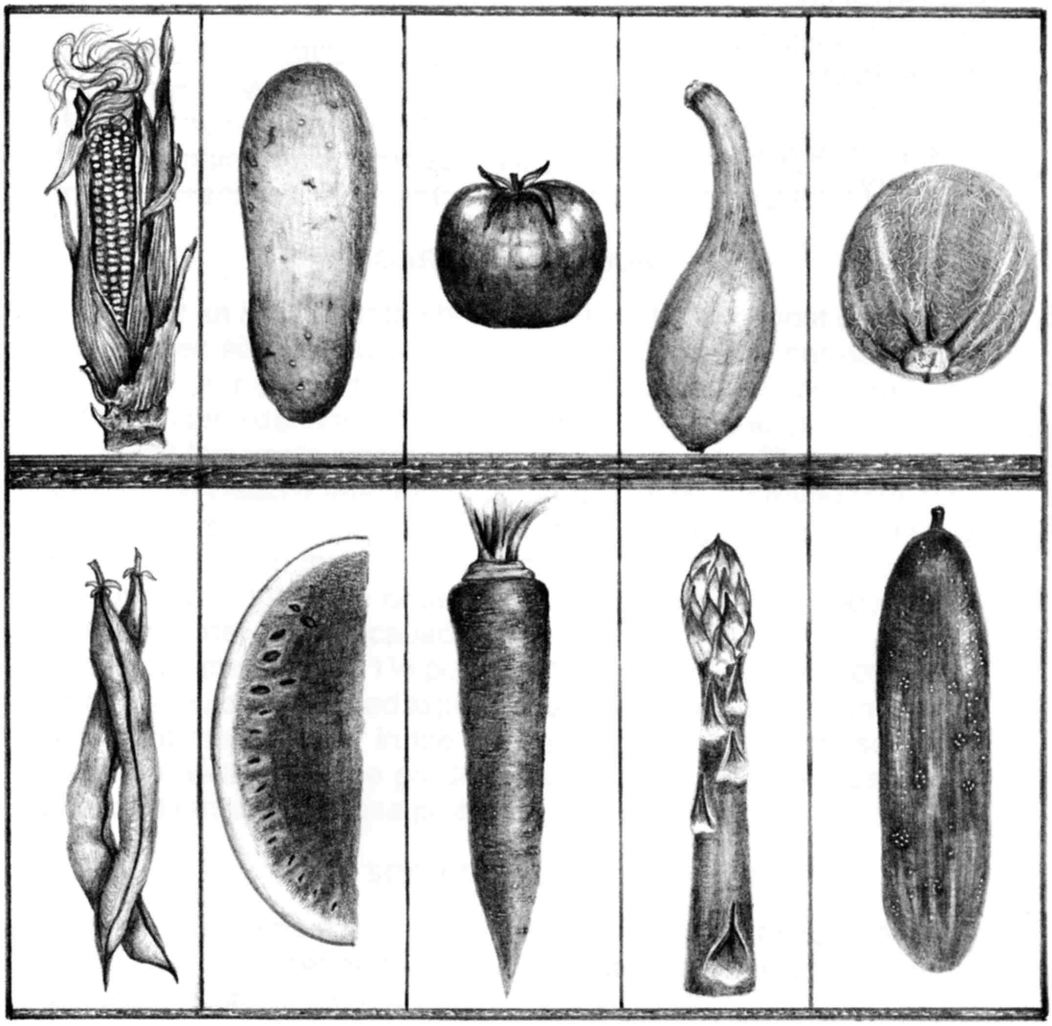
Growing Vegetables Organically



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Garden Location

The garden should have a southern exposure (south side of your home) or be in an open field if at all possible. There should be a minimum of six hours of direct sunlight at the chosen location. A well-drained site even after a heavy rain is ideal. Poor drainage may be improved by regrading, digging ditches, installing a tile drain field, or adding organic matter.

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.

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. Finally, for convenience, a location near the house is desirable.

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 cole crops. 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 6 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

Growing a crop without irrigation is possible, but your success is enhanced with irrigation. 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. The disadvantage of trickle irrigation is cost of installation and maintenance. 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 2 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 leave a deep turned 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 must be added 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

Soil Preparation (continued)

feet per year can have a beneficial effect on soil tilth and plant growth. Table 1 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 for its nutrient content so that application rates can be adjusted accordingly. In all cases, fresh material should be composted to kill harmful pathogens and weed seed. In addition, fresh material can damage plants and be hazardous to the environment through runoff.

Composting

Compost is an excellent source of organic material for your garden. 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 pressure treated lumber can be built to hold the compost, but this is not really necessary. Begin the compost by adding 12 inches of organic matter (kitchen scraps, yard waste, etc.). Then apply 1 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. 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 (which aerates the pile) and adding more high-nitrogen organic fertilizer. This will restart the heating and decomposition process.

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 may be added to the soil when a legume crop is turned under. Table 2 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 should, however, be reserved for solving these specific problems in your garden because it can also kill beneficial microorganisms and insects.

Soil solarization involves covering the soil surface with clear plastic for four weeks or longer. 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 plastic sheet. 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. These starter solutions are often referred to as manure teas. High phosphorus is particularly important in these solutions because it encourages root growth. A good homemade solution consists of 3 pounds of poultry manure plus 3 pounds of steamed bone meal in 25 gallons of water. Stir the mixture often over several days; then strain off the liquid. Use one cup of liquid for each transplant. Fresh manures can contain harmful bacteria, so be sure to wash up after handling.

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 growing season is called successive 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 insect and disease problems and helps maintain soil fertility. Table 3 lists related vegetables.

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 varieties, 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.

F_1 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 more costly and seed saved from hybrids will not perform as well if planted (they are said not to be true to type). In addition, F_1 hybrid varieties are constantly being changed by the seed companies. Not all vegetables lend themselves to F_1 production. Because of the low amount of seed produced from each cross, beans and peas are not usually available as F_1 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 things such as sweet potatoes and Irish potatoes. To improve your results with these crops, buy certified slips for sweet potatoes 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 old hay, straw, leaves, sawdust, paper, or bark. Avoid materials that may have a lot of seed such as fresh-cut hay or overgrown grass clippings. Fresh material, particularly sawdust, 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.

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. Irish potatoes are a notable exception with a desired pH of 5.0 to 5.5. 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 4 and 8, assume you are planting only heavy feeders in your garden and plan to use horse manure as an organic fertilizer. Heavy feeders require 3 pounds of nitrogen per 1,000 square feet (Table 4). Horse manure contains 0.3 percent nitrogen (Table 8). Convert 0.3 percent nitrogen to its decimal equivalent by dividing 0.3 by 100 to get .003. Calculate the pounds of horse manure required to provide 3 pounds of nitrogen by dividing 3 by .003 to get 1,000 pounds. If your garden is smaller or larger than 1,000 square feet, adjust the amount accordingly.

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-resistant material. 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. Check with your local county Extension agent, who can give you the latest information on these products.

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

Material	Rate/1000 Sq. Ft.[1]
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 in it.

Table 2. 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	Nonlegume	14
Crimson clover	Winter	15	Legume	45
Rye	Winter	75	Nonlegume	21
Southernpea	Summer	90	Legume	60
Soybean	Summer	75	Legume	46
Sudan grass	Summer	25	Nonlegume	28
Vetch	Winter	30-50	Legume	62
Wheat	Winter	75	Nonlegume	20

Table 3. Vegetables in related groups or families

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

Table 4. 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_2O_5	K_2O	
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 5. List of vegetables based on whether a light, medium, or heavy feeder

Light Feeders	Southernpeas		
Medium Feeders	Asparagus	Corn	Peppers
	Beans, all	Cucumbers	Pumpkin
	Beets	Eggplant	Radish
	Broccoli	Greens (kale, mustard, turnip, collards)	Squash
	Cantaloupes	Herbs	Sweet potato
	Carrot	Okra	Swiss chard
	Cauliflower	Peas, English	Watermelon
Heavy Feeders	Cabbage		
	Lettuce		
	Onions		
	Potatoes, Irish		
	Tomatoes		

Table 6. 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 7. Recommended vegetable varieties for Georgia

Crop	Recommended Varieties
Asparagus	Jersey Gem, Mary Washington, Viking
Beans, bush	Strike, Bush Blue Lake 274, Provider
Beans, half-runner	State, White Half-Runner
Beans, pole snap	Kentucky Wonder 191, Stringless Blue Lake
Beets	Detroit Dark Red, Ruby Queen
Broccoli	Green Comet, Green Duke, Premium Crop
Cabbage	
Early season	Head Start
Midseason	Market Prize, Gourmet
Late season	Rio Verde
Red cabbage	Red Acre
Cantaloupe	Planter's Jumbo, Edisto 45
Carrots	Scarlet Nantes, Chantenay Red Core
Collards	Georgia, Vates, Carolina
Corn	
Roasting ear	Hybrid Truckers Favorite
Sweet, white	Silver Queen
Sweet, yellow	Seneca Chief, Bonanza, Golden Queen, Merit
Cucumber	
Slicing	Ashley, Marketmore 76, Dasher II, Poinsett 76
Pickling	Chipper, Carolina

Crop	Recommended Varieties
Eggplant	
Cylindrical	Ichiban, Dusky
Oval shape	Black Beauty, Florida Market
Kale	Siberian Curled, Vates
Lettuce	
Head	Great Lakes
Leaf	Grand Rapids
Lima, bush	
Large seeded	Fordhook 242
Small seeded	Henderson's Bush, Nemagreen, Jackson Wonder (speckled)
Lima, pole	Sieva
Mustard	Florida Broadleaf, Tendergreen II (hybrid)
Okra	
Round pod	Emerald
Star pod	Clemson Spineless 80
Onions	
Dry	Crystal Wax, Granex
Green bunching	Crystal Wax, White Portugal
Red	Southport Red Globe
Peas, English or garden	
Edible pod	Sugar Snap
Green	Alaska, Little Marvel, Laxton Progress #9
Southernpeas	California Blackeye #5, Worthmore, White Acre, Mississippi Silver, Zipper Cream
Peppers	
Banana	Sweet Banana
Bell sweet	Yolo Wonder L, Keystone Resistant Giant
Cherry hot	Large Red Hot
Hot	Long Thin Cayenne, TAM Jalapeno
Pimiento	Truhart Perfection
Potatoes, Irish	Kennebec, Red Pontiac
Pumpkin	Big Max (large), Connecticut Field (medium), Jack O'Lantern (small)
Radish	Cherry Belle, Scarlet Globe
Spinach	Bloomsdale Long Standing, Melody
Squash, summer	
Winter	Early Butternut, Table King, Spaghetti
Yellow	Early Prolific Straight Neck, Early Summer Crookneck, Dixie (hybrid), Multipik
Zucchini	Seneca, Zucchini Select
Sweet potato	Centennial, Georgia Red, Red Jewel, Georgia Jet
Tomato	
Determinate	Mountain Pride, Celebrity, Big Set
Indeterminate	Better Boy, Monte Carlo
Paste type	Roma
Turnip	Purple Top, Shogoin, Just Right
Watermelon	AU-Producer, Jubilee, Crimson Sweet

Table 8. Guide to the mineral nutrient value of organic materials

	Percent[1]			
Materials	**N**	**P_2O_5**	**K_2O**	**Availability**
Bone meal (steamed)	.7 to 4	18 to 34	0	Slow medium
Castor pomace	5	1.8	1	Slow
Cocoa shell meal	2.5	1	2.5	Slow
Compost (not fortified)	1.5 to 3.5	.5 to 1	1 to 2	Slow
Cottonseed meal (dry)	6	2.5	1.7	Slow medium
Dried blood (dry)	12	1.5	.6	Medium rapid
Fertrell-Blue Label	1	1	1	Slow
Fertrell-Gold Label	2	2	2	Slow
Fertrell-Super	3	2	3	Slow
Fertrell-Super "N"	4	3	4	Slow
Fish meal (dry)	10	4	0	Slow
Fish scrap (dry)	3.5 to 12	1 to 12	.08 to 1.6	Slow
Garbage tankage(dry)	2.7	3	1	Very slow
Guano (bat)	5.7	8.6	2	Medium
Guano (Peru)	12.5	11.2	2.4	Medium
Kelp[2]	.9	.5	4 to 13	Slow
Manure[3] (fresh)				
Cattle	.25	.15	.25	Medium
Horse	.3	.15	.5	Medium
Sheep	.6	.33	.75	Medium
Swine	.3	.3	.3	Medium
Poultry (75% water)	1.5	1	.5	Medium rapid
Poultry (50% water)	2	2	1	Medium rapid
Poultry (30% water)	3	2.5	1.5	Medium rapid
Poultry (15% water)	6	4	3	Medium rapid
Marl	0	2	4.5	Very slow
Milorganite (dry)	5	2 to 5	2	Medium
Mushroom compost	.4 to .7	.57 to .62	.5 to 1.5	Slow
Peat and muck	1.5 to 3	.25 to .5	.5 to 1	Very slow
Sawdust	4	2	4	Very slow
Sewage sludge (active dry)	2 to 6	3 to 7	0 to 1	Medium
Sewage sludge (digested)	1 to 3	.5 to 4	0 to .5	Slow
Soybean meal (dry)	6.7	1.6	2.3	Slow medium
Tanbark[4]	0	1.5	2	Very slow
Tobacco stems(dry)	2	.7	6	Slow
Urea[5]	42 to 46	0	0	Rapid
Wood ashes[6]	0	1 to 2	3 to 7	Rapid

Some of the materials may not be available because of restricted sources.

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

[2]Contains common salt, sodium carbonate, sodium, and potassium sulfates.

[3]Plant nutrients available during year of application. Varies with amount of straw and method of storage.

[4]Contains calcium.

[5]Urea is an organic compound, but manufactured sources are synthetic, and it is doubtful that most organic gardeners would consider it acceptable.

[6]Potash content depends on the tree species burned. Wood ashes are alkaline, containing approximately 32 percent CaO.

Appreciation is expressed to Willie O. Chance, Extension Agent, for his contributions to this publication.

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Gale A. Buchanan, Dean and Director