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Special Research Report #463: Economic and Postharvest Quality Analysis of Floriculture Crops Produced at Reduced Substrate Moisture Content

Report Category: Post Production

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BACKGROUND

Growing bedding plants in five-inch or larger containers rather than smaller containers and flats is an upward trend in the industry. It is a common practice to irrigate greenhouse crops to container capacity (CC) defined as the amount of water content held in the root substrate after excess water has drained away by gravity. This percentage of root substrate moisture content (SMC) at CC varies with the type of root substrate. The challenge becomes how dry to let the root substrate get before re-watering. Our study analyzed the effects of two ranges of drying down of SMC before re-watering on plant growth and development, postproduction quality, and economic value of bedding plants grown in 6.5-inch containers during greenhouse production. Our hypothesis was that a wider range of SMC during production would lower production costs, control growth, and better acclimate plants to the postproduction environment resulting in better visual quality during shelf life.

MATERIALS & METHODS

In our studies, we grew eight cultivars of bedding plants, including angelonia 'Angelface Blue,' coleus 'French Quarter,' heliotrope 'Simply Scentsational,' petunia 'Colorworks Pink Radiance,' lantana 'Lucky Flame,' impatiens (Sunpatiens) 'Compact Hot Coral' and 'Spreading Lavender' and salvia 'Red Hot Sally II' in 6.5-inch containers in a peat moss: perlite root substrate (BM 6, Berger) and fertilized with each irrigation using 200 ppm 20-10-20. Plants were purchased as liners or plugs, transplanted into 6.5-inch round plastic containers, and allowed 14 days for root establishment before initiation of watering treatments.

Throughout production, using Watchdog 1000 micro stations and SM100 WaterScout sensors from Spectrum Technologies, we monitored SMC and watered plants with one of two drying intervals repeatedly as needed: (1) NR-SMC = narrow range from CC (54% SMC) to 40% SMC; or (2) WR-SMC = wide range from CC to 20% SMC. The narrow range drying interval was much like the conventional way of watering in which the root substrate is kept evenly moist at all times, and the wide range drying interval

allowed the root substrate to dry to the point that the plants were starting to show symptoms of water stress.

Salvia ‘Red Hot Sally II’

Side view of Salvia ‘Red Hot Sally II’ irrigated with a narrow range drying interval (54-40% SMC) on the left and wide range drying interval (54-20% SMC) on the right. Photo was taken after two weeks of shelf life.

We grew the plants in the greenhouse until they were marketable (six to nine weeks), then loaded them onto shipping carts wrapped with plastic before “shipping” them in the dark for 24 hours. Then the plants were placed back on the greenhouse bench and shaded with a 50% shade cloth for two weeks of simulated shelf life. During simulated shelf-life, plants were watered with plain water only when they began to wilt.

Petunia ‘Colorworks Pink Radiance’

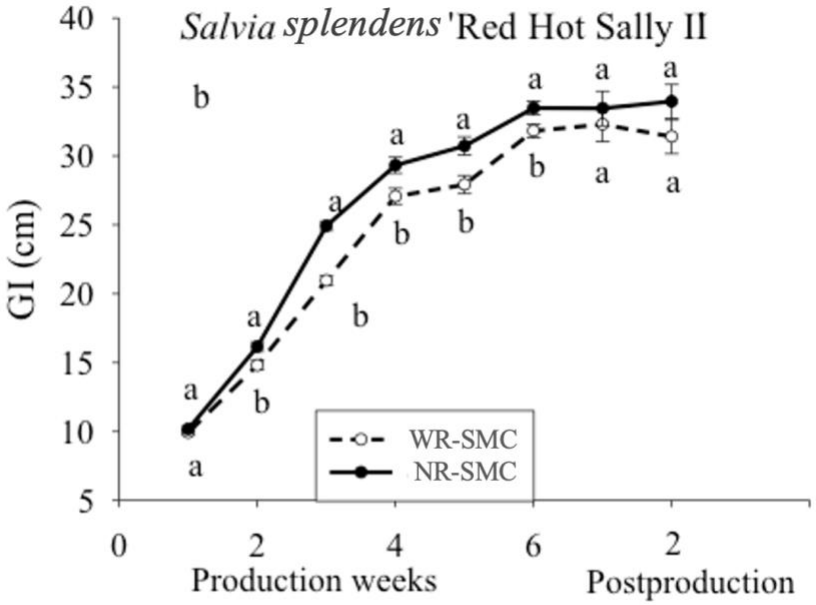
Top view of Petunia ‘Colorworks Pink Radiance’ irrigated with a narrow range drying interval (54-40% SMC) on the left and wide range drying interval (54-20% SMC) on the right. Photo was taken after two weeks of shelf life.

RESULTS

Species varied in their response to reduced water usage, i.e., increasing the time interval between watering. Here is a breakdown of how the different cultivars responded to the wide range (54%-20%) drying interval.

Angelonia, petunia, and salvia – *better quality plants acclimated to shelf life*

These three species really benefited from reduced water usage. Plant height and/or width were reduced without the use of plant growth regulators. The flower number was increased either during production or shelf life, with less loss of flowers during shelf life, and the leaves were darker green. Angelonia and petunia had increased root growth and less water stress during shelf life. Two to four watering events and up to 2 quarts of water per plant were saved during production and shelf life combined.



Growth index (GI) was calculated as: GI = plant height/2 + (plant width1+plant width2)/4 measured weekly throughout production and postproduction.

Coleus, heliotrope, and impatiens 'Sunpatiens Spreading Lavender' – *saved watering events without detrimental effects on plant quality*

In this group, only impatiens had a reduction in plant width. Heliotrope was the only one that had increased flowers at harvest; impatiens had the same number of flowers regardless of the drying interval, and, of course, coleus is not grown for its flowers. Heliotrope was the only one in this group that had more roots. All other measures of quality were not affected by the wide range (54%-20%) drying interval. One to two watering events were saved, but there were no savings in the amount of water except one quart of water per plant for heliotrope.

Impatiens 'Sunpatiens Compact Hot Coral' and Lantana 'Lucky Flame' – *detrimental effects on plant quality*

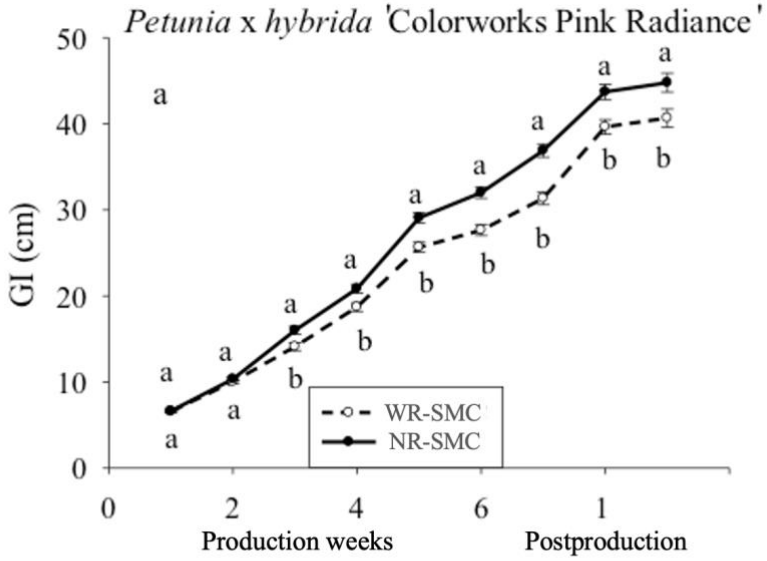
Plant width was decreased for both of these cultivars, and impatiens had more root growth. However, both had a reduced number of flowers at harvest and during shelf life, and lantana had yellow leaves.

CONCLUSIONS

Our study showed several benefits of reducing water usage by increasing the interval between watering during greenhouse production for six cultivars of bedding plants grown in 6.5-inch containers. The results showed that costs of production can be reduced, and production and shelf life quality can be improved by increasing the interval between watering just to the point of plant wilting rather than keeping root substrate

constantly moist. The reductions in costs are a result of the reduced bench space required (which reduced the residency costs expressed by overhead cost per square foot per week), the reduced amount (and associated costs) of water, and the reduced irrigation-associated labor (e.g., to check and repair emitters). For all eight cultivars, the total number of irrigation events was less, with a wide range drying interval of 54-20% SMC during production weeks, but the total amount of water was not always reduced with less frequent irrigation. This was because the containers that were allowed to dry down to 20% SMC were drier compared with 40% SMC; therefore, they needed more water input at each watering event to increase the SMC back to CC.

Considering production and/or postproduction quality, allowing SMC to dry down to 20% between water events during greenhouse production is beneficial as an irrigation method for angelonia 'Angelface Blue,' coleus 'French Quarter,' heliotrope 'Simply Scentsational,' petunia 'Pink Radiance,' impatiens 'Sunpatiens Spreading Lavender,' and salvia 'Red Hot Sally II.' However, considering the crop quality and flower number, we would not recommend this for impatiens 'Sunpatiens Compact Coral' or lantana 'Lucky Flame.'



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INDUSTRY IMPACT

Reducing water usage by increasing the interval between watering events during greenhouse production of bedding plants in 6.5-inch containers has many benefits for our industry, the grower's bottom line, and consumer satisfaction. Although species varied in their response to SMC, we did not see any detrimental effects on plant morphology, physiology, quality, or economic value by lowering SMC to 20% compared to 40% for six of the eight cultivars trialed. Benefits included more compact plants with

the same or increased number of flowers at harvest and during postharvest and increased roots. Photosynthesis and transpiration rate were reduced, and plants were less water-stressed during postharvest. Quality was equal or better with darker green leaves and more percentage of color vs. green in the plant canopy. And, plants were watered less often during production, saving costs of water and labor as well as reducing overhead because more compact plants resulted in more plants per square foot of bench space.

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