



## Using gibberellic acid sprays on navel oranges

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The use of gibberellic acid (GA) is one of the most effective management tools available to citrus growers to improve rind quality and delay rind aging. Appropriate use of GA can result in better packouts and market outturns.

Applying GA can be a costly exercise in terms of time and money, so it needs to be done right. This Primefact outlines how to get the most out of your GA sprays by providing information to help you decide when and how to apply GA to navel oranges.

### What is GA?

GA is a naturally-occurring plant growth hormone found in most plant tissues. It is involved in physiological processes such as flowering, seed set and fruit development, and is used in selected horticultural crops to manipulate flowering and fruit development.

The application of GA to navel oranges can delay fruit colour development, improve rind firmness and fruit quality at harvest, improve packouts, extend shelf-life, and market outturns. The effects of GA are dependent on both the timing of application and the concentration of GA applied.

### Why use GA on navel oranges?

GA can be applied to navel oranges to:

- improve rind firmness and quality at harvest, for increased packouts and market outturns
- reduce albedo breakdown (creasing)
- reduce postharvest rind breakdown and extend postharvest shelf-life
- slow down rind colour development and delay harvesting.

Depending on which effect is sought, separate GA applications and timings are required. Only use GA formulations registered to delay rind ageing and reduce creasing. Correct timing of sprays and good spray coverage of fruit are critical to achieving a successful outcome. It is also important to keep good records of application time, harvest dates, packouts and market outturn performance to build up a picture of how GA can best be used on your trees to achieve the desired results.



Figure 1. A summer GA spray increases rind firmness, resulting in improved fruit quality at market destinations.





Figure 2. A summer application of GA will reduce the incidence of albedo breakdown (left) and postharvest rind disorders (right).

### Application timings

#### Summer GA: to improve rind quality and market outturn

A GA spray applied when the majority of the fruit are 30–50 mm in size in summer (January in southern Australian growing regions) is recommended for navel oranges (especially for export markets) to reduce the incidence of rind disorders such as:

- albedo breakdown (creasing)
- water spot
- postharvest rind breakdown.

GA applied at this time increases rind firmness, improves fruit quality and extends postharvest

shelf-life by reducing fruit susceptibility to moulds. It improves the overall quality of fresh fruit, increasing packouts and market outturns. A GA spray applied before mid-February has minimal effect on rind colour. Research has shown that the summer GA spray can also enhance the effectiveness of the autumn GA spray on rind condition of late-harvested fruit. The positive effects that a summer GA spray has on rind quality can be seen in Figure 3.

There are two application rates of GA registered for use on navel oranges in summer.

**Use a rate of 10 ppm** (2.5 g of the 400 g/kg product or 10 mL of the 100 g/L product) for **all** navel selections if:

- albedo breakdown is not a major problem, and/or

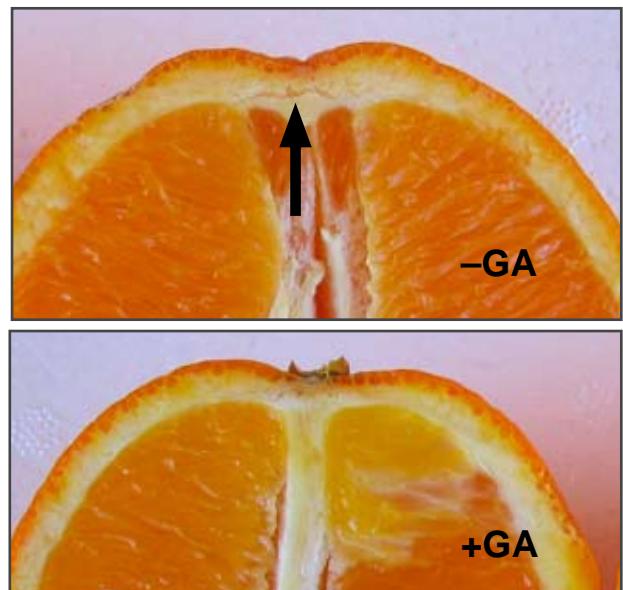
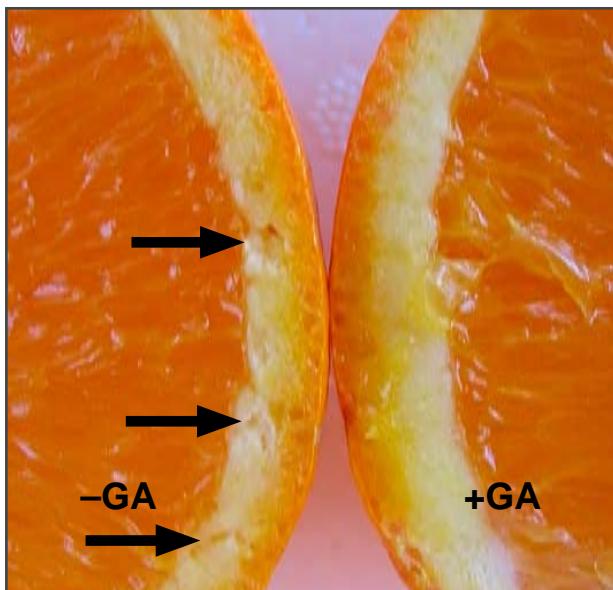


Figure 3. Comparison of untreated (−GA) and GA-treated (+GA) navel orange fruit. The arrows indicate cracks in the albedo tissue of untreated fruit, even though the fruit had no obvious visual symptoms of albedo breakdown.

- fruit will be harvested for early markets.

**Use a rate of 20 ppm (5 g of the 400 g/kg or 20 mL of the 100 g/L product) only if:**

- there is a history of severe albedo breakdown and
- it is an early navel selection.

**Do not use the higher rate on late navel selections as fruit may not fully colour.**

**Summer GA sprays will not affect rind colour at harvest if applied when the majority of fruit are between 30 mm and 50 mm in size.**

#### Autumn GA: to delay rind colour development

A 10 ppm GA spray applied in autumn will delay rind colour development and can be used to strategically extend the harvest period. However, the timing of the autumn application can significantly affect the length of time fruit take to reach full colour. Autumn GA sprays do not affect internal fruit maturity.

#### Timing of autumn sprays

The timing of autumn GA sprays is not an exact science. The delay in fruit colour development can vary with the navel selection as well as district and seasonal conditions. It is recommended to trial the

autumn GA spray on a small section of the navel block to be treated to see the effects on colour development. Keep accurate records of application time, harvest dates, packouts and market outturn performance. Good records will allow you to build up a picture of how GA can be used on your orchard to achieve the desired results.

Experiments conducted in 2004 on Washington navel orange trees in the Sunraysia and Riverland regions of southern Australia gave an indication of the delay in colour development from different timings of 10 ppm autumn GA sprays. Figure 4 shows that the earlier the GA is applied in autumn, the greater the delay in rind colour development. Application in mid-April delayed colour development by around 25 days, compared to untreated fruit, and an application in mid-May delayed colour development by around 10 days.

#### Autumn GA sprays delay rind colour development.

#### Autumn application recommendations

- Only one application of 10 ppm GA should be applied during autumn. Higher rates will cause uneven colouration and/or excessive delays in colour development.
- Care should be taken when applying early autumn GA sprays in blocks with high nitrogen and potassium levels, as this may further delay colour development.

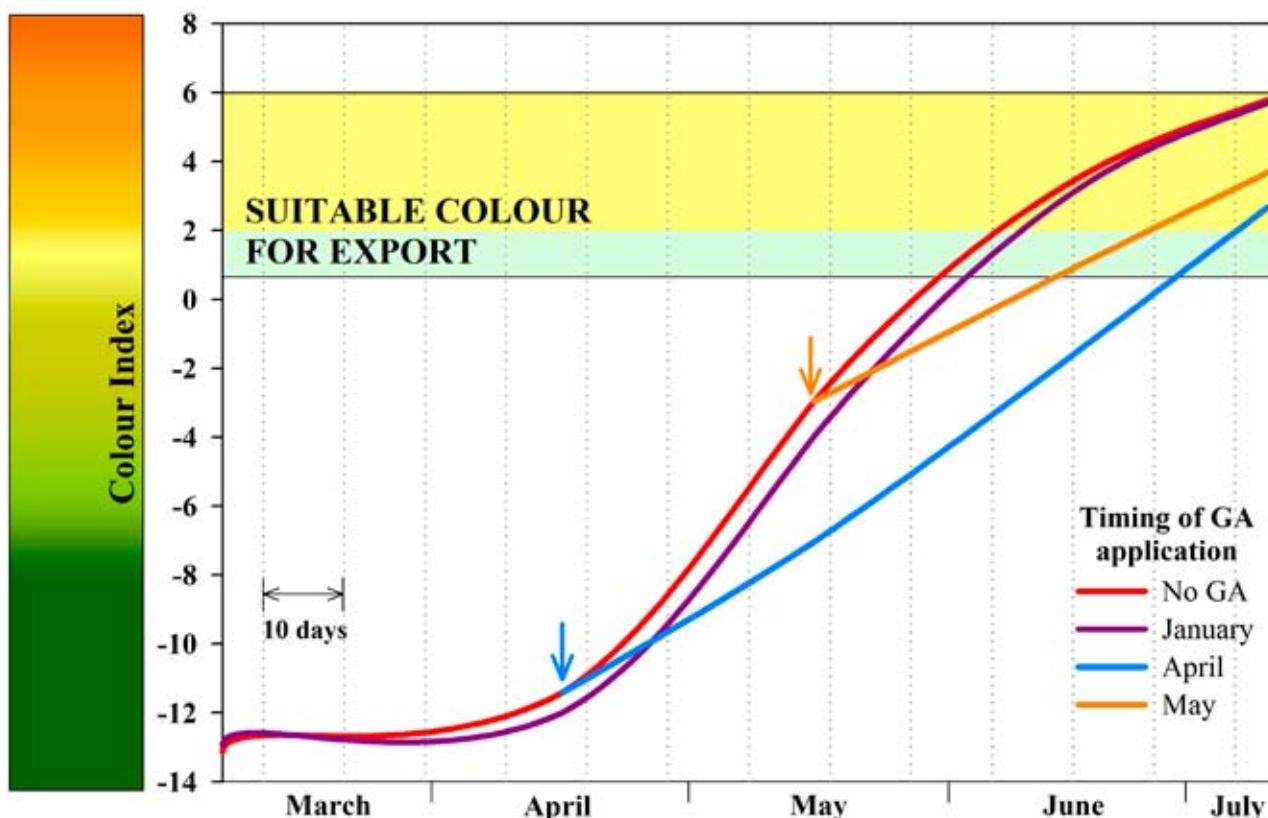


Figure 4. Rind colour development of Washington navel orange fruit sprayed with 10 ppm GA at different times. Arrows indicate when autumn GA sprays were applied. Fruit in the green section of the 'suitable colour for export' may require ethylene degreening.

NB For correct interpretation of the information presented in this Figure it must be printed in colour.

- The earlier that GA sprays are applied during autumn, the longer fruit will take to reach full colour and the more likely that fruit will have uneven colouration.
  - Fruit treated with GA during autumn may also be more prone to developing oleocellosis. Oleocellosis (oleo) is damage to the rind of citrus fruit caused by the release of oil from damaged glands within the rind. Fruit treated with GA in autumn need to be picked and handled carefully.
- Do not apply GA in hot conditions when air temperatures are above 35°C.
- Do not use GA on water-stressed or waterlogged trees. Trees should be adequately watered before and after a GA application.
- Do not apply GA for 3 – 4 weeks after a copper or oil spray. Some copper formulations can react with GA and oil restricts GA uptake.
- Do not use GA on unhealthy trees.
- Do not apply GA to trees carrying badly blemished fruit – GA helps protect the rind but cannot remove blemish.

### Best practice tips for applying GA sprays

- Ensure thorough spray coverage of the fruit surface – GA will only work where the spray makes contact with the rind. Well pruned trees allow better spray penetration into the canopy.
- Recommended water application rates are 5000 L/ha for small trees, 7500 L/ha for medium-sized trees and 10 000 L/ha for large trees.
- The pH of the water used for spraying should be between 4 and 6. Best results in summer are obtained at pH 4 – 4.5. For autumn sprays raise the pH to 5 – 5.5. Test the pH of the water before adding GA to the tank. Add an acidifying agent to reduce pH if the water is too alkaline.
- Always add a spreader. Do not add additional spreader if you used an acidifying agent which normally contains a spreader.
- Always calibrate your sprayer to ensure good fruit coverage.
- GA should be applied on its own. However if fruit drop is a problem, GA can be mixed with stop-drop sprays containing 2,4-D sodium salt.
- Avoid spraying in slow drying conditions, such as late in the day or in overcast or showery conditions. In winter spray in the morning after dew has evaporated. Do not apply if rain is forecast within 6 hours of application.

### Resources for growers

As part of the industry funded Horticulture Australia project CT 01029 ‘Communicating the effects of production conditions on outturn quality’, a Navel Rind Colour Development poster was developed to help growers identify the correct fruit colour stage for applying GA (Figure 6). The poster depicts fifteen ‘true colour’ images of fruit at different development stages. It also outlines the correct fruit development stage for other key management practices, such as degreening and harvesting.

Additionally, the Orange Rind Colour Development Field Guide was developed for citrus growers to use in the orchard (Figure 7). This pocket guide contains 14 flip cards depicting nine key fruit development stages. It also includes a degreening card that can be used to quickly identify the correct colour stage for degreening fruit.

Both the poster and pocket guide should be available from your local citrus advisory officer or industry organisation. For copies you can also contact Steven Falivene at the NSW DPI Daretton office on (03) 5019 8405.



Figure 5. The effect of an autumn GA spray on colour development in Bellamy navel oranges, photographed in late May.

## More information

Harvesting guidelines for citrus are available from the Australian Citrus Growers' website at: [www.australiancitrusgrowers.com.au](http://www.australiancitrusgrowers.com.au)

Bevington K, Zeng L, Falivene S, Lindhout K, Treeby M & Storey R 2007, Final report CT 01029 *Communicating the effects of production conditions on outturn quality*, Horticulture Australia Limited.

## Navel Rind Colour Development



Figure 6. The rind colour poster is a pictorial guide to the colour development stages of navel orange fruit. The poster helps you identify the correct colour stage for key management tasks such as GA application, degreening and harvest.



Figure 7. The rind colour field guide can be used in the orchard to help identify colour development stages of navel oranges. It also includes a degreening card which can be held up against fruit to identify the ideal colour stage for degreening.

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