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CONTENTS

Using STS to Prevent Flower Shattering in Potted Flowering Plants—Progress Report

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Loss of flower parts (shattering or abscission) is often a serious problem during the handling and retail display of potted flowering plants. Zygocactus (Christmas Cactus, *Schlumbergera truncata)* drops up to 30 percent of its flowers during long-distance transit. Other examples include flower drop in snapdragon and calceolaria, petal drop in geranium, and bracteole drop in bougainvillea. This shattering is usually a response to environmental stresses such as drought, heat, cold, low humidity, low light, water stress, or exposure to ethylene, any one of which might be encountered during marketing of potted plants. Treatments which could prevent or at least reduce shattering would be of great value to producers of flowering plants.

Silver thiosulfate (STS) is widely used in the cut flower industry to prevent premature wilting of carnations, gypsophila and other cut flowers sensitive to ethylene (see Spring issue, F&N report). In some way that is not yet understood, silver ion at very low concentrations completely blocks the action of ethylene. We know that low concentrations of ethylene in the atmosphere will cause shattering and that ethylene is produced by plants when they are under almost any kind of stress, so it is probable that shattering of flowers in stressed plants is a direct response to ethylene produced by the plants themselves. Possibly, therefore, STS could be used as a foliar spray to prevent shattering of flowers in potted flowering crops.

How to Make an STS Concentrate

Weights to be used vary depending on the type of sodium thiosulfate used. Check the label and weigh out:

	Grams	Ounces
either (a) prismatic sodium thiosulfate	120	4½
or (b) anhydrous sodium thiosulfate	80	2¾

Dissolve the weighed material in 1 pint of deionized water.

Then weigh out silver nitrate	20	¾

Dissolve this in a separate pint of deionized water.

Prepare stock solution by slowly pouring the silver nitrate solution into the sodium thiosulfate solution. Stir rapidly as the solutions are mixed. Some browning of the concentrate solution may occur during mixing, but this does not matter.

Effects of Ethylene and STS on Zygocactus

Zygocactus plants in the tight-bud stage obtained from a local nursery were sprayed to runoff (5 to 10 ml per plant) in the greenhouse with STS solutions containing 4 fluid ounces of concentrate per gallon and 0.1 percent Tween 20 as spreader/sticker. After at least a day, plants were transferred to the laboratory and exposed to a low concentration of ethylene (0.5 parts per million) in large glass chambers. After 2 days exposure to ethylene, unsprayed plants started to rapidly lose their flowers and after 1 week there were no flowers left (Fig. 1). Almost no flowers fell from plants that had been sprayed with STS (Fig. 2).

Occasionally, STS sprays at the rate of 4 ounces per gallon caused blisters on the leaves, which eventually sunk and left darkened depressions. The incidence seemed to be greater when the plants were held in dark, humid conditions after spraying. Further tests showed that 2 ounces per gallon sprays caused no injury and were just as effective as 4 ounces per gallon sprays in preventing shattering of zygocactus. Sprays containing less than 2 ounces of STS concentrate per gallon gave only partial protection against ethylene-induced abscission.

When zygocactus plants were exposed to environmental stress typical of truck transportation (4 days in the dark at a temperature of 80°F), all flowers fell from untreated plants (Table 1). Plants which had been sprayed with STS 2, 3 or even 4 weeks before harvest lost no flowers even though the stress caused some flower wilting.

Effects of Ethylene and STS on Hybrid Geraniums

'Carefree Red' and 'Sprinter White' seedling geraniums were sprayed with 0.1, 0.5 or 2 ounces of STS concentrate per gallon before buds showed any color. The material was applied either to foliage (to runoff) or to flower heads alone. When the first flowers on the heads were fully open (2 or 3 weeks after they had been sprayed), the plants were transferred to the lab-

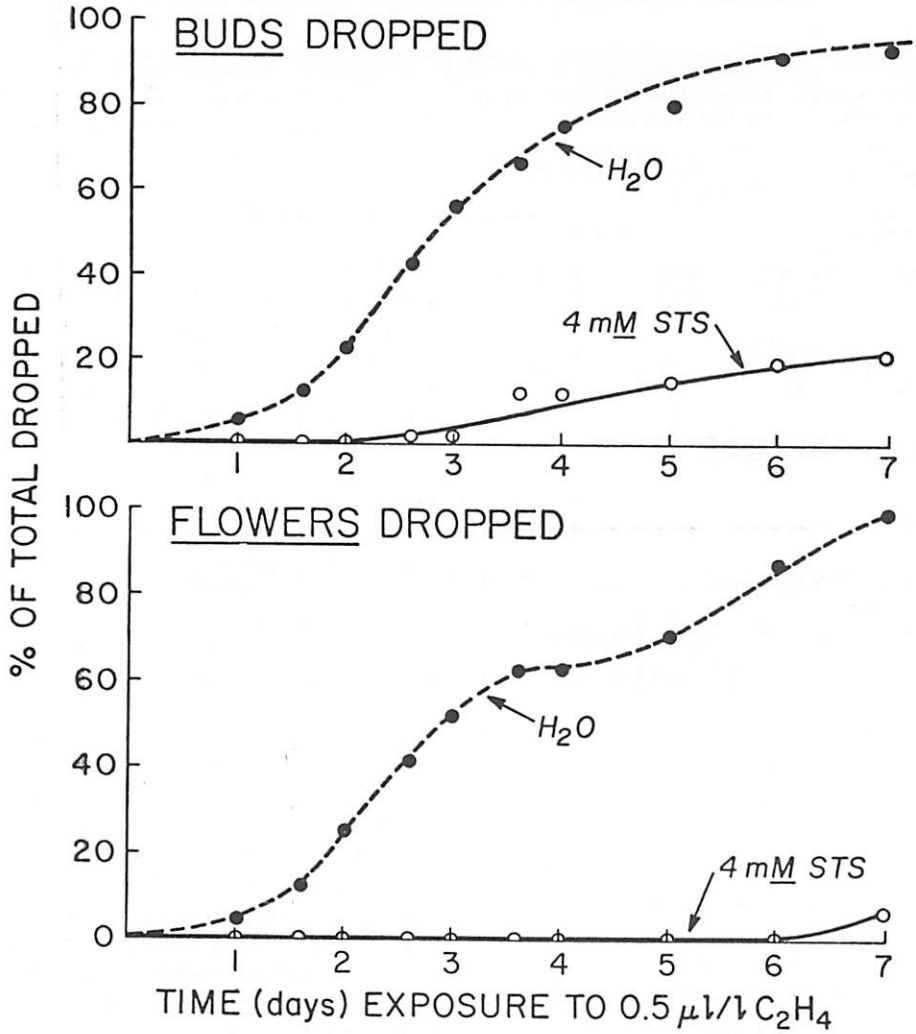

Fig. 1. Percent drop of 'Marie Red' zygocactus buds and flowers following treatment with 0.5 ppm ethylene. Plants were pretreated with sprays of either water or 4 oz STS concentrate/gallon 1 day prior to start of ethylene treatment.

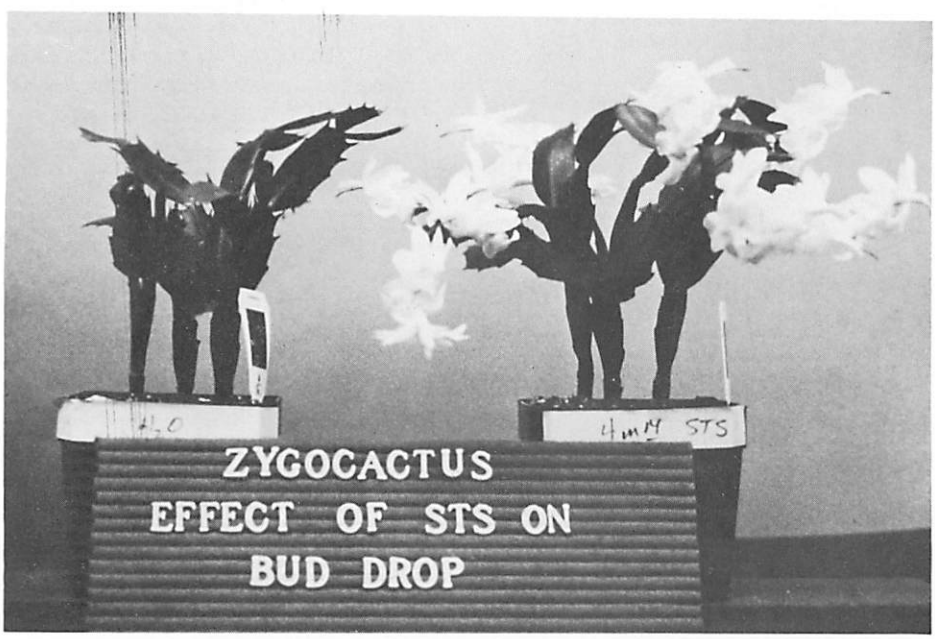

Fig. 2. 'Weiss' zygocactus plants following 7 days' exposure to 0.5 ppm ethylene. The plant on the left was pretreated with a water spray while the plant on the right was pretreated with a spray containing 4 oz STS concentrate per gallon.

oratory and held in a warm, dry, low-light environment.

Petals fell steadily from the flowers of untreated plants (Fig. 3) and also (though at a reduced rate) from flowers of plants sprayed only on developing flower heads with 0.1 ounce of STS concentrate. If the whole plants were sprayed to runoff, the 0.1 ounce per gallon treatment gave almost complete protection, presumably because of the greater amount of silver applied to each plant. The plants sprayed with 0.5 or 2 ounces of concentrate did not lose any petals during the period of the experiment regardless of application method.

Spraying geranium foliage with 2 ounces of concentrate per gallon sometimes caused small darkened circular areas near the margins of the leaves. Such injury was never observed when the spray was restricted to the flower heads, or when lower concentrations of STS were used.

During the evaluation period, flowers continued opening on all plants. Because petals fell from the control plants only, the heads of the STS-treated plants became very densely petalled and hence much showier than the controls. Even when only one flower head had been sprayed with STS, other flower heads developing later on the same plant were also less prone to shattering than those of control plants.

Effects of Ethylene and STS on Calceolaria

Calceolaria plants were sprayed with water or 0.5 ounces of concentrate per gallon before any flowers had opened. The plants were moved to the laboratory after a number of flowers had opened on all plants (1 week later) and were stressed either by 2 days exposure to 1 ppm ethylene or by 4 days of drought (in the dark) to simulate transit. Following exposure to both stresses, the control plants were judged unsalable because of almost complete shattering of flowers; however, the STS-treated plants remained quite acceptable (Table 2).

Effects of Ethylene and STS on Bougainvillea

Bougainvillea plants in full bloom were sprayed with either water or 0.5 ounces concentrate per gallon in the greenhouse and moved to the laboratory 3 weeks later. After 3 days of drought, bracteoles fell freely from water-treated plants; even after watering, bracteoles on these plants continued to drop and

TABLE 1. Effect of 4-ounce STS concentrate per gallon on percent bud and flower drop of zygocactus plants following exposure to 80°F in the dark for 4 days.*

Treatment†	Percent buds and flowers abscissed after stress (80°F in dark)			
	'Marie Red'		'Weiss'	
	Buds	Flowers	Buds	Flowers
Water	100	100	100	100
4 oz STS concentrate per gallon				
held 2 weeks	3	0	0	0
held 3 weeks	5	0	0	0
held 4 weeks	0	0	0	0

*Plants were held 2, 3, or 4 weeks between treatment with STS and stressing.
†Treatment was foliar spray.

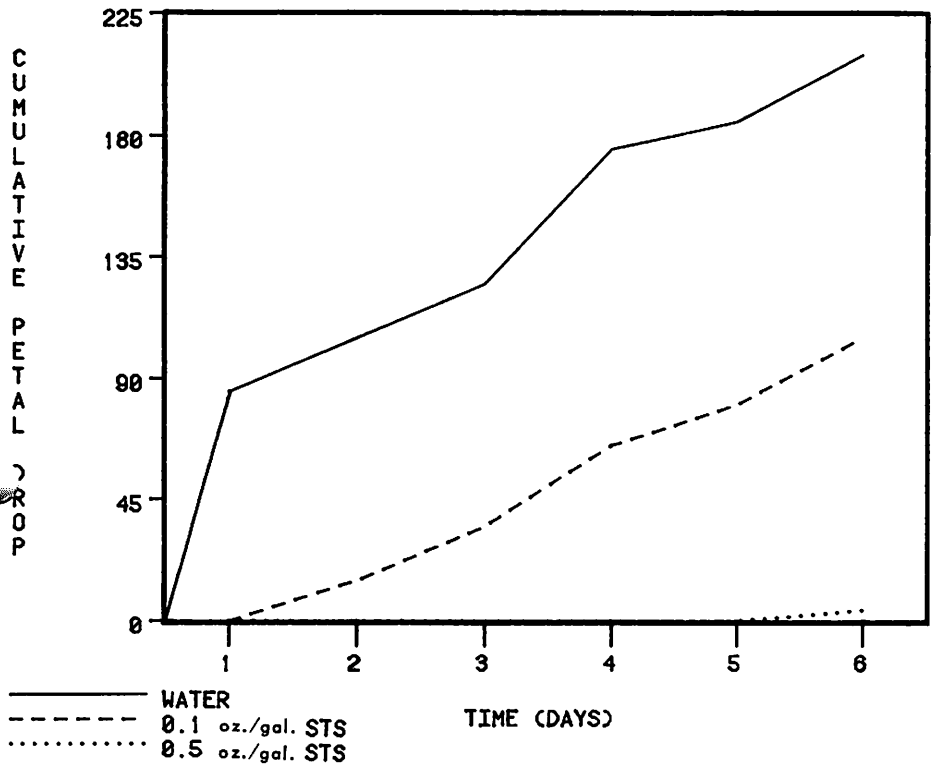

Fig. 3. Cumulative petal drop from 'Carefree Red' geranium with time of holding in a warm dry environment. Plants were pretreated with sprays of water, 0.1 oz STS concentrate/gallon or 0.5 oz STS concentrate/gallon restricted solely to the flower heads.

very few remained on the plants after 6 days (Table 3). STS-treated plants lost relatively few bracteoles and were still attractive at the end of the 6-day observation period.

Conclusions

Foliar application of low concentrations of STS may be a highly effective tool for potted-plant producers concerned with preventing shattering of flowers and buds. In all plants tested, it was found that STS could be applied at least a week prior to exposure to stress conditions and still retain its protective ability. Therefore, plants could be treated well before harvest and still be protected from stress-induced shattering during packing, transit and retail display. Because relatively small amounts of silver are used per plant, STS sprays would be economical, costing less than 0.1 cent per plant at present silver nitrate prices. STS thus has the potential not only to improve the marketability of zygocactus, and seedling geraniums, but also to allow increased production of crops such as calceolaria, bougainvillea, impatiens and mimulus which were previously found to suffer severe losses during handling due to their sensitivity to shattering.

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TABLE 2. Percent flowers dropped from calceolaria plants stressed by 4 days of drought or 2 days of 1 ppm ethylene.*

Treatment	4 days drought (dark-80°F)	2 days 1 ppm ethylene (light-70°F)
Water	83%	91%
0.5 oz STS per gallon	22%	36%

*Percentage drop was estimated immediately after removal from the stress.

TABLE 3. Percent bracteoles dropped from bougainvillea plants droughted for 3 days, and watered during the second 3-day period.

Treatment	Three days drought (light-70°F)	Next 3 days (light-70°F)	Total
Water	56%	34%	90%
0.5 oz STS per gallon	17%	12%	29%

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