

Root Initiation

One aspect of growth is the production of new parts. One type of growth is the increase in the number of roots. Roots may form from root (lateral roots) or stem (adventitious roots) tissues. The ability to cause adventitious roots to form on stems is extremely useful in the production of plant clones for commerce, industry, and research. If one can produce roots on a stem cutting, then it is possible to make as large a clone as desired. As one takes cuttings from the “mother” plant, it branches due to loss of apical dominance, and it thus provides even more cuttings for rooting. What plant growth substance might induce root initiation in stem cuttings?

Mung beans (*Vigna radiata*) were planted about two weeks ago in vermiculite. These have sprouted and now have a shoot that includes a hypocotyl, two small cotyledons (attached or abscising from the cotyledonary node), and two opposite, pointed-oval-shaped primary leaves. The hypocotyl is frequently a light shade of purple in color. The internodes above the cotyledonary node generally lack the purple pigment.

You will be provided with a razor blade to sever the root system, and small plastic cups (3.5 ounce bathroom cups) to receive the cuttings. There are 1 mM stock solutions of various plant growth substances (IAA, IBA, 2,4-D) to test. All dilutions will be made with a solution of soil minerals; we will use a balance to measure 22.5 mL (g) of diluent, and 2.5 mL pipettes are provided to make serial dilutions (10^{-3} to 10^{-9} M plus 0 M) directly in the cups. You can use a marker to write the solution and your name directly on the cup. It would be wise to make the solutions first and the cuttings second. Why? It would be good to have ten cuttings in each cup. Why do you need more than one? The cuttings should be made so that you have 2 cm of hypocotyl on each cutting. The cotyledons (if still present) should be removed. Why would that be important? The cuttings need to be put immediately in the final solution and should be placed so that the cut hypocotyl is standing on the bottom of the cup. Why would that be critical?

The cuttings should be placed under continuous illumination for a week (or more if needed) and watered with distilled water to keep the solution volume at about 22.5 mL. What two processes would cause the level of solution in the cup to drop?

At the end of the incubation period, tally the number of adventitious roots and/or root primordia on each cutting. Calculate an average for each treatment concentration. After the class has shared the data, plot dose responses for each growth substance. Compare the outcomes. Write an abstract in which you discuss a model of how growth substances influence root initiation in mung beans.

Plant Growth Substance Used: _____

| | Individual Plant Data (Number of Adventitious Roots) | | | | | | | | | Mean |
|-------------|--|--|--|--|--|--|--|--|--|------|
| 0 M | | | | | | | | | | |
| 10^{-9} M | | | | | | | | | | |
| 10^{-8} M | | | | | | | | | | |
| 10^{-7} M | | | | | | | | | | |
| 10^{-6} M | | | | | | | | | | |
| 10^{-5} M | | | | | | | | | | |
| 10^{-4} M | | | | | | | | | | |
| 10^{-3} M | | | | | | | | | | |

