



Improving citrus fruit quality using Gibberellic Acid (GA)

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Background

Gibberellic Acid (GA) is a naturally occurring hormone or growth-regulating chemical that is found to varying degrees in all parts of a plant. The highest concentration occurs in the immature seed and is what stimulates fruit to grow. GA stimulates both cell division and cell elongation. Manufactured GA is a product that has been available for many years and there are several products available. GA is highly effective when applied at the right time and at the right concentration. GA can be used to alter the growth pattern of plants considerably.

Why do we use GA on citrus?

GA is used to reduce the incidence and/or severity of some physiological disorders, that is disorders that occur due to environmental conditions not disease.

There are four key reasons for using GA on citrus:

1. Albedo breakdown (sometimes known as creasing) in Navel and Valencia oranges and grapefruit. Albedo breakdown is the separation of the mesocarp or albedo (the layer of white internal rind) from the exocarp or flavedo (the external rind) resulting in the rind developing

creases. It is recognised by narrow sunken groves in the rind. In severe cases the groves intersect making the fruit appear lumpy and soft. It is a serious condition and may cause the fruit to split open under pressure when packed. Up to three calcium (Ca) sprays must be used in addition to GA. Balanced nutrition and irrigation are also crucial. High phosphorus (P) levels are associated with thinner rinds and therefore are more prone to developing albedo. High levels of nitrogen (N) and potassium (K) are associated with thicker rinds. In districts prone to the disorder it may be necessary to accept thicker rinds in order to obtain economic yields. Moisture stress (not enough or too much) significantly increases the incidence and severity of albedo.

2. Watermark on Imperial Mandarins (known as 'waterburn' in the Eastern States) occurs during wet weather when the bottom of the fruit is wet for a prolonged period. The colder and wetter the area the more severe the problem. In the past up to 60% crop losses were recorded from one property alone in the Harvey region when GA was not used (see 'Local Imperial Mandarin Experience' at the end of this Farmnote).



Albedo Breakdown



Watermark

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3. Oleocellosis (sometimes known as ‘oil spotting or burn’) occurs where there is mechanical injury to the fruit. It is caused by the rupturing of oil glands releasing toxic oil during harvest and/or transport from the field to the packinghouse. This oil kills the nearby cells of the flavedo. The oil from injured fruit can also cause oil spotting on the surface of adjacent fruit. It is more common when the fruit is turgid and the weather is cold and/or wet at harvest. Oleocellosis predisposes fruit to storage rots, chilling injury and burning from ozone (where ozone is used to control diseases that develop during storage). The oil from the ruptured cells inhibits degreening and discolours the rind. Over irrigating may contribute to the problem. Careful harvesting, transport and the use of GA will help to reduce the problem.



Oleocellosis

4. Delay rind ageing in late harvested varieties by preventing the rind collapsing due to the weakening of the cell walls and subsequent dehydration of mature fruit. GA maintains rind quality by helping to keep the rind texture looking younger. Some climatic conditions can accelerate the ageing process, for example heavy rains plus high humidity, followed by very cold conditions, also dehydration of the fruit in the orchard during hot conditions. Holding fruit too long between harvesting and packing (low humidity storage in the packingshed). Warm and dry conditions when trees are under water stress. This leads to the dehydration of the stem end of the fruit.

Other benefits of using GA include:

- Better rind firmness at harvest.
- Fruit appears to be less prone to post-harvest decay problems (this may be because of the greater resistance to injury due to the firmer rind).
- Fruit treated with GA also seems to better withstand the effects of adverse weather conditions (hot, wet or windy), rough handling and staining.
- GA also reduces the incidence of both rind puffiness in mandarins and splitting in varieties with a thin rind.

Note: GA has no effect on internal fruit quality or maturity.

When should GA be applied?

Apply GA if your orchard has a history of:

- Albedo breakdown and it is going to be a heavy crop year.
- Watermark on Imperial Mandarins.
- If you suspect the weather will be cold and wet during harvest and Oleocellosis may be a problem.

Apply GA if you wish to:

- Delay rind ageing on late harvested varieties.

Note: If spraying to reduce Albedo breakdown, Oleocellosis and Watermark on Imperial Mandarins, the earlier you spray the less effect the GA will have on delaying colour change. For example an early spray, fruit diameter 30 to 50 mm (early January), may delay colour change by 0 to 5 days instead of 2 to 3 weeks if sprayed in early February. The delay in colour change depends on timing, variety, the rate used, location and prevailing seasonal conditions. Also the earlier you spray the more effective the GA will be.

Things to consider before spraying.

GA works best when:

- You read the product label and comply with all directions.
- Your trees are healthy. Irrigation and fertiliser management is important. Trees must not be over or under irrigated. They must appear to be in generally good condition.
- Your canopy management is effective and up to date, that is the trees have been pruned well so that the spray can penetrate to all parts of the canopy. During years with a heavy crop load, fruit thinning is also advisable.
- The weather must be cool and the fruit dry, that is avoid mornings when there is heavy dew or you are experiencing heatwave conditions. The optimal spraying temperature range is 15 to 30°C. The best time to spray is early in the morning or late in the evening (wait for fruit to cool down). GA works best during slow drying conditions; if it dries too fast it won't work. If rain is forecast within the next 6 hours, wait.
- Temperatures are not too cool. Cold, wet conditions can cause spray damage, symptoms are a tear shaped stain/burn marks.
- You have timed your sprays correctly to achieve the result you want.
- You have not applied copper or oil sprays within the last four weeks. Copper and oil blanket the fruit and therefore restrict the uptake of GA. If possible apply GA before your oil and copper sprays. Stop drop sprays can be applied as normal, but do not mix with GA.
- You are using the correct rates.

- You have adjusted the pH of the water you are using. For Albedo (creasing) breakdown the pH must be 4 to 4.5. For all other applications, for example to delay rind ageing, it should be neutral, that is pH 7. If necessary use a buffer to achieve this pH. The easiest buffers to use are those that change colour when the correct pH is reached. Add a spreader/wetting agent at label rates. An adjuvant can be used instead of a buffer, but they may contain a spreader that is not at the recommended concentration for the GA product you are using. Note: Using too much spreader/wetting agent can burn your fruit.
- Apply using a high volume sprayer that has been calibrated. Check nozzles for wear and make sure they are the correct size. Complete coverage is essential, the spray must penetrate into the canopy, this is why it is critical to correctly prune your trees. Trees must be sprayed to the point of run-off.

Note: GA is best used on its own, that is avoid mixing GA with other products.

How do I time my GA sprays and what rate do I use?

Rates may vary between products.

Read the label. The label will provide you with a very good timing guide, however, there is no substitute for on-farm experience, therefore, you may wish to conduct your own trials to fine tune the timing of sprays so that they work best for your varieties, under your conditions. Also remember that because conditions are different every year some flexibility is required when deciding on timing.

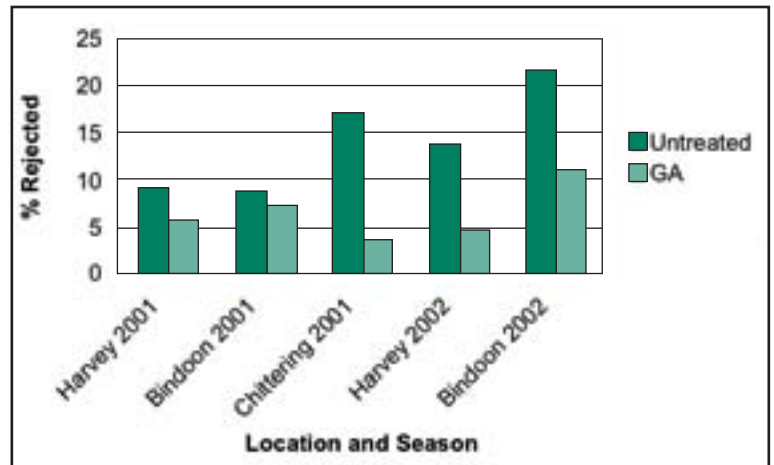
Local Imperial Mandarin experience.

GA is a registered treatment that is widely used with great success in other states. In the past there was considerable reluctance to use GA particularly on Imperial Mandarins in Western Australia. This reluctance was generally based on misinformation; stories loosely based on facts that have been distorted with the passage of time. Local concerns related to delays in colour development, reduced yield in subsequent years and tear stain spray damage.

A series of demonstrations were conducted on orchards in Bindoon, Chittering and Harvey in 2001 and 2002. The GA was applied at label rates and at the correct time. The results showed that the incidence of watermark was reduced by up to 80% without any negative effects.

Before and after surveys provided a useful measure of industry adoption.

In 2000, less than 10% of growers surveyed were using GA to reduce watermark. In 2003 after the demonstrations and an extensive effort, more than 80% of the same group were using GA as a strategy to reduce watermark in their Imperial Mandarins.



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