

home gardens

EB0422



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HOME GARDENS

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Plan your garden in line with what you want from it. If you want vegetables only to eat fresh, make small plantings of each over an extended period so they mature in small quantities. Plant in larger blocks if you want to freeze, can, or dry vegetables so enough are ready for processing at one time.

Some vegetables have a better flavor when grown to their prime maturity, harvested, and prepared immediately for the table (tomatoes, sweet corn, peas). Others store and ship well with little loss in flavor or texture (cabbage, potatoes, dry onions). If your purpose is to grow better tasting vegetables, concentrate on those that benefit most from immediate use after harvest.

You can trim the food budget by growing the more expensive vegetables that your family normally eats. For example, tomatoes, summer squash, and peppers usually cost much more per pound than potatoes and winter squash. Table 1 compares the relative quality, productivity, and monetary values of commonly grown vegetables.

Choose a Good Site

Convenience is important as you select a vegetable garden site, but exposure and suitable soil are more important. Locate your garden for maximum exposure to available sunlight.

Vegetables also require a fertile, well-drained soil. You can add fertilizers to improve soil fertility and use organic matter and sand or vermiculite to improve soil texture. Drainage is determined mostly by the site. Select a location with enough slope for surface drainage and sufficient subsoil permeability to allow water to drain through.

Keep in mind that vegetables can be interspersed with ornamentals. They can become a part of the landscape design.

Match Vegetables to Climate

How well you work with uncontrollable factors determines much of your gardening success. One of the most important is climate, which includes length of growing season as well as what temperatures occur during that season. Vegetables that require a longer growing season than is available will disappoint the gardener.

Figure 1 shows the days of growing season in Washington areas. Table 2 presents the general lengths of growing season some vegetables require. Seed packets and catalogs provide more specific information. Select varieties that will produce well in your area. Vegetables that produce under a wide range of weather conditions can add to the enjoyment of gardening.

Table 1. How Vegetables Compare in Quality, Production, and Monetary Value

Vegetable	Garden & store difference in quality	Production per sq ft	Relative monetary value
Asparagus	high	medium	high
Beans	medium	high	medium
Beets	low	high	medium
Broccoli	medium	high	high
Brussels sprouts	high	low	high
Cabbage	low	medium	low
Carrots	medium	high	medium
Cauliflower	low	medium	high
Celery	low	medium	medium
Chard	high	high	medium
Cucumbers	medium	low	high
Eggplant	high	low	high
Kohlrabi	low	medium	medium
Lettuce, leaf	medium	medium	high
Lettuce, head	low	low	medium
Muskmelon	low	low	medium
Onions, green	high	high	high
Onions, dry	low	medium	low
Parsnips	low	medium	medium
Peas	high	medium	medium
Peppers	medium	low	high
Potatoes	low	medium	low
Pumpkin	low	low	low
Radish	low	high	medium
Rhubarb	medium	high	high
Spinach	medium	low	medium
Squash, summer	high	high	high
Squash, winter	low	medium	low
Tomatoes	high	medium	high
Turnips	low	high	medium
Watermelon	low	low	low

Early Spring Planting

Plants that do well in cool weather include asparagus, lettuce, onions, peas, radishes, rhubarb, and spinach. Asparagus and rhubarb are perennials—usually roots are planted.

Plant cool weather vegetables as soon as the soil can be worked in spring—around March 10 in western Washington and the Walla Walla area and April 10 in central and eastern Washington. Local areas may have different weather than the various general state areas—adjust your planting schedule accordingly.

Mid-Spring Planting

Plant as soon as the soil is warm—about 2 weeks before the last killing frost date (Fig. 2). These plants will tolerate some hot weather: beets, broccoli, cabbage, carrots, cauliflower, celery, chard, kohlrabi, parsnips, potatoes (early), and turnips.

Broccoli, cabbage, and cauliflower are usually set

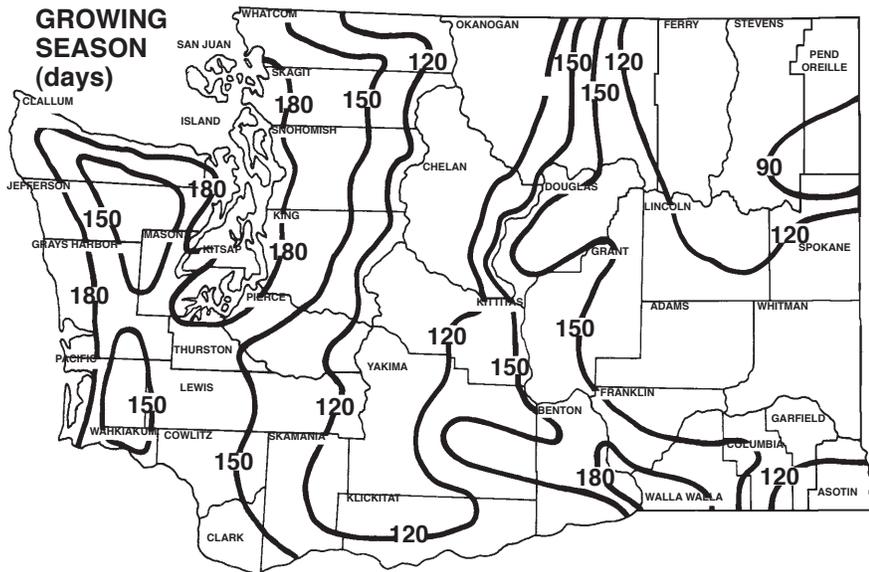


Figure 1. Length of growing season (frost-free days).

into the garden as transplants. Sow seeds for transplants 6 to 8 weeks before they are moved outdoors.

Late Spring Planting

These vegetables are easily injured by frost and must be planted after the last date of killing frost (Fig. 2) as they do not grow well in cool weather: beans, Brussels sprouts, corn, cucumbers, eggplant, muskmelon, peppers, pumpkin, squash (winter and summer), tomatoes, and watermelon.

Eggplants, peppers, and tomatoes usually are set in the garden as transplants.

Fall and Winter Gardens

Use of a garden area can be greatly increased by transplanting or seeding vegetables during midsummer for harvest during the fall and winter months. Two distinct groups of vegetables can be used for fall and winter gardens.

Early summer planting must be done early enough to give the crop time to mature before freezing weather (Fig. 3). The planting date must precede the fall frost date by the number of days to first harvest.

Beans (bush), broccoli, Brussels sprouts, and cabbage are vegetables which fall into this category.

Mid-summer plantings consist of vegetables that can be grown during the cool fall season even after a chilling frost. Generally, root crops that will be stored are best planted in the summer. These plants will do well in cool weather: beets, carrots, turnips, rutabagas, chard, kohlrabi, lettuce, spinach, and radish

Fall and Winter Vegetable Garden in Western Washington

Western Washington has generally cool summers and mild winters in most locations. At altitudes below 1,000 feet, frost in the soil is rare and usually can be prevented by adding light mulch on the soil surface. This combination of weather conditions allows home gardeners to produce satisfactory crops of many vegetables for fall and winter harvest. However, since the fall and winter months are normally quite wet, it is important that the soil be well drained. The following

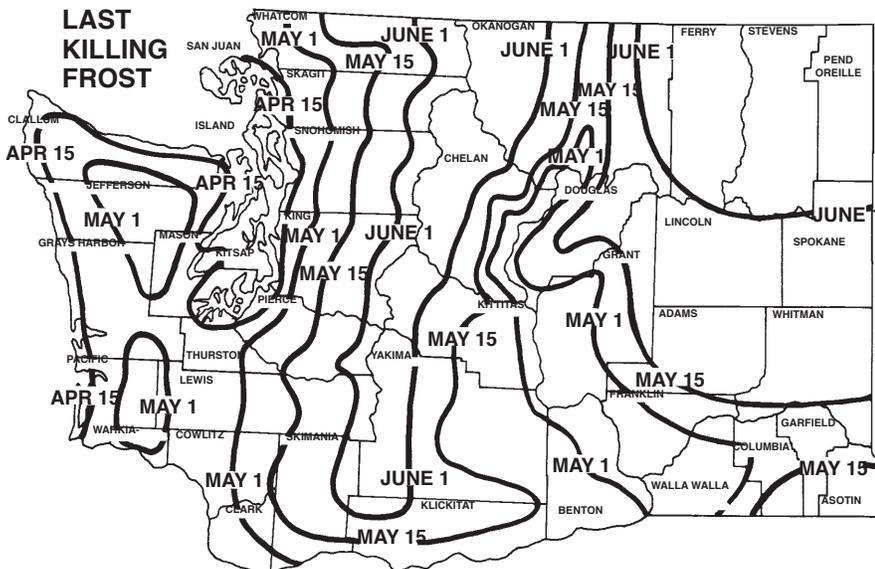


Figure 2. Average last killing frost in spring.

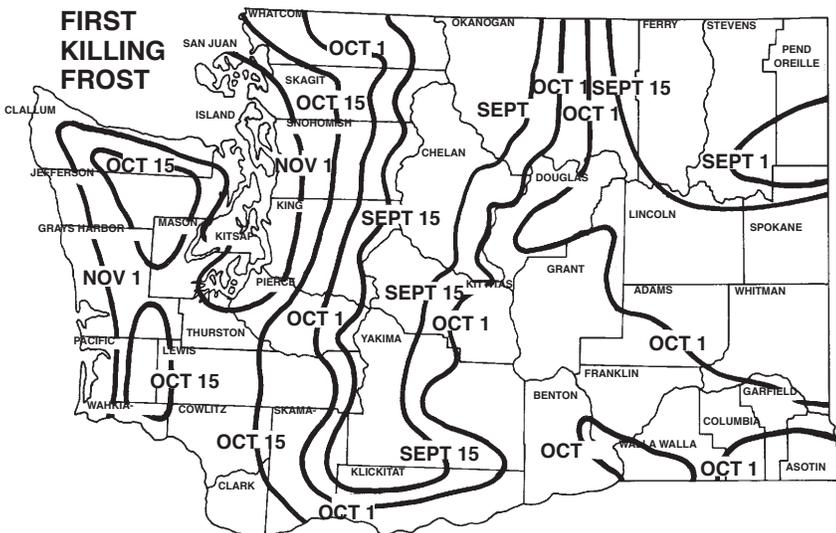


Figure 3. Average first killing frost in fall.

Table 2. Spacing, Production, and Days to Harvest for Selected Vegetables

Vegetable	Min. row spacing	Spacing in row	No. plants/ 10-ft row	Production/ 10-ft row	Days to first harvest*
Asparagus	24"	12"	10	5-8 lb	2 yr
Beans, bush	18"	3-4"	35	6-8 lb	55-75
Beans, pole	18"	3-4"	35	6-8 lb	65-95
Beets	12"	2-3"	50	10-12 lb	65-80
Broccoli	24"	12"	10	10-12 lb	65-100
Brussels sprouts	24"	12"	10	15 pt 8 heads	100-120
Cabbage (early)	24"	16"	8	(10-15 lb) 8 heads	60-90
Cabbage (late)	24"	16"	8	(10-15 lb)	110-130
Carrots	12"	1-2"	60-80	12 lb 9 heads	70-90
Cauliflower	24"	14"	9	(8-10 lb)	50-75
Celery	12"	5-6"	20	20 stalks	100-120
Chard	18"	6"	20	30 lb	60-75
Corn	2'	6"	20	3 doz ears	70-140
Cucumbers (sprawl)	4-6'	2'	5	2-3 doz	60-75
Cucumbers (trellised)	2'	2'	5	2-3 doz	60-75
Eggplant	2-3'	2'	5	15-20 pts	80-100
Kohlrabi	18"	4"	30	7-8 lb	50-75
Lettuce (leaf)	12"	6"	20	20 plants	55-60
Lettuce (head)	18"	12-16"	8-10	8-10 heads	75-80
Muskmelon	6-8'	6'	2	10-20 melons (E. Wash.)	90-115
Onions (green)	6"	1-2"	60-80	10 bunches	50-70
Onions (dry)	6"	3"	40	10 lb	130-180
Parsnips	18"	3"	40	10-15 lb	120-150
Peas	18"	1-2"	60-100	10-12 lb	60-120
Peppers	2'	18"	6	20 lb 2-3 lb (E. Wash.)	90-110
Potatoes	2'	12"	10	20 lb	90-140
Pumpkin	5-8'	3-4'	3	10 pumpkins (30-50 lb)	190-195
Radishes	6"	1"	100-120	10 bunches	25-40
Rhubarb	3'	3'	3-4	15-20 lb (2nd yr)	2 yr
Spinach	12"	3-4"	30-40	5 lb	50-60
Squash (summer)	4'	3'	3	25 lb	60-70
Squash (winter)	5'	4-5'	2	20-30 lb	90-135
Tomatoes (staked)	3'	18"	8	30-50 lb	65-110
Tomatoes (sprawl)	4-5'	3-4'	3	30-50 lb	65-110
Turnips	18"	3-4"	30-40	20 lb	60-70
Watermelon	8'	5"	2	3-5 melons (E. Wash. only)	80-100

*Days to harvest varies with varieties and location. Seed packets and catalogs list information on days required. Cool summer areas may require 20% to 40% more days.

vegetables can be planted in summer or early fall for fall, winter, and early harvest.

Bush beans can be planted until late July and usually produce a good crop before frost. The bean plants develop more rapidly in the warm summer months than in early spring. *Pole beans* require more time to develop; plant them by July 1 for a fall crop.

Beets can be planted until about August 1 and produce a dependable crop. If you want only the tops for beet greens, you can plant until September 1.

Swiss chard planted by mid-July will produce a fall crop; or when planted in late August, the plants will winter over and produce an earlier crop the following year than spring sown plants.

Broccoli, kale, and collards can be direct seeded until mid-July and transplanted until mid-August. A fall

broccoli crop will usually continue to produce until past Thanksgiving and sometimes until Christmas.

Seed *cabbage, Brussels sprouts, and cauliflower* by July 1 and transplant by August 1. Savoy cabbage, like broccoli, can be seeded until mid-July and transplanted until mid-August. Fall cabbage crops will hold in the garden for prolonged periods and can be harvested into early winter.

Chinese cabbage is best planted in late July for a fall crop.

A fall *carrot* crop will keep in the garden until used. Plant carrots by mid-July for fall and winter harvest.

Witloof chicory or *French endive* can be planted until mid-July. The roots can be dug in late fall, placed in a box of moist soil, covered with sand, and forced

in a warm room for winter greens.

Cornsalad, also known as lamb's lettuce or feticus, can be planted in early September for fall use or in late October to overwinter for early spring use.

Fall and Winter Vegetable Garden in Eastern Washington

Plant *beets* July 15 to August 15 for use of roots. If you want tops for greens, plant until early September.

Plant *beans* July 1 to August 1, depending on variety. They must be harvested before frost.

Start *cabbage* plants June 15, and transplant to the garden in August.

Plant *spinach* July 15 to August 15.

Plant *carrots* July 15 to August 1. If you store in the garden, be sure to mulch for protection from freezing.

Turnips, *rutabagas*, and *parsnips* also need a mulch cover to protect them from fall and winter freezing. Leave them in the garden for storage and harvest as you need them during the winter.

Design with Care

A thoughtfully designed garden will be more productive and easier to care for than one that occurs by happenstance. Each type of vegetable requires a minimum amount of room to grow and to develop properly. Some crops mature quickly enough for a second and occasionally a third planting to be grown in the same space.

Locate perennial vegetables along the borders of the garden so they do not interfere with tillage of the annual crop areas. Production of more of any one vegetable than your family can use is wasteful and inefficient. A simple design indicating the amount and arrangement of the vegetables in your garden plot will help you achieve your gardening goals.

Table 2 indicates the minimum spacing and the approximate production from a 10-foot row of the most common garden vegetables. If you have ample garden space and are using mechanized garden tools, you may want to use wider row spacings than the minimums indicated.

Get the Most from Limited Space

If your garden space is limited, the following tips can help you achieve maximum production per square foot.

Use All the Garden Space

In a small garden, maximum use of space produces more vegetables and reduces weed growth. Do not crowd plants but space them closely enough so little soil is left bare when the plants are full grown. Grow onions in rows 6 inches apart, carrots and beets in rows 12 inches apart. Plant two or three closely spaced rows, then leave a slightly wider space for walking room. You do not need walking room next

to every row.

Garden Vertically

Peas, pole beans, and cucumbers can be trained on a fence or trellis of lath and string. This method requires a minimum of ground space.

Succession Crop

Early spring plantings of peas, turnips, beets, radishes, lettuce, and kohlrabi will mature in 40 to 60 days, leaving plenty of time to grow summer or fall crops in the same space in the garden.

Intercrop

Plant radish seeds in the same row with carrots or lettuce. When the radishes mature and are pulled, thin the carrots. Or, plant head lettuce and tomato plants in the same row. The lettuce will mature and be harvested by the time the tomato plants need the room. Plant onion sets 1 inch apart in the row and harvest two-thirds as green onions, leaving one plant every 3 inches to produce a large bulb.

Select Proper Tools and Equipment

Only a few basic tools are needed for gardening. Many experienced gardeners use only a spade, a rake, and a hoe. Power tools can save labor and time in large gardens but are not necessary and have questionable value in smaller garden plots. Gardens of 1,000 square feet or less can be prepared and cared for with only a spading fork for tilling, a garden rake for smoothing the surface and pulverizing clods, and a hoe for shallow cultivation and cutting of weeds. Good quality tools are modest in price and can last a lifetime.

Digging tools, such as round-point shovels and garden spades, should be kept sharp. A sharp edge allows the tool to cut easily through the soil profile with a minimum of effort. When digging, cut only modest slices (2–3 inches) from the side of the furrow and turn the soil over, lifting the shovel only slightly. Overloading the shovel strains both the shovel handle and the gardener's back and does little to speed the tilling task. Shovels are manufactured in various sizes, and the gardener should select one that he or she can handle easily.

Most garden hoes are slicing tools designed to cut off plants at or slightly below the soil surface. Common round-top hoes and narrow bladed onion hoes are designed to cut on the pull stroke. Flat-bladed scuffle hoes are designed to cut on the push stroke. Either type is designed to slice along the surface or in the upper one-half inch of soil. Never chop with a garden hoe.

For deeper cultivation, a triangular shaped Warren hoe or three-tined cultivator can be used. Combination tools that have slicing and cultivating edges are popular with some gardeners. Select hand tools that are comfortable for you to use, keep them sharp, and use them correctly.



Manage the Soil Properly

It is important in vegetable gardening to prepare a good soil—one that has sufficient organic matter to hold moisture and nutrients, is granulated in structure, provides good drainage, has an adequate level of nutrients, and has a satisfactory pH or soil reaction. A soil test before planting can provide an excellent guide for management practices throughout the growing season. WSU no longer tests soils. Oregon State University, the University of Idaho or private labs in Washington will test soils. Ask your cooperative extension agent or master gardener how to take test samples.

Organic Matter

Organic matter is an important soil constituent in the vegetable garden. It helps hold the soil structure together and increases the moisture and nutrient-holding capacity. Organic matter added to heavy soils works to break its dense structure and form clumps or “aggregates.” The increase in pore space allows easier penetration of moisture and air and aids root growth and development. The soil will dry earlier in the spring and will not be so hard to break later in the summer. In sandy soils, organic matter holds water and nutrients.

While organic matter can be added almost anytime before planting, it will benefit the garden most when added immediately after harvest in the fall. Organic matter added just before planting in the spring can tie up nutrients needed by the vegetable plants. The benefits of organic matter applied in the spring will not be evident until late summer or the following season.

Sources of organic matter can include almost anything. However, do not use more than a 1-inch layer of manure in any one year. Excess salts can build up from overmanuring, and this condition would restrict plant development. Work organic matter into the soil to a depth of 6 to 8 inches—the average rooting depth of most vegetables.

Compost

Compost is an excellent source of organic matter. Most gardeners can generate sufficient organic matter for their gardens by composting all of the available organic refuse from their yards—grass clippings, tree leaves, vegetable tops, and even weeds that have not yet formed seed. However, do not add diseased plant material to a compost. Place diseased plants in the garbage or dispose of them in some other way.

It is best in building a compost pile to form some type of bin to contain the organic wastes. This can be wire, boards, concrete blocks, or any other available material. Build the compost pile by alternating layers of organic materials with layers of garden soil, usually 6 to 8 inches of organic matter and 1 to 2 inches of soil. Keep the layers horizontal and finish the pile with a layer of soil that is slightly dished in the center to collect water.

Compost will decompose more rapidly if you add 1 cup of a nitrogen-containing garden fertilizer per 10 square feet of surface area each time you add a layer of organic matter to the pile. This fertilizer will be used by the bacteria as they decompose the organic refuse and will remain in the compost to be added to the garden. In western Washington, it is also beneficial to add 1 cup of lime or wood ashes to each layer.

Normally, a compost pile built throughout one growing season will be decomposed and ready to add back to the garden the following spring. Decomposition will be more complete if the pile is turned one time about 3 to 4 weeks after completion. When turning the pile, slice through the layers and put the materials from the outside into the center of the new stack.

Soil Amendments

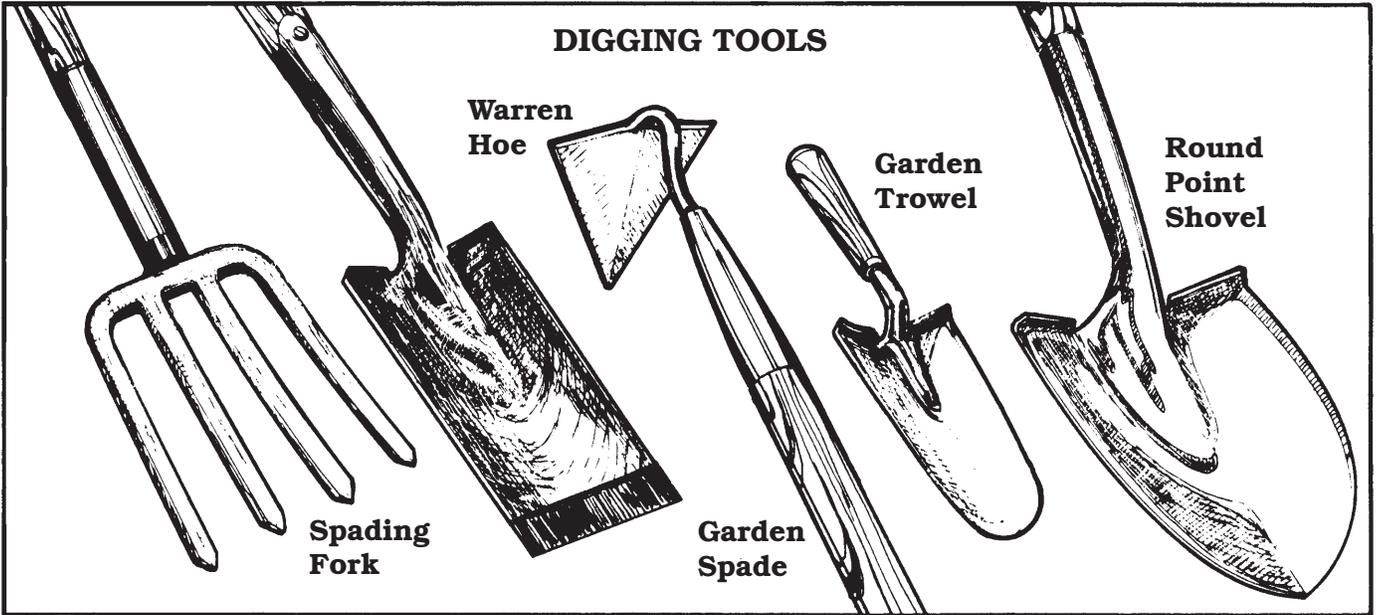
Soils west of the Cascade Mountains differ somewhat from those in eastern Washington. Because of high rainfall, coastal soils are usually acid. A low soil pH can be corrected by incorporating agricultural lime into the soil. A soil test will determine if you need to adjust the soil reaction.

Soils in eastern Washington, because of the drier climatic conditions, are close to neutral in soil reaction. Many of the central valley soils are alkaline (have a high pH). Adjusting the pH of the soil by sulfur and acid residue types of fertilizer is frequently recommended in these situations.

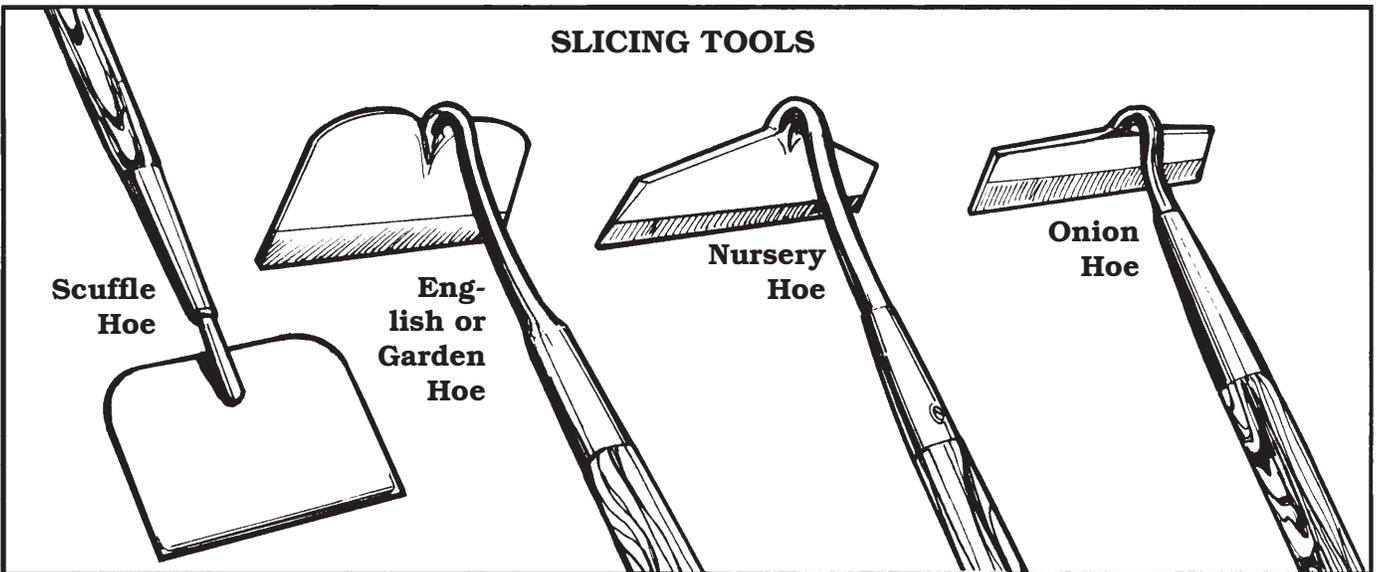
Fertilizers

Vegetable gardens need a high level of fertility to maintain vigorous plant growth. The amount and

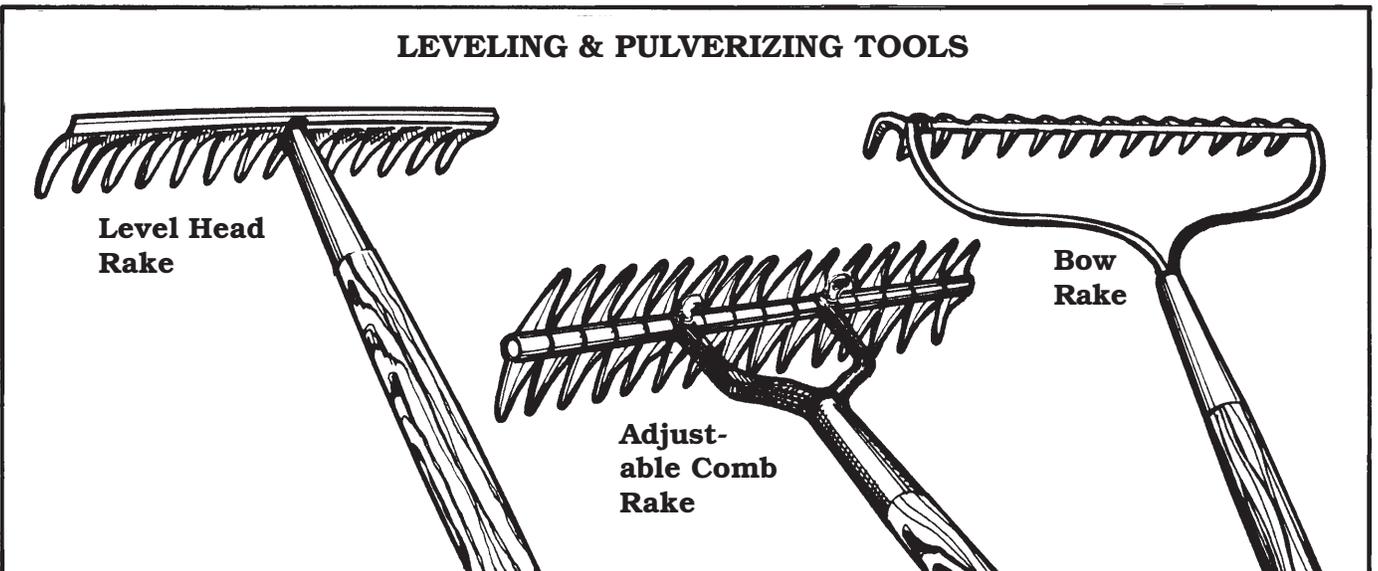
DIGGING TOOLS



SLICING TOOLS



LEVELING & PULVERIZING TOOLS



type of fertilizer needed varies in different areas of the state. In general, western Washington soils require complete fertilizers (ones that contain nitrogen, phosphate, and potash). In eastern Washington, usually only nitrogen is needed. A soil test is desirable to help you select the best type of fertilizer for your area. In the absence of a soil test, rely on the advice of experienced gardeners in your vicinity.

For more complete discussion of soil management and fertilizer selection, request a copy of *Home Gardener's Guide to Soils and Fertilizers*, EB1971E, from your county Extension office.

Seedbed Preparation

The physical preparation of your soil into a suitable seedbed is as important as adding needed fertilizer and soil amendments to your soil. Seedbed preparation includes tilling to mix air, organic matter, and fertilizers into the topsoil, to destroy existing vegetation, and to loosen the soil for the new generation of plants. Tilling can be done by turning the soil with a spade or spading fork or by using a mechanical tiller.

Till when the soil is moist but not wet. Tilling wet soil compresses the soil particles into clods which are difficult to pulverize later into a fine seedbed. To test if your soil is dry enough to till, squeeze a handful into a ball in your fist. If the soil ball will crumble again when tapped with your finger, the soil is dry enough to till. If it remains in a mud ball, it is too wet.

In areas of Washington where the soil normally freezes, till the soil in the fall after harvest is completed. In areas where little or no frost is common, it is best to till in the fall if undecomposed organic matter is being added. A second tilling in early spring is often required in these areas to destroy weeds that germinate in the garden plot over winter.

After tilling, a certain amount of raking is necessary to smooth the garden surface, pulverize small clods, and firm the seedbed. When the garden is tilled in the fall, winter weather tends to break down any clods so that final seedbed preparation in the spring is easier.

Preparing the seedbed is the most important step. Seeds placed in a moist, finely granulated, firm soil germinate and establish readily. Seeds planted in

cloddy soil germinate poorly and often die soon after germination because the soil dries too rapidly.

Gardening Is a Continuous Operation

A productive vegetable garden requires some care and attention from planting time through harvest. Basic considerations and tips on how to manage these operations in your garden follow.

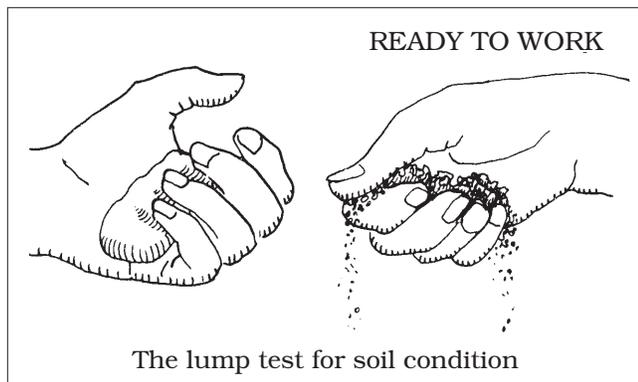
Sowing the Seed

Use care and precision in planting garden seeds. Most seed packages give directions on how deep to plant. If planting depth is not specified, a good rule-of-thumb is to plant four to five times as deep as the diameter of the seed. Plant slightly shallower in clay soils and slightly deeper in sandy soils.

In nonirrigated areas, form the seeding row at the bottom of a slight trench. This places the seed deeper into moist soil and establishes the root system deeper in the soil. Where irrigation is available, furrowing is not needed.

Form the planting trench with either a hoe or a narrow stick. Seeds to be planted 1 inch or more deep will need a planting trench formed with a cutting blade, such as a hoe. Planting trenches for small seeds can be formed with the hoe handle or a small stick. After sowing the seed in the planting trench, cover to the recommended depth and firm the soil around the seed. This can be done by gently tapping the row with the flat side of a hoe or rake.

Sow garden seeds thinly but evenly in the planting trench. Spread small seeds evenly by gently teasing them over the edge of the seed packet or a small measuring scoop. A slight side-to-side motion will move the seeds over the edge a few at a time. It is





difficult to sow small seeds thin enough, so the stand will usually have to be thinned to recommended row spacing after the seeds have germinated.

Plant large seeds, such as beans, corn, and squash at the recommended row spacing to avoid having to thin the stand later.

Using transplants

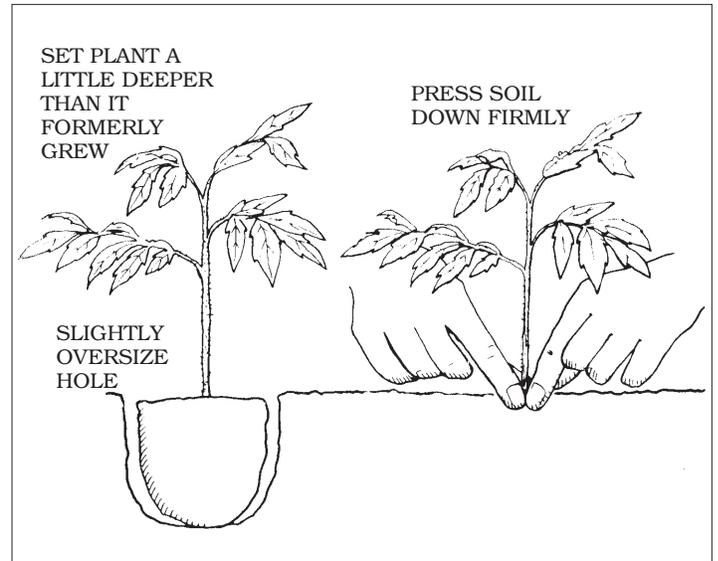
One way to move harvest time of vegetables ahead is to transplant started plants to the garden. Most vegetables can be readily transplanted. Do not expose the roots to drying air, and water the transplanted vegetables to settle the soil around the roots.

Set transplants slightly deeper than they grew in the starting container. If they are exceptionally tall, slant the stems into the soil to keep the roots from being buried too deep. When transplanting from peat pots, cover the pot rim with soil to prevent it from acting as a wick that draws moisture away from the roots.

Most gardeners find it beneficial to use a small amount of soluble or liquid fertilizer around each plant transplanted. The directions for mixing a starter solution appear on all soluble fertilizer products. Follow the directions carefully, and do not add more fertilizer to the solution than is recommended.

Most gardeners prefer to purchase their transplants, but others like to grow their own. A sunny area and suitable temperature conditions for the plants are the main requirements in growing transplants.

All vegetable plants need high light intensity to develop with normal growth. Less than full daylight exposure causes spindly, weak growth which will not produce satisfactory transplants. Warm-season vegetables, such as tomato, pepper, and eggplant, prefer 55 ° to 60° F night temperatures and 70° to 75° F day temperatures for best development. These



are about normal windowsill temperatures in the average home.

Table 3 shows the approximate time required to produce transplants ready for the garden by the single transplant (seed sown directly into flats) and double transplant (seedlings transplanted to flats or pots) methods.

Determine when to sow each vegetable seed by selecting the date you plan to transplant to your garden; count backwards on your calendar the approximate number of weeks needed to grow that vegetable by the method you plan to use. Do not rush the season. Extra large transplants or planting too early rarely speeds the harvest date and may cause you to lose a planting.

Potting Soil

Vegetable transplants do best in a light soil with a good water-holding capacity. You can prepare a good potting soil for your seedling containers by mixing equal parts of garden soil, vermiculite, and fine peat moss or compost. Thoroughly mix the soil, vermiculite, and organic matter before filling the flats

Table 3. Time Required to Produce Transplants for Various Crops

Vegetable	Single transplant	Double transplant
Head lettuce	2-3 wk	3-4 wk
Cabbage, broccoli, cauliflower	4-5 wk	5-6 wk
Tomato	5-7 wk	6-8 wk
Pepper	7-8 wk	8-10 wk
Eggplant	8 wk	9-10 wk
Cucumber	2 wk	
	(seeded into plantable pots)	
Squash	10 days	
	(seeded into plantable pots)	

or pots. It is normally not necessary to sterilize the potting soil.

Hardening-off Transplants

Harden off vegetable plants by exposing them to outdoor temperatures for several days before transplanting them to the garden. Hardening means preparing the tender plants to endure the colder outdoor temperatures and direct sun rays; do this transitioning in steps.

Direct Seeding

Fall crops of cabbage, cauliflower, broccoli, and lettuce can be direct-seeded in the garden or started in short nurse rows in the garden and transplanted as needed. Seeds planted directly into the garden in May and June can be transplanted from late June to mid-August and produce a fall crop in areas where a spring crop has been.

Irrigation

Garden crops usually have rather shallow roots. If the soil becomes too dry, their growth may be seriously limited. Irrigation is essential to successful gardening in the drier parts of eastern Washington. In every part of the state you can produce more and better quality vegetables by following a planned irrigation program.

Any method of applying water is satisfactory if properly used. Avoid a rapid rate of application—it may cause water runoff or soil compaction. All living organisms require free moisture on plant surfaces to germinate and cause infections; thus, avoid overhead irrigation of established plants when possible. Furrow irrigation, a drip system, or use of a soaker hose are more desirable from a disease standpoint. If overhead irrigation is used, make these applications in the morning, allowing time for the foliage to absorb the moisture. Light, frequent applications are needed when starting summer seedings. Apply enough moisture at each irrigation to wet the rooting zone of the crop.

Crops that have developed shallow rooting systems can be injured easily during hot periods. Shallow roots develop both from excessively wet conditions and from frequent light irrigations that do not completely fill the potential rooting depth.

Generally, you should irrigate light, sandy soils every week or oftener and heavy soils every 10 days or 2 weeks, depending upon the weather. On hot, windy days plants can lose two to three times as much moisture as on cool, cloudy, windless days.

Keep the soil moisture supply as even as you can throughout the season. Blossom end rot of tomatoes, knobby potatoes, and bitterness in cucumbers are increased by alternating wet and dry conditions in the soil.

One way of telling when irrigation is needed is by digging into the soil where the roots are feeding. If the soil holds firmly together when pressed in your

hand, there is enough moisture. If the soil crumbles easily when pressed together, it is too dry.

Cultivation and Mulching

Use shallow and frequent cultivation. Keep the soil from becoming packed and soggy. Cultivation following rains controls weeds and prevents crusting of the soil surface.

Strive for a weedless garden. Weeds use valuable plant food and reduce the moisture supply. Garden pests and diseases tend to be more common in weedy than in clean gardens.

Mulching can prevent weed growth as well as add to the organic matter content of the soil. Mulches tend to conserve soil moisture, prevent erosion, eliminate crop damage caused by deep cultivation or hoeing, and keep the fruits clean.

Mulches can be plastic film or layers of organic refuse spread over the soil surface. Almost any material can be used to mulch around plants, providing it allows air and water to penetrate to the soil below. Only a thin layer is needed to conserve soil moisture; however, 2 inches or more is often desirable for weed control.

Coarse-textured materials, such as stemmy hay, straw, and wood shavings or chips are more desirable than fine or flat materials such as leaves or sawdust. When fine materials are used, loosen them occasionally to prevent sealing the soil surface. Perforate plastic film to allow water and air free passage.

Organic materials used as mulches in the summer can be spaded in or plowed down in the fall to build the organic matter content of the soil. If sawdust or shavings are used, additional nitrogen fertilizer may be necessary.

Thinning Plantings

Allowing too dense a stand of plants in the row results in a decrease in both yield and quality of the vegetables. While it is not necessary that each plant have the exact spacing recommended (Table 2), the average density should not exceed those recommendations.

Vegetable plants can compete with themselves (become their own weeds) when planted too close together. Each plant needs growing space to receive the light, water, and nutrients necessary for optimum growth.

Harvesting Vegetables

One of the principal reasons home gardeners grow vegetables is to enjoy the highest quality possible by fresh harvesting. Much of this advantage can be lost if vegetables are not harvested at the proper stage of development.

Pick *tomatoes* when fully colored, but still firm. Once fully colored, the tomato fruits will be in the prime eating stage for about a week. Overripe tomatoes become mushy and lose flavor.

Snap beans (any color) are best when the bean is

about half developed in the pod. Some people prefer them at a slightly less mature stage. The bean pods are edible at any size and are of good quality until the bean is nearly full size, when the pods begin to soften and become stringy.

Harvest *summer squash* at a very immature stage for best flavor. Pick squash when they are 4 to 7 inches long and the skins retain the soft, rubbery feel. Once the skins begin to feel smooth or slick, they are past this best eating stage.

Winter squash (Hubbard, acorn, butternut) should be fully mature before harvesting. The skins should feel hard and waxy. If in doubt whether your squash is fully mature, leave it another week or two. There is



no hurry to harvest winter squash until cold or wet weather in the fall. When mature, pick with the stems attached, cure in a warm, dry place, and store at room temperature. They will keep 3 to 5 months.

Harvest *sweet corn* as soon as the kernels are well filled and while they are still milky. Feel the husk—when it is firm, the ear should be ready. If in doubt, peel back the husk and examine a few kernels before you break off the ear. If it is not ready, just fold the husk back over the ear.

Begin to use *head lettuce* and *cabbage* as soon as the heads become firm. If you have a number of plants, you may want to harvest a few slightly premature, since most of the planting will mature at the same time. Cabbages with firm heads can be given a quarter turn twist to break part of the roots and retard further growth. This will help prevent splitting.

Beets, *turnips*, and *kohlrabi* are usually best when they are 2 to 2½ inches in diameter. They will grow larger if harvest is delayed but may also lose flavor and become woody. If you are new to gardening and unsure about the best size or stage of maturity for any vegetable, try them at different stages and see what you prefer.

Keep Pest and Other Problems Under Control

Relatively few insect and disease problems occur frequently when growing vegetables. Cultural problems are more common than insect infestations or diseases. The best way to prevent insect and disease problems is to maintain vigorous growth. Stressed plants suffer greater damage and succumb more quickly to pest infestation than do vigorous plants.

When damaging insect populations or diseases occur, they can cause considerable damage. Control of the problem may be quite simple or almost impossible. The following section lists the most commonly encountered vegetable problems and recommended control measures. Control measures include cultural practices and mechanical, biological, and chemical controls.

Cultural controls, to a large extent, are prevention techniques that avoid or limit pest infestations. Choosing varieties of vegetables that are resistant to certain diseases or insects minimizes problems from those pests. Proper timing to avoid peak infestation periods or to provide the best climate for vigorous growth avoids or reduces pest-related problems. Removal of weed growth around the garden reduces hosts for many insects and disease organisms, thereby reducing the opportunity for them to spread to the vegetable crops. Crop rotation prevents the buildup of soil-inhabiting disease organisms and insects that can attack only specific kinds of plants. Exclusion cages or floating row covers such as those used to prevent egg laying by cabbage maggot females are useful in preventing larval damage of many insects (see *The Cabbage Maggot in the Home Garden*, EB0859E).

In some locations, certain disease organisms or insect pests exist in such quantities that production of the vegetables they attack is more bother than they are worth. Avoid these plants and replace them with types the pests don't attack.

Mechanical Control

Mechanical controls entail some form of physical destruction of individual pests or the host plants. They are practical when the pests are accessible and the numbers are not overwhelming—for example, handpicking tomato hornworms, individually destroying invading slugs, or pulling and destroying diseased plants to prevent the disease organism from spreading to adjacent healthy plants.

Sometimes large numbers of insect pests can be destroyed with minimum effort—for example, hosing aphids off plants, or cultivating the soil between rows to expose soil-inhabiting grubs and pupae to the harmful rays of the sun, and predation by birds.

Biological Control

Biological controls use one form of life to control another that is causing or can cause problems. A controlling agent can be a disease organism, a predacious or parasitic insect, predacious spiders or mites, or insect-feeding animals (rodents, snakes, toads). A number of companies now supply insect and mite predators and parasites to gardeners and farmers. For current suppliers, refer to the advertisements in gardening publications.

Many of these beneficial organisms naturally occur in most gardens; however, effective numbers develop too late to control the pest organisms before some damage occurs. Populations of predators and parasites can multiply only after a sufficient food supply has developed for them. You cannot have insect-free garden produce and encourage beneficial insects at the same time. Releasing predators can be beneficial in establishing them in new areas.

Crop Rotation

Soil-borne diseases (for example, root rots and wilts) can be very destructive and difficult to control when populations of the disease-causing organisms are allowed to increase in the soil. Avoid planting the same crops in the same area of the garden year after year to minimize these buildups. A 4- to 6-year rotation scheme in a garden is suggested. As an example of a 5-year rotation, the first year could be planted to potatoes in a given area, then the next year corn in that area, then cole crops, then leafy vegetables, then beans, and finally, back to potatoes. Crops belonging to the same family group, such as the cole crops (broccoli, cauliflower, cabbage, radishes turnips, Brussels sprouts) can suffer from the same diseases. Thus, a broccoli planting followed by a cauliflower or cabbage crop would not be an effective rotation.

Chemical Control

Chemical controls involve using a chemical pesti-

cide to destroy the pest organism or prevent it from spreading to other plants. Chemical pesticides can be either organic or inorganic in origin. All pesticides can kill beneficial organisms as well as pests, therefore, observe the following precautions:

1. Be certain that your garden problem is caused by a pest organism and identify which one.
2. Purchase or use a pesticide formulation approved and labeled for control of the specific organism.
3. Apply the pesticide only on the affected crop.
4. Follow label directions for application and observe all precautions listed on the product label.
5. Carefully spray pesticides using good equipment to avoid contacting other plants and beneficial organisms.

Do not apply pesticides just because you think it is the thing to do. Ask your county Extension office for current recommendations.

Bee Warning

Many insecticides kill bees. Some cannot be safely applied anytime plants are in bloom, while others should be applied only in the early morning or late evening when bees are not foraging for nectar and pollen. Avoid spraying insecticides on plants that are surrounded by blooming flowers or weeds. Mow lawns next to the garden area to remove clover blossoms before applying any material hazardous to bees. This is a simple and important step. In all cases, when plants in the infested area are in bloom, select the material least hazardous to bees. Avoid using dusts whenever possible—sprays are preferred for bee safety. See EB0825 for levels of insecticide toxicity to bees.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM

Symptoms	Cause	Corrective Action
Vegetables in General		
Planted seeds fail to germinate	Planted too deep	Correct planting depth. Follow seed packet directions or plant no deeper than 3 diameters of the seed.
Or Germinate unevenly giving poor stand	Cold soil	Plant later in season. Warm-season crops such as beans, corn, and squash will not germinate in cold soil.
	Dry soil around seed	Prepare a fine-textured seedbed (no clods), press soil firmly around seeds—keep moist but do not overwater.
	Poor seed (low viability)	Use fresh seed each year. Store seeds in a cool, dry place.
	Uneven seed distribution	Use care to disperse seeds evenly in row. Small seeds can be teased over edge of trowel or seed packet to help distribute them evenly. Transplant from heavy stands to skips.
	If seeds disappear—predation by birds or squirrels	Net over rows until germination complete. Light mulch of sawdust (1/4 inch or less).
	If seeds rot in soil—overwatering, cold soil, or poor drainage	Water lightly, improve drainage. Use fungicide-treated seed.
Seeds germinate but seedlings die (common in transplant flats)	Damping-off disease	Treat seeds with fungicide. Germinate seeds in sterile medium. Do not overwater. Delay planting until soil warms.
Seeds germinate and are cut off at ground level (common on transplants also)	Cutworms	Handpick at night. Place paper collar around transplants. Weeds serve as alternate food source, so weed management is essential. See EB0825 for chemical control.
Plants grow slowly and are pale green.	Low fertility	Use adequate fertilizer.
Plants grow vigorously but fail to bloom and set fruit	Over-fertility (too much nitrogen)	Water excessively one time to leach out excess nitrogen (3" of irrigation water after soil is wet).
Plants grow and bloom normally but fail to set fruit	Lack of pollination	Protect bees in garden. Hand pollinate. Use blossom-set hormone.
Plants or plant parts eaten—slime trails often present	Slugs	Eliminate slug harbors (clods), boards, debris on soil and around perimeter of garden. Slug baits.
Plants with holes in leaves, plant parts chewed, or sticky substance on leaves	Insects	See specific vegetable problems in following section. See EB0825 for insecticide recommended.
Plants lose color, wilt, often covered with fine webbing	Mites	See EB0825 for chemical control of mites.
Plants wilt or leaves become mottled or turn brown or black	Diseases	See specific vegetable problems in following section.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Asparagus		
Plants become tan or brown from top downward, small beetles (1 1/4 ") present	Asparagus beetle	Hose off plants with strong stream of water to knock off beetles and larvae (as needed). Remove beetles and larvae as soon as noticed—See EB0825 for registered insecticide products.
Spears notched, cut off, or severed at soil line	Cutworms (various species), search just under soil for 1/2"–3/4" curled caterpillars	See general section (cutworms).
Spears thin and weak, or spears do not come up at all	Plants have been weakened by (1) poor cultural care, (2) previous attack by insects or disease, (3) frost or drought damage, (4) harvesting too heavily	Do not harvest to allow plants to recover. Control damage by pests, competition with weeds. Mulch soil to protect from deep freeze.
Beans		
Plants cut off (severed at soil line), pods, or seeds with 1/4" holes, leaves occasionally chewed	Cutworms (various species)—search just under soil line for 1/2"–3/4" curled caterpillars	See general section. Apply <i>Bacillus thuringiensis</i> when cutworms chew on leaves.
Leaves become yellow, sticky with honeydew, masses of tiny plant lice or their castoff skins on undersides of leaves or on new growth	Aphids: bean aphid is black and visible—cast aphid "jackets" are whitish	Hose off leaves frequently to knock off aphids. See EB0825 for chemical control of garden insect pests.
Leaves bronzed or yellowed; leaves and stems heavily webbed	Mites: tiny "dust specks" moving on leaf and underside of web	Hose off mites with strong stream of water—reduces numbers but does not eliminate. Miticides—see EB0825.
Leaves become silvered and yellow, no webbing	Thrips: difficult to see, tiny, elongated	Hose off to dislodge thrips—reduces numbers but does not eliminate. Insecticides—see EB0825.
Plants appear dried and stunted, leaves curl, scattered plants	Curly top virus: leafhopper-borne, eastern Washington only	Pull and destroy infested plants. Resistant varieties. Fungicides not effective.
Plants appear sickly and stunted	Fusarium root rot: look for dark red or brown lesion on stem at or below ground line and on main root, small side roots are killed	Hill up plants to promote extra root growth. Use ammonia form of nitrogen to stimulate growth. Pull and destroy badly damaged plants. Fungicides not practical. Don't replant to beans (5-6 years). Avoid moving soil to adjacent areas.
Leaves mottled with yellow and green patchwork, leaves distorted or stunted, plants stunted	Viruses: a variety of viruses attack beans, each produces symptoms characteristic of the virus species	Plant resistant varieties. Pull up and destroy badly damaged plants.
General yellowing of lower leaves	Nutrition: potash deficiency, poor watering habits	Sidedress with complete fertilizer. Cultivate to aerate soil.
Stems and pods with fuzzy white growth and accompanying watery soft rot	White mold: small black bodies may be seen in the white moldy growth	Disease is favored by moist, wet conditions—increase air circulation—increase plant spacing. Furrow irrigate rather than overhead irrigate. If extensive fungicide can be used, see labels.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Beets and Chard		
Leaves with watery off-green blotches	Beet leaf miner	Floating row covers work well. Pick off and destroy mined leaves. Insecticides are not practical.
Leaves become yellow, sticky honeydew, tiny plant lice or shed skins on leaves.	Aphids	Wash off aphids before cooking.
Small plants wilt and fall over	Damping-off	Plant in warm, well-drained soil—use fungicide-treated seed.
Plants remain small	pH—chard is an indicator of soil that is too acid	Soil test, or apply agricultural lime. See also “General Problems.”
Cabbage Family: Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Collards, Kale		
Plants (especially young) wilt and fall over, roots with tunnels (and associated secondary roots) presence of fat white maggots	Cabbage maggot: adults are flies	Plant large, vigorous transplants. Paper collars around transplants help keep flies away from plants. Screen cages can be used to exclude egg laying females. Insecticides—see EB0825. Floating row covers work also.
Leaves with many tiny holes	Cabbage flea beetle: adults are small black beetles that jump	Insecticides—see EB0825.
Leaves badly chewed (with large holes) or very ragged in appearance	Cabbage worm: furry-looking, green, slug-like caterpillars Loopers: green inchworms	Handpick day or night. Insecticides—see EB0825.
Leaves chewed, silvery trails on leaf surface	Slugs: distinguished by the silvery trail they leave on the plant	Handpick at night or on cloudy, drizzly days. Slug baits—use according to label directions.
Leaves become yellow; sticky with honeydew; large colonies of plant lice throughout head, under leaves, or on flowers.	Aphids	Hose off plants. Wash leaves and heads before cooking (or dunk in salt water solution). Insecticides—see EB0825.
Leaves become silvery and speckled, turn yellow, then brown, finally collapse; presence of thrips throughout heads	Thrips	Wash heads before using or soak in a salt water solution. No insecticides are registered for use on thrips on cole crops.
Leaves with irregular yellowish areas on upper leaf surface, whitish powder on underside of yellow areas	Downy mildew: especially on broccoli, cauliflower, Brussels sprouts	Tolerate. Improve air circulation. Remove badly infested leaves. Fungicides.
Heads suddenly split	Watering: sudden, heavy watering after prolonged dry results in too fast growth, thus splitting	Do not allow soil to get too dry; if it does, apply water slowly at first. When heads are firm, give plants one-quarter twist to break some roots, slowing growth.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Carrots		
Roots are stunted and knobby or distorted, tops may be stunted	Root knot nematode	Fumigation of soil. Destroy diseased carrots. Plant in different area of garden. Control weeds.
Roots develop into odd shapes (no above-ground symptoms)	Rocky soil	Sift soil for carrot beds or plant in raised beds.
Roots with surface tunnels filled with rusty mush, presence of stiff white maggots (no above-ground symptoms)	Carrot rust fly	Peel off damaged areas before using. Harvest carrots as soon as possible. Do not store carrots in ground through winter. Control weed hosts (all <i>Umbelliferae</i>). Insecticides—see EB0825.
Corn		
Small plants cut off at ground line and topple over	Cutworms	Scratch soil surface with finger to turn up caterpillars. Protect plants at soil line with collars. Diatomaceous dust sprinkled in soil around plants may cut and desiccate cutworms. Insecticides—see EB0825.
Plants not growing	Climate too cool	Patience—wait for warmer weather.
Leaves become yellow or light green, growth slows	Nitrogen deficiency	Sidedress with nitrogen fertilizer.
Leaves with reddish streaks	Phosphorus deficiency	Sidedress with complete fertilizer.
Leaves stippled, bronzed, or yellowed; webbing on both leaf surfaces with “moving dust”	Mites	Allow tiny 1/16” black and white ladybugs to work. Hosing will reduce numbers but not eliminate mites.
Leaves become yellow, masses of plant lice (and ants, ladybugs) on leaves	Corn aphids—various species	Hosing to knock off aphids. Allow existing ladybugs, syrphid fly larvae, and other predators (not ants) to work. Insecticides—see EB0825.
Ears, tassels, and silks with worms and/or frass, ears with holes inside; kernels gouged	Corn earworm: medium 1 1/2” caterpillars of variable color	Handpick and destroy. Mineral oil—apply with squirt can to silks and tips of ears after pollination when silk has begun to turn brown. Insecticides—see EB0825.
Ears, tassels, leaves with black gnarled growths	Smut	Remove and destroy growths as soon as noticed; keep black powder in galls from garden area.
Ears only partly filled, shortened silks, presence of earwigs on silks	Earwigs feed on silks and prevent pollination, thus killing kernels	Traps: place rolled newspaper or cardboard or burlap near corn, check daily for earwigs and destroy.
Ears poorly filled, no insect damage to silks	Poor pollination	Plant corn in hills or several rows side by side rather than one long row.
Cucumber Family: Cucumber, Pumpkin, Squash		
Seedlings consumed as they sprout, slimy trail nearby	Slugs	Baits can be placed under boards or other protection to keep them off fruits.
Leaves become stippled and bronzed, webbing and “moving dust” on undersides of leaves	Mites	See EB0825

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Cucumber Family: Cucumber, Pumpkin, Squash (continued)		
Leaves with small speckles which turn yellow, then brown	Squash bug: (eastern Washington only) adult a long, gray black, sucking bug; eggs brown and in clusters along vein	Handpick brown egg clusters and/or adults, especially when plants are young. Insecticides—see EB0825.
Plants wilt and turn brown; brown streaks (if infection is severe) on inner root and stem—shows when split lengthwise	Verticillium wilt: a problem in some parts of central and eastern Washington	Avoid ground previously planted with potatoes or tomatoes. Rotate to new ground.
Leaves yellow and curl, eventually turning dry and brown; plants stunted; fruits few and of poor quality and shape	Curly top virus: eastern Washington only	Since curly top is transmitted by leafhoppers, grow cucumbers among corn. Leafhoppers do not like shade.
Leaves with tan or water-soaked irregular angular spots	Bacterial angular leaf spot	Resistant varieties. Don't touch wet plants.
Fruits with rot at blossom end	Botrytis or graymold	Remove infected fruit. More of a problem where conditions are moist and wet.
Fruits small and rotting at blossom end	Blossom end rot: caused black of pollination	Both male and female flowers and/or plants are required. Sometimes flowers do not develop because of temperature, or because no male plants were planted. Use color-coded seed.
Fruits of squash rot in storage	Storage rot	Store in a dry place at temperatures of 40°-60°F.
Lettuce		
Leaves become yellow, honeydew or presence of plant lice on undersides of leaves (with associated ants, ladybugs)	Aphids	Wash off green leaves before eating. Insecticides—see EB0825.
Leaves become yellow and stunted (no plant lice or honeydew)	Nitrogen deficiency	Sidedress with nitrogen fertilizer.
Melons: Cantaloupe, Honeydew, Muskmelon, Watermelon		
Leaves with small specks which turn yellow, then brown; vines wilt from point of attack to end of vine	Squash bug: injects toxins as it feeds	Handpick brown eggs along veins of new leaves, or the adults. Insecticides—see EB0825.
Plants wilt and turn brown, brown streaks (if infection is severe) inside lower stem and root—shows when split lengthwise.	Verticillium wilt: a problem in some parts of central and eastern Washington	Avoid ground previously planted with potatoes, tomatoes, or cucurbits.
Leaves become stippled and bronzed, webbing and "moving dust" on undersides of leaves	Mites	See general section.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Melons: Cantaloupe, Honeydew, Muskmelon, Watermelon (continued)		
Fruit does not develop	Climate: not enough summer heat for this fruit in western and other parts of Washington	Resignation and acceptance, or modify environment.
Onion Family: Chives, Garlic, Leeks, Onions, Shallots		
Plants send up flower stalks	Bolting: large sets tend to produce seed	Plant small sets for bulb production; use plants from large sets for green onions.
Onions do not set bulbs	Wrong variety: bunching varieties do not produce bulbs	Plant bulbing varieties.
Leaves with silver streaks which later turn yellow then brown; small black dots (excrement) on silver areas	Onion thrips	Insecticides—see EB0825.
Plants collapse; leaves and/or bulbs with white fuzzy growth specked with black bodies; bulbs with a soft watery rot	White rot	Destroy diseased plants. Prevent spread of black bodies in soil. DO NOT COMPOST. Do not replant onions in that area again.
Bulbs rot from stem end in storage; sometimes gray fuzzy growth as black bodies present	Storage rots—gray mold	Artificial drying to properly cure. Store in cool, dry area with good air circulation. Use disease-free sets. Prevent spread of black bodies in soil. DO NOT COMPOST.
Holes in onion bulbs with associated secondary rots (leaves turn yellow, wilt, and die back after mid-season; roots and bulb decay); presence of worms or maggots	Onion maggot	Insecticides—see EB0825. Floating row covers should work well to prevent female flies from laying eggs around plants.
Peas		
Seedlings and small plants cut off at soil line topple over.	Cutworms	See general section.
Small plants consumed (look for slime trail)	Slugs.	Baits.
Plants become stunted and turn yellow, wilt, and die; root system remains healthy	Pea wilt: for diagnosis, cut lower part of stem at or below ground line and see reddish orange color; soil-borne	Plant resistant varieties. Pull up and destroy infected plants as soon as noticed. Do not replant peas in same soil.
Plants stunted, vines appear off-color and may dry up, roots rotted or absent, tends to occur in patches along rows or in fields	Root rot complex: often associated with low or wet spots.	Avoid wet soil or low areas where water may collect. Rotate crops.
Leaves with white powdery growth, sometime accompanied by curling of leaves; especially a problem when humidity is high	Powdery mildew: worse on some varieties	Increase air circulation by spacing plants farther apart. Plant resistant varieties.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Peas (continued)		
New growth distorted, curled, and mottled; pods distorted; plants eventually may die	Virus disease, aphid-borne	Plant early to avoid aphids. Plant resistant varieties. Remove and destroy infested plants as soon as noticed. Aphid control is not practical.
Semi-circular notches on margins of leaves, young plants sometimes appear chewed off at ground level when infestations are severe	Pea leaf weevil adults	Insecticide—see EB0825 for chemical control. Once plants have grown past the 6-leaf stage, treatment normally not necessary as plants can grow away from threat of serious damage.
Peppers and Eggplants		
Leaves roll downward, generally on all plants with no yellowing of new leaves and no stunting	Physiological leaf roll, very common	No action needed.
Leaves curl, new leaves may be yellowish, occurs on scattered plants	Curly top or Western yellow blight—eastern Washington only	Pull out and destroy infested plants.
Yellow blotches, rings, and patterns on scattered plants	Mosaic virus	Dig out and destroy infested plants.
Plants wilt and turn brown, brown streaks inside root and lower stem—shows when split lengthwise	Verticillium wilt: a problem in parts of central and eastern Washington	Avoid ground previously planted with potatoes, tomatoes, or cucurbits.
Leaves wilt and eventually yellow and then turn brown; tiny white specks or moth-like flies fly up when disturbed	Whitefly: especially a problem on young plants in greenhouse	Trap whitefly with squares of yellow board with sticky (tanglefoot, tack trap, SAE 90 motor oil in a thin film) materials; disturb plant foliage frequently to scare up flies, which are then attracted to yellow trap and become stuck. Insecticide—see EB0825.
Small holes in leaves, more damage to lower leaves than to top ones	Flea beetle: tiny black beetles that jump	Insecticide—see EB0825.
Peppers with worm; small hole where worm entered	Corn earworm	Insecticide—none registered for home use.
Plants do not grow, blossoms drop off, peppers do not form, peppers do not develop	Climate too cool	Wait for hot weather.
Potatoes		
Leaves with many pin-sized holes, may become numerous enough to kill leaves or small veins; presence of small, shiny black beetles that jump like a flea	Potato flea beetle (tuber flea beetle)	Usually too numerous and small to handpick. Potatoes safe to eat—peel away damage. Insecticide—see EB0825.
Vines progressively decline and die earlier than normal, brown streaks inside lower stem—shows when split lengthwise	Verticillium wilt: eastern Washington only	Avoid ground planted with tomatoes, peppers, eggplant, or cucurbits. Rotate to new ground.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Potatoes (continued)		
Leaves rolled upward uniformly, plants may be stunted and markedly yellow, tubers with brown netted appearance when cut (may develop in storage)	Leafroll virus, net necrosis: transmitted by green peach aphid	Plant only certified seed pieces. Never use your own potatoes for seed pieces. Spray peach trees for overwintering green peach aphid (the vector).
Leaves mottled, yellowed, rolled, or wrinkled; plants may be dwarfed; symptoms variable	Other viruses: often transmitted by sucking insects	Remove and destroy infected plants when noticed. Plant only certified seed pieces. Controlling insect vectors when practical.
Leaves with large dark green to purplish watersoaked areas; during moist weather (in late season) moldy growth develops on undersides of leaves; vines die as disease spreads rapidly; tubers in storage develop shiny metallic, purplish sunken areas; area beneath skin is discolored about 1/4"; soft rots may follow	Late blight: mostly in western Washington where moist, wet weather favors development	Cut vines 1 inch below soil surface and remove 10–14 days before harvest—considered good cultural practice to prevent tuber infection. Use resistant varieties such as Kennebec or Nooksak. Fungicide will aid if applied prior to summer rain or when symptoms first noticed.
Vines suddenly wilt, especially on hot day; stems with brown lesions or sunken areas which girdle stem (cause of wilt); tubers with black scurf (irregular raised, black, hard areas visible only after scrubbing tuber); no discoloration of tuber beneath scurfy areas	Rhizoctonia: a soil-borne disease	No control. Check seed pieces for signs of scurf (wash skin first). Discard infected pieces. Rotate potatoes to new areas (generally a good cultural practice), do not replant to potatoes for 4–6 years. Peel away damage on tubers.
Tubers with 1/8–1/4" holes and tunnels; stiff, waxy yellow (wireworms) in soil	Wireworms	Harvest early potatoes as soon as possible. Damage will be less if late potatoes are planted in late June. Insecticides—none registered for home use.
Tubers with large gouges or holes	Slugs: millipedes or sowbugs (usually feeding on rot areas)	Slug baits.
Tubers with corky scabs on skin surface	Common scab	Russet varieties more resistant than smooth-skin varieties (Nooksak is resistant). More a problem on alkaline soils or soils with high organic matter. Do not use wood ashes. Peel off scabby skins or cover with foil and bake.
Tubers become rotten and soft in storage	Soft rot: soil-borne bacteria	Avoid wounding tubers during harvest and storing.
Radishes		
Brown mushy tunnels in roots; small white maggots may be present	Cabbage root maggot	Insecticides—see EB0825. Screen cages or floating row covers as described under cabbage.
Slow growth, small roots, strong flavor	Insufficient water	Water regularly to keep soil moist.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Radishes (continued)		
Slow growth, pale pink roots, yellowish leaves	Nutrient deficiency	Increase fertilizer application (see text).
Roots splitting or hollow center (pithy)	Overmature	Plant small seedlings weekly and harvest as soon as roots are large enough.
Bolting: no enlarged roots, seed stalks formed	Long days and short nights	Grow radishes in spring or fall—summer plantings frequently bolt to seed.
Spinach		
Plants begin to grow tall and send up flower stalks	Bolting: caused by alternating cold and warm weather	Grow spinach as fall crop in areas with fluctuating spring temperatures.
Leaves partly or entirely consumed, presence of light-green caterpillars	Loopers: cabbage and/or alfalfa	Handpick and destroy. Insecticides—see EB0825.
Leaves become generally yellow (faded)	Aphids	Hosing may not be practical on low foliage. Wash leaves before eating. Insecticides—see EB0825.
Leaves with light green to yellow tan blotches; pull back skin of blotch to find maggots or their frass in the mine	Leafminer: spinach or beet	Pick off and destroy infested leaves. Floating row covers work well.
Tomatoes		
Leaves roll downward; generally occurs on all plants with no yellowing of leaves and no stunting	Physiological leaf roll, very common	None necessary.
Leaves roll upward, new leaves may be yellowish; plants become stunted	Curly top, Western yellow blight: transmitted by leafrollers—eastern Washington only	Direct seed, sow 25% more seed than needed. Pull up and destroy infected plants. Use resistant varieties such as Saladmaster, Colombia, Row Pak, Rosa.
Leaves either yellow and green or become yellowish	Mosaic viruses: possibly seedborne	Wash hands with soap and water before handling plants. Do not smoke while handling plants since 80% of all cigarettes contain tobacco mosaic virus.
Lower leaves progressively turn yellow, wilt, and die; brown streaks in tissue of lower stem—shows when split lengthwise	Verticillium wilt: a problem in some parts of central and eastern Washington	Avoid ground previously planted with tomatoes, peppers, eggplant, potatoes, or cucurbits.
Leaves become distorted, cupped or curled, and ragged at the edges; veins may be enlarged and may coalesce so leaf looks like a duck's webbed foot	Hormone type herbicides, such as 2,4-D, 2,4,5-T, Dicamba, may drift in from adjacent areas, especially in hot weather	Plants may outgrow if given good cultural care. Use extreme care when using herbicides.
Leaves either partly or entirely eaten or chewed	Tomato hornworm: large 2" green caterpillar with horn at tailend; adult sphinx moth does not directly cause damage	Remove worms by hand or snip with scissors. Insecticides—see EB0825.

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Tomatoes (continued)		
Leaves with numerous holes chewed in them	Colorado potato beetle: plump beetle with yellow and black stripes; fat humpbacked, reddish grubs on undersides of foliage	Remove by hand. Insecticides—if too numerous to control by hand—see EB0825.
Many tiny round holes in leaves, leaves may be so riddled they turn brown and wilt	Flea beetles: tiny shiny black flealike beetles feed on leaves, tiny white worms (larvae) feed on roots causing further damage	When numerous, difficult to control without insecticides. A few holes are not damaging. Insecticides—see EB0825.
Numerous insects sucking sap may cause deformed growth or wilt, plants become weakened	Aphids: masses of tiny green, pink, or black plant lice; found on undersides of leaves or clustered on new growth Whitefly: small pinhead-sized, round, yellow-green larvae on underside of leaves, and small white flies that fly up when foliage is disturbed	Soapy water, if tomatoes have not formed. Control only when damage occurs. A few aphids or whiteflies won't hurt. Insecticides—see EB0825.
Leaves become bronzed and stippled, webbing and "moving dust" on undersides of leaves or in leaf axils	Mites	Miticides—none registered for this use.
Leaves, petioles, and stem with brown or black blotches; fruits with brown wrinkled or corrugated, firm rot; may later become mushy	Late blight fungus: develops in mild, moist weather	Hot, dry weather will slow or stop advance of disease. Fungicides.
Oldest leaves have small dark areas of dead tissue surrounded by yellow; fruit with slightly sunken, circular, water-soaked areas which become 1/2" diameter, more sunken; and have concentric rings of black spots	Anthracnose: a fungus disease coming from soil and spread from plant to plant by gardener when plants are wet	Avoid planting in poorly drained soils. Rotate to new soil each year. Remove and destroy infected plants or plant parts in fall. Fungicides.
Fruit with large holes or completely hollowed out	Slugs	Stake tomatoes or place boards under tomatoes to get off ground. Harvest frequently. Bait for slugs.
Fruit becomes hollow and looks like green peppers (Bell) in cross-section	Poor pollination: may be caused by low light (dark cloudy day), too much nitrogen, heavy rainfall or temperatures that are too high (above 90°F) or too low (below 58°F) or by too much hormone spray (fruit set)	Set tomatoes out later or modify environment with hotcaps, tires, etc., in cool weather, or with shading in hot weather. Use less fruit-set spray (read label again and follow directions).

VEGETABLE PROBLEMS AND WHAT TO DO ABOUT THEM (Continued)

Symptoms	Cause	Corrective action
Tomatoes (continued)		
Fruit with large cracking in concentric circles around stem or in lines radiating from center	Fruit cracking (growth cracks): during high temperatures (90°F) and high rainfall, especially after dry spell (sudden, rapid growth), ripening fruit and fruit exposed to sun most affected	Keep soil evenly moist with proper watering techniques and mulches. Do not remove leaves from plants.
Fruit with black mold along growth cracks (see fruit cracking above)	Fruit rot: develops on damaged, cracked tissue	Prevent fruit cracking (see above). Handle fruit carefully.
Fruits misshapen and mildly to severely deformed with large scars and cavities; common on earlier fruit and larger varieties	Catfacing: caused by incomplete pollination	Encourage bee activity in garden—protect bee population (see bee warning)
Fruit with watersoaked area on blossom end which darkens, becomes larger and flattened	Blossom end rot: caused by lack of water during hot weather, lack of calcium in soil	Keep soil evenly moist and keep fruit off the ground. Soil test will show if soil lacks calcium; correct condition as per directions on returned soil test.
Fruits on ground begin to rot at blossom end and become blackish brown and sunken	Fungus rot	Stake tomatoes or mulch beneath them to get them off ground.
White or yellow spot on green fruit	Sunscald: damage most common on green fruit on area facing sun; varieties with little foliage to protect fruit more susceptible	Some varieties more tender and sunscald more easily. Do not remove leaves from plants.
Turnips and Rutabagas		
Tiny pin-sized holes in leaves; may be numerous and kill leaves	Flea beetles	Usually too numerous and small for handpicking. Insecticides—see EB0825.
Brown, mushy tunnels in roots	Cabbage root maggot	Insecticides—see EB0825. Screen cages or floating row covers as described under cabbage.
Roots tough and fibrous	Overmature	Harvest as soon as roots are 2" or more in diameter.



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Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

College of Agricultural, Human, and Natural Resource Sciences

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EB0422