

Using ABA To Reduce Water Loss In Chrysanthemum & Aster

Michigan State researchers share the effects of ConTego Pro spray concentrations on drought stress tolerance of finished potted garden chrysanthemums and asters.

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GREENHOUSE crop production often employs the use of plant hormones and growth-regulating chemicals to control growth such as plant height, rooting and flowering. Abscisic acid (ABA) is a natural plant hormone produced in roots in response to drought conditions. ABA is moved to the leaves, where it stimulates the closure of stomata, reduces water loss and halts photosynthesis.

Until recently, ABA has not been used in greenhouse crop production because there have been no products registered for commercial use. However, Valent BioSciences Corporation is planning to release ConTego Pro, a new plant growth regulator utilizing S-abscisic acid (S-ABA), the biologically active form of ABA. ConTego Pro has already received EPA registration.

To delay wilting, S-ABA is best applied as a foliar spray. An application causes the stomata to close, and therefore, reduces water loss from the leaves. Treated plants exposed to water-limiting conditions can therefore tolerate a longer period of time between watering. ConTego Pro has the potential to make plants marketable for a longer period of time.

An application of ABA is of particular interest on crops that consume large amounts of water, such as hydrangea and chrysanthemum. This article presents research information generated at Michigan State University (MSU) on the effect of various ConTego Pro spray concentrations on

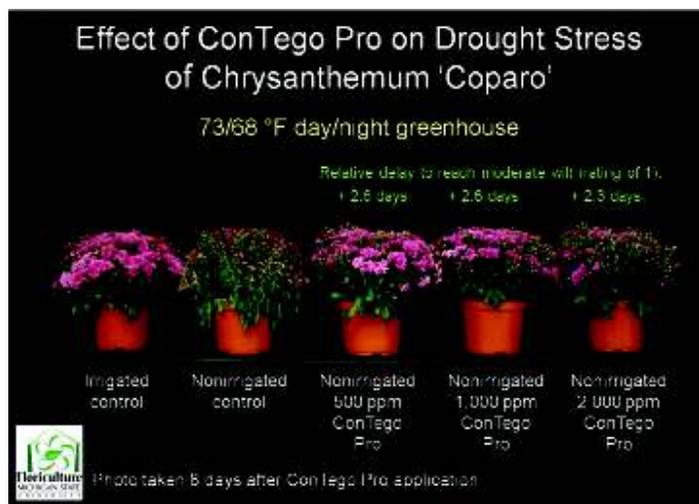


Figure 1. The effect of ConTego Pro application rate on chrysanthemum 'Coparo.' The average delay to severe wilt compared to the non-irrigated control is given for each ConTego Pro rate.



Figure 2. The effect of ConTego Pro application rate on aster 'Hazy.' The average delay to severe wilt compared to the non-irrigated control is given for each ConTego Pro rate. NS = not significant.

drought stress tolerance of finished potted garden chrysanthemum (*Chrysanthemum ×morifolium*) and aster (*Aster novi-belgii*).

Experimental Protocol

One-gallon pots of chrysanthemum

'Coparo', 'Izola Orange' and 'Pizzara Red' and aster 'Days,' 'Hazy' and 'Believer' in the flower bud stage were delivered from Andy Mast Greenhouses, Grand Rapids, Mich., to the MSU floriculture research greenhouses in August 2009. At MSU,

plants were watered, fertilized and grown following standard growing practices until plants had at least 50 percent color.

On September 14, all plants were transferred to two separate greenhouses with natural day lengths to acclimate plants to the two following postharvest conditions: nine-hour days at 73°F/15-hour nights at 68°F (73/68°F) and nine-hour days at 90°F/15-hour nights at 73°F (90/73°F). Two days later, all plants were watered until leaching between 8 and 9 a.m. ConTego Pro was applied in each of the two post-

Table 2. Quality/turgidity scale used to rate the visual drought stress of chrysanthemum and aster.

Rating	Description
3	Plant is of good quality, all leaves are turgid, flower buds are upright.
2	Slight wilt. Plants have begun to wilt; some or all leaves are not fully turgid but flower buds are upright.
1	Moderate wilt. All leaves have lost turgidity; some flower buds have started to droop. Plants are considered unmarketable.
0	Severe wilt. All leaves have lost turgidity, most flower buds are drooping.

harvest environments around 10 a.m. as a foliar spray at 2 quarts per 100 ft² at 500 to 2,000 ppm (Table 1). CapSil was added as a surfactant to improve contact with the leaves. After applications were made, plants were no longer watered, except for those in control treatments. Some of the plants (treatments 6, 7 and 8) received a simulated shipping period in which plants were moved into a dark refrigerated chamber for 48 hours at 41°F, beginning soon after the ConTego Pro applications. Plants were returned to their postharvest environments after the simulated shipping treatment.

Treatment 2 was not included in the high-temperature environment. Asters were only held at 73/68°F and only received treatments 1, 3, 5, 6 and 8. Non-irrigated plants were placed on separate benches to ensure no accidental or spillover watering from neighboring irrigated plants.

Data Collection

Plants were individually evaluated for drought stress daily at 8 a.m. and again at 4 p.m. following the ConTego Pro application. Plants were subjectively rated

Table 1. An overview of the experimental treatments to investigate the effects of ConTego Pro sprays on drought stress tolerance of chrysanthemum and aster.

Treatment	Plants were watered	Two-day simulated shipping	ConTego Pro spray (ppm)
1	Yes	No	0
2	No	No	0
3	No	No	500
4	No	No	1,000
5	No	No	2,000
6	Yes	Yes	0
7	No	Yes	0
8	No	Yes	1,000

between 3 (fully turgid, no evidence of wilting) and 0 (severe wilting) based on their degree of drought stress using the rating scale shown in Table 2.

In each postharvest environment, all treatments were re-watered once the majority of plants in the non-irrigated 2,000 ppm ConTego Pro group had severe wilting (rating of 0). Plants were re-evaluated 24 hours later to determine how well they recovered from the drought stress after re-watering.

Chrysanthemum Results

ConTego Pro application reduced water loss from chrysanthemum and thus delayed time to wilt when plants were not watered. Among the non-irrigated treatments at 73/68°F, the 500 and 1,000 ppm ConTego Pro applications increased the time to initial wilting (rating of 2) by one or one-and-a-half days, time to moderate wilt (rating of 1) by one-and-a-half to three days, and time to severe wilt (rating of 0) by one-and-a-half to three days.

The number of cultivars that responded to ConTego Pro varied with application rate and postharvest environment. At

73/68°F, a spray of 500 or 1,000 ppm delayed time to slight and moderate wilt in all three cultivars, while the highest rate was effective in fewer cultivars. For the cultivar ‘Coparo,’ all three stages of wilting were delayed by each ConTego Pro rate. For example, the time to severe wilt for ‘Coparo’ increased by two to three days compared with the non-treated plants following application of 500, 1,000 or 2,000 ppm ConTego Pro (Figure 1). The 500 and 1,000 ppm applications improved drought-stress recovery after re-watering in all cultivars, while the 2,000 ppm application had no effect.

At 90/73°F, the effect of ConTego Pro was more variable. Average time to severe wilt (rating 0) of plants that received a ConTego application ranged from four-and-a-half to seven days, while the untreated plants reached severe wilt in an average of four days. ConTego Pro application did not consistently improve drought stress recovery after re-watering at this temperature. In either postharvest environment, the simulated shipping treatment did not affect the time to wilting.

Aster Results

Drought stress tolerance of aster was also improved by ConTego Pro. Among the non-irrigated treatments at 73/68°F, 500 and 1,000 ppm ConTego Pro applications increased the time to slight wilt (rating 2) by one to one-and-a-half days and severe wilt (rating 0) by up to six days. The number of cultivars that responded to ConTego Pro varied with application rate.

As with chrysanthemum, increasing the application rate above 1,000 ppm did not have any beneficial effect. For the aster cultivar 'Hazy,' all three stages of wilting were delayed by each ConTego Pro rate. For example, the time to severe wilt for 'Hazy' increased by about two days compared with the non-treated plants following application of 500 or 1,000 ppm ConTego Pro (Figure 2). The 500 and 1,000 ppm applications improved drought-stress recovery after re-watering in most cultivars, while the 2,000 ppm rate had no effect.

Takeaways

Our results indicate that spray applications of S-ABA, the active ingredient of ConTego Pro, can be used to increase the postharvest drought stress tolerance of potted chrysanthemum and aster. Application rates of ConTego Pro at 500 or 1,000 ppm were the most effective at increasing drought-stress tolerance in the cultivars studied. For chrysanthemum, a 500 or 1,000 ppm ConTego Pro application increased the average time to slight, moderate and severe wilt by one, two-and-a-half and two days, respectively – at a day/night of 73/68°F.

For aster at the same temperature, the 500 and 1,000 ppm ConTego Pro applications delayed the average time to slight and severe wilt by one and three days, respectively. The simulated shipping treatment did not influence the effect of ConTego Pro.

As with all plant growth regulators, small trials should be performed by growers to learn more about application effects before applying products to an entire crop. When ConTego Pro is commercially available, carefully read and follow the label for application guidelines. We and others have reported that on some crops, some lower leaves can turn yellow following ABA application. However, we did not observe any leaf yellowing or phytotoxicity symptoms with chrysanthemum or aster at the spray rates tested in this experiment. **GG**

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