

UNDERSTANDING PRE-HARVEST EFFECTS ON POSTHARVEST QUALITY OF PASSIONFRUIT

POSTHARVEST QUALITY STARTS IN THE TWINKLING OF A GROWERS EYE...

DR JENNY EKMAN | APPLIED HORTICULTURAL RESEARCH | JENNYEKMAN@AHR.COM.AU | 0407 384 285

If you really want to grow great quality passionfruit, you need to start before the vines are even planted. Only a healthy plant can produce quality fruit with maximum shelf life. Plant nutrition, variety and climate all influence how quickly fruit will grow and mature, as well as how quickly they break down during storage and transport. For example, wet conditions increase the likelihood of postharvest rots, while physical damage from wind, rain and insects all decrease storage life potential.

VINE NUTRITION

There are plenty of studies showing that fertiliser improves fruit quality. However, it is important not to overdo it!

Nitrogen fuels plant growth. As flowers are produced in the leaf axils, strong vegetative growth can increase fruit production. However, nitrogen is also very mobile in the soil; applying small quantities often is likely to be most effective. Very high nitrogen levels are likely to lead to fertiliser being wasted and can also increase fruit acidity. However, the form of nitrogen may also be important; Japanese researchers found that applying nitrogen as ammonia, rather than nitrate (e.g. cal nitrate), improved the sugar-to-acid ratio in the harvested fruit.

Like nitrogen, potassium is essential to keep vines healthy and productive. Potassium is a major component of fruit; In the Passionfruit Growing Guide, Peter Rigden estimates that 4.3kg of potassium is removed for every tonne of fruit production, compared to 3.3kg of nitrogen and 0.3kg of phosphorus. Increasing potassium can increase fruit weight, rind thickness and vitamin C content. However, like nitrogen it is important not to add too much – excess potassium increases fruit acidity and can reduce the uptake of calcium.

When it comes to postharvest fruit quality, nothing beats calcium. Calcium is an essential part of cell walls so vital for fruit robustness. For diverse fruit from avocados to tomatoes and even zucchini, calcium is associated with benefits such as reduced disease, increased storage life, firmer texture and improved ripening characteristics.

The challenge is getting calcium into fruit. Foliar applications are often ineffective at increasing calcium levels in fruit. This is because calcium moves in the water stream taken up by the roots (xylem), not in the vessels that move nutrients around the plant (phloem). The amount of calcium taken up by the fruit is largely determined by transpiration when the fruit is first developing, as this is what transports calcium into the young fruitlet. It is therefore essential to have plenty of calcium available in the soil when fruit are starting to develop.

Boron is also essential for cell wall development. It is also involved in flowering, pollen formation and pollen germination. For this reason, boron deficiencies can result in poor fruit set. Boron is transported in the xylem but, unlike calcium, may be increased in the developing flowers by foliar applications.

The best way to find out what fertilisers are needed is through leaf tissue sampling. This is usually done in the cooler months, when growth has slowed (about now?). Select the last fully expanded leaves from healthy shoots and keep cool until sent for analysis.

Figure 1. Test the youngest fully expanded leaf



SOIL PH

Nutrients in the soil are one thing, but how efficiently they are taken up by the plant depends on pH. Passionfruit are unusual in that they prefer a fairly acidic soil; Peter Rigden recommends that soil pH should be pH 5.5 to 6.5.

Recent Japanese research suggests that even lower soil pH may benefit fruit quality. Niwayama and Higuchi (2019) found that purple passionfruit growing in soil adjusted to pH 4.5 to 5.5 were larger, heavier, more strongly coloured and sweeter than fruit grown at pH 3.5 or 6.5. Fruit grown with neutral pH tended to be pale and thin skinned, increasing shrivel.

This has yet to be tested in Australia. However, adding nitrogen can help; these fertilisers decrease pH, whereas lime and dolomite increase pH. See FIGURE 2

Total soluble solids (TSS) content of a solution is determined by the index of refraction, measured using a refractometer.

IRRIGATION

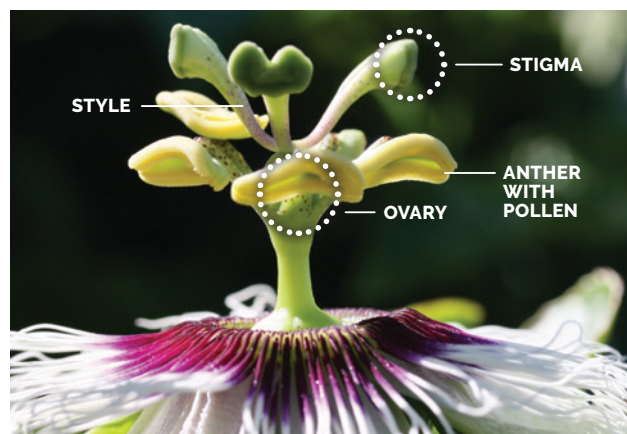
While some may regard passionfruit as relatively “drought tolerant”, fruit quality and yield can be affected well before plants start to obviously wilt. It is important to get irrigation right – just like fertiliser – enough, but not too much.

It is particularly important that there is plenty of soil moisture when fruit is forming, otherwise calcium and boron won't make it up to the developing fruitlets. Low soil moisture increases plant stress, which can result in ethylene production by the vine and fruit drop. Conversely, wet soils increase disease, which can spread and infect fruit.

FLOWERING AND POLLINATION

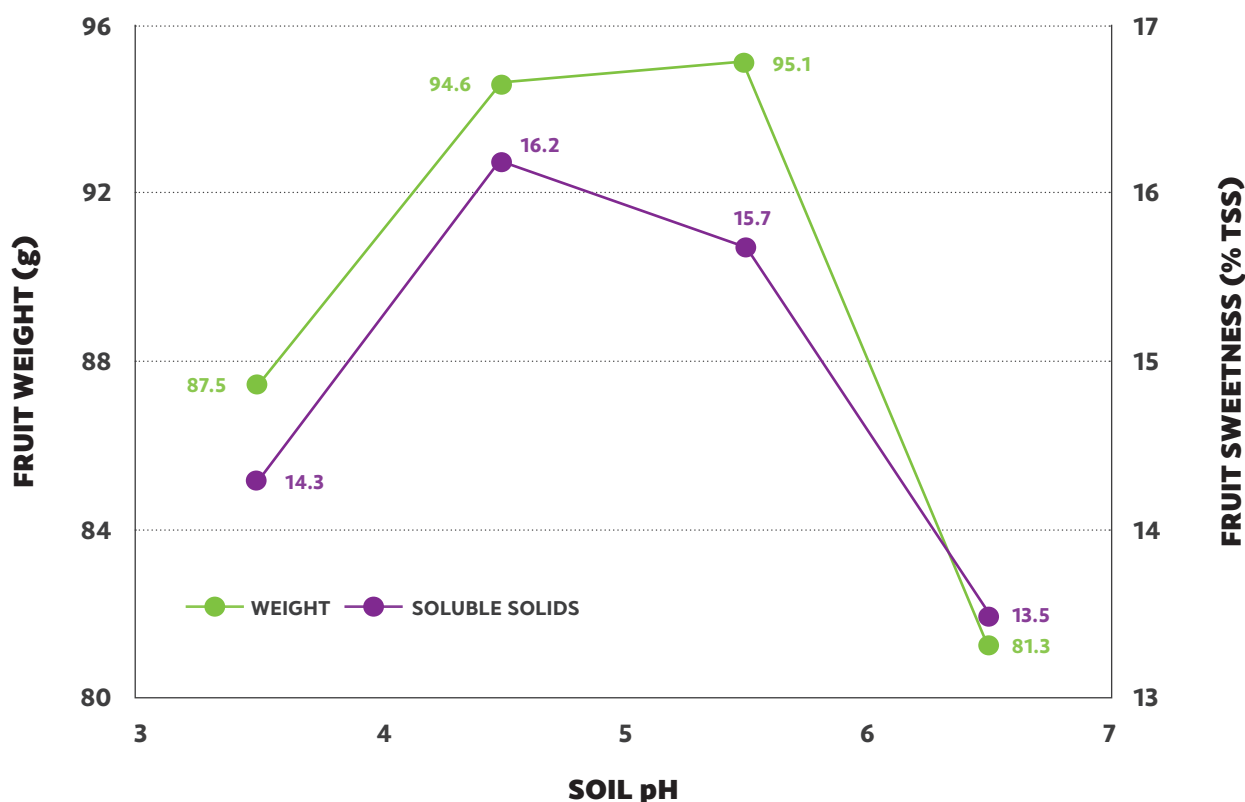
Flowering and pollination are where the rubber really hits the road. Without pollination there can be no fruit. Both purple passionfruit and Panama varieties are self-compatible, meaning flowers can be fertilised by their own pollen. However, the pollen sacs are positioned underneath the stigmas, making it less likely that pollen will fall on the receptive part of the flower. Moreover, passionfruit pollen is heavy and sticky – so not blown around by the wind.

Figure 3. Structure of a passionfruit flower



Pollination is best when flowers are pollinated by larger insects such as honeybees, native bees (e.g. carpenter bees), flies and other insects. A wonderful 1959 publication from the University of Hawaii details the benefits of good pollination for yellow passionfruit. This showed that flowers are receptive for only a few hours after they open. Once pollen is deposited on the stigma, it can take up to 2 hours to germinate. If it rains before the pollen germinates, the pollen is destroyed, and the flower remains unfertilised.

Figure 2. Effect of soil pH on quality attributes of purple passionfruit cv. Summer queen. Data from Niwayama and Higuchi, 2019.



The researchers also showed – in what must have been a very tedious experiment to do – that the number of pollen grains deposited on the stigma directly affect fruit set, seed number and, as a result, fruit size and weight. Hollow fruit are the result of poor pollination. SEE FIGURE 4

Figure 4. The effect of the time delay between pollination and rain on fruit set (top), and the amount of pollen deposited and fruit size (bottom).

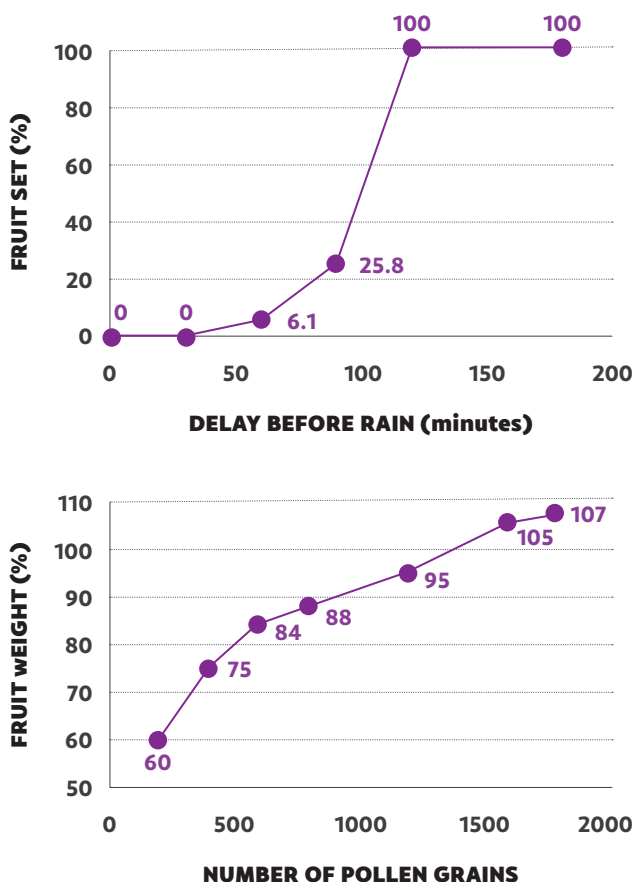


Figure 5. Fully and poorly pollinated fruit cv. Misty Gem.



As large fruit get the best prices, it is essential to ensure thorough pollination by, for example;

- Encouraging native bees
- Locating honeybee hives nearby
- Avoiding spraying insecticides that affect pollinators
- Providing windbreaks

Effective pest and disease control are also clearly essential for good fruit quality. More on that next issue.



REGIONAL FIELD DAYS

Updated dates for the diary

29 APRIL

Far North Queensland's field day is now postponed until later in the year due to travel restrictions.

27 MAY

For the Sunshine Coast and Bundaberg region, we have been forced to cancel this planned day in May.

29 JULY

In Northern NSW, we have chosen to cancel this event and we propose to replace it with a field day component tied to the Passionfruit Australia AGM & Annual Dinner taking place on 9/10 October in Northern NSW.

9 OCTOBER

Our AGM & Industry Dinner is still planned to take place on Friday 9 October with a Field Day element on both Friday afternoon and Saturday morning.

More details will follow but please save the date.

PLEASE VISIT

Our Events portal will always feature the latest information about the status, location and timing of all industry events and is the place where you can register to attend or purchase tickets.

PLEASE NOTE: All Regional Catch-ups have also been put on hold until restrictions on formal gatherings are lifted. If you do have any concerns or just want to talk passionfruit to a fellow grower, please get in touch with one of the Committee Members listed in the front of this magazine