Build Your Own Seed Germination Cabinet for Testing Seed Viability

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Introduction and Background

Saving your own seeds is a cost-effective way to access crop seed for future planting and to help maintain the planet's plant biodiversity. Whether you plant your own saved seeds, give them away to friends and neighbors, or distribute them through your organization, knowing the viability of your seeds is important.

Seed viability is a measure of the percentage of seeds that will germinate after storage. The greater the viability of your seeds, the fewer seeds will be needed to establish a desired number of plants in the field or nursery.

Many easy ways exist to test seed viability. A seed germination test is probably the most simple: seeds are given the needed resources (air, water, warmth, and light) to germinate and grow into a seedling. Simply place seeds in the soil or in a pot of soil and see how many grow. However, the problem with using soil, pots, and outdoor resources is that environmental fluctuation exists. This can cast doubt on the true viability of the seeds (did the seeds fail to germinate because they were dead, or because they were watered erratically, fell victim to fungal attack, got too hot, etc.?).

Lower-than-optimum temperatures for germinating certain types of seeds often occur at the ECHO Asia Seed Bank in northern Thailand during the cold season. Outside nighttime temperatures often dip to 13ºC (55ºF) or lower, and afternoon temperatures rarely rise above 29ºC (85ºF). With cool temperatures complicating certain seed germination trials, the seed bank staff decided that a better way to conduct a seed germination test and reduce uncontrolled variance (forces like irregular watering, fungal spores, temperature fluctuations, etc.) would be to create a dedicated seed germination cabinet where these factors of variance can be moderated.

The seed germination cabinet is now routinely used to test seed viability, and has provided encouraging results. You too can build a low-cost seed germination cabinet to improve seed germination results and to boost your knowledge about the viability of your seed stocks.

Procedures

First you will need a cabinet that can be partially sealed. We purchased a small aluminum kitchen cabinet (122 cm tall, 77 cm wide, and 41 cm deep) from the local furniture store, with two shelves in the uppermost part of the unit and a storage space below (Figure 1). Wood, metal, or plastic cabinets can be used successfully. The cabinet provides a quasi-sealed storage area for maintaining proper temperatures and relative humidity for the germinating seeds (Figure 2). Our cabinet had a wire-screen for sides, so we purchased small sheets of insulating foam and covered the inside of the chamber with the foam to reduce heat loss and prevent outside contamination (Figure 3).

Because most seeds germinate well with high temperatures and high relative humidity, we also wanted to include a heat source. Using a light source to produce heat can produce light and heat simultaneously in the sealed chamber, while helping to maintain a high relative humidity. We elected to use 2 small horizontal 10W florescent T8 (daylight) bulbs that we attached using bolts and nuts via the ballast to the ceiling above each shelf. The cords from each fixture were routed through a hole cut in the shelf below into the bottom storage compartment (we could have easily routed them to the floor or out the side of the cabinet to an outlet). We followed a florescent wiring diagram to connect the ballast, starter, tubes, and power supply (Figure 4).

Because leaving the lights on all of the time would add too much heat to the chamber and dry out our seeds, we needed to moderate the lighting so that it shuts off and on to maintain a relatively constant temperature. Therefore, we wired both of the fluorescent fixtures to a 3-outlet power strip that was connected to a wall timer (Figure 5, Figure 6). Here we needed to do a bit of tweaking: we monitored temperatures in the chamber using a thermometer and adjusted the timer as necessary to maintain as constant a temperature as possible (we found in our conditions that turning the fluorescents on for ½ hour and then off for ½ hour over the course of the day maintained a fairly constant temperature inside of the chamber).

The seed germination cabinet also has many practical and research uses in the field. As part of a USAID-funded HORT CRSP grant with Pennsylvania State University collaborators, ECHO Asia is using a germination cabinet to conduct village-based seed germination studies on locally saved seeds (Figure 7). Because many remote areas in Southeast Asia are not electrified or lack consistent access to electricity, we have augmented an AC-powered cabinet with a 140W photovoltaic array, deep-cycle battery, and DC-AC inverter to supply the power needs for the florescent tubes (Figure 8). The photovoltaic array and battery is enough to power two florescent tubes for 12-18 hours per day (depending upon solar radiance).

Basics of seed germination testing

Once the seed germination cabinet was built, we were free to begin seed germination testing using either: 1) a modified rag-doll test; or 2) a petri dish test. Another *ECHO Asia Notes* article will contain procedures on conducting your own seed germination test. But the gist of the rag-doll test is to place a desired number of seeds on moistened sterile paper towels inside of loosely fitting plastic baggies. These units then go inside the seed germination cabinet and are observed daily for signs of germination; the easiest sign to observe is the emergence of the radicle (the seedling root). [*Ed: For more information about techniques used to measure the viability of seeds, refer to the "Germination and Propagation" section of Chapter 12 of ECHO's "From Amaranth to Zai Holes" which can be accessed via this link: www.echonet.org/content/AtoZChap12/1425*].

Conclusion

With very low financial and labor inputs, a high-quality and highly effective seed germination cabinet can be built from local materials. Its use will more accurately help you to determine the viability of your seeds and the effectiveness of your seed storage techniques. Keep watching for the next issue of *ECHO Asia Notes*, in which we will share how to conduct a simple seed germination test.

Budget

Our total cost for building the seed germination cabinet was: 2,098 baht Thai ($69.13 US). The unit was composed of the following items:

(1) Aluminum kitchen cabinet: 1,300 baht ($42.89)
(2) Florescent ballasts and associated wiring: 150 baht ($4.97) per ballast
(2) Florescent tubes: 19 baht ($0.65) per tube
(1) 3-prong power strip: 120 baht ($3.75)
(1) Indoor timer: 225 baht ($7.43)
(2) Sheets foam insulation sheeting: 30 baht THB ($1.00)
(1) Tube of epoxy for securing foam to cabinet: 85 baht ($2.82)

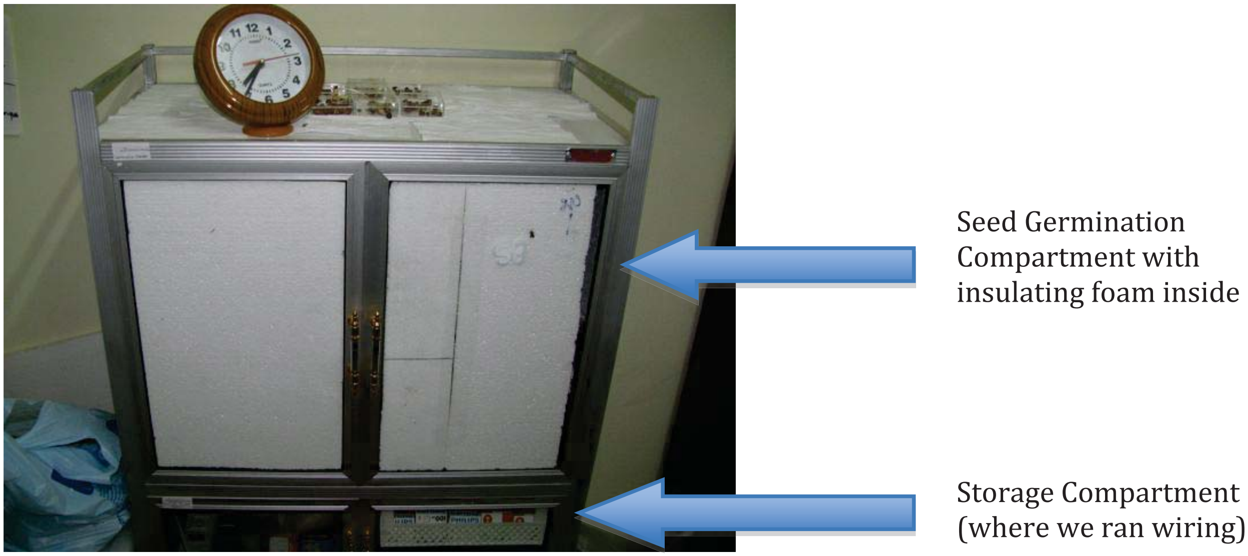

Figure 1: Finished seed germination cabinet made from a simple aluminum kitchen cabinet.

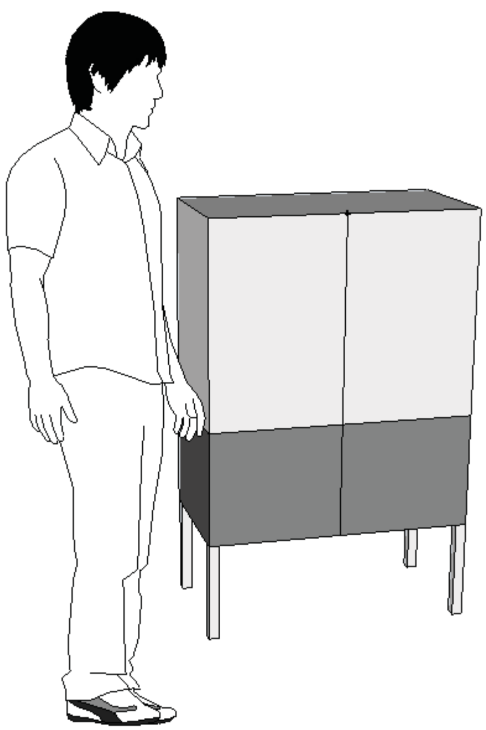

Figure 2: Mock-up of seed germination chamber showing scale of aluminum kitchen cabinet [man is six-feet (1.83m) tall].

Figure 3: Close-up of 2 shelves used for seed germination, and foam cladding on inside of chamber. A fluorescent tube and ballast hangs from the ceiling of each shelf. Power cords to fluorescent tubes are routed through a hole cut into each shelf into the bottom storage area where the power strip and timer are located.

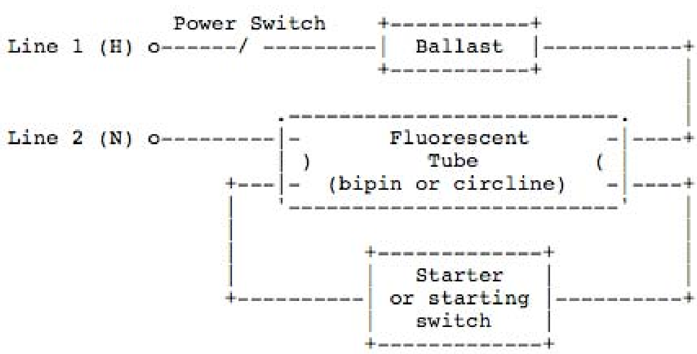

Figure 4: Wiring diagram for a single ballast florescent tube (From http://www.repairfaq.org/sam/flamp.htm#int0)

Figure 5: Power strip assembly receiving lead-wires from florescent tube assemblies.

Figure 6: Timer assembly (connected to power strip in figure 5) to regulate florescent tube on/off duration.

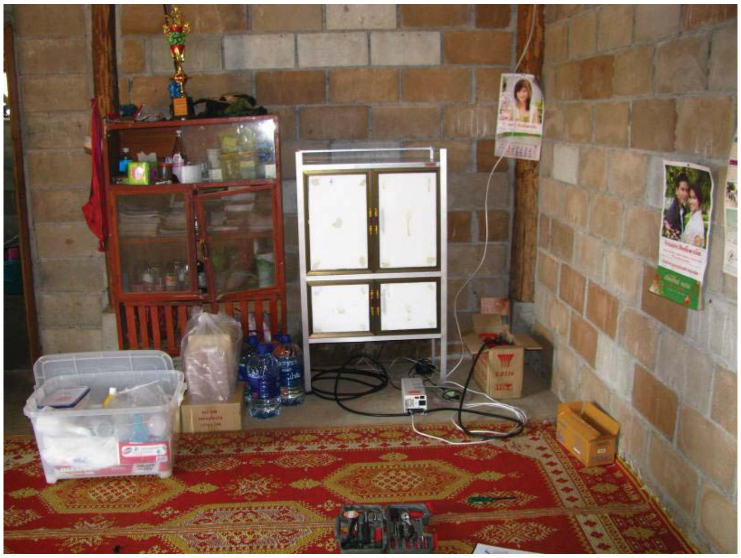

Figure 7: Photovoltaic powered germination cabinet in a villager's home for village-based seed germination studies.

Figure 8: Photovoltaic assembly and inverter for operating cabinet in non-electrified areas.