

Lesson C5–2

Planting and Maintaining a Vegetable Garden

Unit C. Nursery, Landscaping, and Gardening

Problem Area 5. Fruit and Vegetable Crop Production

Lesson 2. Planting and Maintaining a Vegetable Garden

New Mexico Content Standard:

Pathway Strand: Plant Systems

Standard: III: Apply fundamentals of production and harvesting to produce plants.

Benchmark: III-A: Apply fundamentals of plant management to develop a production plan.

Performance Standard: 1. Identify and select seeds and plants. 2. Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development. 3. Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments). 6. Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping). 7. Prepare plants and plant products for distribution.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Determine when to plant the vegetable garden.
2. Understand the selection of seeds/transplants for the garden.
3. Explain general planting procedures .
4. Explain how to control plant growth factors.
5. Discuss how to control weeds and plant pests.
6. Determine when and how to harvest vegetables.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture*, Sixth Edition. Albany, New York: Delmar Publishers, 2002.

Voigt, C.E. and J.S. Vandemark. *Vegetable Gardening in the Midwest* (Circular 1331). Cooperative Extension Service, University of Illinois, Urbana, Illinois.

Other Resources. The following resources will be useful to students and teachers:

Schroeder, Charles B., et al. *Introduction to Horticulture*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

McPheeters, Ken. *Planting The Vegetable Garden*, ITCS, (U5031).

McPheeters, Ken. *Caring For the Vegetable Garden*, ITCS, (U5032).

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheet
Garden seeds
Garden transplants in various types of containers
Tillage tools
Mulch samples
Fertilizer samples
Pesticide samples

Terms. The following terms are presented in this lesson (shown in bold italics):

All-American Selection (AAS)
Biological control
Cell packs
Chemical control
Clean seed
Community pack
Complete fertilizer
Cool-season vegetables
Cultural control
Disease-free seeds
Disease-resistant varieties

Drilled
Fall garden
Flood irrigation
Fresh seed
Frost-free date
Frost-tolerant (semi-hardy) vegetables
Hill dropped
Hot caps
Hybrid seed
Inorganic fertilizer
Integrated Pest Management (IPM)
Irrigation
Jiffy strips
Jiffy-7s
Mechanical control
Mulching
Organic fertilizer
Organic mulches
Quality transplants
Seed tapes
Sprinkler irrigation
Synthetic or inorganic mulches
Tender vegetables
Trickle irrigation
Very hardy vegetables
Viability
Warm-loving vegetables
Warm-season vegetables

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

After the previous lesson on planning and preparing a vegetable garden site has been completed, ask students if they think the class could actually plant and care for a vegetable garden. Generally the opportunity to do the hands-on planting and care will excite them. An identification of what we need to know to carry through with the planting and care of a garden should lead the class toward the objectives of the lesson and the anticipated problems.

Summary of Content and Teaching Strategies

Objective 1: Determine when to plant the vegetable garden.

Anticipated Problem: What determines when to plant various vegetables?

- I. Planting time depends upon the hardiness of the vegetables and the climate in your area. Some vegetables can withstand frost, while others cannot. The **frost-free date** for your area is the average date of the last 32° freeze in the spring or the first freeze in the fall. Vegetables are classified as very hardy, frost-tolerant, tender, and warm-loving, according to their ability to withstand freezes, cold temperatures, and heat.
 - A. **Very hardy vegetables** withstand freezing temperatures and hard frosts without injury so they can be planted four to six weeks before the average frost-free date. Onions, cabbage, lettuce, and Irish potatoes are in this group.
 - B. **Frost-tolerant (semi-hardy) vegetables** can withstand light frost, germinate in cool soils, and can be planted two to three weeks before the average frost-free date. Beets, carrots, radishes, and cauliflower fall into this group.
 - C. **Tender vegetables** are injured or killed by a frost, do not germinate well in cold soil, and should be planted on or after the frost-free date. Snap beans, sweet corn, summer squash, and tomatoes are included in this category.
 - D. **Warm-loving vegetables** are intolerant of frost and cold, require warm soil and air temperatures to germinate, and should be planted beginning one to two weeks after the frost-free date. Examples from this category are lima beans, cucumbers, peppers, and sweet potatoes.
 - E. Very hardy and frost-tolerant vegetables are known as **cool-season vegetables**. Tender and warm-loving vegetables are known as **warm-season vegetables**.
 - F. In addition to the spring/summer gardening described above with vegetables planted in the spring and harvested in the summer, some gardeners plant a fall garden. A **fall garden** is a garden planted in late summer with harvesting in the fall before frost. Fall gardens generally require watering and extra attention to weed, disease, and insect control because of the warm days of the late summer.

Teaching strategy would include the use of TM: C5–2B. Have the class find the frost-free date for your area and determine the planting date for each group of vegetables at your location.

Objective 2: Understand the selection of seeds/transplants for the garden.

Anticipated Problem: What factors determine the selection of a particular seed packet or plant pack?

- II. Choose seed from a reputable seed supplier. Quality seed would be a fresh, clean, viable, disease free, and disease resistant hybrid.
 - A. **Fresh seed** is seed that was grown and packaged for the current calendar year.
 - B. **Clean seed** indicates that the package purchased contains only the named seed (that is, true to name), not plant debris, insects, damaged seeds, or weed seeds.
 - C. **Viability** refers to the ability of the seed to germinate and produce a thrifty plant. Many seed companies package seeds in special moisture-proof foil packets to help maintain the viability of their seeds during storage.
 - D. **Disease-free seeds** are seeds that are not carrying seed-borne diseases. Check seed packets to see that the seed was treated to kill any disease organisms that might be present. **Disease-resistant varieties** are varieties with natural disease resistance bred into the seed development. For example, a tomato seed packet with the letters VFNT indicates resistance to **V**erticillium wilt, **F**usarium wilt, **N**ematodes, and **T**omato ring spot virus.
 - E. **Hybrid seed** is seed that was produced by crossing two parental lines. Hybrids exhibit characteristics of both parents and are generally stronger, healthier, more uniform, more disease resistant, and higher yielding.
 - F. **All-American Selection (AAS)** is a hybrid chosen by a non-profit organization sponsored by the American seed trade as a superior performer.
 - G. Gardeners prefer to plant transplants instead of seed for tomatoes, cabbage, and peppers. Transplants provide the gardener with the advantage of earlier harvest. **Quality transplants** are healthy, stocky, medium-sized, disease-free, and insect-free plants. Do not buy plants that are wilted, yellow, spindly, or have spots on the leaves.

Have a variety of seed packets (some common and some hybrids) and sample transplant packs of various qualities on display. Ask students what we need to consider when selecting seeds or plant packs to buy. They will most likely be able to bring out many of the factors. Use TM: C5–2C to show the information available on a typical seed packet.

Objective 3: Explain general planting procedures.

Anticipated Problem: How should seeds and plants be planted?

- III. Different considerations need to be taken into account when planting seeds and transplants. General guidelines for each are as follows:
 - A. If the seedbed has been properly prepared (see Lesson C5–1), the soil when squeezed together in a handful will crumble easily when dropped. Do not be tempted into the poor practice of planting too thick or too deep. Refer to the seed packet for planting recom-

mendations. Check your garden plan to see the location you want the particular vegetable planted.

1. Use small stakes with a string drawn tight to mark straight rows. Drawing a garden hoe handle along the string line can make shallow furrows, suitable for small seed. For deeper furrows, use a wheel hoe or the corner of the hoe blade. Evenly spaced rows at recommended distances make cultivation easier, particularly if a rototiller or small tractor is used.
 2. Place seeds at the depth and spacing recommended. Home gardeners either plant by hand placement or with a one row garden planter available at local garden centers. Take a few minutes to think before dropping the seeds. One rule of thumb for the depth of seed placement is to plant a seed 2 to 4 times its smallest diameter. **Drilled** seeds are planted one at a time while **hill dropped** seeds are planted in groups of usually two or three in a hill. Small seeds are the most difficult to plant. Small seeds can be carefully placed by dropping from between the fingers or mixed with dry soil or sand and scattered in the row. **Seed tapes** are water-soluble plastic tapes with the seeds attached at the correct spacing for planting. They work well but are very expensive.
 3. Cover the seeds and firm the soil with your hands, feet, an upright hoe, or a rake. Firming prevents rapid soil drying and the washing away of the seeds and the soil when rainfall comes. It also assures good seed-soil contact improving germination.
- B. When planting transplants refer to the variety label with the pack for planting instructions such as spacing in the row and between rows. The ideal time to put transplants in the ground is a cloudy or rainy day, early in the morning, or in the evening.
1. Water the transplants well about an hour before transplanting. Plants growing in a “**community pack**”, one with no divisions, need to be cut into blocks by slicing through the soil and roots so as much soil as possible can be lifted out with each plant. If transplants are grown in individual containers, carefully remove plants keeping the soil mass together. **Cell packs** are plastic packs with 2, 3, 4, 6, or 8 individual compartments. Plants can generally be popped out with their entire root system in tact. **Jiffy strips** are peat pot containers connected together. For plants growing in Jiffy strips or peat pots, remove the container from the soil/root mass prior to planting. These containers tend to dry out and keep roots from growing out in the surrounding soil. **Jiffy-7s** are peat moss containers held together with plastic netting. Most gardeners do not remove the netting when planting.
 2. Dig a hole for each transplant and position it a little deeper than it grew in the container. Fill the hole with soil and firm around the roots. Leave a slight depression around the plant to serve as a catch basin for water.
 3. Water the transplant with a starter fertilizer solution such as 10-52-17 (10% nitrogen, 52% phosphate, and 17% potash) at a rate of about 2 tablespoons per gallon of water.
 4. Early transplants may need to be protected from wind and cold by covering with hot caps. **Hot caps** are plastic coverings for plants that allow sunlight in but protect plants from the cold and wind. A collar of paper, foil, or plastic around the stem 1

inch above and 1 inch below the soil line might be used where problems with insects such as cutworms are anticipated.

The best teaching strategy is to have a garden area prepared for planting and actually plant seeds and transplants. If this is not possible, plant seeds and plants in containers in the classroom. Use LS: C5–2A for starting transplants in the classroom. Having samples of a seed tape, community pack, cell pack, Jiffy strip, Jiffy-7, garden hoe, and one row garden planter on hand would be very helpful. Use TM: C5–2D to show pictures of plant pack containers.

Objective 4: Explain how to control plant growth factors.

Anticipated Problem: How can temperature, moisture, and nutrients levels be altered?

- IV. Plant growth will be the best when temperature, moisture, and nutrient levels areas close to the ideal as possible. We cannot control nature but through management practices we can alter these factors.
- A. **Mulching** is covering the soil around vegetable plants with natural or synthetic materials to moderate temperature, prevent weed growth, conserve moisture, improve plant growth, and keep vegetables clean. Light colored mulch such as straw may retard early season growth by keeping the soil cool but help late in the season by preventing damage from high temperatures. Dark colored mulch such as black plastic may be helpful early in the season to warm soil and speed up plant growth. **Organic mulches** are materials from plants or animals such as straw, leaves, grass clippings, ground corncobs, compost, wood chips, and animal manure. When organic mulch decomposes it adds nutrients to the soil and improves soil structure. **Synthetic or inorganic mulches** are human-made materials such as black plastic film, clear plastic film, paper-plastic combinations, foil, and foil-paper combinations. The main disadvantage of the synthetic mulches is the need to remove them when the season ends.
- B. Water is necessary to produce good vegetable crops. Water vegetables once a week during dry periods (usually when less than 1 inch of rain falls during a week). Watering early enough in the day so that moisture on the plants dries before sunset helps to keep down many diseases. When watering, it is best to soak the soil to a depth of 6 inches once a week rather than sprinkle lightly every day. About 1 inch of water a week, including rainfall is desirable for most vegetables.
1. **Irrigation** is the application of water to the soil by flood, sprinkle, or trickle means to supplement natural rainfall.
 - a. **Flood irrigation** is filling trenches between rows with water and is seldom used in home gardens.
 - b. **Sprinkler irrigation** is the application of water in a spray over the top of the plants. The techniques vary from a handheld sprinkler can or a garden hose with an oscillating sprinkler to very elaborate timer controlled systems. Water on the leaves from this technique can result in foliar diseases. The overhead application also results in considerable evaporation.

- c. **Trickle irrigation** uses a tube or hose, usually at a low pressure directly to the row. Systems range from canvas soaker hoses to plastic tubes of various construction types that pass water through their walls at a very slow rate. These systems may lay on the surface or be placed below the soil surface. These systems are very efficient but may also be expensive.
- C. Fertilizers are often necessary to provide for maximum growth of vegetables. Rate of application depends on the locality, soil fertility, and the crops grown.
1. **Organic fertilizers** are materials derived from living organisms (manure, fish meal, bonemeal, cottonseed meal, compost, etc.). They tend to be bulky, slow acting, and more expensive.
 2. **Inorganic fertilizers** are chemical compounds not produced from living organisms. Typical inorganic fertilizers include ammonium nitrate, superphosphate, and muriate of potash. Plants absorb nutrients without regard for their origin; the chemical form that is taken up by the plant is the same whether derived from organic or inorganic sources. The real value of a fertilizer can be thought of in terms of the cost per pound of the nutrients it contains and the improved plant development it stimulates.
 3. **Complete fertilizers** are fertilizers that provide the three major essential nutrients—nitrogen (as N), phosphorus (as P_2O_5), and potassium (as K_2O). An example of a complete fertilizer would be 10-52-17 or 9-23-30. 18-46-0 would be an example of an incomplete fertilizer. Fertilizer may be applied prior to planting (pre-plant fertilizer), at planting as a starter fertilizer, on the growing plant as a foliar spray, or between the rows of growing plants (side-dressing fertilizer).

Samples of mulch, irrigation equipment, and fertilizer would be useful. Use the text resources for additional information. If possible fertilize, water, and mulch a garden so students have the hands-on experience.

Objective 5: Discuss how to control weeds and plant pests.

Anticipated Problem: How can weeds, diseases, and insects be prevented or controlled?

- V. Pests may be described as unwanted plants, animals, or microorganisms. Pests include weeds that compete for nutrients, sunlight, and moisture; insects that feed on plants; diseases of plants caused by fungi, bacteria, and viruses; nematodes, snails, slugs, rodents, and birds. Preventive measures are best. Careful observation or scouting of the growing plants is necessary to identify and control problems. **Integrated Pest Management (IPM)** is using a combination of cultural, mechanical, biological, and chemical methods to control pests. **Cultural controls** are management practices including crop rotation, planting disease-resistant varieties, disposing of crop residues, and changing planting and harvesting times. Trapping and hand removal would be another example of a cultural control. **Mechanical controls** include plowing, mowing, and rototilling. **Biological controls** are the use of parasites, predators, or disease pathogens to regulate pest populations. Praying mantis and lady beetles are examples of biological controls used in a garden. *Bacillus thuringiensis* is a disease-causing bacteria

that can be applied to the garden to kill leaf feeding caterpillars. **Chemical control** is the use of a chemical compound to kill a pest. Cide means kill, so an insecticide is a chemical that kills insects.

- A. Weed control in a home garden is generally a combination of hand hoeing, pulling weeds by hand, rototilling, and mulching. Herbicides are sometimes used for large gardens.
- B. Insects and disease tend to pose problems in the garden in mid to late summer. The Cooperative Extension and garden centers provide current chemical control recommendations.
- C. Mice, rabbits, and squirrels can cause damage to plants. Fencing around the garden and the use of repellents (mothballs or moth flakes) work well. Trapping is another alternative.
- D. Birds can become pests in the garden. The homemade scarecrow is generally ineffective but stakes and flags work well. Place stakes and strips of cloth or aluminum pie plates every 15 to 20 feet in all parts of the garden.

Supplement this information with text material from Introductory Horticulture and Introduction to Landscaping. Samples of mechanical cultivation equipment and samples of pesticides would be helpful to illustrate this lesson.

Objective 6: Determine when and how to harvest vegetables.

Anticipated Problem: When and how should vegetables be harvested?

- VI. If vegetables are harvested at the wrong time, their quality will be poor or unacceptable, and all your hard work will have been wasted. In many cases, the gardener needs to know when to harvest, since merely looking at produce won't necessarily indicate if it is ready. Proper vegetable harvest times will assure the best flavor, maximum tenderness, and crisp texture. The quality of vegetables does not improve after picking, so it important to harvest at the proper maturity for the best quality.
 - A. Many variables influence vegetable maturity. Water stress, improper soil fertility, damage by insects and diseases, and planting out of season can cause vegetables to mature unpredictably. However, the "days to maturity" listings on seed packets, in gardening books, and in seed catalogs are helpful indicators for calculating approximate dates for harvesting. Record all planting dates to aid in predicting dates of harvest.
 - B. Check garden books for information about harvesting specific vegetables. Recommendations such as harvest color, leave stems on or pull off, pick firm or soft, and so on are answered for each vegetable.

Bring in low and high quality vegetables. Have students identify the quality samples. Explain how harvest maturity and harvest techniques affected the quality. Introductory Horticulture provides specific harvesting information. If a garden is available, harvest vegetables as near as possible to peak quality.

Review/Summary. Use the objectives for the lesson as the outline for reviewing and summarizing the content. Use an existing garden to review planting procedures and care of a growing garden. Use the transparencies to help with the review.

Application. Plant and care for a garden in the community. Encourage students to plant and care for a home garden during the summer.

Evaluation. Observe the work of the students in planting and care of the garden. The written test can also be used as a tool in the evaluation.

Answers to Sample Test:

Part One: Matching

1=i, 2=d, 3=h, 4=j, 5=f, 6=a, 7=e, 8=g, 9=b, 10=c

Part Two: Completion

1. drilled, hill dropped
2. Viability
3. Clean
4. Fresh

Part Three: Short Answer

1. cultural, mechanical, biological, and chemical.
2. a. use of tubes or hoses to deliver water at low pressure directly to the soil/plants.
b. application of water in a spray over the top of the plants.
c. filling trenches between rows with water.
3. moderate temperature, prevent weed growth, conserve moisture, improve plant growth, and keep vegetables clean.

Test

Lesson C5–2: Planting and Maintaining a Vegetable Garden

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|---------------------------------|----------------------|---------------------------|
| a. All-American Selection (AAS) | e. hot caps | i. very hardy vegetables |
| b. cell packs | f. hybrid | j. warm-loving vegetables |
| c. community pack | g. jiffy-strips | |
| d. frost-tolerant vegetables | h. tender vegetables | |

- _____ 1. Vegetables that are planted four to six weeks before the frost-free date.
- _____ 2. Vegetables that are planted two to three weeks before the frost-free date.
- _____ 3. Vegetable that are planted on the frost-free date.
- _____ 4. Vegetables that are planted two weeks after the frost-free date.
- _____ 5. Seed produced by crossing two parental lines resulting in more uniform, stronger plants, better disease resistance, and higher yield.
- _____ 6. Varieties selected for superior performance.
- _____ 7. A plastic covering over newly planted transplants to protect from cold and wind.
- _____ 8. Peat pots attached together.
- _____ 9. Plastic packs with individual containers.
- _____ 10. Plastic pack with a common area for several plants.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. When a single seed is placed at a time we say the seeds are _____. When two or three seeds are placed together at a time we say the seeds are _____.
2. _____ refers to the ability of the seed to germinated and produce a thrifty plant.

SPRING PLANTING GUIDE FOR VEGETABLES

| VERY HARDY | |
|--|-----------------------|
| (Plant 4–6 weeks before average frost-free date.) | |
| Seed | Transplants |
| Kale | Asparagus (crown) |
| Kohlrabi | Broccoli |
| Leaf lettuce | Brussels sprouts |
| Onion | Cabbage |
| Pea | Horseradish (root) |
| Rutabaga | Onion (set or plant) |
| Salsify | Parsley |
| Spinach | Potato, Irish (tuber) |
| Turnip | Rhubarb (root) |
| FROST-TOLERANT | |
| (Plant 2–3 weeks before average frost-free date.) | |
| Seed | Transplants |
| Beet | Cauliflower |
| Carrot | Chinese cabbage |
| Chard | |
| Mustard | |
| Parsnip | |
| Radish | |

Warm-Season Vegetables for Late-Spring Planting

TENDER

(Plant on average frost-free date.)

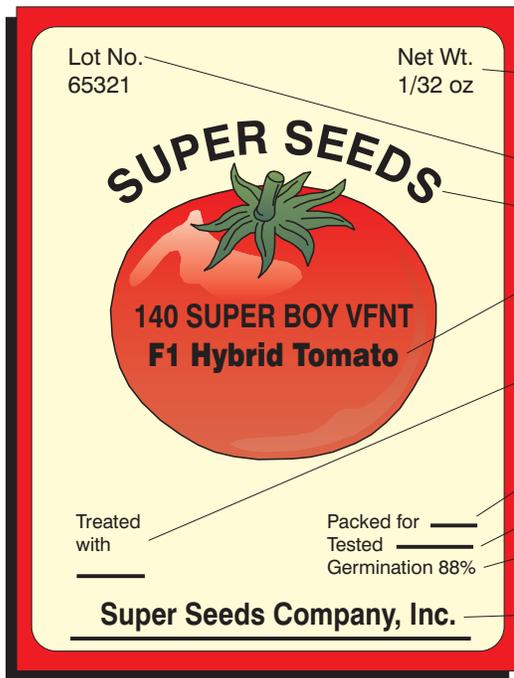
| Seed | Transplants |
|---------------------|-------------|
| Bean, snap | Tomato |
| Corn, sweet | |
| New Zealand spinach | |
| Squash, summer | |

WARM-LOVING

(Plant 1–2 weeks after average frost-free date.)

| Seed | Transplants |
|----------------|---------------|
| Bean, lima | Eggplant |
| Cucumber | Pepper |
| Muskmelon | Potato, sweet |
| Okra | |
| Pumpkin | |
| Squash, winter | |
| Watermelon | |

TYPICAL SEED PACKET INFORMATION



Front

Weight of contents. The weight also may be given in grams. The number of seeds may be indicated.

Lot number. For identification by seller.

Trade or brand name.

Seed catalog number. Name of hybrid, resistance to verticillium and fusarium wilts, nematodes, and tobacco mosaic virus.

Description of seed treatment. Fungicide, insecticide, or hot-water treatments for protection from certain insects and diseases.

Season that seeds were packaged for sale.

Date of germination test.

Percent of seeds germinated under specific laboratory conditions.

Name and address of seller.

Back

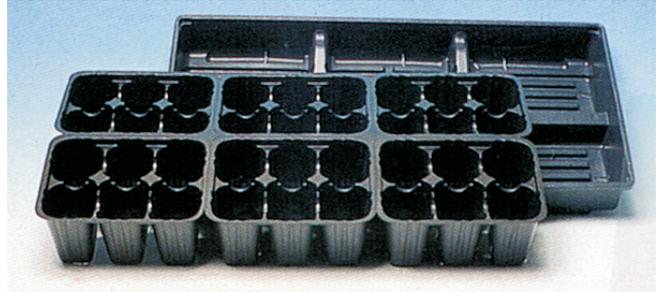
General planting and growing instructions.

Warranty. Limits the liability of the seller to the purchase price of the seeds. The seller guarantees the seeds in this packet to be exactly as described, true to name, and free from insects and diseases.

PLANT PACK CONTAINERS



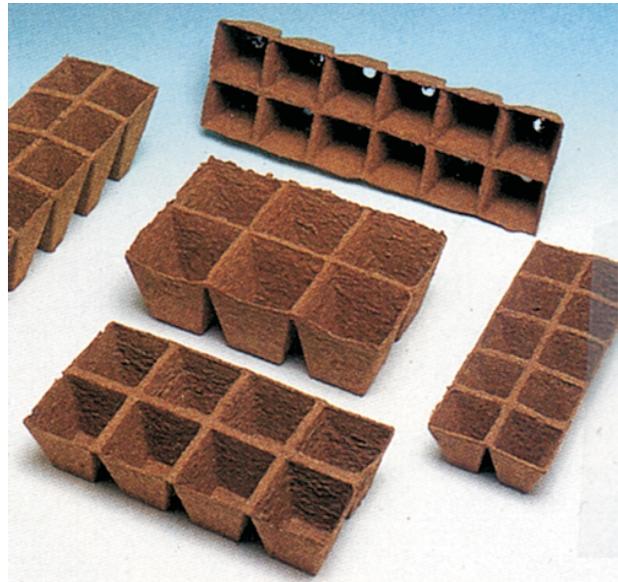
Community Pack



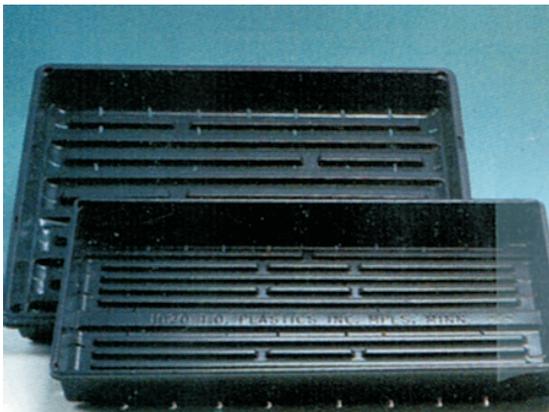
Cell Packs



jiffy®-7 peat pellets



jiffy®-strips



Flats
...holder for plant packs

Lab Sheet

Growing Vegetable Transplants in the Classroom

Materials:

- Seeds
- Vermiculite or other soil-less growing media
- Germinating flats
- Growing packs or flats
- Plant growing support with fluorescent lights

Procedure:

1. Place vermiculite in the germinating flat.
2. Make rows of uniform depth and spacing (follow seed package recommendations).
3. Sow seeds and cover with vermiculite.
4. Cover the seeds with a plastic film to hold in humidity
5. Place the flat in a room at 70°F and set on an 80°F heat pad if available.
6. When the first set of true leaves are visible, transplant the seedlings into cells in growing packs.
7. Place growing flats on the growing support structure and set the lights down near the top of the plants.
8. Water as needed and raise the lights as the plants grow.

