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Special Research Report #462: Pre- and Post-Harvest Treatments for Improved Cutting Durability and Recovery

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Note: John has a separate summary; Clemson work focused on calcium applications.

Part 1. The Use of Calcium Chloride to Improve Cutting Strength

Vegetatively-propagated unrooted cuttings are typically imported to the United States from Central America. Death or damage of cuttings during shipping and propagation can be reduced if cuttings can be made more resistant to external forces such as physical damage or pathogen infection. During the current study, mechanical strength of leaves and other physiological properties that contribute to postharvest durability and propagation success were evaluated following weekly applications of calcium chloride as a foliar spray to stock plants that delivered calcium at the rate of 0, 400 or 800 mg$\cdot L^{-1}$. Mechanical strength of leaves was assessed using a texture analyzer and the peak force to fracture the leaf and work-of-penetration, or area under the force-displacement curve, were utilized as indicators of mechanical strength. For poinsettia (*Euphorbia pulcherrima*), work of penetration increased by 10% with the application of 400 or 800 mg$\cdot L^{-1}$ Ca compared to the control (Figure 1C). Peak force was also greater than the control by 9% (Figure 1A&B). For zonal geranium (*Pelargonium × hortorum*), work of penetration increased 15% with the application of 800 mg$\cdot L^{-1}$ Ca compared to the control. Calcium content in the leaves increased from 1.2 to 2.0% in geranium and from 1.0 to 1.6% in poinsettia with increasing application from 0 to 800 mg$\cdot L^{-1}$ Ca (Figure 2). As determined by a leaf disc assay in poinsettia, disease incidence in response to inoculation with the fungus *Botrytis cinerea* was 55% and 15% less with calcium chloride applications compared to controls with water and surfactant, respectively.

Foliar calcium chloride applications to geranium and poinsettia stock plants can improve mechanical strength of cuttings and increase resistance to *Botrytis* infection.

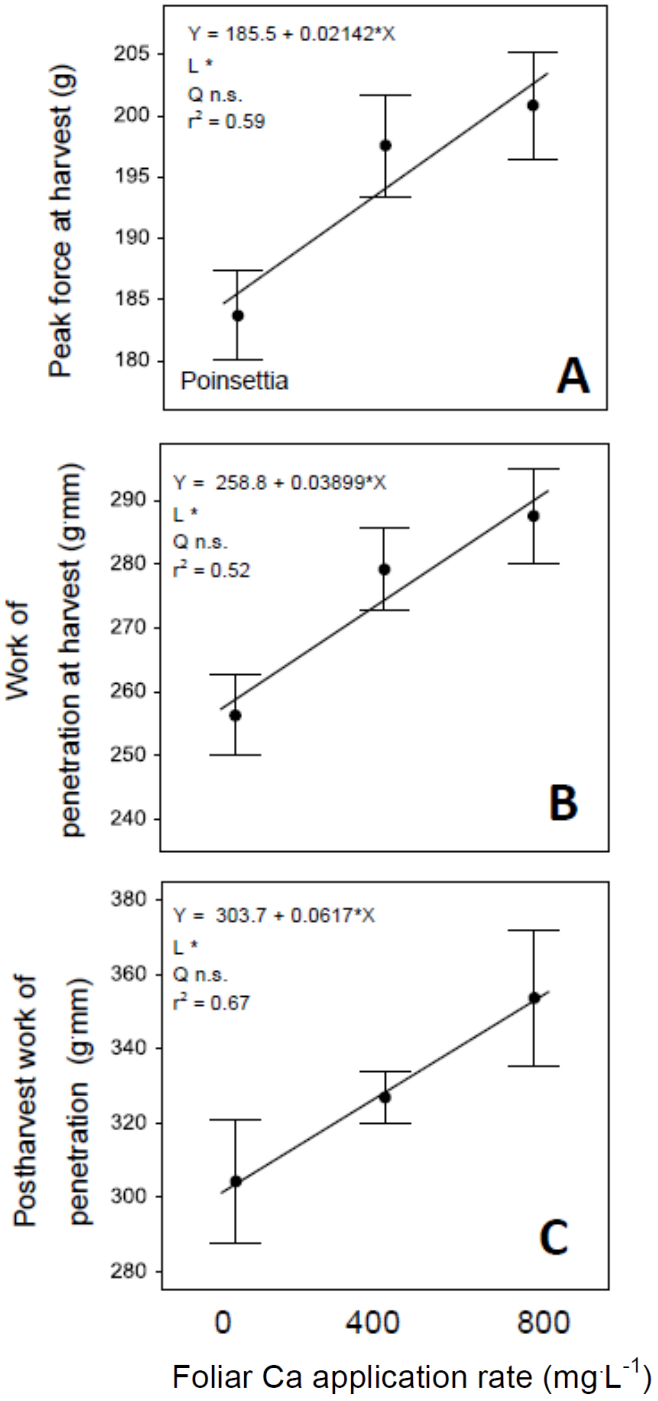

Figure 1. Leaf mechanical strength as indicated by peak force at harvest, work of penetration at harvest and work of penetration after a 3 day postharvest simulation for leaves on poinsettia. Leaves were sampled from cuttings following weekly foliar spray applications of calcium in the form of calcium chloride applied to stock plants during cutting development.

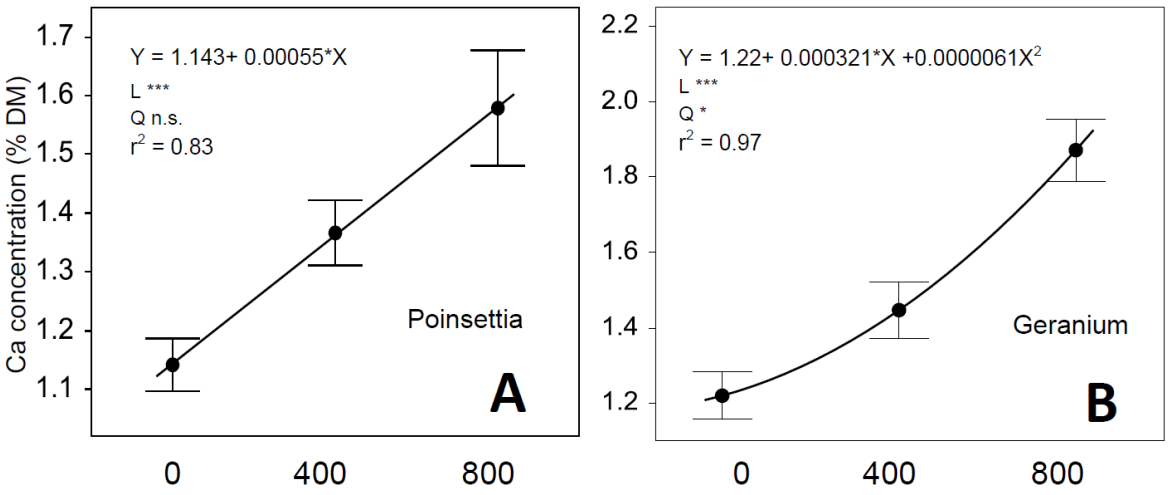

Figure 2. Concentration of calcium as a percentage of leaf dry matter (DM) measured on A. poinsettia and B. geranium leaves following weekly foliar applications of calcium in the form of calcium chloride applied to stock plants during cutting development.

Part 2. Use of Chelated Calcium to Improve Cutting Strength

The use of chelated calcium (Ca-EDTA) providing Ca at 40, 80 or 160 mg□L^{-1} and salicylic acid (SA) at 150 or 300 mg□L^{-1} were tested for the ability to increase the mechanical strength of poinsettia leaves. Calcium concentration in the leaves increased by 27% with increased application of Ca from 0 to 160 mg□L^{-1}. Peak force averaged 26% higher in treatments with Ca at 80 or 160 mg□L^{-1} compared to the untreated control. Work-of-penetration was 24% and 29% greater for treatments with Ca at 80 and 160 mg□L^{-1}, respectively, compared to the control. Foliar application of salicylic acid did not affect leaf mechanical strength. Chelated calcium applied at 160 mg□L^{-1} Ca caused

visual phytotoxicity symptoms, thus applications of 80 mg□L^{-1} Ca are recommended to improve resistance to physical damage for poinsettia leaves.

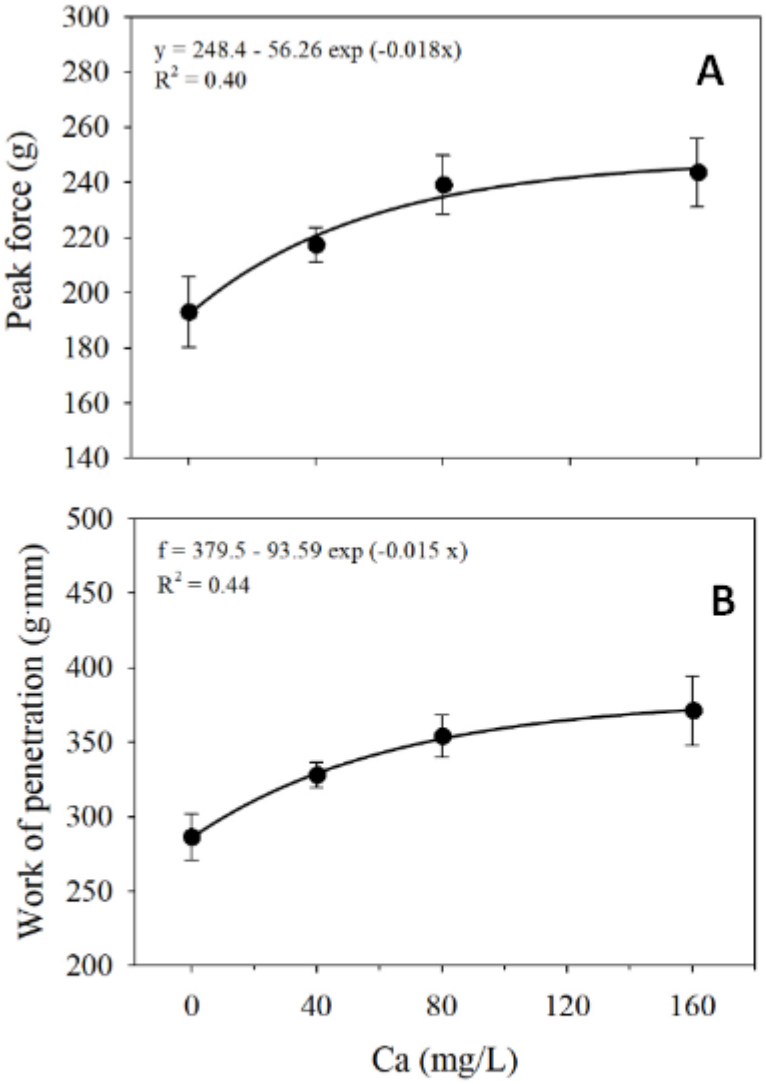

Figure 3. Leaf mechanical strength as indicated by peak force (A), and work-of-penetration (B) for poinsettia leaves. Leaves were sampled from cuttings following weekly foliar spray applications of Ca-EDTA to stock plants during cutting development.

Summary

Foliar calcium applications using calcium chloride or chelated calcium provide an effective and practical tool for improving unrooted cutting performance in the postharvest and propagation environment. Calcium improves tissue resistance to physical damage as well as to fungal (*Botrytis*) infection. Calcium target levels in leaf tissue should be approximately 1.6% to 2.2% of the dry mass of the leaf tissue.

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