

## Seedling emergence patterns

**Learning objective:** To be able to recognize the two major seedling emergence patterns.

**Background information:** There are two common patterns of seedling emergence. The most common pattern is where the cotyledons are raised above ground as the seedling emerges. The seedling forms a hypocotyl hook that pushes through the soil. Once the seedling reaches the light, the hook opens to create a straight seedling. This pattern is called epigeous.



In the second pattern, the cotyledons remain underground and the stem (epicotyl) emerges above ground. This pattern is called hypogeous. Large seeded plants like Kentucky coffeetree and oaks tend to have hypogeous germination.



The cotyledons function as the repository for food reserves in the seed. During seed development the plant stores food in the cotyledons that the seedling will use for emergence. Once the seedling emerges into the sunlight, it can begin to make its own food through photosynthesis.

In the group of plants covered in this website, the oaks, nuts (Ohio buckeye, black walnut and pecan), paw paw, and Kentucky coffeetree have a hypogeous seedling emergence pattern. For black walnut, pecan, and paw paw, the cotyledons never emerge from the seed. All the other plant species on the website have an epigeous seedling emergence pattern.

An easy comparison can be made using Kentucky coffeetree and honeylocust. They are both in the legume family and only have physical dormancy. The seeds are easy to collect, are large and store for a very long time so the experiment can be conducted any time of the year.

**Procedures:**

1. Scarify the seeds using a file. Sow seeds approximately an inch deep in pots containing a greenhouse potting mixture. Keep in a sunny location and do not allow the potting mixture to dry out. The seedlings should emerge within two weeks.
2. When the seedlings reach a stage when they have true leaves, gently wash off the potting mixture from around the roots of the seedlings. Help the students to identify parts of the seedling and the location of the cotyledons. Notice how the cotyledons on the honeylocust are leaf-like and green. They do carry out photosynthesis in the light. The cotyledons on the Kentucky coffeetree remain underground and are large and white. Observe how thick the root on the Kentucky coffeetree has become. A lot of the food reserves in the cotyledon has been transferred to the root even before the shoot has emerged above ground. This is one reason it takes longer to see the shoot emerge in the Kentucky coffeetree compared to the honeylocust.