Response of *Freesia hybrida* Corms to Exogenous Growth Regulator Applications

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Abstract. Vacuum infusion or soaking of freshly harvested *Freesia hybrida* Bailey ‘Moya’ corms in solutions of ethephon, gibberellic acid (GA₃), abscisic acid (ABA), benzylamino purine (BA) or indole-acetic acid (IAA), or in solutions with combinations of these growth regulators, did not decrease the time required for shoot emergence. Ethephon delayed shoot emergence and acted synergistically when combined with GA₃, or with GA₃ and BA, to further delay shoot emergence. Ethephon or ethphon + BA treatments increased the number of shoots produced per corm. Days to flower and flower quality were not influenced by any of the exogenous growth regulator treatments. Presently, there appears to be little horticultural advantage in applying these growth regulators to freesia corms to hasten shoot emergence prior to planting in order to circumvent the need for 10 to 13 week storage treatment at 28°C to remove dormancy and to ensure rapid shoot emergence.

of Minnesota, St. Paul, on July 25, 1978 and stored at 21° ± 2°.

The papery tunics were removed from the corms 3 hr before exogenous growth regulator treatments were initiated on August 1, 1978. The two methods of growth regulator applications were: 1) soaking corms at 21°C ± 2° for 24 hr in respective treatment solutions or 2) by vacuum infusion at 70 mmHg at 21° ± 2° for 30 min followed by a 30 min soaking at normal atmospheric pressures.

A volume of 100 ml of fresh growth regulator solution was used for each replication of the respective treatment solutions (Table 1) in the soak or vacuum infusion chamber. With the exception of ethephon, which is an aqueous solution, all growth regulators were dissolved in 1.5 ml of ethanol prior to their addition to distilled water. Growth regulator treatments were replicated 3 times in both of the application methods with 8 corms treated in each replication.

After the respective soak or vacuum infusion treatments, corms were removed from the solution, air dried for 12 hr at 21°C ± 2° temperature and planted in 51 x 36 x 23 cm wooden flats with a 3 soil:2 sand:2 spagnum peat moss (by volume) mixture and grown in a shaded glass greenhouse. No super or treble superphosphate was used in the medium to eliminate fluoride contaminates and foliar injury (4). Soil temperatures during the shoot emergence period were maintained at 20-22°. A benomyl fungicidal drench was applied at planting and again in 2 weeks. After sprouting, plants were fertilized as needed according to results of weekly soil tests. After emergence, greenhouse temperatures were maintained at 18-22° until 7 visible leaves were present. The greenhouse temperature was then lowered to a constant 13° for floral initiation and development. The number of days from planting to sprouting, the number of shoots per corm and the days to flower were recorded.

The rate of emergence, number of shoots per corm or date of flowering did not differ between the 2 application methods. Therefore, the data were combined for further analysis. However, the exogenous growth regulator treatments affected the number of days to emergence and the number of shoots were sprouted per corm (Table 1). There were no differences in number of flowers between treatments (data not shown). Ethephon alone significantly delayed sprouting. In addition, ethephon appeared to act synergistically with GA₃ or GA₃ + BA as spraying was further delayed by 18.5 and 15.5 days respectively when compared with the control. Normally, only the most apical bud on the corm sprouts, the laterals are apparently under apical dominance. The ethephon or ethephon + BA treatments altered this sprouting pattern by producing an average of 1.5 or 1.7 shoots per corm respectively when compared to 1.1 shoots per corm for the control. There were no significant treatment differences in days to flower. Time of flowering peaked 210 days after planting.

Vacuum infusion or soaking of freshly dug corms in solutions of ethephon, GA₃, ABA, BA, or IAA or in solutions with combinations of these growth regulators, did not decrease the time required for corm sprouting. Other treatment time lengths, treatment concentrations or other gibberellins (GA) or other cytokinins might alter these responses.

Rudnicki (11) stated that GAs are the most favored hormones in respect to the investigation of bulb dormancy. Shoot emergence and more rapid flowering has been induced in dormant bulbs of Lilium speciosum with GA₄₋₇ treatments, alone or in combination with BA. However, GA₃, alone or in combination with BA, had no effect (10). Lin and Wilkins (7) found that dormancy of non-cooled Vitis vinifera was broken with GA₃, ABA partially negated the vernalization effect and GA or ABA had little effect on date of anthesis when these growth regulators were applied as a bulb soak or infusion treatment. Denny (2) found that more rapid flowering of gladiolus corms by ethylene chlorhydrin treatments depended upon cultivar and stage of dormancy. Time of application may influence response. In tulip, application of GA₃ shortened the time from planting to flowering most effectively if the cold requirement was partly satisfied by 6 weeks at 5° (14). Applying exogenous growth regulators to freesia corms after corms are given half of the heat treatment may be more effective. However, unlike the tulip, freesias do not initiate flowers until after shoot emergence and temperature is lowered to 13°.

Unlike previous reports with freesia (9, 13, 17), exogenous applications of BA did not hasten emergence or increase time of flowering. Time of flowering peaked 210 days after planting. Treatment means are combined data for soaked and vacuum infused treatments. Denny (2) published) when ABA was vacuum infused into the tissue. However, ABA did not inhibit sprouting of freesia corms. Exogenous ABA applications failed to inhibit growth of nonresting Vitis buds (3). Milborrow (8) and Wareing and Saunders (16) cite several examples in which ABA or inhibitor levels were not correlated with bud dormancy. Continuous supplying of ABA solutions were needed to inhibit growth in some plant species (8, 16). The ratio or balance of inhibitors and promoters, particularly ABA and GAs or cytokinins, were suggested to be important in the control of dormancy (6, 8, 16). Endogenous GA or cytokinin levels could have counteracted the effects of exogenously applied ABA to the freesia corms. From the present data we could not determine a) whether ABA played a primary role in sprouting; b) if exogenous ABA was metabolized, or, c) if exogenous ABA was rendered inactive due to chemical changes or antagonisms.

Ethylene treatment did not hasten growth of dahlia tuberous roots but it did stimulate the development of a greater number of buds on each rhizome cutting of cannna (12) and increased the number of sprouts per corm in gladiolus (2). Corms treated with ethephon produced more shoots per corm but the number of days required for sprouting increased. Unlike freesias, treating gladiolus corms with ethylene reduced the dormant time period by half and overall growth was advanced by 25 to 30 days. Freesias, however, require a different temperature regime to break dormancy. This may ac-

### Table 1. Mean number of shoots per corm, days to sprout and days to flower in Freesia hybrida ‘Moya’ corms after soaking or vacuum infusion treatment with various exogenous growth regulators.

<table>
<thead>
<tr>
<th>Growth regulator(s)</th>
<th>Conc(mg)</th>
<th>No. days to sprout</th>
<th>No. of shoots/corm</th>
<th>Days to flower</th>
</tr>
</thead>
<tbody>
<tr>
<td>No soak control</td>
<td></td>
<td>38.0abc</td>
<td>1.2a</td>
<td>198a</td>
</tr>
<tr>
<td>1.5% EtOH soak control</td>
<td></td>
<td>34.5ab</td>
<td>1.1a</td>
<td>199a</td>
</tr>
<tr>
<td>Ethephon</td>
<td>2500</td>
<td>44.5d</td>
<td>1.1b</td>
<td>201a</td>
</tr>
<tr>
<td>GA₃</td>
<td>500</td>
<td>40.5cd</td>
<td>1.1a</td>
<td>196a</td>
</tr>
<tr>
<td>ABA</td>
<td>200</td>
<td>37.5abc</td>
<td>1.0a</td>
<td>198a</td>
</tr>
<tr>
<td>BA</td>
<td>100</td>
<td>33.5a</td>
<td>1.1a</td>
<td>201a</td>
</tr>
<tr>
<td>IAA</td>
<td>200</td>
<td>36.0abc</td>
<td>1.1a</td>
<td>198a</td>
</tr>
<tr>
<td>Ethephon + GA₃</td>
<td>2500</td>
<td>56.5e</td>
<td>1.0a</td>
<td>199a</td>
</tr>
<tr>
<td>Ethephon + BA</td>
<td>100</td>
<td>40.5cd</td>
<td>1.0a</td>
<td>195a</td>
</tr>
<tr>
<td>Ethephon + Etrel</td>
<td>2500</td>
<td>56.5e</td>
<td>1.0a</td>
<td>200a</td>
</tr>
<tr>
<td>Ethephon + GA₃ + BA</td>
<td>2500</td>
<td>53.5e</td>
<td>1.0a</td>
<td>200a</td>
</tr>
<tr>
<td>Ethephon + BA</td>
<td>100</td>
<td>53.5e</td>
<td>1.0a</td>
<td>200a</td>
</tr>
</tbody>
</table>

*All applied in 100 ml solution after being dissolved in 1.5 ml EtOH except for ethephon which was applied as Ethrel.

*Treatment means are combined data for soaked and vacuum infused treatments.
count for the differences in responses to ethylene between freesia and gladiolus. Van Staden et al. (15) found that breaking seed dormancy of Spergula arvensis with light and ethylene was accompanied by increases in levels of endogenous cytokinin, especially in cytokininribotides, prior to germination. Pretreatment of seed with cytokinins did not, however, substitute for the light or ethylene requirements. Light and ethylene were also reported to elicit changes in levels of gibberellin-like compounds, however; while GA did promote germination of scarified seed in S. arvensis. It is not known whether the ethephon treatment on freesia seed involved an interaction between ethephon and cytokinins and/or GAs.

Future research focusing on endogenous hormonal balance may provide further insights as to the regulation of sprouting in freesia and help reduce the time required for shoot emergence.

Literature Cited


CULTIVAR & GERMPLASM RELEASES


‘Sunland’ Peach

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‘Sunland’ peach [Prunus persica (L.) Batsch] has been released to provide a cultivar well-adapted to the southeastern United States that ripens slightly later than ‘Harvester’. ‘Sunland’ is similar to ‘Harvester’ in color and firmness, but has larger fruit.

Origin

‘Sunland’ resulted from a 1964 cross of FV323-12 (Southland × Sunhigh) OP × FV9-6345 (Dixiland × Keystone). The seedling was selected by V.E. Prince at Byron, Georgia, in 1966. It has since been tested as FV4-7140 at experiment stations in Alabama, Georgia, Louisiana and Texas, and with grower cooperators in Alabama and Georgia.

Description

‘Sunland’ trees are vigorous and productive. The foliage and fruit are moderately susceptible to bacterial spot incited by Xanthomonas pruni (E.F. Sm.) Dows., similar to ‘Redglobe’. Trees at Byron have been indexed and found to be free of Prunus ringspot virus. Leaf gland type is globose. The chilling requirement to break the leaf bud rest period is about 750 hours below 7.2°C. The self-fertile blossoms have small (non-showy) petals. Fruits (Fig. 1) are large, 5-6.5 cm diameter, and round with a slight tip. The lightly pubescent surface is 75% bright red at maturity, with an attractive yellow undercolor. The yellow flesh is firm but melting, with some red in the freestone pit cavity. Flesh texture is medium and flavor is good. ‘Sunland’ fruit mature with ‘Keystone’ in late June at Byron, 3-5 days after ‘Harvester’ and 20 days before ‘Elberta’.

Availability

‘Sunland’ is recommended for trial wherever ‘Harvester’ is grown. Limited amounts of budwood are available from W.R. Okie.

Fig. 1. Mature fruit of ‘Sunland’ peach.