This experiment will consider the effects of water stress on the growth and development of bean plants. Acting through a variety of cell-level physiological processes, water stress has a number of effects on growth. It is difficult to provide controlled conditions of water stress for an extended period. Even changes in transpiration rate during the day and night affect the water potential of plant tissues. Nonetheless, studies of this stress commonly establish water application treatments and sometimes measure the potential of water in the soil near the roots. For this experiment, we will simply apply different irrigation regimes to plants and observe their responses without actually measuring water potential.

Objectives:
- Observe the physiological responses to drought in bean plants

Materials:
- Bean plants (*Phaseolus vulgaris*)

Two treatments will be developed. The first treatment should be a well-watered treatment where the soil is maintained nearly saturated. The pots must be well-drained, though, to prevent the development of anoxia (low oxygen in the roots). This can be done by growing the bean plants in vermiculite. Vermiculite has a large hydraulic conductivity. For the second treatment, allow the pots to dry and only water once every week or two.

The first week you begin the experiment, you will measure the plant height, and estimate the leaf area by measuring the leaf width and length at its widest and longest points. Will this method over or underestimate the true area? Why?

Next, make weekly observations of the number of leaves and plant height. At the end of the experiment, measure the following:

1. total leaf area,
2. shoot dry mass, and
3. root dry mass.

Make sure the plant is excavated carefully so that all of the roots are included. Also note the occurrence of any leaf abscission. Lastly, calculate the mass ratio of roots and shoot.

Data presentation

The weekly data may be shown graphically, whereas the data collected at the end might be more suitable for tabular presentation.