

FROST DAMAGE PREVENTATION IN COLD SENSITIVE PLANTS :

INTRODUCTION:

Cellular membranes are the primary sites of freezing injury in plants. In herbaceous plants ice formation begins with the growth of an ice crystal into the internal tissue of a plant. The ice crystal may enter the plant through a stomate, broken epidermal hair, crack or wound in the plant cuticle. The crystal then acts as a nucleus for more ice formation. Furthermore, *Pseudomonas syringae* and several other bacterial species found on plant surfaces contain agents that nucleate ice at relatively warm (31- 28°F)sub-zero temperatures. This leads to freezing of water in plant tissues. Plasma membrane function and photosynthetic activity are among the first cellular activities to be damaged by freeziing (1).

Acrylic polyglycerol and polyvinyl alcohol have been shown to effectivly inhibit ice nucleation. They do this by coating the plant with an hydrophobic polymer barrier expelling water, preventing entry of ice crystals through the plant cuticle, and inhibiting ice nucleation agents produced by *Pseudomonas syringae* and other plant bacteria (2).

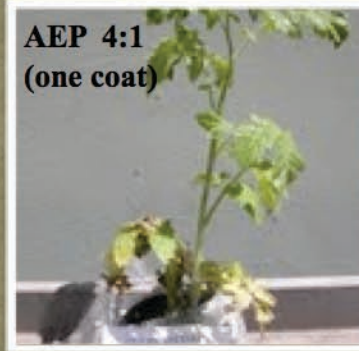
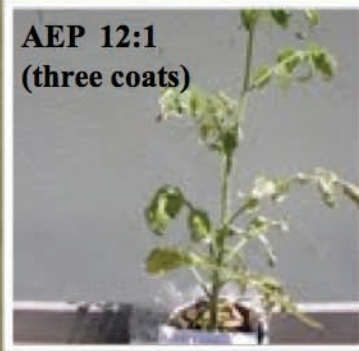
Previous studies have demonstated that Moisturin (GSI Horticultural), a product containing PGL provided significant protection from cold damage at 3.3°C/38°F, a temperature commonly used for shipping commercial plants (3). An additional study demonstrated that Moisturin and other hydrophobic polymer barriers limit plant damage at temperatures as low as -2.5°C. However, in that study plants were only exposed to freezing temperatures for 15 minutes (1). The current study is designed to evaluate frost (31°F) protection of tomato plants treated with hydrophobic "acrylic emulsion polymer" (AEP) formulated by GSI Horticulture (Well Plant) in collaboration with Zorrotech, Portland, OR.

ANALYTIC PROCEDURE:

The plants used in these tests were seven (six week) husky red cherry hybrid tomatoes. This variety originated in Mexico and is considered cold sensitive and susceptible to frost damage (4). Plants were purchased from a local nursery (Home Depot). All plants were in plastic pots containing potting soil and were in excellent condition at the beginning of the study.



**AEP 4:1 (one coat)
3 weeks post transplanting**



FROST DAMAGE PREVENTATION IN COLD SENSITIVE PLANTS :

RESULTS:

After the 7 tomato replicates reached 31°F they were examined every hour for the next five hours. Plants were upright and healthy in appearance. The plants were left overnight and examined again after 16 hours exposure. Plants still appeared healthy. Cold exposure was then terminated. The plants were moved to an adjacent walk-in refrigerator and held at 40°F for 30 minutes. At that point a dramatic change occurred. The three control plants completely wilted, collapsed and died. The sprayed plants showed some signs of wilting but were still upright and alive.They were taken outdoors, watered daily and observed.. They remain alive after 7 days. The results are summarized in Table 1.

Table 1. Tomatoes (31°F - 16hours).

Outdoor Observations = Following frost exposure plants were watered and left outdoors at ambient temperatures. Observations were made on day one and for seven days following frost exposure.

Frost Damage: 0 = no damage 1 = slight injury, partial wilt, and damage to leaf margins

2 = partial wilt, injury to leaf margins and a few leaves killed 3 = some wilted stems and a moderate number of leaves killed 4 = severe wilting only a few leaves uninjured 5 = dead plant

Acrylic Polymer Coating	16 hours exposure (31°F)
AEP 12:1 (one coat)	4 = severe wilting with only a few surviving leaves. Dead after 24 hours.
AEP 12:1 (two coats)	2 = minor wilt and leaf damage
AEP 12:1 (three coats)	2 = minor wilt and leaf damage
AEP 4:1 (one coat)	2 = minor wilt and leaf damage
AEP 4:1 (two coats)	1 = slight leaf damage
AEP 4:1 (one coat, outdoor control)	0 = no damage
Controls 1 - 3 (no AEP)	5 = all controls dead

COMMENTS:

This study is evidence that Acrylic Polymer Coating (APC) provides significant protection to young tomato plants exposed to frost conditions for 16 hours. No unsprayed control plants survived.