Growing Vegetables Organically

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Growing vegetables organically can be rewarding and productive. This publication explains the basic elements of successful organic vegetable production, from initial site location, soil preparation, irrigation and variety selection to insect and disease control, composting, mulching and fertilization, and successive planting and crop rotation.

Garden Location

The garden should have a southern exposure (south side of your home) or be in an open field if at all possible. Full sun all day is desirable; however, at the least there should be a minimum of 6-8 hours of direct sunlight at the chosen location. A well-drained site even after a heavy rain is necessary particularly for root vegetables. Poor drainage may be improved by regrading, digging ditches, installing a tile drain field, or building raised beds.

Nearby trees and shrubs may have extensive root systems that may interfere with water and nutrient uptake of plants at your site. Locate the site to minimize or avoid this problem. As a last resort, consider removal of trees and shrubs that may interfere with production.

Land with a slope of 1.5 percent or greater (18-inch elevation change in 100 feet) should be avoided or terraced to prevent runoff and soil erosion. Contour planting, which is setting the rows to follow the contour of the land, can also help with runoff problems. Ask your local county extension agent for more information on dealing with this situation.

The site should also have a water supply nearby. Sites with serious weed problems such as nutsedge, Bermuda grass, or kudzu should be avoided unless adequate measures are taken to control them. This does not preclude using these sites, but considerable work is required to remove and control these weeds.

You should consider fencing the site if you have a significant wild animal population nearby. Deer, raccoons, and rabbits, to name a few, may become problems. Domestic animals such as dogs may also become a problem because many like to dig. Fences as high as 6 feet, an electric fence, or some combination may be required to control animals such as deer. Local building codes and/or restrictive covenants may govern what type of fence or even if a fence can be erected. Electric fences in particular may be prohibited in residential neighborhoods. Finally, for convenience, a location near the house is desirable.

Not all of the above recommendations can be accommodated in all situations. Many established neighborhoods have large shade trees and extensive landscaping. This may preclude having a garden, but container gardens may still be possible where they can be moved to sunny locations as needed. Growing leafy greens may still be possible in a less than ideal light situation, but they will require some full sun during the day.

Garden Planning

The size of your garden will determine, in part, many aspects of your garden plan. Large gardens where tractors will be used can be worked more easily with long rows; small gardens may be worked more easily in small beds with footpaths surrounding them.

There are many other things to consider in planning your garden. Fertility requirements vary with the crop, so heavy feeders and light feeders may be grouped separately to help manage fertilization. Long-season crops such as eggplant, tomato, pepper, and okra should be planted so they don't interfere with replanting short-season crops such as beans and brassicas. Tall-growing crops such as pole beans, tomatoes, and corn should be planted so they don't shade shorter crops. You may not be able to accommodate all of these recommendations in your garden, but you should try to accommodate as many as possible to help insure a successful garden.

An important part of garden planning is record keeping. General information about soil amendments used and weather information (particularly rainfall and first and last frost dates) can be useful, especially when tracked from year to year. Specific information about a particular vegetable can also be helpful for future planning. Information such as variety selection, planting date, days to harvest, disease, and insect problems should be noted. This data can help you determine which vegetables and varieties are best for your location.

Watering, fertilizing, and any cultural practices should also be recorded. This helps in determining what should be done in the garden from day to day.

Finally, keep track of what is grown where in your garden. This information will help with successive plantings and crop rotation as noted elsewhere in this publication.

When to plant is also an important part of garden planning. Table 1 lists the hardiness and days to maturity for several vegetables. Vegetables can be classed into two broad categories: warm- and cool-season crops. Warm-season crops can be further subdivided into tender and very tender vegetables, and cool-season crops can be subdivided into hardy and half-hardy crops. Very tender crops cannot stand any frost and will not do well under cool nighttime temperatures (below 55°F). Tender crops also don't like frost but can stand cooler night temperatures. Hardy cool-season vegetables can withstand frost and can be grown during the winter in all, but the coldest northern parts of Georgia. Half-hardy cool-season vegetables can withstand cool temperatures and light frosts, but hard freezes and heavy frost can be detrimental.

Irrigation

Irrigation is critically important when growing vegetables. Several different methods of irrigation can be used, with overhead and trickle irrigation the most common.

Trickle irrigation is the most water-use efficient because water is delivered directly to plant roots with a low volume soaker hose, drip tape, or emitters. There are some disadvantages of trickle irrigation including cost of installation and maintenance. These types of systems may need to be monitored more closely especially with newly transplanted plants. These systems may not wet the soil sufficiently or evenly for new plants. Drip irrigation tape or soaker hose placement may have to be adjusted particularly during plant establishment

Overhead sprinkler systems are easy to use and require less maintenance and monitoring. They can; however, result in uneven water application and use water inefficiently. For more detailed information on irrigation see Irrigation for Lawns & Garden, Bulletin 894 from Georgia's Cooperative Extension Service.

Soil Preparation

Organic gardening requires a long-term outlook with respect to soil preparation. In fact, the key to successful organic gardening is to feed the soil with organic matter, which feeds the plant, rather than to feed the plant with inorganic fertilizer as in conventional production. An ideal soil would have equal parts of sand (0.02 to 2.0 millimeters), silt (0.002 to 0.02 millimeters) and clay (0 to 0.002 millimeters), and contain about 5 percent organic matter. Most mineral soils in Georgia will have less than 1 percent organic matter and are rarely ideal. However, with work, most soils can be improved and made productive.

Because it takes a long-term outlook to build a good soil, don't be disappointed if your results are less than ideal the first year or two. New sites should have all plant matter removed or turned under. Areas with Bermuda sods or other invasive plants should have the plants removed to the compost pile (see "Composting" in this publication) and the soil turned under to expose roots and rhizomes to desiccation. In addition, soil solarization (see "Soil Solarization" in this publication) can help control these hard-to-control weeds.

Some soils may have hardpans, which are impervious layers several inches under the soil. These hardpans are often found on old farmland or new home sites where equipment has compacted the soil. In either case, these hardpans must be broken up. On clay soils this can be very difficult.

Soils should be turned to 10 to 12 inches deep. One method is to double dig the garden. Dig a trench 6 to 8 inches deep along one side of the garden, placing the soil on the outside edge of the garden. Then use a spade or garden fork to loosen the soil 6 inches deep at the bottom of the trench. Soil adjacent to the trench on the inside edge of the trench is moved to fill the existing trench, creating a new trench in its place. Again with a spade or garden fork, loosen soil in the bottom of this trench to a 6-inch depth. Continue in this fashion until the entire garden has been double dug. The soil from the first trench can then be moved into the last trench. This method of garden preparation will result in a deep tumed soil, but is very labor intensive. Alternatives include use of equipment such as tractor-mounted plows or a rototiller set to the deepest depth. Organic matter should be added during this deep-turning process.

Organic matter in soil is important for two reasons. First, as it breaks down, it releases nutrients that crops can utilize, and second, it improves the water- and nutrient-holding capacity of the soil. The amount of organic matter to add varies with the chosen material, the type of soil, and weather conditions. On sandy soils in tropical and subtropical regions, as much as 2,300 to 4,600 pounds per 1,000 square feet may be required to gain a benefit from the addition of organic matter. On heavier soils in regions with cooler climates and less rainfall, as little as 200 pounds per 1,000 square feet may be sufficient.

As an example, an acre of dry soil 6 inches deep weighs about 2 million pounds, which means that 1,000 square feet of soil to the same depth weighs approximately 46,000 pounds. If we wished to raise the organic matter of this soil 1 percent, we would have to add 460 pounds of organic matter. The amount of material required may actually be quite a bit more because most organic sources have a high water content, as much as 50 percent or more. In addition, many have high ash (nonorganic residues) content, as high as 25 percent or more. Organic matter with 50 percent water content and 25 percent ash would require 1,840 pounds applied to 1,000 square feet to raise the organic fraction of the soil 1 percent. This may be impractical both in terms of obtaining the necessary organic matter and the fact that organic matter may be required each year to sustain the increase. Low rates (200 pounds per 1,000 square feet) of organic matter can have a noticeable improvement in soil tilth. Additions of 500 to 1,000 pounds of organic matter per 1,000 square feet per year can have a beneficial effect on soil tilth and plant growth. Table 2 lists the minimum amounts of several types of organic matter that should be added to the soil. It is highly recommended that you have the organic matter tested so that application rates can be adjusted accordingly. The University of Georgia's Soil Test Laboratory (http://aesl.ces.uga.edu) can perform this function. In all cases, fresh manures should be composted to kill harmful pathogens and weed seed. In addition, fresh manures can damage plants and be hazardous to the environment through runoff.

Composting

Compost is an excellent source of organic material for your garden. If you make it yourself, it has the added benefit of reducing the amount of waste your household generates. All organic kitchen and garden waste except animal products can be composted. Material such as bones and animal scraps should be avoided because they attract vermin, flies, and scavenging animals. A convenient size for a compost pile is 4 feet wide by 5 feet long by 5 feet high. A frame made of rot resistant lumber can be built to hold the compost. In addition, containers specifically designed for composting can be purchased including types that can be easily tumbled.

If you build your own compost pile, begin the compost by adding 12 inches of organic matter (kitchen scraps, yard waste, etc.). Then apply I to 2 pounds of high-nitrogen organic fertilizer such as dried blood, guano, or poultry manure. Finally, add 2 inches of soil. Continue building the compost pile in this layered fashion as you generate organic matter. Another method of composting is to add 65% 'brown' material with 35% 'green' material. 'Brown' materials include yard clippings and raked leaves, while 'green' material include grass clippings and kitchen scraps. For complete and rapid decomposition, the compost

pile should be turned regularly particularly during the initial stages. The center of the pile should be concave to hold rain water. The center of the pile should begin to heat up within a couple of weeks. The composting process should be complete within two to three months, depending on material and outside temperature.

Large material such as tree limbs, corn stalks, etc., should be chopped into smaller pieces to facilitate decomposition. Some materials, such as lawn clippings, will decompose very rapidly; others will require turning the compost pile to reposition the material and adding more high-nitrogen organic fertilizer. This will restart the heating and decomposition process.

If you use materials from outside sources (i.e. pasture hay or straw), you should check to make sure no persistent herbicides have been applied. Herbicides such as picloram (Grazon®) are extremely persistent and will damage your plants.

Green Manures

Any crop grown on land with the intent of turning it into the soil is called a green manure. Generally, legumes and various grasses are grown as green manure. Turning under a crop can provide a number of benefits, including increasing organic matter of the soil, decreasing certain disease problems, and increasing the nutrient level in the soil. After the green manure is turned under, it decomposes and adds nutrients and organic matter to the soil.

When used as a green manure, grasses and small grains can decrease the incidence of nematodes. Nematodes are microscopic worms that feed on certain plant roots, weakening the plants.

Using various legume crops can increase the amount of nitrogen in the soil. The amount of nitrogen will depend on the crop, the time of year, and when in the crop cycle the plants are turned under. Anywhere from 30 to 125 pounds of nitrogen per acre may be added to the soil when a legume crop is turned under. Table 3 lists several crops that can be used as green manures.

Soil Solarization

Difficult to control weeds and soilborne pathogens may be controlled with soil solarization. Soil solarization in temperate regions where there can be a significant number of overcast days may require an entire season to be effective. For best results solarization should extend over the entire summer. Although an entire season may be lost, weed and soilborne pathogen control will carry over to the following season. This can be particularly effective when done prior to winter vegetable production.

Soil solarization involves covering the soil surface with clear plastic for eight to 12 weeks or longer. Clear plastic is used because most of the light energy is transferred to the soil. Black plastic absorbs a lot of heat, but it also shades the soil and is not as effective as clear plastic.

To begin with, all plant material and crop residue, as is practical, should be removed. The soil should be turned to break up any clods of soil and raked smooth. The area should be watered thoroughly so the soil is saturated. The area then should be covered with a clear plastic sheet of 1-4 mils thick. The sheet can be secured along the edges with soil or rocks. Soil solarization works best when air temperatures are high and sunlight is most intense during the summer months. Soil solarization is not effective during extended periods of cool temperatures or overcast weather.

Starter Solutions

Starter solutions can help get transplants and newly emerged seedlings off to a good start. High phosphorus is particularly important in these solutions because it encourages root growth, however, high phosphorus organic fertilizers may not be readily available. Water soluble fertilizers such as fish emulsion can help plants get off to a good start. This material should be mixed with water at a rate of 2-4 tablespoons per gallon and applied to newly set transplants. Apply ½ to 1 pint of this solution to each plant.

In the past manure teas were recommended as a starter solution. This practice should be abandoned because of the possibility of transmitting human pathogens.

Successive Planting and Crop Rotation

Because of the relatively long growing season in Georgia (particularly South Georgia), it is possible to produce more than one crop a year on the same land. Planting a second or third crop on the same land within the same year is called successive cropping or double cropping. Crop rotation, on the other hand, refers to planting different vegetables on the same land from year to year. Related vegetables should not be planted on the same land in succession or rotation. For example, squash should not be followed with a related vegetable such as watermelon, cantaloupe, or cucumber. This practice helps minimize soilborne disease problems and helps maintain soil fertility. Table 4 lists related vegetables, which will help you plan successive plantings and rotations.

Crop and Variety Selection

One of the most important decisions an organic grower makes is crop and variety selection. Not all vegetables do well in all locations. Vegetables commonly grown in your area are your best bet for success. Trial and error will also help determine which vegetables are best suited to your area. As you try different vegetables, keep records so that this information can be used in planning subsequent years. Climate, disease, and insect problems will be important criteria when selecting vegetable crops. It should be pointed out; however, that one year's results may not be enough to determine the success of a particular vegetable. For example, a mild winter may result in a greater insect problem than one might expect the following season. On the other hand, a cold winter may result in sufficient suppression of the insect to make for a successful year.

Variety selection is another important consideration when selecting crops to be grown. When available, varieties with disease and insect resistance are best. Resistance, however, is seldom 100 percent, and the plant may show some symptoms but less severe symptoms than susceptible varieties.

Varieties can be grouped into two broad categories based on how they were developed. F1 hybrids are developed from crossing lines that have been inbred for several generations. These varieties have advantages of increased uniformity and, often, increased yield compared with open-pollinated varieties. The disadvantage of these varieties is that the seeds are costlier and seed saved from hybrids will not perform as well if planted the following year (they are said not to be true-to-type). In addition, F1 hybrid varieties are constantly being changed by the seed companies. Not all vegetables lend themselves to F1 production. Because of the low amount of seed produced from each cross, beans and peas are not available as F1 hybrids.

Open-pollinated varieties are less expensive, and popular open-pollinated varieties will remain in the market for years. In addition, these seed will remain true-to-type from one year to the next. Most older varieties are open-pollinated types. Very old varieties are often referred to as heirloom varieties, and many can be dated to the previous century and beyond. These varieties are often sources of unusual colors, shapes, and flavors.

Several vegetables are reproduced vegetatively; that is, from parts of the plant itself. These would include sweetpotatoes and Irish potatoes. To improve your results with these crops, buy certified slips for sweetpotatoes and seed pieces for Irish potatoes. The certification process insures true-to-type, disease-free material.

Mulching

Mulching serves several purposes in organic production including reducing weed growth, conserving soil moisture and nutrients, regulating soil temperature, helping prevent soil erosion, and reducing water splashing on plants (which keeps them cleaner and reduces the spread of disease). An added benefit comes from organic mulch: As it decomposes, it increases the amount of organic matter in the soil. Almost any organic matter can be used successfully as mulch. This can include things such as hay, straw, leaves, pinestraw, or bark. Avoid materials that may have a lot of seed such as overgrown grass clippings. Fresh material, particularly sawdust should be avoided because it can rob your soil and thus your plants of nitrogen. In addition, avoid organic material that may be contaminated with toxic chemicals or herbicides because these may damage your plants. Pastures are often treated with herbicides that can injure plants when mulch is used from such sources. In addition, some herbicides such as picloram (Grazon®) can even survive the composting process.

Mulches should not be applied too early in the spring because this can delay soil warming. Wait until the soil is 65°F to a depth of 4 inches before applying. Solid materials such as newspapers should be weighted with soil to prevent them from blowing away. Weed control with mulches may require the continual addition of new material to smother weeds as they emerge. Keep all mulches 2 to 3 inches back from the stems of plants.

Fertilization

You must have accurate information about your soil to fertilize properly. First, the pH of the soil is important in determining nutrient availability to the crop. Optimum pH for most vegetables is between 6.0 and 6.5. Soil testing is the only accurate method of determining the soil pH. Such tests will offer recommendations on the amount of lime to apply if the soil pH is too low. Approximately 1 ton of lime is required to raise the pH of an acre 1 point. This is about 5 pounds per 100 square feet. The actual amount of lime required, however, will vary based on soil texture, the crop grown, and the buffering capacity of the soil. In order to determine proper fertilization, it is important to know the nutrient status of the soil, which a soil test will provide. To illustrate using tables 5 and 6, assume you are planting only heavy feeders in your garden and plan to use Fertrell Super as an organic fertilizer. Heavy feeders require 3 pounds of nitrogen per 1,000 square feet. Fertrell Super contains 4% nitrogen. Convert 4% nitrogen to its decimal equivalent by dividing 4 by 100 to get 0.04. Calculate the pounds of Fertrell Super required to provide 3 pounds of nitrogen by dividing 3 by 0.04 to get 75 pounds. If your garden is smaller or larger than 1,000 square feet, adjust the amount accordingly.

Organic fertilizers are low in solubility. In addition, since plants require nutrients in their simple ionic form, these nutrients must undergo a process of mineralization to become available for plants to use. This means that organic growers need to plan ahead concerning their fertility needs. Organic fertilizers generally will have to be applied earlier than conventional fertilizers and may have to be applied in greater quantities. Applications of organic materials such as manures and compost are not necessarily to added to soils as fertilizers, but rather to improve soil characteristics such as water and nutrient holding ability.

Weed Control

Weed control will the single most difficult problem that organic growers will face. Although effective herbicides are few, there are several things growers can do to manage this problem.

Using stale seedbed preparation can dramatically reduce the amount of weeds. This involves preparing land for planting at least two weeks before planting. During this two week period weed seedlings are allowed to germinate. The land is then lightly tilled (2-3 inches) to kill these emerging weeds. Deep turing can be counterproductive because it brings weed seed to the surface from deeper in the soil.

Cover crops can help reduce subsequent weed pressure, particularly when sown at a heavy rate. Some covers like brassicas and certain grasses can have allelopathic effects, that is they inhibit the germination of other species.

Soil solarization and mulches, both natural and synthetic, as mentioned above, can also be very effective at controlling weeds. There are a handful of natural herbicides available; however, they tend to be expensive, non-selective, and not particularly effective.

Finally the most important method of weed control is physical control of weeds. This can be as simple as hoeing your garden regularly, to using more sophisticated weeding equipment such as tine weeders, rototillers, sweeps, etc.

Insect and Disease Control

The best first-line method of reducing insect and disease pressure is to use resistant varieties when available. A good example is VFN tomatoes, where the VFN stands for Verticillium-, Fusarium-, and nematode-resistance. Your local county Extension office or seed supplier will have the latest information on available resistant varieties.

Keep the garden as free of diseases as possible. Plants with disease symptoms should be removed and destroyed. A properly constructed compost pile, which should heat up in the center, can

control many diseases.

Keeping your plants dry will help reduce disease pressure. Using trickle irrigation rather than overhead will reduce the amount of time plants remain wet and also conserve water. Of course, there's nothing we can do about the rain.

Crop rotation also can be an important method of controlling some, but not all soilborne diseases. The proper crop rotation can substantially reduce nematodes in the soil, but will do little to reduce southern blight.

Insect control begins with healthy plants. Don't bring problems into your garden; buy insect-free transplants. Timing is also important. Insect populations tend to increase as the season progresses, so planting early can avoid many insect problems. Encourage beneficial insects to stay in your garden. This can be as easy as nailing a horizontal board to a fence to encourage wasps to build a nest.

Finally, there are many organically acceptable products that can be applied to your crops. Find the most recent list of products acceptable for organic farming from the Organic Materials Review Institute (http://www.omri.org/omri-lists/download).

To control diseases there are several products that can be used. Using sodium bicarbonate (baking soda) or potassium bicarbonate has been successfully used to control some diseases. Sodium bicarbonate has the disadvantage of accumulating sodium over time, whereas potassium bicarbonate is a source of potassium, an important plant nutrient.

Sulfur and lime-sulfur are effective fungicides against some diseases. Sulfur has been used since ancient times particularly for controlling rust diseases. Lime-sulfur will be more effective at lower concentrations; however, it has a strong rotten egg smell.

Copper based fungicides have also been around for a long time. Copper sulfate, known as bluestone, is an effective fungicide. When mixed with lime (calcium hydroxide) it is known as Bordeaux mixture and was originally used to control grape diseases.

In addition to organic fungicides there are organic insecticides available that can be effective. Horticultural oils, particularly neem oil, can be effective against many insects. Horticultural oil can also be effective in preventing the transmission of plant viruses by aphids.

Spinosad is a naturally occurring bacteria that has insecticidal properties. It is very effective against a wide range of insects by disrupting their nervous system.

Insecticidal soaps are effective against soft bodied insects like aphids and mites. It is important to use the right kind of soap. Long-chain fatty acids act as insecticides whereas short-chain fatty acids act as herbicides. The latter can cause extensive damage to plants.

BT is also a naturally occurring bacteria that affects caterpillars. The caterpillars have to eat the material and it then kills them by affecting their gut. Because the insect must consume it first, it should be applied before insects are present.

Beauveria bassiana is a fungus that attacks the cutin (insect exoskeleton) causing the insect to literally rot.

Finally, naturally occurring pyrethrins are very effective insecticides that are made from Chrysanthemums. Check with your local county Extension agent, who can give you the latest information on these insect, disease, and weed control in organic production.

Tables

Table 1. Vegetable hardiness and days to maturity

Crop	Hardiness	Days to Maturity
Asparagus	Perennial, winter tolerant	Second Season
Bean, bush	Tender	50-60
Bean, pole	Tender	65-75
Bean, lima	Tender	65-75
Beet	Half-hardy	55-65
Broccoli	Hardy	60-80
Cabbage	Hardy	65-80
Cantaloupe	Very tender	80-90
Carrot	Half-hardy	70-80
Cauliflower	Half-hardy	55-60
Collard	Hardy	55-70
Corn	Tender	80-100
Cucumber	Very tender	60-65
Eggplant	Very tender	75-90
Kale	Hardy	50-70
Lettuce	Half-hardy	60-85
Mustard	Hardy	40-50
Okra	Very tender	55-60
Onion	Hardy	100-120
Peas, garden	Hardy	60-80
Pepper	Very tender	65-80
Potato, Irish	Half~hardy	70-90
Radish	Hardy	25-30
Southernpea	Tender	60-70
Spinach	Hardy	40-45
Squash, summer	Very tender	50-55
Squash, winter	Tender	85-120
Sweet potato	Very tender	90-150
Tomato	Tender	70-85
Turnip	Hardy	45-65
Watermelon	Very tender	80-90

Table 2. Amount of organic matter to add from various sources.[1]

Material	Rate/1000 Sq. Ft.
Cattle manure	150-500 lbs.
Compost	4 bushels
Horse manure	100-200 lbs.
Poultry manure	50-200 lbs.
Sheep manure	75-100 lbs.
Swine manure	75-100 lbs.

[1]Rates are minimum initial applications; you may wish to experiment with more or to have the material analyzed for actual nutrient content and adjust application accordingly. In addition, you may wish to have your soil tested to determine the amount of organic matter present.

Table 3. Green manure crops, season of growth, amount of seed, and type.

Crop	**Season**	**Seed** (lbs./acre)	**Type**	**Nitrogen** (lbs./ton dry material)
Buckwheat	Summer	75	Non-legume	14
Crimson clover	Winter	15	Legume	45
Rye	Winter	75	Non-legume	21
Southernpea	Summer	90	Legume	60
Soybean	Summer	75	Legume	46
Sudan grass	Summer	25	Non-legume	28
Vetch	Winter	30-50	Legume	62
Wheat	Winter	75	Non-legume	20

Table 4. Vegetables in related groups or families.

Nightshade Family	**Legumes**	**Cucurblts**	**Brassicas**
Eggplant	English pea	Cantaloupe	Broccoli
Irish potato	Lima beans	Cucumber	Cabbage
Pepper	Peanuts	Pumpkins	Collards
Tomato	Snap beans	Squash	Mustard
Southernpea	Watermelon	Turnips	

Table 5. Comparison of fertilizer needs for heavy, medium, and light feeders with a medium soil test for phosphorus and potassium in pounds per 1.000 square feet of actual nutrient (nitrogen, phosphorus, or potassium).

N	**P**	**K**	
3.0	2.8	2.8	Heavy Feeders
2.2	1.8	1.9	Medium Feeders
0.8	0.9	0.9	Light Feeders

Table 6. List of vegetables based on whether a light, medium, or heavy feeder..

Relative fertilizer needs	**Crops**		
Light Feeders	Southernpeas		
Medium Feeders	Asparagus	Corn	Peppers
	Beans, all	Cucumbers	Pumpkin
	Beets	Eggplant	Radish
	Broccoli	Greens	Squash
	Cantaloupes	Herbs	Sweetpotato
	Carrot	Okra	Swiss chard
	Cauliflower	English peas	Watermelon
Heavy Feeders	Cabbage	Lettuce	Onions
	Potatoes	Tomatoes	

Table 7. Vegetable hardiness and days to maturity

Vegetable	Days to Maturity*	Cultivars**	Planting Dates		Seeds or Plants/100 ft.	Spacing Rows/Plants	Depth to Plant***
			Spring	Fall			
asparagus	2nd year	Jersey Giant, Jersey Knight, Mary Washington, Purple Passion	January 15 - March 15	November & December	50 roots	36" x 18-24"	6"
beans, bush	50 - 60	Bronco, Blue Lake 274, Half-Runners (State, White, Volunteer) Kentucky Runner, Roma	March 15 - May 1	July 5 - August 10	½ pound	36" x 2-4"	1" – 11 ½"
beans, pole	65 - 75	Blue Lake, Dade, Kentucky Blue, Moccasian	March 15 - May 10	July 1 - August 1	½ pound	36" x 4-12"	1" - 1 ½"
beans, lima	65 - 75	Henderson's Bush Fordhook 242, Jackson Wonder (Speckled)	March 15 - June 1	July 1 - August 1	½ pound	36" x 3-4"	1" - 1 ½"
beans, pole lima	80 - 85	Sieva, Florida Speckled	March 15 - June 1	July 1 - August 1	½ pound	36" x 6-8"	1" - 1 ½"
beets	55 - 65	Detroit Dark Red, Red Ace, Ruby Queen	February 15 – April 1	August 1 – Sept. 20	1 ounce	18-36" x 2"	½ '
broccoli	60 - 80	Marathon, Packman, Patriot, Premium Crop, Bravo, Decathion	February 15 - March 15	August 1 - Sept. 1	100 plants	36" x 12"	----------
butterpea	70	Dixie	April 1 – May 1	July 1 – August 1	½ pound	36" x 3-4"	1" – 1 ½"
cabbage	70 - 120	A&C No. 5+, Blue Dynasty, Bravo, Early Round Dutch, Rio Verde, Green Jewel	January 15 – March 15	August 1 – October 1	100 plants	36" x 12"	----------
cantaloupe	80 - 90	Ambrosia, Athena, Saticoy Early, Sweet	March 20 - June 20	----------	1 ounce	60" x 36"	1"
carrot	70 – 95	Chantenay, Scarlet Nantes, Sweetbites, Sweet Delight, Thumbelina (small)	January 15 - March 20	August 20 - Sept. 15	½ ounce	18-36" x 2-3"	¼"
cauliflower	60 - 75	Absolute, Early Snowball, Graffiti (purple color), White Magic, Symphony	March 1 - April 1	July 15 - August 15	100 plants	36" x 12"	----------
collards	55 - 85	Blue Max, Georgia Southern, Hevi-Crop	February 1 - March 15	August 1 - Sept. 1	½ ounce	36" x 8-16"	½"
corn, yellow	65-90	Bodacious, Golden Queen, Honey Select, Mirai 131, Seneca	March 15 – June 1	----------	¼ pound	36" x 12-18"	1" - 1½"
corn, white	65-90	Avalon, How Sweet It Is, Seneca Sensation, Silver King, Silver Princess, Silver Queen	March 15 – June 1	----------	¼ pound	36" x 12-18"	1" - 1½"
corn, bi-color	65-90	Ambrosia, Butter & Sugar, Honey 'n Pearl, Mirai 301, Peaches & Cream, Serendipity, Sweet Breed Chorus	March 15 – June 1	----------	¼ pound	36" x 12-18"	1" - 1½"
cucumber, slicing	50-65	Bush – Salad Bush Hybrid, Bush Crop, Fanfare	April 1 – May 15	July 15 – August 15	1 ounce	60" x 12"	½" – ¾"
cucumber, pickling	50-65	Vine – Burpless Hybrid, Diva, Marketmore, Straight Eight, Sweet Slice, Sweet Success	April 1 – May 15	July 15 – August 15	1 ounce	60" x 12"	½" – ¾"
cucumber, gynoecious	50-65	Bush Pickle, Calypso, County Fair Calypso, General Lee	April 1 – May 15	July 15 – August 15	1 ounce	60" x 12"	½" – ¾"
eggplant	75 – 90	Black Beauty, Classic, Dusky, Ghost Buster's (white), Calliope	April 1 – May 15	July 10 – July 30	50 plants	36" x 24"	----------
kale	50 – 70	Vates, Dwarf Siberian, Blue Armor, Blue Knight	February 1 – March 10	August 1 – September 1	½ ounce	36" x 8-16"	½"
lettuce	60 - 85	Butterhead, Romaine, Buttercrunch	January 15 - March 1	Sept. 1 - October 1	¼ ounce	18-36" x 8-12"	1/8"
mustard	40 – 50	Florida Broadleaf, Southern Giant Curled, Red Giant, Savannah	January 15 – April 1	August 15 – Sept. 15	½ ounce	18-36" x 2"	½"
okra	55 - 65	Annie Oakley II, Burgundy, Cajun Delight, Clemson Spineless	April 1 - June 1	June 15 - July 10	1 ounce	36" x 12"	1"

Vegetable	Days to Maturity*	Cultivars**	Planting Dates		Seeds or Plants/100 ft.	Spacing Rows/Plants	Depth to Plant***
			Spring	Fall			
onion, green	60 - 90	White Portugal	January 1 - March 15	Sept. 1 - December 31	300 plants	18-36" x 3"	----------
onion, dry bulb	100 - 120	Burgundy, Excel, Grano, Red Creole, Savannah Sweet	January 1 - March 15	October 10 - Nov. 10	300 plants	18-36" x 3-4"	----------
peas, garden (English)	60 - 70	Lincoln, Jackson Wonder, Wando, Little Marvel, Green Arrow, Maestro	January 15 - Feb. 15	----------	1 pound	36" x 2"	1" - 2"
peas, edible pod	60 - 70	Sugar Daddy, Snow Pea, Sugar Snap	January 15 - Feb. 15	----------	1 pound	36" x 2"	1" - 2"
peas, Southern	60 - 70	Blackeyed - California #5, Pinkeyed - Purple Hull FVR, Cream Pea - Texas Cr´eme, Crowder Pea - Mississippi Silver, Zipper Cream	April - August 10	----------	½ pound	36" x 3-4"	1" - 2"
pepper, bell	65 - 80	Big Bertha, Camelot x3a, Colossal, Karma	April 1 - June 1	July 25 - August 10	50 plants	36" x 24"	----------
pepper, hot	65 - 95	Habeñero, Jalepeno, Tula, Marbles	April 1 - June 1	----------	50 plants	36" x 24"	4" - 5"
pepper, hot-sweet	65 - 95	Banana Supreme, Kuberille, Sweet Banana)	April 1 - June 1	----------	50 plants	36" x 24"	----------
potatoes, Irish	70 - 90	Red (Pontiac), White (Kennebac, Atlantic, Yukon Gold)	January 15 - March 1	----------	12 pounds	36" x 12"	4" - 5"
potatoes, sweet	90 - 120	Centennial, Georgia Red, Giant Jet, Hernandes, Red Jewel	April 15 - June 15	----------	100 plants	36" x 12"	----------
pumpkin, tiny	85 - 120	Little Ironsides	May 15 – July 1 (depending on maturity date)	----------	1 ounce	72" x 48"	1"
pumpkin, pie type	85 - 120	Small Sugar, Sugar Baby, Touch of Autumn	May 15 – July 1 (depending on maturity date	----------	1 ounce	72" x 48"	1"
pumpkin, small	85 - 120	Autumn Gold, Jack O Lantern, Jack of All Trades	May 15 – July 1 (depending on maturity date	----------	1 ounce	72" x 48"	1"
pumpkin, large	85 - 120	Aladdin, Gold Rush, Major Lantern, Merlin	May 15 – July 1 (depending on maturity date	----------	1 ounce	72" x 48"	1"
pumpkin, giant	85 - 120	Dill's Atlantic, Giant, Prize Winner	May 15 – July 1 (depending on maturity date	----------	1 ounce	72" x 48"	1"
radish	25 – 30	Cherry Bell, Scarlet Globe, Champion	January 15 – April 1	Sept. 1 – October 15	1 ounce	24" x 1"	½"
spinach	40 - 45	Melody, Winter Bloomsdale, Hybrid #7	January 15 - March 15	Sept. 1 - October 15	1 ounce	18-36" x 2"	½" – ¾"
squash, summer (zucchini)	40 - 55	Any yellow or green—all are good and easy to grow. Use compact varieties for limited space gardens	April 1 - May 15	August 1 - August 25	½ ounce	36" x 24"	1" - 2"
squash, winter	85 - 120	Acorn, Buttercup Bonbon, Butternut	April 1 - July 1	----------	½ ounce	60" x 36"	1" - 2"
tomato, determinate	70-90	Bush - Celebrity, Early Girl BHN 444, BHN 640, Celebrity, Mountain	March 25 – May 1	June 15 – July 15	50 plants	48" x 24"	----------
tomato, indeterminate	70-90	Fresh, Mountain Spring, Rutgers, Amelia, Mountain Pride	March 25 – May 1	June 15 – July 15	50 plants	48" x 24"	----------
tomato, cherry	70-90	Early Girl, Better Boy, Big Beef, Big Boy, Beefmaster	March 25 – May 1	June 15 – July 15	50 plants	48" x 24"	----------
tomato, grape	70-90	Jolly, Sweet Baby Girl, Super Sweet 100, Grape, Juliet	March 25 – May 1	June 15 – July 15	50 plants	48" x 24"	----------

Vegetable	Days to Maturity*	Cultivars**	Planting Dates		Seeds or Plants/100 ft.	Spacing Rows/Plants	Depth to Plant***
			Spring	Fall			
turnip	40 – 60	Purple Top, Royal Crown	January 15 – April 1	August 10 – Sept. 15	½ ounce	18-36" x 2"	½"
watermelon – large	80 - 90	Mardi Gras, Royal Majesty, Sangria	March 20 - May 1	----------	1 ounce	72" x 36-48"	1" - 2"
watermelon – round	80 - 90	Baby Doll, Crimson Sweet, Ice Box, Imagination, Jade Star	March 20 - May 1	----------	1 ounce	72" x 36-48"	1" - 2"
watermelon – small	80 - 90	Palm Melon, Solitaire	March 20 - May 1	----------	1 ounce	72" x 36-48"	1" - 2"

*Days to maturity are from planting seed or setting transplants in the garden. The number of days will vary depending on cultivar (some mature earlier than others) temperature and general growing conditions. Check catalogues for individual maturity time.
**Cultivars listed in the chard represent a few of those recommended. There are many other good cultivars worthy of trial.
***Plant shallowly in heavy (clay) soil when adequate moisture is present.

Table 8. Vegetable hardiness and days to maturity

Materials	Percent[1]			Availability
	N	P_2O_5	K_2O	
Bone meal	0.7 – 4	18 – 24	0	Slow/medium
Compost	1.5 – 3.5	0.5 – 1	1 – 2	Slow
Cottonseed meal (dry)	6	2.5	1.7	Slow/medium
Blood meal	12	1.5	0.6	Medium rapid
Fertrell Blue Label	1	1	1	Slow
Fertrell Gold Label	2	2	2	Slow
Fertrell Super	3	2	3	Slow
Fish meal	10	4	0	Slow/medium
Guano	6 – 12	9 – 11	2 – 3	Medium
Chilean nitrate	15	0	0	Rapid
Green sand	0	0	3	Slow
Kelp				
Fresh manures				
Cattle	<1	<1	<1	Medium
Horse	<1	<1	<1	Medium
Poultry	3 – 4	1 – 3	1 – 2	Medium/rapid
Mushroom compost	0.5 – 1	<1	0.5 – 1.5	Slow
Peat	1 – 2	<1	1	Very slow
Soybean meal	6 – 7	2	2	Slow/medium
Wood ashes	0	1 – 2	3 – 7	Rapid

[1]The percentage of plant nutrients is highly variable; with some materials, average percentages are listed.

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