Seed Starting –Take Control of Your Garden

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The Seed Germination Process

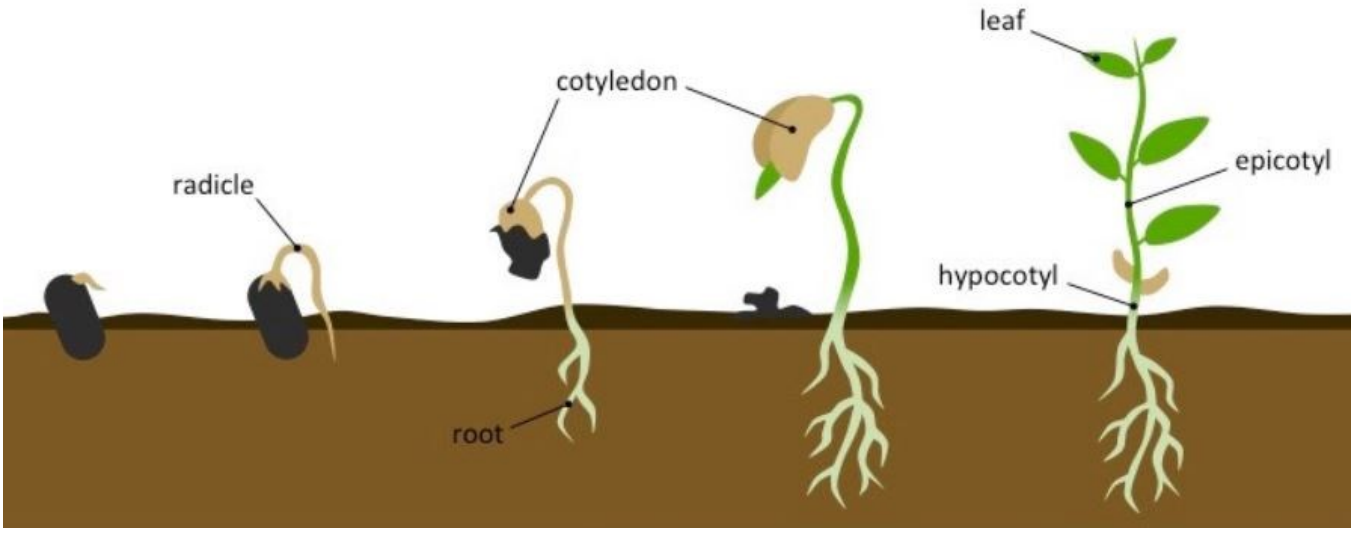
1) Imbibition: water fills the seed.

2) The water activates enzymes that begin the plant's growth.

3) The seed grows a root to access water underground.

4) The seed grows shoots that grow towards the sun.

5) The shoots grow leaves and begin photmorphogenesis.



Seeds That Prefer the Light

Most vegetables need UV radiation to germinate, so we're not going to list them all here. But here are a set of plants commonly grown from seed that will not germinate without light. All of the examples here are of plants with tiny seeds that have thin seed casings.

- Lettuce: here we have an example of a seed that doesn't need to be covered with soil to germinate in your garden. Lettuce seeds must be exposed to light to grow into seedlings. You can sprinkle them on soil or vermiculite and then cover them with a thin layer of soil or vermiculite.
- Carrots: much like lettuce, to get carrot seeds to germinate, expose them to light by sprinkling them on the surface of the soil. Use the same method as lettuce: plant seed in a row on soil or vermiculite and cover with soil or vermiculite.
- Rose: rose seeds germinate best in direct sunlight. Keep soil moisture at the right level and seedlings will emerge in about six weeks.
- Certain salvias: check varieties here because there are some salvia species that prefer darkness. After direct sowing in the ground of your garden, keep the soil moist but don't wash tiny seeds away.

Seeds That Prefer the Dark

As we've covered, there are several species that prefer existing in darkness. Many of these are popular vegetable garden varieties with thick seed casings, and they germinate well when under dark cover deep in the soil.

- Nasturtium: the benefits of gardening with nasturtium are many. Direct sow nasturtium seeds about three times their diameter, covering them with rich organic soil. Soon after you'll have happy round-leaved seedlings popping up!
- Calendula: sun inhibits calendula growth. Cover these worm-like seeds in 1 inch of organic soil out of direct sunlight. Keep the soil moist when gardening with calendula.
- Sunflower: mammoth varieties require a planting depth of three times their diameter and do best under a plastic covering before they germinate. Once the first sign of germination shows, remove the plastic covering and transfer seedlings into direct light.
- Onion: Allium seeds are large with a thick seed casing and will not germinate in direct light. They actually prefer long nights during germination. So you can start them indoors under plastic, and remove the plastic and place them under light after they've sprouted.

Seeds That Don't Really Care

The following plants will sprout either with or without light. Their seed sizes tend to fall in between the large and small categories of those mentioned above.

- Tomato: start these indoors or outdoors in the right temperature conditions and you'll have a tomato crop growing all the way up to the middle of fall in some places.
- Cucumber: personally, I can't prevent a cucumber seed from sprouting. They will sprout under almost any condition where the soil is involved. If you're looking for a high germination rate, save seeds from your favorite cucumber variety. One thing to remember with cucumber is to leave out the vermiculite when starting the seeds.
- Eggplant: although eggplant seeds don't need light to germinate, it doesn't hurt either.
- Zinnia: zinnias need to be directly sown in a sunny spot under light soil cover. If you've ever tried transplanting a zinnia seedling, you know they are subject to transplant shock, so avoid starting them indoors. They're a great accompaniment to your tomato and lettuce crop.

Ideal temperatures

Seeds

	Minimum (F)	Optimum Range (F)	Optimum (F)	Maximum (F)
Beet	40	50-85	85	85
Cabbage	40	45-95	85	100
Cauliflower	40	45-85	80	100
Celery	40	60-70	70	85
Chard	40	50-85	85	95
Cucumber	60	60-95	95	105
Eggplant	60	75-90	85	95
Lettuce	35	40-80	75	85
Melons	60	75-95	90	100
Onion	35	50-95	75	95
Parsley	40	50-85	75	90
Pepper	60	65-95	85	95
Pumpkin	60	70-90	90	100
Spinach	35	45-75	70	85
Squash	60	70-95	95	100
Tomato	50	70-95	85	95

Soil temperatures should be taken by inserting a soil thermometer 3-4 inches deep into the soil surface and noting temperature. Adapted from Kemble and Musgrove (2006).

Seedling Development

The optimal temperature for growing seedlings may be different from that for seeds (Table 2). Remember, optimal temperature will stimulate optimal growth. You can control temperature to control plant height. Cooler temperatures generally slow down growth, and warmer ones speed up growth.

	Day (F)	Night (F)	Time (weeks)
Broccoli	60-70	50-60	5-7
Cabbage	60-70	50-60	5-7
Cauliflower	60-70	50-60	5-7
Celery	65-75	60-65	10-12
Cucumber	70-75	60-65	3-4
Eggplant	70-80	65-70	6-8
Lettuce	55-65	50-55	5-7
Melons	70-80	65-70	3-4
Onion	60-65	55-60	10-12
Pepper	65-75	60-65	6-8
Squash	70-75	60-65	3-4
Tomato	65-75	60-65	5-7

From Maynard and Hochmuth (2007).

How to Tell Vegetable Seedlings from Weeds

When plants are very young and just tiny seedlings, it can be difficult to tell vegetables apart from weeds. Here's a guide to identifying some of the most common vegetable seedlings!

When weeds really kick into action (usually by late spring/early summer), it can be challenging to identify a vegetable seedling from a weed seedling! This is a visual aide to help.

If you do see a weed in your vegetable plot, the most effective way to weed is to use a hoe in the morning in dry weather so that weeds will cut cleanly from the soil.

First Leaves vs. True Leaves

The first two leaves that many vegetable seedlings put forth are called **cotyledons** (*seed leaves*), which do not pattern themselves after the leaves of the mature plant. They mainly serve as "snack packs"—energy bars for the infant plant to consume so that it can put forth its own **true leaves**.

While your seedlings sport their early cotyledons, it can indeed be difficult to distinguish them from each other and from weeds!

After the true leaves emerge, which can take several weeks, you'll be able to spot more differences between seedlings as they take on the special shape and form of their kind.

The cotyledons, having served their purpose, will eventually die off.

Beans (Pole and Bush)

The bean seedling's first seed leaves often appear to be heart shaped. It's true leaves will be smooth-edged and arranged three to a stem, with two opposite each other and one above.

Beets

With proper watering, beet seedlings will emerge in five days to two weeks after planting. Young beets put forth smooth, oblong green leaves on red or pinkish/purple stems. Because several seedlings can grow from one beet "seed," you may need to thin them by snipping some off at ground level.

Broccoli (and Cauliflower)

Broccoli and cauliflower seedlings produce two kidney-shaped seed leaves before their true leaves, which are more rounded and may have vaguely serrated edges.

Carrots

Carrot seedlings in the earliest stages may be mistaken for grass because their seed leaves, unlike some other vegetable cotyledons, are tall and thin. A young carrot's true leaves, shown below, have a distinctive, fern-like shape.

Cucumbers

The oval seed leaves of emerging cucumber and squash plants look very much alike, but the cucumber's true leaves will be triangular and lobed with a fuzzy surface and serrated (toothy) edges. As the cucumber vine develops, its delicate-looking but tenacious tendrils will grip and climb anything in their path.

Kale

Kale comes in many varieties, with true leaves that may be either smooth or fancily ruffled. Its seed leaves may peek above the soil in about a week and the plants should be thinned to a foot apart when they reach five inches tall. The benefit of thinning kale is that you can enjoy the snipped seedlings in a salad!

Kohlrabi

Kohlrabi—a Brassica—initially resembles seedlings of other members of this family, like broccoli, cauliflower, and kale. Until its first true leaves appear, it may be hard to recognize it! True leaves will have deeply serrated edges (more so than broccoli) and its leaves will be more pointed than rounded.

Lettuce

The many varieties of looseleaf and head lettuce are characterized by their leaves. Depending on whether the leaves will become soft or stiff, loose or bunched, lettuce seedlings will vary in appearance. Lettuce seedlings respond well to consistent watering and cooler temperatures and, if started indoors, will need to be hardened off before being planted outside.

Peas

You won't see seed leaves emerging from pea seedlings because, unlike those of many other vegetables, pea cotyledons remain underground. Peas like to climb and will form oval leaflets with tendrils that readily wind around supports.

Pumpkins

Pumpkin, squash, watermelon, and cucumber seedlings may be hard to tell apart because they belong to the same family, the cucurbits. A pumpkin's seed leaves will be large, flat, and rounded, looking a little like small elephant ears. As it grows, a pumpkin will form huge leaves and its vines may eventually cover a lot of territory.

Radishes

Radishes have smooth, heart-shaped seed leaves that soon give way to elongated and scalloped or gently serrated true leaves. Radishes are fast-growing, and those planted in the cool days of spring may be ready to eat in just three or four weeks. The nutritious radish leaves, or "tops," may be eaten as well as the roots.

Squash (Summer and Winter)

While all squash will emerge with rounded cotyledons, squash seedling leaves will vary by type the more that they grow. Summer squash will develop prickly, semi-triangular, jagged-edged leaves. A winter squash leaf will generally be broader and more rounded and, while hairy, not prickly.

Swiss Chard

Like beets (a close relative), chard typically produces 1 to 3 seedlings per seed cluster. Seedlings have narrow seed leaves and—depending on the type of chard—red, white, yellow, or orange stems.

Tomatoes

The seed leaves of tomato seedlings are long and narrow, while the true leaves tend to have asymmetrical lobes, very similar to the leaves of the adult plant. Look for three connected (or nearly connected) leaves at the end of each branch, with one or two smaller leaves farther down the branch. The seedlings' stems and leaves may also be lined with small hairs.