Chapter 4

Maintaining a Healthy Environment

FROM:
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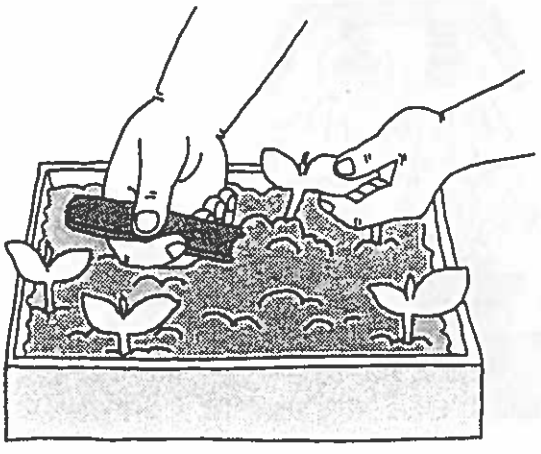
Whether you're gardening on a windowsill, under a two-tube fluorescent light fixture, or in a Grow Lab garden laboratory, the environment must meet specific plant needs if your plants are to thrive. This chapter describes those basic needs and explains how to meet them in your indoor garden.

Although different plants have specific needs for ideal growth, you will maintain conditions that may be a compromise, offering an average of what most plants will need for reasonable growth, within your setting. (Consult your Growers' Guide, Appendix A, for information on expected yields in an indoor garden.)

Remember, there are a number of lessons to be learned from failures as well as successes in the garden. Even with the most careful garden management, plants sometimes fail to thrive. Accidents happen. Pests or diseases cause crop failure. Seeds may fail to germinate. But a failure of one sort or another can become the focus for a new lesson or experiment. For example, if your beans develop a mold and the plants die, seize the opportunity to investigate the life of molds. Use magnifying glasses and microscopes to examine them. Find out what conditions they need to thrive. Try growing molds on different substances. Learn about helpful molds.



Note...
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Do not angle the lights so that one end is higher than the other. This is unsafe since water could condense and run down to the light terminal, creating the danger of electric shock.

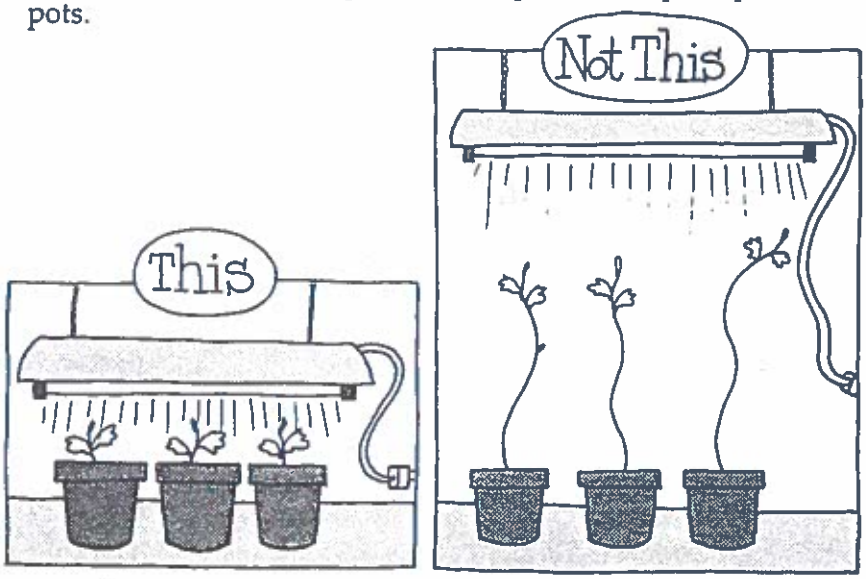
Light

One of the most critical factors for your indoor plants is light. Using the right type and number of tubes, as described on page 30, will not, by itself, ensure success. It's important that you follow the height and duration recommendations in this section to provide adequate light for a thriving garden.

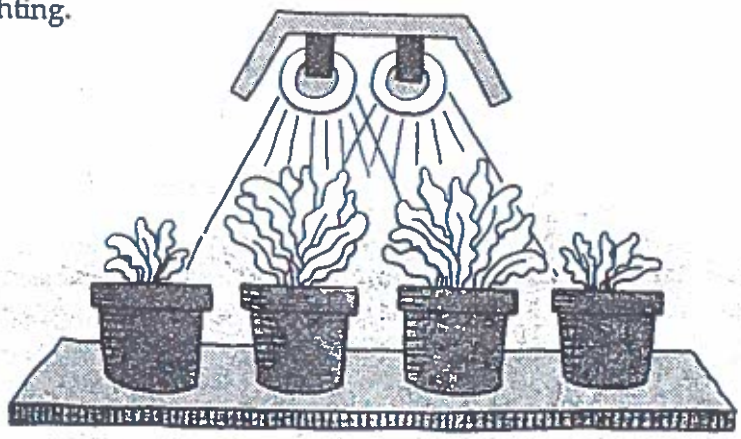
Adjusting Light Height

Always keep the lights 3 to 6 inches from the tops of the plants to foster good plant growth. The amount of light reaching your plants drops drastically as you raise the lights, so resist the temptation to keep lights high for good viewing. If your lights are on adjustable chains, you can raise them easily while children are watering, inspecting plants, or conducting investigations. If your plants are very tall and spindly looking, your lights are probably too high.

Since you will have plants of varying heights but will still want to maintain light at the proper distance, you should arrange plants according to height with some lights higher than others. Another way to adjust height is to place shorter plants on top of upturned pots.



Light intensity is much greater at the center of your tubes than at the several inches on either end and greater in the middle of the Grow Lab than near the edges. Rotate your plants every couple of weeks to ensure that all plants have a chance to receive adequate lighting.



Light Intensity

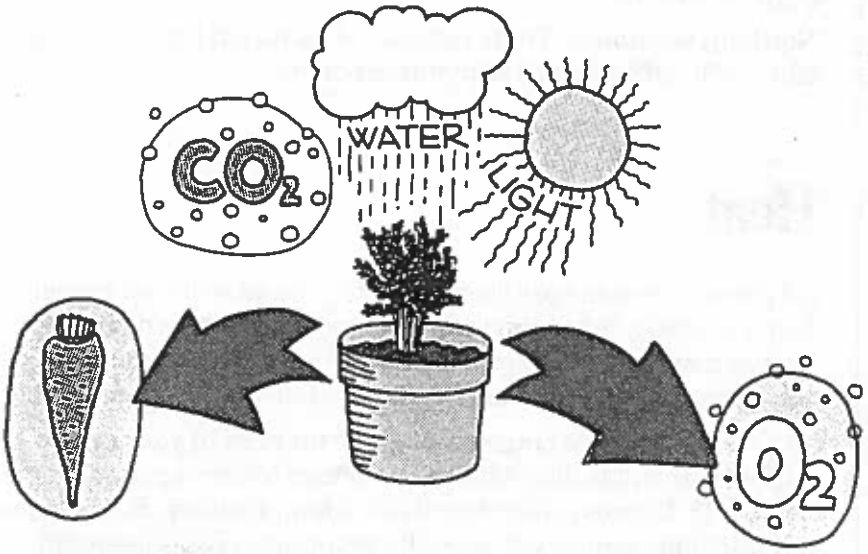
Intensity is an important aspect of light affecting plant growth and development. The other important factors are color (spectrum) and duration. See pages 90 through 92 in the curriculum guide, GrowLab: Activities for Growing Minds for a thorough explanation of these key factors.

Most of the flowers, vegetables, and herbs that you'll grow indoors do quite well with the 1,000 to 1,500 footcandles of light provided by six fluorescent tubes, and some will do well with quite a bit less. (A footcandle is the amount of light produced in a totally dark space by one candle shining on a white surface that is 1 square foot in size, 1 foot from the candle.) By contrast, 500 footcandles is average office light, and the light at noon on a sunny day might be as bright as 10,000 foodcandles.

The amount of light that your indoor garden receives will depend on many factors, including the time of year, orientation of the window, and proximity of lights to a reflective surface. Placing your light garden near a white wall or backing it with aluminum foil increases, through reflection, the amount of light available to your plants. You and the children can investigate various ways to increase the light available to your plants. Use a light meter to check your efforts (see Digging Deeper, page 46).

Controlling Light Duration

Plug your lights into a timer so you can control them automatically, and leave them on for fourteen to sixteen hours per day. Leaving the lights on continually will not cause plants to produce more abundantly. Plants actually require a period of darkness each day in order for respiration to occur. Respiration, which takes place primarily at night, is the process whereby plants convert the products of photosynthesis into usable energy.



Windowsill Light

The amount of light that your plants receive on a windowsill depends on the direction the window faces, whether the sun is blocked by trees or a building, the number of cloudy days, and how much overhang your roof has. Another consideration with windowsill plants is the duration of light. During most of the school year, even the best south-facing window will receive fewer than the fourteen to sixteen hours we recommend.

Given the light limitations of most windowsill gardens, it's best to stick with leaf and root vegetables here. Since we don't eat the fruits of these vegetables, it's not necessary to have the high level or longer duration of light required to induce flowering in many plants. Crops recommended for windowsill gardens include:

beets	radishes
carrots	tomatoes
garlic	herbs
lettuce	flowering bulbs
mustard	houseplants
onion tops	fruit seeds

On a sill, light comes from only one direction, so you'll need to rotate your plants every couple of days as they begin to lean toward the light. Your class can investigate this movement toward light, called "phototropism." Set up experiments indoors and identify the process outdoors in the environment.

Although many factors determine the amount of light available to windowsill plants, the following describes the lighting conditions of different windowsill orientations.

Understanding Photosynthesis

Life on earth is completely dependent on the food and oxygen produced by plants and a few other organisms during the process of photosynthesis.

Photosynthesis is the process by which plants containing green chlorophyll employ the energy of light to combine carbon dioxide (CO_2) from the air with hydrogen (H) from water (H_2O) to produce sugars.

The relatively simple sugars, produced through photosynthesis, are later built into more complex plant foods such as starches, fats, and proteins.

Some of the food produced by a plant during photosynthesis is temporarily stored in the leaves. The remainder is transported through the stem to other parts of the plant where it is stored until needed. This food energy might be stored in a number of forms — as a starch (in potatoes) or as a fat (in peanuts), for example.

The plant eventually uses the stored food to produce more foliage, roots, stems, flowers, and ultimately, to produce offspring, thus beginning the cycle again.

Many of your teaching materials have further explanations of photosynthesis and respiration. Use those references to make these concepts part of your Grow Lab lessons.

How Plants Can Live in an Enclosed System

After helping to build a class terrarium, one thoughtful fifth-grade student asked, "If we need oxygen (which plants give off) and plants need carbon dioxide (which we give off), how can plants survive in an enclosed terrarium?" If you study the cycles described above, you'll notice that plants both photosynthesize *and* respire. During respiration they produce the carbon dioxide that they need for photosynthesis. (The decay of plant matter also produces carbon dioxide.) Thus, technically, we cannot live without them, but they can live perfectly well without us!

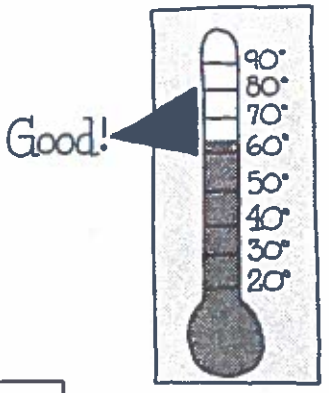
Measuring Light Intensity

One class of eighth-grade students used the light meter in a camera to measure the intensity (foot-candles) of light available to plants in various parts of the room and at various distances from the tubes. This is the procedure they used:

Set the film speed at ASA 200 and the shutter speed at 1/125 second. Aim the camera at a white sheet of paper where your plants will be located. Get close enough so the meter records only light reflected from the paper. Be careful not to create shadows.

Focus on the paper and adjust the f-stop until a correct exposure shows in the light meter of the camera. F-stops will equal approximate footcandles as follows:

F-stop	Footcandles
2.8	32
4.0	64
5.6	125
8.0	250
11.0	500
16.0	1,000
22.0	2,000



Cool and Warm Weather Crops

In outdoor gardens, we distinguish between cool and warm weather crops. As the terms indicate, cool season crops are those which produce best growth, or will mature only during cool temperatures (40 to 65 degrees). Warm season crops require warmer temperatures (above 65) for best growth. Since classroom temperatures tend to be warm, there are certain cool weather crops, like spinach and peas, that can be quite difficult to grow indoors. Others, like lettuce, will grow nicely indoors but may become bitter with temperatures that are too warm. *Continued next page*

Eastern windows – These receive two to four hours of morning sun. Reserve these locations for growing radishes, lettuce and other leafy vegetables, root vegetables, and houseplants that require minimal light.

Southern windows – These receive full sun during most of the day and are a good choice for growing all of the windowsill crops. Plants can, however, get too hot, dry out quickly, and scorch on an unshaded southern windowsill.

Western windows – These generally receive good light for about eight hours a day.

Northern windows – These receive only diffused light. Most vegetables will not grow well with this exposure.

Heat

All plants have a range of temperatures for optimal seed germination. Generally, the optimal air temperature for growing the mature plants is slightly less than that for germinating seeds. (See page 41 for information on germination and temperature.)

The 60- to 80-degree range is adequate for most of your indoor garden plants. Ideally, night temperatures for most plants should be 10 to 15 degrees cooler than the day temperatures. Both of these day and night ranges will typically be found in your classroom climate. The plastic or foil covering that you use to maintain humidity in your indoor garden (see page 31) will also help to maintain somewhat higher than room temperatures.

In extremely cold situations, such as over a vacation when the heat is off, you can use a heating cable to maintain heat in your classroom garden. If using a heating cable, do so only for germination or to maintain a reasonable temperature in the garden. Too much heat can cause plants to dry quickly. Remember, when using a heating cable, always keep the base material moist. (See Appendix D for information on how to set up a heating cable.)

Water

Plants need water because it carries nutrients through the soil, into the roots, and up through the plant to places where the nutrients can be used. Plants use water as a raw material in photosynthesis. Water also helps to keep the plants erect, enabling them to take full advantage of light for photosynthesis.

Too little water will cause wilting, decrease nutrient transport and photosynthesis, and will lead to death of the plant.

Too much water will prevent air exchange around the roots, which essentially suffocates them and leads to rotting of the roots. (Roots that have to search a little for water will become stronger than those that are overwatered.)

Overwatering can cause at least as many problems with your plants as underwatering.

Watering Your Garden

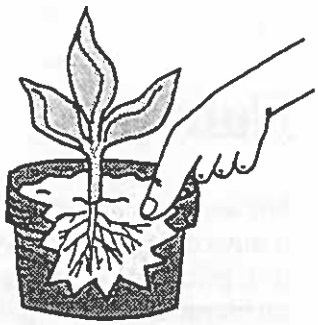
It's best to water only when the plants need it rather than on a set schedule. Large plants with lots of leaves use water faster than small plants. Porous planting containers, like clay pots, will lose water much more quickly than solid (plastic) containers. The soil will dry out more quickly when classroom temperatures are high. If you use a heating cable (see Appendix D), pay particular attention when it is on.

To tell when your plants need water, stick your finger about an inch into the soil in a pot. If soil adheres to it and/or feels moist, you do not need to water yet. Be sure to check a number of pots. Some classes purchase water meters at garden stores and compare the instrument readings with the students' own subjective readings.

When you water, give each plant enough to wet the soil thoroughly. Add water until it comes out from the bottom of the pot.

When watering young seedlings, use only a gentle sprinkling head or a squeeze bottle to avoid washing them away.

(See page 54 for information on providing water during vacations.)



Controlling Your Garden's Humidity

The humidity in your classroom will fluctuate a great deal. Winter conditions indoors tend to be dry. The ideal humidity for the plants in your indoor garden is between 50 and 70 percent. You will not have to keep a careful eye on the specific humidity, but rather, notice and respond to the signs of extremes in humidity. You can purchase a humidity gauge from a hardware store to measure and experiment with humidity's effect on plant growth.

Regularly moisten the base material in your gardening unit to maintain proper humidity.

Moisten it during the week when watering, and let it dry out somewhat between waterings. Constant moisture could create disease problems. Before a weekend or vacation, provide a reservoir of water as described on page 54.

If you have a windowsill garden, keep a tray with a moistened base material (sand, perlite, gravel, capillary matting) under your plants. If the air is very dry, keep plants close together as they help provide humidity for each other. Enclose windowsill plants in large plastic bags if you plan to be away for an extended period of time.

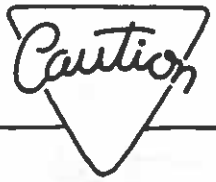
Keep the covering on the top and three sides of your Grow Lab. If your Grow Lab shows signs of excessive humidity, lift all or part of the covering to provide better air circulation.

Table 7 lists symptoms of an excess or deficiency of humidity and offers suggestions for addressing these problems.

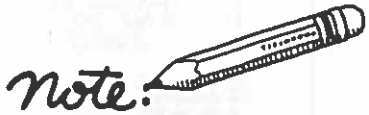
Continued . . .

All of the crops listed in the Growers' Guide have been successfully grown in an indoor environment. If you have very extreme temperature conditions in your classroom, choose crops accordingly. Below is a list of some common cool and warm weather crops that you can grow:

Cool	Warm	
peas	tomatoes	cucumber
radishes	peppers	marigolds
lettuce	eggplant	basil
carrots	beans	zinnias
snapdragons	peanuts	



Water and electricity don't mix. Raise lights when watering so that watering is done beneath, not above, light fixtures. Some teachers prefer to remove pots from the garden during watering. If fixtures do get wet, unplug or turn off the lights immediately. Dry lights thoroughly before you turn them on again.



If you're using a heating cable, as described in Appendix D you should keep the base material constantly moist, since this will help conduct the heat to the root zone of the plants.

Regulating Humidity — Table 7

Humidity Too High	Humidity Too Low
Symptoms: White fungus or green algae growth on soil or base material	**Symptoms:** Leaves curling downward, tips brown
How to lower humidity: Partially remove covering (plastic or foil) from your garden to increase air circulation.	**How to raise humidity:** Keep the garden covered with plastic or foil.
Let the base material in the garden dry out.	Keep the base material constantly moist (not soaked).
Cut back on your frequency of watering.	Keep a number of pots clustered together.
Thin plants (don't crowd them).	If you do not have a Grow Lab, set your pots of plants in a container filled with 1 inch of pebbles, perlite, or sand and keep them moist.
Create breezes (open window, run fan, etc.).	Mist plants every few days.

Note:

Some people prefer misting to other methods of raising humidity. Its effect on raising humidity, however, is only temporary. Misting does help clean dust from plant pores. If you mist, do so lightly and early in the day. (Wet foliage at night can create pest and disease problems.) Do not mist plants that have hairy leaves and stems, such as tomatoes and African violets.

Nutrients

For healthy growth, all plants require certain nutrients that normally come from the soil. The three primary nutrients are nitrogen (N), phosphorus (P), and potassium (K). There are other essential nutrients that are equally important but plants require them in much smaller amounts. (See Table 8 for information on nutrient functions.) Although soilless mixes generally contain some nutrients to get plants off to a good start, you and your students will have to provide additional fertilizer to your plants on a regular basis.

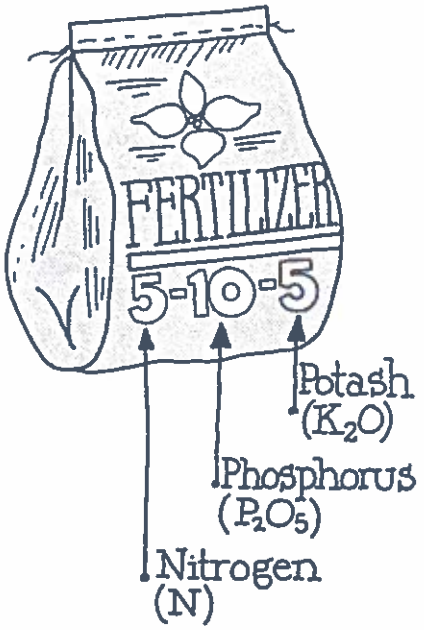
We recommend a complete water-soluble liquid fertilizer for use with indoor gardens for several reasons:

It is widely available in garden stores and catalogs.

It is relatively inexpensive.

It is rapidly available to plants and the concentration can be easily controlled.

The three numbers on a fertilizer container (5-10-5, for example), represent the percentages of nitrogen (5 percent), phosphorus (10 percent), and potassium (5 percent) in an available form in that particular fertilizer. A complete fertilizer is one that contains all of these three primary plant nutrients. Use a fertilizer with equal amounts of nitrogen, phosphorus, and potassium, such as 10-10-10, or with a higher percentage of phosphorus, such as 15-30-15.

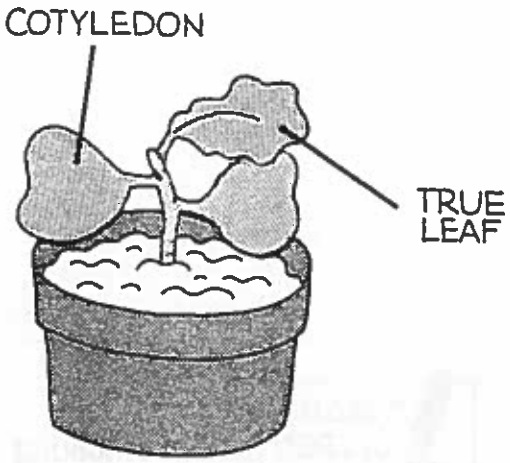


Fertilizing Your Garden

Follow the directions on the fertilizer container to determine proper dilution and frequency of fertilizing. Overfertilizing can be as harmful as underfertilizing.

The dilution rate will vary greatly with the type of fertilizer. Manufacturers of most liquid and water-soluble fertilizers recommend that you fertilize every two weeks with a full strength dose. Some teachers prefer fertilizing with one-fourth the suggested strength every time they water. This requires less attention than remembering when to fertilize. It's often convenient to mix up a large batch of fertilizer in plastic gallon milk jugs and pour that into the watering can as needed.

Start fertilizing plants only after the third leaf appears on the plant. The first two "leaves" or cotyledons are actually a part of the seed and contain nutrients to support early development of the plant.



Other Fertilizer Options

There are other types of fertilizers that you can use in an indoor garden. Below is a description and comparison of fertilizer alternatives.

Organic Liquid Fertilizers—Fish emulsion, seaweed, and combinations of these are commonly used fertilizers. The proportions of nutrients are lower than in synthetic fertilizers, but the instructions for application will compensate for that.

Advantages: They are rapidly available to plants but less concentrated so there is less chance of overfertilizing.

Disadvantages: Most of these have a disagreeable smell. They will be more expensive in the long run than other water soluble liquids.

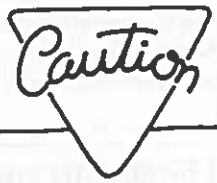
Slow-Release Fertilizers—These are generally beads of fertilizer that are initially mixed in with soil as it is moistened, or applied on the surface after planting. Most brands continue to release nutrients for three to four months or more, depending on heat and moisture. The more often you water the plants, the more quickly fertilizer is released. Warm water also hastens fertilizer release.

Advantages: They require no attention or additional fertilizing for three or four months after the initial mixing.

Disadvantages: Young children may be tempted to put beads into their mouths. (The beads are toxic.) The availability of nutrients is less controlled and they will run out with very long-term crops. (You can then add additional fertilizer beads, or water with a liquid fertilizer.) There is a danger of overfertilizing plants and causing a buildup of harmful fertilizer salts if you use too much water, or water that's too warm.

Compost or Soil in Potting Mix—While soilless mixes have many advantages, potting mixes that also contain some compost or soil are commonly used.

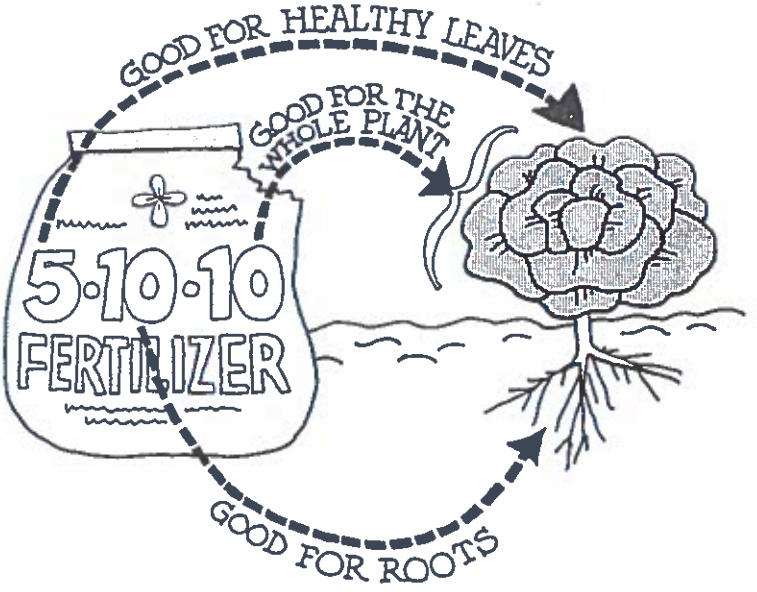
Advantages: Compost and soil contain many trace elements and beneficial organisms, are less expensive than commercial ferti-



Fertilizer is made of concentrated chemicals that can be dangerous if taken internally. Blue, water-soluble fertilizer might be a particular temptation to young gardeners. Slow-release fertilizers are easily ingestible beads and could also be a hazard. Store these supplies out of the reach of children, and discuss these safety issues early on with the class. If fertilizer is ingested, do not induce vomiting unless advised to do so by a doctor or poison center. Rinse the child's mouth thoroughly with water and call a poison center immediately.

lizers, and more closely approximate outside soil conditions.

Disadvantages: They increase the possibility of pest and disease problems and can make the mix too heavy. You will have less precise control over nutrient amounts. You'll need to pasteurize compost and soil by heating small batches in an oven at 180 degrees for thirty to forty minutes. (This decreases nutrient availability and smells bad.)



Nutrient Troubleshooting

Table 8 outlines the functions and symptoms of deficiencies and excesses of the three major plant nutrients. The table simplifies what are actually very complex nutrient functions.

If you are using a complete fertilizer and are using too little or too much, the problem will be most apparent as a deficiency or excess of nitrogen.

Nutrient Functions and Deficiency and Excess Symptoms — Table 8

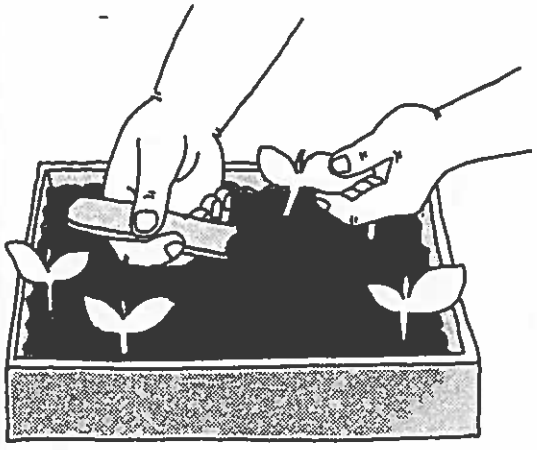
Nutrient	Function	Deficiency Symptoms	Excess Symptoms
Nitrogen (N)	necessary for foliage, growth	yellowing of leaves, beginning with the youngest	long, weak stems and lush, thin foliage, failure to flower
Phosphorus (P)	necessary for root growth, flowering, and fruiting	development of deep green or purplish hue on lower leaves	(not apparent)
Potassium (K)	contributes to overall vigor and resistance	slow growth, stunting, and browning of leaves	(not apparent)

Transplanting

Transplanting is the process of removing young plants from containers in which you first planted them and transferring them into new, generally larger containers. Remember, some crops should never be transplanted. (See page 24 for information on which crops withstand transplanting.) Carefully transplanting plants into new, more comfortable homes can be a thrilling experience for youngsters. Make sure that you read through the following steps to increase transplanting success.

How To Do It

1. **Don't transplant until the seedlings show their first true leaves** after the first two seed leaves (cotyledons) have appeared. The cotyledons provide food to the plant until the true leaves are available to make food through photosynthesis. A week or so after the cotyledons have appeared, you'll see a true leaf that is more characteristic of the plant. Once these true leaves appear, it's time to transplant. You can wait a couple of weeks, but don't wait much longer because roots will develop and intertwine, making it difficult to lift out seedlings without some damage to the roots.
2. **Prepare the containers into which you will transplant seedlings.** Clean previously used containers with a bleach solution of ½ cup bleach to 1 gallon of water and rinse them with clear water to remove any bleach residue. Fill containers with premoistened soilless mix, leaving an inch of head room.
3. **Use your finger or a pencil to make planting holes in the soil.** Holes should be deep enough to accommodate the fully extended roots of the seedlings, and wide enough to allow you to lower these seedlings into the holes.
4. **Grasp a seedling by one of the seed leaves.** (If a seed leaf is torn off, the plant won't be harmed.) Pulling on the leaf gently, coax the seedling out of the soil with a pencil, potting label, toothpick, or similar tool. Don't grasp the seedling by the stem. The stem may seem stronger than the seed leaf, but it is much more important to the plant. If the stem is damaged, circulation to the upper part of the plant is shut off and the plant dies.
5. **Lower the seedling into a planting hole.** Use the pencil or potting label to tease the roots down into the hole. Help the roots to spread out as much as possible.
6. **Press the potting mix around and into the hole with your fingers or potting tool.**
7. **Water the pot thoroughly once it is completely planted.** This gives the plant plenty of water to start with and also helps pack the potting mix around the roots.
8. **Put a label in the pot to identify variety and dates of planting and transplanting.**



A Creative Lesson on Thinning

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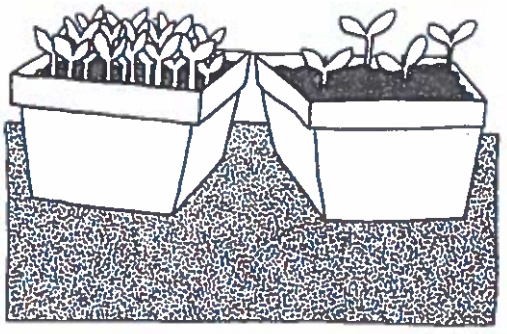
One second-grade teacher used role playing to teach children about the difficult task of thinning. She had a group of eight children stand very close together in front of the room and asked them to imagine that they were lettuce plants growing very tightly in a pot. She asked some on the outside to bend and cast a shadow over the others and told the eight "plants" that they would have one glass of water and one sandwich to share among themselves.

The "lettuce plants" were then asked how it felt to be so tightly packed; to share that small amount of food and water. How long did they think they could survive like that? The children then began to relate this to the discussion of plants. One of the other students then selected five of the "plants" to thin out and transplant to other pots. Then all the "plants" stretched out and described what it felt like to have room to grow!



Thinning

Thinning involves removing some plants from groups that are growing close together to allow the remaining plants more room and better conditions for growth. Thinning, both in outdoor and indoor gardens, is an often overlooked and disliked task. After all, how can we bear to pull out any of our precious, carefully tended seedlings?

Failure to thin plants is a common reason for poor plant growth in both indoor and outdoor gardens. Plants growing too closely together will compete with one another for water and nutrients. They'll all suffer and you will not have healthy plants or a harvest if you don't thin them. Crowded plants also suffer from decreased air circulation and increased risk of disease and pest problems.

The sooner you thin, the better. The longer you wait, the more time the plants will have had to compete, the harder it will be to avoid disturbing the other plants, and the more attached you and the children will have gotten to the plants.

How To Do It

1. **Look for the healthiest looking plants and thin out the rest.** Do this as soon as it's obvious that you have too many plants crowded together (once the first true leaves have formed). Check your Growers' Guide (Appendix A) to see how many plants should remain in each container, and thin to that number. Teachers should carefully oversee the thinning process, since it's easy to become overzealous or careless when thinning.
2. **The most benign way to thin crops that can be transplanted is to transplant them into other containers.** If you don't have room in the class to keep them, you can give them as gifts to other classrooms or send them home with the children.

   Another method of thinning is to cut off the unwanted plants with your fingernail just above the soil line. The bottom of the plant will eventually die. This is preferable to pulling out plants to be thinned, since the pulling may disturb the roots of other plants.
3. **Add additional soilless mix to the pot if you have thinned root crops like radishes, turnips, or carrots.** Add enough to cover the roots (they tend to heave up out of the soil in this light mix). This will improve the root quality at harvest. Exposed roots become dry and scaly.
4. **Water again.** You may have disturbed plant roots during thinning.
5. **Your class can enjoy eating the resulting thinnings** if the plants, like lettuce, mustard, beets, parsley, onions, or herbs, have edible leaves. No sense in letting the products of your labors go to waste!

Pollination

Pollination is the process by which pollen from the tip of the stamen (called the anther) of a male flower is transferred to the tip of the pistil (called the stigma) of a female flower so that fertilization, and then fruit and seed production, can occur, thus completing the full cycle in the life of a plant. (See Flower Power in Appendix B.)

In a garden, pollination is only necessary for those crops that produce edible fruit or seeds. If we eat the root or leaves of a plant (as with carrots and lettuce) there is no need for pollination in order to achieve a harvest. Crops like cucumbers and tomatoes, that produce edible fruit or seeds, must somehow be pollinated in order to produce a harvest. In nature, pollination is most often aided by the action of wind and insects.

Most flowers are bisexual, that is, they have stamens and pistils in the same blossom. (These are called "perfect" flowers.) Pollination occurs easily in perfect flowers since their parts are arranged to enable pollen to transfer easily. The slightest touch or air movement around most perfect flowers will lead to pollination. Indoor garden crops that have perfect flowers and require only slight movement to pollinate themselves include tomatoes, peppers, eggplant, peas, and beans.

Some species, such as cucumbers and squash, have separate male and female blossoms, called "imperfect" flowers. You can recognize the female blossoms by the miniature fruit (ovary) that develops behind them, even before pollination occurs.

In your indoor garden, cucumbers are the only crop that you should pollinate by hand to simulate the role of bees.

Pollinating Cucumbers Indoors

Since there are (hopefully!) no bees in your classroom to carry the pollen from the male to the female flowers of your cucumbers, you and the children must fill that role. To do this, you'll need to distinguish the male flower from the female flower. As the plants flower, you will notice that some of the blossoms have a miniature fruit (ovary) at the base. These are the female flowers.

Although this miniature fruit looks like the beginning of a cucumber, it won't continue to develop unless it's pollinated. Male flowers are generally the first to appear and they do so in greater numbers than the female flowers. Male flowers don't have a miniature fruit at the base of the blossom. Once you have some female flowers, you can try your hand at pollination.

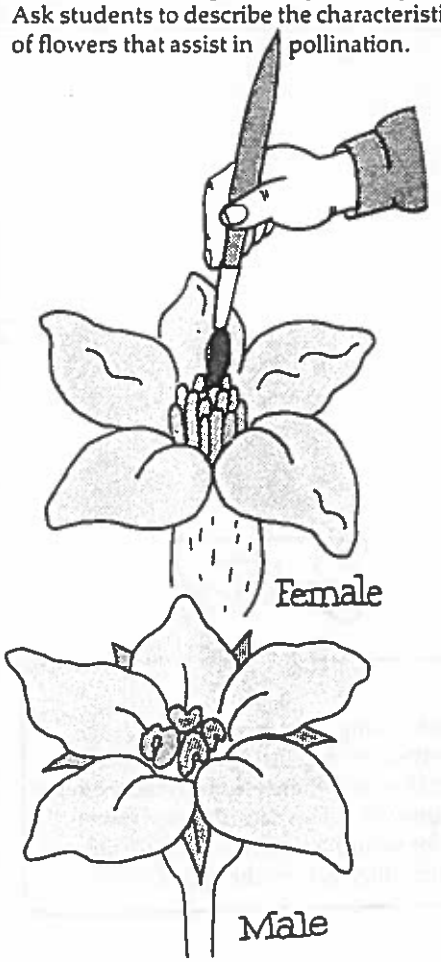
Using a small paintbrush, carefully collect the yellow pollen grains from the tip of the stamen (the anther) on the male flower, and gently touch the brush to the tip of the pistil (the stigma) of the female flower. As long as some of the yellow pollen is transferred to the female, you're likely to achieve pollination. Female flowers that have not been pollinated will die.

Pollination Adaptations

An exciting concept for children is that the primary "purpose" in the life of a flower is to become pollinated. Flowers all have adaptations such as color, size, shape, fragrance, etc., to attract bees and other pollinators (or assure pollination by wind or other means). The pollinator uses the sweet nectar and pollen to make food for itself and its young. While collecting pollen, the bee or other pollinator inadvertently transfers pollen from one flower to another.

Many flowers (such as grasses) are small and inconspicuous, while others (cucumbers, roses, etc.) are showy, bright, and fragrant. Flowers that are wind-pollinated need to be light and airy while flowers that need to attract insects must be bright, fragrant, and flamboyant!

Have your students study flowers from outdoors, from home, and from the classroom garden. Use magnifying glasses to examine them and try to identify some of the flower parts. (Not all flowers will have all of the parts shown in the diagram in Appendix B.) Feel some stigmas to see if they are sticky and have children guess why this might be. Ask students to describe the characteristics of flowers that assist in pollination.



Preparing for a Vacation

After carefully tending your indoor school garden for weeks or months, you may find yourself worrying about having to leave it for a week or two because of a school vacation. While some teachers avoid this problem altogether by planning the calendar so that garden projects end just before a vacation and new ones begin afterward, many teachers choose to carry plants through a vacation period.

How will those plants get along without you? Will you need to come to school in the middle of a vacation just to water them?

Experience has shown that, although disasters can occur, there are some simple steps you can take that enable you to safely leave your plants unattended for up to two weeks at a time. The most important step you can take in preparing to leave your plants for a vacation is to make sure that the soil around them remains moist. During a vacation, the most serious problem you must guard against is drought. Here is what you can do to prevent it:

1. **If you have sand or perlite in the base of your garden, fill it with water so that it nearly touches your pots.** (Two to three gallons should be plenty.) This water will evaporate during the vacation, keeping the humidity in your garden high. High humidity reduces water loss from your plants and growing medium.

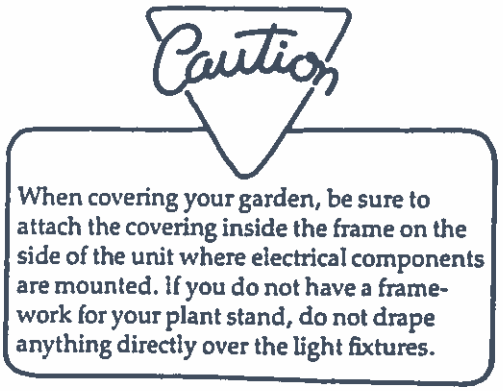
   If you are using capillary matting on top of trays as illustrated on page 30, fill the tray with water, moisten the matting, and dip the ends of the matting in the water to act as a wick. Water will be drawn up continually, providing humidity for the plants.

   If you are using matting directly on the plastic liner, fill a large bowl, pot, plastic tub, etc., with water and wet your capillary matting wick and the fabric. Place one end of the wick in the reservoir and the other end under the matting, ensuring good contact with the matting. If you have room, your best bet is to leave the reservoir inside the enclosed Grow Lab. If you must leave it outside, cover the reservoir to reduce evaporation.

2. **Completely cover your light garden with plastic or foil** (if fire regulations allow). Sealing the unit in this way will prevent moisture from escaping, forming what amounts to a large terrarium. Make sure that the covering is tucked inside the base. Otherwise, condensation will drip outside and you'll lose moisture and create a real mess.

   Cover plants with plastic bags if you don't have a Grow Lab or other light garden framework, or if you have mature plants that are in danger of using all of the moisture in their soil over vacation. Pull the bag down over the plant and tuck the bag opening into the top of the pot. In that way, any moisture that condenses will run back into the pot, continuing to water the plant. Support the bag inside with sticks so the bag doesn't touch the leaves. Don't leave the plant in strong sunlight or it will scorch.

3. **Reduce the number of hours that your lights are on.** Although fluorescent lights produce little heat, they do produce some



When covering your garden, be sure to attach the covering inside the frame on the side of the unit where electrical components are mounted. If you do not have a framework for your plant stand, do not drape anything directly over the light fixtures.

and the longer they're on, the more water the plants will be using for increased growth. Plants can easily get by on ten hours of light each day during short periods.

4. **If you are using a heating cable, don't leave it plugged in.** The heat would speed evaporation of water from the base and the pots. An exception to this is if there is a danger of temperatures dropping very low over vacation. Leave the cable on in these circumstances after checking with the custodian regarding safety precautions. (If you must leave the heating cable on, you'll need to find a reliable person to come in and water your plants every few days.)
5. **If you have someone come in to water your plants,** make sure that the person is reliable, will come in once or twice a week, knows just what to do, and will seal up the covering again afterward. Otherwise, he or she can do more harm than good.
6. **When you return, uncover the plants and check carefully for signs of insect or disease problems.** These problems can develop easily in those still, warm, humid conditions. Check immediately so that you can take action if necessary. If the soil and air are very damp after having been covered, try plugging in your heating cable, if you have one, to dry out the garden.