What’s Ahead
In this lesson, you’ll learn:
☐ the parts of a seed;
☐ how seeds grow;
☐ good seed sources; and
☐ how to grow healthy transplants and move them to your garden.

What’s a Seed?
The seed is made up of three major parts: the embryo, the endosperm and the seed coat.

The embryo is actually an immature plant in an arrested state of development; it will grow to form the plant. Most seeds also contain a built-in food supply called the endosperm. The endosperm is made up of proteins, carbohydrates and/or fats. The third part is the hard outer covering, called a seed coat. This protects the seed from disease and insects. It also prevents water from entering the seed and causing the seed to germinate before it’s supposed to.

How do Seeds Grow?
The seed’s first step in growing is germination. The radicle emerges first, and from it roots will develop. Above the radicle are the “seed leaves,” or cotyledons. These serve as a food supply. They are usually different in shape from the true leaves that the mature plant produces.

Plants with one cotyledon are called monocotyledons. Grasses are the most common “monocots.” Plants producing two cotyledons are called dicotyledons or “dicots.” Most “broadleaf” plants, i.e. vegetable seedlings, are “dicots.”

Getting Good Seed
Good seed must be free from disease. Diseases can be carried both inside and on the outside of the seed coat. Those on the outside can be controlled by seed treatment. That’s why many vegetable seeds are treated with fungicides. Internal diseases can be controlled by treatment, too. Your best bet is to buy seed that has never been infected.

Good seed must be true to its varietal name. Varieties of a particular vegetable can have different yields, quality, disease resistance and ripening rates. Early ripening is helpful for long-season vegetables, such as corn and melons, because Maine’s growing season is short. You may want later ripening varieties to extend your harvest season. However, these varieties may need extra protection in our colder climate.
Lesson 4
All About Seeds,
Growing Seedlings
and Transplants

Sources for Seeds
Vegetable seed growing
is a highly specialized
business requiring
knowledge and skill.
That's why smart
gardeners buy their
seeds from reliable
sources. Some gardeners
save seeds from
crops to plant next
season, especially vari-
eties that may be hard
to find. However, you'll
probably have better
luck if you purchase
seed to plant.
Seeds of hybrid vegeta-
bles should never be
saved, as they will not breed true. Hybrid seed is
created by crossing two inbred parents that may
not look like their offspring.

Growing Your Own Transplants
Do you want to grow some crops that need a
long season, such as tomatoes, peppers or
melons? Do you want to get an extra early
harvest from your lettuce or cabbage? If so, you
may want to start your plants in a greenhouse,
hotbed or sunny window in the early spring.
Then they'll be ready for transplanting into the
garden when the weather warms.

Here's a list of vegetables that would be
good candidates for home-grown transplants:
tomatoes  broccoli
tomatoes  broccoli
tomatoes  broccoli
tomatoes  broccoli
tomatoes  broccoli

Sow seeds evenly in germinating flats or containers (above, left). Cover lightly with soil or
vermiculite. Transplant the seedlings into other flats, pots, peat pellets or growing contain-
ers soon after the seed leaves are fully developed. To transplant (above, right), make a hole
in the medium with a pencil or stick. Hold the seedling carefully by the tip of the seed leaf.
Insert the roots of the seedling in the hole and gently firm the medium. Water well.

cucumbers  winter squash
cauliflower

Growing transplants requires some dedication
and skill. If you have the time, interest and
space, it can save you money. However, if you
only need a few transplants, it may be cheaper
for you to buy transplants from a commercial
greenhouse or garden center.

When starting plants, consider the soil.
Use a good plant-growing soil that is loose and
crumbly, will not form a crust and will hold mois-
ture but not get water-logged. Ordinary topsoil
from your garden is not good for starting trans-
plants. It tends to cake and not allow water to
drain when used in containers. Garden soil may
also contain disease organisms that will affect
young seedlings indoors.
Most gardeners buy growing media (with soil or soil-less) from garden stores or seed companies. Whatever mix you buy, be sure that it is free of diseases, insects and weeds, and is lightweight. This will reduce the potential for "damping off," a common fungus disease.

Here are some suggested steps to start transplants:

1. Make holes in the bottom of transplant containers for drainage, if necessary.
2. Fill the container with moist growing media until it overflows, then pat it down gently. The soil should be level with the top of the container.
3. Make rows two inches apart and 1/4 inch deep across the container. Sow tomato and pepper seeds two to three seeds per inch. Sow lettuce and cabbage one to two seeds per inch. Use the seed packet or a card folded into a "V" to sprinkle the seed.
4. Cover the seed with media no deeper than twice its thickness. Press lightly. Many gardeners like to put paper (or a plastic bag) over the container to keep moisture in and help seeds germinate.
5. Place the containers in an area warm enough so the soil will be about 65 to 75 degrees F.
6. When the seedlings emerge, remove the cover and place the containers in full sunlight.

7. When seedlings get larger, transplant them into other containers to prevent overcrowding. This will also help them develop a well-branched root system. Overcrowded plants will look leggy or spindly. You can transfer the seedlings after the two cotyledons have separated, and before the true leaves emerge.

Select only the most vigorous seedlings for transplanting. Handle them gently by their leaves, not stems, and replant them slightly deeper than they grew in the seedling container.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Problem</th>
<th>Solution</th>
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<tbody>
<tr>
<td>Leggy or spindly</td>
<td>Not enough light: overcrowded</td>
<td>Provide more light; thin the number of plants; lower temperatures</td>
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<tr>
<td>Seedlings fall over at soil level and die</td>
<td>Damping-off disease</td>
<td>Use only sterilized soil, sterile pots and tools; keep soil level with top of pots</td>
</tr>
<tr>
<td>Insect damage</td>
<td>Aphids; white fly; leafminer</td>
<td>Remove or disinfect house plants before starting vegetables</td>
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Water each container regularly to keep the soil from drying out. An occasional watering with starter solution (dilute fertilizer or commercial mix made for transplanting) may be helpful if your plants are growing slowly and lack firm, rich green foliage. However, the starter solution should not touch the plant because it may injure it.
Lesson 4
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Melons, cukes and squash can be difficult
to transplant. Grow them from seed in large
containers so that they can go right to the garden
without disturbing the root system.

Sow three to five seeds in each container.
When the seedlings emerge, thin them to one to
two plants per unit.

Your plants need 14 to 16 hours of light
each day to grow well. You may have to add
“sunlight” with a cool white fluorescent lamp.

Transplanting Outdoors
Vegetable transplants should be healthy and
vigorous, with good roots. You’ll need to “harden
them off” before transplanting. To do this, gradu-
ally reduce the growing temperature or water
supply. Many growers harden-off plants by plac-
ing them outside during nice weather in the
shade two to three weeks before planting them.
Gradually increase the amount of direct sunlight
each day. Take the plants indoors if temperatures
drop below 40 degrees F.

Have the garden soil ready before you
transplant. Transplant on a cloudy day, in late
afternoon, or in early evening to prevent
wilting. It helps to water the plants several
hours before transplanting. Handle
plants carefully. Avoid disturbing the
roots or bruising the stems.

Dig a hole large enough to
hold the transplant roots. Set the

plant slightly deeper than it was growing and at
the recommended spacing (check the seed
packet). Press soil firmly around the roots of
transplants. Pour about a cup of starter fertilizer
solution around the plant. You can make a
starter solution by mixing at half strength the
fertilizer recommended for the plant during the
normal growing season. Diluted fish emulsion
may also be used.

After transplanting, protect the plants and
encourage new growth by covering them with
milk jugs, hot caps or rowcovers. Water the
plants once or twice during the next week if there
is less than two inches of rainfall. Remove hot
caps when plants become crowded or start to
flower.

Timing Your Transplants
Seed your transplants early enough so they will
be ready for planting outdoors at the right time.
Here’s a list of suggested starting times for
Maine:

Peppers: Start eight to 10 weeks before
planting.

Broccoli, cabbage, cauliflower,
tomatoes: Start four to six
weeks before planting.

Cucumber, melon, pumpkin,
winter squash: Start two to
three weeks before planting.
Summary
In this lesson, you've learned about seeds and transplants. Now try to answer the Study Questions and check your answers. The Study Activities will help you expand on your new knowledge. In Lesson 5, we'll discuss ways you can boost your garden's soil for a bountiful crop.

Study Questions
1. Describe how a seed germinates.
2. How do you harden-off a transplant before planting outdoors?
3. Name the parts of a seed.
(See answers at bottom of page.)

Study Activity
Germination Check
Most seed companies print the germination percentage of the seeds on the seed packets.

However, you can test seeds for germination before you plant them. This is a good idea if you have any doubt as to the viability of the seed or if you have saved last year's unused seeds. Here's how.

Count out 20 seeds; place between two paper towels that have been soaked in water and wrung out so that they are damp, and place in a shallow dish. Cover with another dish, inverted, to prevent evaporation of moisture. At 60 to 70 degrees F, the viable seeds will begin to sprout in a few days. Count the seeds that germinate and divide by 20. Then multiply by 100. This is the percentage of germination. Don't count seeds that produce weak, tardy sprouts. They often fail when planted in the soil.

Example: 15 seeds germinate.
20 divided by 15 = .75 x 100 percent = 75 percent
Germination is 75 percent.
Increase your seeding rate to get the number of plants you want. For example: If germination rate is 75 percent, and you want 20 plants, you'll need 27 seeds.
(20 divided by .75 equals about 27.)

Other Resources:
Check with your county Extension office for these publications:
- Bulletin #2078, Home Vegetable Gardening
- Bulletin #2106, Natural Gardening
- Bulletin #8039, Vegetable Gardening

Study Question Answers
1. The hypocotyl is the first part of the plant to emerge. It develops into a root and a shoot. The top part of the hypocotyl is the plumule, or seedling root, of the plant. It is different from the other leaves of the plant and serves as the plant's initial feeder. The plumule starts growing as soon as the plant emerges from the soil. 
2. Reduce the growing temperature, withhold water or increase light intensity.
3. The embryos, the endosperm and the seed coat.