VEGETABLE and HERB GARDENING

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Vegetable gardening is a major interest and hobby of the American people. Vegetable gardens should be fun, environmentally safe, and provide fresh produce for the family. Certified nursery and plant professionals are expected to know, recognize, and understand the cultural requirements of vegetables and herbs.

Site Selection

The land for a vegetable garden should be fairly level, well drained, and should not have low areas where water might stand. In windy regions, gardens should be protected by shelterbelts or buildings, but should not be shaded. Vegetables should receive a minimum of six hours of direct sunlight per day. Trees and shrubs decrease sunlight and compete with vegetables for water and minerals. However, when space is limited, some vegetables can be incorporated into landscape plantings or can be grown in containers.

Vegetable Selection

When selecting vegetables for the garden, consider the likes and dislikes of the client's family and include vegetables with different maturation dates. Disease-resistant cultivars usually make the gardening task easier and should be used whenever possible. The Cooperative Extension System is a good resource for information on new and disease resistant varieties. In addition, "All-America winners" generally perform well and can be used in most parts of the country. Cool season crops are those generally tolerant of frost. They are listed in Table 16-1 under early and mid spring selections. Warm season crops are those generally damaged by frost and are listed under late spring selections. Long season versus short season crops depends on the number of days required for the plant to mature. Many warm season crops are also long season crops.

Herb Selection

Many herbs are easy and fun to grow. Some are perennial and spread easily such as mint and oregano. Others are annual and frost tender such as basil. Herbs are well suited for growing in containers or in the garden. Herbs can be started from seeds or purchased as plants. They thrive with minimal fertilization and less water than most vegetables. Almost all herbs prefer full sun. Herbs for culinary use should be pinched back to keep them from flowering, as the flavor decreases once the plant matures. Many herbs have ornamental value and can be interplanted with perennials. A few good herb books are listed in the reference section at the end of this chapter.

Garden Layout

Encourage prospective gardeners to put their garden plan on paper. The plan should be drawn to an appropriate scale showing the size of the garden, spacing between rows, species and cultivars to be planted, date of planting, length of row for each crop, spacing of transplants in the row, succession plantings, and specific arrangement of crops. Plans should be kept on file for 2 or 3 years to serve as references of how various crops did in

particular locations, and to assist in garden planning and crop rotation. Disease and pest control is improved by rotating the locations of crops from year to year. For instance, tomatoes should not be planted where tomatoes or related crops, such as potatoes, grew the previous year. Rotation can be difficult in small gardens due to space limitations.

Once a plan is drawn, the physical work can begin. Using stakes and string, lay out rows or blocks. If power equipment, such as a rototiller, is used, reduce the amount of turning necessary by making long rows. Short rows are less monotonous, and work well if cultivation is to be done by hand. On a slope, rows should run along the contour or across the slope to reduce erosion. Crops should be arranged so that tall plants, such as sweet corn and pole beans, don't shade small plants. Tall plants should be grown on the northern side of the garden. Crops should also be grouped according to the time they mature to facilitate succession plantings, rotation, or planting of green manure crops after harvesting the early crop.

Perennial plants, such as asparagus, rhubarb, and small fruits, should be placed together on one side of the garden where they won't interfere with garden preparation. Melons, squash, cucumbers, and other vine crops can also be planted along one side to allow them to spread into surrounding open areas. Finally, sweet corn should be placed in several short rows as a block to facilitate pollination, rather than in long single rows.

Cultural Practices

Soil and Fertilization

Garden soil should be worked when it has moderate soil moisture content. Under ideal conditions, the soil will crumble and break into fine particles in your hand. Soil that is too dry is hard to break up and tends to become powdery when worked too much. Working soil that is too wet destroys soil structure and results in compaction. Soil can be worked in the fall or spring, and should be raked immediately following tilling or spading.

Although rich, sandy loam soils are best for vegetable gardens, heavy or sandy soils can be used when amended with liberal applications of organic matter each year. Soil structure can be improved by working in four to six inches of peat moss, well-rotted manure, or compost and a few inches of sand. This loosens compacted soil, helps maintain moisture and nutrients, and enhances root development.

If the soil is very heavy or otherwise poorly drained, raised beds 6 to 12 inches high make excellent vegetable gardens. The beds can be formed from well-drained topsoil or you can make a potting mix using peat moss, ground bark, sawdust, compost, sand, or manure. The beds can simply be raised mounds of soil or may be enclosed with wood, concrete blocks, stones, or other material. Avoid using landscape timbers as they usually have been treated with creosote or other toxic preservatives. Sloping the beds gently (5-10%) to the south is also beneficial.

Vegetables do best on neutral to slightly acid soils that contain plenty of readily available nutrients. Nutrients can be supplied through applications of compost or rotted manure. These organic fertilizers are generally lower in nutrient content than commercial fertilizers. They often release nutrients over a longer period of time as well as raising the organic matter content of the soil. Composts and manures carry the risk of weed seed introduction. Commercial fertilizers can also be used and they provide a more accurate application of specific nutrients without the potential of significantly increasing soluble salts. Almost any complete garden fertilizer is suitable for the vegetable garden. One to two pounds actual nitrogen of a complete garden fertilizer (10-10-10) per 1,000 square feet can be worked into the soil before planting. It should be worked to a depth of four to six inches with a rototiller. Commercial fertilizer can also be applied during the growing season as a side dressing for example, when corn plants are ten inches tall, tomato fruits are golf-ball size, and vine crops start to run. Side-dressed fertilizers should be lightly worked into the soil on both sides of the vegetable rows. Side dressing is especially good where intensive gardening is practiced and when succession or fall crops follow early season crops. Nutrients removed from the soil by a previous crop need to be replenished before sowing a succession crop.

Seeds and Seeding

Some gardeners save seeds from their gardens to use in future years. Many heirloom varieties have been preserved this way. While seed saving works well for some crops, such as beans, a gardener may have problems getting true-to-type varieties with crops that cross-pollinate, including corn, cucumbers, melons, pumpkins, squash, onions, spinach, radishes, beets, turnips and cabbage. To avoid cross-pollination, isolate the crop from other varieties or only grow one variety of a particular vegetable that you wish to save seed from. Hand pollination and bagging also prevent cross-pollination. Collect seeds from plants that show the best characteristics for that variety. Seeds collected from hybrid varieties of any vegetable will not produce a true-to-type variety. Label seeds as to variety and year collected. Store seeds in a cool dark place. Seeds to be saved for the following year may be treated with a fungicide to help check seedling diseases such as damping off. This will in turn also produce more uniform plantings. Many commercial seeds are treated prior to purchase. Most seeds remain viable for a few years, if stored correctly. Old seed can be tested for germination by sprouting a few seeds on a damp paper towel in a plastic bag.

It's very difficult to sow small seeds uniformly enough to permit all plants to develop well. Surplus plants compete and should be removed. When the soil is moist, surplus plants can be removed easily without injuring the remaining plants. Early thinning is especially important in root crops such as beets, carrots, parsnips, rutabagas, and turnips. The tops of surplus beets, lettuce, chard, parsley, and turnips make fine greens for the table. After thinning, water to settle the soil back around the remaining plants' roots.

Some tender vegetable crops can be seeded or planted individually earlier in the season by using hot caps or wall-o-waters. Place hot caps over the soil one week before seeding to warm the soil and help the seeds germinate more quickly. Using hot caps allows seeding and transplanting a week or two earlier then the normal frost-free date. Remove the hot caps after the plants have emerged. Wall-o-water protectors can stay on until late spring. For many warm season crops, such as melons, plastic film can be placed on the soil around the plant to increase soil temperatures. Clear plastics are most effective in raising soil temperatures. Black plastics do not significantly raise the soil temperature but control weeds better. Floating row covers and frost fabric also help protect vegetable plants grown in early spring. Where the growing season is long enough, many vegetable crops may be planted at biweekly intervals during the early summer to extend the harvest period. Two plantings of corn and snap beans can be made in one season. Carrots and beets for winter storage may be sown in late June.

All crops have optimum temperature ranges for seed germination, growth, and maturation. The time required for maturation also varies tremendously, from as little as a few weeks for radishes to four months or more for some vine crops. For these reasons, proper timing is critical when planting and transplanting. Planting charts are available from local cooperative extension service offices, and are often included in vegetable gardening books. These charts include information on recommended seeding dates, spacing, seeding rates, and growing season requirements. See Table 16-2 for an example of a planting chart.

Warm season crops such as tomatoes, peppers, eggplant, and celery need a long, hot growing season and will not mature if seeded directly into the soil. Transplants of these crops provide the best results. Cool season crops, such as head lettuce, cabbage, cauliflower, and broccoli must mature before hot summer weather arrives to reduce bolting and maintain quality. Cool season crops can also be sown in late June so they will mature during cool fall weather. These later crops usually have a higher quality than the same plants maturing in summer. Proper timing of planting is difficult in Montana and Idaho where spring is often short and contracted, and fall comes early. The following table applies to a protracted spring and fall, and areas with a long growing season.

Early Spring
As soon as the ground can be worked
Seed: Kale, onions (seeds or sets), parsnips, peas, radishes, rutabagas, spinach
Set out transplants: asparagus, leeks

Mid-Spring
When there is little chance of late frosts and the soil has become relatively warm
Seed: beets, carrots, corn, cucumbers, lettuce, parsnips, potatoes and swiss chard.
Set out transplants: broccoli, brussel sprouts, cabbage, cauliflower, celery, leek, lettuce and onions.

Late Spring
After all danger of frost is past; soil and air warming
Seed: beans, cucumbers, corn.
Set out transplants: artichokes, cucumbers, eggplants, melons, peppers, pumpkins, squash, and tomatoes

Early Summer
Areas not ready for earlier planting or now ready for a second crop
To extend the supply of fresh vegetables into fall if the weather is mild
Seed: beans, brussel sprouts, carrots, kohlrabi, lettuce, radishes, spinach, swiss chard, turnips
Set out transplants: beets, broccoli, bunching onions, cabbage

Table 16-1

Seeds are commonly planted two times as deep as their diameter. Plant seeds slightly deeper in light, sandy soil and not as deep in heavy soil. Planting too early, in too-wet soil, and at too great a depth, often causes seed loss and poor germination.

To facilitate good germination of late-planted seeds, lightly mulch the rows with finely chopped straw, dried grass clippings, or old potting mix. A light mulch helps keep the soil moist and prevents crusting. Organic mulches improve the organic content of soil. Make sure that your mulch is free of weed seeds. Light shading is also beneficial when seeding late.

Transplants

Vegetable transplants are often used with warm-season or long-season crops, such as tomatoes and peppers, which will not ripen if seeded directly into the garden. They are also used to produce early harvests from other crops, including broccoli and cabbage. While some gardeners grow their own transplants in greenhouses, cold frames, or kitchen windows, vegetable transplants are a popular item in retail nurseries. Table 16-1 lists crops that respond well to transplanting and when to set out.

Commercial vegetable transplants are commonly grown in cell packs, solid packs, or large containers. If a cell is tightly root-bound, the root ball should be opened slightly when planting. Transplants should be vigorous but not overgrown.

Transplanting is best done in the late afternoon or on a cool, cloudy day. The plants should be watered well before planting. When transplanting vegetables, make a hole large enough to easily accommodate the root ball of the plants. Soil should then be back-filled and firmed around the roots, and the plant watered in with a starter fertilizer solution. Shade new transplants for a few days if the weather is hot and sunny. New transplants may need water every day for the first week. Long, spindly, tomato plants can be planted in trenches about four inches deep, leaving only the top six inches of the plant exposed. Remove leaves from the portions of the stems that will be buried. The practice of deep planting only applies to tomatoes, however. Other vegetables planted deeper than they grew in the pot are subject to stem and crown rot.

Watering

You can produce more and better quality vegetables by following proper irrigation guidelines. Avoid high volume water applications that run off. For most applications, apply just enough moisture each time to penetrate to the rooting zone depth of the crop. Amounts will vary depending on soil type, but a good rule of thumb is one to two inches of water per week. Place a shallow pan out to measure how long you need to water to apply the desired amount. Infrequent deep watering is better than shallow frequent watering unless the soil is very sandy. Several times each season irrigate heavily to leach excess salts out of the root zone.

Allow the soil surface to dry slightly between irrigations, but avoid alternating between excessively dry and excessively wet conditions. Irregular soil moisture can cause troubles such as blossom end rot of tomatoes. Check the soil by probing with a stick. The soil should be moist and crumbly below the surface.

Warm, windy conditions cause high evaporative loss of irrigation water. Whenever possible irrigate during cool, windless conditions. The best practice when using sprinkler irrigation is to water early in the morning to allow the fruit, foliage, and flowers to dry quickly thereby reducing pest and disease problems. Drip irrigation systems can be more expensive than sprinklers but are much more efficient in terms of water use. They can also help to reduce disease problems by keeping water off the leaves.

Weeding

Weeds rob crop plants of nutrients and moisture, as well as furnishing hiding places for pests. One main reason for lack of gardening success is the failure to get the first weeding job done when plants are small. The average home gardener should forget about chemical vegetable garden weed controls and return to the basics.

Hoes are cutting tools that should be used to slice off weeds at or slightly below the soil surface. Keep hoe blades sharp. Action or scuffle hoes that are used with a back-and-forth sliding motion have become popular and work well on moist, light soils. Rototilling or mulching between rows also helps keep weeds down. Weeding a day or so after a rain or irrigating greatly eases the task when compared to weeding hard, dry soil.

Cover crops or green manure crops can also be grown between the rows in larger gardens to serve the dual purpose of weed control and soil improvement. Cover crops are typically a nitrogen-fixing legume that is grown between crops or in a fallow portion of the garden and then tilled under to add organic matter and nutrients to the soil, as well as to reduce erosion.

Pest Control

The most important step in garden pest control is to catch problems when they first begin by frequent and thorough scouting. Make a quick survey of the garden every few days. Common pests include slugs, aphids, cabbageworms, various beetles, cutworms, cabbage looper, onion maggot, corn earworm, and leafhoppers. Effective gardeners soon learn to distinguish beneficial insects and mites from pests. Pest control programs should be designed to keep pest populations manageable while impacting beneficial organisms as little as possible. See chapter 6 for information on Integrated Pest Management.

Pesticide registrations and labels change frequently so no attempt will be made here to recommend specific products. State Cooperative Extension Offices can supply up-to-date information on recommended pesticides. Always caution customers to follow label directions.

Disease Control

The best disease control practice is to select vegetable varieties that are resistant to the diseases in your area. Another important practice, especially for root diseases, is crop rotation. To reduce foliage and fruit diseases, avoid irrigating in the late afternoon or evening to prevent the foliage and fruit surfaces from remaining wet for long periods of time. Space plants far enough apart to provide good air circulation and light penetration. Trellis or stake tomatoes, peas, pole beans, cucumbers, and other vine crops to improve air circulation and light penetration. Except for shade-tolerant or shade-loving crops, locate the garden where it will not be shaded by trees or buildings.

Recommendations for chemical disease control are also available from State Cooperative Extension Offices. Always follow pesticide labels carefully.

Harvesting

Many crops should be picked early in the day for best quality. Timely picking forces many crops such as beans to continue to set flowers and fruit by diverting energy away from seed development. Many crops are damaged by excessive moisture as they approach ripeness, such as splitting tomatoes or cracking in cabbage heads. Consult a good reference book for specifics on harvesting all the different types of vegetables. Several are listed at the end of this chapter.

Curing is used with some crops, such as dried beans, onion, herbs or garlic that will be stored for extended periods of time. Examples of curing include exposing pumpkins and squash to the sun after picking to harden the rinds. Garlic should be dried and hung in a well-ventilated storage room.

Optimum storage conditions vary according to the type of vegetable. Except for dried and frozen vegetables, however, most vegetables store best under cool temperatures and high relative humidity that keeps them from shriveling. Free moisture should never be present because it leads to rot problems.

Intensive Gardening

When space is limited, intensive vegetable gardening can increase the efficiency of a small garden space. Intensive gardening practices include:

Succession planting

This involves planting a quick maturing crop, such as lettuce, followed by a crop that will mature in cool weather, such as cabbage, in the same area. Succession planting only works in areas with longer growing seasons.

Intercropping

Intercropping is the technique of planting or seeding quick-maturing crops that require narrow spacing (peas, spinach, radish) between rows of longer-term crops that require wide spacing (melons or cucumbers). Another method of intercropping, known as nurse cropping, grows an early-maturing crop such as radishes (thinly) in the same row as a late-maturing slow-generating crop such as carrots or parsnips. This will aid seedling emergence and will make early cultivation easier.

Staking or Trellises

Supports are recommended for tomatoes, pole beans, peas, and light vine crops such as cucumbers. Trellising and staking allows for vertical growth and reduces the horizontal space required. Damage from slugs and rot is also reduced when plants are off the ground.

Container Gardening

Patio tomatoes, bush cucumbers, lettuce and various herbs can be successfully grown in containers. Deep containers with several drain holes and well-aerated soil is recommended. Potting soils based on bark, peat, or compost should be used for container gardening. Regular garden soil or topsoil does not work well in containers, creating a hard, poorly drained material that is difficult to water. Containers require strict cultural practices because of the need for frequent watering and proper fertilization of the plants. Containers can also heat up in bright sun causing root damage to the plants. Many vegetable varieties that have been especially bred for container growing are now available.

Table 16-2. Vegetable seed planting chart

Kind of Seed	Time to Plant Outdoors	Distances Between Plants Between Rows	In Rows	Seed Required		Ready To Use
Asparagus	March-Apr.	5-6 ft.	18-24"	2 oz.-20 ft.	2-3 lbs.	2nd Spring
Beans, Bush	Apr., May and June	2-3 ft.	3-4"	6 oz.-50 ft.	50-60 lbs.	50-70 days
Beans, Pole	Apr., May and June	3 ft.	4-5"	6 oz.-45 hills	30-40 lbs.	70-90 days
Beans, Lime	May-June	2-4 ft.	6-8"	6 oz.-30 hills	50-60 lbs.	90-130 days
Beets, Table	March-July	14-20"	2-4"	2 oz.-50 ft.	10-15 lbs.	45-60 days
Broccoli*	June-Aug.	24-30"	14-18"	2 oz.-750 plants	6-8 oz.	70-120 days
Brussels Sprouts*	Apr.-June	30-36"	18-24"	2 oz.-100 plants	6-7 oz.	90-120 days
Cabbage, Early*	Feb.-Apr.	30-36"	16-24"	2 oz.-1000 plants	6-8 oz.	90-120 days
Cabbage, Late*	May and June	36-42"	24-30"	2 oz.-1000 plants	6-7 oz.	110-120 days
Carrots	Apr.-July	12-24"	2-3"	2 oz.-100 ft.	3-4 lbs.	65-90 days
Cauliflower*	March-June	3-4 ft.	24-30"	2 oz.-750 plants	6-7 oz.	60-80 days
Celery*	Apr.-July	18-36"	6-10"	2 oz.-4000 plants	4-5 oz.	120-150 days
Chicory	March-May, Sept.	16-20"	6-8"	2 oz.-100 ft.	3-4 lbs.	90-120 days
Chives	Apr. and May	12-18"	4-6"	2 oz.-100 ft.	4-5 lbs.	125-150 days
Sweet Corn	Apr.-June	3 ft.	4-5"	6 oz.-100 ft.	12-15 lbs.	60-100 days
Cress	March-May-Sept.	12-18"	4-6"	2 oz.-125 ft.	3-4 lbs.	45-60 days
Cucumber	Apr.-July	4-6 ft.	10-12"	2 oz.-25 hills	2-3 lbs.	50-75 days
Egg Plant*	Apr. and May	24-30"	18-24"	2 oz.-750 plants	4-5 oz.	80-100 days
Endive	May and June	18-20"	10-12"	2 oz.-150 ft.	3-4 lbs.	90-100 days
Herbs, Annual	March and Apr.	20-24"	10-12"	2 oz.-100-300 ft.	3-10 lbs.	125-150 days
Herbs, Perennial	Apr.-June	20-24"	10-12"	2 oz.-100-300 ft.	3-10 lbs.	Next Season
Kale	March and Apr., Aug.	18-24"	12-18"	2 oz.-1000 ft.	6-8 oz.	55-60 days
Kohlrabi	March-May	16-24"	6-8"	2 oz.-150 ft.	3-4 lbs.	50-70 days
Leek	May-June	14-20"	4-6"	2 oz.-75 ft.	4-5 lbs.	120-150 days
Lettuce, Leaf	March-Sept.	12-18"	4-6"	2 oz.-100 ft.	4-5 lbs.	40-70 days
Lettuce, Head	March-Aug.	12-16"	12-14"	2 oz.-1500 plants	1-12 lbs.	70-90 days
Muskmelon	Apr.-June	6-8 ft.	4-6 ft.	2 oz.-20 hills	3-5 lbs.	90-150 days
Watermelon	May and June	8-12 ft.	6-10 ft.	2 oz.-12 hills	4-6 lbs.	85-120 days
Mustard	March-May, Sept.	12-18"	2-3"	2 oz.-300 ft.	4-5 lbs.	45-75 days
Okra*	Apr. and May	22-3 ft.	18-24"	2 oz.-125 plants	5-6 lbs.	50-75 days
Onion, Seed	Apr. and May	12-18"	2-4"	2 oz.-100 ft.	4-5 lbs.	90-120 days
Onion, Sets	Oct.-May	12-18"	2-3"	I lb.-50 ft.	2-3 sacks	50-70 days
Parsley	March-May, Sept.	18-24"	12-16"	2 oz.-125 ft.	3-4 lbs.	65-90 days
Parsnip	Apr.-June	15-20"	2-4"	2 oz.-150 ft.	4-6 lbs.	95-110 days
Peas, Dwarf	March and Apr.	18-24"	2-3"	6 oz.-50 ft.	150-175 lbs.	60-75 days
Peas, Tall	March and Apr.	3 ft.	2-3"	6 oz.-50 ft.	100-125 lbs.	70-90 days
Pepper*	May and June	18-24"	14-16"	2 oz.-750 plants	3-4 oz.	75-85 days
Potatoes, Irish	March-June	24-36"	14-18"	I lb.-15 ft.	7-9 sacks	90-150 days
Pumpkin	May-July	8-12 ft.	6-8 ft.	2 oz.-15 hills	4-5 lbs.	90-125 days
Radish	March-Sept.	12-18"	1-2"	2 oz.-50 ft.	8-10 lbs.	20-75 days
Rhubarb	March-June	30-36"	16-24"	2 oz.-125 ft.	6-8 oz.	3rd Year
Rutabaga	May and June	18-24"	6-8"	2 oz.-200 ft.	2-3 lbs.	90-120 days
Salsify	March-May	18-24"	2-4"	2 oz.-60 ft.	8-10 lbs.	120-150 days
Spinach	March, May, Sept.	12-18"	3-6"	2 oz.-50 ft.	10-12 lbs.	45-60 days
Squash, Bush	Apr.-June	5 ft.	5 ft.	2 oz.-15 hills	4-6 lbs.	55-70 days
Squash, Winter	May-July	10-12 ft.	8-10 ft.	2 oz.-7 hills	3-4 lbs.	90-125 days
Swiss Chard	March-July	12-18"	4-8"	2 oz.-75 ft.	6-8 lbs.	45-60 days
Tomato*	Apr.-June	3-4 ft.	2-3 ft.	2 oz.-1500	3-4 oz.	70-100 days
Turnip	March-Aug.	12-15"	3-4"	2 oz.-200 ft.	2-4 lbs.	45-90 days

Planting dates shown for crops marked "*" are intended to be for setting plants into the garden. Seeds should be sown 40 to 60 days earlier, indoors or under glass. Information in the chart was provided by the Lilly Miller Company and adapted for Montana conditions by the Montana Nursery & Landscape Association.

Seeds should be covered from three to five times its diameter. Press soil down firmly. Keep moist continuously.

The above chart gives distances between rows for hand cultivation; where garden tractor is used the rows should be farther apart.

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Numerous publications are available from the Montana Cooperative Extension Service at www.montana.edu/wwwpubs/pubscatalog.html or write Extension publications, P.O. box 172040, Bozeman, MT 59717-2040

Numerous publications are available from the Agricultural Communications Center, Idaho Street, University of Idaho, Moscow, ID 83843-4196.

Chapter Review

A. List several examples of each of the following:

Cool-Season Crops _____

Warm-Season Crops_____

B. When can garden soil be safely worked in the spring? Why is this important?_____

_____

C. Make two recommendations that will allow a new gardener to grow vegetables on a site with extremely heavy clay soil.

1. _____

2. _____

D. How would you fertilize a new garden using commercial fertilizer _____

_____

E. What are the two main problems with saving seed for a future vegetable garden?

_____

F. Explain how the gardening season can be extended using:

Hot Caps _____

Transplants_____

G. What is intercropping and where is it most successfully used?

H. What are some general guidelines for watering a vegetable garden.

_____

_____

I. Briefly describe several cultural practices that can help to reduce disease problems.

1. _____

2. _____

3. _____