

Special Research Report #533 Production Technology Water Requirements of Herbaceous Perennial Plants

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BACKGROUND

The amount of water applied to plants impacts growth and quality, yet, very little has historically been understood about how water impacts herbaceous perennial plant production. Our goal was to determine how much water a variety of perennial plants need for high quality growth.

MATERIALS & METHODS

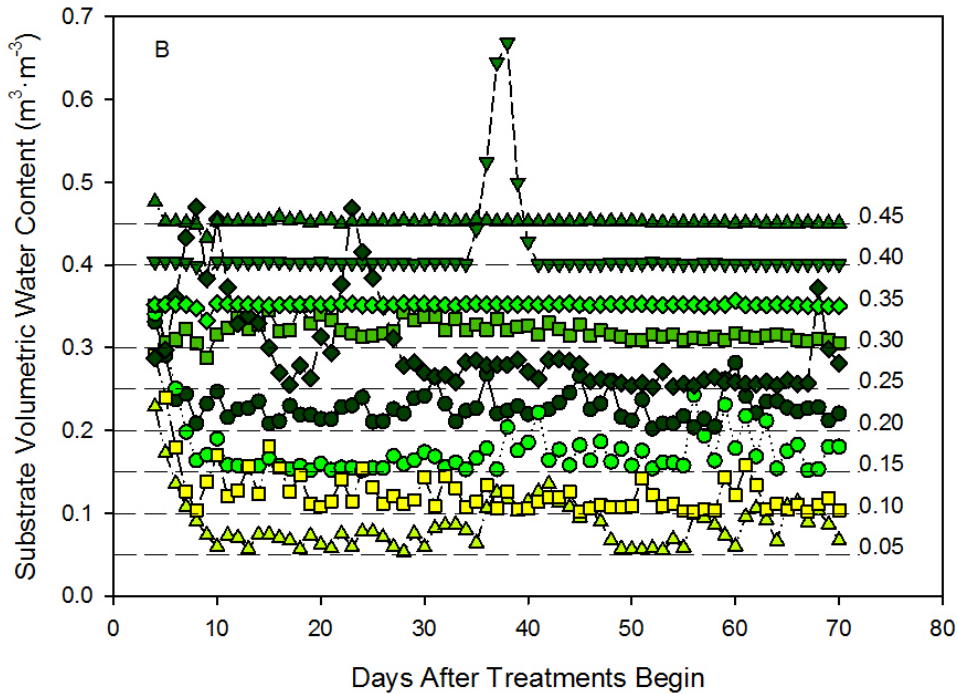
A drip irrigation system automated using soil water sensors was used to water plants. Using this system, plants were maintained at the following constant substrate water contents: 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, or 45%. Plants were transplanted from 72-cell flats obtained from a commercial grower into 6" pots containing a peat-lite substrate amended with controlled release fertilizer. After transplanting, they were hand-watered for at least two weeks as needed before the experiment began. Perennials used in this study were Rosemary, Dianthus 'Bath's Pink', and Aquilegia 'Pink Lanterns. Height and final fresh and dry weight of the perennials were measured at the end of the experiment. Leaf photosynthesis of Dianthus and Aquilegia was measured using a portable photosynthesis meter (Li-Cor 6400). In addition, the volume of water applied to plants during the entire study was quantified.



UMaine Students Julie Hintz and Shuyang Zhen installing sensors into Dianthus pots.

RESULTS

Substrate water contents were accurately maintained at their set points throughout most the experiment (Fig. 1). All perennials were generally larger when they were grown at higher substrate water contents.



Fresh and dry weight of all herbaceous perennials increased when they were grown at higher substrate water contents (Fig. 2). Leaf number and size of *Dianthus* and *Rosemary* also increased when plants were grown with more water. Although all plants had greater shoot dry weights when grown with more water, *Aquilegia* did not increase in height at substrate water contents above 25% (Fig. 3). By comparison, rosemary height increased with increasing substrate water content over the entire range tested (5% to 40%). Many rosemary plants died at either 5% or 10% water content in the substrate, which did not cause mortality for *Aquilegia* or *Dianthus*.

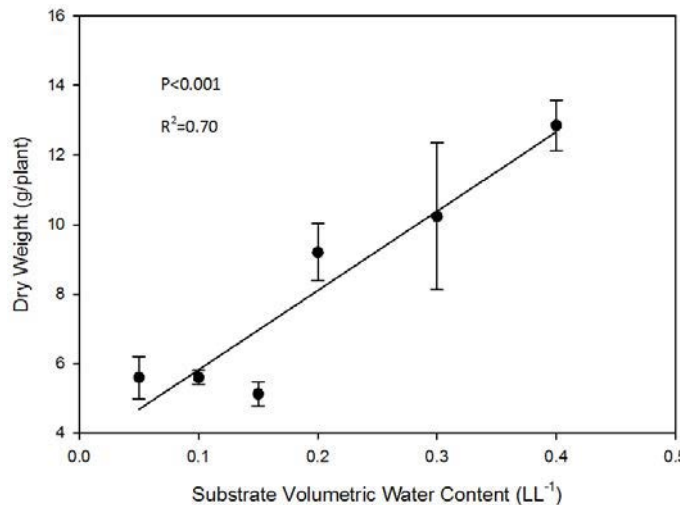


Fig. 2: Dry weight of rosemary increased as plants were grown with more water. Similar trends were observed for *Dianthus* and *Aquilegia*.

Net photosynthesis of Dianthus and Aquilegia increased as plants were grown with more water, which likely contributed to the greater shoot dry weights.

Total water applied was greater when plants were grown at higher water contents, and generally, all species required very little water. For example, Aquilegia needed 2-5 L per plant for the entire cropping cycle while Dianthus received 4-15 L of water per plant. Each day, plants received approximately 28 to 70 mL/plant (Aquilegia) or 58 to 220 mL/plant (Dianthus).

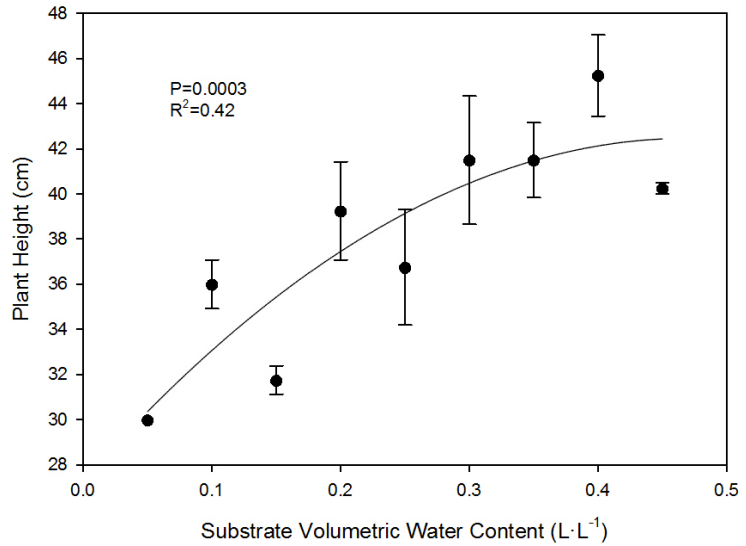


Fig. 3: Height of Aquilegia 'Pink Lanterns' was greater when plants were grown in substrate moisture contents of 30% to 45%

CONCLUSIONS

Growth, indicated by height and dry weight, of all three perennials was greater when they were grown at higher substrate water contents. Aquilegia or Dianthus grown at 25% (Aquilegia) or 35% (Dianthus) were shorter than those grown at higher moisture contents, but still high quality. Rosemary should be grown in the highest substrate water contents for plants to have the highest fresh and dry weight. However, if maximizing growth is not the objective, substrate water content can be adjusted to manipulate plant growth, providing growers with a non-chemical approach to growth regulation. The volume of water applied per plant was as low as 28 mL per day and did not exceed 220 mL per day.

INDUSTRY IMPACT

It is possible to grow high quality Dianthus, Aquilegia, and Rosemary with relatively little water using soil water sensors. Water restriction was an effective height control method for all three species and also reduced Dianthus width. To prevent excessive growth, recommended water contents would be 25% (Aquilegia and Dianthus) or 30% (Rosemary). However, Rosemary should not be grown in extremely dry substrates (lower than 10% water contents) and should be irrigated consistently to avoid mortality.



Fig. 4. Aquilegia and Dianthus grown at substrate water contents of 45% to 5% (Left to Right); Rosemary grown at water contents of 40% to 5% (Left to Right; 25% was missing).

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