CALCIUM DEFICIENCY ON POINSETTIA STOCK PLANTS

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Poinsettia leaf edge burn (LEB) occurs on vegetative stock plants under heavy cutting production.

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Introduction

Poinsettia leaf edge burn (LEB) occurs on vegetative stock plants under heavy cutting production. Symptoms appear after several flushes of cuttings have been removed, when numerous axillary shoots are developing simultaneously. Young, expanding leaves on these shoots exhibit a marginal chlorosis which can rapidly progress to necrosis, while interior portions of the leaf retain a normal green color. As marginal tissue ceases to grow, continued expansion of the leaf blade causes a puckering of the leaf surface and a downward curling of the leaf tip and margins. 'Gutbier V-14 Glory' is especially sensitive to LEB, but it can occur on other poinsettia cultivars.

Leaves affected by LEB are highly susceptible to secondary *Botrytis* infection. This may be only a limited problem on stock plants, where prevailing environmental conditions do not encourage its development and spread. However, *Botrytis* can be a severe problem during rooting of cuttings under mist and during cutting shipment.

Leaf edge burn expression is often transitory on a given shoot and limited to the first three or four unfolding leaves. If shoots are allowed to continue elongating, healthy cuttings can be taken above affected leaves, however this can delay cutting harvest, disrupt scheduling and reduce total cutting production. Symptom free cuttings may also develop LEB during propagation. Removing these damaged leaves to prevent *Botrytis* can be time consuming and expensive for the commercial producer.

Initial research on LEB indicated that limited Ca translocation, N fertilizer source and vegetative growth rate were associated with LEB occurrence (Zakkour, et al., 1986). These results suggested that LEB on 'V-14' stock plants is similar to marginal bract necrosis on 'V-14' flowering plants (Nell and Barrett, 1985; Woltz and Harbaugh, 1986). A series of experiments were conducted to further investigate these possibilities in order to find effective control methods for LEB under conditions simulating commercial cutting production. Total cutting production was also studied, since any control measure for LEB which reduces cutting production would be undesirable.

Materials and Methods

Single 'V-14' plants were grown in 6 inch plastic pots in a peat : perlite : sand (2:1:1 by volume) medium. Pots were spaced 11 inches between centers in a greenhouse maintained as closely as possible to a constant 75°F. All plants were pinched to nine nodes five weeks after potting of rooted cuttings, and weekly harvests of 2 1/4 in. cuttings began five weeks after pinching. Experiments 1 and 2 were continued for 14 weeks of cutting production, and LEB symptoms were observed for the last half of this period.

Expt. 1. Fertilizer treatments differing in NH_4-N:NO_3-N ratio (0:1, 1:2, 2:1) were applied to three groups of 12 plants. Each fertilizer supplied 250 ppm N, 75 ppm P, 350 ppm K, 235 ppm Ca and 70 ppm Mg. Sulfate was the balancing anion and increased as the NH_4-N proportion increased. Micronutrients were supplied every 2 weeks with Peter's S.T.E.M. (1/8 oz./gal. H_2O).

Data were collected on the number of leaves showing LEB symptoms, number of cuttings produced, and Ca concentrations in marginal and interior leaf tissue from both healthy appearing and LEB affected young leaves.

Expt. 2. The same NH_4-N:NO_3-N ratios were used and five plants from each fertilizer regime were given one of the following supplementary treatments:

1) untreated control
2) tap H_2O spray
3) foliar Ca spray
4) medium applied Ca
5) foliar Ca + medium Ca

The same data were collected as in Expt. 1.

Spray treatments began after the first cutting harvest and were applied weekly. Chelated Ca (This White Label Calcium, Stoller Chem. Co.) supplied 500 ppm actual Ca (1 1/4 oz. by weight of 'This Calcium' per gal. of H_2O). The tap H_2O spray contained 25-30 ppm Ca. All sprays were applied to runoff and contained 0.5 ppm wetting agent (Regulaid, Kalo Inc.). Medium applied Ca treatments received 0.15 oz. per pot powdered $CaSO_4$ (gypsum) at monthly intervals.

Results and Discussion

Expt. 1. The NH_4-N:NO_3-N fertilizer ratio significantly affected both LEB occurrence and cutting production (Table 1). Number of LEB leaves per plant increased nearly 100% with either the 1:2 or 2:1 NH_4-N:NO_3-N ratio compared to total NO_3-N (0:1 ratio). Number of cuttings per plant increased nearly 40% with either level of NH_4-N. The increase in LEB with NH_4-N was more than a simple reflection of the increased vegetative growth, since the ratio of LEB leaves to cutting numbers was 1.4 times greater with the two NH_4-N containing fertilizers.

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Leaves with LEB symptoms had lower Ca concentrations than healthy appearing leaves in both interior and marginal sections (data not presented). In addition, concentrations of Ca were higher in interior sections of the leaf blade than in the outer 0.5 cm margin regardless of whether the leaves appeared healthy or had LEB. Chlorotic and necrotic marginal tissue had a mean Ca concentration that was only 63% of the Ca concentration in healthy appearing, green marginal tissue. The Ca distribution in young leaves is consistent with the hypothesis that LEB is a localized Ca deficiency.

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Expt. 2. Responses to fertilizer N source were similar to Expt. 1, so only supplemental treatment effects will be discussed. Calcium sprays, with or without medium applied $CaSO_4$, reduced the number of LEB leaves by 90% compared to the control or $CaSO_4$ alone (Table 2). Tap water plus wetting agent sprays reduced

Table 1. *Effects of NH_4-N:NO_3-N fertilizer ratio on LEB and cutting production (Expt. 1.).*

NH_4:NO_3 ratio	No. LEB leaves	No. cuttings
0:1	19.7	39.8
1:2	38.3	55.6
2:1	39.0	55.0

Medium applied $CaSO_4$ was ineffective in both reducing LEB and increasing leaf Ca, although soil tests showed that Ca levels in the medium were increased by 50%.

Table 2. *Effect of supplemental treatments on the number of LEB leaves per plant and the mean Ca concentration in healthy appearing young leaves (Expt. 2.).*

Supplemental treatment	No. LEB leaves	Ca (%)
Control	32.5 a[z]	0.37 a
$CaSO_4$ (medium)	31.4 a	0.38 a
Tap H_2O spray	15.6 b	0.48 b
Ca spray	3.5 c	0.65 c
Ca spray + $CaSO_4$ (medium)	3.1 c	0.69 c

[z] Means within columns followed by the same letter are not significantly different at the 5% level.

A calcium concentration of 0.5% is considered to be the critical level in recently matured poinsettia leaves.

This research indicates that LEB is a localized Ca deficiency due to inadequate Ca uptake and/or translocation to the numerous axillary shoots simultaneously developing on poinsettia stock plants.

LEB leaves by 50% compared to the same groups.

Concentrations of Ca in young leaves were separated into the same treatment groupings. All supplemental treatments which reduced LEB, including tap water plus wetting agent sprays, also increased leaf Ca concentrations. The Ca sprays increased Ca concentrations 60-80% over the control and $CaSO_4$. Tap water plus wetting agent sprays increased Ca concentrations 20-30%. Medium applied $CaSO_4$ was ineffective in both reducing LEB and increasing leaf Ca, although soil tests showed that Ca levels in the medium were increased by 50%.

There were no treatments with deionized water or tap water without wetting agent, so it is not possible to clearly differentiate between effects due to the Ca content of the tap water and indirect effects due to the wetting agent. A possible explanation is that the wetting agent and the Ca in the tap water acted synergistically. Efficient Ca penetration into leaves which were near the critical Ca level may have been enough to inhibit LEB development. A calcium concentration of 0.5% is considered to be the critical level in recently matured poinsettia leaves (Ecke and Matkin, 1976). Tap water plus wetting agent sprays increased leaf Ca concentrations to 0.48% compared with less than 0.40% in the control and medium applied $CaSO_4$. This increase in tissue Ca in the tap water treatments is in the range where a positive response could be expected. The beneficial effect of sprays with tap water containing 25-30 ppm Ca suggests that concentrations below the 500 ppm Ca used in this study, or less frequent applications, may be equally effective.

Conclusions

This research indicates that LEB is a localized Ca deficiency due to inadequate Ca uptake and/or translocation to the numerous axillary shoots simultaneously developing on poinsettia stock plants. Foliar Ca sprays are a promising method for reducing LEB. Complete spray coverage of young leaves on developing axillary shoots is critical, because Ca movement is limited and very little transport will occur from one leaf to another. Thorough coverage of the outer plant canopy will not be completely effective if shoots developing below the canopy are missed. Weekly Ca sprays of 500 ppm were effective, but lower concentrations may be adequate. Ca chelate, $CaCl_2$ and $Ca(NO_3)_2$ produced similar responses when a single application was made (unpublished data). In a commercial situation, $CaCl_2$ would be the most economical Ca source. However, $CaCl_2$ should be used cautiously because repeat $CaCl_2$ applications could result in cumulative salt damage to leaves.

Very high Ca levels in the medium using gypsum is an ineffective control measure, although maintaining Ca levels in the recommended range should still be a priority. Fertilization with NO_3-N as the sole N source limits LEB, but maximum cutting production appears to require a combination of NH_4-N and NO_3-N.

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