Guidelines for Starting Healthy Seedlings: Tips & Troubleshooting Advice

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Starting your own seeds is a great way to extend the growing season, grow a wider selection of varieties, and save money. This document is designed to provide some general tips and troubleshooting advice for growers who are starting seedlings indoors.

Starts at the Johnny's research farm in Albion, Maine

Soil blocks of various sizes.

BENEFITS OF TRANSPLANTING

- **Helps achieve an earlier harvest.** Plants already a few weeks old can be placed outside as soon as the soil and air temperatures are warm enough. This gives you an early jump on the season. For crops with a long maturity period, this ensures you have a growing season long enough to have a harvestable crop.
- **Gives you access to a wider selection of varieties** than when purchasing seedlings.
- **Decreases the potential risk** of introducing a pathogen or insect pest from purchased seedlings.
- **Helps you grow the exact number of plants** you want in the field. Whereas, direct seeding can sometimes lead to spotty germination either because of sub-optimal temperatures, insufficient or excessive water, birds, etc.
- **Reduces weed competition.** Seedlings transplanted to the garden or field compete better with weeds than smaller, direct-sown seedlings.

GOOD SEED-STARTING PRACTICES

1. **Choose a growing medium designed specifically for starting plants.** An ideal growing medium is highly absorptive but also resists compaction and provides good aeration to plant roots. In contrast, regular potting soil or garden soil can be too heavy or may contain pathogens that can infect seedlings. Germination or seed starting mixes are generally made of compost combined with fibrous or porous ingredients that lighten the mix and improve moisture retention and aeration. Typical ingredients may include perlite (a naturally occurring volcanic glass that looks like small Styrofoam balls), peat moss, and/or coir (an alternative to peat moss, made from coconut husks). A "germination mix" is usually used with small-seeded crops that will be bumped-up (see below) at least once before transplanting out. A "seed starting mix" is usually used for larger-seeded crops.

Crop-Specific Requirements:

While much of good seed-starting practices applies to all crops, always check crop-specific information, such as timing, seeding depth, temperature, and light requirements. Please refer to the information in our catalog, on our website, or on the back of the seed packet.

2. **Use shallow containers or trays** rather than deep pots and make sure that your container also has drainage holes. For crops that dislike having their roots disturbed (for example, cucurbits), choose a pot size large enough to accommodate the plant until it is time to transplant into the field. As an alternative to plastic trays, try seeding into soil blocks. Soil blocks help keep plants from becoming root-bound and also reduce the risk of transplant shock.

3. **Pre-moisten** the growing medium before you seed. This ensures there are no dry pockets when you sow your seeds. Moisten the growing medium so it holds its shape when squeezed, but does not release water. (Too much liquid in the starting mix may lead to the seeds rotting before germination.)

4. **Place seeds in the medium**, carefully following variety-specific instructions for seed spacing. Seeds sown too densely are at risk for disease.

5. **Press seeds firmly** into the growing medium for maximum seed-to-soil contact.

6. **Cover seeds** with a small amount of your growing medium according to the growing instructions on the packet. (Note that some seeds may not need to be covered; follow growing instructions carefully.) Take care not to plant seeds deeper than recommended, as this can cause poor germination.

7. **Gently water-in** to avoid washing away the seeds. It is important to keep the seeds consistently moist—but not over-saturated with water—during the germination period. Water gently by hand or with an overhead mister. For small seeds, misting is best. Alternatively, you can nest each tray within a leakproof tray and bottom-water. Use plain water; using fertilizer prior to seedling emergence is not recommended, as the salts in the nutrients can make it difficult for the seeds to take up water and begin growing, making the initial root growth less vigorous.

8. **Cover the tray** with a humidity dome, plastic wrap, or an inverted tray to retain soil moisture to help maintain consistent moisture and retain warmth and humidity. Ventilate the cover during sunny, warm conditions; otherwise, the temperature may rise too much and inhibit germination. Remove the cover as soon as the seeds germinate.

9. **Maintain optimal soil temperature** for germination. Check the growing instructions for crop-specific recommendations and adjust temperatures up or down as necessary; use a heat mat to raise soil temperature if necessary. You can use a soil probe thermometer to monitor temperature. Typically, the recommendation for germination temperature is higher than for newly-germinated seedlings. Once the seedlings are established, reduce the temperatures as recommended. There may also be recommendations for alternating day-time high temperatures and night-time low temperatures.

10. **Fertilize lightly.** Some growing media, such as Johnny's 512 mix, have enough nutrients that fertilizing may not be necessary for the first 2-3 weeks. For other growing media without as much nutrition, you may want to start fertilizing once the plants have emerged and developed their first true leaves. In either case, use a dilute nutrient solution according to the directions on the product label.

11. **Add supplemental lighting** if you are growing indoors.

12. **Bump up** (also called potting on) depending upon the crop. Bumping up is the process of moving the seedlings into larger containers prior to being planted in the field. There are several reasons to do this: it gives the seedlings more room and therefore leads to better root development; it places the seedlings in a planting medium with better fertility (larger plants

The seedlings above were originally seeded in 20-row flats. They are being bumped up into 50-cell plug flats.

need more nutrients and may have utilized the available nutrients in the starting mix), and it's a chance to cull out the weaker seedlings. When the seedlings have 4 sets of true leaves, remove seedlings from their original container by grasping their leaves, not the stems. Be careful not to damage the roots. A widger can be used to dislodge seedlings from the soil. Place seedlings slightly deeper than their soil line in the larger container. Press the mix around the stem gently and water in the seedlings with warm water.

TROUBLESHOOTING GERMINATION PROBLEMS

If you are having trouble with poor germination, here are a few factors to consider:

1. **Check the soil temperature.** Soil temperature is critical for good germination and the ideal temperature varies for different crops. Some crops (for example, lettuce and spinach) prefer cool temperatures, while other crops (for example, peppers) prefer warm temperatures. A soil thermometer is necessary for monitoring the temperature of your growing media; without one, you cannot be sure your soil is at optimal temperature for germination. You may need to adjust your growing environment to achieve the appropriate temperature. For example, you may need to use a heat mat to warm the growing media. Or, if the weather is hot and you are starting cold crops, you may need to move your trays into the shade or to a cooler location until the seeds germinate. If using a heat mat, note the temperature range of your mat. Some heat mats, such as our Hydrofarm Seedling Heat Mat, heat only to about 20°F/7°C above ambient temperatures, whereas other heat mats, such as our Redi-Heat™ Heat Mat, are capable of heating up to about 120°F/50°F even if ambient temperatures are on the low side.
2. **Check moisture levels.** Inconsistent or inadequate water is a common reason for poor germination. Keep the growing media consistently moist, but not over-saturated with water. Seeds need consistent moisture to germinate, but over-watering can cause rot and mold.

3. **Check the days-to-germination.** Some crops take a long time to germinate and have uneven germination, meaning some of the seeds will sprout much earlier than others, despite being in the same tray and exposed to the same growing conditions. Other crops emerge quickly and evenly. Johnny's website provides information on days-to-germination for herbs and flowers. Some crops that can have somewhat long germination times include angelica, asparagus, columbine, and parsley.

4. **Check the lighting requirements.** Most crops do not need light for germination, but that is not universal. Some crops, for example, savory and columbine, need light for germination; for these crops, growing instructions may tell you to sow shallowly or to not cover the seeds at all.

TROUBLESHOOTING SEEDLING ISSUES

Damping-off

"Damping-off" is a term used to describe sudden death of young seedlings. It can be caused by several different fungi, such as *Alternaria, Pythium,* and *Fusarium,* and can be a problem in humid conditions. The fungi attack the roots and the base of the stems, causing the stems to appear pinched, and causing the plants to fall over. Prevention is key, as treatment options have limited success at best.

We have already covered (above) some of the seed-starting best practices that will help reduce the risk of damping-off:

- Use a growing medium designed specifically for starting plants.
- Follow crop-specific instructions for seeding density. Dense plantings can be more susceptible to damping-off.
- Remove humidity domes as soon as seeds have germinated.

- Provide adequate light and fertilizer levels, and maintain temperatures appropriate for the crop. In general, strive for sturdy, healthy seedlings, as they will be less susceptible to disease than weak, spindly seedlings.

Additionally, the following can be good preventative measures:

- Once seeds have germinated, allow the growing medium to become moderately dry between waterings. Over-saturated growing media can lead to disease.
- Provide adequate ventilation and a source of moving air, such as small fans positioned over greenhouse benches.
- Use a preventative a product like RootShield® which can either be added to the germination mix or watered-in after sowing seeds. This product contains a beneficial fungus that protects seedlings. It is a preventive measure, not a cure, so it must be used at the time of seed sowing.

Many growers want to know why damping-off happens when they have not had the problem before, or why one tray of seedlings will get it when trays nearby do not. This is like asking why one person will catch a cold when another person will not. There are many factors at play and it is difficult to say with certainty why some plants succumb, and others do not.

For more information about damping off:

- "Damping Off" by Brian Hudelson, UW-Madison Plant Pathology
- "How to Prevent Seedling Damping Off" by Michelle Grabowski, University of Minnesota Extension

Stretching and Legginess

Once germinated, seedlings need light for healthy growth. A sunny windowsill seldom provides vegetable crops with enough direct sunlight to produce strong seedlings. Symptoms of light-deficiency include stretching or legginess, in which the plant grows a weak, spindly stem as it reaches toward the light. Unless you are starting seedlings outdoors in a greenhouse, you will most likely need to provide supplemental lighting in the form of grow lights. Choose a full-spectrum light specifically designed for growing plants and hang the light so that it is only 3-6" from the tops of the plants.Vegetables typically need 14 hours of light per day. For more information about grow light specifications and how to choose a grow light, see our "Guide to Choosing a Grow Light" tech sheet.

Leggy seedlings stretching toward an insufficient light source.

Hardening-off and Transplanting Out

Seedlings need to be gradually acclimated to outdoor conditions before being transplanted. Place plants in a shaded, sheltered location for a few hours during the day and bring back inside at night. Gradually introduce the plants to increasing amounts of direct sunlight and outdoor conditions. Harden the plants off in this way over the course of a week, then transplant outdoors on a cool, cloudy day when the weather is settled.

If you do not harden plants off, the plants may struggle after being transplanted—suffering from sunburn and windburn. Sunburn appears as white patches on the leaves. Plants will recover from mild sunburn, but the damage can set them back.

Seedlings are still tender even when hardened off. Avoid transplant shock by handling gently and disturbing the root system as little as possible during transplanting. Water regularly for the first week after the plants have been transplanted, to help ease the transition.

Tomato leaves with sunburn from lack of hardening-off.

Root Bound Plants

Plants can become rootbound if they are seeded too early and the seedling exceeds the container space available to it. As a result, the roots continue to grow, but circle and overlap themselves in the container, forming a rather solid ball. Try to avoid allowing plants to become root bound, however, if transplanting root bound plants, be sure to separate and loosen this root ball before transplanting to prevent the roots from continuing to grow in that same pattern.

ADDITIONAL RESOURCES

- ATTRA's list of Potting Mixes for Certified Organic Production
- Johnny's Seed-Starting Date Calculator
- Seed Starting at Johnny's Selected Seeds: Three Systems for Indoor Seed Starting
- Growing Tips for Successful Pepper Transplants
- Microgreens Production Tech Sheet #8079
- Shoots Production Tech Sheet #8222
- Sunflower Shoots Production Tech Sheet #8972

Tell us what you think!

We would love your feedback about this information! Please take 1 minute to answer 3 short questions to share your thoughts!

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