

Instructions for growing dwarf crop plants under electric lights

Bruce Bugbee
Crop Physiology Laboratory
Utah State University

1. Start by getting a bag of potting soil and some pots at a garden store. The pots should be at least 15 cm tall, and 20 to 25 cm tall would be better. Be sure the pots have at least one drain hole in the bottom.

If you are unfamiliar with centimeters, get a ruler with centimeters (cm) on it and bring it with you to the store. One of the things you will learn in the process of measuring plant growth is how to use the metric system. You may not be able to explain your metric measurements to your grandparents, but you will be able to communicate to research scientists and to all the rest of the people in the world.

2. Get a small container of house plant fertilizer and use it according to the directions on the label. MiracleGro is a good fertilizer because it has all of the micro-nutrients needed for plant growth, but other brands also work well. It is best to water with a dilute solution of fertilizer every time you water. *Be careful not to put on too much fertilizer!* Everyone gets tempted to add extra fertilizer in the hope that it will make their plants grow faster. Fertilizing too much will make your plants sick - like over feeding a cat or a dog. If you have a 2 liter watering can you will only need to add a gram of fertilizer per container (2 liters) to have ample nutrients for plant growth.

[metric conversion: a teaspoon of fertilizer is about 5 grams, so a quarter teaspoon of fertilizer (1.25 grams) per 2 liter container provides plenty of nutrients for plant growth].

3. Fill the container with the potting soil. Do not pack the soil in the container because roots need air to grow properly. Plant the seeds about 1 cm deep and about 5 cm apart. Water with fertilizer solution to get things started.

4. The seeds should start to come up in 4 to 6 days.

5. The most difficult part of growing excellent crops is getting the plants enough light. Our eyes adjust when we go outside, so we don't realize that outside light levels in the summer are 200 times brighter than a well lit office or kitchen. House plants have been selected to grow in the low light levels of a house, but crop plants do not have a low gear and will not grow their best in the low light levels of even a south facing window. The solution is to use electric lights. Cool white fluorescent lights work well for growing plants. *DO NOT buy Grow lights*, (Gro Lux or any other brands). These lights are expensive and they do not work as well as standard fluorescent lamps. A 120 cm long (4 foot), two tube fixture works well. High output (HO) fluorescent lamps put out twice as much light as standard fluorescent lamps and the plants will grow twice as fast, but they are twice as expensive.

Keep the light within about 15 cm of the top of the plants so that the plants get as much light as possible. Either raise the light or lower the pots to keep the tops of the plants close to the lights. Try not to let the leaf tips touch the light bulbs because the leaf tips will get too hot and die. Our research at Utah State University has shown that wheat plants never need to sleep so keep the lights on for 24 hours a day for wheat. This gives the plants more light and they will

grow faster. If the lights are on for 24 hours a day they will grow twice as fast as if the lights are on for only 12 hours a day. Tomato and pepper plants need to “sleep”, however. You will need a time clock set so that the lights are off for 8 hours at night. This will give the plants 16 hours of light each day.

6. The other environmental conditions are much less important than high light. The temperature should be a comfortable room temperature, which is between 20 and 25 degrees Celsius. Cooler air temperatures are better since the plant leaves will be warmed by the heat of the lights. Get a thermometer and put it with the plants under the electric lights. If the temperature gets above 25 C, get a small fan and blow air over the plants to help them stay cool. The best temperature is 23 C until the plants flower (24 to 30 days after planting), then the optimum temperature is about 17 C.

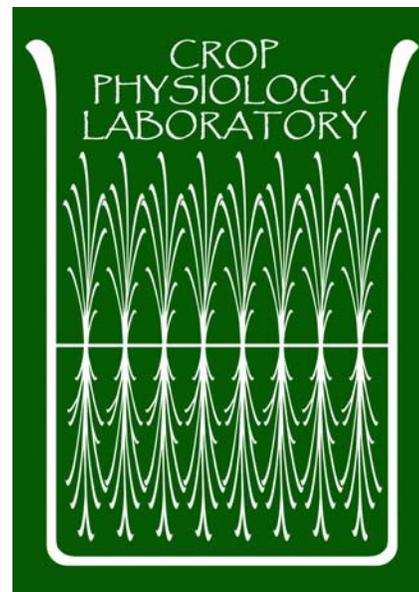
7. The plants should flower about 4 weeks after planting and the plants should be ready to harvest 10 weeks after planting. If the air temperature is warmer, the plants will be ready sooner, but the seed number and seed size will be smaller.

8. Keep the soil moist, but not soggy. It is best to let the surface dry out a little bit before watering again. When you add water, make sure to add water until it starts to drip out the drain hole in the bottom of the pot. Put a saucer under the pot to catch the water that comes out. Pour the excess water down the drain so the bottom of the pot stays dry because the roots at the bottom of the pot need air too.

9. Keep records of plant height each

week and number of leaves. It helps to record observations on a calendar so you can keep track of the date when things happen.

For more information see the Crop Physiology Laboratory website at www.usu.edu/cpl



Procedure for Germinating Small Seeds

Cody Tramp and Bruce Bugbee

Small seeds, like MicroTina Tomato and Triton Pepper, benefit from germination in a container.*

1. Take a plastic container with a lid and fold layers of brown paper towel in the bottom until the stack is about 0.5 to 1.0 cm (1/4 to 1/2 inch) thick. Brown paper towels make it easier to see the white emerging roots.
2. Add cool tap water to the container until the paper towels are thoroughly soaked. Do not use soft water. It contains sodium, which is harmful to the germinating seeds.
3. Pour off excess water. When tilted onto a corner, there should be about 15 mL (1 tablespoon) of water in the corner. The seeds must be above the water level.
4. Place the seeds on top of the paper towels, about 1 cm (1/2 inch) apart.
5. Put the lid on the container to keep the paper towels from drying out and to provide a humid environment. It is not necessary to put holes in the lid. Opening the container every few days will provide enough oxygen for seed respiration.
6. Keep the container at room temperature and away from heating or cooling units, as percent germination can be decreased if the temperature is above 30 °C (86 °F).
7. Do not leave the seeds by a window or other source of bright or direct light. Classroom light levels are fine for germination. Seeds do not need to be in the dark.
8. Check the container daily to see if the paper towels are drying out. Maintain water level so there is about 15 mL (1 tablespoon) of water in a corner.
9. Check the container daily for any seeds covered in mold. These seeds are dead. A living seed can protect itself against mold growth. Remove dead seeds from the container.
10. When the root, called the “radicle”, appears, carefully transplant the seed to a pot. Pick the seeds up by the seed coat, and not by the radical, which is easily damaged.
11. Seeds should germinate in 4 to 7 days.



Container with paper towels and seeds



Germinating seeds with emerging roots. The fuzzy appearance is caused by healthy root hairs and is not mold. Seven seeds are ready to transplant. The remaining eight are not ready yet.



The two seeds on the left are healthy. On the right, the top seed is covered in a white mold, and the bottom seed is covered in a black mold. Both are dead and should be discarded.

*Larger seeds (wheat, soybean, and pea) can be planted directly into pots.