

Maximise your lychee crop with better pollination

UNDERSTANDING LYCHEE FLOWERING

1

Lychee (*Litchi chinensis*) produces large numbers of flowers grouped in dense clusters, but fruit set per flower is generally low. Even so, by increasing pollinator visits to flowers it's possible to enhance fruit set, and small increases in fruit set can lead to significant increases in yield.

Lychee flowering is a complex process and generally occurs in three distinct stages. Each cluster of flowers, or panicle, on a tree may contain hundreds of individual flowers.

The first flowers to open are male (Figure 1, M1, left). They are followed by the female flowers, which open after the male flowers have finished. Female flowers are easy to recognise by their forked style (Figure 1, F, centre) and stunted anthers without any pollen.

Finally, a second type of male flower (Figure 1, M2, right) open, with anthers that produce a large amount of pollen. Even though they have a rudimentary style (like female flowers), these M2 flowers do not produce fruit.

Table 1 summarises the stages of lychee flowering and the production of nectar, pollen or fruit from each stage. This sequence of flowers means that most of the fruit on a single tree are pollinated by M2 male flowers that overlap with the female flowers.

So that you have both female and M2 pollen producing flowers present at the same time, multiple cultivars with offset flowering times need to be planted. Growing the trees where the microclimate affects flowering time (eg on a slope) may also help to ensure that plenty of M2 pollen is available for female flowers.

Table 1: Lychee flower stages and production of nectar, pollen or fruit

	M ₁	F	M ₂
Nectar	yes	yes	some
Pollen	some	no	yes
Fruit set	no	yes	no

What you need to know

- Both female and M2 flowers need to be available at the same time to maximise pollination.
- Not all female flowers will set fruit, but monitoring yields and fruit set can help to ensure that pollination is not limiting your production.
- Many insects can contribute to lychee pollination, including managed honey bees.
- Ensure that strong honey bee hives are provided for pollination. Work with your beekeeper to know what you are getting.
- Honey bees are most effective when spread throughout the growing area.
- Bird or hail netting can interfere with honey bee behaviour. Work with your beekeeper to make sure that hive strength is not affected. When possible, open sections of netting to allow pollinators to come and go.

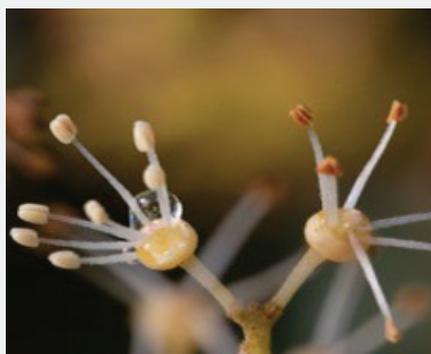


Figure 1. Stages of lychee flowering. The sterile male phase (M1, left) opens first and produces nectar and pollen, but does not contribute to fruit set. The second phase is the female phase (F, centre) which can be fertilised and produce fruit, but does not produce pollen. Finally, the second male phase (M2, right) that cannot produce fruit, but is the source of most of the pollen, causes fruit set in female flowers.

INSECT POLLINATION

2

In most regions, lychee flowers are visited by many types of insects. Most insects are likely to move pollen between flowers both within and between trees. The efficiency of these pollinators will differ: insect body size, shape, and behaviour influence the number of pollen grains they pick up and transport to pollinate other flowers.

Even small insects can pollinate lychee flowers. For example Australian native stingless bees (*Tetragonula* sp., Figure 2A) contact the parts of male and female flowers and occasionally deposit pollen.

HONEY BEES

3

The European honey bee (*Apis mellifera*, Figure 2B) is a frequent visitor to lychee flowers, and numerous studies show that its presence results in good fruit set and production.

The generally recommended honey bee hive stocking rate for lychee is 2.5 hives per hectare.

The actual number needed though will depend on how many other pollinators are in the area, and other flowering plants in the surrounding landscape.

It's best to spread honey bee hives throughout the growing area to cover all parts of the crop.

It is important that pollination hives contain strong colonies with a good number of foraging bees, as well as space within the hive for collected resources.

Developing a relationship with your beekeeper, and establishing a pollination contract and a plan for auditing colony strength, can help to ensure that the hives on your farm are suitable for pollination.

The Asian honey bee (*Apis cerana*), which is a little smaller in size than the European honey bee, is also a frequent visitor to lychee flowers around Cairns.

However, growers are reminded that they are required to report Asian honey bee to Queensland Department of Agriculture and Fisheries, and that it is a biosecurity offence to keep or move them.

OTHER POLLINATORS

4

The contribution of insects like beetles, flies and moths (Figure 2C and D) to lychee pollination is not fully understood, but studies show that in some regions they may have a substantial effect on pollination and boost yields.

Having a diverse range of pollinators in the orchard ensures that pollination can occur throughout the day and in varying weather conditions, including when it's cold or wet when honey bees may be absent.

Wild pollinators may come from habitat on the farm or in surrounding areas. It is important to keep in mind that land management and land-use changes can influence the numbers and activity of these important insects. Many of these insects shelter within the crop (rather than in a remote hive) so they can be vulnerable to pest control measures, even during the night and early morning when the risk to honey bees is low.

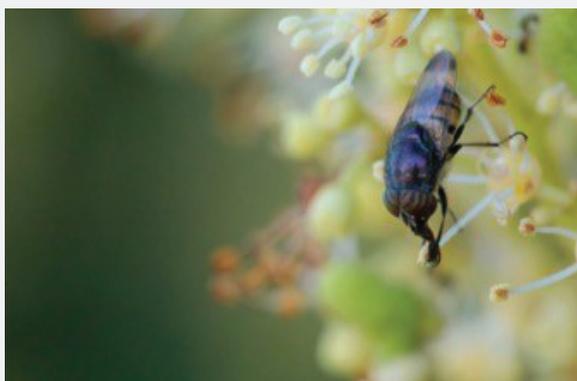


Figure 2. Some frequent visitors to lychee flowers in Queensland. A) a stingless bee (*Tetragonula* sp.) B) European honey bee (*Apis mellifera*), C) a nose fly (*Rhiniinae*), and D) a moth (*Lepidoptera*)



Top tip

Lychee flowers are visited by many types of insects.

Keep tabs on what's happening on your farm to better understand which pollinators are in your orchard, so you will know if something changes.

PROTECTED CROPPING

5

It is common for farms to have protective netting covers to prevent damage from storms and pest animals. These covers can disrupt normal pollinator behaviour and beekeepers may be reluctant to move hives into covered blocks.

Where possible, it is recommended to leave the sides of protected areas open during flowering to allow natural foraging of honey bees and wild pollinators.

Some unmanaged pollinators and Australian stingless bees appear to be less affected by covers and may be particularly useful as pollinators in these situations.



Hail and bird netting (left and above) has potential to alter behaviour of both managed and unmanaged pollinators. Raising the sides of some netting to allow pollinator movement is a strategy for getting good pollination and keeping honey bee hives strong.



6 CHECKLIST

DEVELOP A POLLINATION PLAN FOR YOUR CROP			
ACTION	YES	NO	COMMENT
Both female and M2 flowers are available at the same time in each block.			
Plant cultivars with slightly offset flowering times are used to ensure overlap in flowering.			
Crop loads (e.g. number and quality) are recorded over multiple years, providing a benchmark to assess changes in pollination.			
Crops with multiple varieties are regularly checked to compare flowering intensity and weather records, to understand patterns of flowering.			
Orchard staff can identify common insects visiting flowers.			
The number of insect pollinators active on four, 10 m transects located diagonally across the flowering crop are counted (recommended time is 10 am – noon).			
Staff are aware that land use changes can influence the populations and activity patterns of unmanaged pollinators.			

HIVE MANAGEMENT			
ACTION	YES	NO	COMMENT
Pollination agreements are drawn up with beekeepers, detailing respective responsibilities.			
Beekeeper has provided evidence of compliance with the Australian Honey Bee Industry Biosecurity Code of Practice.			
When or where pollinator activity is lower than usual, additional managed honey bee hives are brought in to maintain pollination rates.			
Honey bee hives are placed in small groups that are evenly spaced in the orchard, at an overall stocking rate of 2.5 hives per hectare.			
Where possible, openings are created in covers and enclosures during flowering to promote honey bee health and to allow access for other pollinators.			



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Goodwin (2012) *Pollination of Crops in Australia and New Zealand* 121 p.
 Images courtesy of Brian Cutting of Plant & Food Research Australia, unless otherwise stated.