
VEGETABLE GARDENING

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Vegetable gardening is a major interest and hobby of the American people. Information pertaining to variety selection, planting, and culture may be requested from garden center professionals. These professionals should make suggestions for environmentally safe practices that will produce quality products. Certified Professionals, particularly those that work in garden centers, are expected to know, recognize, and understand vegetables and their culture.

Site Selection

The site for a vegetable garden should be fairly level, well drained, and should not have low areas where water might stand. In windy regions, gardens should be protected by shelterbelts or buildings, but should not be shaded because vegetables grow best in full sunlight. Most vegetables should receive a minimum of six hours of direct sun per day. Trees and shrubs decrease sunlight and compete with vegetables for water and minerals, therefore, the garden should be located a reasonable distance from trees and large flowers. Conversely, when space is limited, some brightly colored vegetables such as sweet peppers and flowering edible cabbage or kale, can be incorporated into landscape plantings.

Vegetable Selection

When selecting vegetables for the garden, consider the likes and dislikes of household members. Also consider vegetables with different maturation dates and select disease-resistant cultivars. The University of Minnesota Extension Service has good resources on new varieties and disease resistant varieties. In addition, "All-American Winners" generally perform well and can be used in most parts of the country. The time required for various vegetables to mature is an important factor. Tables 1, 2, and 3 provide maturation time periods and planting information.

Seeds and Seeding

Some gardeners want to save seeds from gardens, however, most of the seeds planted are hybrids, so the seed produced from these hybrid plants will not be true to the parent plant. Often seeds are treated with

fungicides to prevent damping-off or other seed-borne diseases. This information should be on the packet label.

It is very difficult to sow small seeds thinly enough to permit all plants to develop well. Surplus plants are comparable to weeds and should be removed and transplanted to another location in the garden. When the soil is moist, surplus plants can be removed easily without injuring the remaining plants. Early thinning is especially important in root crops such as beets, carrots, parsnips, rutabagas, and turnips. In the thinning process, the tops of beets, lettuce, chard, parsley and turnips can be used as salad greens or in soup stocks.

Most vegetables fit into one of the following seven categories:

1. Leafy Crops: lettuce, spinach, Swiss chard.
2. Root Crops: carrots, radish, parsnips, onions.
3. Cole Crops or the Cabbage Family: broccoli, cabbage, cauliflower.
4. Legumes: beans, peas.
5. Squash and Melons: zucchini, acorn squash, watermelon, cantaloupe.
6. Tomato Family (Solanaceae): peppers, tomato, egg plant, potato.
7. Corn.

When planning the vegetable garden, change the location each year where each vegetable category is grown to minimize the build-up of insects and diseases. The pests that affect one member in a category generally are problems for other vegetables in the same category. Insects and diseases can overwinter on plant debris and/or in the soil, and their populations can build up if the host is located in the same spot in the garden year after year.

Temperature controls the photosynthetic and growth rates of most plant species. Some vegetables put on growth at temperatures as low as 45°F, but they grow most vigorously at temperatures between 50°F and 70°F. Plants meeting this temperature growth pattern are placed in a category referred to as “cool season vegetables”. Most of the cool season vegetables are grown for the use of their vegetative plant structures including leaves, roots, and buds. These vegetables are included in Categories 1, 2, and 3 above. Peas are the one exception, wherein the seed is eaten as part of the fruiting structure. Cool season vegetables should be planted two to four weeks before the last day of frost. Often a second crop can be planted in late summer for a fall harvest.

In contrast, “warm season vegetables” need a base growth temperature of 55°F and grow most vigorously at temperatures above 70°F. Most of the warm season vegetables are grown for the use of their flowering or fruiting structures and are included in Categories 4, 5, 6, 7 above. Warm season vegetables will generally benefit from the use of black plastic or black landscape weed barrier mat placed on the soil. Seeds can be planted in strips cut out within the rows or the mat can be laid around emerged plants to increase the soil temperature. These materials also reduce weed growth. Warm season vegetables do not tolerate frost or cool temperatures and should be planted one to four weeks after the last day of frost in the spring.

The number of days it takes for a vegetable crop to germinate and produce mature, harvestable plant parts varies significantly and should be considered in planning a garden (Tables 1 and 2). Plants with long growing seasons may not mature if seeded directly into the garden and should be seeded indoors and then transplanted into the garden. Cole crops such as the cabbage family, and crops in the Solanaceae family such as tomatoes and potatoes (Categories 3 and 6 above) are examples of crops generally planted as transplants.

Short season crops, such as green beans and radishes, may be planted at biweekly intervals during the summer to extend the harvest period. Two to three plantings of different varieties of corn usually can be made in one growing season to extend the harvest season.

Garden Layout

It is advisable to put a garden plan on paper. The plan

should be drawn to scale showing the size of the garden, spacing between rows, row length for each crop, spacing of transplants in the row, species and cultivars to be planted, succession plantings, specific arrangement of crops and date of planting. It is recommended that plans be kept on file for two to three years so crops can be rotated from year to year for disease control. For instance, tomatoes should not be planted where they grew the previous year. See Table 3 for spacing requirements.

If power equipment will be used, unnecessary turning around can be avoided by making long rows. Short rows are less monotonous if cultivation is to be done by hand. On a slope, rows should run along the contour or across the slope to reduce erosion. Crops must be arranged so that tall plants, such as sweet corn and pole beans, do not shade small plants. Therefore, tall plants are grown on the north side of the garden. Use Tables 1 and 2 to facilitate succession plantings, crop rotation, or planting of green manure crops after harvest of an early crop.

Perennial plants such as asparagus, rhubarb, and small fruits should be placed together on one side of the garden where they will not interfere with garden preparation. Vine crops should be planted on the edge of the garden so they can spread into any surrounding open area.

Cultural Practices

Soil – A garden should be worked when the soil moisture content is at a reasonable level. It should not be too wet or too dry. Under ideal conditions the soil will crumble and break into fine particles in one's hand. Soil can be worked in the fall or spring and should be raked following tilling or spading.

Although the preferred soil for a vegetable garden is a rich sandy loam, a clay or sandy soil can be used when amended with liberal amounts of organic matter each year. Soil condition can be improved by working in four to six inches of peat, well-rotted manure, or composted vegetation. Individuals can make their own compost, or it can be obtained from community municipal compost sites. Compost must be completely composted or pathogens may be present and nitrogen will become deficient. Organic matter will loosen heavy soil, help maintain moisture and nutrients, and enhance root development.

Nutrients – Vegetables do best with a soil pH of 6.0 to 7.0. In addition, the soil should contain plenty of

readily available nutrients. Some of these nutrients can be supplied through liberal applications of rotted manure. Commercial fertilizers can also be used and will provide a more accurate application of specific nutrients without the potential of significantly increasing soluble salts. Almost any complete garden fertilizer is suitable for the vegetable garden, however it must not contain any herbicides. The most appropriate means to determine appropriate fertilization for the garden is to take a soil test. The county Extension Office and soil testing labs can assist in soil testing. If a soil test has not been taken, then a general recommendation would be to use a medium nitrogen fertilizer as excessive nitrogen will favor leaf development and delay flowering and fruiting. Fifteen to twenty pounds of a complete garden fertilizer such as 20-20-20 or 18-18-8 per 1,000 square feet or two pounds per 100 square feet can be worked into the soil before planting. It should be incorporated into the soil to a depth of four to six inches. These fertilizers can also be applied as a side dressing when corn plants are ten inches tall, tomato fruits are golf-ball size, and vine crops start to run. The fertilizer should be lightly worked into the soil on both sides of the row where plants are growing. This method is especially useful where intensive gardening is practiced and when succession or fall crops follow early season crops. Nutrients removed from the soil by a previous crop need to be replenished before sowing a succession crop. On sandy soils, controlled or slow release fertilizers have the advantage of providing nutrients throughout the growing season.

Mulches – To ensure good germination, mulch the garden with finely chopped seedless straw, ground corncobs, dried grass clippings not treated with herbicides, or well composted wood chips. This will improve growth and yield, moderate soil moisture and temperature, and control weeds.

Transplants – Vegetable transplants are grown in cell packs, solid packs, or larger containers. Transplants should be vigorous, but not overgrown. Plants grown in cell packs have less transplant damage than those in solid packs. If each cell is tightly root-bound, the root ball should be opened and loosened slightly. If it is hot, sunny, or windy when planting, provide extra watering and protection from wilting the first few days. A light covering of seed-free straw or dry grass accomplishes this. Transplanting is best done in the late afternoon or on a cool, cloudy day. Vegetable transplants should be watered well before planting.

When transplanting vegetables, a hole large enough to easily receive the root ball of the transplant is necessary. Soil should then be backfilled and firmed around the roots, and the plant thoroughly watered. Plant vegetables at the proper depth as transplants planted deeper than they are growing in the pot or flat are subject to stem and crown rot.

Weed and Pest Control – Plant Health Care (PHC) includes regular weed and pest control, which are significant practices for successful gardening. Manual cultivation, particularly when the weeds are young, even at the cotyledon stage, provides the most effective and safest weed control. Chemical weed control options are quite limited in the vegetable garden. To use an herbicide in the garden, both the weed to be controlled and the nearby vegetables must be listed on the label of the herbicide package.

Insect and disease control are discussed in the chapters on Insects and Diseases. Although these chapters are directed to the landscape setting, the principals are similar. The vegetable garden is especially suited to bio-rational control methods, such as planting sweet alysum and marigold flowers for insect control, or planting pest resistant varieties.

Intensive Gardening – When space is limited, intensive vegetable gardening can be practiced for efficient use of space. Such practices include:

Succession Planting – Succession planting involves following a quick maturing crop (Tables 1 and 2) such as lettuce with a crop such as cabbage in the same area.

Intercropping – Intercropping is accomplished by planting or seeding quick maturing crops that require narrow spacing (Table 3) between rows of longer-term crops that require wide spacing. Another method of intercropping is to sow an early-maturing crop (Tables 1 and 2) thinly in the same row as a late maturing crop. This facilitates germination and early cultivation.

Staking or Trellis Work – Supports are recommended for tomatoes, pole beans and vine crops. This allows vertical growth and less horizontal space will be required.

Containerized Raised Beds – Raised beds improve yield, minimize compaction, and are easier on gardeners' backs. They can be constructed with 2-inch x 6-inch boards. Once they are established, they are easy to maintain. Extra watering may be necessary.

Container Gardening – Patio tomatoes, bush cucumbers, lettuce, onions and herbs can be successfully grown in containers. Proper, well aerated, growing media in the container and strict cultural practices, including frequent watering and proper fertilization are necessary to ensure healthy container plants. The containers should be deep and have several drain holes. If they are too small or are constructed of unglazed clay, they may need watering twice daily.

Table 1. Approximate time from planting to market maturity under optimum growing conditions. From: Knott's Handbook for Vegetable Growers by O.A. Lorenz and D.N. Maynard. Copyright 1988. John Wiley & Sons, Inc. Reprinted by permission of John Wiley & Sons, Inc.

Vegetable	Time to Market Maturity (Days)		
	Early Variety	Late Variety	Common Variety
Bean, broad	--	--	120
Bean, bush	48	60	---
Bean, pole	62	68	---
Bean, Lima, bush	65	78	---
Bean, Lima, pole	78	88	---
Beet	56	70	---
Broccoli ¹	55	78	---
Broccoli raab	60	70	---
Brussels sprouts ¹	90	100	---
Cabbage	62	120	---
Cardoon	--	--	120
Carrot	50	95	---
Cauliflower ¹	50	125	---
Celeriac	--	--	110
Celery ¹	90	125	---
Chard, Swiss	50	60	---
Chervil	--	--	60
Chicory	65	150	---
Chinese cabbage	70	80	---
Chive	--	--	90
Collard	70	85	---
Corn, sweet	64	95	---
Corn salad	--	--	60
Cress	--	--	45
Cucumber, pickling	48	58	---
Eggplant ¹	50	80	---
Endive	85	100	---
Florence fennel	--	--	100
Kale	--	--	55

Table 1 (Continued). Approximate time from planting to market maturity under optimum growing conditions.

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Vegetable	Time to Market Maturity (Days)		
	Early Variety	Late Variety	Common Variety
Kohlrabi	50	60	---
Leek	--	--	150
Lettuce, butterhead	55	70	---
Lettuce, cos	70	75	---
Lettuce, head	70	85	---
Lettuce, leaf	40	50	---
Melon, casaba	--	--	110
Melon, honeydew	--	--	110
Melon, Persian	--	--	110
Muskmelon	85	95	---
Mustard	35	55	---
New Zealand spinach	--	--	70
Okra	50	60	---
Onion, dry	90	150	---
Onion, green	45	60	---
Parsley	70	80	---
Parsley root	--	--	90
Parsnip	--	--	120
Pea	56	75	---
Pea, edible-podded	60	70	---
Pepper, hot ¹	65	80	---
Pepper, sweet ¹	65	80	---
Potato	90	120	---
Pumpkin	100	120	---
Radish	22	30	---
Radish, winter	50	60	---
Roselle	--	--	175
Rutabaga	--	--	90
Salsify	--	--	150
Scolymus	--	--	150
Scorzonera	--	--	150
Sorrel	--	--	60
Southern pea	65	85	---
Spinach	37	45	---
Squash, summer	40	50	---
Squash, winter	85	110	---
Sweet potato	120	150	---
Tomato ¹	60	90	---

Table 1 (Continued). Approximate time from planting to market maturity under optimum growing conditions.

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Vegetable	Time to Market Maturity (Days)		
	Early Variety	Late Variety	Common Variety
Turnip	40	75	---
Watercress	--	--	180
Watermelon	75	95	---

¹ Time from Transplanting.

Table 2. Approximate time from pollination to market maturity under warm growing conditions. From: Knott's Handbook for Vegetable Growers by O.A. Lorenz and D.N. Maynard. Copyright 1988. John Wiley & Sons Inc. Reprinted by permission of John Wiley & Sons, Inc.

Vegetable	Time to Market Maturity (Days)
Bean	7-10
Corn, ¹ market	18-23
Corn, ¹ processing	21-27
Cucumber, pickling (3/4-1-1/8 in. in diameter)	4-5
Cucumber, slicing	15-18
Eggplant (2/3 maximum size)	25-40
Muskmelon	42-46
Okra	4-6
Pepper, green stage (about maximum size)	45-55
Pepper, red stage	60-70
Pumpkin, Connecticut Field	80-90
Pumpkin, Dickinson	90-100
Pumpkin, Small Sugar	65-75
Squash, summer, Crookneck	6-7 ²
Squash, summer, Early Prolific Straightneck	5-6 ²
Squash, summer, Scallop	4-5 ²
Squash, summer, Zucchini	3-4 ²
Squash, winter, Banana	70-80
Squash, winter, Boston Marrow	60-70
Squash, winter, Buttercup	60-70

Table 2 (Continued). Approximate time from pollination to market maturity under warm growing conditions.
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Vegetable	Time to Market Maturity (Days)
Squash, winter, Butternut	60-70
Squash, winter, Golden Delicious	60-70
Squash, winter, Hubbard	80-90
Squash, winter, Table Queen or Acorn	55-60
Strawberry	25-42
Tomato, mature green stage	35-45
Tomato, red ripe stage	45-60
Watermelon	42-45

¹ Days from 50% silking.
² For a weight of ¼ to 1/2 lb.

Table 3. Spacing and depth requirements for planting vegetables.

Crop	Depth to Plant (Inches)	Planting Distances	
		Between Rows (Inches)	In the Row (Inches)
Cool Season Crops			
Asparagus (crowns)	6-8	36-60	12-18
Beets	¼-½	15-24	2-3
Broccoli	¼-½	24-36	12-18
Brussels sprouts	¼-½	24-36	18-24
Cabbage	¼-½	24-36	12-18
Cabbage, Chinese	¼-½	18-30	8-12
Carrots	¼-½	15-30	2-3
Cauliflower	¼-½	24-36	18-24
Celery	1/8	18-36	4-6
Chard, Swiss	¼-½	18-36	6-8
Chives	½	15-24	6-8
Collards	¼-½	24-36	18-24
Cress, upland	¼-½	15-30	2-3
Endive	¼-½	18-36	12
Garlic (cloves)	1½	18-24	3
Kale	¼-½	18-36	8-12
Kohlrabi	¼-½	18-36	4-6

Table 3 (Continued). Spacing and depth requirements for planting vegetables.

Crop	Depth to Plant (Inches)	Planting distances	
		Between Rows (Inches)	In the Row (Inches)
Cool Season Crops (Continued)			
Leeks	½	12-30	2-3
Lettuce, heading	¼	18-30	12
Lettuce, leaf	¼	12-18	4-6
Mustard	¼-½	18-24	3-4
Onions, plants		15-24	3-4
Onions, seed	½	15-24	3-4
Onions, sets	1-2	15-24	3-4
Parsley	¼	15-24	6-8
Parsnips	½	18-30	3-4
Peas	1-2	8-24	1
Potatoes	4	30-36	12
Radishes	½	12-24	1
Rhubarb, crowns		26-48	36-48
Rutabagas	¼-½	18-30	3-4
Spinach	½	12-24	2-4
Turnips	¼-½	18-30	2-3
Warm Season Crops (Soil Temperature of 55°F or above)			
Beans, lima	1-1½	24-36	3-4
Beans, snap	1-1½	24-36	1-2
Cantaloupes	1	48-72	24-30
Cucumbers	1	48-60	12-18
Eggplant	¼	30-42	18-24
Okra	1	36-48	12-18
Peas, southern	1	24-36	4
Peppers	¼	30-42	18-24
Pumpkins	1	60-96	36-48
Spinach, New Zealand	½-1	30-42	15-18
Squash, summer	1-1½	48-60	18-24
Squash, winter	1-1½	60-96	36-48
Sweet corn	1-2	30-36	10-12
Sweet potatoes		30-36	12-15
Tomatoes	¼	36-60	18-24
Watermelons	1-1½	60-96	36-60