Use of Lysophosphatidylethanolamine (LPE), a Natural Lipid, to Enhance Opening and Retention of Flowers on Bedding Plants Experiencing Water Stress During Retail Sales

A. Snider
Nutra-Park, Inc.
3225 Deming Way Suite 140
Middleton, WI 53562
USA

J.P. Palta
Dept. of Horticulture
1575 Linden Drive
University of Wisconsin-Madison, WI 53706, USA

T. Peoples
Nutra-Park, Inc.
3225 Deming Way Suite 140
Middleton, WI 53562
USA

Keywords: *Impatiens*, drought, wilt, annual plants, phospholipids, senescence, shelf life

Abstract

We investigated the influence of a spray application of LPE on the marketable quality of bedding plants subjected to cycles of water stress using number of flowers per plant as an indicator of marketable quality. One week after transplanting, plants were sprayed to drip with a solution containing 0, 50, 100, or 200 ppm LPE. The *Impatiens* were put under drought stress by withholding water, and drying to wilt between each watering. Following a water stress cycle, LPE-sprayed plants consistently had a higher number of open flowers compared to control plants. With subsequent stress cycles, the differences between LPE and control became larger and more significant. In most cases LPE-treated plants had more than twice the number of open flowers per four-pack and recovered more quickly from periods of stress than controls. LPE has the potential to enhance the opening and retention of flowers on bedding plants undergoing water stress cycles during marketing.

INTRODUCTION

Spring bedding plants sold at retail outlets are regularly exposed to less-than-ideal growing conditions. Even if these plants are of very high quality when they leave the greenhouse, the mass markets and retail outlets are where they suffer the most stress (Armitage, 1982). Often these plants are not watered enough to maintain their health. They are subjected to periods of drought stress followed by excessive water, and then the drought cycle is repeated. Marketability of these bedding plants is seriously compromised by these cycles of water stress, and keeping quality of a mistreated bedding plant can decline within hours of experiencing poor care (Armitage, 1983). Water stress reduces the opening, retention, and production of flowers (Fernandez et al., 2002).

Recently a natural lipid, lysophosphatidylethanolamine (LPE), has been shown to prolong the shelf life of fruits, foliage, and cut flowers, (Farag and Palta, 1993a; Kaur and Palta, 1997). LPE was found to inhibit activity of phospholipase D (PLD), an enzyme activated during stress and that enhances senescence (Ryu et al., 1997). Furthermore LPE mitigates injury from chemical stress (Farag and Palta, 1993b; Ozgen et al., 2002). This technology was patented by the University of Wisconsin and is being commercialized by Nutra-Park, Inc. We investigated the influence of a spray application of LPE on marketable quality of bedding plants subjected to cycles of water stress to see if senescence could be slowed and the negative effects of drought stress could be mitigated.

MATERIALS AND METHODS

Three experiments were conducted to determine the effect of LPE on bedding plants. Six-week-old seedlings of *Impatiens wallerana* 'Super Elfin', 'Rose' or 'Dazzler Salmon', from a commercial grower, were transplanted into 1204 cell packs containing Fafard 3B Potting Mix. One week after transplant (4 weeks after transplant in experiment 3), the plants were sprayed to drip with a solution containing 0, 50, 100 or 200 ppm LPE. Plants were given 14 hours of fluorescent light at 22 °C during the day and 18 °C at night. Each flat was placed six inches from two 40 watt cool white fluorescent bulbs and two 40 watt plant and aquarium bulbs. The *Impatiens* were put under drought stress by withholding water, and allowed to dry to wilt between each watering. The 1204 packs (with drainage holes) were placed in flats without drainage holes. Water was placed in the flat and was taken up by the plant through the holes in the 1204 pack. This way all 4-packs had access to the same amount of water. The number of flowers per 4-pack was used as and indicator of the severity of water stress and the influence of this stress on the plants. The number of open flowers per four-pack was recorded daily.

Experiment 1 used *Impatiens wallerana* 'Dazzler Salmon.' Each treatment was replicated 12 times. Experiments 2 and 3 used *Impatiens wallerana* 'Super Elfin Rose.' Treatments in experiment 2 were replicated 8 times and treatments in experiment 3 were replicated 12 times.

RESULTS AND DISCUSSION

Impatiens plants sprayed with LPE retained more flowers during periods of drought stress than unsprayed plants. The number of flowers in all treatments was reduced with progressive stress. In general LPE-treated plants retained more flowers at the periods of highest stress and recovered from that stress more quickly than control plants.

In experiment 1 (Fig. 1) plants treated with various concentrations of LPE were given one cycle of water stress. At 12 days after treatment, 100 ppm LPE was the best treatment with the highest number of flowers. The average number of flowers per four-pack was reduced from 8 to 2 during nine days of progressive water stress. Three days after rewatering, plants treated with 100 ppm LPE had an average of about six flowers per four-pack compared to 3.8 in control (significant at P=.001). During water stress, flower numbers in plants treated with 50 ppm LPE declined at a similar rate to those treated with 100 ppm LPE, but after rewatering the former plants did not recover as well as those receiving the 100 ppm treatment. From day 7, plants receiving 200 ppm LPE performed similarly to the controls.

Super Elfin Rose Impatiens plants treated with 100 ppm LPE had more marketable flowers than control plants throughout experiment 2, in which plants experienced three full cycles of water stress (Fig. 2). Differences between the two treatments were apparent 1-2 days after rewatering. The plants experienced three full cycles of water stress. After the first rewatering, plants treated with 100 ppm LPE had an average of 3 flowers per 4-pack, approximately twice that of the untreated control (significant at P=.003). Plants treated with 200 ppm LPE had an average of over 2.5 flowers per 4-pack at this time (Fig. 3, P=.002). After the final watering on day 12, flower numbers on untreated control plants declined. At the end of the experiment, the flower number on 100 and 200 ppm LPE-treated plants was significantly higher than controls.

In experiment 3, an extended duration of stress was applied after the third rewatering (Fig. 4). Flowers were also treated at a later developmental stage than in previous trials. Flowers were sprayed 4 weeks after transplant rather than 1 week after transplant as in previous trials. Initially, untreated control plants had more flowers than plants receiving 100 ppm LPE. After the second and third waterings, plants that had received 100 ppm LPE, recovered more quickly than controls. By day 19, plants from both treatments produced only 2 flowers per 4-pack. The difference in response to the 100 ppm LPE treatment in this experiment compared with the response of the 100 ppm LPE treatment in previous experiments may be due to the later timing of the LPE treatment. Application timing may be critical to obtain the desired results.

CONCLUSION

LPE application to *Impatiens wallerana* during periods of drought stress results in retention of more flowers and enhances the rate of plant recovery after rewatering compared with untreated plants. This may benefit sales in retail outlets when plants may be subjected to frequent drought stress and sporadic watering. Application of LPE at the correct stage of growth may be important in attaining the desired response. Since many customers choose plants based on the number of flowers on a plant, an LPE treatment before shipping may promote increased flower number, improved keeping quality, and increased purchases with a higher turnover of product.

Literature Cited

Armitage, A.M. 1982. Keeping quality of bedding plants: whose responsibility is it? Flor. Rev. 171:34-39.

Armitage, A.M. 1983. Keeping quality of bedding plants. Flor. Rev. 172:63-66.

Farag, K.M. and Palta, J.P. 1993a. Use of lysophosphatidylethanolamine, a natural lipid, to retard tomato leaf and fruit senescence. Physiol. Plant. 87:515-521.

Farag, K.M. and Palta, J.P. 1993b. Use of natural lipids to accelerate ripening and enhance storage life of tomato fruit with and without ethephon. HortTechnology 3:62-65.

Fernandez, R.T., Schutzki, R.E. and Prevete, K.J. 2002. Influence of spring and fall drought stresses on growth and gas exchange during stress and posttransplant of container-grown Magnolia x soulangiana 'Jane.' J. Amer. Soc. Hort. Sci. 127:38-44.

Kaur, N. and Palta, J.P. 1997. Postharvest dip in a natural lipid, lysophosphatidylethanolamine, may prolong vase life of snapdragon flowers. HortScience 32:888-890.

Ozgen, M. and Palta, J.P. 2002. A natural lipid, lysophosphatidylethanolamine (LPE), can mitigate adverse effect of fungicide, chlorothanil, on fruit set and yield in cranberries. Acta Hort. 628:747-752.

Ryu S.B., Karlsson B.H., Ozgen M. and Palta J.P. 1997. Inhibition of phospholipase D by lysophosphatidylethanolamine, a lipid-derived senescence retardant. Plant Physiol. 98:613-615.

Figures

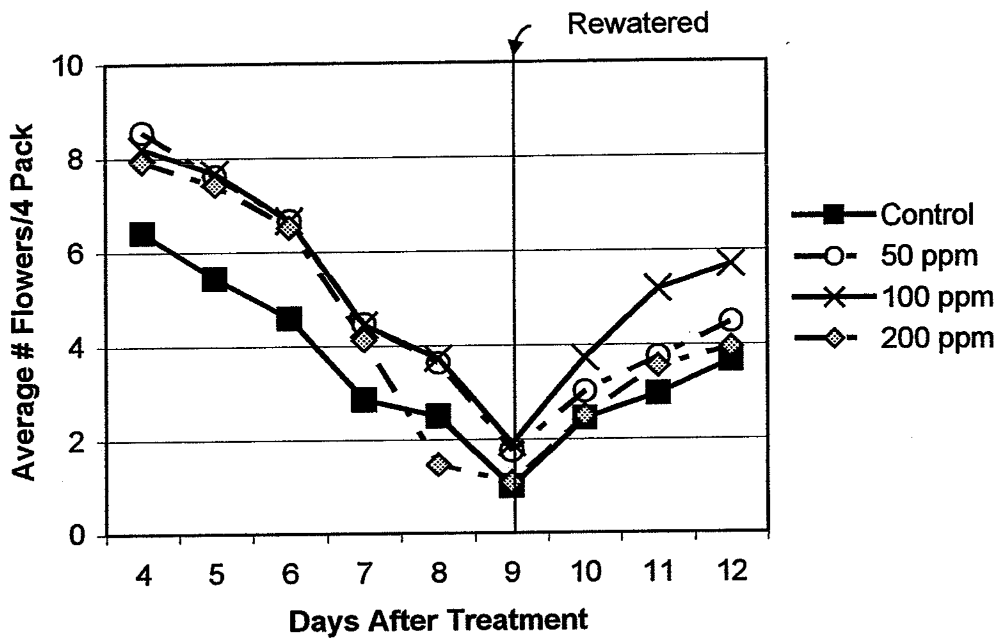

Fig. 1. Number of flowers produced by *Impatiens* 'Dazzler Salmon' during one cycle of water stress following spray treatment with various concentrations of LPE. Values are the mean of 12 replicates. For day 12, Control vs 100 ppm, LPE P=.001.

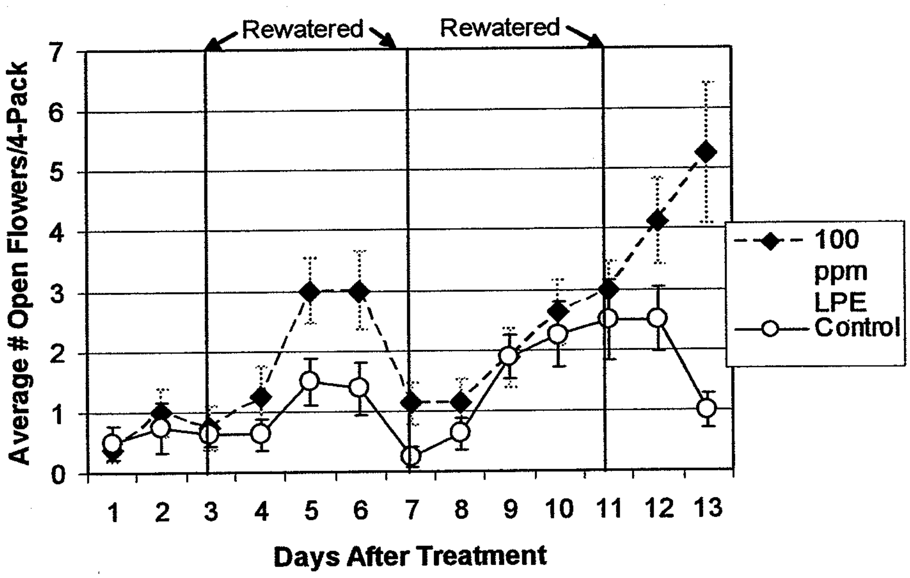

Fig. 2. Number of flowers produced by *Impatiens* 'Super Elfin Rose' during three cycles of water stress after spray treatment with 100 ppm LPE. Values are the mean of 8 replicates. For day 13, P=.003.

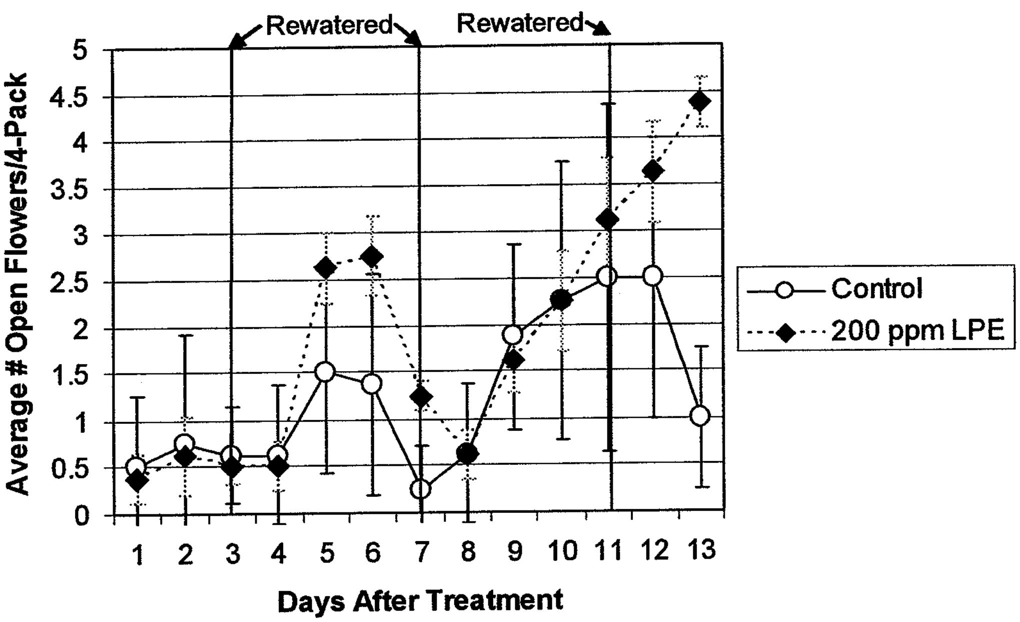

Fig. 3. Number of flowers produced by *Impatiens* 'Super Elfin Rose' during three cycles of water stress after spray treatment with 200ppm LPE. Values are the mean of 8 replicates. For day 13, P=.002.

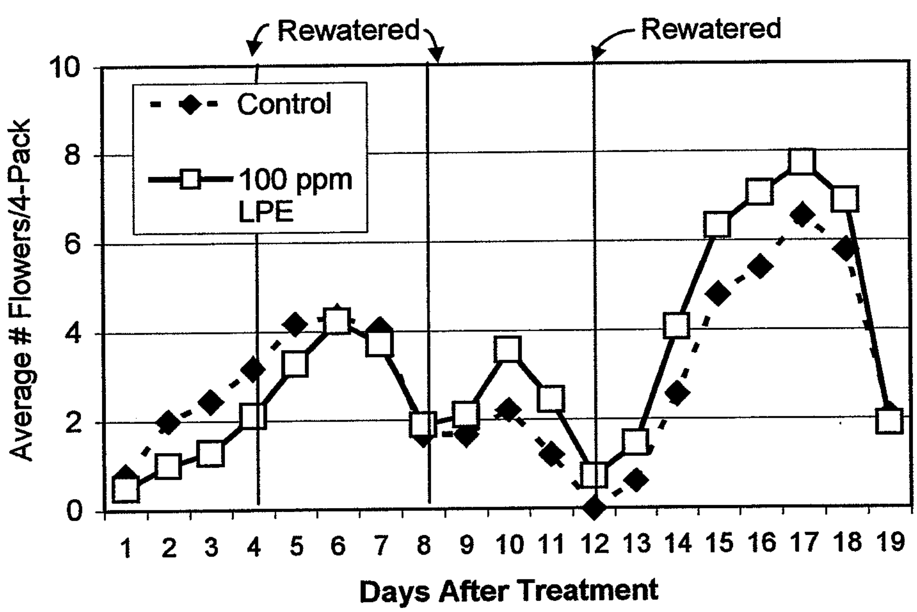

Fig. 4. Effect of LPE spray treatment on the flowers produced by 'Super Elfin Rose' *Impatiens* during four cycles of water stress. Values are the mean of 12 replicates.