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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. Here are some general tips and troubleshooting advice for growers who are starting seeds indoors.

## 5 BENEFITS OF STARTING PLANTS FROM SEEDS INDOORS

- **Gives you access to a wider selection of seed varieties.** When purchasing seedlings, you are limited by availability.
- **Gives you a jump toward a productive growing season.** Seedlings a few weeks old can be transplanted outside as soon as soil and air temperatures are warm enough. This enables you to achieve an earlier harvest. Crops with a long maturity period can be started early enough for them to produce a harvestable crop. Crops with a short maturity period can be sown in succession, to keep the harvest coming week after week.
- **Gives you greater control over the health of your seedlings.** You can optimize conditions to produce the healthiest possible outcome. Starting your own seeds also decreases the potential risk of introducing pathogens or pests from purchased seedlings.
- **Helps you grow the exact number of plants you need.** In comparison, direct seeding can result in spotty germination. Gaps in a direct-seeded stand can occur from variables difficult to control such as unfavorable temperatures, precipitation, or seed predation by birds, mammals, or insects.
- **Reduces weed competition, as well as labor spent weeding and thinning.** Seedlings transplanted to the garden or field compete better with weeds than emergent, direct-sown seedlings.



Seedlings started in flats at our research farm in Albion, Maine.



Soil blocks of varying size accommodate a range of crops at different stages of growth.

## 12 GOOD SEED-STARTING PRACTICES

### 1. Practice good sanitation.

Clean all work surfaces, planting and watering tools, and any previously used containers, such as seedling [trays, flats, domes](#), or pots that you intend to use. Keep planting materials and tools up off the ground, and store in a clean place when not in use.

### 2. Choose a growing medium specifically formulated for starting plants.

An ideal [growing medium](#) is one that is highly absorptive yet resists compaction and provides good aeration to plant roots. In contrast, ordinary potting soil or garden soil can be too heavy, and garden soils and reused potting mix can introduce pathogens that can infect seedlings.

### Crop-Specific Requirements

While the seed-starting practices described here apply broadly to most crops, there are often additional, crop-specific requirements that should be observed as well.

Among seed-starting factors that can vary by crop are seeding depth, moisture, temperature, and light requirements. Optimum timing frequently varies by variety as well.

For best results, be sure to refer to the crop-specific [Key Growing Information](#) in our Grower's Library, catalog, and seed packet backs.

Germination and seed-starting mixes are generally made of compost combined with fibrous and porous ingredients that lighten the mix and improve moisture retention and aeration. Typical ingredients include perlite (a volcanic mineral that has been heat-treated; resembles small Styrofoam balls), vermiculite (another naturally occurring mineral that has undergone heat-treatment), peat moss, and/or coir (made from coconut husks).

- **Germination mix** is usually an extra light-weight formulation suitable for small-seeded crops to be bumped-up (see below) at least once before transplanting out.
- **Seed-starting mix** is usually suitable for larger-seeded crops.

### 3. Use shallow containers or trays.

Make sure your seed-starting containers have drainage holes. Avoid deep pots, but for crops that fare poorly if their roots are disturbed (for example, cucurbits), choose a cell or 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 [biodegradable pots](#) or [soil blocks](#). Soil blocks help keep plants from becoming root-bound and reduce the risk of transplant shock.

### 4. Moisten the growing medium before you seed.

This helps eliminate dry pockets. Add sufficient water to the medium so it holds its shape when squeezed but does not release water. (Excess liquid in the starting mix can lead the seeds to rot before germination.)

### 5. Place seeds in the medium, carefully following variety-specific instructions for seed spacing.

Seeds sown too densely are at higher risk for disease.

### 6. Press seeds firmly into the growing medium.

Seed-to-soil contact is critical for germination. Use a small amount of your growing medium to cover the seeds according to the growing instructions on the packet, or a light sprinkling of vermiculite for minute seeds. *Note that some seeds need light exposure to germinate, however; follow key growing instructions carefully.* Take care not to plant seeds deeper than recommended, as this can hinder germination.

### 7. Water-in gently.

Take care to avoid washing away the seeds. It is important to keep the seeds consistently moist but not over-saturated 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, tepid water (68°–77°F / 20°–25°C); avoid adding fertilizer prior to seedling emergence, as the salts in the solution can be detrimental to the seed's ability to take up water and its initiate root growth.

### 8. Cover the tray.

Use a [humidity dome](#), sheet of transparent plastic or glass, plastic cling wrap, or an inverted tray. This will help to maintain consistent moisture and retain warmth and humidity. Ventilate the cover during sunny, warm conditions; otherwise, the temperature may rise too high 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 temperature recommended for germination is higher than the temperature that newly-germinated seedlings require. Once the seedlings are established, reduce the temperatures as recommended. There may also be recommendations for alternating daytime high temperatures and nighttime low temperatures.

### 10. Fertilize lightly at first, and only as needed.

Some growing media contain enough fertility to sustain the emerging seedlings for the first few weeks. [Johnny's 512 Mix](#), for example, contains sufficient fertility to sustain many seedlings to the transplant stage. When using growing media without much nutrition, by contrast, start fertilizing once the seedlings have developed their first true leaves. When fertilizing young seedlings, use a dilute nutrient solution according to the directions on the product label.

**11. Add supplemental lighting if you are growing indoors.** Window light alone is insufficient.

**12. Bump up according to the specific crop needs.**

Also called *potting on*, bumping up is the process of moving the seedlings into larger containers prior to being planted in the field.

There are several reasons for doing this.

- First, it provides more room for seedling root development.
- Second, it is an opportunity to provide the seedlings with a more fertile growing medium (larger plants need more nutrients and may have spent available nutrients in the starting mix).
- Third, it's a chance to cull out weaker seedlings.



Seedlings originally seeded in 20-row flats are being bumped up into 50-cell plug flats.

Once the seedlings have developed 4 sets of true leaves, remove them from their original container by grasping their leaves, not the stems. Be careful not to damage the roots. A [widger](#) can be used to gently prize the seedlings from their cells, separate them, and dibble a hole in the larger-celled container. 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 tepid water.

## TROUBLESHOOTING POOR GERMINATION: 4 COMMON PROBLEMS

If you are having trouble with poor germination, consider the following four factors.

**1. Check soil temperature.**

Soil temperature is critical for good germination, and the ideal temperature range varies for different crops. Some crops, for example, lettuce and spinach, prefer cool temperatures, while others, for example, peppers and tomatoes, prefer warm temperatures. A [soil thermometer](#) is essential 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-season 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 Mats](#), heat only to about 20°F/7°C higher than ambient temperatures. Others, such as our [Redi-Heat™ Heat Mats](#), are capable of heating up to about 120°F/49°C, even when ambient temperatures are on the low side.

**2. Check moisture levels.**

Inconsistent or inadequate water is a common reason for poor germination. Water frequently enough to keep the growing media consistently moist, but not oversaturated. Seeds need consistent moisture to germinate, but overwatering can promote rot and mold.

**3. Check the variety's 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. Days-to-germination are given in [Johnny's Key Growing Information for Herbs](#) and for [Flowers](#). Crops that take longer to germinate than most include [angelica](#), [asparagus](#), [columbine](#), and [parsley](#).

**4. Check the crop's lighting requirements for germination.**

Most crops do not need light for germination, but some crops, for example, savory and columbine, need light for germination. For crops that require light to germinate, our growing instructions may direct you to sow shallowly or not to cover the seeds at all.

## TROUBLESHOOTING POOR SEEDLING HEALTH: 4 COMMON PROBLEMS

### 1. Damping-off

*Damping-off* is a term used to describe sudden death of young seedlings caused by several different fungi and fungal-type organisms, most commonly *Rhizoctonia*, *Fusarium*, and *Pythium*. The pathogen colonizes the roots and/or the stem at, below, or near the soil line, causing decay, a pinched appearance, and collapse, at which point the seedling topples over and dies. Damping off can be particularly problematic in humid conditions, and prevention is key, as treatment options provide limited success at best.

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

- Practice good seeding sanitation.
- Use a growing medium designed for starting plants.
- Follow crop-specific instructions for seeding density. Dense plantings can be more susceptible to damping-off.
- Remove tray coverings or 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. Additional preventative measures include the following.

- Once seeds have germinated, allow the growing medium to become moderately dry between waterings. Oversaturation can lead to disease.
- Provide adequate ventilation and a source of moving air, such as small fans positioned over the seedlings.
- A formulation such as [RootShield®](#) can be added to the germination mix or watered-in after sowing seeds. This contains beneficial fungi that protect seedlings, so it is a preventive measure, not a cure, that must be used at the time of seed sowing.

Many growers want to know why damping-off has occurred when they have never had the problem before, or why one tray of seedlings was affected when nearby trays nearby were not. While there is no one answer for every case, plant disease is always attributable to a trifecta of factors known as the [disease triangle](#): presence of the pathogen, a favorable environment, and a susceptible host plant.

For more information about damping off, including images of affected plants, see:

- [Hudelson, B. 2004. Damping Off.](#) UW-Madison Plant Pathology.
- [Grabowski, M. 2018. How to Prevent Seedling Damping Off.](#) University of Minnesota Extension.

### 2. Stretching and Legginess

Once germinated, seedlings need light for healthy growth. A sunny windowsill seldom provides enough direct sunlight to produce strong vegetable, herb, or flower seedlings. *Etiolation* is the most obvious symptom of light deficiency, characterized by seedlings that develop small leaves, pale coloration due to lack of chlorophyll, and weak, spindly stems as they reach toward the light.

Unless you are starting seedlings outdoors in a greenhouse, you will likely need to provide

[supplemental lighting](#) in the form of grow lights.

Choose a full-spectrum light specifically designed for growing plants. Hang the light just 3-6" from the tops of the plants. Most vegetable, herb, and flower seedlings need 14 hours of light per day.

For more information, see our [Guide to Choosing a Grow Light](#).



Leggy seedlings stretching toward an insufficient light source.

### 3. Hardening-off and Transplanting Out

Seedlings need to be gradually acclimated to outdoor conditions before being transplanted, a process referred to as *hardening off*.

To harden off seedlings, set plants outdoors in a shaded, sheltered location for a few hours during the day and bring them 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 seedlings 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.



Tomato leaves with sunburn from inadequate hardening-off.

Even when properly hardened off, seedlings are still tender. Avoid transplant shock by handling gently and disturbing the root system as little as possible during transplanting. A [plug popper](#) can be used to quickly and gently loosen the seedlings from the flat before transplanting. Water regularly for the first week after the plants have been transplanted, to help ease the transition.

### 4. Rootbound Plants

Seedlings can become rootbound if seeded too early and root growth exceeds the available container space. The roots may continue to develop but encircle and overlap themselves in the container, forming a solid rootball mass. It's best to avoid this altogether, but if the seedlings do become rootbound, very gently loosen the tight rootball when transplanting to encourage normal root growth thereafter.

## ADDITIONAL RESOURCES

The information here applies broadly to most common crops and should help get your seedlings off to a good start. Given attention to their more specific requirements, however, many crops will fare even better. The additional resources listed below offer more detailed information about starting your own plants from seed.

- [Johnny's Seed-Starting Date Calculator](#)
- [Transplanted Vegetable Crops • Average Plants per Seed Quantity & Average Yield](#) *Chart (PDF)*
- [Seed Starting at Johnny's Greenhouses: 3 Systems for Indoor Seed Starting](#)
- [Soil-block Making: A Better Way to Start Seedlings](#), *by Eliot Coleman*
- [Guide to Choosing a Grow Light](#) *Tech Sheet (PDF)*
- [Potting Mixes for Certified Organic Production](#) *ATTRA Sustainable Agriculture Program (PDF)*

### 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!