Light Levels and Plant Size Are the Main Factors Determining Water Use of Hydrangea

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Significance to Industry: Water availability and usage is becoming an increasingly important issue for the nursery industry. Growers often encounter pathological problems (both foliar and root-related) due to improper irrigation practices, which can result in decreased product salability and increased crop losses. Unfortunately, there is a lack of quantitative information regarding the water requirements of plants. We determined the effect of plant size and environmental conditions on water use of hydrangea 'Pia' and 'Fasan'. Daily water use ranged from 50 to 300 ml/plant per day (about 1.5 to 10 fl. oz.). Plant size and daily light integral (DLI, the total amount of sun light over a day) were the most important factors determining daily water use of the plants. Our results suggest that taking plant size and DLI into account can help growers determine the daily water needs of hydrangeas, and thus help to make irrigation more efficient.

Nature of Work: Excessive irrigation can result in a wide array of economical and physiological problems in ornamental plant nurseries. Over-watering can increase plant susceptibility to root diseases, such as phytophthora, and can lead to eutrophication of lakes due to high levels of nitrogen and phosphorus contained in irrigation runoff. We investigated the relationship between plant size, environmental factors, and water consumption of *Hydrangea macrophylla* in order to quantify which of these factors have the most impact on plant water use.

64 rooted *Hydrangea macrophylla* cuttings, 32 'Fasan' and 32 'Pia' were transplanted into #2 containers filled with a composted pine bark medium. The plants were arranged on a custom drip irrigation system with four plants from each cultivar mounted on load cells. Light levels, temperature, and humidity were collected throughout the study. All sensors were connected to a datalogger. The datalogger used all the light measurements from one day to calculate the daily light integral (DLI).

The plants were watered daily at 10 pm for 30 minutes to bring the substrate to container capacity. Leachate was allowed to drain for an hour and a half before the plants were weighed at midnight, establishing a base weight for the start of each day. At 10:00 pm every night, the datalogger again weighed the eight plants on the load cells, before the plants were irrigated again. The decrease in weight that occurred between midnight and 10 pm was the daily water use (DWU).

After 83 days, the plants mounted on the load cells were harvested and their leaf area was measured. The effects of environmental and plant parameters on daily water use of the plants were tested using regression analysis.

Results and Discussion: Average DWU rates of both cultivars increased gradually over time from 50 to 300 mL/day (1.7 to 10 fl. oz.) (Fig. 1), because of increasing plant size. There was a 12% difference in average DWU between 'Fasan' (231 ml/day, 8 fl. oz.) and 'Pia' (207 ml/day, 7 fl. oz.). On the 48th day of the study, shade cloth was pulled over the hoop house, which resulted in an immediate and sustained decrease in DWU of both cultivars (Fig. 1). DLI was the only environmental factor affected by the application of the shade cloth (Fig. 2). DLI had a clear effect on DWU; on days with low light levels DWU was low as well (*e.g,*, day 3, 61, and 73).

Regression analysis indicated that 83.2% of day-to-day changes in DWU of 'Fasan' and 90.8% of fluctuations in DWU of 'Pia' could be explained based on plant age, final leaf area, and DLI combined. VPD and temperature explained only a small fraction of fluctuations in DWU. This shows that light is by far the most important environmental variable affecting plant water use.

By monitoring plant size and DLI, growers can more accurately determine the daily water requirements of hydrangea and irrigate their stock more efficiently. Irrigation volume and/or frequency can be adjusted based on light levels and plant size, improving both economical and environmental aspects of ornamental plant production.

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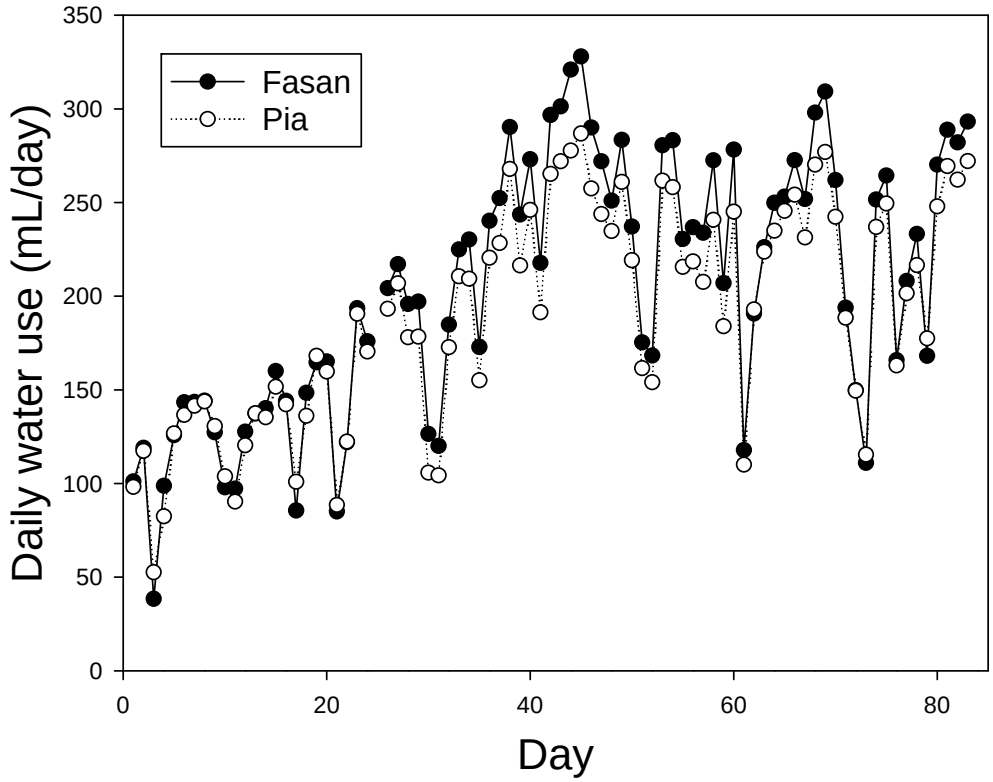

Fig. 1. Daily water use of Hydrangea macrophylla 'Fasan' and 'Pia'.

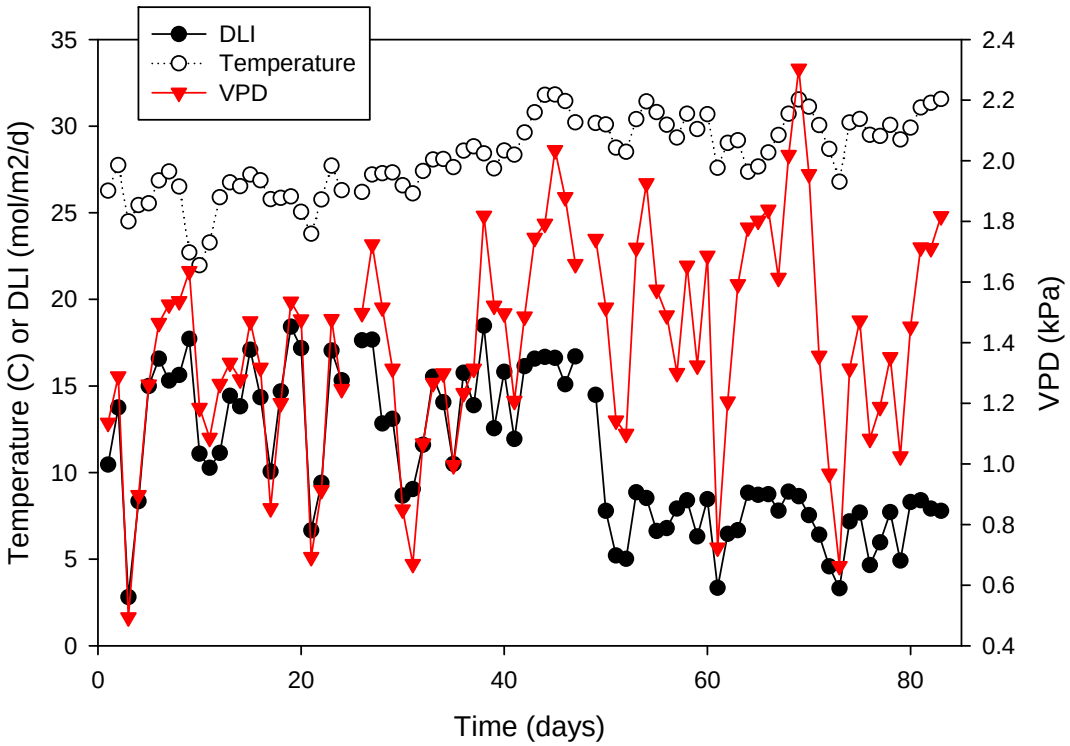

Fig. 2. Daily light integral (DLI), temperature, and vapor pressure deficit (VPD) over the 85 day experiment. Note that changes in DLI coincide with low water use in Fig. 1.