Table 3. Segregation of muskmelon crosses involving virescent (v) "P1" and halo (h) "P2".

<table>
<thead>
<tr>
<th>Generation</th>
<th>Phenotype of parent</th>
<th>Segregation</th>
<th>Expected ratio</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>v</td>
<td>h</td>
<td>All v</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>F2</td>
<td>h</td>
<td>v</td>
<td>All h</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>F1 x F2</td>
<td>h x v</td>
<td></td>
<td></td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>F3</td>
<td>Normal x v</td>
<td>Normal x h</td>
<td>1:1</td>
<td>0.05</td>
<td>0.80-0.90</td>
</tr>
<tr>
<td>F3</td>
<td>Normal x hv</td>
<td>Normal x hh</td>
<td>1:1:1:1</td>
<td>1.39</td>
<td>0.70-0.80</td>
</tr>
<tr>
<td>F3</td>
<td>Normal x hv</td>
<td>Normal x hh</td>
<td>1:1:1:1:1:1:1</td>
<td>3.34</td>
<td>0.20-0.25</td>
</tr>
<tr>
<td>F3</td>
<td>Normal x hv</td>
<td>Normal x hh</td>
<td>1:1:1:1:1:1:1</td>
<td>3.34</td>
<td>0.20-0.25</td>
</tr>
</tbody>
</table>

2The plant used in F1 x F2 backcross was one of the 580 F4 hv seedlings from F3 hhVv plants.

Literature Cited


Extending Vase Life of Carnations with Aminoacyclic Acid, Polyamines, EDU, and CCCP

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Additional index words. aminoethoxyvinylglycine, Dianthus caryophyllus, preservative solution, postharvest handling, putrescine, spermidine, spermine

Abstract. Aminoacyclic acid (AOAA) at a concentration of 0.5 mM extended the vase life of carnations (Dianthus caryophyllus L. cv. White Sim) to a degree comparable to that shown by 0.1 mM aminoethoxyvinylglycine (AVG) (71 to 94%). Increases in vase life ranging from 22 to 53% were also obtained with N-[2-(2-oxo-1-imidazolidinyl)ethyl]-N'-phenyleurea (AVG), carboxycyliamid m-chlorophenyl-hydrazone (CCCP), spermidine, putrescine, or spermine. Combinations of AVG and EDU or AOAA and EDU further extended the vase life 134 to 140% over that of the control flowers. These increases were additive to the beneficial effects obtained from the control preservative solution, which contained 2% sucrose and 200 ppm 8-hydroxyquinoline citrate.

AVG has been demonstrated to be very effective in extending the vase life of carnations (5), snapdragons (12), and irises, daffodils, and chrysanthemums (11). It was shown that AVG increases the longevity of cut flowers by inhibiting ethylene production (5, 10, 12).

Recently, in an in vitro study, Yu et al. (13) reported that AOAA was as potent as AVG in inhibiting 1-amino- cyclopropanecarboxylate (ACC) synthesis, a key enzyme in ethylene biosynthesis. Since AOAA is readily available and relatively inexpensive, we decided to compare its ability to improve the keeping quality of cut flowers with that of AVG. Several polyamines and an anti-ozone protectant, EDU, were also included in this study because of their anti-senescence properties (2, 6-9).

Carnations grown in Colombia were obtained from a wholesale nursery. Uniform flowers were cut to 30 cm and placed in 1-litter glass jars containing 500 ml of solution. Test chemicals included 0.1, 0.5, and 1 mM of AVG, AOAA, spermidine, putrescine, or spermine; 0.05 and 0.1 mM or CCCP; and 0.4, 1, and 2 mM of EDU. In the second experiment, combinations of AVG (0.1 mM) and EDU (1 mM) or AOAA (0.5 mM) and EDU (1 mM) were used. The solutions were made up with deionized water. Each test chemical was added to the preservative solution containing 2% sucrose, 200 ppm 8-hydroxyquinoline citrate, and 0.02 M citric acid buffer adjusted to pH 4.6 with KOH. The jars containing preservative solutions and flowers were placed randomly in a room maintained at 20°C, 50 to 60% relative humidity and under continuous 1.1 klx cool-white fluorescent light. Five flowers were placed in each jar, and the vase life was evaluated individually. Two replicates were used for each treatment.

Among treatments in which only a single test chemical was added to the preservative solution, AVG and AOAA were superior to other chemicals tested (Table 1 and Fig. 1). AVG at concentrations of 0.1 to 1 mM increased the vase life of carnations 71 to 91% over that of the control flowers (Tables 1 and 2). At 0.1 mM, AOAA was not as effective as AVG. However, at a concentration of 0.5 mM, AOAA appeared to be comparable in effect to 0.1 mM AVG. When compared to the flowers held in deionized water alone, the flowers in these treatments lasted 3 to 3.5 times longer. Significant but smaller increases in vase life were obtained with spermidine, putrescine, spermine, or CCCP. These increases ranged from 22 to 32%. EDU at the concentration of 1 mM increased vase life 53% of that of the control flowers. At higher concentration, EDU was not as effective, possibly because of a toxic effect on stem tissue. Combinations of AVG and EDU or AOAA and EDU further extended the vase life 134 to 140% over that of the
control flowers (Table 2).

AVG and AOAA have been shown to be strong inhibitors of ACC synthase (13). AVG was found to inhibit ethylene production by blocking the conversion of S-adenosylmethionine to ACC, which is the immediate precursor of ethylene (1). AOAA was also shown to inhibit ethylene production of etiolated mung bean hypocotyls (4) and suppress epinastic growth of tomato leaf petioles (3). The additive effect obtained from EDU when it was added to the solution of AVG or AOAA indicates that AVG might delay senescence of carnations through mechanisms other than inhibition of ethylene biosynthesis. It is possible that EDU extended the vase life of carnations by sustaining RNA and protein levels in the tissues, as proposed by Lee et al. (9). The vase life of carnations in solutions containing AVG or AOAA and EDU was four times that of the flowers in deionized water.

Our data indicate that AOAA is as effective as AVG in extending vase life of carnations although the concentra-

tion of AOAA must be higher than that of AVG. The prospects of using AVG or AOAA to improve the keeping quality of cut flowers appear even more promising if EDU is combined with these chemicals in the vase solution.

### Literature Cited


