control. Sprays or dusts must be directed into the growing whorl of the plant. Start treatments when corn is "shoe-top" high.



Fig. 24. Larvae or "worms" of corn-borer (enlarged twice).

CORN EARWORMS — The corn earworm (Fig. 23) appears when the corn is in the "milk" or "dough" stage. It tunnels into the ears through the silk on which the eggs are laid. This last point is essential in practicing the

only really effective and applicable control measures suited to the small garden. If the ends of the ears are snipped off just after pollination has taken place — in other words, when the silk begins to turn black — very little difficulty will be experienced with corn earworms.



Fig. 25. Mineral oil dropped in the silk end of the ear after pollination controls corn earworm.

Another method is to use an oilcan filled with mineral oil, such as is used for medicinal purposes, and to squirt about 10 drops of the oil into the tips of the ears.

Various dusts, including 5% DDT, have been tried for this worm, but none of them seem to give the effect that is secured by the simple measures outlined above.

White Grub — see page 40

Wireworms — see page 40

Cutworms — see page 39

Diseases

Seedling blights often cause considerable rotting of the small sweet corn plants. These diseases may be materially reduced by seed treatment. Treat the seed by dusting with Semesan Jr., Spergon, Arasan, or Barbak-D.

Place the seed in a tight container and add dust at the rate of 2 ounces to the bushel of seed. Shake or rotate the container until each seed is covered with the dust.

This dust treatment will control seedling blight and insure a better stand when sweet corn is planted early in cool moist soil.

Smut is one of the most common diseases of sweet corn. Boils of various sizes may appear on any part of the plant above the ground. These at first are small white pustules, later turning gray as the smut fungus matures inside the boil. The membrane of the boil breaks, allowing the black smut spores to scatter upon the ground. These cause infection of the corn the following year.

Seed treatment will not prevent smut. Rotation of the corn plot, and picking and burning of the smut boils before they break often will materially decrease the amount of this disease.

Stewart's Disease — Use resistant varieties such as Golden Cross.

CUCUMBERS

RECOMMENDED VARIETIES:

For slicing — A & C; Marketer

For pickling — National Pickling, SR-6 (scab-resistant), MR-17 (mosaic-resistant)

Cucumbers do best on a rich sandy loam soil containing an abundance of organic matter and plenty of fertilizer. For best results they should be irrigated during droughts, and they must be sprayed or dusted regularly to control the insects described below.

Under good conditions a dozen hills should produce enough for slicing and pickling to satisfy the needs of a family of 5. Five to seven seeds should be sown in rows, spaced 6 feet apart, as soon as all danger of frost is over. The seedlings are then thinned to one plant every foot after they have developed to a height of 3 or 4 inches. For an extra-early crop, sow seeds in strawberry boxes or plant bands in the house about May 1.

Since cucumbers do not transplant well, merely cut the bottom out of the box and carefully plant the whole thing in the garden. If sown out of doors, the crop may be hastened some by placing hot-caps over the hills and leaving these on until the weather becomes warm.

Cucumbers may be harvested at any size or state of maturity, but they should be gathered preferably every 2 or 3 days. If large cucumbers are allowed to develop and ripen, production will be considerably reduced.

Insects

CUCUMBER BEETLE — The small striped beetle known as the cucumber beetle is the worst enemy of cucumbers. The insect is slightly more than one-eighth inch in length, appears in large numbers, and attacks the cucumbers soon after they appear above the ground. It can always be recognized by the three black stripes on its back.

A 3-percent methoxychlor dust may be used on cucumbers, and is preferable to calcium arsenate. This insect is controlled also by dusting with 5-percent calcium arsenate, thoroughly mixed with 95-percent agricultural gypsum. In case the gypsum is not available, flour may be used. For small quantities, the amounts are 5 ounces of calcium arsenate and 6 pounds of gypsum or flour. A $\frac{3}{4}$ - to 1-percent rotenone dust can also be used. The dust can be applied with a coarse piece of cloth such as burlap.

Since cucumber beetles spread bacterial wilt it is doubly important to control this pest.

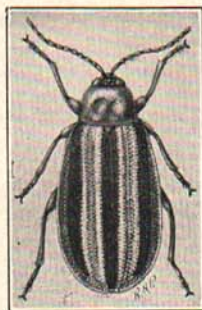


Fig. 26. The striped cucumber-beetle (greatly enlarged).

PLANT LICE OR APHIDS — The under side of the leaves of cucumbers are sometimes found to be badly infested with plant lice. The best way to control these is by spraying with a nicotine mixture, such as is recommended for cabbage lice.

It is usually necessary to turn the vines over to arrange things in such a way that the spray will hit the under side of the leaves. Strong nicotine dust is effective for cucumber lice, but is not usually available for general garden use.

Diseases

Bacterial wilt is probably the most serious disease of cucumbers. Wilting of the leaves takes place very soon after infection of the plant. From the leaves, the disease spreads throughout the plant until it withers and dies. A reliable field test for bacterial wilt may be made as follows: Cut across a wilted stem and place a finger tip over the cut surface. If the plant is affected with bacterial wilt, the sap is sticky and adheres to the finger tip so that the sap can be pulled out into long threads. This disease is carried from plant to plant by means of the striped and twelve-spotted cucumber beetles. To control bacterial wilt, pull out the wilted plants as soon as they appear and eradicate the cucumber beetle (page 68).

Mosaic — This disease is carried in the juice of infected plants, and is spread by contact. Milkweed, ground cherry, and catnip also become infected with mosaic and serve to carry the disease over winter. Plant lice spread mosaic from infected weeds, melons, or cucumbers to healthy plants. This disease produces a yellowish mottling and crinkling of affected leaves and causes dwarfed, mis-shapen, white-mottled pickles and ill-flavored melons. Keep all milkweed, ground cherry, pokeweed, and catnip out of melon and pickle fields and also for a distance of 150 feet on all sides of the field. Pull out and burn affected young melon or cucumber plants showing mosaic.

OTHER DISEASES OF LEAVES, VINES AND FRUIT

To control seed borne organisms, soak the seed 5 minutes in a solution of corrosive sublimate (1 ounce corrosive sublimate dissolved in 7½ gallons of water).⁹ Rinse the seed 15 minutes in fresh water at once after treating. At weekly intervals spray or dust with a zinc carbamate such as Ziram, Zineb, or fixed copper. An insecticide may be added to the spray or dust material for insect control.

⁹Corrosive sublimate is extremely poisonous. Dispose of all containers and wash hands vigorously after using the material.

EGGPLANT

RECOMMENDED VARIETIES: Black Beauty; Black Magic

Usually six plants of eggplant will produce all the fruits that will be used by a family of 5. Plants grown from seed started indoors in late March should be transplanted into the garden after all danger of frost is over. They should be planted 24 to 30 inches apart in rows spaced 30 inches apart. They are not transplanted easily, so care should be taken to disturb the roots as little as possible when planting out. The seedlings may be grown in pots or plant bands.

Eggplants will respond well to one or more applications of a complete fertilizer, and artificial watering when necessary is very desirable. The fruits should be harvested while they are still shiny (Fig. 27).



Fig. 27. Pick eggplants when the fruits are glossy.

Insects

See insects affecting potatoes, page 82, and Cutworms, page 39.

Diseases

Leaf spot and *fruit rot* sometimes affect eggplant in the home garden. Thorough spraying or dusting with copper fungicides, as for potatoes, will prevent this disease.

ENDIVE

RECOMMENDED VARIETIES: Green Curled; Full Heart Batavian

Endive is handled in a manner similar to that of lettuce — except that, since endive grows best in the cool season of the year, it is usually sown in late June or early July for a fall crop. It may be sown directly in the garden, then thinned to stand about 15 to 18 inches apart in the row. Or it may be sown in a seed row, then transplanted to its permanent location in the garden.

When the plant has reached a diameter of approximately 15 inches, the leaves should be gathered and tied up so that the heart will blanch. If the weather should be warm and wet after the plants are tied up, they should be examined frequently to be sure that they have not started to rot.

Since endive withstands considerable cold, the plants may be covered with straw in late fall. They may then be used until early winter.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

KALE

RECOMMENDED VARIETIES: Dwarf Blue Curled; Dwarf Green Curled Scotch

Kale is one of the best sources of vitamins and minerals in the garden. It is another of the cool-weather plants which does best in Michigan as a fall crop, sown in July in rows 30 inches apart and thinned to 15 to 18 inches in the row. It is similar to cabbage in its cultural requirements, and the leaves are either cooked like cabbage or the young leaves may be eaten as a salad. It withstands cold very well and, with a light protecting straw cover, can be used from the garden until early winter. It can be harvested by cutting only the outer leaves as they mature or by cutting the entire plant.

Insects

See Cabbage, page 54.

Diseases

See Cabbage, page 56.

KOHLRABI

RECOMMENDED VARIETY: Early White Vienna

Kohlrabi produces a thickened stem resembling a turnip, both in appearance and taste, just above the surface of the ground. It is a short-season crop and should be eaten when the enlarged stem is about the size of a large egg. If allowed to grow too large it becomes woody and strong. The outside should be peeled off before being eaten. The stems are usually cooked like turnips but are tasty when eaten raw.

Two or three sowings can be made in early spring directly in the garden or plants can be started inside and set out about May 1. A fall planting can be sown in late July or early August in the vicinity of East Lansing. Thin the plants to stand 6 to 8 inches apart in the row.

Kohlrabi from a late planting can be stored for winter use.

Insects

See Cabbage, page 54, and Cutworms, page 39.

Diseases

See Cabbage, page 56.

LEEKs

RECOMMENDED VARIETIES: Emperor; American Flag

Leeks resemble green onions, except that the leaves are flat. They are considerably thicker and do not form bulbs. They are used for flavoring or may be boiled and served with a white sauce.

They are usually grown from seed sown in a trench 2 or 3 inches deep and thinned to stand 3 inches apart in the row. As they grow, the soil is hilled in around the stems to bleach them.

Seed can be sown indoors in March and the plants planted into the garden in late April for an earlier crop.

The plants can be dug with the roots intact in the fall and replanted in the storage room in soil for winter use.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

LETTUCE

RECOMMENDED VARIETIES:

Leaf: Salad Bowl; Black Seeded Simpson; Slobolt

Head: Great Lakes; 456

Cos or Romaine: Trianon; Paris White

LEAF LETTUCE

Leaf lettuce can be sown out of doors as soon as the ground can be worked, and small succession plantings made every 10 days throughout the summer to provide a continuation of crisp salad greens. Many gardeners, however, make only one or two plantings in the spring, then, instead of cutting the whole plant, cut merely the outside leaves as the plants grow. The plants will then keep producing over a long period of time. The seed is sown directly into the garden and the plants should be thinned to stand 4 to 6 inches apart if the whole plant is cut, or 10 to 12 inches apart if the outer leaves are to be taken and the plants permitted to grow throughout the season. The thinnings can be used on the table.

HEAD LETTUCE

Head lettuce does best in very early spring or in the fall. For the spring crop, three small sowings should be made indoors at weekly intervals starting

about Feb. 15. These plants can then be set in the garden about April 1-15 and at that time one or two sowings of seed can be made directly in the garden. These crops will mature over a fairly long season in about 80-90 days from date of sowing. Head lettuce should not be allowed to stand in the garden after reaching maturity, and for that reason only as much as can be eaten in a comparatively short time should be sown in one planting. Head lettuce does not have to be tied up to make it head.

Most varieties should be planted about 12 inches apart. The variety Great Lakes should be planted 15 to 18 inches apart, however. In addition to the spring crops, one or two plantings can be made in late June or early July to mature in late September and early October.

COS OR ROMAINE LETTUCE

This is a heading type of lettuce which grows upright forming a rather cylindrical loose head. The seed can be sown directly in the garden or it can be sown indoors then transplanted out. Plants should be spaced 10 to 12 inches apart in the row, and for best results the heads should be tied up to assist the bleaching. The flavor of this lettuce is excellent.

Insects

Leafhoppers carry the aster yellows disease to lettuce. At present there is no completely satisfactory control of this insect. Dusting with 1/10 of 1% pyrethrum will help to control this pest and the disease it spreads.

DDT and arsenicals should never be used on lettuce. Nicotine sulfate should not be used on lettuce or plants which are to be used for greens within a week. For this reason it is probably better to use rotenone or pyrethrum for controlling insects on this plant. It is suggested that the material be used according to the directions of the maker.

Diseases

Lettuce-drop, *Bottom-rot*, and *Gray Mold-rot* are common diseases of this crop and may become destructive under conditions of high soil moisture. These diseases may affect the plant in the seedling stage or when it is ready for harvesting. The rotting in these diseases usually begins on the stem or leaves near the soil surface, gradually spreading until the plant wilts and topples over or stands erect with the head converted into a slimy mass.

Removing affected plants as soon as the diseases appear, and light cultivation to decrease surface moisture, will aid in holding the disease in check. Dusting the plants with fixed copper dust will also reduce the amount of gray mold-rot.

MELONS

RECOMMENDED VARIETIES:

Muskmelon: Honey Rock; Golden Delight; Delicious 51

Watermelon: Rhode Island Red; Dixie Queen; Kleckley's Sweet; Honey Cream

MUSKMELONS

Muskmelons need a long, warm growing season and a rich sandy loam soil with plenty of moisture to produce best results. They should be planted in hills spaced 3 to 6 feet apart each way. A hole 12 to 15 inches deep should be dug, half-filled with rotted manure, then filled level-full with soil. Sow 5 seeds to the hill, then thin to the three best plants when they are about 4 inches high. Earlier plants can be obtained by sowing 3 to 5 seeds in a berry box or plant band indoors about April 10. Melons are very tender and seed should not be planted outdoors until the ground has started to warm up. Muskmelons are ready to pick when the melon will separate from the stem easily.

WATERMELONS

Watermelons are handled much the same as muskmelons. They are heavy feeders and require lots of moisture. Hills are prepared as for muskmelons but they should be spaced 6 to 10 feet apart. Six to eight seeds should be sown to the hill but they are thinned to 3 plants to the hill as are muskmelons. Watermelons when still green give a sharp metallic ring when snapped with the fingers. Ripe ones give a dull hollow sound.

Insects

See Cucumbers, page 68.

Diseases

See Cucumbers, page 69.

MUSTARD GREENS

RECOMMENDED VARIETIES:

Southern Giant Curled

Tendergreen

Mustard greens have a very short season, and are easily grown in Michigan. Three or four successive sowings can be made at 10-day intervals starting in early spring to provide a continuation of the crop in early summer, and can be sown again in the late summer for a fall crop. The plants should be thinned to stand about 6 inches apart in the row, and

the rows spaced 18 inches apart. Especially in midsummer mustard greens will go to seed fairly soon after maturing, so should be cut as soon as ready and cooked like spinach.

Insects

See Cabbage, page 54.

Diseases

Ordinarily disease-free.

OKRA

RECOMMENDED VARIETIES:

Dwarf Long Pod

Clemson Spineless

Although not grown much in Michigan, okra is very popular throughout the South. It is used mostly in soups and mixed dishes and occasionally cooked alone. It likes hot weather and should be sown after the danger of frost is over, in rows about 3 feet apart. The seedlings should be thinned to stand 12 to 15 inches apart in the row. The long pods should be harvested within a few days after the flower petals have fallen; if allowed to remain on the plant too long they will become tough and stringy. The young pods can be dried or canned for winter use.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

ONIONS

RECOMMENDED VARIETIES:

Seed — Early Yellow Globe; Brigham Yellow Globe; Downing Yellow Globe

Plants — Sweet Spanish

Sets — Ebenezer (Yellow); White Portugal or Silverskin (White)

Onions can be grown from sets, which are small onions $\frac{1}{2}$ - $\frac{3}{4}$ inch across that were produced the previous year from seed. They may be grown from seed sown directly out of doors just as soon as the ground can be worked, or from plants grown from seed sown indoors in February, or from plants purchased from a greenhouse operator or plant dealer.

Many gardeners like to plant several successive plantings of sets for green onions during spring and early summer. Although these plants can also be allowed to mature as dry bulbs, they are not usually considered so good for storage as those grown from seed or plants.

Since onions require a long season and make their best growth in the cool early spring, they should be sown just as early as the ground can be worked. The rows can be spaced 18 inches apart and the seed sown thinly. The plants should be thinned finally to stand about 4 inches apart in the row, but the thinnings can be used for green onions or boiling onions. In late summer or early fall when the tops have died down, the onions may be pulled and brought under cover to dry. The tops should then be cut off, leaving an inch of the stem on the bulb, and the onions placed in slatted crates or coarse mesh-bags and stored in a dry, dark, storage room at around 40° F. If the tops have not started to die down when cold weather approaches, or if they are dying down very irregularly, the maturity may be hastened by breaking them over with a rake. Usually this is not necessary, however.

Since they are very hardy, plants can be set out just about as early as the ground can be prepared. It is good practice to harden them off some by placing the flats out of doors for several days, taking them in at night if freezing weather threatens previous to the time of transplanting. The plants should not be set much deeper than they were in the flat.

Multiplier onions are hardy perennials planted in the fall for early green onions. They are grown from top sets — sets that develop on top of the plant in July. They may also be grown from divisions of the clumps that develop.



Fig. 28. Onion maggot and its work in small onion, enlarged about twice.

Insects

ONION MAGGOTS — The only insect affecting onions to any degree in the home garden is the onion maggot. (Fig. 28.) Five treatments of bichloride of mercury solution, prepared according to the treatment for the cabbage maggot (page 54) and applied at intervals of about 7 to 10 days, will control these insects.

The usual strength of bichloride of mercury for this purpose is 1 ounce in 8 gallons of water.

Control may also be obtained by dusting with 5 percent chlordane. Repeat 4 or 5 times at 7-day intervals. Avoid using chlordane where root vegetables are to be grown within 3 years. On green onions or scallions, dust with a $\frac{3}{4}$ or 1 percent rotenone dust. Repeat every 5 days for 6 or 7 treatments.

Diseases

Ordinarily disease-free.

PARSLEY

RECOMMENDED VARIETIES: Moss Curled; Paramount

Half-a-dozen parsley plants in the garden will provide amply for garnishes during the summer, and two or three of the plants may be dug, potted, and grown on in a light basement for winter use.

Seed may be sown directly in the garden as soon as the ground can be worked or it can be sown indoors in March, then transplanted out. Since the seeds germinate slowly, a few radish seeds may be mixed with it to mark the row. Plants should be thinned to stand 4 to 6 inches apart in the row. Soaking the seed in warm water for 6 hours before planting will hasten germination.

In addition to the parsley varieties grown for garnishing, there is also a rooted variety called Hamburg that produces a parsnip-like root good for flavoring soups. The roots may also be cooked like carrots.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

PARSNIPS

RECOMMENDED VARIETIES: Hollow Crown; Model

Parsnips require a long season for their development. They should be sown as soon as the soil can be fitted. The seeds germinate very slowly. If sown too late, germination will be poor. Radish seeds can be mixed with them to mark the row and also to provide an extra crop in the same space. Since they root very deeply, the soil should be prepared to a depth of at least 12 inches.

The flavor of parsnips is improved by freezing; therefore many gardeners leave them in the ground over winter and use them in late winter before they start to grow again. They can be dug in late fall and stored in boxes of sand as you would store carrots or other root crops.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

PEAS

RECOMMENDED VARIETIES:

First Early: Thomas Laxton

Early: Resistant Progress (wilt-resistant); Laxton's Progress; Little Marvel

Midseason: Alderman (Telephone); Morse Market (wilt-resistant); Shasta

Any of the foregoing are satisfactory for freezing.

Edible podded varieties: Mammoth Melting Sugar; Dwarf Grey Sugar

For success with peas in Michigan they should be planted very early — at the latest by May 15 in the southern part of the state. In favorable seasons, however, a fairly successful crop can be grown in the fall if sown about July 15 so that they will mature in September.

For the spring crop, best results will be obtained by planting early, midseason, and late varieties all at one time — as early as possible — rather than making successive plantings. Unless the soil is very weedy the seeds may be sown in double rows spaced 6 inches apart. To facilitate training, this is especially desirable with taller varieties. If the soil is particularly weedy, more hand weeding will be necessary than with a single row. Peas should be seeded to stand about an inch apart in the row.

Tall varieties can be supported by sticking brush 30 to 36 inches high

in the ground alongside the row, by placing chicken wire alongside the row, or by wires and strings as described under beans, page 46.

Peas can hardly be considered to be a profitable crop unless they are sown before May 1 to permit them to mature in time to utilize the space with another crop.

Edible podded peas are a comparatively new crop. Their culture is similar to that of garden peas, but they do not need supporting. They are ready to eat just as soon as the seeds start to form. They are cooked like green beans, or they may be eaten as shelled peas after the seeds have developed.

Insects

PEA WEEVIL — The only insect of any consequence affecting peas in the home garden is the pea weevil. This insect resembles the bean weevil which has previously been described under "beans". It is somewhat larger but differs in habit in that it attacks peas only. It does not attack dried peas, but does over-winter in them in an inactive condition. If seed peas are free from weevils when planted, there will be little danger of attack. Plant clean seed, making sure that your seeds are clean, either by procuring them from a reputable seedsman or by fumigating them. Keeping the plant covered with rotenone dust for about a week just at blooming time will reduce infestation.

Diseases

Bacterial and fungus blights and root rots are common diseases of peas in the garden. Plants affected with the fungous blights show purplish streaks on the stems and spots of various shapes on the leaves. If the disease is severe, whole leaves may be destroyed and the pods may also show similar spotting. The bacterial blight produces water-soaked spots on the leaves and pods which later turn yellow or brown. Affected plants may show a gradual yellowing before they die.

Root rots appear on the small roots of young plants or upon the base of the stem, depending upon the causal fungus. In pulling a diseased plant, the roots may be decayed and slough off or the plant may be girdled at the base of the stem and break off just above the ground. In either case, the normal growth of the plant is retarded and in cases of severe infection few pods are borne.

There is no seed treatment known at present which will entirely prevent these diseases. They are most abundant in seasons of high rainfall. Early planting of treated seed in well-drained soil, avoiding stiff soils which readily hold moisture, will do much to prevent serious damage. Dusting seed with Arasan, Phygon, Cuprocide or other suitable material will reduce seedling diseases.

PEPPERS

RECOMMENDED VARIETIES:

Sweet: California Wonder; Sunnybrook; Pennwonder; Vinedale

Hot: Long Red Cayenne; Red Chili; Hungarian Yellow Wax

Twelve to eighteen plants of peppers will provide amply for salads, sauces, chili, etc., for most families of five. Of these, three-fourths of the plants should usually be of the sweet type.

Since they are very tender and require a long season for maximum production, plants started from seed sown indoors about March 25 should be set in the garden after all danger of frost is over. They should be



Fig. 29. Sweet peppers are ready to eat when firm.

transplanted with considerable care to prevent checking growth which will reduce production materially. Irrigating will prove beneficial during mid-summer when the plants wilt rather easily.

Peppers are ready to be picked when they are firm and crisp. (Fig. 29). They are usually preferred while the color is still green, but are still very edible after turning red.

"Hot" peppers that haven't ripened before frost can be pulled by the roots and hung in the basement where they will mature.

Insects

Comparatively insect-free. Flea beetles sometimes eat small holes in the leaves. Dust with rotenone or methoxychlor.

Diseases

In the garden, peppers are often affected by diseases causing spotting of the leaves and fruit. Spraying the plants with fixed copper fungicides at weekly intervals will control these troubles. Plants may be dusted with fixed copper or with copper lime dust 20-80.

POTATOES

RECOMMENDED VARIETIES:

Early: Irish Cobbler

Medium Early: Chippewa, Pontiac

Late: Russet Rural, Katahdin, Sebago

Late (for Lake Superior district only): Green Mountain

The potato may prove a satisfactory crop for some home gardens. It is not recommended for the small garden or for gardens with heavy clay soil; nor is it recommended for gardeners who are not prepared to protect it from insect and disease pests.

The potato grows best on well-drained, sandy loam soil, that is well supplied with organic matter. It does especially well when it follows an alfalfa or clover crop. Rye, planted in August or September and plowed down the following spring when it is 6 inches to 12 inches tall, adds organic matter and frequently reduces damage from scab. Potatoes should not be planted on old grass sods because these are often infested with grubs which injure the potatoes. The soil should be plowed 6 to 8 inches deep in the spring and should be harrowed thoroughly so that it is in a mellow condition and free from lumps.

Certified seed should be planted, because it is relatively free from disease and generally out-yields ordinary seed. Michigan-certified seed is sold in 100-pound sacks through certain farmers' organizations and local seed stores. (Additional information on sources of Michigan-certified seed can be obtained from the Farm Crops Department, Michigan State College, East Lansing.) A 100-pound sack of seed is sufficient for a plot about 100 by 50 feet, and should produce 10 or more bushels of potatoes.

If the crop is wanted for use in July or August, the seed should be planted from April 15 to May 10 in Ingham County. For fall and winter use the plantings may be made from May 10 to June 10. Just previous to planting, the seed potatoes should be cut into pieces about the size of a small hen's egg. Each piece should be cut in a square or blocky shape and should have two or more eyes.

The cut seed should be kept in a cool place until it is planted. Do not plant if the soil is very wet. With a small garden plow or large hoe, make rows $3\frac{1}{2}$ to 4 inches deep and 28 to 36 inches apart. The seed pieces may be dropped in the rows at intervals of about 15 inches and covered immediately with 2 inches of soil. After the plants are above the ground the remaining $1\frac{1}{2}$ or 2 inches of soil can be worked into the furrow.

The soil should be kept well cultivated during the first few weeks after planting so that all grass and weeds are destroyed. All cultivation should

be shallow to prevent root injury. Cultivation should cease when the plants begin to blossom and set tubers. Any weeds or grass that appear late in the season should be cut off at the surface of the ground with a sharp hoe.

In cultivating potatoes the soil should be kept quite level. It is not necessary to hill up potatoes unless the soil is poorly drained or the potatoes appear above the ground.

Harvesting should generally be delayed until the vines mature or until after they have been killed by frost. Well-matured potatoes are of better eating quality than immature stock, and they keep better in storage. If possible, dig the crop on a clear day when the soil is not wet. Dig and handle the potatoes carefully to prevent bruises and cuts. Let the potatoes dry off well before putting them in storage.

Success in storing potatoes depends largely upon the quality of the crop stored. Well-matured potatoes that are relatively free from bruises and other defects will keep the best in storage. Special precautions should be taken to store only sound stock. The storage cellar should be well insulated so that during the winter months a uniform temperature of 40° F. can be maintained. The storage cellar must be kept dark to prevent the potatoes from turning green and developing a bitter flavor.

Insects

Potato insects, with the exception of stalk borer, are controlled best with a 5% DDT dust or a spray of 1 ounce of 25% DDT in 2 gallons of bordeaux or other fungicidal spray. The older formulas for control as given below are still effective, and are given in case DDT is unavailable.

POTATO BEETLES — The adult potato beetle and its larva cause a considerable loss to the crop. If a dust is preferred for this control, a mixture of 5 parts of calcium arsenate with 95 parts of hydrated lime is satisfactory. If hydrated lime is not available, cheap flour may be used. Paris green, 3 parts to 100 of hydrated lime, is also used. A calcium arsenate spray at the rate of 2 pounds of calcium arsenate to 100 gallons of water or bordeaux mixture is effective. Repeated applications are necessary for the control of this insect and should be made when the insects appear.

POTATO LEAF-HOPPER — This tiny, green, jumping, and flying pest usually appears, if at all, during dry spells. It causes the leaves to turn brown, curl, and finally to die. Pyrethrum dust will kill leaf-hoppers effectively if used once a week. Apply it to hit both the upper and under sides of the leaves. About three or four applications are usually necessary.

PLANT LICE — Plant lice on potatoes can be readily controlled by a spray of nicotine or pyrethrum, although it is usually necessary to use the material twice as strong as for most other aphids.

COMMON STALK BORER—This insect is a slender, naked caterpillar which sometimes attains a length of a little more than an inch. It is cream colored and striped longitudinally with narrow stripes of chocolate brown. The middle of the body is also colored brown.

No spray treatment is known that will prevent these borers from attacking fleshy-stemmed plants. The best treatment is to keep down all weeds in the vicinity within 2 rods of the planting, as these insects have a tendency to migrate from plant to plant.

Diseases

Potato diseases are carried to the garden on or in the seed pieces or by insects and other agencies from nearby potato fields. In cutting the seed-pieces, first cut off a slice one-half inch thick from the stem end. If a brown ring is disclosed, discard this tuber because it is probably affected with the *Fusarium wilt* disease. Plant only certified seed.

Virus diseases causing mottling, crinkling, rolling and yellowing of the leaves and stunting of the plants are carried in the tuber, but they show little indication of their presence in the seed piece. For this reason use, if possible, sound, clean stock, known to be free from such diseases as *Mosaic*, *leaf roll*, *spindling sprout*, *yellow dwarf*, and other virus diseases. These diseases are also carried and spread by insects such as the potato aphid and leaf-hopper.

Other leaf diseases such as *early blight* and *late blight* often appear in late summer. The early blight shows as brown to black spots with target-board markings. Late blight is first seen as small, water-soaked spots on the leaf. These enlarge, involving entire leaves with a white moldy growth of the parasite on the under surface. Both these diseases may be prevented by thorough dusting or spraying with a fixed copper material at intervals of 10 days from the time the plants are about 6 inches high. Four to six applications should be made during the growing season.

PUMPKINS

RECOMMENDED VARIETY: New England Pie (Syn. Sugar Pie, Small Sugar),
Cheyenne Bush (for small areas)

Pumpkins require so much space that they are seldom recommended for the small garden. Bush types can be used in small gardens. They can be planted 4 feet apart each way. Pumpkins can be planted in the early corn to conserve space, provided there is sufficient moisture and fertilizer available to mature the two crops. They like a well-drained, sandy loam soil. Four to six seeds are usually sown to the hill. The hills of vining types are spaced 6 to 8 feet apart each way. The seedlings are thinned to 3 to the hill when they start to come up.

Insects

See Squash, page 87.

Diseases

See Cucumber, page 69.

RADISHES**RECOMMENDED VARIETIES:**

Summer: Scarlet Globe; Cherry Belle; Icicle

Winter: California Winter White; Round Black Spanish; Long Black Spanish

Radishes do best in cool weather and when given plenty of moisture. Under those conditions they will grow rapidly and produce crisp and crunchy roots. Although a few feet of row may be sown every 10 days throughout the summer to provide a succession of this crop, since mid-summer plantings often become rather "bitey," many Michigan gardeners prefer to make only three or four plantings in early spring, then perhaps two in the fall.

Winter radishes are sown in July or early August and can be stored like other root crops for winter use. They grow larger than summer radishes but have a very mild flavor and fine texture.

Insects

CABBAGE MAGGOT — About the only insect that damages radishes in the garden is the cabbage maggot. This insect can be controlled as if it were attacking cabbage — through the use of a solution of bichloride of mercury, 1 ounce in 8 gallons of water, applied to the soil alongside the plants at weekly intervals.

Remember that this material is very poisonous and that the radishes treated with it should be very thoroughly washed before using.

A substitute treatment consists of dusting the radishes as soon as they come up with $\frac{3}{4}$ or 1 percent rotenone for 6 or 7 treatments at 4-5 day intervals.

Diseases

Ordinarily disease-free.

RHUBARB

RECOMMENDED VARIETIES:

MacDonald

Victoria

Strawberry

Rhubarb does best in a rich soil with plenty of moisture, but it should not be planted in a place where water is likely to stand in the spring.

It is propagated by divisions of the old plant. The divisions may be planted either in late September or in early spring. The crowns should be placed just at the surface of the ground. The stalks should not be cut the first year after planting. After the first year cutting should cease about July 1. If seed stalks appear they should be cut off. An application of manure or commercial fertilizer made about July 1 will help to build up the plants for the coming year.

Rhubarb can be forced indoors for winter use. Dig a few plants just before the ground freezes. Leave the soil on them but allow them to lay outside until after several hard freezes. Then put them in a basement. Pile sand around them and keep it moist. The temperature should be between 50 and 60° F. Stems which develop are delicious and tender.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

RUTABAGA

RECOMMENDED VARIETIES: American Purple Top; Laurentian

Although similar to turnips in many respects, rutabagas should be sown about a month earlier — not later than June 20 — for best results. They do best in a deep, rich, sandy loam soil. The seed is sown in rows spaced 24 inches apart, and the plants are thinned to stand 6 to 10 inches apart in the row. They will withstand light frost but should be dug before the ground freezes. The roots can be stored for winter use in sand at a temperature of 33-40° F.

Insects

See Cabbage, page 54.

Diseases

Ordinarily disease-free.

SALSIFY

RECOMMENDED VARIETY: Mammoth Sandwich Island

Salsify or vegetable oyster roots resemble small parsnips in appearance; when cooked their flavor resembles that of oysters. They require a long season. Seed should be sown as early in spring as possible in rows 18 inches apart. The plants should be thinned to stand 3 to 4 inches apart in the row. A rich, sandy loam soil is necessary for this crop, otherwise the roots will grow deformed. The roots may be dug late in the fall and stored, or they may be left in the ground and used during the winter if mulched with straw or leaves.

Insects

Comparatively insect-free.

Diseases

Ordinarily disease-free.

SPINACH

RECOMMENDED VARIETIES:

Long Standing Bloomsdale
America

Spinach is definitely an early spring and late fall crop. It should be sown just as early as the soil can be worked in the spring. A second crop can be sown about two weeks later and a third crop can be sown in late July or early August for fall use. Late spring or early summer sowings will invariably bolt to seed. Spinach does best in a neutral to slightly alkaline soil. The seeds are sown in rows spaced 18 inches apart and the plants thinned to stand 3 to 6 inches apart.

Insects

Comparatively insect-free. Leaf miners are sometimes troublesome. Although they do not usually affect the plant's vigor, they do make it necessary to sort out infested leaves before using. Early spring or fall plantings usually escape damage.

Diseases

Downy mildew sometimes affects spinach in the home garden causing the formation of spots on the under sides of the leaves. These often are covered with the downy growth of the fungus. Spraying or dusting with fixed copper will hold the disease in check. Application of fungicides must be thorough. The copper material must be carefully rinsed off the leaves before they are used for food. Seed treatment as indicated in the chart on page 43 may be used.

SQUASH

RECOMMENDED VARIETIES:

Summer: Early Prolific Straightneck; Zucchini (Green Italian type); White Bush, Caserta

Winter: Table Queen (Syn: Acorn, Des Moines, Pepper); Buttercup; Hubbard; Delicious; Butternut

Six plants of summer squash will usually produce plenty of fruits for a family of five, and six hills each of Table Queen, Buttercup, and Hubbard or Delicious will provide for winter storage. The variety Delicious is similar to Hubbard, but smaller and more of a size that will be eaten by the small family.

Squash is very tender and should not be planted until after the ground has become warm in the spring. The vining type should be planted in hills spaced 6 to 8 feet apart, while the bush type may be planted 4 feet apart each way. Sow 6 to 8 seeds in a hill, then cut out all but the three best plants when the true leaves start to develop. Earlier squash can be obtained by sowing the seed indoors in baskets or plant bands about 3 to 4 weeks before time to set out. Better results will be obtained if a hole 12 inches deep and 2 feet in diameter is dug where each hill is to be. This hole should be half-filled with manure, then filled level with soil before planting.

To conserve space, squash hills can be located at the edge of the garden and the vines can be trained on the fence or on the adjoining grass.

Squash is sometimes planted in the early corn, but in dry weather both crops will suffer. If this is done, the corn should be cut as soon as it matures.

Insects

SQUASH BUG—Squash bug is a dark gray or nearly black bug, about $\frac{3}{4}$ inch in length. This pest sucks the sap from the squash vines, leaves, and stems. It is readily recognized by the odor given off when one is crushed. In the home garden, one of the best methods for controlling this insect is to place boards in the garden at night and then pick them up early in the morning and throw the bugs found beneath them into kerosene or crank-case oil. Sabadilla, dusted on squash plants, also gives effective control of this insect.

Covering the bugs with dirt 2 or more inches deep will kill them.

SQUASH VINE BORERS—Squash vine borers tunnel into the stem at the base. They are not commonly noticed until they have become fat, white, and $\frac{3}{4}$ inch long. They hatch, however, from eggs laid on the outside of the plant just as it begins to run. Repeated spraying with an arsenical in

bordeaux mixture or dusting with 5% methoxychlor or rotenone on the first 6 to 10 inches of vine will control them. The proper time to spray is between June 20 and July 15. Start when the vines begin to run. Cover plants with dirt at the nodes, causing them to root and you may raise squash in spite of borers.

Diseases

See Cucumber, page 69.

TOMATOES

RECOMMENDED VARIETIES:

Early: Valiant; Early Chatham; Early Wonder

These latter two varieties are recommended for the northern part of the state. If chosen in southern Michigan, only a few plants should be grown for the extra-early crop. The main crop there should be of midseason or late varieties.

Midseason: Stokesdale; Longred; Pritchard; John Baer or Bonny Best

Yellow Varieties: Jubilee; Sunray

Tomatoes are very tender and should not be planted out until all danger of frost is past. The plants are started indoors from seed sown about April 1. In the southern counties, they can be seeded directly out of doors about May 10, but this practice is not usually recommended.

A sandy loam soil is best for tomatoes, particularly for the early crop, however, clay loam is very satisfactory for the late crops.



Fig. 30. Tomato plant with collar of stiff paper to protect plant from cutworms.

Tomatoes may be staked, or they may be allowed to spread over the ground. If they are staked the plants may be spaced 2 to 3 feet apart, in rows 3 feet apart. If they are allowed to run, they should be spaced 4 to 5 feet apart each way. Although more plants are required to plant a given area when they are staked, the production per plant is reduced by the pruning that is necessary and, consequently, the production per square foot is not greatly increased. The main advantage in staking lies in the fact that there is usually a higher percentage of perfect fruits.

If, however, a mulch of straw, grass clippings or even pea vines is placed on the ground under plants that are not staked to keep the fruits off of the soil, very little

rotting will occur and the mulch will help to retain an even soil moisture content, and reduce to some extent injury from blossom-end rot which is caused by insufficient soil moisture.

When the plants are staked, stakes at least 1½ inches square and 6 feet long should be driven securely at the spots where the plants are to be set. When the vines are 12 to 15 inches long, remove all but one or two main stems and tie these loosely to the stake, using soft string or rags. Loop the string around the stake once to hold it in place, then fasten the string around the stem, preferably just below a large leaf. The stem should not be drawn tightly against the stake.

Staked plants will need to be pruned about every week or 10 days by removing the young branches that develop in the axils of the leaves. Leaves should not be removed since they shade the fruits and prevent sunburning. Plants that are not staked do not need to be pruned.

Instead of stakes, slatted frames can be made over which the plants can be trained. When handled in this manner, less pruning is necessary.

Short stocky plants are preferred for setting out. If the plants have become leggy, however, they can be set deeply in the soil. Plants a foot or so tall can be placed in the soil rather deep and at an angle. They will root out along the stem. Many growers prefer to use about a cupful of a starter solution (made by dissolving 1 ounce of a complete all-soluble fertilizer high in phosphorus to 1 gallon of water) to water the plants with when transplanting.



Fig. 31. Tomato worm.

About a dozen unstaked plants or 20 staked plants should be planted for each adult member of the family to produce enough for fresh use, canning, and juice.

Insects

TOMATO WORM — Tomato worms are large green worms which are often found devouring the leaves of plants late in the season. (Fig. 31.) Under garden conditions probably the best way to get rid of them is to pick them off by hand and destroy them.

They can be controlled by spraying or dusting with calcium or various other materials while they are small, but after they become 2 inches or more long it is almost impossible to kill them with insecticides. DDD, when available, gives good control.

APHIDS — Aphids may become a serious pest on tomatoes. Make repeated dustings with $\frac{3}{4}$ % Rotenone for control.

CUTWORMS — Cutworms are very troublesome. *See page 39.*

FLEA BEETLES — Flea beetles eat small holes in the leaves of recently set tomatoes. Rotenone or methoxychlor can be used to prevent damage.

Diseases

The common diseases of this crop are the *leaf and fruit spots* and *blossom-end rot* of the fruit. The leaf spots may appear either on young or fruiting plants. These spots are black or brown, at first small, but later enlarging until a considerable area of the leaf may be involved. Spraying with fixed copper at intervals of a week or 10 days from time of setting will prevent the leaf spot diseases. Blossom-end rot is a non-parasitic disease which first appears as a small sunken water-soaked spot at the apical end of the fruit. As this spot enlarges, it turns darker in color and becomes leathery. Blossom-end rot is caused by a lack of, or severe fluctuation in the water supply of the plant at the time fruit is forming. Irrigation, cultivation to kill weeds and conserve moisture, or the use of mulch will lessen or prevent this trouble.

TURNIPS

RECOMMENDED VARIETY: Purple Top White Globe

Although turnips can be grown as a spring crop, much less trouble will be experienced with maggots if they are planted after July 1. They mature quickly and can be planted as late as August 1 in southern Michigan.

The seed should be sown in rows spaced 18 to 24 inches apart, and these seedlings should be thinned to stand 4 to 6 inches apart in the row. The thinnings may be used for turnip greens.

Like other root crops, they can be stored over winter either in outdoor pits or in moist sand in a storage room at 33° to 40° F.

Insects

See Cabbage, page 54.

Diseases

Usually disease-free.

THE STORAGE OF GARDEN VEGETABLES

The storage of vegetables is perhaps the easiest and least expensive of all methods of food preservation. Many families prefer to store such things as carrots, beets, and pumpkins rather than can them. Some vegetables such as turnips, rutabagas, salsify, parsnips, potatoes and onions can best be preserved by storing. For satisfactory results, good storage conditions are essential whether you store in the basement or out-of-doors.

Although each family's requirements vary, the quantities recommended in Table 4 will meet the needs of the average family of five.

TABLE 4—Store these quantities for a family of five

Beets.....	1/2- 1 bushel	Onions.....	1- 2 bushels
Carrots.....	2- 3 bushels	Cabbage.....	25-35 heads
Turnips and rutabagas....	1- 2 bushels	Squash and pumpkins.....	20-25 fruits
Salsify and parsnips.....	1- 2 bushels	Dry beans (navy, lima, soy)..	8-12 quarts
Potatoes.....	12-20 bushels	Tomatoes (green-mature)...	1- 2 bushels
	Celery—Chinese Cabbage, Brussels Sprouts		} Sufficient for a short time

The amount of each kind of vegetable to be stored will depend upon the family's tastes and upon the amount of canning done. If you can carrots and beets or make lots of kraut, naturally the quantity of these vegetables to be stored would be reduced. By having plenty on hand, however, you can encourage your family to eat more of the healthful, nutritious foods listed. It is better to store too much than too little.

Vegetables can be listed according to their temperature and humidity requirements. Table 5 indicates the conditions under which each crop stores best.

Carrots, beets, parsnips, salsify, rutabagas and turnips must be kept cool and very moist. A humidity of 90 to 95 percent is suggested. Naturally this high humidity is very difficult to achieve in an open basement storage room. Therefore, they are usually stored in sand or in leaves so that the high humidity can be maintained. Parsnips and salsify are frequently left in the ground over winter. With a mulch of straw or leaves over them, they will keep very well. However, it is better to dig at least enough for use during the severe part of the winter and to store them where they are easy to

TABLE 5—*Proper storage conditions for home garden vegetables*

Cool and Moist 32° to 40° F. Humidity 90 to 95%	Cool—Moderately Moist. 32° to 40° Humidity 75 to 80%	Dry and Cool	Dry and Warm
Carrots Beets Parsnips Salsify Rutabagas Turnips Celery	Potatoes Cabbage Cauliflower Chinese Cabbage	Onions Beans Peas Soybeans	Pumpkins Squash

obtain. If stored in the basement, carrots may be packed in cans or similar containers with leaves or sand to maintain a high humidity.

The second column of Table 5 lists those vegetables that need to be kept cool and moderately moist. A humidity of 75 to 80 percent is suggested. These need not be stored in sand, for this humidity can be maintained in the average basement storage room.

Apples and pears are sometimes wrapped if the storage facilities are not ideal and they do keep much better in this way. This is not necessary, however, if the temperature and humidity suggested can be maintained.

Cabbage should be pulled rather than cut for storage. It will keep better if the roots are then replanted in sand. Cabbage stored in the basement has a tendency "to scent up" the house, so you may prefer to store it outdoors by one of the methods suggested later.

In the third column, Table 5 lists those vegetables that require a cool dry storage. Onions should not be pulled until the tops have dried. They should then be spread out in a well ventilated place to cure for a week or 10 days before being placed in storage. A moist root cellar or basement storage room is not a good place to store onions. The attic or a cold dry room in the basement will be best. They must not be allowed to freeze. They can be stored in slatted crates, coarse mesh bags or on shelves in thin layers but should not be packed too deeply or in closed containers because of possible heating.

Dry beans, soybeans and peas should be stored in closed containers, such as glass jars.

The last column of Table 5 indicates those vegetables that need to be stored in a dry warm place. Most common of these vegetables are pumpkins and squash. Store them at about 40° to 50° F. in a dry room. They keep best if placed on shelves so that they do not touch each other.

Green, mature tomatoes can be kept from 6 to 8 weeks if perfect, mature, green fruits are picked before danger of severe frost and then

stored at a temperature of about 55° to 65° F., on shelves. They will ripen over a period of about 2 months. Cauliflower and brussels sprouts, like cabbage, should be pulled and replanted. Kohlrabi and winter radishes, although not listed on the charts, should be stored at about 35° F. in moist sand or covered boxes.

BASEMENT STORAGE CONSTRUCTION

Those who have a well-constructed basement storage room are indeed fortunate. Figure 32 indicates the type of construction suggested. If the walls are to be made of wood, a double wall should be constructed and insulating material such as rock wool or redwood bark should be used between the walls.

A corner of the basement in which there is a window should be selected for this storage room. A framework of 2 x 2's or 2 x 4's should then be made to enclose the area, and the framework should be covered with water-proof building paper. The walls should then be sheathed up with lumber or wall board. The space between the studs should be filled with the insulating material. A ceiling should be built, using either matched lumber or wall-board, and 2 or 3 inches of the insulating material should be used between the ceiling and the floor above. The door should fit well and, preferably, should be insulated.

A ventilating flue should be built into the space where one of the panes of glass has been removed from the window. This flue should extend almost to the floor to serve as a cold air intake. It should be fixed so that it can be closed in extremely cold weather. One pane of glass in the window should be fixed so that it can be opened to permit the escape of warm air.

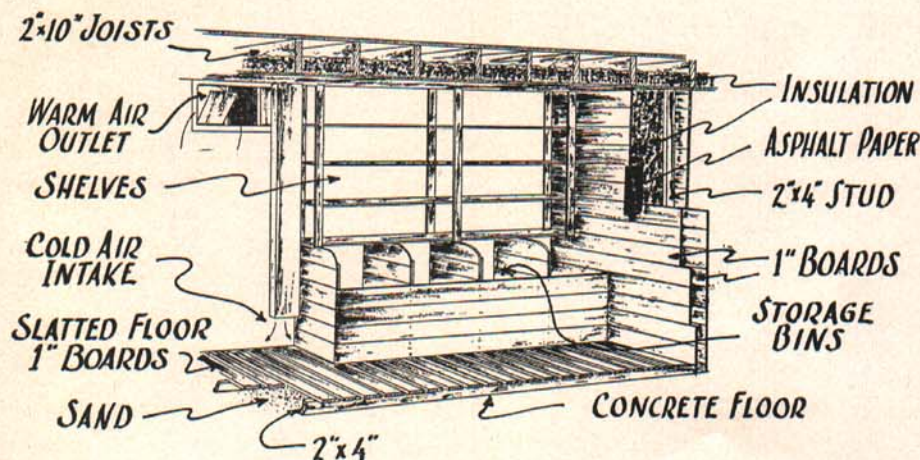


Fig. 32. If available, a well ventilated and insulated basement storage is the most convenient place in which to store vegetables.

Both this and the third pane should be darkened so that the basement can be kept dark at all times. It is suggested that a slatted floor be constructed over a layer of about 3 inches of sand which is placed on the concrete basement floor to maintain proper humidity in the storage room. Shelves can be built in the storage room to provide more storage space. If your shelves are wide, it will be satisfactory merely to place the sand on the floor underneath the shelves and pack your vegetables in it. It would then not be necessary to use a slatted floor. Storage bins for various kinds of vegetables are a great convenience.

OUTDOOR STORAGE

Probably many home gardeners will not have suitable basement storage rooms or find it convenient to construct them. In that case most vegetables can be stored out-of-doors by one of several methods. In any type of vegetable storage, it should be remembered that particularly during the early storage period there is some physical and chemical breakdown in the plant tissues, resulting in the creation of some heat and the giving off of some gases. It should also be remembered that stored vegetables are merely dormant — not dead — and in that stage they take in certain gases from the air and give off others. For these reasons ventilation of some sort must be provided.

In a very small storage pit (less than one bushel), dry straw or leaves lining the pit will probably provide all the ventilation necessary. The straw

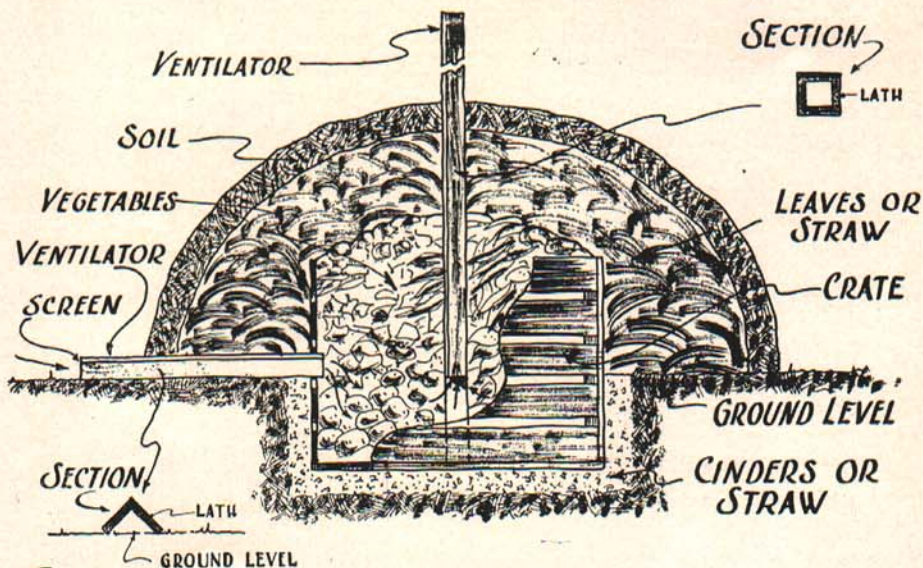


Fig. 33. An assortment of vegetables stored in each of several slatted crates in this ventilated mound storage will keep fresh and crisp throughout the winter.

or leaf covering should be added gradually as the outdoor temperature drops. This provides better ventilation early in the storage period and avoids heating at that time. Be sure always to have plenty of covering to avoid freezing. In larger pits a ventilator should be used.

CRATE STORAGE

Of all the methods of outdoor storage, crate storage is probably the best. An assortment of vegetables is placed in each of several slatted potato crates so that an entire crate can be taken into the house at one time during the winter to provide a variety of vegetables for a 2- or 3-week period. The crates are then placed in a well-drained spot out-of-doors. They should have a layer of 3 to 4 inches of straw or leaves under them, and should be spaced far enough apart in order that sufficient straw can be placed between the crates, so that when one is removed in winter the remaining ones will not be exposed to the cold.

Intake ventilators, each consisting of two pieces of lath, are then nailed together as shown in Fig. 33 and placed horizontally on top of the soil, with one end running into each crate and the other extending beyond the area to be covered with straw. Outlet ventilators, each consisting of four pieces of lath, are then nailed together as shown. The bottom ends of those ventilators run to the center of each crate and the tops extend up above the area to be covered with straw.

The crates are then covered with a heavy layer of straw or leaves (perhaps 2 or 3 feet will be necessary.) Cover this with a layer of 4 to 6 inches of soil. The outer ends of the ventilators should be protected against rain, snow, and mice.

The advantage of this type of storage over others lies in the fact that as the temperature of the vegetables rises in early winter, owing to the slight and unavoidable breakdown or deterioration in the early storage period, more cold air is drawn in through the horizontal lath vent on top of the ground, forcing the warm air and gases out the vertical ventilator at the top. When the outdoor temperature drops far below the freezing point, the ventilators can be plugged with straw.

BARREL COVERED WITH STRAW AND EARTH

There are several other methods of outdoor storage that are easy and satisfactory. A barrel, such as shown in Fig. 34, can be used and packed with vegetables. It is better to arrange several layers of vegetables divided with straw or leaf partitions. Pack a layer of assorted vegetables in the bottom, then a layer of straw, another layer of vegetables, etc. When you open the barrel during the winter and take out all of the vegetables in one layer, the straw below it protects the other vegetables from the cold. The

barrel can be set vertically in the ground, or it can be inclined slightly or laid horizontally. In the latter case, a hole should be dug about 12 inches deep to accommodate the barrel.

In any event, the barrel should be covered first with a good layer of straw and then with soil. Such a barrel should be ventilated to provide for the escape of gases created, particularly, during the early storage period. This ventilation can be provided by running a piece of perforated down-spout into the center of the barrel. The exposed end of the ventilator pipe should be protected from rain, snow and mice and it should be plugged during extremely cold spells.

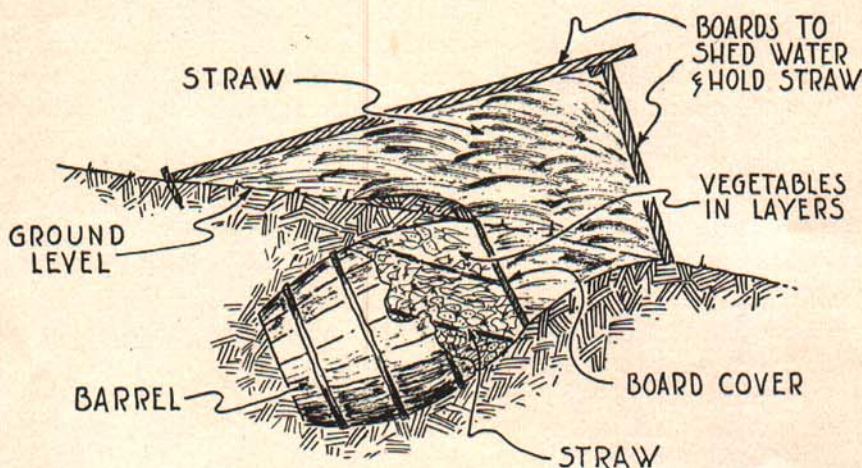


Fig. 34. When storing in barrels, separate the layers of vegetables with straw to provide ventilation and protection against cold when the barrel is opened.

CABBAGE AND CELERY STORAGE

Cabbage, chinese cabbage, and celery keep best if stored so that the air can circulate around them. To store these crops, a frame can be made by driving four stakes into the ground with about 18 inches of the stakes protruding above the soil. Side boards are then fastened to the outside of the stakes to enclose the area, and enough boards or cornstalks are placed over the top to support the straw or leaves needed to protect the plants. The cabbage and celery plants are pulled up by the roots and replanted very close together, inside the frame. A heavy layer of straw or leaves is then added to prevent freezing. Ventilation can be provided by means of a piece of down-spouting or a wooden ventilator. The exposed end should be protected from rain, snow and mice and should be plugged during very cold weather.

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Eighth Revision, April 1947

Ninth Revision, May 1949

Tenth Revision, March 1951

Eleventh Revision, April 1954

