Sustainable Development: A Comparison of Irrigation Techniques

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Abstract

Climate change is theorized to result in extensive droughts to varying areas. Contemporary attitudes towards water usage are indeed, wasteful and inefficient. The majority of available fresh water is used to irrigate crops, and thus, severe drought would result in the near collapse of the agricultural industry. The current study sought to evaluate the efficacy of 4 methods of irrigation (using 3 volumes of water) on common household plants (Easter Bonnet Deep Rose – Alyssum). Plant health was assessed by 1) weighing the plant and 2) by measuring the length of a representative stalk on each plant. These measures were taken over a 10 day period. While conventional watering treatment using 40mL seemed to foster plant growth, the drip irrigation technique using 20mL seemed to maintain plant mass sufficiently well.

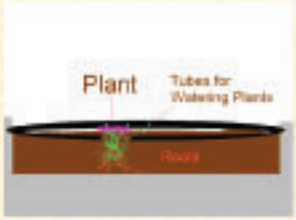
Irrigation Methods Compared

1: Conventional "Pour Over" Method

2: Furrow Irrigation

3: Drip Irrigation

2: Lepa Irrigation



1: Conventional Irrigation
The conventional method is one of the easiest. This model represents the conventional method of irrigation. In this method you simply pour water on your plant to water the roots. This is one of the easiest and most convenient methods of irrigation. One of the drawbacks is how much water is wasted due to evaporation, or runoff.

2: Furrow Irrigation
In this method of irrigation, moats are dug on both sides of a row of plants, and water is run through the trenches. A potential benefit of this technique is that runoff does not occur, and all water is kept close to the roots of the plants.

3: Drip Irrigation
Drip irrigation is a method in which tubes with holes, are strategically placed on either side of the plant roots below the soil. Due to the water being introduced so close to the plants, it is likely that small amounts of water would suffice in maintaining the plant.

4: Lepa Irrigation
Lepa irrigation is a special way of irrigation in which a tube runs around the plant. Implanted in the tubes are holes to let water pass through. The holes are directed at the base of the plant. Water is injected through the tube and let out through the holes. This system of irrigation can be quite effective. The water is directed at the base of the plant. This gives the water a chance to efficiently foster the plant's roots. Some of the water is runoff, but the majority of the water successfully hits the roots.

Building the Water Delivery Systems, Planting the Subjects and Taking the Measurements

- Aluminum cooking trays were used to house the soil and plants.
- Plastic tubing was used to deliver water in the Lepa and Drip Conditions

- Soil was distributed evenly across the plants in a given condition
- Water was administered into tubes using syringes

- A kettle was loaded with the proper volume and used to water the Conventional and Furrow plots
- Data were logged each day prior to treating the plants with water for 10 days

Data

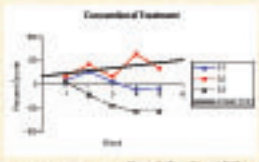
1=20mL 2=40mL 3=60mL

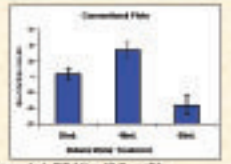
Table showing stalk length (mm) for each plant across the 10 days of data collection

1=20mL 2=40mL 3=60mL

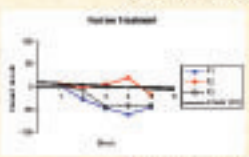
Table showing weights (Kg) for each plant across the 10 days of data collection

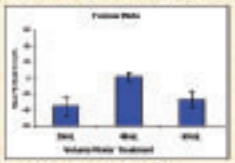
Experiment 3: FG & Spontaneous Recovery II



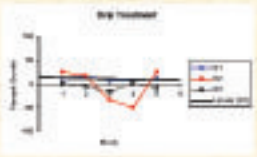


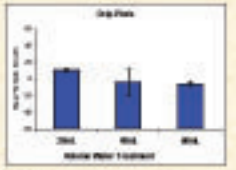
Conventional: Overall Significant Differences revealed, $F(2,14) = 10.7$, $p<.01$
Post Hocs: 20mL, = 40mL
Differences Between: 20mL & 60mL as well as between 40mL & 60mL.



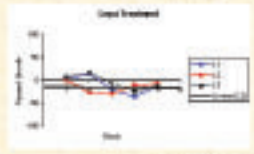


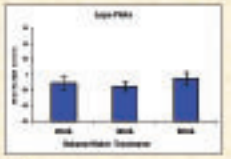
Furrow: Overall Significant Differences revealed, $F(2,14) = 4.46$, $p<.05$
Post Hocs: 40mL, = 60mL, and 20mL=60mL
Differences Between: 20mL & 40mL





Drip: No Significant Differences Among The Conditions F (2,14) = 0.4, $p>.05$





Lepa: No Significant Differences Among The Conditions F (2,14) = 0.8, $p>.05$

Conclusions

- Conventional irrigation can result in plant growth when using higher volumes of water. However, too much water has a deliterendal effect.
- Furrow irrigation at intermediate volumes is effective at maintenance, but not at fostering growth.
- Drip irrigation is probably the most efficient method for maintaining plants. In that 20mL can maintain mass over 10 days. However, no drip plot showed considerable growth.
- Lepa irrigation resulted in loss of plant mass at all volumes, indicating extensive runoff.

Limitations:
- Water delivery systems could be improved: More plants in each volume group. Plant that can grow larger may have cleaner results. No weekends...

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