Seed Starting 101: Success for Seedlings

What is a seed?
A seed is a plant’s means of reproducing. A seed only has energy and capacity to germinate. Once a seed germinates, a radical (root) is formed, then a hypocotyl (stem) with cotyledons (seed leaves) appear, it is now a plant. Anything that happens after seedling plants form are due to environment, growing conditions, and care. Not the seed itself.

4 Main Requirements for Germination
1) Proper moisture level.
2) Proper soil temperature.
3) Seed depth
4) Oxygen.

1. Proper Moisture
   - Water soaking through the seed coat to the embryo is what triggers germination.
   - Pre-soaking seeds for 8 hrs. helps speeds germination.
   - Pre-soaking seed starting mix.
   - Covering trays or pots with plastic to retain moisture.

NOTE: Not all seeds can or should be pre-soaked. (See scarification below)

Low or No Germination due to Moisture Issues:
   - Poor seed to soil contact prevents proper moisture absorption.
     - Avoid air pockets by ensuring the mix is thoroughly moistened and firmly packed.
     - When direct sowing, avoid cloddy, or clumpy soils and air pockets.
     - Ensure proper depth for the type of seed being planted.
       - The smaller the seed the closer to the surface it should be.
   - Newly purchased seeds that fail to germinate is most often due to simple lack of moisture.
   - Even a few hours of drying causes failures once process has started.
   - Media/soil that is too wet can lead to seeds damping off (See below) or rotting.

2. Proper Soil Temperature
   - Soil temperature directly correlates to germination and the number of days seeds will take to germinate.
     - All veggie varieties have an optimal temperature range needed for germination.
     - All seeds have minimum temps they will germinate at, but the lower the temperature the longer it takes for germination and seeds sitting in cold wet soil are prone to damping off or rotting. Over-all, the quicker seeds germinate the better.
   - Temp. range for most seeds is 65°-70°F but different types have optimal temperatures for germination.
     - Cucumbers 75°-85°F
     - Other cucurbit like melons, squash, and pumpkins is 85°-95°F
     - Peas: 65°-75°
     - Brassicas (Cole crops) 60°-75°F
     - Tomato, Pepper, Eggplant: 75°-85°F.

Note: The hotter the pepper, the hotter the media temp. should be (90°-95°F for hot peppers), but not higher than 105°F.
Low or No Germination due to Temperature Issues:
- If the media/soil is too cold for the type of seed being planted, or in rare cases too hot.
- Cool soil temperatures require more time for seeds to germinate. Have they had enough time?
- Improper temperature combined with lack of moisture or too much moisture are highly detrimental.

3. Seed Depth
- The size of the seed matters.
- The volume of embryo/endosperm (food-storage capacity) dictates maximum depth for proper germination.
  - If a seed is planted too deep, the seedling runs out of energy before breaking the surface.
  - Seed packs give specific instructions for seed depth.
  - If in doubt, the rule is to bury seeds no deeper than the seed is long.

4. Proper Oxygen
a. If seeds & seedlings do not have proper oxygen, germination and seedlings can fail.
   b. Always use fresh, new Seed Starting Mix for starting seeds.
      i. Seed starting media is typically sold in smaller packages, with the intention that gardeners will buy exactly what they need for each season and not keep any left over. (Once the bag is open and dipped into, it is no longer sterile!)
      ii. Do not use potting soil. Potting soil is too dense, holds too much moisture & leads to a lack of oxygen, rotting or damping off.
- Maintain proper air circulation indoor with small, oscillating fan on low.

Low or No Germination due to Oxygen Issues:
- Lack of oxygen prevents cellular respiration of the seed. No respiration, no energy.
- Lack of adequate oxygen can lead to suffocation of the radical.
  (Common but unrecognized cause of seed failures is suffocation)
- Lack of air movement can prevent proper gas exchange.

Scarification & Stratification
To scarify a seed is to nick, etch or permeate the seed coat. This can be done by mechanical means, by pre-soaking seeds to soften the seed coat, or both if needed.
- Some seeds should not be scarified.
  - Pelleted seeds should not be soaked or scarified.
  - Thin or papery seeds and seeds that readily absorb moisture like marigolds or chickpeas.
  - Cucurbit sp. that are to be direct sown into the garden.

To stratify is to provide a period of cold treatment to help break seed dormancy.

NOTE: Most vegetable seeds, or annual flower seeds do not require stratification. However, many perennials benefit from or require it. Perennials have evolved to cast seed in fall, to lay in cold over winter then sprout in spring. Artificial cold treatments can be done in moist sand in a Ziplock® bag placed in the refrigerator (not the freezer) for 30-90 days.

Damping Off
Seeds that germinate, then die off seemingly overnight in patches is typically due to damping off.
- Damping off is a common and serious fungal disease affecting seeds and young seedlings.
- Lack of proper sanitation and overly wet conditions are most common causes, but proper air flow, temperature, light and nutrition are all factors that influence conditions for damping off.
- The pathogen responsible for damping off can also lead to seed death prior to hypocotyl formation.
Other Seed or Seedling Issues

- Cover trays or pots with plastic. Covering helps retain moisture until germination, then uncover.
- Soil that's too wet can cause problems for the seed or the radicle, and lead to damping off issues.
- Damping off is due to damaging fungi from unsanitary conditions and excess moisture makes it worse.
- Monitor media temperature. Room temp. does not equate to soil temp., use a heat mat for control & a thermometer.
- Stretching stems (hypocotyl) is due to lack of light or too warm of temperature. Remove covers at 50% germination. Move from bottom heat. Move into bright light to prevent stretching.
- Seedlings also need periods of darkness to properly mature. 12-16 hrs. of light & 8-12 hrs. of darkness.
- Stuck seed coats are due to seeds planted too shallow or media is too dry, or both.
- Droopy seedlings are caused by roots deprived of oxygen, brought on by excessive moisture or dense media.
- White discoloration or blotches on leaf surface is usually due to sunscald.
- Pale, yellow leaves or stalled growth means nutrients are lacking (N). Fertilize once per week, with balanced, naturally derived liquid food at 1/2 strength after cotyledons form to prevent stalled growth. (See below)
- Purple/reddish leaves means lack of phosphorus. Fertilize with balanced liquid food at 1/2 strength as needed. (See below)
- Once seedlings are mature enough, harden them off outside with protection, in part sun during the day, for 7-10 days to acclimate to garden conditions.
  - Keep them up off the ground.
  - Out of strong breezes.
  - Monitor soil moisture, when they go out and back in.
  - Fertilize once per week with liquid, balanced food. (See above)

Essential Supplies

- Seed Starting Mix / Jiffy® Starting wafers / Coco coir mat
- Heat mat with a thermostat
- Sterile trays, cell packs, plug trays, peat pots, plastic pots or paper cups.
- Plastic dome or kitchen wrap cover
- Clean water bottle with spray nozzle.
- Watering cans with soft shower head.
- Plastic or wood labeling stakes & water-proof pen or wax pencil.
- Clean flat moisture proof surface.
- Grow lights - Florescent lights, incandescent or special LED types.
- Complete, liquid, water-soluble fertilizer concentrate
  - ALGOplus All-purpose 6-6-6, Tomato 4-6-8, Flowering plant 4-6-7
  - Neptune’s Harvest Tomato & Veg. 2-4-2, or Fish & Seaweed 2-3-1
  - Root & Grow® by Bonide® 4-10-3
  - Miracle-Gro® Quick Start® 4-12-4