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Effects of Temperature on Unrooted Cutting Post-harvest Longevity

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BACKGROUND

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Unrooted cutting (URC) performance following shipping is determined by the post-harvest conditions to which the cutting is exposed. Temperature is the predominant post-harvest factor that impacts cutting performance. URC are shipped via air freight, thus post-harvest temperatures are highly variable.

The objective of this project was to determine the effect of post-harvest temperature on cutting performance of URC's. Specifically, we examined the effect of temperature on cutting respiration, ethylene production and post-harvest longevity.

MATERIALS AND METHODS

1. Respiration

Poinsettia, petunia, double impatiens and New Guinea impatiens cuttings were harvested from stock plants and placed into coolers maintained at 0, 5, 10, 15, 20 or 25C (32, 41, 50, 59, 68 or 77F). Respiration rates were measured over 3 days.

2. Ethylene production

Five poinsettia cuttings were placed into 1 gallon plastic bags, then placed at 10, 18, or 26C (50, 64 or 78F) for three days. Ethylene production was measured over three days. Half of the bags received 1-MCP (Ethylbloc) which blocks ethylene action.

3. Cutting Longevity

Poinsettia cuttings were placed in coolers at 0, 5, 10, 15, 20 or 25C (32, 41, 50, 59, 68 or 77F) for 2, 4, 6, 8, 10, 12, or 14 days, then placed in propagation and evaluated for rooting performance.

4. Identifying the storage potential of nine species.

Cuttings were harvested from stock plants and placed at 0, 5, 10, 15 or 20C (32, 41, 50, 59 or 68F) for 2, 4, 6 or 8 days and then placed into a simulated shipping environment for two days to determine the storage potential for the following ten species: *Artemisia xhybrida*, *Angelonia angustifolia*, *Crossandra infundibuliformis*, *Diascia xhybrida*, *Gaura lindheimeri*, *Ipomea batatas*, *Nemesia xhybrida*, *Solenostemon scuttelariodes* (coleus) and *Verbena xhybrida*.

RESULTS

Respiration rates are at their peak immediately following cutting harvest. As temperature increases the rate of respiration increases. In general the rate of respiration increased from 1.5 to 3-fold with every 10C (18F) increase in temperature. The respiration rate decreases continuously during the first 24 hours, regardless of temperature, before reaching a steady state level. The declining rate of respiration is a result of the reduction in carbohydrate in the tissues

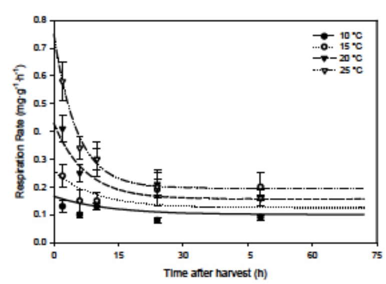

Fig. 1 Effect of temperature on respiration rate of unrooted cuttings of New Guinea impatiens over time.

Ethylene production increased as temperature increased. After 48 hrs at 26C (78F), 0.5ppm ethylene was detected in the bags. Bags treated with 1-MCP had considerably higher ethylene production, up to 2.2 ppm. Leaf yellowing and abscission was correlated with ethylene production, and 1-MCP significantly reduced leaf yellowing and abscission. Ethylene was first detectable in bags at 2 to 3 hrs after packaging when bags were at 20 to 25C (68 to 77F).

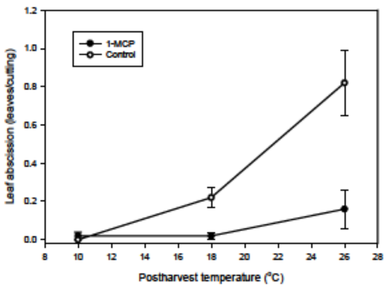

Fig. 2. Effect of post-harvest temperature and 1-MCP on leaf abscission of poinsettia unrooted cuttings in propagation.

Poinsettia longevity was greatest at 10C (50F) with 100% survival after 8 days in storage. Cutting survival was also good at 5 and 15C (41 and 59F), while survival was poor at 0, 20 and 25C (32, 68 and 77F).

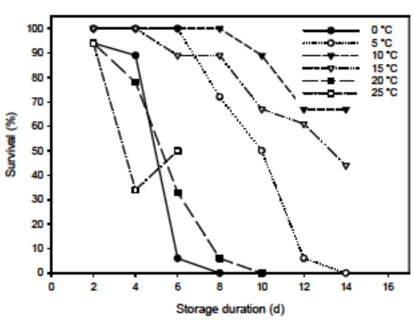

Fig. 3. Effect of post-harvest temperature and duration on poinsettia cutting survival.

Angelonia, *Crossandra* and coleus were the least cold tolerant species, e.g., they did not survive 2 days at 0C (32F). *Angelonia*, *Crossandra*, *Angelonia, Crossandra* and *Diascia* were the least heat tolerant species, e.g., they did not survive for even just two days storage at 20C (68F). While the optimal temperature varied from 5 to 15 C (41 and 59F) for each species, all species performed very well at 10C (50F). All species survived at least four days in storage at 10C (50F). *Nemesia* had an optimum temperature of 5C (41F), while coleus had an optimum temperature at 15C (59F).

Table 1. The number of days that cuttings were successfully stored at the indicated temperatures then placed into a two day simulated shipping environment and then propagated.

	Days storage				
	Temperature (°F)				
	32	41	50	59	68
Artemisia	6	6	8	8	4
Angelonia	0	8	8	8	0
Coleus	0	4	4	8	4
Crossandra	0	0	6	2	0
Diascia	4	8	8	4	0
Gaura	4	6	6	6	2
Ipomea	4	4	8	8	8
Nemesia	6	8	4	2	2
Verbena	6	8	8	8	4

CONCLUSIONS

Temperature management is the key factor that influences the success or failure of cutting survival in the post-harvest environment. If all species must be handled at just one temperature, then 10C (50F) is ideal. However, if two temperatures are available, then 5 and 10C (41 and 50F) are the best options, since some species, like geraniums, benefit from the lower temperature.

At low temperatures (<10C, 50F), chilling injury or freeze damage will reduce cutting performance of some species. The primary symptoms appear as shoot-tip death.

At high temperatures (>15C, 59F), high respiration rates quickly deplete the carbohydrate resources of the cutting while ethylene production increases. The interaction of low carbohydrate and high ethylene result in leaf chlorosis or abscission. The use of 1-MCP in the post-harvest environment can reduce leaf abscission on ethylene-sensitive species. However, some delay in rooting may result from the use of 1-MCP, so the use of rooting hormone is recommended.

IMPACT TO THE INDUSTRY

We have been working closely with URC suppliers to improve the post-harvest performance of their products. The results of this project have served to improve the methods of handling cuttings so that the U.S. floriculture industry receives a consistent supply of strong-performing products.

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