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PB901-Growing Vegetables in Home Gardens

The University of Tennessee Agricultural Extension Service

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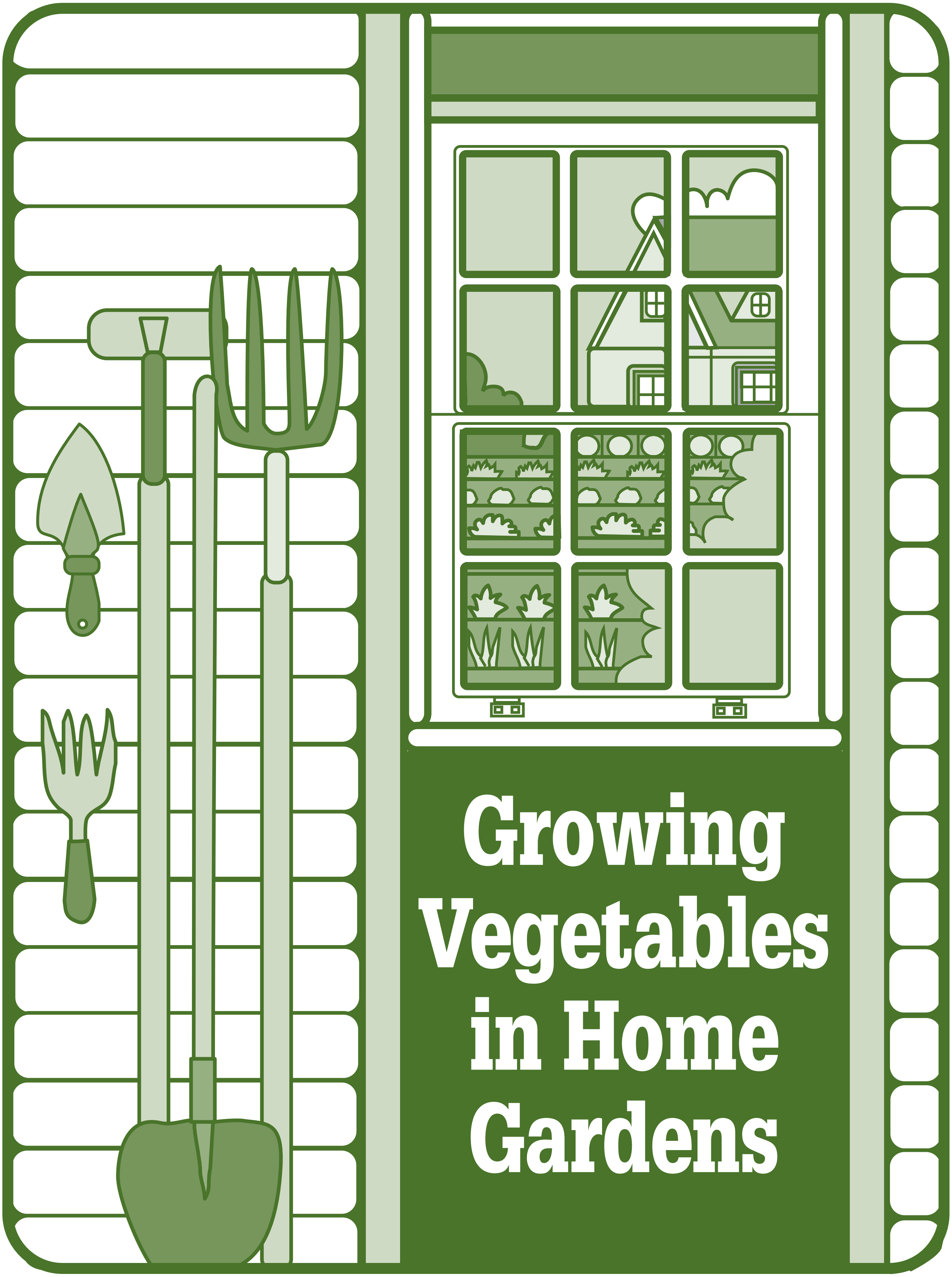

Growing Vegetables in Home Gardens

THE UNIVERSITY of TENNESSEE

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Growing Vegetables in Home Gardens

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Introduction

Gardening can be highly rewarding, but it is not without problems and efforts. A successful garden requires a good site, careful planning, good management and considerable hard work. Insects, diseases and weeds require control measures. Acidic, infertile, poorly drained or sandy soil may have to be improved. Shade and extremes of moisture and temperature are other problems that must be overcome for a garden to be successful.

For those willing to plan carefully and to perform timely gardening tasks, gardening can be very worthwhile. A vegetable garden can produce a steady supply of vegetables from spring to fall. These vegetables can be harvested at optimum maturity and eaten or preserved while fresh. Fresh vegetables may be higher in flavor and nutritive value and lower in cost than purchased vegetables, which may have been harvested several days earlier. Vegetable production provides healthful exercise and an interesting outdoor activity for the entire family. Many gardeners feel the sense of accomplishment, self-sufficiency and security accompanying a successful garden are other significant rewards of gardening.

Basic Techniques

Site Selection

A good garden site is essential for high vegetable yields. Poor sites not only produce low yields, but may also be extremely difficult to grow a garden on at all.

Choose a garden site with deep, medium-textured, well-drained, nearly level soil. Fine-textured, clay soils stay wet late into the spring, are difficult to work and tend to crust badly. Sandy soils dry out very quickly and require frequent nutrient applications. Excessive slopes tend to erode. A slight slope, however, is desirable to prevent cool air from collecting and forming a frost pocket.

Most garden vegetables require six hours of sunlight or more per day to produce well. The more the garden is shaded, the slower the vegetables will grow and the lower their yields will be. Trees and large shrubs not only shade gardens, but also use nutrients and water needed for proper vegetable growth.

A site near the house makes it more convenient to care for the garden and to harvest vegetables. Water is available for transplanting and irrigation. Children or animals in the garden can be observed, and the garden may be protected from these and other potential problems.

Planning the Garden

A garden plan will save time, space and money. Yields will be increased, as will the length of the harvest season.

Begin by making a scale drawing of your available garden area on graph paper. Divide the drawing into cool-season and warm-season vegetable planting areas.

Cool-season vegetables are those such as onions, cabbage, radishes and English peas. They require cool weather to grow and mature properly and can withstand some frost. Cool-season vegetables are planted in the early spring and again in the fall. Warm-season vegetables require warm weather to grow properly and are planted after the soil has warmed up. Frost will kill warm-season vegetables. Examples of warm-season vegetables include okra, sweet potatoes, cucumbers and tomatoes.

The cool-season section of the garden will be planted early and harvested in time to be replanted. Alternate the cool and warm-season areas of the garden each year to reduce plant pest problems.

Decide which vegetables to grow and the amount of each vegetable you want. Use Tables 1-3 (pages 5 through 7) to estimate the row lengths required to obtain the desired amounts. Sketch and label the rows of each vegetable on your plan to scale, using the row spacings suggested in Tables 1-3. Be sure to arrange the rows so tall vegetables won't shade shorter ones. Make a note of the planting dates, varieties and amount of seeds required on your plan so a periodic glance will show what needs to be done.

Gardening Tools

An efficient garden that's fun to work in requires the correct tools. It is not necessary to have a lot of tools, but they should be good quality. All gardeners will require the following:

1. ***A shovel or a spade.*** Shovels are long-handled and have wide, rounded blades. Spades are shorter and

usually have narrow blades. Sharpshooter shovels are spades. Some prefer a long-handled shovel for nearly every gardening task from spading soil to planting and transplanting shrubs. The shorter spade is stronger but harder to use. The spade works well to dig a raised bed or a post hole. It is also a good tool for prying, cutting larger roots and even spading. All gardeners should have one or the other, and both would be a good investment.

2. ***A hoe.*** The hoe is a universal gardening tool. There are dozens of kinds, sizes and shapes. The standard square-bladed gooseneck hoe is the one to begin with. It is suitable for removing weeds as well as opening and closing furrows for seeding. Other hoes can be added if and when you need them.
3. ***A rake.*** The bow rake is essential for smoothing and leveling seed beds. It may also be used to cover planting furrows, move mulches, clean up debris and kill emerging weeds.
4. ***A trowel.*** Buy a good trowel, 3 or 4 inches wide. Use it to transplant small plants, open short rows, dig small holes and even to weed and cultivate around small plants.
5. ***Small supplies.*** Use twine and stakes for marking rows, maintaining straight rows and supporting plants. A bucket for carrying fertilizer and water to the garden and vegetables to the house is very helpful. A hose is essential for irrigation. Perhaps the most essential small tool is a good-quality file. Carry it with you when you work in the garden and use it frequently to keep tools sharp.

Store all tools away from sun and rain. Weather will deteriorate and roughen handles, as well as rust metal parts. Rust can be prevented by wiping a light coating of oil on metal after use. Rough handles can be smoothed with sandpaper. Well-cared for tools are easier to use and last much longer.

You will want to add additional tools and equipment as your needs grow and finances permit. The following items will prove useful:

1. ***Watering cans, hoes, nozzles and sprinklers*** for watering.
2. ***A spading fork*** for soil preparation and harvesting root crops.
3. ***A manure fork*** for turning compost and moving garden residues.
4. ***A wheelbarrow or garden cart*** for hauling large amounts of soil, fertilizer, plant residues or produce.
5. ***A rototiller*** for preparing large areas of soil and controlling weeds.

There are many sizes and types of rototillers. The large machines with tines in front of the wheels are the standard. They are less expensive and do a good job breaking up compacted soil, but require considerable physical strength to use.

Large, reartine machines are much easier to use and more suited to large garden areas, but they are also considerably more expensive to purchase. They do a better job of preparing a seedbed, especially in wet soils.

The last few years have seen the development of small rototillers weighing only about 20 pounds with an effective tilling width of 9 to 12 inches. These machines are too small for breaking up large gardens or sod, but they are excellent for working up a row in a previously turned garden or to remove weeds. They are especially good at working wet soil into a suitable seedbed.

Soil Preparation

Begin soil preparation by removing old plant supports, plastic mulches, excessive vegetative residues and other debris from the garden area several weeks before planting to allow the soil to dry out. The amount of plant residue that may be turned under depends on how large the pieces are, how the garden will be turned and how long before the area will be worked.

Long cucumber or tomato vines, for example, may be spaded or plowed under but may tangle on the tines of a rototiller. Cover crops and thick mulch or crop residue should be turned under six weeks or more before planting. This will promote decay and reduce nutritional and insect and disease problems in the garden. Adding three pounds of ammonium nitrate per 1000 square feet of soil surface before turning organic materials under will speed decay considerably.

Turning under significant amounts (an inch or more) of plant materials such as compost, organic mulches, leaves or cover crops annually will gradually increase soil organic matter content and improve most garden soils. The moisture-holding capacity will improve, as will the soil structure and nutrient-holding capability. Root penetration will improve on clay soils and soil crusting will be reduced.

Figure 1. *Pick up a handful of soil and roll it into a ball. If the soil sticks together and will not crumble easily, it is too wet to work.*

Table 1. Guide to Spring-planted, Cool-season Vegetables							
Vegetable	Planting interval	Seed or plants per 100-foot row	Inches between rows	Inches between plants	Days to first harvest	Length of harvest season	Yield range per 100-foot row
Beets	Mar. 1 to Mar. 10	½ oz. seed	14 to 36	2 to 3	55 to 60	4 weeks	75 to 150 lbs.
Broccoli	Mar. 1 to Apr. 1	80 plants	24 to 36	15	60 to 70	4 weeks	50 to 100 lbs.
Cabbage	Feb. 20 to Apr. 1	80 plants	24 to 36	15	60 to 75	3 weeks	125 to 200 lbs.
Cauliflower	Mar. 1 to Apr. 1	80 plants	24 to 36	15	55 to 65	2 weeks	50 to 100 lbs.
Carrots	Mar. 1 to Apr. 1	¼ oz. seed	14 to 36	2 to 3	75 to 85	4 to 6 weeks	50 to 100 lbs.
Collards	Mar.	¼ oz. seed	18 to 36	15	65 to 75	4 to 30 weeks	100 to 150 lbs.
Kale	Feb.	¼ oz. seed	18 to 36	12 to 15	55 to 65	4 to 20 weeks	100 to 150 lbs.
Kohlrabi	Feb. or Mar.	¼ oz. seed	14 to 36	6	40 to 50	4 weeks	50 to 75 lbs.
Lettuce, Head	Feb. or Mar.	¼ oz. seed	14 to 36	12 to 15	65 to 80	2 to 3 weeks	50 to 100 lbs.
Lettuce, Leaf	Feb. to Apr.	½ oz. seed	14 to 36	6	40 to 50	4 to 6 weeks	50 to 75 lbs.
Mustard	Feb.	¼ oz. seed	14 to 36	5 to 10	35 to 45	3 to 6 weeks	75 to 100 lbs.
Onions, Bunch	Feb. or Mar.	400 to 600 sets	14 to 36	2 to 3	30 to 60	3 weeks	30 to 50 lbs.
Onions, Storage	Feb. or Mar.	200 to 400 sets	14 to 36	3 to 6	100 to 120	2 weeks	50 to 100 lbs.
Peas, English	Feb. 1 to Mar. 20	½ to 1 lb. seed	12 to 36	2 to 4	65 to 70	2 to 3 weeks	20 to 30 lbs.
Peas, Snap	Feb. 1 to Mar. 20	½ to 1 lb. seed	12 to 36	2 to 4	65 to 75	2 to 3 weeks	30 to 50 lbs.
Potatoes, Irish	Mar.	14 lbs. seed	30 to 36	12	90 to 110	4 months stored	100 to 120 lbs.
Radish	Feb. 15 to Apr. 15	½ oz. seed	14 to 36	1 to 2	25 to 30	3 weeks	50 bunches
Spinach	Feb.	1 oz. seed	14 to 36	3 to 4	40 to 50	3 weeks	10 to 30 lbs.
Swiss Chard	Mar.	½ oz. seed	18 to 36	6 to 8	50 to 60	4 to 30 weeks	50 to 150 lbs.
Turnip, Greens	Mar.	½ oz. seed	18 to 36	2 to 4	30 to 40	Several weeks	50 to 100 lbs.
Turnip, Roots	Mar.	¼ oz. seed	18 to 36	3	40 to 65	6 months	100 to 150 lbs.

Garden soil should not be worked when it is too wet. Pick up a handful of soil and roll it into a ball. If the soil sticks together and does not crumble when dropped, it is too wet to work. Soil worked too wet forms large, hard clods which are difficult to break up and are completely unsuitable for a seedbed.

Soil should be worked to a depth of at least 6 or 7 inches and smoothed before planting. Seed should be planted only in moist, finely aggregated soil. Soils worked into a powdery condition are more likely to crust. Small seed planted in cloddy soil usually dry out and germinate poorly. Garden soil may be worked with farm equipment, a rototiller or spaded with a shovel.

Fertilizer and Lime

Vegetable gardens will not reach their potential unless the soil is properly limed and fertilized. Liming decreases soil acidity, increases fertilizer availability and reduces certain physiological problems such as blossom-end-rot of tomatoes, peppers and watermelons. A soil test is the only reliable method of determining the optimum amount of lime and fertilizer to apply.

Table 2. Guide to Warm-season Vegetables

Vegetable	Planting interval	Seed or plants per 100-foot row	Inches between rows	Inches between plants	Days to first harvest	Length of harvest season	Yield range per 100-foot row
Beans, Bush Snap	Apr.10 to June 20	¼ lb. seed	24 to 36	3 to 4	52 to 60	2 weeks or more	80 to 120 lbs.
Beans, Pole Snap	Apr.10 to June 20	¼ lb. seed	36 to 48	3 to 4	60 to 65	5 to 6 weeks	100 to 150 lbs.
Beans, Bush Lima	May or June	½ lb. seed	24 to 36	3 to 4	65 to 75	3 weeks	20 to 30 lbs. shelled
Beans, Pole Lima	May or June	½ lb. seed	36 to 48	3 to 4	80 to 90	4 weeks.	25 to 50 lbs.
Cantaloupe	May	¼ oz. seed	72	24	80 to 90	3 weeks	100+ melons
Corn, Sweet	Apr. 1 to June 1	¼ lb.seed	36	8 to 12	80 to 95	7 to 10 days	90 to 120 ears
Corn, Super Sweet	Apr.15 to June 1	¼ lb.seed	36	8 to 12	80 to 95	10 to 15 days	90 to 120 ears
Cucumber, Pickling	May	¼ oz. seed	72	12	50 to 55	3 to 6 weeks	115 to 250 lbs.
Cucumber, Slicing	May or June	¼ oz. seed	72	12	50 to 65	3 to 6 weeks	115 to 250 lbs.
Eggplant	May	50 plants	36	24	65 to 80	2 months or more	75 to 150 lbs.
Okra	May 5 to May 20	1 oz. seed	36	6 to 12	50 to 60	7 to 9 weeks	50 to 100 lbs.
Peas, Field	May or June	¼ lb. seed	36	4	65 to 80	3 to 5 weeks	30 to 40 lbs.
Pepper, Sweet	May or June	60 plants	36	18 to 24	55 to 80	2 to 3 months	50 to 75 lbs.
Pepper, Hot	May or June	60 plants	36	18 to 24	60 to 70	2 to 3 months	10 to 25 lbs.
Potato, Sweet	May	100 slips	36	12	110 to 120	5 months stored	75 to 125 lbs.
Pumpkin	May	1 oz. seed	120 to 144	48	100 to 120	4 months stored	40 to 50 pumpkins
Squash, Summer	May or June	1 oz. seed	48 to 60	12 to 24	40-50	6 weeks	100 to 150 lbs.
Squash, Winter	May or June	1 oz. seed	72 to 96	24 to 36	90-110	4 months stored	50 to 200 lbs.
Tomatoes	Apr. 10 to June 10	50 plants	48	24	70-80	8 weeks or more	200-300 lbs.
Watermelon	May	¼ oz. seed	120 to 144	48	80-90	3 weeks	20-25 melons

Table 3. Guide to Fall Vegetables							
Vegetable	Planting interval	Seed or plants per 100-foot row	Inches between rows	Inches between plants	Days to first harvest	Length of harvest season	Yield range per 100-foot row
Beans, Bush Snap	July 15 to Aug. 15	1/4 lb.	24 to 36	3 to 4	52 to 602	weeks or more	80 to 120 lbs.
Broccoli	July 15 to Aug. 15	66 plants	24 to 36	18	60 to 70	4 weeks	50 to 100 lbs.
Cabbage	July 5 to Aug 15	66 plants	24 to 36	18	60 to 75	3 weeks	125 to 200 lbs.
Cabbage Chinese	,July 1 to July 30	100 plants	24 to 36	12	40 to 50	4 weeks	200 to 300 lbs.
Cauliflower	July 15 to Aug. 15	66 plants	24 to 36	18	55 to 65	2 weeks	50 to 100 lbs.
Collards	July 1 to Sept.1	¼ oz. seed	18 to 36	18	65 to 75	4 to 30 weeks	100 to 150 lbs.
Cucumber, Pickling	July 1 to Aug. 1	¼ oz. seed	72	12	50 to 55	3 to 6 weeks	115 to 250 lbs.
Cucumber, Slicing	July 1 to Aug. 1	¼ oz. seed	72	12	50 to 65	3 to 6 weeks	115 to 250 lbs.
Kale	July 1 to Sept. 1	¼ oz. seed	18 to 36	12 to 15	55 to 65	4 to 20 weeks	100 to 150 lbs.
Kohlrabi	July 15 to Sept 1	¼ oz. seed	14 to 36	3 to 6	40 to 50	4 weeks	50 to 75 lbs.
Lettuce, Leaf	July 1 to Sept. 15	½ oz. seed	14 to 36	6	40 to 50	4 to 6 weeks	50 to 75 lbs.
Mustard	July 1 to Sept. 1	¼ oz. seed	14 to 36	5 to 10	35 to 45	3 to 6 weeks	75 to 100 lbs.
Potatoes, Irish	July 1 to July 31	14 lbs. of seeds	30 to 36	12	90 to 110	4 months stores	100 to 120 lbs.
Radish	Aug. 1 to Sept. 15	½ oz. seed	14 to 36	1 to 2	25 to 30	3 weeks	50 bunches
Spinach	Sept. 10 to Sept. 20	1 oz. seed	14 to 36	3 to 4	40 to 50	3 weeks	10 to 30 lbs.
Squash, Summer	July 15 to Aug. 15	1 oz. seed	48 to 60	12 to 24	40 to 50	6 weeks	100 to 150 lbs.
Tomatoes	July 1 to Aug. 1	50 plants	48	24	70 to 80	8 weeks or more	200 to 300 lbs.
Turnip Greens	Aug. 1 to Sept. 30	½ oz. seed	18 to 36	2 to 4	30 to 40	Several weeks	50 to 100 lbs.
Turnip Roots	Aug. 1 to Sept. 15	¼ oz. seed	18 to 36	3	40 to 65	6 months	100 to 150 lbs.

Instructions for taking soil samples and soil sample boxes are available at your county Extension office. The samples are sent to the University of Tennessee Soil Testing Laboratory in Nashville. The returned report indicates the amount of lime and fertilizer recommended. There is a small fee for this service.

Soil acidity is measured in pH units. Most vegetables grow best at a pH of 6 to 6.8. Once this pH is reached, it is generally necessary to check the pH only about every three years.

Lime requires time to dissolve and become be fully effective. For this reason, it is generally best to apply lime in the fall and to mix it into the soil. However, spring application of lime is better than no lime at all. The more finely ground lime is, the more likely a spring application is to produce the desired pH change.

Vegetable gardens require a "complete" fertilizer such as 6-12-12, 10-10-10, 13-13-13 or 15-15-15 for proper growth and development. The three numbers are referred to as the fertilizer analysis. The first number is the percentage of nitrogen in the fertilizer by weight. The second and third numbers are the percentages of phosphate and potash, respectively.

Manure is a complete fertilizer and may be used to supplement chemical fertilizer. Manure varies considerably in nutrient value, depending on the type of animal, length of storage, amount of bedding material and the moisture contained. Since most manure has less than 2 percent phosphate and less than 1 percent nitrogen and potash, several times more manure than chemical fertilizer must be applied if only manure is used. More detail on using manure as a fertilizer may be found in Extension PB 1391, "**Organic Gardening and Pest Control**."

Apply fertilizer to garden soils in the spring before planting. Manure is generally broadcast. Chemical fertilizers may be broadcast, applied in the rows or banded near or under the rows. If fertilizer is broadcast or applied in the rows, it should be worked into the soil before planting. Bands are most effective when placed about 2 inches to the side and 2 inches below the seed. Vegetable plants may be damaged by over-fertilization or fertilizer placed too near them. Soil test reports give amounts of fertilizer to broadcast in pounds per 1000 square feet and per acre. (Three rows 36 inches apart and 100 feet long equal 900 square feet). To convert the soil test recommendations to amounts per 100 foot of row, use Table 4.

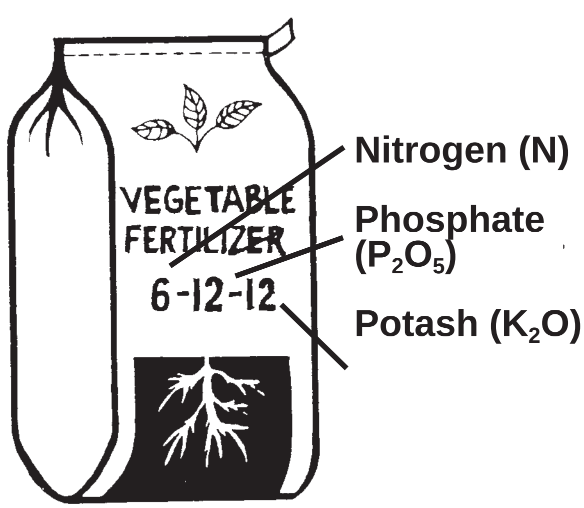

Figure 2. *Fertilizer analysis numbers refer to the percentage by weight of N, P_2O_5 and K_2O (nitrogen, phosphate and potash).*

Greens and vegetables with a long growing or production season benefit from additional nitrogen during the growing season. This is called "sidedressing." Sidedress by applying ammonium nitrate along the row, keeping 4 to 6 inches away from the base of the plants. Water or work the ammonium nitrate into the soil. Specific amounts of ammonium nitrate to use and growth stages where sidedressing is most effective are given in Table 5.

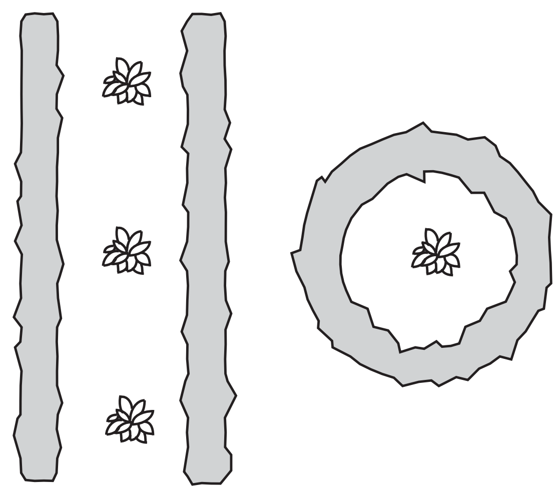

Figure 3. *Apply nitrgen sidedressings in bands along rows or circles around plants. Keep the fertilizer 4 to 6 inches from the plants.*

A complete fertilizer may also be used to sidedress vegetables, but the amount required will vary with the percentage of nitrogen in the fertilizer. Ammonium nitrate is about 34 percent nitrogen. Adjust the amount of other fertilizers used as sidedressing so the amount of nitrogen is the same as if ammonium nitrate were used.

Seeding and Spacing

Proper spacing among rows and between plants within rows is essential for maximum production of high-quality vegetables. Use the in row spacings suggested in Tables 1, 2 and 3. These spacings may be achieved by properly planting high-quality seed and thinning the rows, if necessary, when the seedlings are a few days old.

Tables 1, 2 and 3 also suggest between row spacings. These spacings assume mechanical equipment, such as a rototiller, is used to work the garden. If large farm equipment is used, the rows may need to be farther apart. If only a hoe is used, rows can be closer together.

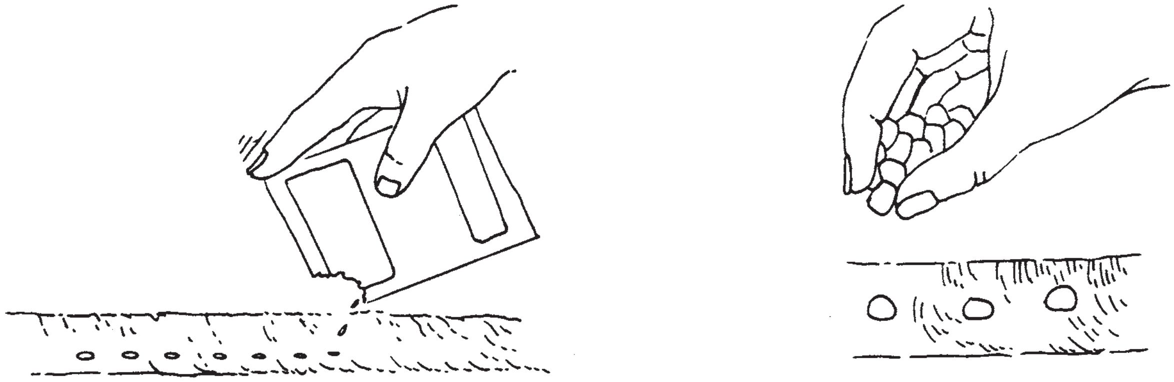

Figure 4. *Small seeds may be sown directly from the packet (left); large seeds should be dropped from the fingers (right) and carefully spaced. Do not sow seeds too deeply or thickly.*

Be sure to plant in a good seedbed, as described previously under soil preparation. Planting on ridges will further ensure good stands of cool-season vegetables and make it easier to plant at the proper time. Ridges promote germination early in the spring because they warm up and dry out quickly. Ridges also reduce the chance of spring vegetables being flooded during heavy rains. Later in the season, ridges may reduce germination or plant growth by drying out too quickly.

The soil must not be allowed to crust or dry out before seedlings emerge. Sand, compost, potting soil or similar materials may be placed over seed to prevent crusting in gardens with heavy clay soils.

It is also important that seed be planted at the correct depth. As a general rule, seed should be planted at a depth equal to two to four times their diameter. Plant shallowly early in the spring when the soil is wet and cold and a little deeper in the summer when soils are drier. Plant shallowly in heavy clay soils and a little deeper in light sandy soils.

Timing Plantings

Tables 1, 2, and 3 divide vegetables into cool-season, warm-season and fall vegetables. The recommended planting dates for each type of vegetable are quite different. There is also considerable variation as to the heat or cold tolerance of each vegetable. Plant within the recommended planting interval for each vegetable to ensure that the vegetable will have the maximum chance of growing and maturing properly.

Within the planting interval for a crop, you will often have adequate time to stagger several plantings. With many vegetables, such as lettuce, you may prefer a small but steady supply rather than a lot all at once. One of the best ways to achieve this is by making several small plantings two or more weeks apart. The same technique is appropriate for corn. With corn, the first planting can be larger if you plan to preserve some. This large initial planting may be followed by one or more smaller plantings made when plants of the previous planting have three fully developed leaves.

Transplants

Some vegetables are easier to grow from transplants than from seed. Beginning with transplants rather than seed will also speed vegetable maturity. Other vegetables, such as sweet potatoes or Irish potatoes, may not be commonly grown from true seed. Thus, gardens will likely contain vegetables grown from transplants, slips or seed pieces as well as from true seed. Cabbage, cauliflower, broccoli, tomatoes, peppers and eggplant are usually transplanted into the garden rather than direct-seeded. Cantaloupe, cucumbers, squash and watermelon may be transplanted if they are grown in individual containers and are transplanted without disturbing their roots. These vining vegetables should be seeded in containers 3 inches or more across, and transplanted about three weeks after seeding.

Most home gardeners purchase transplants rather than growing them. Transplant production is discussed briefly later in this publication (See page 18). More detailed instructions are contained in SP 291-A, "**Growing Vegetable Transplants for Home Gardens**."

When buying transplants, select short, stocky, healthy plants without yellowing or dying leaves. Avoid plants with dead spots or insects on the leaves. Choose plants in large containers over plants in smaller containers and plants in small containers over bare-root plants. Do not buy broccoli or cauliflower plants that are already beginning to form heads.

Transplants that are too old may be stunted. Very large transplants in small containers are often overhardened. They undergo considerable transplanting shock when set in the garden, because the small rootball has difficulty taking up sufficient water for the large leaf area. Vine crops should have only one or two sets of true leaves when set in the garden. Other transplants usually have three or four true leaves.

A small amount of purple color in the veins on the underside of the leaves is an indication of hardening. Transplants may be injured by sun, wind and cold temperatures if they are set in the garden without some hardening. You can

Table 4. Approximate Pounds of Fertilizer to Apply to 100-Foot Rows to Equal Recommended Rates

Recommended soil test rate		Fertilizer rates in pounds per 100-foot rows for various row widths*				
Per acre	Per 1000 sq. ft.	18 inches	24 inches	30 inches	36 inches	48 inches
435	10 lbs.	1.5	2.0	2.5	3.0	4.0
650	15 lbs.	2.3	3.0	3.8	4.5	6.0
870	20 lbs.	3.0	4.0	5.0	6.0	8.0
1090	25 lbs.	3.8	5.0	6.3	7.5	10.0
1305	30 lbs.	4.5	6.0	7.5	9.0	12.0

* One pint of dry fertilizer will weigh about one pound.

Table 5. Recommendations for Sidedressing Vegetable Crops

Crop	Ammonium nitrate per 100-foot row	Ammonium nitrate per plant	Time of application
Cucumbers, Cantaloupe, Pumpkins, Squash, Watermelon	1 to 1½ pounds	1 tablespoon	When vines are 1 foot long.
Tomatoes, Pepper, Eggplant	1 to 1½ pounds	1 tablespoon	When first fruits are 1 inch or more in diameter.
Sweet Corn Okra Lettuce	1 to 1½ pounds	----------	When 12 to 18 inches long. After the first picking. Three to four weeks after seeding.
Greens, (Turnips,Spinach, Collards, Kale, Mustard)	2 to 3 pounds	----------	Six weeks after seeding.
Broccoli, Cabbage, Cauliflower, Brussels Sprouts	1 to 1½ pounds	½ tablespoon	Three to four weeks after transplant.

harden vegetable plants by lowering temperatures 10 degrees for 10 to 14 days. Allowing the plants to wilt slightly between waterings will also harden them. However, lowering the temperature or water supply too much will stunt or kill the plants. If the leaf tissue between the veins is purple, the plant is probably overhardened or stunted. A stunted plant may never recover and is slow in producing if it recovers. Never harden cantaloupe or other vine crops.

Set transplants on a cool day or in the evening. Watering transplants with one-half to one pint of a starter solution per plant will reduce transplanting shock and produce earlier vegetables. Mix one tablespoon of water-soluble, high-phosphate fertilizer such as 10-50-10 per gallon of water to make a starter solution. Never set transplants in dry soil without watering them.

Set transplants at the depth they previously grew or slightly deeper. Leggy tomatoes may be set deeper as the stem will root if buried. Always be sure the top of peat containers are buried ½ to 1 inch below the soil surface or the containers will act as a wick and dry out the rootballs.

Transplants may need initial protection against strong winds, hot sun or freezing temperatures. Hotcaps can be made from newspapers or gallon milk jugs with the bottoms removed. Be sure to remove the caps from milk jugs to prevent plants from overheating on sunny days. A wooden shingle stuck into the ground on the sunny or windy side of a newly set transplant will also provide some temporary protection. More information on protecting transplants is contained under "Protective Devices" on page 16.

Irrigation

Vegetables require 1 to 1½ inches of water per week for maximum production. Most years have dry periods when irrigation will greatly increase growth, fruit set, total yield and quality.

The easiest way for most gardeners to irrigate is with a sprinkler. Apply water slowly to prevent runoff and erosion. Place several cylindrical containers in the area covered by the sprinkler to measure the water applied. Apply 1 to 1½ inches of water, then do not irrigate again for several days. Frequent shallow waterings promote shallow root growth, which is easily damaged by cultivation or dry periods. Irrigation early in the day so plants will dry before night is less likely to spread diseases. See also the section on trickle irrigation under "Advanced Gardening Techniques."

Weed Control

Weeds compete with vegetable plants for water, nutrients and sunlight. Weeds reduce yields and may cause crop failure unless they are controlled.

There are several methods of controlling weeds. Commercial vegetable growers use a combination of mechanical methods and chemical weed killers called herbicides. Most herbicides are not recommended for use in home gardens. They are difficult to use because no one chemical can be

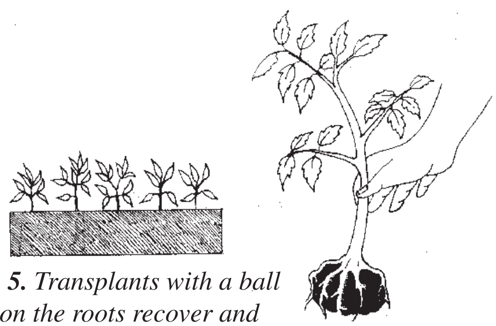

Figure 5. *Transplants with a ball of soil on the roots recover and begin to grow more quickly after transplanting than those whose roots have been dried or severely damaged.*

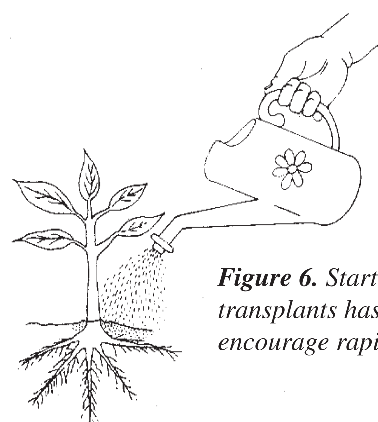

Figure 6. *Starter solutions applied to transplants hasten establishment and encourage rapid growth.*

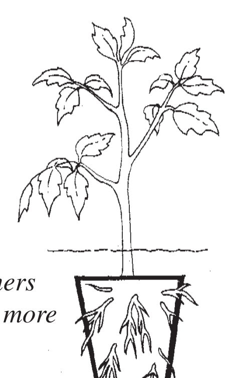

Figure 7. *The top of peat containers must be covered with 1/2 inch or more of soil.*

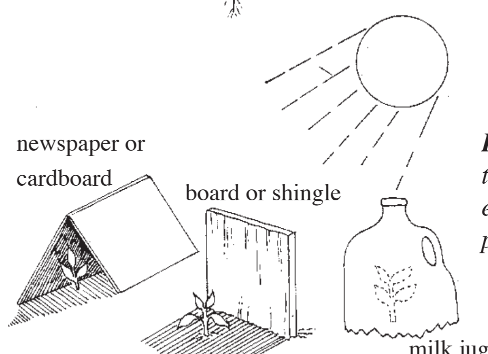

Figure 8. *Hotcaps protect transplants from wind and extreme temperatures and permit earlier planting.*

used on all vegetables and because it is difficult to apply small amounts of chemicals uniformly over the garden area. Herbicides and other methods of weed control are discussed in more detail in SP291-I, "**Weed Control in Home Gardens**."

Hoeing and cultivating are the most common methods of weed control for home gardeners. Hoe or cultivate shallowly to avoid the losing soil moisture or cutting the roots of desirable plants. Hand-pull weeds in or very near the vegetable row. There will be less damage to vegetable plants if weeds are removed while they are small.

Both plastic and organic mulches may also be used to control weeds. This is discussed in the mulching section (page 14).

Use of proper cultural practices will also help control weeds. Never allow weeds or vegetable crops to develop mature seed in or near the garden. Cultivate to prevent weeds from seeding, even if vegetable production is finished. If erosion is likely to be a problem, the vegetable garden area may be kept mowed when not in use.

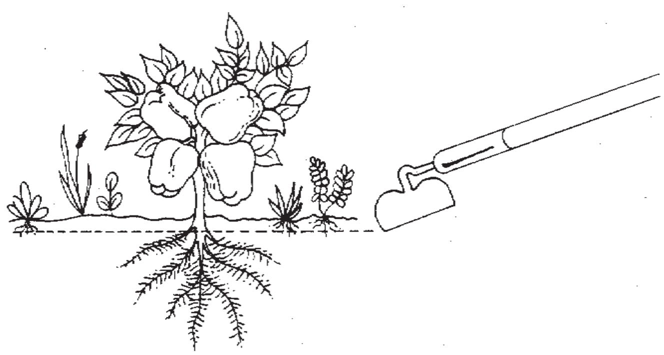

Figure 9. *Use very shallow cultivation to prevent damage to vegetable plant roots.*

Insect and Disease Control

Garden vegetables are susceptible to many insect and disease problems. Unless these problems are effectively controlled, they greatly reduce vegetable quantity and quality.

Begin control of garden insects and diseases by following good cultural and sanitation practices. Rake and burn or bury insect-infested or diseased plant residues after harvest so these problems will not overwinter in the garden. Turning plant residues under in the fall allows them ample time to decay before spring. Avoid the use of diseased plant material in a compost pile. Keep weeds and fencerows mowed.

Rotate families of vegetables among different areas of the garden each year. Grow resistant varieties whenever possible. Do not save seed if diseases are present. Other tips concerning cultural control of insects and diseases are found in Extension PB 1391, "**Organic Gardening and Pest Control**."

When insect and disease problems occur, they must be identified and treated as soon as possible if damage is to be minimized. County Extension offices can assist with identification. Extension PB 595, "**You Can Control Garden Insects**," and PB 1215, "**Disease Control in the Home Vegetable Garden**," contain recommendations for controlling specific insect and disease problems.

Gardeners should always be careful to apply chemicals according to the instructions on the container. Some diseases are present every year and are more easily controlled if preventative treatment begins soon after seedlings emerge or transplants are set in the garden. Other diseases and many insects should be treated as soon as they appear. Sprays are usually more effective than dusts, because they provide better coverage and are less likely to burn or otherwise harm growing plants. Compressed air sprayers are superior to other types of home garden sprayers.

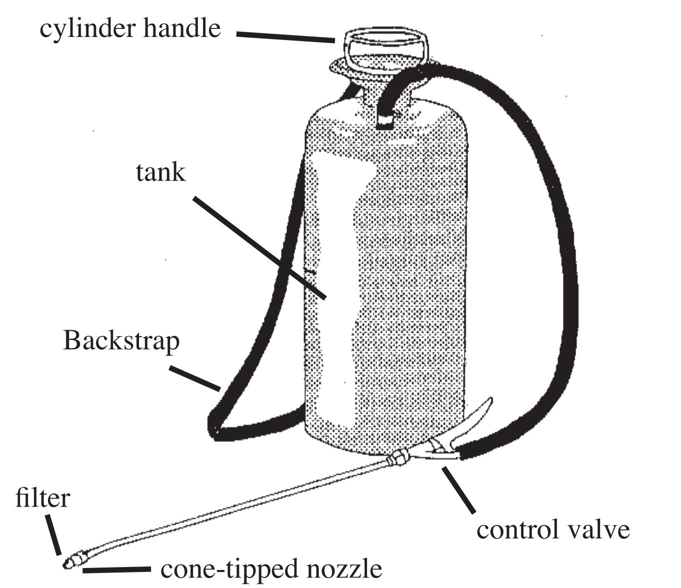

Figure 10. *Compressed air sprayer for use in home garden.*

Harvesting

Many vegetables must be kept harvested if the plants are to maintain production. Allowing oversized greenbeans, okra, summer squash or cucumbers to remain on vegetable plants will reduce future yields significantly.

Vegetables which ripen such as tomatoes and peppers will have greater nutritional value if they are harvested when fully ripe. Information emphasizing vegetables as a potential source of nutrition may be obtained from Extension PB 1228, "**Gardening for Nutrition**."

Table 6 contains suggestions as to when to harvest many common vegetables.

Table 6. When to Harvest Garden Vegetables

Vegetable	Vegetable appearance
Asparagus	When spears are 6 to 9 inches tall.
Beans, lima	When pods are full but seeds are green.
Beans, snap	While pods snap easily and are still smooth.
Beets	1½ - to 2½-inch beets have highest quality.
Broccoli	Before flowers show yellow color.
Cabbage	When heads become firm and heavy.
Cantaloupe	When melons can be lifted and the vine slips without pressure.
Carrot	Any time roots are firm and brittle.
Cauliflower	Before curd loosens and discolors.
Collard	When leaves are large but still green and firm.
Corn	When kernel juice is milky, silk begins to dry and ears are full to end.
Cucumber	When seeds are small, flesh is firm and color is green.
Eggplant	Before color begins to dull.
Kale	When leaves are large but before they yellow.
Kohlrabi	When 2 inches or more in diameter but still tender.
Lettuce	When tender and mild flavored. Before bolting.
Mustard	When leaves are crisp and tender.
Okra	When pods are 2½ to 3½ inches long.
Onion	For green onions: when bulb is ⅜ to 1 inch in diameter.
	For storing: after the tops have died down.
Parsnip	After cool weather has improved quality.
Peas, English	After pods have filled but before they turn yellow.
Peas, snap	After pods form but before yellowing.
Peas, Southern	For fresh use or freezing: When pods shell easily.
	For drying: After pods are dry and brittle.
Pepper, hot	After pods reach full size.
Pepper, sweet	When pods are full size and still firm.
Potato, Irish	For immediate use: After tubers are 1 inch in diameter.
	For storage: After vines have died and skin has set.
Potato, sweet	After reaching desired size but before cool fall rains.
Pumpkin	After they are full grown and mature colored. Before frost.
Radish	When firm and brilliantly colored.
Rutabaga	Before becoming tough.
Spinach	When leaves are crisp and dark green.
Squash, summer	When large end is 1-2½ inches in diameter and skin is still tender.
Squash, winter	When rind is not easily scratched by fingernail.
Swiss, chard	When leaves are crisp, tender and still green.
Tomato	When fully colored but still firm.
Turnip greens	While leaves are green and crisp.
Turnip roots	After 2 inches in diameter but while still tender.
Watermelon	When tendrils adjacent to fruit die and rind on ground becomes yellow.

Advanced Gardening Techniques

Plant Supports

Gardens will produce more in less area and quality will be higher if certain vegetables are grown vertically rather than horizontally. Vegetables grown vertically have an extended harvest season and are easier to spray, tend and harvest. They have fewer disease and insect problems because of improved air circulation and better spray coverage.

English peas, snap peas, cucumbers and pole beans are some of the vegetables that are commonly grown vertically. These vegetables may be trained on a fence, in a wire cage or on a trellis. Pole beans may be grouped around individual stakes or stakes may be pulled together at the top and tied for additional strength. Trellises may be constructed from cane supported by a wire on top, string woven between top and bottom wires or from nylon netting.

Tomatoes respond well to vertical culture, since many of the fruit will rot if they lay on moist soil. Home garden tomatoes are usually supported by 5- or 6-foot stakes or a wire cage. Use stakes at least 1½ inches square and drive them a foot or more into the ground. Plants are pruned to one or two stems and tied loosely to the support at 8- to 12-inch intervals.

A second method of supporting tomatoes is with wire cages constructed from concrete reinforcing wire. Cages should be 20 to 22 inches in diameter, which will require a 6-foot length of wire bent into a circle. Firmly anchor each cage so it will not blow over. Cages may be anchored by tying them to individual stakes or by tying them to a wire that is attached to posts at each end of the row of cages.

Set a single indeterminant tomato plant in each cage. Allow the plants to grow without pruning. Push the ends back into the cage as they grow. Harvest fruit by reaching through the mesh.

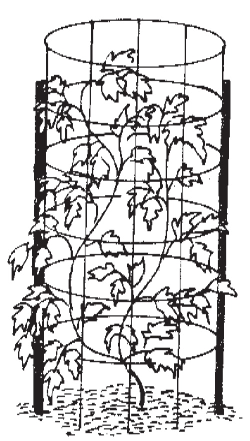

Figure 11. *Caging tomatoes reduces labor for supporting the plants and increases yield. Be sure to fasten cages to stakes driven into the ground.*

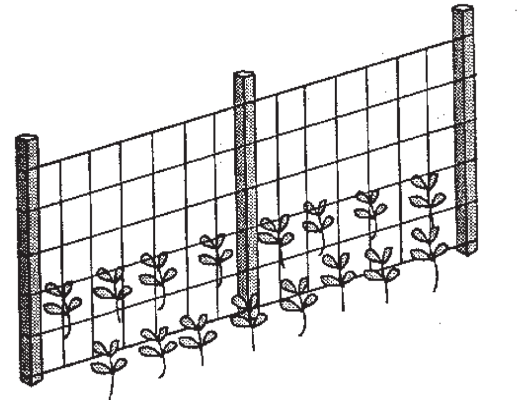

Figure 12. *A double row of English peas 8 inches apart will increase yields and may be supported by a single netting.*

Mulching

Either organic or inorganic mulches may be used in the home garden. Common organic mulches include straw, grass clippings, leaves, compost and rotted sawdust. The most common inorganic mulch is black plastic. Both organic and inorganic mulches reduce weed growth and conserve soil moisture. Organic mulches also improve soil structure and water-holding ability. They increase soil organic matter and eventually improve soil nutrient content. Black plastic mulch also increases soil temperatures.

Apply organic mulches around established plants in a layer 2 to 4 inches deep. Organic mulches are generally light-colored, reflect sunlight and keep the soil cool longer in the spring. They work best on cool-season vegetables early in the spring and on warm-season vegetables after soils warm. Add ¼ pound of ammonium nitrate fertilizer or its equivalent to each bushel of mulch.

Apply black plastic mulches over freshly fertilized and worked soils several days before planting. Shape the soil surface so drainage is toward the plants and use strips of plastic, not sheets. This will help water to reach the plants. It is important to thoroughly cover the edges of the plastic with soil to prevent wind damage. Insert plants or seed through holes or slits cut in the plastic. Because black plastic absorbs sunlight and warms the soil, warm-season plants such as tomatoes, eggplant, watermelon, peppers and cantaloupe can be set through plastic about a week earlier than they can be planted in bare soil. The first harvest of these crops will also be earlier when black plastic mulch is used. Because black plastic mulch warms the soil, it is not well suited to cool-season vegetables.

One disadvantage of black plastic is that it must be removed from the garden and discarded after the growing season. Another disadvantage is that it is hard to water or to apply nitrogen sidedressings under plastic. You can lay black plastic over a trickle irrigation tube and water through this tube. It is also possible to sidedress through irrigation water. More information on mulches may be obtained from Extension SP 291-H, "**Mulching Home Gardens**."

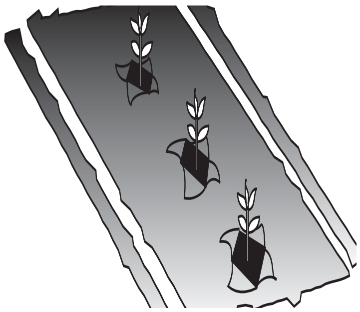

Figure 13. Apply organic mulches 2 to 3 inches deep around established plants after the soil warms up.

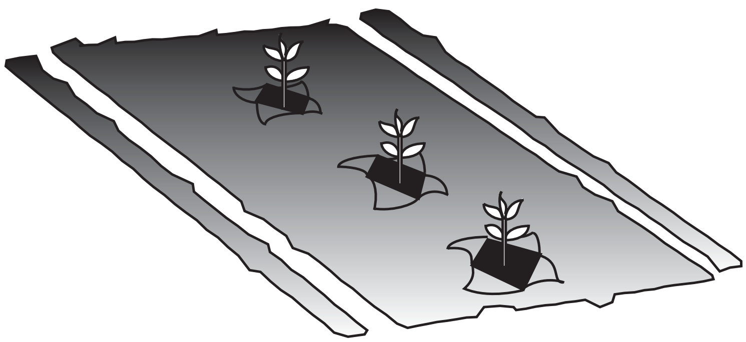

Figure 14. Spread black plastic before planting. Plant warm season crops through slits or holes in the plastic.

Composting

Compost is a dark, easily crumbled substance that develops from the partial decay of organic material. Making compost greatly reduces the volume of garden refuse, provides mulching materials for garden plants and contributes organic material to garden soils.

Most gardeners who compost produce compost in a "compost pile." Begin with almost any plant material. Examples include grassclippings, garden prunings, spent plants, leaves, hay, straw, manure and immature weeds. Do not compost meat scraps, diseased vegetables or plants or weeds with mature seed.

Start the pile directly on the ground. Sides of wire, wood or concrete block may be used to keep the pile in place. Begin the pile with a 6- to 8-inch layer of chopped organic material, since chopped materials have greater surface area and will decay more quickly. Moisten the layer and add 1 to 2 inches of manure or one cup of commercial fertilizer to supply nitrogen. Lastly, add a small amount of soil or finished compost to supply composting organisms. Repeat these layers to the height desired. The compost pile will require six to 12 months before it is dark, crumbly and ready to use. Turning the pile so the inside is moved to the outside and vice versa four to 10 weeks after it is begun will speed up the composting process somewhat. Keeping it moist but not soggy will also speed up the process.

You can also make compost by working organic material directly into the soil. Simply spread a 2- to 4-inch layer of a material such as leaves over the soil and work it in. Do this in the fall or several weeks before planting so the material will decay before planting.

More information on composting may be obtained from Extension PB 1479, "**Composting Yard, Garden and Food Wastes at Home**."

Reduced Spacing

Several systems are designed to increase the number of vegetable plants grown and the produce harvested during a single season in a given area. These systems increase yields without increasing the area to be fertilized, irrigated or weeded. Some of them also increase the length of the harvest season. We have discussed succession planting previously, and now will look at intercropping, double cropping, multiple rows and planting in raised beds.

Intercropping is growing more than one crop in a single area at the same time. Fast-growing and slow-growing vegetables may be planted together, either by alternating rows or by alternating plants within the row. The fast-growing vegetable matures and is removed before the slow-growing vegetable needs the space. For example, radishes and tomatoes, or onions and peppers may be planted in alternate rows, closer together than usual, since the onions and radishes can be harvested in time to provide space for the tomatoes and peppers.

Pole beans are often intercropped with corn in Tennessee. The bean yield is reduced, but two crops are produced in the space usually required for corn alone. Another example of intercropping is planting lettuce, radishes or onions early in the spring and setting caged tomatoes or vine crops between the rows in late April or May. The spring crops will soon be harvested, making room for the tomatoes or vine crops to grow. With intercropping, the control of insects, diseases and weeds is more difficult. Many intercropping combinations are difficult to apply in commercial production.

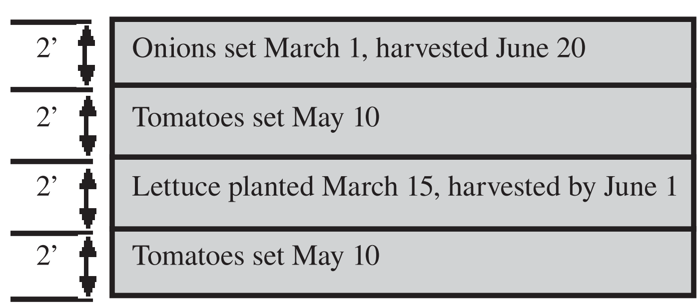

Figure 15. Intercropping of onions, lettuce and tomatoes.

Double-cropping is growing one crop and harvesting it, before planting and growing a second crop in the same spot the same year. By grouping cool-season and warm-season vegetables, you can grow spring and summer crops or spring and fall crops in the same space.

warm-season vegetable and then another cool-season vegetable in the same garden area in a single year. Two rapidly maturing warm-season vegetables, such as green beans or summer squash, may also follow each other in a single year.

Two or more rows of vegetables planted very close together are often called multiple rows. Vegetables are usually grown in long narrow rows with wide spacings between them. However, it is possible to increase production of some vegetables by planting two or more rows close together (double or multiple rows) or by broadcasting seed in a bed.

Vegetables suitable for multiple row or bed plantings are listed in Table 7, while the minimum spacings are contained in Table 8.

Begin by marking off multiple rows or beds. Beds may be any width as long as you can reach the center. Four feet is an often-selected width for raised beds. Leave aisles for walking between the beds or multiple rows. Beds or rows may be raised in home gardens if desired. Raised beds may be useful in poorly drained areas, because they will dry out earlier in the spring for planting and be easier to work. A small garden composed of raised beds can be extremely productive, attractive and may be edged with bricks, railroad ties, landscape timbers or other materials. Permanently raised beds, however, are very difficult to work with rototillers and other powered equipment.

Space the plants far enough apart so they will not be crowded, but close enough so they will occupy all available space when they mature. Recommended spacings for multiple rows of vegetables are given in Table 6.

Shade from mature vegetable plants reduces weed growth and evaporation from the soil surface. Because more vegetables are growing in less space, you must maintain a high fertility level and supply moisture during periods of drought. Be sure to fertilize beds as recommended by in your soil test, and apply nitrogen sidedressings as recommended in Table 4.

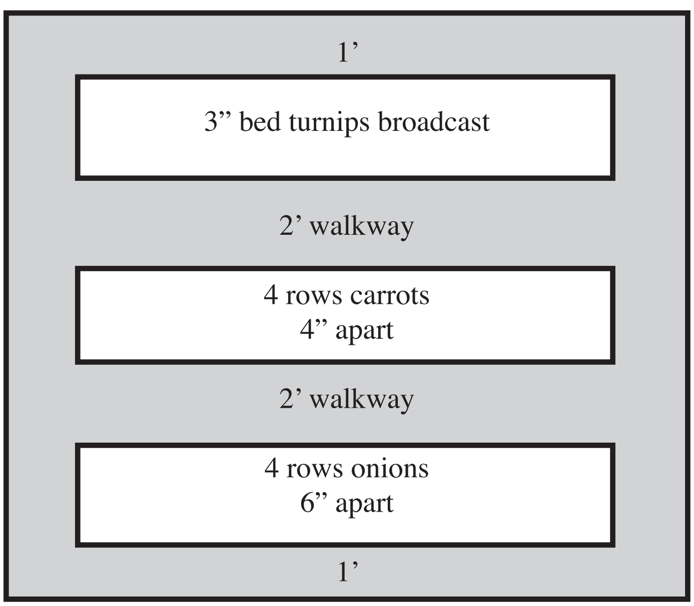

Figure 16. *Beds and multiple rows allow greater vegetable production in less space.*

More information on building and using raised beds may be obtained from Extension SP291-N, “**Raised Bed Gardening.**”

Figure 17. *Raised beds dry out early in spring. They may be both attractive and productive.*

Protective Devices

The most commonly used plant protectors formerly available to home gardeners were buckets and old blankets. These still work, of course, but protective devices have evolved considerably. Plants can be covered not only to prevent damage during cold weather, but to modify climates and extend growing seasons.

One-gallon milkjugs are cheap, readily available and highly useful. Simply cut out the bottoms, take off the caps and push the remainder of the jug 1 inch into the soil directly over the small plants. The plants will be protected from cold winds and freezing temperatures, and will grow faster. Protection from cutworms will be an additional benefit. Remove the milkjugs when the weather moderates. Your reward will be greater and earlier production.

The jugs can be pinned to the ground with a long wire hairpin if necessary. The bottoms of the jugs can be used as small platforms to support cantaloupe, pumpkins and winter squash off the ground.

You can protect groups of plants by modifying the climate under an entire row or even several rows. Spun-bonded or floating row covers, for example, are placed loosely over one or more rows of young plants. They lie directly on the plants and are lifted as the plants grow. Floating row covers raise the temperature considerably during the day and offer two or three degrees of frost protection at night. This results in more rapid plant growth and early harvests.

It is important to apply these covers loosely so they can be lifted as the plants grow. Remove them from plants requiring pollination when they flower so insects can reach the flowers. The protection of young plants from insects is an important secondary effect of spun-bonded row covers. Try these covers on cabbage and broccoli where protection from insects is important, and over watermelon and cantaloupe, which respond well to increased heat units. Be sure to use them on weed-free soils or only on small areas, as they will have to be removed to control weeds.

There are also various kinds of small plastic tunnels used to protect plants. They consist of plastic strips 5 or 6 feet wide. The plastic may be clear or translucent with numerous slits or holes down the sides, or it may be solid.

The plastic is supported by 6-foot lengths of #10 wire bent into a hoop shape and inserted over the row at 6- to 10-foot intervals. The edge of the plastic must be well covered with soil to prevent its removal by wind.

Install plastic row covers immediately after planting or transplanting. Much of their benefit comes from increased soil temperature, which requires time to achieve. They are often used with black plastic mulch, which assists in weed control.

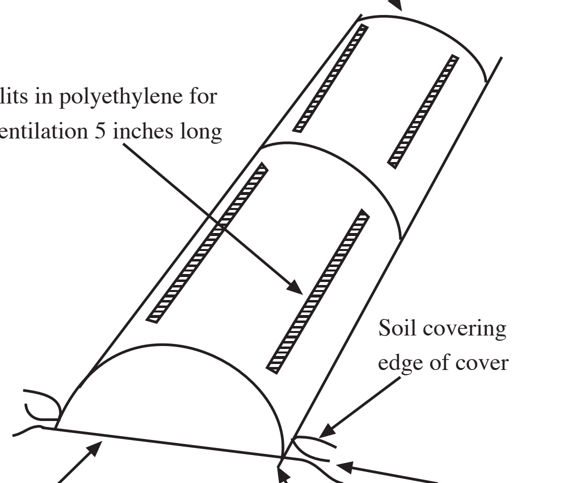

Figure 18. *Slitted row cover.*

Table 7. Vegetables Suited to Multiple Row or Bed Planting

Double row only	Multiple row or bed
Beans, Bush	Beets
Beans, Pole	Carrots
Collards	Chard, Swiss
Corn, Sweet	Lettuce
Kale	Mustard
Peas, English	Onions
Pepper	Radishes
	Spinach
	Turnips

Table 8. Recommended Spacings for Vegetables Planted in Double or Multiple Rows

Vegetable	Inches between rows	Inches between plants
Beans, Bush	10 to 12	3 to 4
Beans, Pole On Wire	8	3 to 6
Beets	6	2 to 3
Carrots	4	2 to 3
Chard, Swiss	8	6 to 8
Collards	12	12
Corn, Sweet	12	8
Kale	6	6
Lettuce, Head	12	12 to 15
Lettuce, Leaf	6	6
Mustard	6	6
Onions	4	3
Peas, English	6	3
Pepper	10 to 12	12
Radishes	4	1 to 3
Spinach	6	3 to 4
Turnip, Greens	4	2 to 3
Turnip, Roots	6	3

Row covers provide two or three degrees of frost protection and a considerable increase in heat units. They can shorten the cantaloupe growing season as much as two weeks and increase both early and total yield.

Like floating row covers, slitted row covers reduce insect infestation. They must also be removed from plants requiring pollination when they flower and from crops that cannot withstand extreme summer temperatures. The wires and perhaps even the plastic may be re-used. Row covers are very conducive to high-yielding small gardens, but difficult to use with some other cultural devices, such as plant supports.

Trickle Irrigation

Trickle or drip irrigation systems use a network of water-conducting tubes placed at the side of plant rows to distribute small amounts of water directly to growing plants. Water emerges through small sprinkler heads, leaks through small emitter holes or soaks through the porous sides of the tubes.

Trickle systems are more costly than sprinkler systems, but they require much less water. This can be a real advantage to city gardeners who must pay for water, and perhaps for waste water treatment also. Trickle systems consist of a water source, a backflow valve, a filter, a pressure gauge, header pipes, emitter tubing and possibly emitters (see Figure 19.) They operate under very low pressure (six to 20 pounds) and are easily installed. Because the small holes are easily clogged, they require clean water and adequate filtration. City or well water is suitable for use in a trickle system, but river or pond water will require excellent filters.

Trickle systems use less water, partly because of reduced evaporation. Water is placed at the base of the plant, not released into the air where it may evaporate or blow away. The aisles between rows are not watered. Plants remain dry so diseases are less common and severe. Growth is rapid because of the constantly available moisture. Trickle tubes may also be placed under black plastic or used to fertilize vegetables.

Because trickle tubes wet only a portion of the soil, they must run every day or two. It may be difficult to determine how long they need to run. Like traditional irrigation systems, they should wet the soil a foot deep. Gardeners should experiment and see how long this takes.

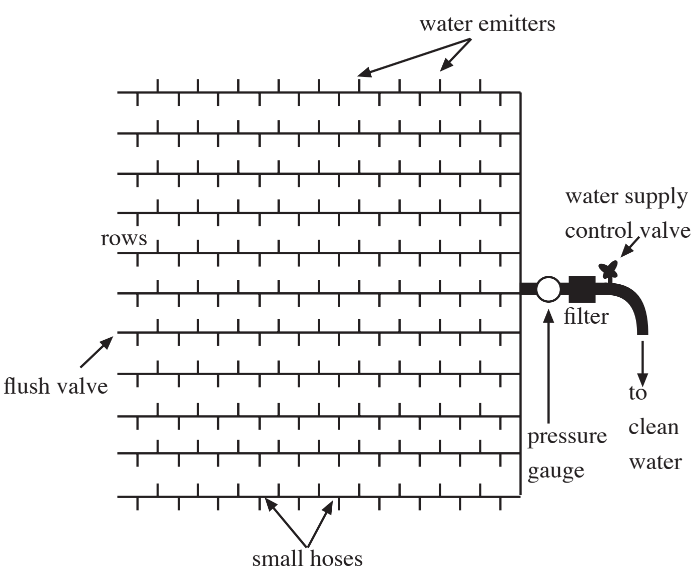

Figure 19. *Diagram of trickle irrigation system set up to water small garden area. Plants are set by water emitters.*

Transplant Production

Most home gardeners purchase vegetable transplants. There are, however, several advantages to growing your own. If you grow your own transplants, they will be the size you want when you are ready to plant them. The container size can be controlled, as can the variety. There will be less danger of bringing in insects and diseases, and you can properly harden the transplants before planting. The cost may also be less.

Unfortunately, vegetable transplants are not easy to produce in the home. Optimum growth requires a heated structure, a greenhouse. If you grow transplants in the home, you will face two severe problems. First, vegetable transplants usually grow best with night temperatures 10 degrees below day temperatures. Second, the light intensity, even in a south-facing window, is not adequate to produce most vegetable transplants.

The first difficulty can be overcome by growing transplants in an unheated room and supplying heat only in the daytime or by simply turning down the thermostat at night. You can increase the light to suitable levels by building a light box. A light box is a partial-box with bottom, back and ends only. Make it about 15 inches high, a little over 4 feet long and about 18 inches from front to back. Line the inside with foil. Place the box in front of a south-facing window and set a fluorescent light on the open top. Attach the light to a timer set to turn on near dawn and to turn off 16 hours later. The light will not be sufficient to grow plants, but it will supplement the natural light from the south-facing window nicely. Special plant grow lights are available and work better than ordinary fluorescent lights for growing plants.

Use this plant box to grow a few transplants or to germinate many. If seedlings are started in this box, they will need to be moved to a more roomy, protected environment when they require additional space. A coldframe may be used for this. A coldframe or hotbed may be built according to the design in Extension PB 819, "**Vegetable Transplant Production**." This frame or bed will suffice to raise seedlings to the transplant stage. See also Extension SP291-A, "**Growing Vegetable Transplants for Home Gardens**." See Table 9 to determine ideal germinating and growing temperatures, as well as the time required to produce different kinds of vegetable plants.

Saving Seed

You may occasionally acquire vegetable seed that you do not plant immediately. Sometimes, only part of a seed packet is planted. You may even wish to preserve a favorite heirloom variety. How can seed best be stored?

Seed is alive and must remain alive if it is to grow. The best way to keep it alive is to keep it cool and dry.

Begin by resealing partially filled seed packets with tape. Place the seed packets in containers such as glass jars with lids, plastic containers or boxes with tight-fitting lids.

Add a small envelope of calcium chloride or powdered milk to the container to absorb moisture, and then refrigerate or freeze the seed. Seed kept dry and cool will remain free of insects and may remain viable for several years.

Be careful what seed you attempt to collect and save. Seed of hybrid varieties should never be saved, because plants grown from it may vary considerably from the parent plants. Seed of cross-pollinated plants, such as vine crops, may not grow into plants exactly like the parents either. Some seed can also carry diseases. Bean and pea seed are examples that often carry bacterial or viral diseases. Therefore, saving seed is always risky. The best way to ensure healthy seed is to purchase fresh seed each year.

If you do have old seed, it may be wise to test it. Roll 10 to 20 seed in a paper towel and moisten the towel. Put the moistened towel in a glass jar with a top or in a plastic container with a tight-fitting lid so the paper towel will not dry out. Place the container where it will remain warm. After eight to 10 days, check to see how many seed appear to be vigorously sprouting. If less than half are sprouting, discard the remaining seed. If about half are sprouting, you may wish to plant the remaining seed thickly. If most are sprouting, then the seed may be planted at normal thickness.

Table 9. Details of Transplant Production

Vegetable	Approximate growing time (wks.)	Germination temperature (degrees F)	Growing temperature (degrees F)	Conditions for hardening
A. Cool-Season				
Broccoli	5 to 7	70	60 to 65	50 to 55F for 10 days
Cabbage	5 to 7	70	60 to 65	50 to 55F for 10 days
Cauliflower	5 to 7	70	60 to 65	50 to 55F for 10 days
Head Lettuce	5 to 7	70	60 to 65	Lower temperature and moisture
B. Warm-Season				
Cucumber	2 to 3	75	65 to 75	Reduce moisture
Cantaloupe	2 to 3	75	65 to 75	Reduce moisture
Eggplant	6 to 8	75	70 to 75	Reduce temperature and moisture
Pepper	7 to 9	75	60 to 70	Reduce temperature and moisture
Squash	2 to 3	75	65 to 75	Reduce moisture
Tomato	5 to 7	75	60 to 70	Reduce temperature and moisture
Watermelon	2 to 3	80	65 to 75	Reduce moisture

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