

Plant Propagation

Grades 6-8



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Seed Germination

Transplanting Seedlings

Master Gardeners

The University of California Cooperative Extension (UCCE) Master Gardener Program (MGP) is an educational program designed to teach and effectively extend information to address home gardening and non-commercial horticulture needs in California.

UCCE is the outreach arm of UC's division of Agriculture and Natural Resources (ANR). Master Gardener volunteers (MG volunteers) promote the application of basic environmentally appropriate horticultural practices through UCCE-organized educational programs that transfer research-based knowledge and information.



University of California

Agriculture and Natural Resources

UCCE Master Gardener Program



Learning Goals

Student gardeners will learn the following principles of plant propagation:

- How to germinate seeds
- How to transplant seedlings.

Why is this important?

- Plant propagation is the process of increasing the number of a plant species. How a plant is propagated can increase new cultivars and greater diversity within a species.



Part 1: Seed Germination

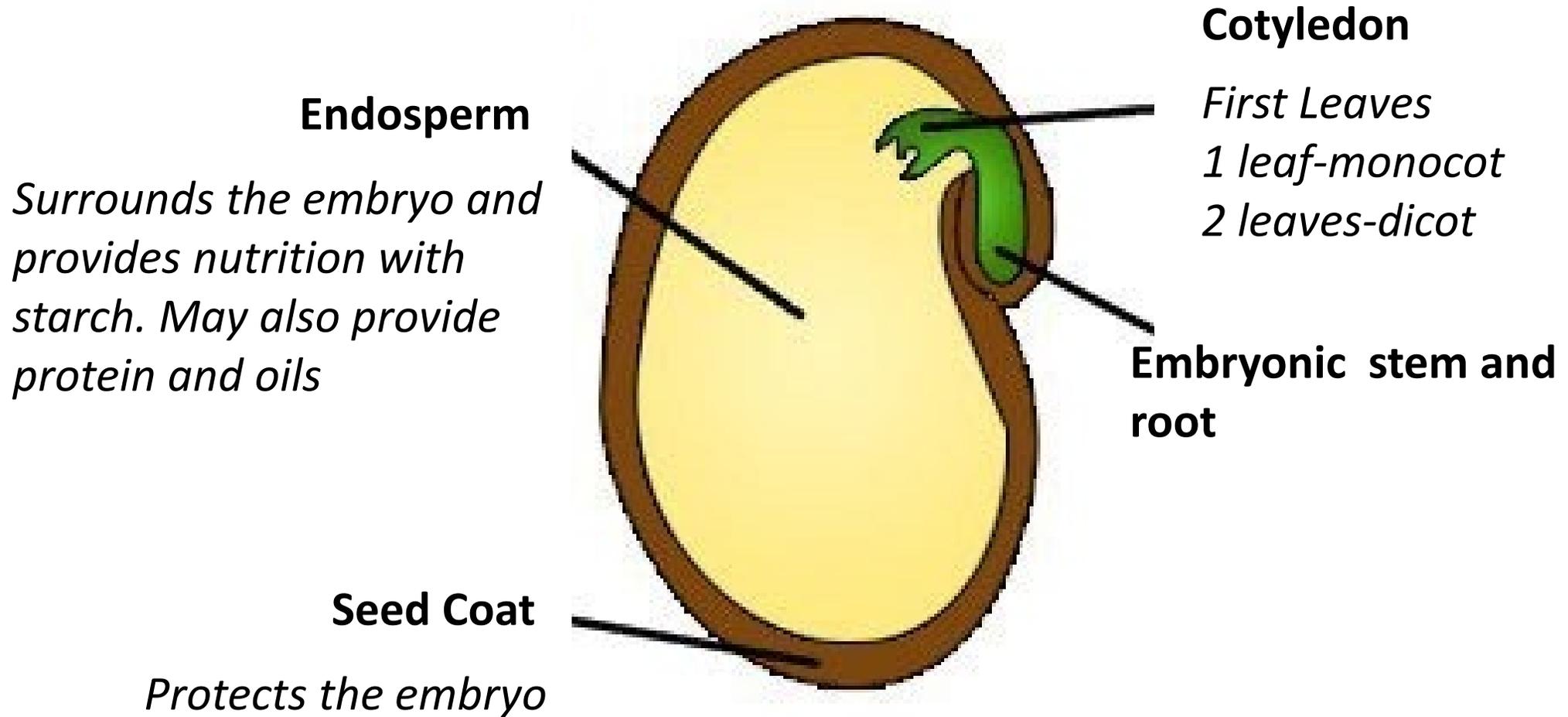
Understanding Seed Germination

- Annual, most biennial, and many perennial plants begin their growth and development at seed **germination**.
- Seeds capable of germination are said to be **viable**. They contain a living embryo that is **respiring** at a low level.
- Germination starts when a seed **first takes in water** and ends when the seedling is self-sustaining.



The inside of a Ginkgo seed, showing a well-developed embryo, nutritive tissue , and a bit of the surrounding seed coat.

Inside a Seed

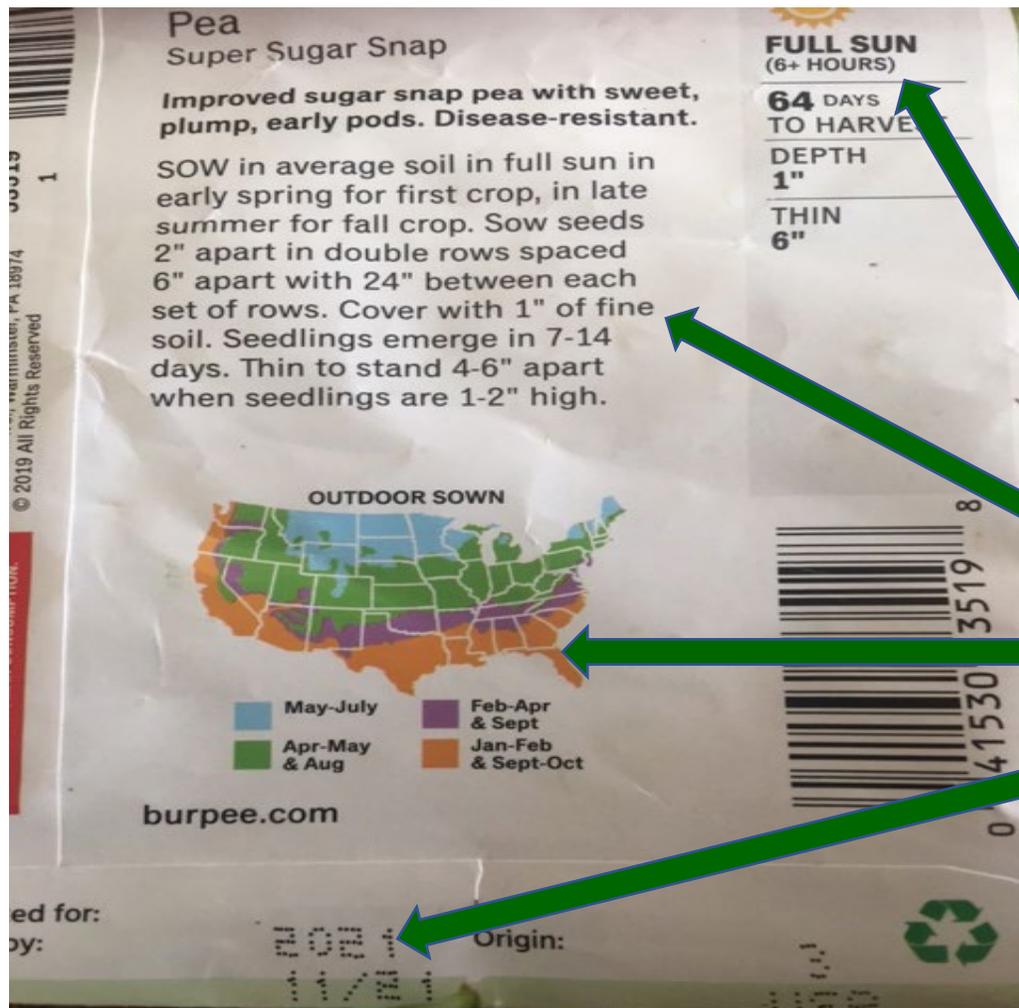


Environmental Factors are Critical

Before germination occurs, a seed must be surrounded by suitable environmental conditions:

- **Water:** A continuous water supply is needed for germination. Lack of water means the embryo will die.
- **Oxygen:** Because respiration increases during germination, the soil the seed is planted in should be loose and aerated.
- **Temperature:** The correct growing temperature will increase the rate of germination .
- **Light:** Light stimulates growth in some species and inhibits it in others.

Read Your Seed Planting Directions Carefully!



It will provide information on the important environmental factors for your seed's growth.

Light,

Oxygen,

Temperature,

And viability of the seed

Video: Planting Seeds



Check For Understanding

- What does germination mean?
- Germination begins when a seed first takes in _____.
- A viable seed has a living embryo that is _____.
- What does the endosperm provide?
- How is the embryo protected?
- Name an environmental factor that is critical for seed germination.



Application Activity

Watch a time time lapse video of seeds sprouting:

[Germination of a Radish Seed](#)

and /or

[Peas Growing](#)

- Create your own version of an above ground “time lapse “ by taking pictures of your seeds sprouting and growing over a two-to-three-week period.



Twining motion of vines

Extend Activity: Grow Micro-greens!



Micro-greens are seeds sprouted and eaten shortly after sprouting.

- These are young vegetable greens that are approximately 1–3 inches (2.5–7.5 cm) tall, when harvested. They are fast growing.

Recommended Seeds:

- Radish, kale, broccoli, lettuces, mustard, cabbage, watercress, arugula, beets, peas, spinach to name a few.

[Fact Sheet on easy steps to growing micro-greens](#)



Part 2: Transplanting Seedlings



Transplanting

Most plants transplant well and can be started from seed indoors. The few plants that are difficult to transplant (such as zinnias, squash, melons and potatoes, are usually seeded directly outdoors.

Why Transplant a Seedling?



Seedlings must be transplanted to give them proper growing space if they have been:

- planted in a growing flat,
- planted in a container with other seeds,
- or are outgrowing their individual container.

The ideal time to transplant a seedlings is when it is small and there is little danger of setback.

- This is usually when the first true leaves develop above or between the cotyledon leaves which are the first leaves the seedling produces.

Three Steps for Transplanting

Whether the seedlings will be transplanted into larger containers or directly into a garden bed, the following three steps must be followed.



Step 1: Carefully Dig!

To dig seedlings out of the planting medium use:

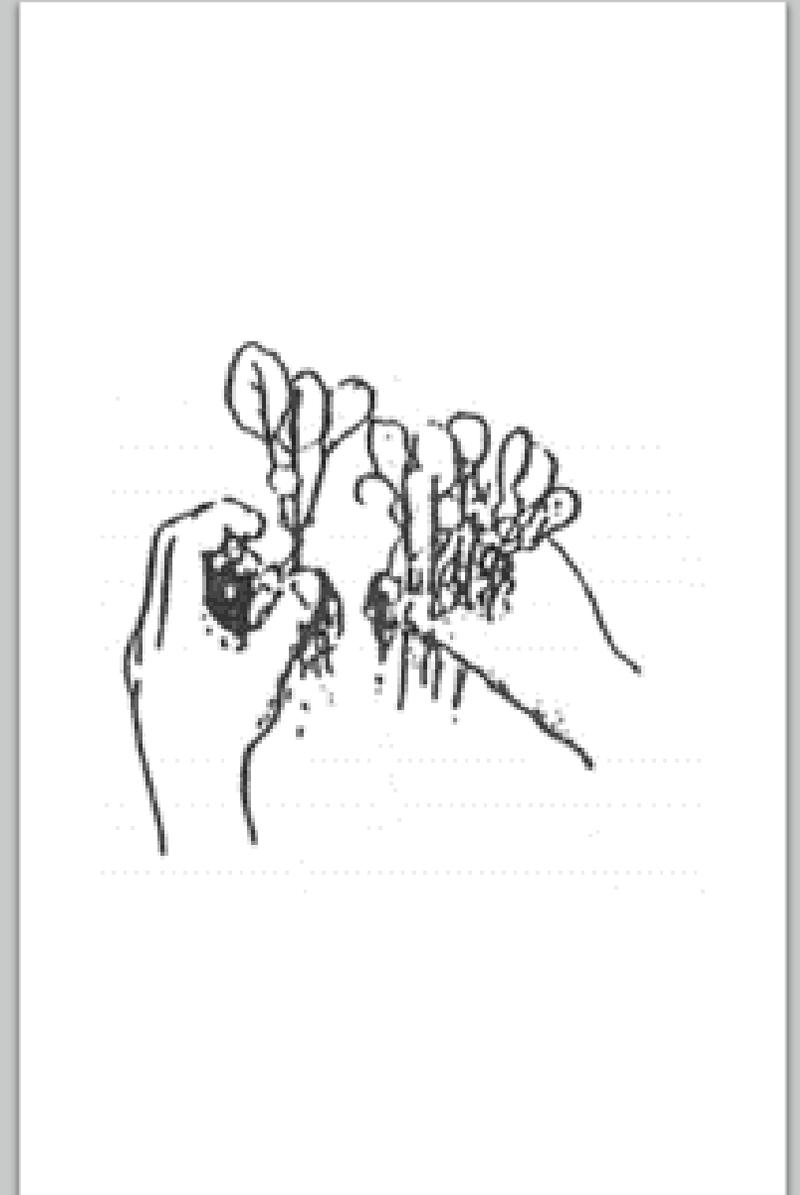
- Wooden plant label (popsicle stick)
- Sharpened pencil
- Dowel
- Fork or spoon for larger seedlings



Step 2: Carefully Remove!

If seedlings have been grown together, gently ease the plants apart into smaller groups using a pencil point, popsicle stick or butter knife .

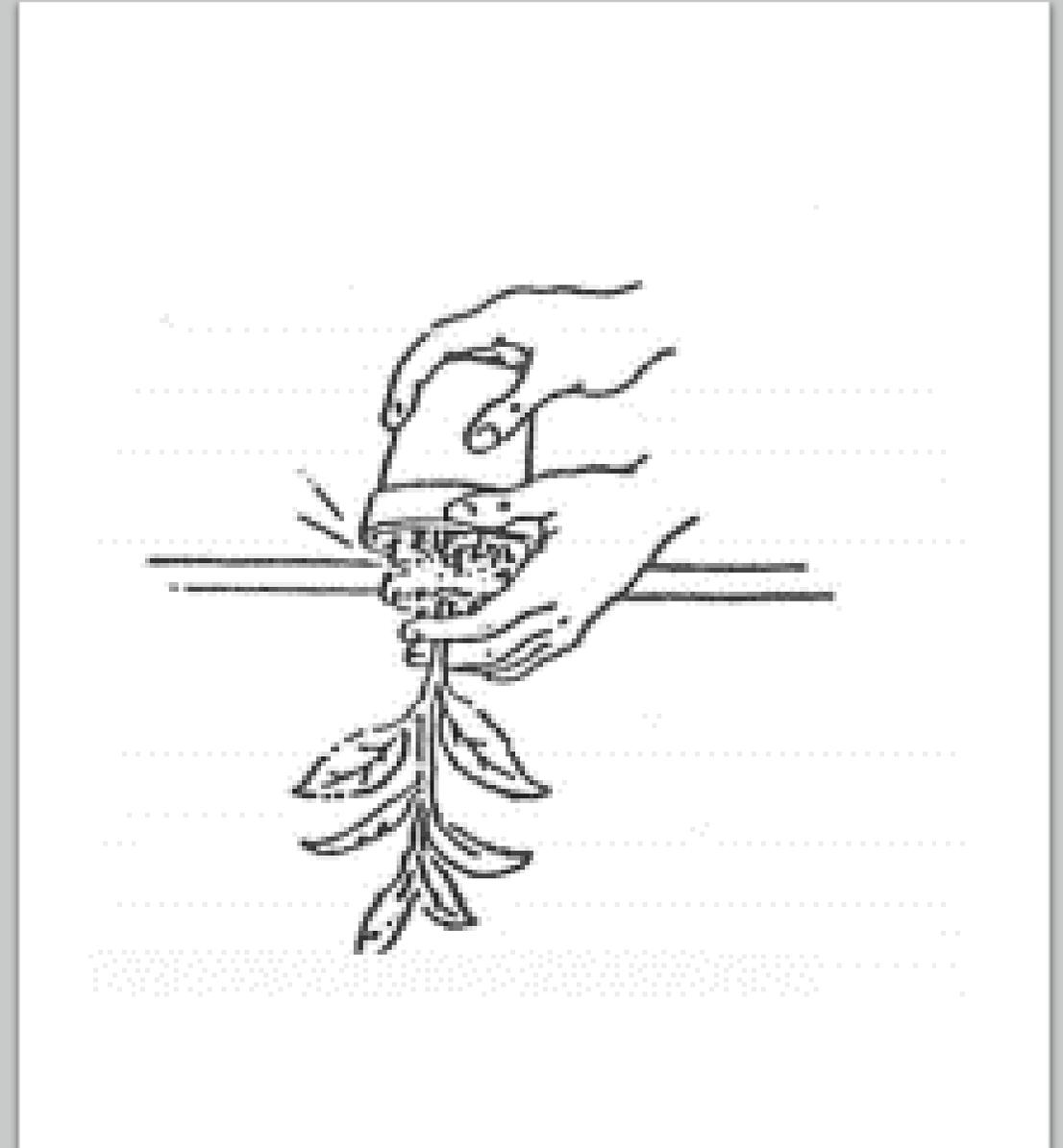
- This makes it easier to see individual plants.
- Do not handle the seedling by its stem.
- Minimize transplant shock:
 - Tear roots apart as little as possible.
 - Try to leave as much soil as possible on each seedling's root ball.



Step 2 Continued

If the seedling was grown in its own container:

- Gently tap the sides and bottom on the container to loosen the soil and roots or cut the container open.
- Then turn the container over with one hand while supporting the plant the other so it does not fall out.
- Do not pull the stem as this may damage the plant.
- If the plant is root-bound with a large mass of roots at the bottom of the plant, gently break up the roots before transplanting.



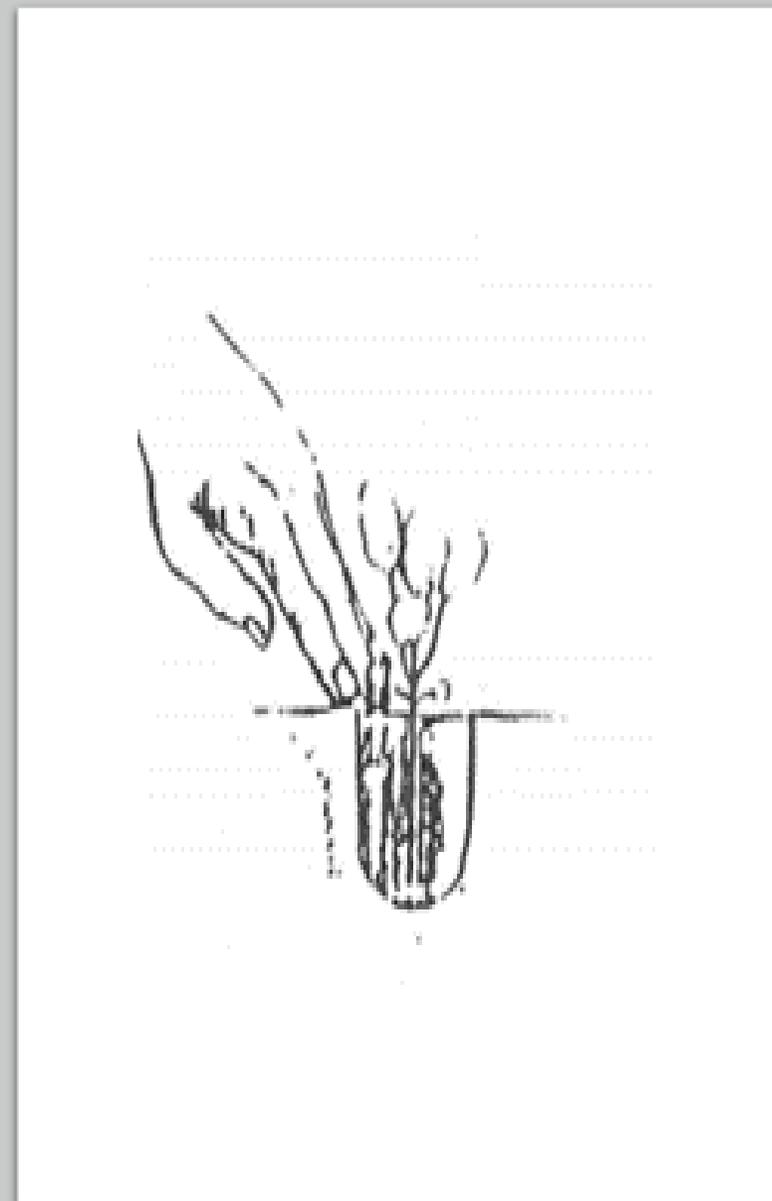
Step 3: Carefully Plant!

- Transplant seedlings into moist soil that is neither too dry or soggy.
- Avoid transplanting outside during mid-day heat.



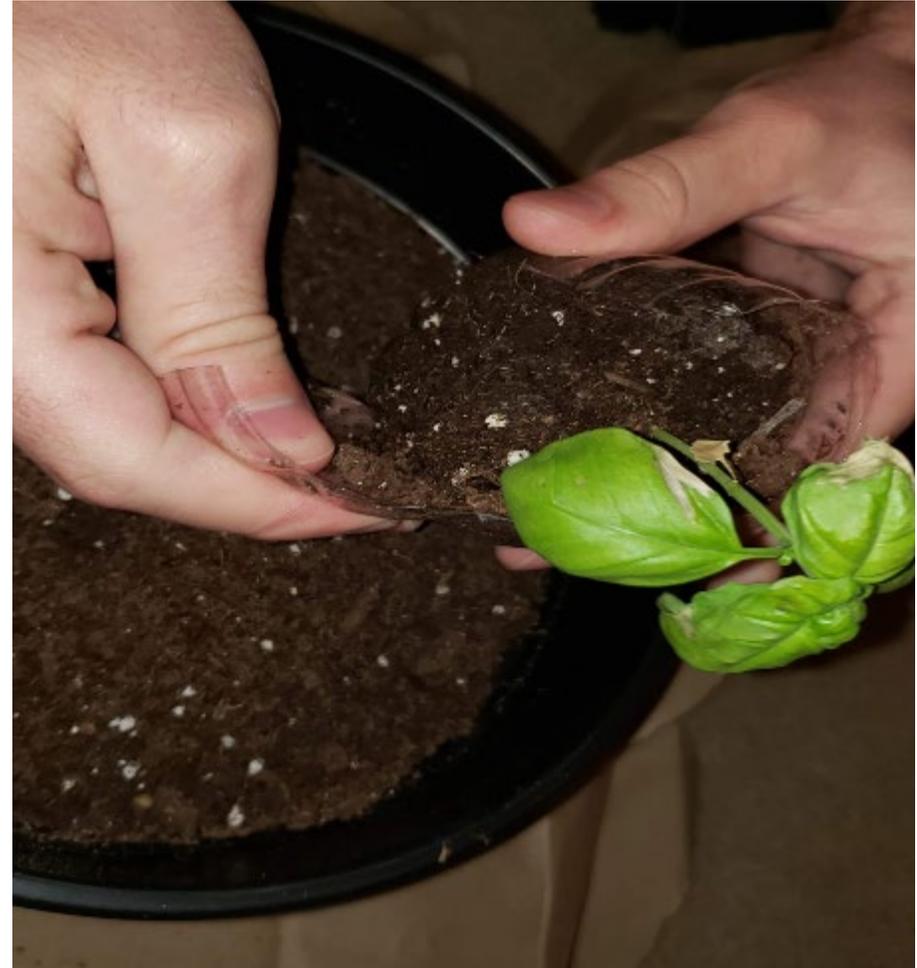
Step 3: Continued

- Dig a hole the same depth the plant was growing in the container.
- If the transplant is root-bound with a large circle of roots at the bottom of the container, gently loosen up the outer soil and roots on the root ball to stimulate new growth.
- Make sure the roots have contact with the bottom of the hole.
- Fill in with soil and gently firm that soil around the plant.
- Water the soil thoroughly.



Transplanting into a Larger Container

- A wide variety of containers can be used.
- If reusing a container, remember to clean and disinfect it in order to avoid spreading pests or diseases.
- Do not reuse potting mix to fill a container. Use fresh potting mix.



Growing Your Transplant Outdoors



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A severe check in growth can occur when plants grown *indoors are moved outside* to the garden.

- To help a seedling's transition to being transplanted outside it must go through a "hardening-off" process.

Hardening-Off Process

Hardening-off means to gradually lower the temperature and reduce the amount of water for the plant

- This causes the young plant to accumulate carbohydrates (its food) and its wall cells to thicken. The plant goes from a softer appearance to firmer stem and growth.
- Seedlings purchased from a nursery have already gone through this process.



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Gradually Increase Exposure to Outdoor Temperatures and Sunlight

- To harden-off, set the seedlings outside in a protected area, gradually increasing the amount of time outdoors and the exposure to sunlight.
- A patio or porch is an ideal location to harden-off seedlings.
- This process should begin about two weeks before planting directly outdoors in a garden bed or larger container.



Video: Transplanting a Seedling



Check For Understanding

- When is the best time to transplant a seedling?
- How do you carefully dig a seedling from its growing container?
- Do you ever pull or tug on a seedling's stem to help remove it from a container?
- How deep should you dig a hole to transplant a seedling into?
- Why is the hardening-off process important?
- How do you harden-off a seedling for transplanting outdoors?

Application Activity

Track the growth of your transplant(s).

If multiple seedlings of the same type of plants are transplanted, assign one to each student or team of student gardeners.

- Begin on the day the seedling is transplanted.
- Record the plant name of the seedling, the date and initial height.
- Measure growth weekly.
- At the end of thirty days and at the date of plant maturity per planting label, evaluate your transplant's height data for
 - Period of greatest increase in height/growth.
- Other growth tracking options:
 - The date first flowering is observed.
 - If this is a vegetable or fruit producing the date that first fruit /vegetable formation is observed.



Extend Activity: Transplanting a Tomato Seedling

Roots will form on the buried portions of a tomato's stem!

Burying your tomato plants deep into the soil helps them grow better because tomatoes form roots all along any buried portion of the stem. These are called [adventitious roots](#). This means your tomato has an increased ability to take in water and nutrients, making for a healthier plant that is less susceptible to drought.

- Vigorous, 6–8 inch transplants can be planted about 2 inches deeper than they were in their pot.
- Tall, lanky tomato seedlings can have the lower leaves pinched off and planted using one of two methods demonstrated in this [Master Gardener video](#).



Next Generation Science Standards

LS1.B: Growth and Development of Organisms

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

LS2.A: Interdependent Relationships in Ecosystems

Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

MS LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

Career Technical Education Standards

Ornamental Horticulture Pathway

F2.0 Summarize plant physiology and growth principles.

- F2.2 Diagram the seed's essential parts and explain the functions of each.
- F2.4 Experiment with the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.

F3.0 Demonstrate plant propagation techniques.

- F3.1 Explain the different forms of sexual and asexual plant reproduction.
- F3.2 Demonstrate the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, seeds).

Resources

- California Master Gardener Handbook, Pettinger, 2015
- [Healthy Garden Tips](#); Transplanting Small Plants and Flowers, V. Fish and P. Martin, UC Master Gardeners of Napa County
- [Best Way to Plant Tomatoes for Strong Growth](#); The Spruce
- [Seeding and Transplanting](#); Life Lab Science Program
- [Tips to Successfully Grow Healthy Tomatoes](#); UCCE Master Gardeners of Yolo County
- [Vegetable Gardening Handbook for Beginners](#) ; UC Master Gardener Program of Contra Costa County; 2015
- Images: Creative Commons; UCANR, UC Master Gardeners of Napa County
- Videos: Mindlapse; Regenerative Agriculture; UCCE Master Gardeners of Riverside County; UCCE Master Gardeners of Santa Clara County

Gardening Questions?

- Email or Call the UCCE Master Gardeners of Riverside County
- Email Helpline
 - anrmgriverside@ucanr.edu
- Telephone Helpline
 - 951-683-6491, ext. 232 or 231
- [Riverside Master Gardeners Website](#)



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