Managing Perennial Stock Plants with Florel

Michigan State research determines whether Florel can be used as a tool to keep perennial stock plants vegetative and increase the number of cuttings harvested for six perennial species.

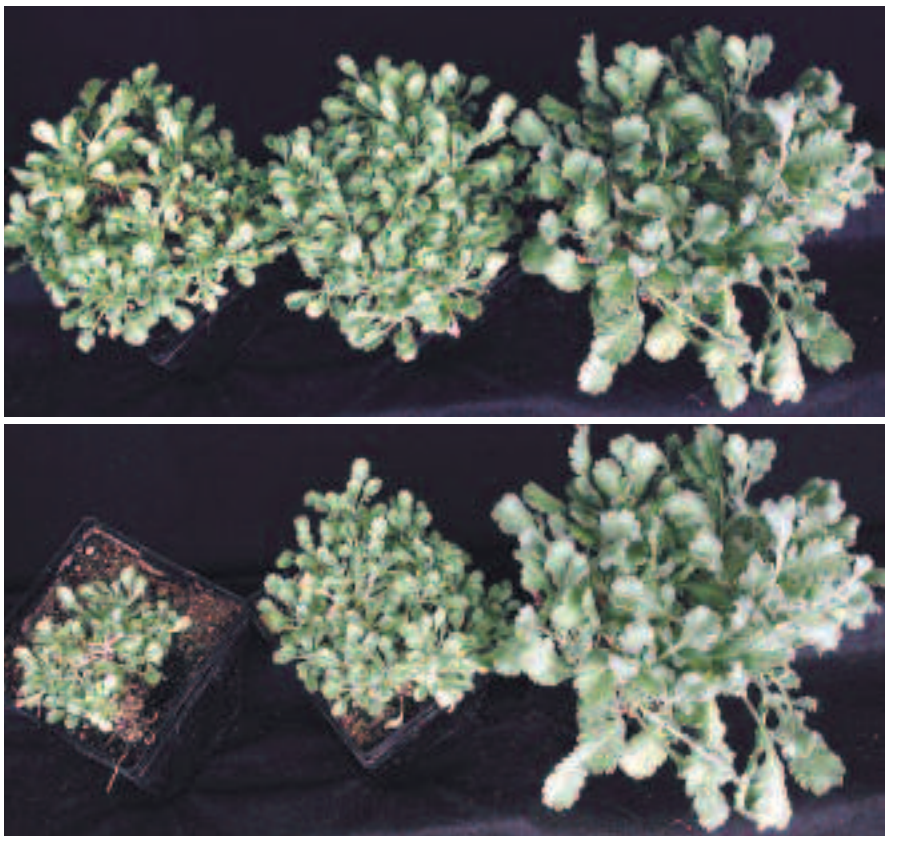
By Janelle Glady, Suzanne Lang and Erik Runkle

In the past decade, the perennial industry has become a significant segment of floriculture crop production. Similar to vegetative annuals, new cultivars of perennials are released every year, many of which are propagated by cuttings. In most cases, it is best to begin production using cuttings that are completely vegetative. Cuttings that are reproductive (with flowers or flower buds) can have reduced or delayed rooting, be problematic when flowers senesce (Botrytis can form on flowers) and lead to a nonuniform crop at finish.

Florel (ethephon, Monterey Chemical) is an ethylene-releasing plant growth regulator that can control plant height, promote branching and abort flowers and buds of various garden plants. Florel efficacy is dependent upon interactions between the plant and its environment and is often species-dependent. Research has shown how Florel can be used to manage plant growth and development on several bedding plant crops. However, few studies have been published on the use of Florel to maintain vegetative growth of herbaceous perennials.

The ability to maintain vegetative stock plants for cutting propagation is challenging for some herbaceous perennial species (such as salvia 'May Knight') that initiate floral buds under most environmental conditions. Thus, we performed studies in two consecutive springs (2002 and 2003) to investigate if Florel could be used as a tool to maintain vegetative stock plants and increase the number of cuttings harvested for six perennial species. Species were chosen for the study based on grower ➧

Top: *Biweekly applications of 0, 0 (plus water), 400, 600 or 800 ppm Florel (left to right) on* Coreopsis verticillata *'Moonbeam'.* ***Bottom:*** *Weekly applications of 0, 0 (plus water), 400, 600 or 800 ppm Florel (left to right) on* Coreopsis verticillata *'Moonbeam'. Photos were taken 10 weeks after the start of Florel application and cuttings were harvested three times. (Photos courtesy of Erik Runkle)*



Top: *The effects of Florel sprays at 400 ppm applied every week (left) or every two weeks (center), compared with no Florel application (right).* ***Bottom:*** *The effects of Florel sprays at 800 ppm applied every week (left) or every two weeks (center), compared with no Florel application (right). Growth was stunted following repeated applications used in an attempt to abort flower buds.*

interest and because many cannot be easily maintained in a vegetative state using photoperiod or temperature treatments.

TREATMENT

Coreopsis verticillata 'Moonbeam', *Veronica spicata* 'Sunny Border Blue', dianthus 'Cinnamon Red Hots', *Salvia nemorosa* 'May Night', *Scabiosa columbaria* 'Giant Blue' and *Thalictrum kiusianum* were received as commercially propagated and rooted plugs. For 2002, plugs were received February 6, 2002, grown for 15 weeks and then cut back to approximately 2 inches prior to Florel application. For 2003, plugs were received May 14, 2003, and Florel treatments began three weeks after transplant.

Phytotoxic effects on veronica foliage from weekly Florel applications at 600 ppm.

Plants were grown in a glass greenhouse with a temperature set-point of 68° F at the Michigan State University research greenhouses. The photoperiod was maintained at 16 hours using natural 9-hour photoperiods extended with light from incandescent lamps. The average daily temperature during the experiments was 72-73° F, and the average daily light integral was 12 and 14 $mol \cdot m^{-2} \cdot d^{-1}$ for 2002 and 2003, respectively.

Florel was applied as a spray at 400, 600 or 800 ppm biweekly (every 14 days) or weekly for 10 weeks. Florel was sprayed using a hand-pump sprayer with a volume of approximately 2 quarts per 100 ft^2, which was adequate to uniformly wet foliage and stems. For comparison, two control groups were not sprayed with Florel: 0 ppm and 0 ppm with a water spray. All applications were made in the late afternoon (around 4 p.m.).

Cuttings were harvested when shoots had a pre-determined number of nodes available per cutting, depending on the species, and were subsequently rooted under mist in a propagation house. Plant height (from soil base), shoot length, number of shoots, number of reproductive buds, number of vegetative cuttings and number of cuttings with reproductive buds were recorded. Cutting quality was evaluated two or three weeks after the date cuttings were stuck, depending on the species.

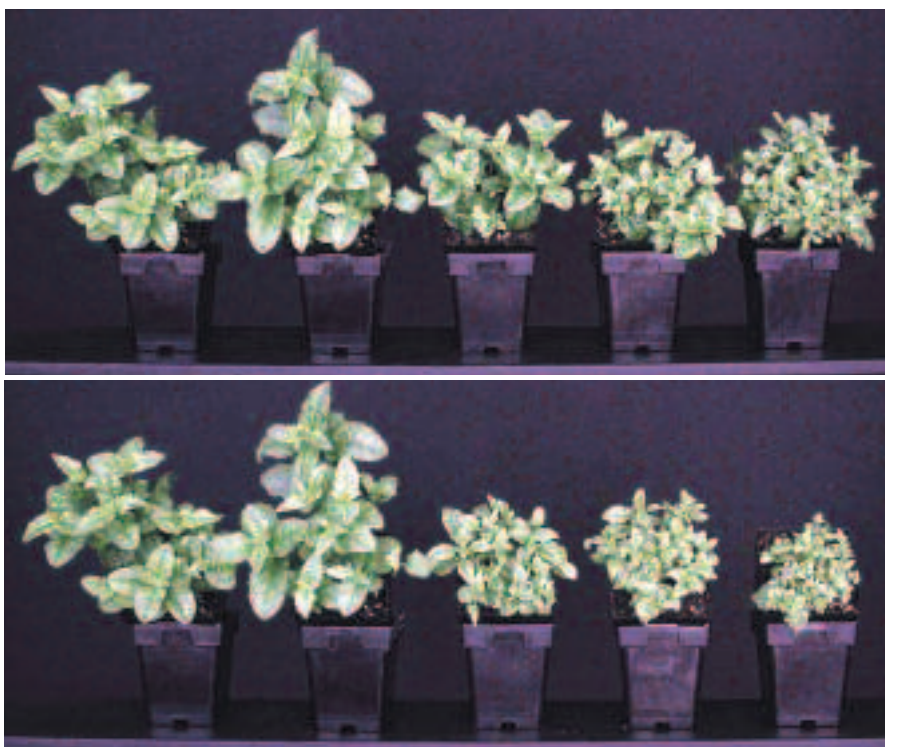
RESULTS

Coreopsis Moonbeam. Previous research at Michigan State University has shown that this perennial requires long days for flowering. Plants can be maintained without flowers under short days (12 hours or less), but growth is also dramatically inhibited, plus very few cuttings can be subsequently harvested.

During both years, Florel decreased plant height, shoot length, the number of reproductive buds and the number of cuttings with flower buds. In addition, Florel increased the number of shoots and vegetative cuttings harvested during the second year. A treatment application of 600 ppm biweekly reduced the number of reproductive buds by 90 percent, increased the number of shoots by 32 percent and increased the number of vegetative cuttings by 78 percent.

There were three cutting harvests during the experiment in the second year, and the total number of vegetative cuttings harvested from plants sprayed with Florel biweekly at 400, 600 or 800 ppm was 34-, 55- and 56-percent greater, respectively, than plants not sprayed with Florel. Cuttings from Florel-treated plants had thicker and shorter stems and fewer flower buds after propagation, than untreated plants.

Veronica Sunny Border Blue. Previous research indicates that this perennial flowers after providing a cold (vernalization) treatment, such as six weeks at 41° F. Plants can be maintained in a vegetative state if not exposed to cool temperatures. However, noncooled plants can be less vigorous and develop fewer branches (and thus fewer cuttings) than cooled, reproductive plants. Therefore, in the second year, we ➧



Top: *Biweekly applications of 0, 0 (plus water), 400, 600 or 800 ppm Florel (left to right) on vernalized* Veronica longiflora *'Sunny Border Blue'.* ***Bottom:*** *Weekly applications of 0, 0 (plus water), 400, 600 or 800 ppm Florel (left to right) on vernalized* Veronica longiflora *'Sunny Border Blue'. Photos were taken 10 weeks after the start of Florel application and cuttings were harvested twice.*

exposed an additional group of veronica plants to a cold treatment (eight weeks at 41° F) prior to Florel application.

Florel decreased plant height, shoot length, the number of reproductive buds and the number of cuttings with reproductive buds. In addition, the number of shoots and vegetative cuttings increased. A treatment application of 400 ppm weekly was adequate to manage vegetative plants without severe phytotoxic effects. Plants sprayed with 600 or 800 ppm of Florel developed leaf necrosis and deformed growth at both spray frequencies.

During 2002, Florel-treated plants at 400 ppm weekly were about 6 inches shorter, had six fewer reproductive buds per plant and yielded 30-percent more vegetative cuttings than controls. In 2003, plants treated with 400 ppm Florel weekly were shorter with fewer reproductive buds than control plants, regardless of whether plants were cooled or not. For example, compared with plants not sprayed with Florel, cooled plants that received 400 ppm Florel weekly were about 3 inches shorter, had eight more shoots per plant and yielded 26-percent more vegetative cuttings. For both years and cold treatments, cutting quality was similar between control plants and those treated with 400 ppm. Cuttings taken from plants treated with 600 ppm and 800 ppm Florel were of lower quality because of minor to moderate phytotoxic symptoms and a reduction in leaf size.

Other perennials. Florel was not effective at maintaining vegetative growth for dianthus Cinnamon Red Hots, salvia May Night, scabiosa Giant Blue and *Thalictrum kiusianum* using the rates and frequencies in our experiments. For example, salvia and scabiosa initiated and developed flowers regardless of Florel application rate and frequency. In addition, these repeated applications of Florel caused undesirable responses, including marginal leaf necrosis and overly stunted growth. Even biweekly applications of Florel at 400 ppm dramatically reduced leaf and stem size of scabiosa, making cuttings difficult to harvest. Thalictrum was extremely sensitive to Florel, and all treated plants died during the first experiment.

CONCLUSIONS

Florel can be used to inhibit flowering and promote vegetative growth for some perennial species, such as coreopsis Moonbeam and veronica Sunny Border Blue. Thus, Florel can be used effectively to manage

growth of stock plants to increase cutting yield and quality for these species. However, Florel was not effective at inhibiting flowering of, or had phytotoxic effects on, several other perennials studied. Although Florel apparently does not inhibit flowering of these plants, it still might be used commercially as a growth retardant to inhibit extension growth during the finish stage.

Recommended application rate and frequency of Florel depends on species and the desired response. To inhibit flowers and promote branching, biweekly applications of Florel at 600 ppm is suggested for coreopsis Moonbeam. For veronica Sunny Border Blue, weekly or biweekly applications at 400 ppm are suggested. However, these rates and application frequencies are based on our spring and summer greenhouse conditions in Michigan and may need to be adjusted based on your growing environment and the magnitude of the desired response.

Caution should be taken to avoid phytotoxic effects, which were seen in all species except coreopsis. In such instances, cutting harvest became difficult and cutting quality decreased due to the severe reduction in shoot size and deformed growth. In the extreme, applications of Florel at 400 ppm or higher caused plant death of thalictrum. Therefore, as with all growth regulators, on-site trials are recommended on a small scale before being implemented on a wide scale. GPN

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