From Margaret Roach - awaytogarden.com

MAYBE YOU'RE WONDERING this about now: Why do vegetable seedlings stretch and grow spindly sometimes, and how can you prevent such leggy seedlings? That was how I began a note to Dr. Thomas Bjorkman, Professor of Crop Physiology at Cornell, seeking an answer to a question I'm asked a lot.

He's a botanist whose research focuses on the effects of environmental stimuli on plant growth and development, particularly in vegetables. So I asked him what's going on—are the leggy seedlings reaching for light, or is something else at work? (I couldn't resist sharing the mung-bean time-lapse video, above…though probably not what you're sowing at the moment.)

Everything I'd read over the years listed a range of possible causes for leggy seedlings:

- too little light (maybe also too much);
- the intensity of the light source;
- temperature, and even the temperature difference between day and night;
- improper use of fertilizers;
- leaving seedlings in "germination chamber" conditions (extra-warm and extra-humid) too long, under that plastic dome or on that heat mat or both;
- …and the list goes on.
- Turns out even the spacing between seedlings can affect the way they grow.

But all the cited research had been done in the light- and climate-controlled conditions of a lab, or commercial greenhouse—not the less-formal home seed-starting environment. So what are the answers for home-garden types, I kept wanting to know?

Preventing Spindly Seedlings: Q&A with Thomas Bjorkman

Q. For a home seed-starter like myself, wanting to grow sturdy tomato seedlings like the ones above or other stout, strong transplants, what's the likely cause of seedlings that seem to reach for the light, and stretch?

A. The stretching that home gardeners experience is almost entirely from insufficient light. There are a bunch of other factors (as you mention) that play smaller roles, but most people starting seedlings can safely concentrate on making the light brighter.

Q. But the fluorescent tubes under my seed-starter hood look so bright and the tubes are close to the seedlings, and I leave them on 12 hours a day. How can it not be bright enough?

A. Our eyes have an incredible capacity to adjust to different light intensities, which makes it easy to underestimate how dim the light really is for seedlings. Putting them by a window is rarely enough. Fluorescent lights are rarely enough, unless they are almost touching, but that can get hot. (Some of the new LED fixtures are attractive in putting out concentrated light with low risk of fire.)

When I measure the light intensity in the units that the plant uses, under regular fluorescent lights it is typically 50 to 100 *μ*mol/m2.s **[that measure, micromoles per square meter per second, quantifies the number of photons used in photosynthesis that fall on a square meter every second]**. With Super High Output fluorescent lights spaced 2 inches apart, we can get 400 at about 6 inches.

On a *cloudy* day outside in the spring 500 to 800 is common. On a *clear* day in late May (when a lot of seedlings come up) the light will be 1,500 to 2,000. So even though a T5 fluorescent grow light looks bright to your eyes, it is practically dark compared to what the seedlings are used to.

Q. I have read in technical papers that one failure can be leaving seedlings too long in the "germination chamber," which in my home setup would very roughly mean on the heating mat and under a plastic dome.

A. I have a germination chamber in which I have messed up many times. It provides humid heat at 80°F, so the seeds germinate really well. If it is done right germination is fast and uniform, and the plants do really well later.

But if the cotyledons so much as peek up above the soil surface in there, they are a lost cause. They put up thread-thin hypocotyls very fast, and those will never survive in the greenhouse air. With brassica crops, for example, I need to get them out of the chamber in 36 hours.

Q. I have read about mechanical tactics for making stems stronger, as if they were out in nature getting buffeted a bit, so I was fascinated by the "brushing" work you published some years back.

A. Brushing the seedlings is helpful from the cotyledon stage to fully expanded first leaf stage for the species that can handle it (tomatoes, brassicas). The work I did with it was all in a commercial greenhouse where the light was already high. It was helpful because we were using plug trays that had the seedlings spaced about an inch apart.

That raises the issue of spacing. Putting the seedlings out to 1-1/2 or even 2 inches apart once they have the first leaf will keep them shorter. Bigger distances tend to stunt the small vegetable seedlings. Overplanting and then thinning is just asking them to stretch.

About the Cornell Lab of Dr. Thomas Bjorkman

ON THE CORNELL website, Dr. Bjorkman's faculty bio page explains his background and work. A main focus of his is in developing broccoli varieties more suited to an Eastern climate (most is grown in the very different conditions out West); more about that here.

My takeaways on preventing spindly seedlings

- **I long ago replaced my old traditional shop-light fluorescent hood** with a small one that's reflective and holds four T5 tubes (no longer sold), which are up to eight times brighter but not nearly equivalent to outdoors. The hood was not adjustable in height; you have to rig up S-hooks and chains or some kind of pulleys (thankfully good ones are easily purchased). I also have a 4-foot "Jump Start" T5 stand.
- **I'd been watching LEDs as they got more competitive in price**, to select bulbs that I can retrofit my T5 hoods with for even more light output, or just get a new setup. The LED strip lights by SunBlaster are recommended (and come in different lengths), so that's my next generation. More on growing indoors under lights here, and on shopping for seed-starting lights here.
- **I'm being careful to remove the heat mat and clear plastic dome as soon as germination occurs.**
- **I'm spacing things more carefully,** slowing down when seeding to get it right in the first place, or as farmers say, "planting to stand."
- **When the weather allows, I'm giving my seedlings time in natural light** (such as in a bright protected porch–not out in the open right away) to increase their overall exposure to light.
- **I don't feed too soon;** seeds are pre-loaded with the nutrients they need to germinate. I never feed earlier than when the cotyledons are showing, and if then, only with a very dilute solution of seaweed and/or fish emulsion. Mostly I start at first true-leaf stage, with half-strength dilute seaweed/fish emulsion, and work up to following the label directions for seedlings as the plants approach transplant stage.

- **It seems like a little hands-on TLC in the form of brushing can't hurt** with certain crops, as Dr. Bjorkman mentioned–and hey, it feels good to me, too, especially after a long winter.
- **Need to know when to start seed?** My handy seed-starting calculator will help with vegetables, and common herbs and flowers, too, by creating a custom chart of when to start seeds indoors for your area.
- **Need to upgrade your gear?** All my basic seed-starting equipment is on this page.
- **For a crash course in growing from seed: My 18 Confidence-Building Tips.**

(*Video of mung bean germination by Wjh31, CC-BY-SA-3.0, via Wikimedia Commons license. Disclosure: Purchases from Amazon affiliate links yield a small commission.*)

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