

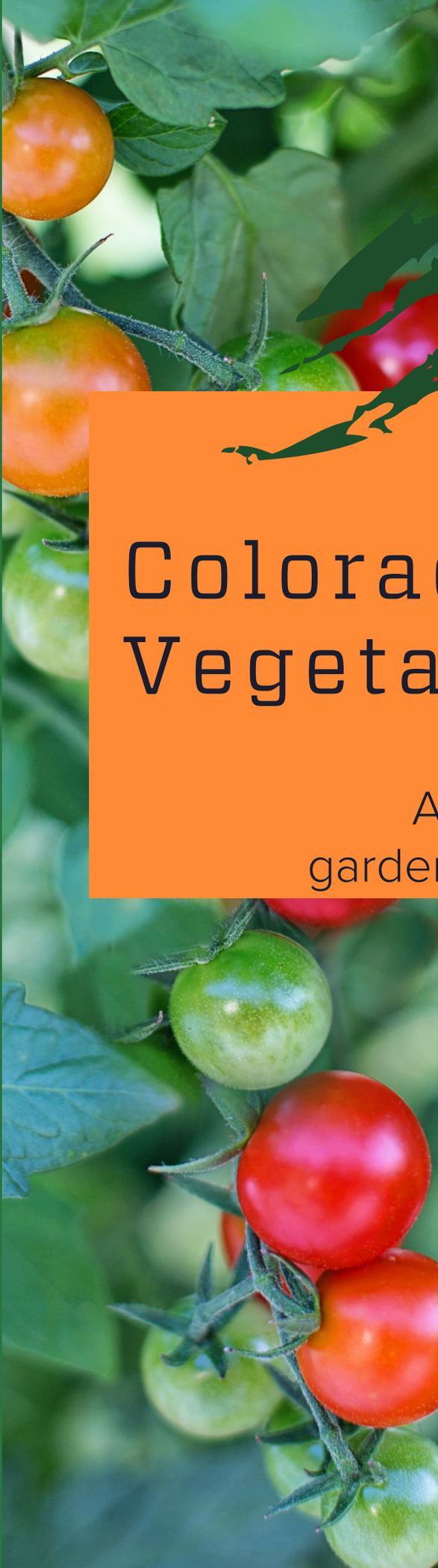


# Colorado Vegetable Guide

A guide for the backyard vegetable garden, covering all regions of Colorado



**COLORADO STATE UNIVERSITY**  
**EXTENSION**



# Introduction

## Preface

This booklet is intended to provide research-based information about vegetable gardening in Colorado. It was adapted from an excellent guide produced in El Paso County by Colorado Master Gardener Volunteers.

If you need lawn or gardening information or problem-solving assistance, please stop by, call, or send email to your local county extension office. To find your local office go to the following link: <https://extension.colostate.edu/staff-directory>

## How to Use This Booklet

This booklet will guide you in selecting types and varieties of vegetables that will grow well in Colorado. As Colorado has a wide variety of different environments, much of the booklet will discuss generalities with highlighted differences for mountain or plains growing practices. It will also assist you in diagnosing insect, disease and environmental problems. Many vegetables can be grown successfully in the Pikes Peak region, but anyone new to vegetable gardening (or new to gardening in this area) would be wise to spend some time learning about and understanding our soil and what is meant by proper soil preparation. Other important topics to explore are irrigation and mulching, as well as the planting dates for the various cool and warm weather crops and which vegetable varieties have short maturity dates and do well in Colorado. Ideally, this should all be done before one seed is planted.

When you begin to plan your garden, first go over the basic gardening information at the beginning of the booklet. Once you have chosen which vegetables to grow, read about the culture of each vegetable, which is covered separately in the Vegetable section of this booklet.

If problems develop after your garden is growing, turn to the back of the book where you will find sections for insects, diseases and environmental problems as well as regional and organic growing options. These sections will help with diagnosis, control and/ or prevention of insect and disease damage. We hope you find this booklet useful in starting your garden as well as throughout the growing season.

## Acknowledgements

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# General Information



## Climate

The climate in Colorado, much more so than in other places, makes for challenging gardening. The climate itself is influenced primarily by the range of elevation of between 4,000-12,000 (or more) feet. Our clear atmosphere, normally low humidity, intense sunlight and extreme variations in precipitation and temperature are unique. They provide a challenge and an opportunity to do some interesting and productive vegetable gardening.

The average annual precipitation in Colorado is about 15 inches, which classifies the area as semi-arid. This makes supplemental irrigation a necessity. Eighty percent of the precipitation falls between April 1 and September 30, mostly in heavy downpours. Precipitation can vary greatly from location to location, month to month, and year to year.

The semi-arid conditions of our area have limited the growth of plants for many thousands of years. Consequently, our soils lack adequate organic material for good soil structure. Soil improvement, using organic material, is a necessity for good results.

One of the most important factors to consider in vegetable gardening is the length of the growing season. The average last killing frost in the spring is can range from May 15 to as late as July, and the average first killing frost in the fall is can be as early as August into October. Growing seasons can therefore range from 30-150 days. Remember, these are just an average. The beginning and ending of the growing season are quite variable from year to year. Planting the right crops at the right times and providing frost protection when needed will help ensure success.

Cool season crops are frost hardy and thrive in cool weather. Some may be planted as early as the first of April. With our intense sunlight, daytime temperatures may become relatively high, even in the winter, and then drop drastically when the sun is obscured by clouds or mountains. These conditions are great for growing cool season vegetables.

Warm season plants are frost tender and should not be planted until all danger of frost is past (see Appendix I). To adjust dates for a specific elevation, count forward or backward from the frost dates, one day for each 100-foot change in elevation above or below 6,300 feet.)

Winters that are warmer and drier than normal influence insect populations. Over-wintering insects may not be reduced in number by hard freezes and may survive to plague the gardener.

Another important weather phenomenon is wind. High winds are common throughout Colorado, particularly in the spring and fall. Wind often accompanies the thunderstorms that begin in April, peak in July and end in September. High winds necessitate some sort of protection for many plants, especially those that are weak- stemmed or newly transplanted.

Finally, hail is a common occurrence throughout Colorado and many gardeners find ingenious methods to protect their vegetable gardens. A sheet or tablecloth or anything light weight will do in a pinch. For long-term protection, you can install hoop tunnels covered with plastic or bird netting.

## Garden Site Selection

Of prime importance in selecting a garden site is the availability of light. Most vegetables require at least six hours of sunlight each day. If there is a choice, morning sunlight is preferable to that of late afternoon because mornings generally have cooler air temperatures. An area to the southeast of a building is ideal because the structure will provide some protection from wind and will radiate heat back to the garden at night.

Look around your yard and identify the different climate zones (also known as microclimates). Some areas may seem to never warm up while others, on the south and southwest, harbor warm soil in April. Areas on the south and southwest that are next to fences or buildings retain the day's heat through much of the night and are sheltered from spring's harsh winds. These are the spots where cool weather plants will do the best in early spring.

A level site is desirable, but hillsides may be terraced to provide garden plots. If space is scarce, vegetables may be very effectively mixed with flowers and shrubs or grown in containers on decks and patios.

Mountain gardens benefit when sited on a south facing slope if possible.

## Garden Layout - Rows and Beds

When laying out a new garden, a decision must be made: will there be the traditional one-plant-wide rows, or will you plant in wider beds? Both rows and beds have their advantages and disadvantages.

If mechanical cultivation will be used, rows are preferred. The space left between traditional rows allow a rototiller room to cultivate. Furrow irrigation also requires a row layout. A major drawback to gardening in rows is the need for more space, and, therefore, more water, fertilizer, amendments, mulch, and weeding. Also soil compaction (from walking next to your plants) can seriously stunt plant growth. Vegetable plants that grow to large sizes, such as asparagus, tomatoes, potatoes, corn, and squash, do well in rows.

Beds and wide rows allow the gardener to produce more vegetables in less space. Because water, fertilizer, and amendments are only applied to the growing area, less is needed. Beds should be no more than four feet wide, as the gardener must be able to reach the middle from the edges. This prevents soil compaction, since there is no need to ever step into the bed. Length is determined by the space available and the gardener's preference.

Beds may be raised, with or without a surrounding frame, or lowered to allow for flood irrigation. Inside the bed, plants are spaced to just touch at maturity. For example, instead of spacing beets three inches apart in rows two feet apart, they are spaced three inches apart in every direction. That means you can grow 16 beets in one square foot of garden space. Gardening in beds is particularly recommended for small crops such as beets, carrots, celery, chard, kohlrabi, lettuce, onions, parsnips, radishes, spinach, and turnips.

## Irrigation

Because Colorado is semi-arid, water is a precious resource which will be in greater demand as the population increases. It is important to use existing water resources as wisely as possible. There are many ways to provide supplemental water to the garden. A standard row-furrow system of irrigation may be used, but other methods are more effective. Furrow irrigation is accomplished by creating small parallel water channels along the length of the row.

A relatively new method is a drip irrigation system which delivers water to each individual plant through a network of tubes. This eliminates wasting water on areas where it is not needed, limits evaporation, and cuts down on weed growth. These systems are now widely available and easy to build and maintain.



Another option is the flood or “bathtub” irrigation method, where crops are planted in blocks with a dike around each block. The bathtub is flooded periodically as needed. Both the drip and the flood methods greatly reduce evaporation and disease.

With loamy soil, deep, infrequent watering is superior to superficial daily watering. Sandy soils, which lose water more quickly than clay soils, need more frequent, less deep, watering.

Newly planted seedbeds require frequent sprinkling to insure the germination of seeds. A very light layer of mulch will keep seedbeds moist between watering. The frequency of irrigation will depend on your soil conditions, natural precipitation, wind, and temperature.

Plants that are wilting in the morning hours are showing that they need more water. Plants with large leaves (such as cucumbers, chard and squash) may wilt in the late afternoon on very hot days even when soil is relatively moist; this is usually because water loss from the leaves exceeds water replenishment through the roots. This does not necessarily mean that more water is required.

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Soil moisture may be checked by digging a test hole (12 inches for deep-rooted plants and 6 inches for shallow-rooted plants). It is also possible and often recommended to check soil moisture with a finger or screwdriver.

## Soil

Soil should readily allow air and water to infiltrate. Loamy soils, comprised of a variety of particle sizes and containing 5% organic matter, are optimal for a good garden. However, most areas in the region are not blessed with this type of soil. Soil in Colorado ranges from sandy or clay to decomposed granite. Soil type will substantially impact how you manage your garden area.

A soil test will identify soil type (texture) and basic nutrient availability, and it can be done at a reasonable cost. Test kits are available from CSU Extension. You can download a form to send in here: <http://www.soiltestinglab.colostate.edu/> or contact your local county office. The kits provide easy-to-follow instructions that explain how to gather the sample. After you mail your sample to Ft. Collins, the soil lab will analyze your soil and provide specific recommendations tailored to your garden.

Nearly all soil can be improved by adding organic matter, such as sphagnum peat moss, coco coir, dry grass clippings or plant-based compost (all gardeners can benefit from the creation of a home compost pile). Manure or manure-based compost can be beneficial when applied with care. It is best to incorporate organic amendments into the top ten inches of soil during the fall to allow earliest possible planting in the spring. However, spring application is perfectly good depending on the needs of garden and gardener.

Organic matter is essential for retaining nutrients, allowing adequate aeration and creating proper drainage conditions. NOTE: Many manure-based products, especially commercial steer manures, have a very high salt content and should be avoided or used sparingly. In general, animal manures should be aged for at least six months.

Care should be taken to avoid adding too much organic matter all at once. No more than three cubic yards of partially decomposed organic material per 1,000 square feet (approximately a one-inch layer spread over the entire surface) should be added in one year. This amount will improve soil tilth slowly over a period of years. Also note that too much organic matter can be as problematic as too little. Nutrients may become unbalanced, stunting plant growth. Generally, an organic matter percentage of 4-5% is ideal. Avoid adding sand to soils containing clay; the results may resemble concrete.

Once the garden has been tilled, it is important to avoid stepping on the soil in which the plants will be growing. Tilled soil is particularly susceptible to compaction. Plants cannot grow in heavily compacted soil because roots require air to grow. Wide rows, raised beds, and boxed planting areas all help keep feet away from plant roots.

Special mention should be made of a condition found in some areas known as hardpan. This is a subsurface layer of extremely compacted soil which is almost impervious to water and root penetration. If such a layer is within four or five inches of the surface, it can seriously impede root growth, especially in root crops such as carrots. Also, it may cause drowning or rotting of roots because water will not drain. Hardpan layers should be broken up and amended with organic matter to allow adequate root growth and water movement in the garden soil.

## Soil Temperature

Along with frost-date, soil temperature determines the success of growing vegetables early in the season. Soil temperature needs to be warm enough to germinate seeds and for transplants to grow. Cool season crops (lettuce, peas, radishes) will germinate when the soil reaches 40°- 50°F.) However, all crops will take longer to germinate at colder soil temperatures. Warm season vegetables (peppers, tomatoes, squash) need the soil temperature to be at least 70°F. to thrive.

Clear, black, and “IR” (short for infrared) plastic may be used to help warm the soil prior to planting. Clear plastic raises temperatures the most but permits weed growth underneath. Black plastic blocks light, and therefore weeds. “IR” plastic combines the weed- blocking benefits of black plastic with the soil heating capability of clear plastic. It is available in well-stocked garden centers and from gardening catalogs.

## Nutrients

Along with good irrigation and soil structure, adequate nutrients are essential in any garden plot. Most vegetables are rapidly growing annuals; for them to produce an optimal crop of tender, delicious produce, they must have nutrients available.

The three primary nutrients in chemical fertilizers are nitrogen (N), phosphorus (P), and potassium (K). In a bag of fertilizer, the percentage, by weight, of each of these nutrients is indicated by numbers, i.e., “5-15-10” means 5% of the weight is nitrogen (N), 15% of the weight is phosphorus (P) and 10% is potassium (K).

Nitrogen is very soluble and consequently washes out of the soil quite rapidly. Leafy crops, (such as lettuce) require more nitrogen than root crops. Nitrogen stimulates leaf production and should not be used in high concentrations where root or fruit production is important.

In general, root crops and crops that produce fruit (such as tomatoes and peppers) perform better with adequate phosphorus. Most soils contain plenty of phosphorus. It remains in the soil year after year. Adding more where it is not needed can eventually cause problems.

Potassium, required for disease resistance, is also usually found in sufficient quantities in local soils. Phosphorus and potassium do not readily leach from the soil, so over-fertilization of these elements should be avoided.

Depending on the results of your soil test, nitrogen may be the only fertilizer you need to add. Fertilizers containing only nitrogen are available. The most concentrated source of additional nitrogen is found in commercial fertilizers. Organic fertilizers containing nitrogen include blood meal, cottonseed meal, and poultry manure. Care should be taken in using direct applications of large amounts of high nitrogen fertilizers, as they may injure plant roots. Always follow the manufacturers’ directions. As a rule, more is not better.

Rather than guessing how much organic matter is needed, or which fertilizers to apply, a soil test is highly recommended. This is particularly true if: A) you are starting a new garden; B) if your soil has never been tested; or C) if an existing garden is becoming less productive.

## Side-Dressing

Some vegetables will benefit from a side-dressing of fertilizer at a certain point in their growth period. Follow the directions on the fertilizer bag, spread the measured amount on the soil around the plant over the root zone or along the row on both sides. Work into the soil approximately three inches deep and water in. To avoid burning tender plant tissues, keep fertilizer from directly contacting the stem and leaves.

## Mulching

Mulching conserves moisture, helps prevent weeds, encourages earthworms, and mitigates soil temperature fluctuations. Mulch the garden with organic material, such as shredded leaves or straw, thin layers of dry grass clippings or shredded plant materials that are seed free. Polyethylene plastic or biodegradable sheets also may be used over a drip or furrow irrigation system.

Mulch should not be applied until after soil temperatures rise and are stable at growing temperatures. Plastic mulches can be laid early, as they help warm the soil. Weeds should be controlled manually until mulch can be applied.



A few perennial vegetables, such as asparagus, horseradish, and rhubarb, may need some protection during winter months. Desiccation by wind and sun may be prevented by mulching and deep watering once every month or so during the winter when snow cover is sparse or nonexistent and temperatures are above freezing. Mulching also will keep ground temperatures uniform and prevent damage to plant roots caused by alternate freezing and thawing.

## Choosing Vegetable Varieties

Which types of vegetables should be selected from your catalog or garden center? In much of Colorado, those with the shortest maturity date often provide the best yield.

While you are considering which varieties to buy, remember that the term “days to maturity” (or “days to harvest”) can mean several different things. Some seed companies start counting when the seed is sown outside in the ground. Others count from the day the seed germinates. For crops that are typically started indoors, days to maturity are counted from the date the seedling is planted in the garden.

Be aware that each seed company uses data from their own trial gardens. While a helpful guide, “days to maturity” should not be considered a precise measurement.

Our shorter growing season makes it desirable to use transplants for broccoli, Brussels sprouts, cabbage, cauliflower, tomatoes, onions, peppers, squash and eggplant to achieve the earliest possible harvest. If seeds of these plants are placed directly in the garden in April or May, they

probably will not germinate because of the temperature (except for onions). If seeded later in the summer, after the ground has warmed up, immature fruit will probably be destroyed by early frosts. Exceptions to this are late cauliflower and Chinese cabbage; seeds sown in July will be ready for harvest in the fall if short-maturation varieties are selected.

For mountain communities with cool, short seasons, look for varieties that will mature quicker, compared to other varieties, within the average number of frost-free days for your area. It is good to allow a buffer of extra days to maturity because crops may mature more slowly due to cooler temperatures overall. Look for varieties that can withstand cooler soil and night temperatures. Cool season crops are good choices for short season areas even if they have a days to maturity that is slightly longer than the frost free growing season because they can withstand some frosts and even improve in quality. Warm Season crops with long days to maturity can only be grown to harvest grown under season extension cover.

## Seed Starting

There are several reasons why starting seeds indoors for your garden can be beneficial – cost effectiveness, more choice in varieties, seed saving and control of seedling growth. This is also a good way to work around the short growing season, especially for those gardening in Colorado's mountain communities.

For the most consistent results, use new seeds. If using older seeds, check a few seeds for germination on some damp paper towels before planting the main crop. Virtually all seed packets today give guidance on indoor germination of seeds. Follow directions on the seed packet.

For best results, use sterile planting mixes, either commercially prepared or mixed at home. There are a variety of supplies available such as humidity tents, heat mats and indoor lighting to help create the best environment for seed germination. Be sure containers also are sterile; soaking them in a bleach solution of one-part bleach to nine parts water will do the job. For mountain communities, the timing of seed starting and planting out need to be adjusted.



## Light for Seedlings

Adequate light is critical. Seedlings can go on the windowsill but be careful of direct sunlight or if the weather is very cold. Seedlings grown in a windowsill will also start to lean toward the light, so turning the plants often is recommended. Another option is to artificial lighting such as LED (light emitting diode), HID (high intensity discharge) or fluorescent bulbs to provide the adequate amount of lighting that seedlings need to grow. Keep the lights as close to the plants as possible, raising them as the seedlings grow. If the lighting light level is too low, seedlings can become leggy and flop over. use a pair of ordinary fluorescent tubes such as in a shop light.

## Hardening Off Seedlings

In general, transplants should be six to eight weeks old with at least four true leaves before planting outside. Once seedlings are strong enough to be planted outdoors, begin the hardening off process.

Hardening off may be accomplished in outdoor cold frames where plants can remain overnight or by placing plants outdoors during the day, a little longer each day, and returning them inside at night. Choose a protected location initially, in the shade and out of the wind. Gradually increase exposure to outdoor conditions until the plants are fully acclimated. One to two weeks of this treatment prior to planting in the garden is usually enough. Do not get overly eager. For warm season crops, wait until after the last average frost date when the soil has warmed to plant the transplants into the garden. Cold soil does not promote quick establishment. It's also a good idea to prepare the planting area before bringing the transplants outside, especially if transplanting will take place on a hot sunny day. Once transplants are put in the ground, they need to be watered well in order to remove air pockets and create good contact between the roots and the soil.



## Season Extension

Season Extension is any technique that will add to the time and/or conditions a specific crop needs to produce its best quality and yield. Season Extension techniques are sometimes necessary to grow certain vegetables to maturity in Colorado, especially in mountain communities with cool, short seasons.

Season Extension can be achieved by both cultural methods and by 'covers'. Some cultural methods to consider are siting your garden on a south-facing slope, providing wind breaks, using raised beds and other soil warming techniques like incorporating organic matter into the soil and applying mulch. You can also plant transplants instead of direct seeding and succession plant. Season Extension covers can allow earlier planting in the spring and later harvest in the fall by maintaining warmer temperatures under the covers. Both the air and the soil temperatures under Season Extension covers can be up to 10 degrees warmer than the temperatures outside the covers. Examples of covers are hot caps, walls of water, and many types of row cover fabrics and plastics, both pliable and rigid. Covers can be placed directly over crops or held above the plants attached to some type of structure. Greenhouse are the ultimate in season extension and can be simple or complex.

## Crop Health

Plants that are not under stress make healthier crops, leading to more defense against insects and diseases. Planting a variety of crops and practicing crop rotation will also help to keep pressure from pests down.

Many plant diseases can survive indefinitely in the soil from year to year. Such diseases are favored by continuous planting of the same crop in the same location every year because many of these diseases are host specific to certain types of crops. Because of this relationship between diseases and host plants, crop rotation can be critical for managing



soil borne diseases in the garden. It is a good rule of thumb to avoid planting the same or related crops in the same area more than once every three to four years, particularly if diseases have been a problem. Table 1 provides a list of commonly grown vegetables and their botanical families; this may be helpful in designing an appropriate rotation scheme.

Also, follow other disease management recommendations such as selecting disease resistant varieties and healthy-appearing plants at the nursery. Keep your equipment clean and immediately remove any old crop residue and diseased plants from the garden. Composting diseased plants will likely not kill the disease and may introduce it into other areas of the garden as the compost is spread. Therefore, you should only compost healthy plants.

Avoid soil compaction and soggy soil, especially around the stem of the plant, by improving the soil structure prior to planting. For more in-depth disease management information, see the Disease section of this booklet.



## Saving Seed

The knowledge and skill to save seeds from our vegetables and replant them has many benefits. Perhaps the most important is that saving seeds with special care and selection will over time result in a more locally adapted strain of that variety. Seed Saving can also save money, ensure you have a source of your favorite varieties, contribute to food security as well as be a fun challenge that gives you seeds to share!

The basic steps to save seed successfully are: Start with an open pollinated variety so you can get plants true to that variety. Knowledge about your plant species will give you the information you need to protect your variety from cross pollination with related plants. This can be done by planting a single variety, by covering and/or hand pollinating or by separating similar varieties by enough distance to prevent cross pollination. Plant a large enough population size to get adequate pollination among your plants to maintain genetic vigor of your seed. Save seeds from the healthiest plants that have the traits that you want and get rid of the plants that don't. Harvest at the correct time to get good seed. This may mean you don't get to eat all of the fruit of your labor—some plants might need to be saved for seed. Process your seed for the type of plant it is. Store your seed properly to ensure it remains viable. Generally, keep seeds dry, cool and dark. Replant and repeat! Over time, you will get a more locally adapted variety with the characteristics you want and that will perform well in your area.

# Table 1 - Plant Families

This chart can be helpful in determining plant families when planning your garden and considering crop rotation, variety preferences, companion planting etc. It is advisable to rotate your crops from season to season and to avoid plants that are within the same family.

Table 1. Vegetables and Herbs - Common Plant Families

<b>Common Name</b>	<b>Edible Members</b>
Allium family	Onion, garlic, shallot, chive, leek, asparagus
Beetroot family	Beet, Swiss chard, spinach
Umbel family	Carrot, parsnip, cilantro, celery, chervil, caraway, fennel, parsley, dill, cumin
Composite family	Lettuce, endive, escarole, radicchio, Jerusalem artichoke, salsify
Brassica family	Cabbage, broccoli, cauliflower, Brussels sprouts, arugula, kohlrabi, turnips, radish, kale, rutabaga, bok choy, collards, mustard greens
Cucurbit family	Cucumber, melons, pumpkin, squash, cantaloupe
Grass family	Corn, millet
Legume family	Peas, green beans, lima beans
Nightshade family	Eggplant, pepper, potato, tomato, chilis, tomatillo
Mint family	Mints, basil, rosemary, thyme, oregano, lavender, marjoram

# Crops:

## Asparagus

### Site Characteristics

Asparagus is a perennial crop that takes several years to get up to full production.

- Sun exposure – Needs 6-8 hours of full sun daily
- Soil condition – Soil should be well well-drained, and no activity can disturb the roots. Soil should be kept slightly moist.
- Irrigation needs – needs reliable moisture through the season, especially in May and June during harvest time. Ample irrigation necessary to help establishment.
- Mulching – mulch will keep roots moist and asparagus productive
- Fertilizer - During the second and subsequent years, apply any needed fertilizer twice a year: once in the spring before growth starts and again as soon as harvest is completed.

### Plant Traits

- Size/spacing – Mature plants grow to about 2-3' tall and 1-2' wide.
- Bloom time – n/a
- Flower color – n/a
- Root depth – up to 24" deep

### Growing Information

- How to plant - Prepare the soil in the fall so that planting can be done as early as possible the following spring. Asparagus does best in a well-drained soil which is high in organic matter. If needed, add up to two inches of organic matter to the bed and till in. Work the bed to a depth of about 24 inches to be sure no hardpan exists to restrict drainage. Leave the bed 4 to 10 inches lower than the final grade desired and about 12 inches wide. Stockpile the remaining soil mix for use in the asparagus bed in the spring after roots are planted. Before planting roots in the spring, check your soil fertility. If you add fertilizer, work it into the top eight to ten inches of soil. Adequate potassium is essential to sprout production. Improper soil fertility or improper watering will result in slow fern growth. Asparagus may be started from seed or planted as roots. Roots will usually provide a harvest the third year after planting as opposed to four years for plants started from seeds. It makes no difference if you



choose to buy one-, two- or three-year old roots. Roots should be planted in the trench at least one foot apart in April. Spread the roots flat and cover with two inches of soil mix. As new shoots appear, keep them covered to half their height as they grow. Do not harvest shoots the first year but let them grow to a full fern top so that roots become well established.

- Maintenance - Spring frost damage may cause new spears to die back or shrivel. Cut the tops back after frost has browned them, removing debris and possible over-wintering aphid eggs. In late fall, cover with mulch after the ground is frozen to keep it frozen throughout winter. There is usually a modest harvest the second year.
- Harvest – Wait for first harvest until 2-3 years after initial planting. Never harvest more than 1/3 of shoots in a season. Harvest when shoots are over 3/8 inches in diameter, usually between May 20 and June 20, just before the heads begin to open. Waiting too long results in tough, stringy shoots. When harvesting, snap shoots off as close to ground level as possible to avoid damaging new growth. Cutting shoots off below ground level causes new shoots to curl or grow crooked.
- Pests – Asparagus beetle, asparagus aphids, grubs, symphylans, wireworms, cutworms, asparagus miner
- Diseases - fusarium can be introduced by miners, rusts

**Mountain communities:** Asparagus can be grown at elevations up to 10,000 feet. Prefers cooler summers.

# Beans

## Site Characteristics

Beans are a warm season crop that grow well in most places.

- Sun exposure – full sun
- Soil condition – best direct seeded into soils that are at least 50-60 degrees F. Tolerant of a variety of soils.
- Irrigation needs – responds best with row or drip irrigation to reduce disease. Water approximately 1" a week especially during bean development.
- Mulching - use organic mulch such as grass or straw.



## Plant Traits

- Size/spacing – Bush snap beans, either green, yellow or Romano (the flat, green bean), produce earlier than pole beans. Bush snap beans set the majority of the crop at once, making them a good choice if you intend to preserve your harvest. They also take less space in the garden. Pole beans provide consistent harvest through the season. Other types of beans, such as lima beans, are marginal in many locations in Colorado. If you wish to try other types, consult a seed catalog for information.
- Bloom time – early summer, typically will fruit by midsummer
- Flower color – varies from white to purple between species and varieties
- Root depth – relatively shallow

## Growing Information

- How to plant - Do not cultivate after rain or early in the morning when the plants are wet. This encourages the spread of diseases. For the same reason, row or drip irrigation instead of overhead watering is desirable. Keep the leaves dry and the soil moist to a depth of six inches. Plant when soils are above 60 degrees F, direct sow into the garden.
- Maintenance – check frequently for pests or disease. Successive plantings at 15-day intervals will produce beans throughout the growing season. Pole beans, on the other hand, continue to produce beans until the plants are killed by frost.
- Harvest - Harvest when a bean snaps cleanly in your fingers. Typically, a bean will round out, but the seed will not be easily distinguishable.

- Pests - If Mexican bean beetles have been a problem in the past, bush beans are less susceptible than pole beans.
- Diseases: few common in backyard gardens.

**Mountain communities:** Seek out short season varieties and bush varieties. Most bean plants will benefit from season extension covers.

# Beets

## Site Characteristics

- Cool season crop, best planted from seed.
- Sun exposure – need full sun but can tolerate partial shade.
- Soil condition - Beets prefer a soil particularly high in organic matter. Mix well-rotted compost to a depth of nine inches. If your soil needs fertilizer, add it in the spring just before planting. Go easy on the nitrogen unless you are aiming for greens rather than roots.
- Irrigation needs – consistent watering is key for good production and flavor.
- Mulching – mulch with grass or straw.

## Plant Traits

- Size/spacing – varies but typically requires 2-4” spacing between roots. Thinning is necessary
- Bloom time – n/a
- Flower color – n/a, biennial crop so flowers don’t emerge.
- Root depth – varies



## Growing Information

- How to plant - Beets can be seeded every two weeks from mid-April (frost will not hurt the seeds or your plants) until mid- summer. Late summer sowings, planted ten weeks before the first expected fall frost, give the crop adequate time to mature. To improve germination soak seeds before planting or place in a bag with a paper towel for 24 hours prior to planting.
- Maintenance - In a well-prepared bed, beet roots develop quickly. Thin plants to 3 inches apart and use the young tops as greens.
- Harvest - Harvest should begin when roots are 1½ inches in diameter. Leave an inch or so of stalk on each beet to prevent bleeding (loss of juices) prior to use.
- Pests – leaf miners
- Diseases – boron deficiency, powdery mildew

Other: Can be grown for leaves as well as the beet root.

Mountain communities: This is a great crop for mountain communities.



# Broccoli

## Site Characteristics

Cool season crop, can be grown spring and fall

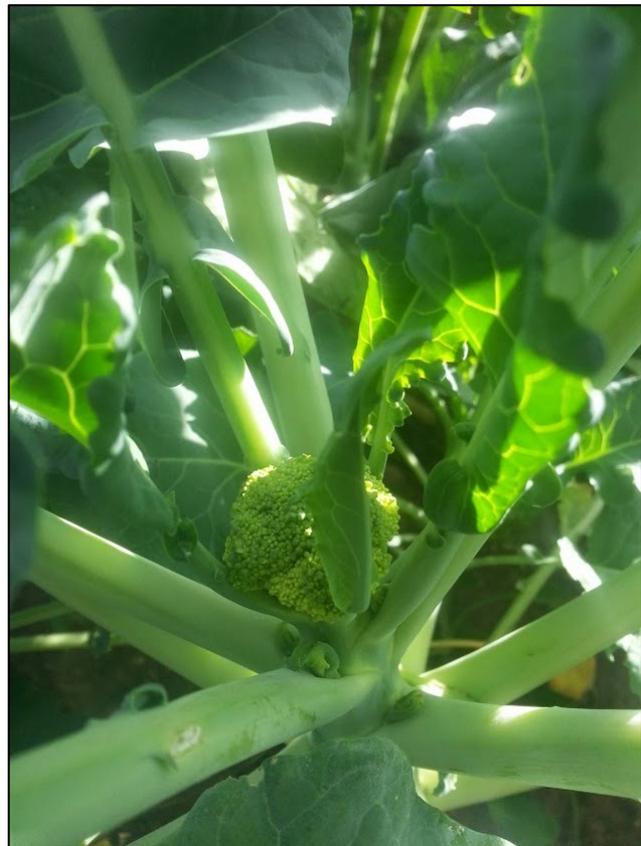
- Sun exposure – full sun
- Soil condition – well draining, fertile soil.
- Irrigation needs – regular water is key. If the plant becomes drought-stressed it will negatively impact the flavor profile.
- Mulching – mulch can help reduce watering needs.

## Plant Traits

- Size/spacing – most will grow 2' tall, 1-2' wide
- Bloom time – n/a
- Flower color – yellow
- Root depth – shallow

## Growing Information

- How to plant – Using transplants is the most reliable method for spring crops. Sow indoors March 1. Set young, hardened-off plants outdoors in mid-April, spacing them 24 inches apart. Closer plantings may cause the head size to be smaller than normal. Can be sensitive to freezing temperatures when forming heads but heads up best in cool weather.
- Maintenance – fertilize before planting, and before heading, again if it is a variety that grows side shoots (approximately every three weeks).
- Harvest – Harvest when heads have formed and flowers are still tight. Some varieties will produce side shoots that can be harvested longer into the season.
- Pests – cabbage looper <https://extension.colostate.edu/docs/pubs/insect/05564.pdf> Fact Sheet 5.564
- Diseases - black leg – ensure seeds are disease free.



**Other:** If the young seedlings are constantly exposed to temperatures below 40°F for more than a couple of days, the plants will “button.” This means that instead of growing and producing a

normal crop, they will be stunted, producing only tiny heads very early in the season. There is no solution; compost the failed crop and perhaps plant later in the year next time.

Varieties that produce side shoots give an extended harvest.

**Mountain communities:** This takes a long time but can be planted before last frost and can make good quality heads in cooler mountain temperatures. Using varieties that produce side shoots is preferable.

# Brussels Sprouts

## Site Characteristics

A cool season crop with a long season, often harvested in fall.

- Sun exposure – full sun
- Soil condition – well amended soil is necessary. Nitrogen fertilizer can be amended 6” deep before planting. Side dress 3 weeks after planting as sprouts begin to appear. Don’t plant where brassica plants have been grown before.
- Irrigation needs – consistent moisture is key.
- Mulching – mulch can reduce watering needs and keep soil cool.

## Plant Traits

- Size/spacing – 18”+ in diameter
- Bloom time – n/a
- Flower color – yellow
- Root depth – shallow root system. Weed cultivation should be done with care.



## Growing Information

- How to plant - Six- to eight-week-old transplants set out a few weeks before the last frost date is recommended. Start them indoors around March 1 and harden them off before setting out.
- Maintenance - As sprouts form in the axils of leaves at the bottom of the plant, remove lower leaves and stems. Pinch out the center or growing point at the top of the plant about September 15. This encourages rapid development of sprouts at the top of the plant. Brussels sprouts do best with cool temperatures during sprout formation.
- Harvest - Sprouts are harvested from the bottom up as they reach about an inch in diameter. Sprouts harvested after mild freezes are sweeter in taste.
- Pests – aphids, cabbage looper
- Diseases – black leg, be sure to buy disease free seed.

**Mountain Communities:** usually require a long season so timing is important to get sprouts.

# Cabbage

## Site Characteristics

Cabbage is a cool weather crop. Its short time- to-maturity (60 to 65 days) permits both spring and fall crops in our area. It can be grown from seeds or as transplants.

- Sun exposure – full sun but can tolerate some shade
- Soil condition – well amended, loose soil is best. Work necessary fertilizer into the soil before planting.
- Irrigation needs – consistent watering needed especially during head formation
- Mulching – a mulch can help with moisture retention

## Plant Traits

- Size/spacing – varies
- Bloom time – n/a
- Flower color – n/a
- Root depth – shallow, take care when weeding

## Growing Information

- How to plant – Cabbage is one of the easiest of the heading brassicas (broccoli and brussels sprouts). Sow cabbage directly in the garden about July 15 for a fall crop. Be sure to select late varieties Transplants that are five- to six-weeks old seem to survive adverse weather conditions better than older ones. They may be set out about April 15 for spring crops. Early varieties usually produce smaller heads – later varieties, larger heads. If your variety still has a small head at maturity, plants may have been placed too closely together at planting. Small heads are good for cooking and salads. Large heads are good for sauerkraut. Red leaf cabbage varieties mature later than green leaf varieties.
- Maintenance – fertilize before planting and mid-season.



- Harvest - Harvest when heads become firm. Cut the heads off and remove the outer leaves. Don't let them age in the garden. They will either get sunburned or will split. If you can't harvest heads when firm, bend the plant over to break about half of the root system. Plants will hold for several weeks without splitting. It's best to freeze or preserve the excess spring crop. Heads from the winter crop are most readily stored in outside pits head down, root up, buried and mulched. Remove all damaged and diseased leaves before storing.
- Pests – aphids, cabbage looper.
- Diseases – be sure to rotate crops from year to year. Cabbages are a brassica as are Kale, broccoli, cauliflower, Brussels sprouts etc.) This can reduce the chances of disease.

Mountain communities: a good choice for mountain growing as it is tolerant to frosts.

# Carrots

## Site Characteristics

Carrots are a cool-season crop.

- Sun exposure – full sun
- Soil condition - Do not use fresh manure to amend the soil in a carrot bed (or in any root crop bed). It can cause tough skins and hairy roots. Carrots grow best in loose, sandy soil; they are not able to germinate properly if there is crusting of clay soil. Do not compact the soil in your carrot bed when working it for cultivation but use a board to stand on. Compacted soil can cause crooked, forked carrots at harvest time.
- Irrigation needs – consistent moisture is key especially for germination.
- Mulching – if mulching, wait until after seedlings are up. Mulch can help prevent greening of the carrot shoulders.

## Plant Traits

- Size/spacing – varies
- Bloom time – n/a biennial
- Flower color – n/a biennial
- Root depth – minimum of 12”

## Growing Information

- How to plant - Sow your first spring crop in late April to take advantage of snow-moistened soil. Seeds are very slow to germinate, taking up to three weeks. They must be kept damp the entire time. A mister on a timer can help keep the soil moist until the seeds sprout or a row cover fabric can be laid directly on the soil. A fall crop may be sown in August in many locations to be left in the ground, well-mulched, and used over the winter.
- Maintenance - Thinning of small seedlings will probably be necessary. Follow this with plantings at three-week intervals through June. Be sure to keep the carrot crown covered with a half-inch of soil or mulch to avoid direct sunlight which causes inedible green root tops. Mulch also keeps soil moisture levels constant, so the roots don't crack.



- Harvest - Harvest when the crown is orange-red (variety dependent) and the roots are sweet and flavorful. To harvest baby carrots, choose a variety that colors and sweetens at an early age. Cut the green tops of carrots off before storing to prevent sprouting. Carrots should be stored at near freezing with a high relative humidity. Roots are sweeter when harvested in cool temperatures and are sensitive to large temperature swings.
- Pests – mammals, carrot rust fly larvae, carrot weevil larvae, nematodes on roots
- Diseases -

**Other:** Forked roots from shallow or compacted soil, pale roots from high water or too hot, hairy roots from too high Nitrogen

**Mountain communities:** a good choice for mountain growing.

# Cauliflower

## Site Characteristics

Cauliflower is a cool weather crop. The best varieties have maturity between 47-60 days and are excellent for both spring and fall planting. Four- to five-week old transplants are recommended for the spring crop.

- Sun exposure – Sun, some shade can be tolerated.
- Soil condition – well amended and light soils are ideal. Amend prior to planting at least 12” deep.
- Irrigation needs - Adequate moisture to a depth of 12” results in slow, steady growth, and produces the mildest, most tender heads.
- Mulching – mulch to increase soil moisture.

## Plant Traits

- Size/spacing – 18-24” in diameter
- Bloom time – n/a, harvest occurs before flowering occurs
- Flower color – n/a, harvest occurs before flowering occurs
- Root depth – shallow rooted.



## Growing Information

- How to plant - Sow seed outdoors in late July for a late fall crop. The crop should be ready to harvest in late September. Handle transplants carefully so as not to damage the growing tip.
- Maintenance - Cauliflower heads must be protected from sunlight in order to remain white. If exposed to direct sun, the heads will turn yellowish and develop a strong flavor. To protect heads, they are blanched by folding leaves over the developing heads when they are about two inches in diameter and tying the leaves in place to shield the heads from the sun. There are also self-blanching types which produce curled, upright leaves that self-wrap and shade the heads.

- Harvest - Cauliflower plants produce only one head. Pick the head while it is firm and white. Snow Crown hybrid, for example, is ready for harvest when the head is about eight inches across. Yellowing of the head indicates that the seed process has started, and the crop is too mature.
- Pests – cabbage worms and cabbage loopers
- Diseases – Black leg

**Mountain Communities:** Can be a good choice for mountain communities as it does not grow well in hot weather.

# Celery

## Site Characteristics

- Sun exposure – full sun but does require blanching
- Soil condition – well-amended soil will get the best results. Fertilize every two weeks with high nitrogen fertilizer.
- Irrigation needs – Keep soil damp to 8”
- Mulching - Add mulch as the plants grow.

## Plant Traits

- Size/spacing: 12”+
- Bloom time – n/a
- Flower color – n/a
- Root depth - medium



## Growing Information

- How to plant - Seeds must be started indoors about February 15. Sow in deep flats (four inches or more) in a sterile planting mix. The seed should be slightly covered and kept moist. It takes from 10 to 21 days at 65°F to germinate. When seedlings are about two inches high, thin them to two inches apart. Keep the soil in the flats moist throughout and fertilize at half strength every two to three weeks with a balanced (20-20-20) fertilizer. Eight hours of light each day is essential. Set out transplants after night temperatures are uniformly 50°F. or above (celery bolts and forms seeds in cooler temperatures). Plants should be placed about 12 inches apart and the bed graded for irrigation.
- Maintenance - Add mulch as the plants grow. This will help the soil retain moisture, keep the plants erect and help in blanching the stalks (soil mounded around the plants in mid-season blanches the stalks.)
- Harvest - Harvest when plants are 10 to 12 inches tall. Pull with the roots attached. At first frost, store remaining plants in a heavily mulched pit.
- Pests -
- Diseases -

**Mountain Communities:** Not generally recommended for growing at higher elevations.

# Collards

## Site Characteristics

Collards are a warm weather crop, providing a harvest of cooking greens in mid-August if seeded in mid-May.

- Sun exposure – full sun
- Soil condition – do well in a well amended light soil. High nitrogen can be worked into the soil before planting.
- Irrigation needs – keep soil moist at least 6” deep
- Mulching – can benefit from mulching

## Plant Traits

- Size/spacing – 18-24”
- Bloom time – n/a
- Flower color – n/a
- Root depth – medium rooted.



## Growing Information

- How to plant – Can be direct sown, grows very well for a fall harvest.
- Maintenance – Thin mature plants to 12” apart, fertilize regularly (every two weeks) for optimal production.
- Harvest – Can harvest young plants and cook the whole plant or larger plants for the leaf
- Pests – Cabbage worms, cabbage loopers.
- Diseases – Do not plant in soil that has grown members of the cabbage (*Brassica*) family in the last two years.

**Mountain Communities:** Can be grown with appropriate protective garden materials.

# Corn

## Site Characteristics

Corn is a warm-season crop.

- Sun exposure – Minimum 8 hours of sun each day
- Soil condition - Soil temperatures must be at least 50°F to germinate properly. Corn is a grass plant requiring large amounts of nitrogen and water to develop big plants and ears. An application of a high nitrogen fertilizer should be made at the time of planting. Work this into the top three inches of soil. If seedlings turn purple, try adding a side-dressing of phosphorus (cold soils can prevent roots from absorbing the phosphorus already in the soil).
- Irrigation needs – Corn needs large amounts of water throughout its growing season. Furrow-row irrigation is best. Keep the soil moist to 12". Overhead watering of corn usually results in incomplete development of ears due to partial pollination. To hand pollinate, shake the tassels over the silks.
- Mulching - Mulch to retain moisture in the soil.



## Plant Traits

- Size/spacing – varies
- Bloom time – summer
- Flower color – insignificant
- Root depth – shallow

## Growing Information

- How to plant - Plant at least four rows of a single variety side by side to assure proper wind pollination. In home gardens, it is best to plant only one variety. Cross pollination may occur if different varieties are planted within 200 feet of each other. Block planting is also a good option for optimal development.
- Maintenance - Plants should be side-dressed with additional nitrogen when they are eight to ten inches high and again when the tassels form. Corn has shallow roots so carefully work fertilizer into the soil away from the stalks to a depth of about six inches. Protect from high winds.
- Harvest - Harvest your crop when the kernels are well filled and tightly packed. A ripe kernel should squirt a milky substance when penetrated by your thumbnail. Yellow

varieties should have yellow kernels all the way to the tip. Use or process your harvest as soon as possible after picking for best flavor.

- Pests - Corn should never be planted in the same location two years in a row. Rotation in the garden discourages root worms. Earwigs, corn earworm, corn borer
- Diseases -

**Other:** Prevent squirrel and bird damage to ears by slipping a small paper bag over each ear about two weeks before harvest. Raccoons are a bigger problem. They wait for the crop to mature and can ravage a field in a short time.

**Mountain communities:** there are short season varieties that can tolerate cool soils. Growing with a high tunnel will extend the season.

# Cucumber

## Site Characteristics

Cucumber is a warm-season crop

- Sun exposure – At least 8 hours of sun is necessary
- Soil condition – Well amended soil with good drainage.
- Irrigation needs – Avoid soggy soil. Irrigate to keep soil moist to a depth of ten inches; dry soil may cause deformed fruit. However, avoid overhead watering as it tends to spread airborne diseases that might be present.
- Mulching – Mulch can be beneficial but only after plant has established.

## Plant Traits

- Size/spacing – varies depending on variety
- Bloom time – early summer
- Flower color – yellow
- Root depth – moderate

## Growing Information

- How to plant – Wait until soil temperatures have reached at least 60°F and all risk of frost is over before planting. Time to harvest can be shortened by starting seeds indoors and transplanting three-week-old plants to the garden. Be careful to avoid disturbing the root system when transplanting. Additional fertilizer applied as a side-dressing when the vines first begin to run, and again when blossoms set, will improve fruit bearing.
- Maintenance - Most cucumber varieties require both male and female flowers before a plant will bear fruit. (Some varieties set fruit without pollination; these are ideal for greenhouse production.) Choosing a variety that produces mostly female flowers may increase your yield. Don't worry if your plants are producing flowers but not yet fruit; most varieties produce male flowers before female flowers. Male flowers are on a long stalk. Female flowers have no stalk and are attached to a small swelling resembling an immature fruit. If space is a premium in your garden, you can train the vines up a trellis. Note that yields may be higher on un-trellised plants—the ground reflects heat and staying low keeps the plants out of the wind. Or, try one of the bush varieties. Plant a few in a ten-gallon container and grow as above in full sun.



- Harvest - Cucumbers can be harvested at almost any size, depending upon how you want to use them. Pick different sized cucumbers at the same time. Use the small ones for sweet pickles and the larger ones for salads and dill pickles. The long slender “burpless” hybrids are excellent for fresh use. Plants will continue to produce if the cucumbers are picked before seeds mature.
- Pests -
- Diseases - Select varieties that are resistant to cucumber diseases such as mosaic, angular leaf spot and various mildews. Do not plant cucumbers where they were grown the prior year. Many plant diseases overwinter in the soil.

**Mountain Communities:** Grow short season varieties under cover, focus on finding smaller fruiting varieties such as lemon or pickling cucumbers.

# Eggplant

## Site Characteristics

Eggplant is a warm season plant

- Sun exposure – full sun but site should be protected from wind
- Soil condition – well amended soil, apply fertilizer when planting if necessary
- Irrigation needs – once established can tolerate less regular watering.
- Mulching – can create a wire cage wrapped with plastic to combat drying winds, mulch with straw or grass to retain soil moisture.

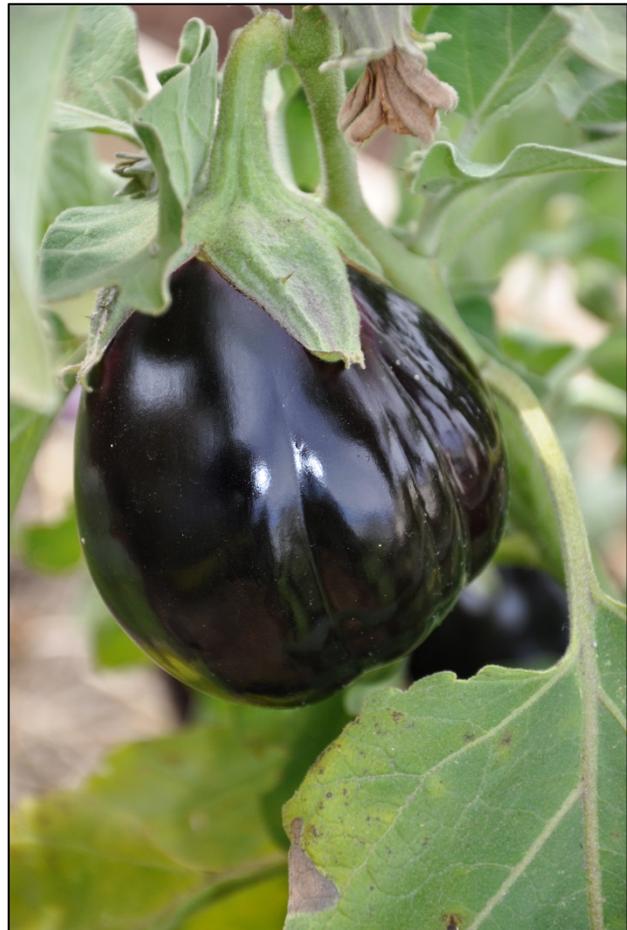
## Plant Traits

- Size/spacing – need good space to grow, up to 2'
- Bloom time – summer
- Flower color – purple
- Root depth

## Growing Information

- How to plant – Start indoors before frost date. When true leaves are about 3/8 inch in diameter, transplant the seedlings to three-inch pots and reduce the temperature to 65°F. The seedlings need to be kept moist. Harden seedlings off then set them out in the garden.
- Maintenance - Side dress with fertilizer three weeks after transplant.
- Harvest – harvest when fruits reach mature size and color, and skin is glossy.
- Pests -
- Diseases -

**Other:** The plant can be quite attractive and can fit into ornamental beds.



**Mountain communities:** not best unless growing under cover and must grow short season varieties

# Horseradish

## Site Characteristics

Horseradish is a perennial crop that can be replanted every year or every few years.

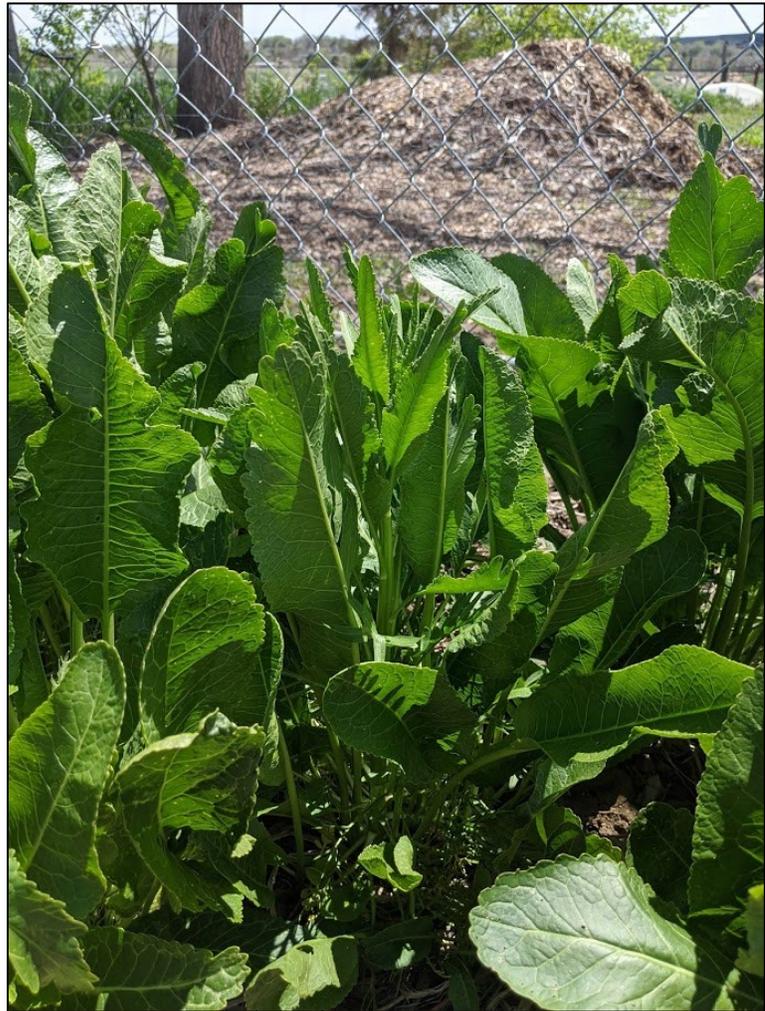
- Sun exposure – Full sun, but can tolerate some shade
- Soil condition – Tolerates a variety of soils
- Irrigation needs – Less water increases the intensity of flavor
- Mulching – Deep organic mulch is beneficial

## Plant Traits

- Size/spacing – Will spread readily up to 4'
- Bloom time – n/a
- Flower color – white
- Root depth – deep 18+ inches

## Growing Information

- How to plant – Plant single root.
- Maintenance – Does not require a lot of additional work. Divide and re-plant every few years.
- Harvest – Harvest in fall or if soil can be worked. Harvest what you need and leave the remaining roots in the soil.
- Pests
- Diseases



# Kohlrabi

## Site Characteristics

Kohlrabi is a cool season crop

- Sun exposure – Full sun
- Soil condition – Well amended soil
- Irrigation needs – Keep soil moist to about 6 inches
- Mulching – Can benefit from mulching once plant has established

## Plant Traits

- Size/spacing – 18” tall
- Bloom time – n/a
- Flower color – n/a
- Root depth – shallow rooted

## Growing Information

- How to plant – Transplants will do better than seeds. Seeds can be started 6 weeks before last frost date. Can also be direct sown.
- Maintenance – Side dress halfway through the growing season (several weeks after transplanting)
- Harvest – When the swollen stem is 2-2.5 inches in diameter. The stem has a mild, sweet flavor like broccoli but not as strong. Kohlrabi leaves have a strong cabbage flavor.
- Pests
- Diseases



Mountain communities: Good choice for mountain growing.

# Leeks

## Site Characteristics

Leeks require a long planting season, generally over 130 days.

- Sun exposure – Need 10+ hours of light starting in April – August.
- Soil condition – Well drained, moist soil. Can do well in slightly alkaline soils.
- Irrigation needs – Consistent moisture
- Mulching – Mulch to retain water and help blanch the stems.

## Plant Traits

- Size/spacing – 18” minimum
- Bloom time – n/a
- Flower color – n/a
- Root depth – n/a

## Growing Information

- How to plant – Transplants will guarantee a fall crop. When seedlings reach three inches, apply a water-soluble 20-20-20 (or equivalent) fertilizer at half-strength every two weeks. Keep the height of your seedlings at about six inches by shearing the tops. Six inches is the best size for transplant purposes. Transplant the seedlings to the garden a few weeks before the last frost date. The garden soil should be amended with well-rotted compost. Place the transplants in furrows six inches deep and about four inches apart. Fill in the furrows as the plants grow to blanch the leek stalks.
- Maintenance – Side-dress with nitrogen in mid-summer.
- Harvest – When stalks are one inch in diameter. Those left in the ground should be hilled up and mulched before first freeze. They can be dug during the winter or in early spring.
- Pests
- Diseases

**Other:** It is possible to separate, save and replant the baby bulbs of leek plants for a new crop the following season.

**Mountain communities:** a great choice for mountain growing



# Lettuce

## Site Characteristics

Lettuce grows best as a cool season crop.

- Sun exposure – Full sun to part shade
- Soil condition – Well amended soil, does well in sandy soils.
- Irrigation needs – Keep soil moist to a depth of at least 6". Erratic watering can cause off flavors, tip burn, and tough leaves.
- Mulching – Mulch with grass or straw once plant is established.

## Plant Traits

- Size/spacing – Varies
- Bloom time – n/a
- Flower color – n/a
- Root depth – Shallow

## Growing Information

- How to plant - Plant as early as your ground can be worked and successively at convenient intervals in spring to early summer to extend harvest. Plant again in late August for a fall crop. Seeds are planted at ¼ to ½" so keep soil moist for successful germination.
- Maintenance - Side-dress three weeks after transplanting and again three weeks later. Thin leaf lettuce varieties to stand at least 6 inches apart; thin head lettuce varieties to 12 inches apart.
- Harvest - Leaf lettuce can be productive for a long period of time if outer leaves are picked leaving the inner leaves to mature. Leaf lettuce varieties produce earlier than the head lettuce varieties. Cos is another type of lettuce that is easy to grow in Colorado. It is more heat tolerant than other



leaf types. Multiple harvests can be had from leaf lettuce by cutting the head approximately 1-2" above soil line. Cos (or romaine) is another type of lettuce that is easy to grow in Colorado. It is more heat tolerant than other leaf types.

- Pests – slugs and worms
- Diseases – rare

**Other:** Lettuce comes in colors from deep red to lime green. The leaves may be plain or frilly, short or tall. Some types hold up better in summer, while others survive temperatures down to 10°F. Read the description in the catalog or on the packet and have fun experimenting. With warm temperatures and longer hours of sunlight, leaf lettuce will begin to bolt and become bitter. Using a shade cloth can help keep temperatures down at crop level.

**Mountain communities:** Head lettuce is a good vegetable for higher elevations. Heads are ready for harvesting when they are firm. Pick before the stems start to elongate and leaves become bitter. Look for varieties and types with shorter days to maturity.

# Melons

## Site Characteristics

Melons are a warm-season crop and can be difficult to transplant. In most of Colorado it is wise to seek out varieties with a short growing season.

- Sun exposure – Full sun
- Soil condition – Soil temperatures need to be at least 75°F for best germination. Well amended soil is best.
- Irrigation needs – Keep soil moist 8-10 inches deep. Be careful when cultivating as some roots are close to the surface.
- Mulching – Mulch can be useful but not necessary.

## Plant Traits

- Size/spacing – Large and spreading plants several feet in diameter at minimum unless trellised
- Bloom time – summer
- Flower color – yellow
- Root depth – shallow

## Growing Information

- How to plant - It's best to start melons indoors in to have four-week-old plants ready to transplant. Transplant carefully, as roots are fragile. In many parts of Colorado direct sowing is also possible and can prevent the stress of transplanting.
- Maintenance – Protect fruit from rodents, keep off bare ground either with mulch, trellising etc. Fertilize regularly. It may be necessary to remove flowers from the plant in order to have at least some fruit mature before the first freeze.
- Harvest – Harvest can vary depending on variety, some varieties have a stronger smell when ripe, muskmelons will “slip” their stem, watermelons will have curly tendrils that start



to brown. Read your seed packet if counting the days to maturity from bloom is the best way to tell ripeness.

- Pests – Slugs, worms, cucumber beetle
- Diseases – Powdery mildew

**Mountain communities:** Very difficult to have success unless grown under cover and short season varieties.

# Onions

## Site Characteristics

Onions are a warm-season plant that tolerates cool weather so their long season can be manageable. Seek out long day or day-neutral varieties.

- Sun exposure – Full sun
- Soil condition – Onions prefer more clay soils, but high in nitrogen. If needed work fertilizer into soil prior to planting.
- Irrigation needs – Moist but not wet, onion roots will not tolerate being water-logged.
- Mulching – Can be done, not necessary

## Plant Traits

- Size/spacing – Bulbs vary from 1” to 4”
- Bloom time – n/a biennial
- Flower color – n/a biennial
- Root depth – Shallow roots mean that weeds will easily outcompete the onions.

## Growing Information

- How to plant - There are three ways to grow onions in your garden—from seeds, from sets, or from transplants. In much of Colorado sets or plants are the best methods (sets are the small onion bulbs sold in bulk in the spring). Growing from seed is most economical, but seed takes about 110 days to mature in the garden. Seed should be started indoors about ten weeks before the last spring frost. Keep tops trimmed to six inches. When plants are about half the diameter of a pencil, plant outdoors at two to three inches apart. Transplants or sets should be planted in the spring between mid-April to Mid-May. Press sets or plants into one-inch deep furrows and cover with soil to ground level. Space at two- to three-inch intervals. If needed, side-dress with fertilizer three weeks after setting out when the tops are six to eight inches tall, and again when the bulbs start to swell.
- Maintenance – Side dress several times through the season with nitrogen. Stay on top of weeding as onions can easily be outcompeted.
- Harvest – When stalks have “fallen” also called lodging. If onion bulbs are at a desired size you can also crimp the leaves by lightly stepping on them. This will mimic the



“falling”. Cure bulbs in a warm, dry area out of the sun. Wait to store until necks have dried completely.

- Pests – Thrips
- Diseases - Pink root

**Other:** Onions come in many shapes and sizes. Egyptian walking onions are a fun perennial option. Onions form bulblets at the top of the plant which droop down, self-seed and grow for the next season. New growth can be harvested as green onions and the bulblets can be treated as pearl onions.

**Mountain Communities:** Because onions tolerate cold well, they can grow with protection and early starting in some places. Better yet, grow as green onions, or choose walking onions.

# Parsnips

## Site Characteristics

Parsnips are a cool season crop that will mature into the warm season

- Sun exposure – full sun.
- Soil condition – well amended soil that is loose at least 18” deep
- Irrigation needs – water regularly to maintain moist soil to the depth of a shovel.
- Mulching – mulch well with straw or grass

## Plant Traits

- Size/spacing – narrow plant
- Bloom time – n/a biennial
- Flower color – n/a biennial
- Root depth – can be very deep, up to 18”



## Growing Information

- How to plant – seeds may take up to 20 days to germinate. Don't let the seeded area dry out. Mulch young plants with straw or grass.
- Maintenance – crop can be left in the ground and dug over the winter.
- Harvest – dig as needed, remainder of crop can be left in the ground. Protect the bed with a thick (12” +) layer of mulch before the ground freezes.
- Pests -
- Diseases -

Mountain communities: great choice for mountain growing

# Peas

## Site Characteristics

Three general types of peas: shelling, snap (edible pods), and sugar peas. Snap and sugar peas will continue to produce if they are kept consistently picked.

- Sun exposure – Full sun to light shade
- Soil condition – Well drained and amended soil.
- Irrigation needs – Consistent moderate irrigation
- Mulching – Can mulch, not always necessary.

## Plant Traits

- Size/spacing – Can vary
- Bloom time – Late spring to early summer
- Flower color – White to pink
- Root depth – Relatively shallow

## Growing Information

- How to plant – Can be planted as soon as the soil can be worked. Sow successive crops every 7-10 day. If no peas have ever been planted, you can amend with rhizobium on seed for the first year. Peas can suffer in the middle of the summer; an August planting can provide an additional crop in the fall.
- Maintenance – No need to fertilize, peas fix their own nitrogen. Harvest to keep production going. Trellising will encourage new growth and reduce chance for disease.
- Harvest - Harvest edible-pod peas when they are young, and peas barely show through the pod. Sugar snaps and garden peas are harvested when the pods are round, and the just-developed peas are bright green. Picking the pods encourages new flower growth which can lead to greater harvests.
- Pests -
- Diseases – powdery mildew



Mountain communities: Peas are a great choice for higher elevations.



# Peppers

## Site Characteristics

Peppers are a warm season crop. Two main types: sweet and hot.

- Sun exposure – Full sun, although shade cloth can be beneficial to prevent sunburn on the fruit.
- Soil condition – Well amended soil, amend with fertilizer prior to planting if needed, and again mid-season to encourage fruit production.
- Irrigation needs – Keep soil moist to a shovel depth (10 inches).
- Mulching – Plastic mulch can warm the soil and encourage rapid growth.

## Plant Traits

- Size/spacing – 18” plants or larger
- Bloom time – Summer
- Flower color – Yellow
- Root depth – Moderate to deep



## Growing Information

- How to plant – Start seedlings inside 10 weeks before transplant. Seedlings are very slow to develop. Nighttime temperatures should be above 58°F.
- Maintenance – Water and fertilize regularly through the growing season. Peppers need high levels of nitrogen to establish plant size and leaf canopy to reduce sunburn on fruit. Shade cloth can also be added as the peppers begin to set flowers and fruit to prevent sunburn. Staking the plant is recommended as stems are relatively weak.
- Harvest – Depending on the crop peppers can be harvested either when green (immature) and at a desirable size or once color begins to develop. Be aware that if you want the fruit to go to a mature color, expect an additional 3 weeks until harvest.
- Pests -
- Diseases – blossom end rot

**Other:** Can be susceptible to sunscald. Using shade cloth can be beneficial to preventing sunscald.

**Mountain communities:** Peppers can be very difficult, even under cover. Try short season or small-fruited varieties tolerant of cool nights and plant under cover until flowers form.

# Potatoes

## Site Characteristics

Potatoes are a full-season crop, planted in the cool season, and harvested before the first frost.

- Sun exposure – Full sun
- Soil condition – Potatoes prefer well drained and amended soil. A potato plant needs large amounts of phosphorus and potassium and small amounts of nitrogen. While most Colorado soils have plenty of phosphorus and potassium, there are exceptions. If your soil lacks these nutrients, start with two tablespoons of 1-15-10 worked into the soil about four inches deep for each seed piece planted. A shallow side-dressing of a similar fertilizer is recommended in mid- summer.
- Irrigation needs - Keep potato plants uniformly moist to a depth of 18 inches throughout the growing season. Dig a test hole to check moisture. Fluctuations in soil moisture will result in knobby potatoes. If plants receive too much water, especially later in the season, the tubers may decay. Irrigation rather than overhead watering is recommended. Do not allow soil to stay saturated. This drives oxygen out of the soil.
- Mulching – Use a deep layer of grass or straw mulches.

## Plant Traits

- Size/spacing – 12-15” between plants
- Bloom time – summer but n/a
- Flower color – white purple
- Root depth – deep



## Growing Information

- How to plant – Planting can start before risk of frost is over, even as early as April if soil can be worked. Use seed potatoes. (available from a garden center or catalog) disease free assurance. Avoid potatoes purchased from the produce departments; they’ve probably been treated with sprout inhibitors and won’t grow. Additionally, if you plan to grow potatoes, do not compost peelings from market-bought tubers. They frequently carry scab, a potato disease that reduces yields, and will permanently infect your soil. If you cut your own seed potatoes, try to get four seed pieces from an eight-ounce tuber, one or more eyes on each piece. Keep seed pieces at room temperature for about a week before planting, to allow the cuts to dry. Plant each seed piece about two inches deep. Allow three square feet for each plant.
- Maintenance - If needed, side dress with fertilizer when plants begin to bloom. Plants should be hilled to a depth of eight inches. Hilling should be gradual as plant growth

progresses. Make hills of large diameter to provide adequate coverage of new tubers. If hills are too shallow, your tubers may be green. Don't eat them as they contain a toxic substance known as solanine. The small above-ground fruits contain the same substance.

- Harvest - Don't harvest the crop too soon. Tops of plants should wither and die before harvest unless you want "new" potatoes. If by beginning of October plants haven't died back, then cut foliage to 1" above ground. Cut off all irrigation 1 week before harvest so the tubers can develop a thicker skin.
- 
- Pests - Colorado potato beetle, potato flea beetle, tuber flea beetle, potato psyllids, potato leafhopper, potato aphids.
- Diseases - Early blight, late blight, ring rot, alfalfa mosaic virus (AMV), tobacco ringspot virus, potato leaf roll virus, common potato scab, black stalk.

**Other:** make sure you have day neutral or long day varieties. A few varieties are short day and will not do well in Colorado.

**Mountain communities:** potatoes are a great choice if they are planted early enough and are not a long season variety.

# Pumpkins

## Site Characteristics

Pumpkins are a warm season crop and take a long time to mature 100-120 days and may not be the best choice for many parts of Colorado.

- Sun exposure – Full sun.
- Soil condition - Pumpkins like a loose, well-drained soil fortified with a shovelful of well-rotted compost for each “hill” (several seeds planted together in one spot). Hills should be from six to eight feet apart; a spacing many home gardener cannot afford.
- Irrigation needs – consistent and deep watering is necessary for a good crop especially at seedling emergence, bloom and 10 days before harvest. Irrigation is better at the root system than overhead watering.
- Mulching – Can be mulched but not necessary

## Plant Traits

- Size/spacing – Large: plants can be 4’ or larger in diameter
- Bloom time – Summer.
- Flower color – Yellow.
- Root depth – Shallow to medium rooted.

## Growing Information

- How to plant - Seed the hills in once soil temperatures are above 60°F. Plant several seeds in each hole. When plants are two inches or so high, remove all but the two strongest from each hill. Mulch the remaining plants heavily and keep the soil moist to a depth of 10 to 12 inches.
- Maintenance - If a soil test indicates, apply a mid-season dressing of 5-10-5 fertilizer when vines begin to run and again when blossoms set. When the first fruits have been set, pinch back all vine ends and remove all small fruit, leaving the largest to keep growing.



- Harvest - Pumpkins should not be harvested until the vines have been frost-killed and the skin cannot be penetrated with your thumbnail. Three-inch stems should remain on the fruit to protect against disease invasion and prevent fruit from drying out in storage.
- Pests – Squash bug.
- Diseases – Powdery mildew.

Mountain communities: can be very difficult to grow.

# Radish

## Site Characteristics

Radishes are a cool season crop.

- Sun exposure – Full sun but cool temperatures. Prone to bolting (going to seed) once temperatures heat up.
- Soil condition – Sow in well amended soil that is easy to break up.
- Irrigation needs – Require consistent water to get a good, crisp, but not hot product.
- Mulching – Optional

## Plant Traits

- Size/spacing – Small, 1” bulb roots.
- Bloom time – n/a
- Flower color – n/a
- Root depth – Shallow.

## Growing Information

- How to plant – Plant as soon as soil can be worked or a month before the last frost date. Repeat sowing every ten days until early summer.
- Maintenance – Be sure to thin as needed, seeds planted too densely will cause them to grow deformed.
- Harvest – Radishes are good only for a few days, harvest as they reach mature size. If left too long they can become woody or pithy and will not taste good.
- Pests
- Diseases



**Other:** Radishes make an excellent green manure crop in spring or fall because they germinate quickly, and seed is inexpensive. Sow seeds densely using the broadcast method. Turn leaves and roots into the soil to increase nitrogen and organic matter.

**Mountain communities:** great choice, very short season crop

# Rhubarb

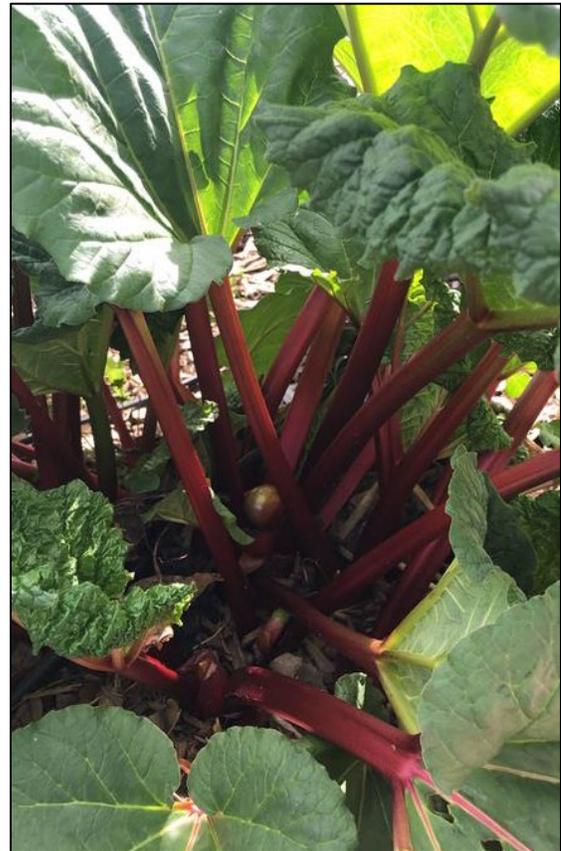
## Site Characteristics

Rhubarb is a cold-hardy perennial vegetable that needs two months of freezing over winter and a long, cool spring for best quality and yield.

- Sun exposure – Full sun, although some varieties do not tolerate summer heat well.
- Soil condition - Rhubarb needs a soil rich in organic material (well-rotted compost) and nutrients. A soil test is recommended, since the plants will be in place for many years. If needed, amendments and fertilizer should be worked into the soil to a depth of 18” at planting time.
- Irrigation needs - Irrigate to keep the soil moist to a depth of 18” throughout the growing season.
- Mulching - Mulch your rhubarb with rotted compost after the ground has frozen in winter.

## Plant Traits

- Size/spacing – Large 3-4’ plants.
- Bloom time – Summer but not linked to harvest
- Flower color - Keep rhubarb plants from blooming by removing flower stalks as they appear. Flowers divert energy from growth, and the abundant seedlings can become a problem.
- Root depth – Fairly deeply rooted.



## Growing Information

- How to plant - May be started from seed early in the spring. Plants will produce usable stalks in two years. Purchased roots give faster results, providing usable stalks in one year from planting.
- Maintenance - Select a site in your garden that will not be disturbed by annual plantings. Set roots three inches deep, about two feet apart. Be sure roots do not dry out before planting. After plants are established, a handful of fertilizer each spring as shoots appear will help produce a good crop. When production diminishes after a few years, the plants can be divided in early spring. Replant the best ones, making sure they each have at least two buds.

- Harvest - Only the stalks of rhubarb are edible. Leaves are not since they contain large amounts of oxalic acid and are poisonous. Keep your first harvests small so plants can grow (less than 1/3 of the total plant). After this, harvest may take place over an eight-week period. Hasten stalk development in the spring by placing an open-ended, five gallon plastic bucket over the emerging shoots. The plant will develop extended stalks searching for light. Remove stalks as they appear in late spring. Grasp the stalk at the base and pull sharply. Leave the stalks that are under 1/2" thick. If you find the stalks are too mushy or hollow, harvesting was done too late.
- Pests
- Diseases

**Other:** Red or green stalked varieties are available. Red stalks are sweeter.

**Mountain communities:** Rhubarb are a great choice for mountains as rhubarb can tolerate quite cold conditions.

# Spinach

## Site Characteristics

Spinach is a cool-season crop that is very intolerant of heat.

- Sun exposure – Full sun
- Soil condition – Tolerant of many soils with enough moisture
- Irrigation needs – Keep soil moist to at least six inches
- Mulching – Mulch can keep spinach through much of the winter in many climates.

## Plant Traits

- Size/spacing – 6-8” wide
- Bloom time – n/a
- Flower color – n/a
- Root depth – medium

## Growing Information

- How to plant – Plant early 6-8 weeks before last frost. Ensure even moisture to guarantee good germination.
- Maintenance – When seedlings are 4” tall thin them to six inches apart. Spinach can bolt with 14 hours of sunlight,
- Harvest - Harvest leaves as they mature, you can allow the plant to regrow between harvests. Finish harvesting before the heat of summer as spinach is very prone to bolting.
- Pests
- Diseases



**Mountain communities:** great choice for mountains, can tolerate quite cold conditions.

# Summer Squash / Zucchini

## Site Characteristics

Summer squash includes zucchini, patty pan, etc. They have tender flesh and can be harvested through much of the season.

- Sun exposure – Full sun
- Soil condition – Prefers a light soil but tolerates a well amended soil. High nutrients levels are beneficial.
- Irrigation needs – Water regularly. Don't let your plants dry out, can cause fruit to be deformed. Plants will wilt during hot days, if they recover, they are getting sufficient moisture.
- Mulching – Plants respond well to plastic mulch to help warm the soil.

## Plant Traits

- Size/spacing – Large plants, 3'+ diameter
- Bloom time – Summer
- Flower color – Yellow
- Root depth – Shallow to moderate

## Growing Information

- How to plant – It is possible to either direct sow or plant transplants. Be sure to transplant when the plant is still small (3 weeks old). Make hills to raise soil temperatures. If direct sowing plant several seeds in each hill, thin once seedlings have germinated successfully.
- Maintenance – Squash produce male and female flowers. Typically, there will be male flowers before female, eventually both flowers will appear simultaneously.



- Harvest - Summer squash, such as zucchini, patty pan, and crookneck squash, are harvested at an immature stage while the rind of the fruit is still soft, when the rind can easily be penetrated by a thumbnail. Summer squash can be frozen or used for baking, salads and relishes. Continue to harvest to get the plant to continue to produce.
- Pests – squash bug, harlequin bug
- Diseases – powdery mildew

**Mountain communities:** short season varieties, grown in warm locations can succeed. Use frost cloth but allow for pollination.

# Swiss Chard

## Site Characteristics

Swiss Chard is a cool-season crop

- Sun exposure – sun but can tolerate some shade
- Soil condition – tolerant of a wider variety of soils, likes high nitrogen
- Irrigation needs – regular irrigation necessary, can dry out between watering.
- Mulching – organic mulch can improve soil moisture.

## Plant Traits

- Size/spacing – 12-24” wide
- Bloom time – n/a
- Flower color – n/a
- Root depth – moderate to deep rooted

## Growing Information

- How to plant – Direct seed into garden
- Maintenance – Keep well-watered and weeded. Fertilize regularly (every two weeks) with a light fertilizer. Thin seedlings as necessary to allow growth to maturity.
- Harvest – Pick outer leaves, allowing the center leaves to grow and produce a new crop. Plants should be about ten inches high at harvest time. Smaller leaves or smaller seedlings being thinned are good to eat.
- Pests
- Diseases



**Mountain Communities:** As a cool season crop that grows rapidly, chard can be a good choice for mountain growing.

# Tomatoes

## Determinate/Indeterminate

### Site Characteristics:

Tomatoes are a warm season plant; the favorite of many gardener's vegetable plots. They can have very specific requirements and are prone to complications. With care you can have a great crop!

- Sun exposure - Select a site in your garden where the plants will get at least eight hours of sunlight each day and where the soil will warm up early in the spring. Some gardeners prefer to provide shade from the late afternoon sun.
- Soil condition - Prepare the tomato bed by adding organic matter and fertilizer based on soil test recommendations; spade it in at least 12 inches (preferably more).
- Irrigation needs - From time of transplant to late August, keep soil moist to about 12". Do not let soil dry out.
- Mulching – mulch once the plant has established.

### Plant Traits

- Size/spacing – Varies but generally at least 18-24" diameter.
- Bloom time – Throughout the season.
- Flower color – Yellow
- Root depth – Deep rooted.



### Growing Information

- How to plant – Due to the long season tomatoes need to be started inside or purchased as transplants. Plants set out in the garden should be eight weeks old and hardened to current outdoor conditions (see introduction). It is important to harden tomato transplants with consideration for temperature, wind and direct sunlight. There is little point in risking early planting unless the soil is warm enough to support root growth. You can preheat soil with a sheet of plastic until the temperature at root depth is at least 60°F.
- Plants should not be permanently set out until after all danger of frost is past. By using plant protectors such as "Walls 'o Water" (a commercial product) or gallon-size plastic bottles with the bottoms cut out, for example can nudge planting earlier. Plastic pails and other opaque protectors must be removed in the daytime when temperatures are above

freezing and restored to the plant each afternoon until night temperatures reach a dependable 50°F.

- Maintenance - Side-dress with a water soluble fertilizer two or three weeks after transplanting, before first picking, and again two weeks after first picking. Do not use large amounts of nitrogen and stop fertilizing once tomatoes reach 2" in diameter. Fertilizers high in phosphorus and low in nitrogen promote flowers and fruit
- Harvest - Ripening of fruit in late August can be hastened by reducing irrigation but not to the point that the plant wilts. If fruit has reached mature size it can be harvested and placed in a box or bag with a ripe tomato, banana, apple, or other fruit that produces ethylene. Keep in a dark place.
- Pests - tomato horn worms, psyllids, spider mites
- Diseases - To grow healthy tomatoes, select only those varieties resistant to soil-borne diseases; these will be labeled VF or VFN (resistant to Verticillium Wilt, Fusarium Wilt and Nematodes). Other diseases include early blight, late blight, tomato spotted wilt, tobacco mosaic virus.

**Other:** Tomato plants may be determinant (bush type) or indeterminate type (a vining plant requiring a trellis or fence). Determinant tomatoes stop growing when fruit sets on the terminal (top) bud; fruit matures and ripens all at the same time. Pruning or removing suckers will reduce the crop. Indeterminate varieties produce fruit until killed by frost but do need consistent removal of suckers.

**Mountain communities:** Select short season, 'cold' tolerant varieties or small-fruited varieties.



# Turnips

## Site Characteristics:

Turnips are a cool season crop.

- Sun exposure – Full sun
- Soil condition – Tolerant of a wide variety of soils provided it is well amended. If needed, side dress with fertilizer when plants are 1/3 grown.
- Irrigation needs – Keep soil uniformly moist.
- Mulching – Can mulch but not necessary

## Plant Traits

- Size/spacing – Varies.
- Bloom time – n/a
- Flower color – n/a
- Root depth – Moderate



## Growing Information

- How to plant – Plant early when soil can be worked. Thin as needed.
- Maintenance – Side dress as needed. As the crop grows cover the roots to prevent discoloration.
- Harvest – Harvest at mature size. The greens can also be harvested and eaten; some varieties only produce greens.
- Pests – Flea beetles, root maggots
- Diseases

**Mountain Communities:** Turnips can be a great choice for mountain growing.

# Winter Squash

## Site Characteristics

Winter squash is typically harvested at the end of the growing season. Varieties include butternut, acorn, delicata.

- Sun exposure – Full sun
- Soil condition – Prefers a light soil but tolerates a well amended soil. High nutrients levels are beneficial.
- Irrigation needs – Water regularly. Don't let your plants dry out, can cause fruit to be deformed. plants will wilt during hot days, if they recover they are getting sufficient moisture.
- Mulching – Winter squash respond well to black plastic mulch to help warm the soil.

## Plant Traits

- Size/spacing – Large plants 2-4' wide
- Bloom time – Summer
- Flower color – Yellow
- Root depth – Shallow to moderate

## Growing Information

- How to plant - It is possible to either direct sow or plant transplants. Be sure to transplant when the plant is still small (3 weeks old). Make hills to raise soil temperatures. If direct sowing plant several seeds in each hill, thin once seedlings have germinated successfully.
- Maintenance – Squash produce male and female flowers. Typically, there will be male flowers before female, eventually both flowers will appear simultaneously.
- Harvest - For winter squash, fruit must remain on the plant until the vines have been frost killed and until the fruit is mature (also when the rind cannot be penetrated by the thumbnail and the shell is quite hard). Leave part of the stem attached and cure for about ten days at temperatures from 80°F to 85°F. An exception to this process is acorn squash, which should not be cured.



- Pests – squash bug, harlequin bug
- Diseases – powdery mildew

Mountain communities: very hard to grow unless short season variety grown under cover.



# Insects



## Pesticide Use

Insects are often more of a disfiguring nuisance in vegetable gardens than an actual threat to yield. For home gardeners, the level of tolerance to insect disfiguration is a matter of personal acceptance. Tomato hornworms can be very alarming due to their size and voracious appetites. It should be remembered that some crops can have up to 30-50% of their foliage removed without significant reduction in yield.

The frontline controls for insects in a home vegetable garden should be sanitation and exclusion. Sanitation methods include:

- Remove debris and clean areas where insects might overwinter.
- Remove harmful insects by hand picking or washing them off the plant with a stream of water.

It is important to understand the lifecycle of pest insects; it is especially important to know which phase of the lifecycle is harmful. For example, the caterpillar phase may be damaging due to feeding while the adult moth or butterfly phase may provide beneficial pollinators.

Many of today's pesticides are destructive to beneficial insects including pollinators. Be careful when using these products in your garden. First, identify the pests and determine if chemical control is warranted. For example, flea beetles on radish leaves won't hurt the crop at all. If none of the natural or mechanical methods of control are working and the problem is getting worse, select the correct pesticide and carefully follow the directions on the label. Do not assume that pesticides used on ornamentals are safe for food crops, including fruit trees and shrubs used in the landscape. If the label does not list the crop you wish to protect, do not use that chemical.

Read the entire label and observe the waiting period before harvest. Be sure to read the warnings and cautions. To repeat, some chemicals can harm honeybees and other beneficial insects.

Be aware of accidental over-spraying of ornamental sprays near vegetable gardens. This may contaminate your food crops.

Information about chemicals listed in this booklet, e.g., *Bacillus thuringiensis* (Bt), is based on information from major manufacturers of pesticides and/or from CSU fact sheets.

**Many pesticides are destructive to beneficial insects including pollinators.**

**Read the complete label and follow the directions carefully.**

**Note on the label the number of days to wait to harvest your food after using a pesticide.**

# Table 2: Insect Diagrams

**Table 2. Common Garden Insects - Descriptions, Symptoms and Management Options**

Insect	Diagram <i>(not to scale)</i>	Description	Plant Symptom	Prevention and/or Management Options
Aphid		Soft-bodied, rounded or pear-shaped, seldom over 1/8 inch long. Pale colored, usually light green, but has wide range of colors. May be winged.	Distortion or curling of leaves, Sticky honeydew substance on leaf surfaces. Loss of plant vigor. Light spots on leaves. Curled leaves turn limp or die. Die-back of stems.	Hose off with strong spray of water. Hand pick or treat with insecticidal soap. Yellow sticky traps may help. Mulch peppers with aluminum foil. Remove unhealthy plants.
Aphid, Asparagus		Pale green, no cornicle at hind end like other aphids. Difficult to see.	Stunted plant, bushiness of leaf stalks. "Witches broom" new growth. Dormant buds on stems released early. Young plants may die.	Remove leaf stalks from last year (eggs overwinter in them). Insecticidal soaps may work in early stages, but if large populations are present, aphids are fairly protected.
Aphid, Cabbage or Turnip		Cabbage aphid has powdery, waxy covering. Turnip aphid does not have covering. Both are similar otherwise. Pale grayish green.	Stunting and wilting of plant. Leaves curl and die.	Inspect plants frequently for these pests. Turnips die quickly with large infestations. Hose off or hand-pick. Insecticidal soap may help. Destroy garden debris.
Aphid, Corn Leaf		Aphids may cover tassels and upper leaves.	Sticky honeydew build-up. Corn leaves and tassels may wilt with yellow or dead areas. Mold growing on honeydew makes leaves look purplish-black.	Doesn't affect yield; just cosmetic injury. Aphid population disappears right after tassels form. Hose off with strong jet of water. No need for insecticides.
Aphid, Pea		Soft-bodied, larger than most aphids, green. May develop wings.	Wilting. New growth may die back. Sticky substance on leaves. Leaves curl, especially on terminal growth.	Hose off with strong jet of water. Soaps and detergent sprays may help. Usually controlled by natural enemies.
Beetle, Asparagus		Adult feeds on spears; black-headed gray grub- like larvae feed on fern tips. Shoots blackened by eggs. Adult blue-headed, 1/4" black body with red-margined yellow spots.	New spears look chewed. Whitish lead stalks. Shoots may be blackened. Pits chewed in spears cause a crook in spears. Reduced plant vigor.	Well-established plants aren't severely injured. Larvae can be sprayed off with a strong jet of water or hand remove. Remove plant debris before winter.

Table 2 (continued). Common Garden Insects - Descriptions, Symptoms and Management Options

Insect	Diagram (not to scale)	Description	Plant Symptom	Prevention and/or Management Options
<b>Beetle, Colorado Potato</b>		Orange and black-striped beetles. Orange and red larvae, 3/5" long, humpbacked, feed on leaves and stems. Most damage occurs in warm weather.	Large area chewed in leaves. Orange eggs on underside of leaves. Stems chewed. Decreased plant vigor.	Hand-pick beetles. Bt can be used on larvae. If available, choose early varieties. Till deeply in fall.
<b>Beetle, Flea</b>		Shiny black 1/16" to 1-1/4" long beetle. Jumps like a flea when disturbed. White, worm-like larvae feed on plant roots.	Leaves appear to be shot full of tiny holes, especially on seedlings. Problems begin early. Small pits in leaves. Retarded seedling growth. Plants may die.	Clean up debris. Rotenone or diatomaceous earth are good controls. Radishes can be used as a trap crop. Use transplants or cover seeds with transplant caps.
<b>Beetle, Mexican Bean</b>		Copper-colored ladybug-sized beetle with 16 black spots on back. Yellow-bodied larvae with yellow spines. Eggs laid in orange-yellow clusters on underside of leaves.	Leaves brownish, chewed. Skeletonized leaves and pods. Most damaging to yield at flower and early pod stages.	If you see what looks like a ladybug feeding on bean plants, it's probably his beetle instead. Pick off adults, crush eggs. Shouldn't affect yield.
<b>Beetle, Spotted Asparagus</b>		Reddish-brown with 12 black spots on its back. One-half to 1½ inches long. Larvae have orange bodies.	Ferns and new spears look chewed. Whitish ferns. Shoots may be blackened. Pits chewed in spears cause a shepherd's crook.	Well-established plants aren't severely injured. Larvae can be sprayed off with a strong jet of water.
<b>Beetle, Spotted Blister</b>		Black, long legs. One-half inch long. Dense grayish covering. Black shows through as spots.	Leaves eaten late in season.	Hand pick wearing gloves. Beetles can produce a toxic chemical that raises blisters on human skin.
<b>Beetle, Spotted Cucumber</b>		Greenish-yellow with black head and 11 black spots on back. One-quarter inch long. Larvae are ½ inch long, yellowish white with brown heads. Feed on roots and stems.	Fruits tunneled into. Sudden wilting. Small pits chewed in seedlings.	Make thick planting, then thin survivors to desired population. Keep fruit off ground with mulch. Limit watering as fruit ripens. Remove mulch in fall. Till in early spring.
<b>Beetle, Striped Cucumber</b>		One-quarter inch long, yellow to orange-yellow, 3 straight stripes on back, rows of small depressions on wings. Larvae feed on roots of cucumber plants.	Same as Spotted Cucumber Beetle: pitting of fruit. Watermelon-scarring on bottom of fruit and leaves. Flowers look chewed.	Make thick planting, then thin survivors to desired population. Keep fruit off ground with mulch. Limit watering as fruit ripens. Remove mulch in fall. Till in early spring.

Table 2 (continued). Common Garden Insects - Descriptions, Symptoms and Management Options

Insect	Diagram (not to scale)	Description	Plant Symptom	Prevention and/or Management Options
Beetle, Japanese		Oval, 7/16ths-inch metallic green and copper scarab beetle. Five tufts of white 'hair' along irth side of rear abdomen. Adults feed on over 300 host plants, larvae feed on grass roots.	Skeletonized leaves, chewed flowers and buds. Damage may be concentrated in area of plant; Japanese beetles often cluster together, but individuals damage plant too.	Scout twice daily, knock adults into jar of soapy water. Various insecticides are labeled for use but are harmful to pollinators. Bt galleriae is effective with very low risk to pollinators.
Borer, European Corn		Larvae are ¾ to 1 inch long, grayish with dark head, two small dark spots on each abdominal segment. Eggs laid near midrib on underside of leaves in clusters.	Bean pods, peppers, corn ear tips and stalks tunneled into. Small corn plants wither and die. Stalks break. Small ears. Leaves chewed.	Hose off with strong jet of water in mid-late June right after egg hatch. Plant as early as possible with resistant varieties.
Borer, Squash		Larvae are white with brown heads. One inch long when full grown. Adult has bright orange/red abdomen with black stripes. Front wings covered with orange scales.	Vine suddenly wilts and dies. Leaves fold on mature plants and plants collapse.	No remedy. Borer has entered main stalk of plant and cut off its circulatory system. Destroy plant. A preventive spray can be applied to plant at six-inch height.
Bug, Harlequin		Shield shaped, 3/8ths-inch brightly colored bug in black and orange-red. Nymphs also have white banding on abdomen. Eggs are barrel-shaped, white with black bands laid on underside of leaves. Prefer cruciferous crops.	Leaves stippled, have light-colored cloudy or dead patches. Plant wilt, stunting, failure to produce head, plant death.	Sanitation in fall to remove plant debris. Trap crops of mustard plants. Control mustard weeds, like blue mustard, pigweed, lambsquarters. Crush egg masses, knock adults into jar of soapy water.
Bug, Pill/Sow		Not true insects. Light to slate gray colored, ½ inch long. Segmented bodies roll up into a pill when disturbed.	Carrot roots tunneled into at or near the shoulder.	Plants usually outgrow the damage. Bugs can be trapped under boards placed in the garden—pick and destroy. Clean up weeds and garden debris.
Bug, Squash		Black with orange and brown abdomen, ½ inch long. Shiny brown eggs laid in groups on underside of leaves. Nymphs are pale green, turn brown. Feed on leaves.	Leaves and stems wilt. Fruit doesn't develop or may be wounded. Leaves ragged, may drop and turn black.	Locate and crush eggs under leaves. Bugs will hide under boards at night. Collect and destroy. Resistant to most insecticides. Remove all plant debris in the fall.
Bug, Stink		Green, ½ to 2/3 inch long, shield shaped bug. White, barrel-shaped eggs laid in clusters of 10-30 on undersides of leaves darken as they mature. Feed on tomato, pepper, eggplant fruit.	Injury to fruit. Green fruit shows dark spots with yellow halos; ripening fruit yellow or white, hard, calloused areas under skin. Misshapen or shrived fruit or entire fruit looks yellowed.	Scouting early in season crucial, as control should begin early. Hand pick adults, nymphs, and eggs, knocking into jar of soapy water. Control weeds around perimeter of garden.

Table 2 (continued). Common Garden Insects - Descriptions, Symptoms and Management Options

Insect	Diagram (not to scale)	Description	Plant Symptom	Prevention and/or Management Options
<b>Cabbage Worm, imported</b>		Caterpillars 1 inch to 1½ inches long, pale green with numerous spots. Body covered with fine hairs, dark strip down back. Row of yellow spots along each side.	Large, ragged holes in leaves. Holes chewed in heads of crucifers.	Hand pick. Hose off with water. Insecticides effective on your caterpillars. Bt is effective. Plant early plantings. Mulches provide cover for natural predators.
<b>Cabbage Looper</b>		Green caterpillar, 1 inch long. Walks with a looping motion. White stripes.	Large, ragged holed in leaves. Holes chewed in heads of crucifers.	Susceptible to Bt. Tilling garden debris kills overwintering pupae. Insecticides are effective on young caterpillars. Hand pick or hose off.
<b>Cutworm</b>		Larvae are gray/brown to nearly black, 1 to 1½ inches long. Found in top 2 inches of soil around damaged plant. Worms coil when disturbed.	Seedlings cut off at ground level. Leaves chewed. Potato tubers are chewed.	Surround young plants with paper cup with bottom cut out, leaving 1 inch or so above soil surface. Remove when plant is older. Bt is effective. Rotate crops. Till in Fall.
<b>Earworm, Corn</b>		Young larvae are white with black heads. Mature, green/black; to 1½ inches long. Two dark lines down back; yellowish orange head. Larvae feed on leaves, tassels, silks and ears.	Kernels on tips of ears are eaten away. Eggs on leaves of young plants and later on corn silks. Peppers: fruits chewed and tunneled into.	Resistant to most insecticides. Can inject mineral oil into silks after pollination. If using insecticides, put on ear tips from time first silks appear to when they turn brown. Bt okay.
<b>Grasshopper</b>		Greenish-tan; long hind legs, winged. Will jump when disturbed.	Leaves with crescent-shaped portions eaten out. Corn not all kernels in the ears are full.	Till garden every fall. Apply baits to weedy areas where they breed. Keeping weedy areas moist will keep grasshoppers out of garden.
<b>Hornworm, Tobacco/Tomato</b>		Very large green caterpillar, white stripping down the sides, horn at hind end. Three-fourths inch long.	Large areas chewed in leaves. Rapid defoliation – can strip a tomato plant in a day!. Fruits may be chewed.	Inspect plants frequently. When you find hornworms, pick them off and destroy them. Easier to find in morning— look on healthy leaves next to chewed ones. Bt effective.
<b>Leafhopper</b>		Greenish with faint white spots on head. One-fourth inch long and winged. Found on underside of leaves.	White dots on leaves, followed by yellowing and eventually browning. Leaves die back at edges and appear scorched. Yield is not affected too much.	Use reflective mulches. Overhead irrigation. Early plantings. Keep garden weed free.

Table 2 (continued). Common Garden Insects - Descriptions, Symptoms and Management Options

Insect	Diagram (not to scale)	Description	Plant Symptom	Prevention and/or Management Options
Leafminer		Usually white, 1/8 inch to 1/2 inch long. Feeds between upper and lower leaf surfaces. Tear leaf apart to see larvae. Adult flies lay eggs on underside of leaf surface.	Serpentine or dark, blotchy, gray areas on leaves.	Remove and destroy damaged leaves. Destroy egg masses on underside of leaf. Fine screening keeps adults from laying eggs on leaves. Fall and early spring plantings will avoid infestations.
Maggot, Cabbage or Radish		White, 1/4 inch long, blunt at one end, pointed at the other.	Stems and roots tunneled into. Sudden wilt in warm weather.	Avoid planting radishes in old cabbage ground. Destroy wounded plants.
Maggot, Onion		White, blunt at one end, pointed at the other. One- third inch long.	Young transplants collapse and die. Older plants are more susceptible to bulb rot after being wounded by maggots.	Rotate crops. Minimize watering. Clean up debris. Till in the fall to expose overwintering pupae to predators. Avoid intensive use of organic matter.
Maggot, Seadcorn		Larvae are 1/4 inch long, whitish/yellow. Adults are common small gray flies. Maggots feed on germinating seeds, tubers, decaying plants.	Poor seedling emergence. Scarred seedlings. Damage occurs mid to late May during cool temperatures. Seedlings become weakened	Avoid early plantings. Plant seeds when soil has warmed up. Avoid heavy use of animal manures. Don't over water. Yellow sticky traps may work.
Mite		Tiny, red, 8-legged arachnid, appear as tiny speck on underside of leaf. Hold piece of paper under leaf, then shake plant. Observe walking specks that fall on paper	Small, white flecking injuries. Premature leaf drop on heavily infested plants. Bronzed foliage. Fine webs on plants, reduced plant vigor. Thrive in hot, dry weather.	Hose off with strong spray of water. Mites infest weak plants. Provide good culture and sufficient moisture. Avoid chemicals (most will kill beneficial insects too). Insecticidal soaps okay.
Moth, Diamondback		Caterpillar stage is green, 1/4 inch long. When disturbed, will wriggle so much that it falls to ground.	Large, irregular holes chewed in leaves.	Till garden debris in fall to kill overwintering pupae. Hand pick. Becoming resistant to many insecticides.
Psyllid, Potato		Black and white banded, winged adult lays orange/yellow eggs on underside of leaf. Young are tan/green, flattened, scale-like. Sugary droppings on underside of leaf.	Reduced yield. Tuber skin rough. Stunted growth. Large, irregular holes chewed in leaves	Uncontrolled damage will result in inferior yield and low quality fruit. Early plantings avoid injury. Insecticidal soap or sulfur dust on underside of leaf will help control.

Table 2 (continued). Common Garden Insects - Descriptions, Symptoms and Management Options

Insect	Diagram (not to scale)	Description	Plant Symptom	Prevention and/or Management Options
Pysllid, Tomato		Black and white banded, winged adult lays orange/yellow eggs on underside of leaf. Young are tan/green, flattened, scale-like. Sugary droppings on underside of leaf.	Stunting. Leaves small, narrow, stand upright; may curl, turn yellowish purple with purple veins. Little or no fruit set. Poor yield. Small, mealy-textured fruit.	Early planting may help avoid injury. Use insecticidal soap or sulfur dust on underside of leaf to control. Insecticidal control not recommended for peppers.
Rootworm, Western Corn		Yellowish-green beetle-like adult. Larvae are wrinkled, threadlike, white with dark head.	Corn stalks blow over by July. Larvae feed on roots at base of plant. Corn silks are chewed and clipped by adults. Squash: scars on developing fruit.	Plant corn early. Late plantings are more tender and more sought after by the insect. Rotate crops - very important.
Slug		Soft, slimy, like snail without shell. Gray/brown, 1/4 to 4 inches long. Leaves glistening, slimy trail. Night feeder. Hides in daytime under refuse in damp places.	Poor seedling emergence. Later in season leaves are chewed and ragged, noticeable in early morning but no slugs in sight.	Decrease excess moisture. Increase air movement. Avoid organic mulches, eliminate debris. Trap at night under boards and newspapers or use a pan of sugar water and yeast mixture. Won't cross copper barrier.
Thrips, Onion		Young are tiny, winged, milky white insects. Hard to see with the naked eye. Later turn green with red eyes. Feed on tender parts of center leaves. Takes a lot of thrips to do any damage.	Scarring wounds on leaves, small white spots. Vegetables are smaller than normal.	Powerful overhead irrigation can destroy thrips. If they are exposed on leaves, insecticidal soap is effective. Otherwise, hard to control. Plant resistant varieties.
Whitefly		Adults are small, wedge-shaped white insects. Fly like snowflakes when disturbed. Young are pale green, rounded, flat, stay motionless under leaf.	Weak plants with sticky honeydew present. Light colored spots on leaves. Leaves wilt.	Check transplants when purchasing. Yellow sticky traps catch adults. Insecticidal soap and oil sprays effective on leaf undersides to kill nymphs. Use light-colored mulch.

**Remember, reducing insecticide use is the best way to conserve beneficial insects and pollinators.**

# Table 3: Insect - Vegetable Host Matrix

Table 3. Insect - Vegetable Host Matrix

	Aphid	Aphid, Asparagus	Aphid, Cabbage/Turnip	Aphid, Corn Leaf	Aphid, Pea	Beetle, Asparagus	Beetle, Colorado Potato	Beetle, Flea	Beetle, Mexican Bean	Beetle, Spotted Asparagus	Beetle, Spotted Blister	Beetle, Spotted Cucumber	Beetle, Striped Cucumber	Beetle, Japanese	Borer, European Corn	Bug, Harlequin	Borer, Squash	Bug, Pill/sow	Bug, Squash	Bug, Stink	Cabbage Worm, imported	Cabbage Looper	Cutworm	Earworm, Corn	Grasshopper	Hornworm	Leafhopper	Leafminer	Maggot, Cabbage/Radish	Maggot, Onion	Maggot, Seedcorn	Mite	Moth, Diamondback	Psyllid, Potato	Psyllid, Tomato	Rootworm, Western Corn	Thrips, Onion	Slugs	Whitefly		
Asparagus	*	*				*				*				*									*																		
Beans	*				*			*	*			*		*	*	*				*			*		*		*				*	*						*	*	*	*
Beets	*										*												*			*	*												*	*	*
Broccoli	*		*				*							*								*	*	*		*							*					*	*		
Brussels Sprouts	*		*				*							*								*	*	*										*				*	*		
Cabbage	*		*				*							*								*	*	*		*			*								*	*			
Carrots	*																*						*		*		*										*	*			
Cauliflower	*						*								*							*	*	*		*		*	*					*				*			
Celery	*																										*	*													
Chard	*																								*	*															
Collards	*		*				*							*	*	*					*	*	*			*	*														
Corn	*			*			*				*	*	*	*	*				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Cucumbers	*						*				*	*	*	*	*				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Eggplant	*						*				*	*	*	*	*				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Horseradish	*						*							*								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Artichokes	*													*								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Kohlrabi	*						*							*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Leeks	*						*							*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Lettuce	*						*							*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Melon	*						*				*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Onions	*						*				*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Parsnips	*						*							*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Peas	*			*			*							*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Peppers	*					*	*				*	*	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Potatoes	*					*	*			*	*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pumpkins	*					*	*			*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Radishes	*					*	*			*	*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Rhubarb	*					*	*			*	*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Spinach	*					*	*			*	*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Squash	*					*	*			*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tomatoes	*					*	*			*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Turnips	*	*				*	*			*	*	*	*	*	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

# Table 4: Disease Management



**Table 4. Disease Symptoms, Prevention and Management**

Name of Disease/Symptom	Management and/or Prevention
<p><b>ALTERNARIA LEAF SPOT</b> – Also known as <b>Early Blight</b>. Dark brown to black concentric spots on foliage (spots are yellow on cole crops), usually on upper leaf surface. May cause black cankers on roots. Seedlings may be stunted or killed. Fruit may become brown. Spots generally start on lower leaves and appears to move up the plant.</p>	<p>Caused by a fungus, <i>Alternaria alternata</i>. Rotate crops. Remove old garden debris. Irrigate properly. Be sure soil is well drained. For tomatoes, nitrogen management is critical as nitrogen deficiencies can exacerbate Early Blight on tomatoes. Fungicides may be available, be sure to read the label.</p>
<p><b>ANGULAR LEAF SPOT</b> – Angular, irregularly- shaped brown spots on leaves between veins. Spots turn gray &amp; tear out, leaving crusty, white, ragged leaves. Small water-soaked spots on fruit may cause decay.</p>	<p>Often caused by a bacterium. Do not irrigate from overhead. Use healthy seeds. Rotate crops. Destroy diseased plants. Use resistant varieties if available.</p>
<p><b>ANTHRACNOSE</b> – Yellow to brown irregular spots on leaves. Elongated dark spots with light centers on petiole and stems. Circular, watery.</p>	<p>Caused by several genera of Fungi. Prevalent in cool, moist weather. Survives in plant debris for two years. Destroy infected plants. Rotate crops yearly. Don't disturb planting area when it's wet. Use disease-resistant types. Fungicides may be available.</p>
<p><b>ASTER YELLOWS</b> – Yellow, dwarfed, twisted new leaves; red/purple outer leaves. Tufts of dense, hair-like roots. Bushy new growth. Dark spots along central leaf vein. Head fails to form. Symptoms on carrots are purplish leaves and hairy roots.</p>	<p>Phytoplasma spread by aster leafhopper (look for 6 dark spots on front of head). Reflective mulches may help. Keep garden weed-free. Destroy plants. Insecticides may be available for leafhopper management, but no pesticides are available for the Phytoplasma.</p>
<p><b>BACTERIAL BLIGHT</b> – Leaves have brown, water- soaked spots with yellow border that change to irregular, dead, brown spots. Bean pods show circular, water-soaked spots that ooze yellow masses, changing to reddish-brown spots.</p>	<p>Caused by either <i>Pseudomonas</i> or <i>Xanthomonas</i> spp. Likes moist, warm weather. Destroy plants. Plant resistant varieties and rotate crops every three years. Avoid overwatering. Use certified, disease-free seed.</p>
<p><b>BLACK LEG</b> – Black, oval sunken areas at base of stem girdle and kill plant. Leaves wilt and die but remain attached to stem; bluish-red edges. Tiny black specks on cankers. Potatoes: yellow, stunted leaves curl upward.</p>	<p>In cruciferous crops, this is caused by the fungus <i>Phoma lingam</i>. In potato, black leg is caused by bacteria in either <i>Dickeya</i> or <i>Pectobacterium</i> spp. Remove diseased plants. Rotate crops yearly. Plant disease-resistant varieties. Sanitation important. Potatoes: cut seed tuber with disinfected knife.</p>
<p><b>BLACK ROT</b> – Yellow, angular spots progressing inward from leaf edges. Veins are black. Black discoloration in stem when cut lengthwise. Fruit may be deformed.</p>	<p>Rotate crops if possible. Discard infected plants. Avoid overhead irrigation. Use certified, disease-free seed. Plant resistant varieties. Caused by <i>Xanthomonas</i> spp. In cruciferous crops.</p>

**Table 4 (continued). Disease Symptoms, Prevention and Management**

Name of Disease/Symptom	Management and/or Prevention
<p><b>BOTRYTIS LEAF BLIGHT &amp; NECK ROT</b> – White specks/white sunken spots on foliage; soft bulb at neck with sunken, spongy tissue, usually develops at harvest and storage. May have brown-purple dead areas on foliage. Top dies in a week.</p>	<p>Caused by <i>Botrytis cinerea</i>. Rotate crops, remove old debris. Avoid injury to bulbs at harvest. Often a storage problem, so proper storage (provide good aeration, dry location and temperature of 34° to 36°F) is important.</p>
<p><b>BEET CURLY TOP VIRUS (BCTV)</b> – New growth is small, brittle, discolored. Curled leaves, can be purplish. New growth can also exhibit bunching. Poor yield.</p>	<p>Transmitted by beet leafhoppers. Overhead irrigation will reduce population. Older plants less sensitive to effects of the disease. Not common in the Front Range of CO, more common on the Western Slope. Floating row covers can be used to protect plants during leafhopper flight.</p>
<p><b>DAMPING OFF</b> – Soft rot of stems in seedlings. Seedlings fail and die, or they fail to emerge at all. Most likely to occur during a damp spring. Discolored, rotted and water-soaked roots.</p>	<p>Caused by several species of fungi or fungal-like organisms. Prior to planting, treat seeds and/or seedbed with protective fungicide. Don't plant too early. Raised beds may help. Rotate crops. Till deeply.</p>
<p><b>DOWNY MILDEW</b> – Yellow spots on upper leaf surface. Whitish or light gray mycelium on lower leaf surface. Spots turn brown. Leaf dies. Stunted fruit. Favored by cool, moist weather.</p>	<p>Rotate crops. Remove old crop debris. Plant on recommended dates—not too early. Water crops in the morning. Avoid overcrowding. More common in greenhouses with high humidity.</p>
<p><b>FUSARIUM BASAL ROT</b> – Inner neck tissue of bulb feels soft. When onion is cut, semi-watery decay is found. Tops may turn yellow and wilt. Symptoms may not occur until storage.</p>	<p>Affects Alliums, cause by the fungus <i>Fusarium oxysporium</i> f. sp. <i>cepae</i>. Enters plant through areas injured earlier. Most severe when plants are grown in poorly drained soil and stored where humidity is high. Harvest promptly; destroy infected bulbs.</p>
<p><b>FUSARIUM WILT</b> – Also known as <b>Fusarium Yellows</b>. Stunting, yellowing, sudden wilting and dying on one side of plant or one or on one shoot. Lower leaves yellow then die. Reddish discoloration inside stem at soil line. Roots appear brown.</p>	<p>Caused by <i>Fusarium oxysporum</i> f. sp. <i>niveum</i>. Can survive in soil for many years. Crop rotation important. Some varieties more resistant than others. Plant “VFN” plants. Sanitation, deep tillage and well- drained soil important. Affects solanaceous and other crops.</p>
<p><b>NEMATODES</b> – Wilting, stunted plants, pale, green/yellow leaves. Reduced yields. Knots or galls on roots. Rotting roots later in season.</p>	<p>Crop rotation, plant resistant varieties (“VFN”). Be sure your soil is well drained. Nematodes prefer sandy soil. Add organic matter.</p>
<p><b>PHYTOPHTHORA</b> – Dieback of leaves from edges, sudden wilting, root rot may occur. Dead areas on stem near soil line. Dead, blotchy areas on fruit. May have white mold on leaves. Infected seeds turn dark and shrivel.</p>	<p>Rotate crops. Well-drained soil and raised beds help. Till deeply in the fall. Good sanitation is important. Avoid excess nitrogen. Not common in Colorado.</p>
<p><b>PINK ROOT</b> – Affected roots turn yellow, pink to brown, shrivel and die. New roots continue to be killed. Bulbs are reduced in size and are rotting. Leaves may show tip dieback.</p>	<p>Caused by the fungus <i>Phomo terrestris</i>. Can survive in the soil for several years. Use resistant varieties. Discard infected plants. Crop rotation is very important. Deep tillage. Well- drained soil.</p>

**Table 4 (continued). Disease Symptoms, Prevention and Management**

Name of Disease/Symptom	Management and/or Prevention
<b>POWDERY MILDEW</b> – White coating on leaves and stems. Severely infected leaves shrivel and die. Fruits may be small and deformed. Infected plants are yellow and stunted.	Thrives in the humid plant canopies. Destroy infected plants. Don't overwater. Use sulfur dust on leaves. Avoid overhead irrigation. Don't crowd. Avoid heavy applications of fertilizer.
<b>PURPLE BLOTCH</b> – Brown to purple sunken spots on leaves, yellow border. Eventually turn yellow and wilt downward. Dark purple areas on fruit. Losses are greatest in storage. Bulbs can become infected through neck wounds.	Most common in Alliums. Caused by the fungus <i>Alternaria porri</i> . Plants weakened by thrips are most vulnerable. Manage thrips. Rotate crops, use sanitation and weed management. Proper storage important.
<b>RHIZOCTONIA</b> – Sickly yellow leaves, purplish border at vine tip. Discoloration in center of stem. Sunken, reddish cankers on seedlings and roots. Fruit may get yellowish-brown sunken spots that rot.	Soilborne fungus, no practical management. Causes root rots, stem rots, damping-off and, in some cases, leaf blights. Destroy infected plants. Plant resistant varieties next time. Plant at proper time. Rotate crops. Soil should be well drained.
<b>RUST</b> – Blister-like pustules on leaves may be surrounded by yellow border. Contain orange (usually) powdery spores. Growth slow. Upper leaf surface may have yellow spots. Orange or yellow blisters on lower leaf. Early death of plant.	Caused by rust fungus. Destroy infected parts or entire plant. Don't irrigate overhead. Fungus over winters in crop residue. Remove old residue. Use raised beds. Till deeply in fall. Purchase resistant varieties.
<b>SEPTORIA LEAF SPOT</b> – Spotting dieback of leaves. Numerous small gray circular leaf spots with dark border. Black specks inside the circles.	Often affects tomatoes. Caused by the fungus <i>Septoria lycopersici</i> . Survives in diseased plant residue. Sanitation and crop rotation are very important.
<b>SMUT</b> – Large gray/black puffy balls in corn stalks, tassels or ears during hot, dry weather. Seedlings become twisted and streaked with dark brown blisters filled with spores.	Caused by the fungus <i>Ustilago maydis</i> . Cut off as they appear and destroy. Left alone, they will produce spores that are viable for 4 to 5 years. Plant smut-resistant varieties next time.
<b>TOBACCO MOSAIC VIRUS (TMV)</b> – Light yellow, puckered, mottled leaf. Runners twisted, stand upright. Stunted growth. Fruit distorted, misshapen blistered. Leaf curl; few blossoms. Sudden wilting.	Transmitted mechanically (hands, pruning tools, etc.). Destroy plants. Rotate crops. Smokers, wash hands with soap and water before handling tomato plants. Plant resistant varieties. Keep garden weed-free. Practice good sanitation.
<b>TOMATO SPOTTED WILT VIRUS (TSWV)</b> – Faded yellow blotches or brown spots on leaves. Brown spots and streaks on leaf stalks and stems. Plants stunted and wilted, new growth small and discolored. Fruits show discolored rings. Roots appear healthy.	Throw away diseased plants. Spread by thrips especially in greenhouse. Overhead irrigation may kill thrips. If possible, remove living unaffected plants from area. Start with clean transplants. Insecticides are available for thrips management.
<b>VERTICILLUM WILT</b> – Plants wilt, roots appear brown. Same symptoms as Fusarium Wilt but whole plant is affected, not just one side. Leaves on bottom turn yellow, wilt and drop. Higher leaves turn upward.	Caused by the soilborne fungi <i>Verticillium dahlia</i> or <i>V. albo-atrum</i> . Destroy plants. Plant resistant varieties ("VFN"). Rotate crops.
<b>WHITE MOLD</b> – Water soaked spots on foliage, branches and pods, becoming covered with white substance with black dots. Favored by cool, moist weather after flowering. Fruit may have a soft, watery rot.	Caused by the fungus <i>Sclerotinia sclerotiorum</i> . If possible, next time rotate crops with corn or other grain. Plant resistant varieties. Be sure soil is well drained.

# Table 5: Disease - Vegetable Host Matrix



Table 5. Vegetable/Disease Matrix

	Alternaria	Angular L. S.	Anthraxnose	Aster Yellow	Bacterial Blight	Black Leg	Black Rot	Botrytis L. B...	BCTV	Damping Off	Downy Mildew	Fus. Basal Rot	Fusarium Wilt	TMV	Nematodes	Phytophthora	Pink Root	Powdery Mildew	Purple Blotch	Rhizoctonia	Rust	Septoria	Smut	TSWV	Vert. Wilt	White Mold	
Asparagus													*		*	*					*					*	
Beans		*	*		*					*			*	*	*					*	*						*
Beets									*																		
Broccoli	*					*	*			*							*										
Brussels Sprts.	*					*	*																				
Cabbage	*					*	*			*	*		*		*	*											
Carrots	*			*						*	*			*	*	*											
Cauliflower	*					*	*								*	*											
Celery				*						*																	
Chard																											
Collards																											
Corn										*												*		*			
Cucumbers	*	*	*							*	*		*	*	*	*		*		*	*						*
Eggplant	*			*						*			*	*	*	*										*	
Horseradish																											
Jer. Artichokes																											
Kohlrabi																											
Leeks								*												*							
Lettuce										*	*			*	*										*		*
Melon	*	*	*							*	*		*	*	*	*		*									
Onions				*				*		*	*	*			*	*	*		*	*				*			
Parsnips																						*					
Peas					*				*	*				*	*			*									
Peppers	*													*	*	*									*		
Potatoes	*			*		*							*		*	*		*		*	*					*	*
Pumpkins																											
Radishes																											
Rhubarb			*																								
Spinach			*							*						*						*					
Squash		*	*							*			*	*		*		*									
Tomatoes	*		*						*	*			*	*		*							*		*	*	*
Turnips																											

# Table 6: Environmental Disorders

Table 6. Environmental Disorders, Causes, Prevention and Management

NOTE: See Table 7. Vegetable/Symptom Matrix for which crops are affected

No.	Environmental Symptom	Cause, Prevention, and/or Management
1	Poor seedling emergence	Planting too deep, incorrect planting time for that vegetable, soil crusting due to lack of water, poor seeds. Also could be caused by damping off (see Disease Charts), or slugs or cutworms (see Insect Charts).
2	New leaves twisted, puckered. Irregular browning. Fruit twisted, deformed or scarred.	Check for insects such as aphids. Potential herbicide damage if spraying was done recently for weeds near the garden. Avoid using same sprayer for other pesticides as for herbicides.
3	Retarded growth, seedlings wilt and die. Vines yellow, foliage burned at edges. Leaves curl in toward central vein. Afternoon/evening wilt of foliage.	Drought stress from winds, prolonged hot weather, lack of moisture at root level. Using a mulch may help, along with maintaining a regular irrigation schedule, especially during drought.
4	Entire leaves chewed, stems remain.	Possible insects such as grasshoppers. Possible rabbits - Put up a one-foot high, small gauge fence, anchored at the bottom.
5	Leaves turn yellow between veins, later will turn completely yellow. Usually no dead areas.	Could be an iron deficiency. Chelated iron applications may help.
6	Bottom leaves are light green, pale yellow. May drop off. New leaves are small. Slender, fibrous, hard stems.	Could be nitrogen deficiency. Apply nitrogen fertilizer as a side-dressing.
7	Afternoon wilting.	Usually is not a problem. Some types of vegetables, mostly ones with larger leaves, may wilt in afternoon and are fine the next morning. Check soil by digging test hole. Soil should be moist. If not, irrigate.
8	Sudden wilting. Leaf edges and areas between veins turn dark brown and die. May drop off. White crust on soil.	May be caused by salt injury. Try increasing amount of water applied at one time to leach salts from soil. When preparing to plant, make sure the soil drains well. Avoid manures and other salty amendments.

Table 6 (continued). Environmental Disorders, Causes, Prevention and Management

NOTE: See Table 7. Vegetable/Symptom Matrix for which crops are affected

No.	Environmental Symptom	Cause, Prevention, and/or Management
9	Flowers but no fruit.	Some vegetables produce male flowers before female flowers. Be patient. If flowers of both sexes are present but still no fruit set, cause may be excessive heat/cool, or rainy weather during flower formation or lack of pollinating insects. Use a blossom-set hormone or hand-pollinate, moving pollen with a small paintbrush.
10	Leaves shredded or entirely stripped. Wounds or deep gouges in fruit and stems	Hail damage. Prune off damaged fruit and shoots. Fertilize and maintain good cultural conditions. New growth should start again if early enough in season. Can affect all vegetables.
11	Blossom drop, no fruit set, or malformed fruit.	Can be caused either by very low night temperatures or by very excessive heat during pollination. Irregular watering can also be a cause. To protect against cold, cover plant at night. Provide even amounts of moisture during hot weather.
12	Fruit is whitish/tan, papery, slightly sunken. Blotchy, dead areas. Black mold may grow on affected areas, causing fruit to rot.	Sunscald. Caused by fruit being exposed to direct sun. Occurs more often on plants that are losing their leaves due to excessive pruning or disease. Cover exposed fruits with light covering of straw mulch. If mold hasn't set in, the fruit may be eaten. Just cut away the scald.
13	Round, sunken, water-soaked areas on bottom of fruit that soon turn dry and leathery, brownish-black. Mold may grow on rotted surface.	Blossom End Rot. Could be a calcium deficiency caused by fluctuations in moisture, lack of or excessive nitrogen fertilization, or root pruning (cultivating too close to roots). Maintain a uniform supply of water. Provide mulch.
14	Misshapen fruit.	Could be due to erratic watering habits or soil low in phosphorous.
15	Stem rot, head decay.	May be caused by overwatering. Also check the Disease Charts.
16	Bolting to seed.	Occurs during very warm weather, usually because of exposure to cold temperatures early in growth. Be sure to plant at appropriate time - cool season crops early, warm season crops later. Toss affected plants in compost pile. Also can be caused by not harvesting at the correct time or lack of moisture at root level.

# Table 7: Vegetable Symptom Matrix



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Note: See Table 6 for descriptions

Table 7. Vegetable/Symptom Matrix

Crop	Symptom Number															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Asparagus										*						
Beans	*	*	*	*	*					*						
Beets										*					*	
Broccoli										*						
Brussels Sprts.										*						
Cabbage										*						
Carrots										*						
Cauliflower										*					*	*
Celery										*						
Chard			*				*			*						
Collards										*						
Corn			*		*	*				*						
Cucumbers		*	*				*		*	*						
Eggplant										*						
Horseradish										*						
Jer. Artichokes										*						
Kohlrabi										*						
Leeks										*						
Lettuce	*		*							*					*	*
Melon									*	*						
Onions	*									*						
Parsnips										*						
Peas			*	*						*						
Peppers										*	*	*		*		
Potatoes										*						
Pumpkins										*						
Radishes										*						
Rhubarb										*						
Spinach										*						*
Squash							*	*	*	*			*			
Tomatoes										*	*	*	*			
Turnips										*						*

# Table 8: Planting Guide

<b>Annual Vegetable</b>	<b>Length of Growing Period</b>	<b>Period of Ripeness</b>
Beans	7 - 10 weeks	4 - 5 weeks
Beets	7 - 15 weeks	4 - 6 weeks
Broccoli	9 - 17 weeks	8 - 10 weeks
Brussels Sprouts	10 - 16 weeks	6 - 8 weeks
Cabbage	9 - 19 weeks	4 - 6 weeks
Carrots	8 - 12 weeks	6 - 8 weeks
Cauliflower	9 - 13 weeks	1 - 2 weeks
Celery	13-17 weeks	6-8 weeks
Chard, Swiss	8-9 weeks	to fall
Collards	14 weeks	to fall
Corn	9-14 weeks	1-2 weeks
Cucumbers	9-13 weeks	4-6 weeks
Eggplant	13-17 weeks	to fall
Kohlrabi	3-9 weeks	to fall
Leeks	18 weeks	to fall
Lettuce, leaf	6-7 weeks	2-3 weeks
Lettuce, head	9-15 weeks	2-3 weeks
Melon	10+ weeks	to fall
Onions, seed	15-20 weeks	4-8 weeks
Onions, sets	7-13 weeks	4-8 weeks
Parsnips	13-21 weeks	to fall
Peas	10-14 weeks	1-2 weeks
Peppers	11-14 weeks	to fall
Potatoes	13-17 weeks	n/a
Pumpkins	3-9 weeks	to fall
Radishes	6-11 weeks	1-2 weeks
Spinach	9-11 weeks	1-3 weeks
Squash, summer	14-20 weeks	to fall
Squash, winter	9-11 weeks	to fall
Tomatoes	11-21 weeks	6-12 weeks
Turnips	6-8 weeks	to fall

NOTES:

NOTES:



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