The effects of benzyladenine as a preservative on the stem bending of gerbera cut flowers

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ABSTRACT: The current study was conducted to evaluate the efficiency of individual application of BA, without the presence of antimicrobial agents, on the postharvest life of gerbera cut flowers. The gerbera cut flowers were treated by the four different concentrations of benzyladenine (0, 50, 100 and 150 mg l\(^{-1}\)). Results revealed that the solution uptake levels in the all treatment groups decreased with in length of time, however, the reduction rates were decreased by the application of the BA and the fewest used concentration was more effective than others as it was indicated by the best results observed in BA50 group. The application of different concentrations of BA in this research work could improved the rates of stem bending where the best results observed in BA50 group. Results of the present research indicated that the individual application of BA, especially low concentrations in pulse method, have potential to induce desirable changes, thereby promoting the longevity of gerbera cut flowers.

Keywords: Cut flower; Cytokinin; Postharvest; Solution uptake; Stem bending

Abbreviation: BA- benzyladenine

INTRODUCTION

There are more concerns in the modern horticulture to obtain economical effective preservatives to extend the longevity of cut flowers. The implication of plant growth regulators in the control of the senescence process is well documented. According to the latest evidences, it is obvious that the postharvest life of cut flowers could be influenced by the different chemicals (Prashanth et al., 2010; Danaee et al., 2011; Oraghi Ardebili et al., 2013). In order to extend the longevity of cut flowers, the application of various chemicals such as salicylic acid (SA), cytokinin and gibberellic acid (GA) as preservatives in the vase solution have been recommended by the many researchers (Emongor, 2004; Singh et al., 2008; Danaee et al., 2011; Mohammadi et al., 2013; Oraghi Ardebili et al., 2013). As cytokinin, a phytohormone, involves in the critical process like cell division, tissue metabolism and senescence (Riefler et al., 2006; Choi et al., 2011), its exogenously application may lead to the considerable results in horticultural activities. In addition, depend on plant species, the applied preservatives and various concentrations, the observed reactions in the various researches are different. Thus, the determination of suitable preservatives and concentrations to promote the vase life of cut flower is of importance for modern industries related to the ornamental plants. Benzyladenine (BA), a synthetic cytokinine, as a preservative in the vase solution has been used in combination with an antiseptic compound like 8- hydroxyquinoline sulphate, however, there is not enough study on its individual applications. Gerbera belongs to Asteraceae family and is known as a worldwide important ornamental plant. As the stem bending, a sudden bending of the stem, is known as the main factor for evaluating postharvest quality of cut gerbera flowers and a practical problem affecting its sale, the screening of gerbera cut flowers mainly based on the mentioned parameter is of importance (Nazari Deljou et al., 2011). The aim of current study was to evaluated efficiency of individual application of BA, without the presence of antimicrobial agents, on the stem bending parameter during the postharvest life of gerbera cut flowers.
MATERIAL AND METHODS

The gerbera cut flowers, Gerbera jamesonii Dune, were purchased from the local growers (Banaian greenhouse, Pakdasht, Tehran). The experiments were performed based on completely randomized design in a postharvest room (22 ± 1 °C, 60 ± 5% relative humidity, and 12h photoperiods). The cut flowers were recut, weighed, placed in containers and grouped into 5 different treatment groups including control samples in distilled water (CW), pulse treated in 8% sucrose (CS), benzyladenine of 50 mg l⁻¹ (BA50), benzyladenine of 100 mg l⁻¹ (BA100) and benzyladenine of 150 mg l⁻¹ (BA150) with three replications and five flowers per each replication. The gerbera cut flowers were treated in pulse way (24 h) by the 4 different solutions of benzyladenine (0, 50, 100 and 150 mg l⁻¹) containing 8% sucrose and then transferred to the distilled water. The solution uptake rates were estimated by measuring the vase solution remaining and recorded as ml. Stem bending in gerbera was determined during the experimental times by measuring the angle of the scape by protractor and measurements were expressed in degrees.

Statistical procedure

The analysis of variance was performed on the obtained data using SPSS software. The mean separation was done based Duncan's multiple range test at P < 0.05.

RESULTS AND DISCUSSION

The solution uptake levels in the all treatment groups decreased in length of time, however, the reduction rates were declined by the application of the BA and the fewest used concentration was more effective than others as it was indicated by the best results observed in BA50 (Table 1). It is well documented that the microbial contamination is the most limiting factor in the postharvest life of cut flowers (Kazemi et al., 2011). The microbial contamination and/or air emboli during the postharvest life of cut flowers results in the stem blockage and the restricted solution uptake. Therefore, acidic solutions (unsuitable media for the growth of bacteria) are usually have favorable effects for the most cut flowers. The longevity of Acacia cut flowers were promoted by the application of a germicide and acidic pH of the vase solution (Horlock et al., 2000). However, the application of BA in the vase solution led to the increased pH (the suitable condition for bacterial growth). It seems that low concentrations of BA, in pulse way, is more effective than the high levels most probably due to the higher pH.

As it was shown in table 2, the application of different concentrations of BA had effects on the rates of stem bending where the best results observed in BA50 group. It is probable that the higher solution uptake rates and BA induced metabolic changes were responsible for the decreased stem bending and inhibited premature senescence observed in BA treated samples. The stem bending caused by a premature senescence is often introduced as the most limiting factor of cut gerbera longevity (Prashanth et al., 2010). It is stated that the stem biochemical status is directly implicated in the process of stem bending (Ferrante and Serra 2009; Prashanth et al., 2010). The senescence of cut flowers is controlled by hormones (Singh et al., 2008). It seems that cytokinin may induce special physiological responses and alter the source–sink metabolism via sink formation. The involvement of cytokinin in process such as influencing nutrient mobilization, forming sink tissues and inhibiting senescence have been well documented (Riefler et al., 2006; Choi et al., 2011). Postproduction longevity of Tulipa gesneriana ‘Seadov’ were improved by preharvest treatment, regardless developmental stage, with GA₄+7 plus BA where the second one was the main active ingredient in the mixture (Kim and Miller, 2008).

In conclusion, the individual application of BA, especially low concentrations in pulse method, has potential to induce desirable changes thereby promoting the longevity of gerbera cut flowers.

ACKNOWLEDGEMENTS

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Table 1. The effects of different concentrations of BA as a preservative on the solution uptake of gerbera cut flowers during the postharvest days.

<table>
<thead>
<tr>
<th>Days treatments</th>
<th>1</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW</td>
<td>51.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>46.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36.00&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>CSW</td>
<td>57.33&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>48.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>37.33&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA50</td>
<td>63.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>56.33&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>51.33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA100</td>
<td>63.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>53.33&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>48.33&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA150</td>
<td>62.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52.67&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>48.00&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*Mean values followed by different letters are significantly different at P < 0.05 according to Duncan’s multiple range test.

Table 2. The effects of different concentrations of BA as a preservative on the stem bending of gerbera cut flowers during the postharvest days.

<table>
<thead>
<tr>
<th>Days treatments</th>
<th>0</th>
<th>1</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW</td>
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<td>22.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>CSW</td>
<td>30.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>28.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>52&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA50</td>
<td>30.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.7&lt;sup&gt;c&lt;/sup&gt;</td>
<td>15.0&lt;sup&gt;c&lt;/sup&gt;</td>
<td>18.9&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA100</td>
<td>30.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>18.9&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>22.8&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BA150</td>
<td>30.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>18.9&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>24.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*Mean values followed by different letters are significantly different at P < 0.05 according to Duncan’s multiple range test.

REFERENCES

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