Ebb and Flow Irrigation and Bedding Plants in the Greenhouse

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Nature of Work: Water quality issues are rapidly coming to the forefront in the southeast with much attention focusing on fertilizer runoff from agricultural production. As the bedding plant industry increases in sales every year, water quality and pollution are very important issues that growers must confront now before federal and state legislation forces them to. One option for growers is the adoption of irrigation practices that reduce or eliminate runoff from the greenhouse and reduce water consumption. Ebb and flow irrigation is an attractive choice to help in solving these environmental problems.

Research conducted at the University of Georgia Experiment Station in Griffin, Ga. is directed to minimizing the amount of fertilizer runoff, including nitrates, from greenhouse operations. Currently we are conducting a series of experiments on the use of ebb and flow irrigation in the production of bedding plants. Ebb and flow is a self-contained system that causes no runoff. Plants are grown on water-tight benches instead of traditional greenhouse benches. These benches are flooded to a depth of approximately one inch with water containing a soluble fertilizer, then immediately allowed to drain back into the nutrient solution holding tank. The potting media absorbs the irrigation water from the holes in the bottom of the pot, and water never needs to be added from overhead. Because the water is pumped from and returns to a storage tank, no water runs out of the pot or from a hose nozzle to the ground. In comparison to overhead watering, copious amounts of water and fertilizer are saved. With traditional production methods, as much as 50% of the water and fertilizer can be lost as runoff.

To produce top quality bedding plants using ebb and flow irrigation, cultural guidelines need to be established. Several factors are being studied in a series of ongoing experiments. First, we are using three different blends of soilless media in each experiment to determine if the structural qualities affect plant growth. These medias vary in the amount of vermiculite, peat moss, and pine bark that they contain. We have also been comparing a media with coconut coir fiber to those containing peat moss, a natural resource that is rapidly being depleted. Information to determine optimum fertilizer rates is being gathered in these experiments.

Begonias and petunias were grown in four inch pots on ebb and flow irrigation tables. Three different media were used, Scott's Metro-Mix 220,

366, and 500. 220 is high in vermiculite content, while 550 has a higher percent of pine bark. 366 was used in order to observe growth in a medium containing coconut coin Water-soluble fertilizer (20-10-20 Peat-Lite Special) was applied via the ebb and flow system at six different (0, 0.6, 1.2, 1.8, 2.4, and 3.0 mS/cm) rates of electrical conductivities (EC).

This roughly corresponds to 0, 75, 150, 250, 350, and 425 ppm nitrogen, depending on the water source (The Experiment Station is supplied water by the city of Griffin).

Results and Discussion: As the level of fertilizer increased, the dry weight of the petunias also increased, not showing any adverse effects due to high levels of fertilizer (Fig. 1). But the additional growth due to higher rates of fertilizer may not be sufficient to warrant higher rates of application. We noted good quality plants in the range of 1.2 to 2.4 mS/cm.

The begonias showed a decline in dry weight for treatments with EC above the 1.2-1.8 range, at which growth peaked (Fig. 2). There was also a difference in the density of growth in the begonias as the levels of fertilizer rose. The growth pattern of the plants was more compact at EC levels of 2.4 and 3 mS/cm. Quality plants were grown mS/cm, with slightly more dense growth at 1.2 and 1.8 mS/cm.in a fertilization range of 0.6 to 1.8

Both experiments showed trends in pH and EC of the media leachate. EC steadily rose over the course of the experiment, while pH dropped. This was true for all three growing media, but was most pronounced for Media-Mix 220 (high in vermiculite content). During the first week of the experiment, the soil leachate of begonia plants irrigated with fertilizer solution of 1.8 mS/cm had an EC level of 2.7, while by the end of week five it was 5.2 mS/cm. The pH dropped from 6.0 to 5.4 in the same time period. The rise in EC and drop in pH did not, however, have any adverse effects on plant growth.

Significance to Industry: The continued decrease in availability of water resources is forcing growers to find better means of irrigation that will both reduce the amount of water they use and reduce the amount of fertilizer runoff they discharge into local waterways. The ebb and flow system was designed for the most effficient use of water and fertilizer, and to prevent fertilizer runoff from the greenhouse. But before alternative irrigation systems such as ebb and flow become widely used, information must be available on growing practices.

This research offers cultural guidelines for bedding plant production that will make the change from traditional irrigation methods to ones that conserve water, fertilizer, and time an easier one. We found the optimum

fertilizer levels for growing begonias on ebb and flow irrigation tables to be in the range of 0.6 to 1.8 mS/cm. A rate of 1.2 mS/cm produced quality begonias with good height and density of foliage. An EC higher than 1.8 resulted in a decline in quality. For petunias, we did see an increase in plant dry weight as the levels of fertilizer increased up to 3 mS/cm. But the overall quality of the plant did not increase with higher fertilization levels, so our optimal growth was found in the wide range of 1.2 to 2.4 mS/cm. The solution of 1.8 mS/cm resulted in quality plants without using excess fertilizer.

Literature Cited

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3. Elliott, George. 1990. Reduce water and fertilizer with ebb and flow. Greenhouse Grower 8(6): 70-72, 74, 75.

Figure 1.

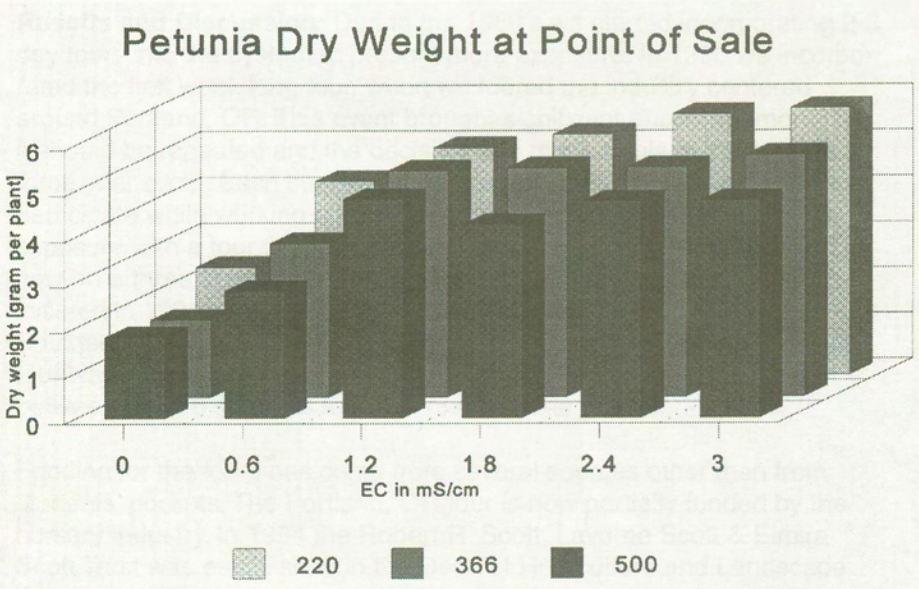
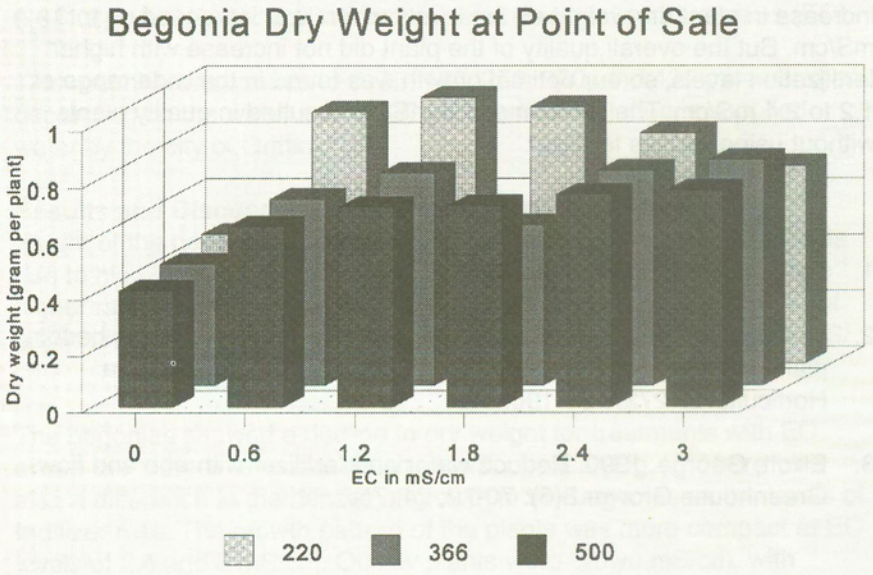


Figure 2.


Begonia Dry Weight at Point of Sale
Dry weight [gram per plant]
1
0.8
0.6
0.4
0.2
0
0
0.6
1.2
1.8
2.4
3
EC in mS/cm
220
366
500