AUSTRALIAN MACADAMIA SOCIETY

POLLINATION ROUNDUP

Pollination in macadamias is an ongoing area of investment for R&D, however, research to date has been inconclusive. The bad news about that is that hard and fast recommendations are difficult to give; the good news is that this situation presents an opportunity for innovation and ideas. One example is the research being done by Brad Howlett and his team.

Cross-pollination is an area where there are different views – whether there is a need for it and, if so, which methods are the most effective. With the investment of time, energy and brainpower into pollination research (both on farm research and as scientific research projects), more certainty will be achieved. Until that time, a range of perspectives will be considered, two of which we present in articles by Cliff James and Chris Fuller.

Is your orchard under pollinated?

Chris Fuller, Kin Kin Native Bees, Kin Kin Queensland

The new season is upon us and as the flowers start to punch out as part of our annual cycle, no doubt the yearly debate about macadamia pollination will soon follow. Every year the same questions come. "Doesn't wind do the job?" "Aren't macadamia self-pollinating?" "Do we even need bees?"

The simple answer to these questions is: no, wind plays little if any role in pollination, macadamias are predominantly cross-pollinated and, yes, we need bees as they are the most important of our floral insect visitors and are the most effective and efficient at moving cross pollen to where we need it on the flowers.

While a range of insects, such as this lycid beetle, can deliver pollen to macadamia flowers, this doesn't always result in pollination. The reason is that pollen must be delivered to the stigma, and research has shown that some insects place pollen more often on styles rather than stigmas. In the case of lycids, they were found to place pollen on the styles of all flowers visited but delivered pollen directly onto stigmas a third of the time.

Native stingless bee (Tetragonula cabonaria) *with a full pollen load.* Photo. Chris Fuller

Macadamia flowers do not have any of the characteristics of wind-pollinated plants. Wind-pollinated plants have large surfaces to catch airborne pollen whereas the stigmatic groove on the macadamia is tiny. Wind-pollinated plants have easily dispersed pollen grains yet macadamia have sticky pollen which forms clumps and is not easily dislodged by wind. There is no need for a wind-pollinated plant to produce nectar. Nectar is produced to attract pollinators and macadamia produce nectar.

Macadamia can produce some nut through self-pollination. There is a clever mechanism in the flower which deposits self-pollen on the stigmatic surface of the style as the flower opens. This is a survival strategy of the species so the tree can still produce some offspring when there is a deficiency in pollen collecting insects.

Macadamia can produce much more and higher quality offspring (nut), however, through cross-pollination. DNA testing of nuts produced on a solid block of one variety (27 rows wide) in Bundaberg showed that even in the centre row of the block, 95 m from the closest tree of another variety, the vast bulk of the nuts produced were the result of cross-pollination.

I have been a pest consultant to the macadamia industry for 25 years. During flowering, I spend my days in the field looking at what is visiting macadamia flowers and what they are doing. I noticed early on that stingless bees were very active pollen gatherers in our orchards here on the Sunshine Coast. I started reading everything available that had been published on macadamia pollination and concluded that the industry, on the whole, is well under-pollinated. I also found that there was not one scientific paper that promoted wind or self-pollination and any evidence of their benefit was

anecdotal. For this reason, I started to propagate and build up hives of stingless bees to help growers improve nut set and yield through better cross-pollination.

There is a new research paper now available on the Hort Innovation website titled *Optimising pollination of macadamia and avocado in Australia* (MT 13060). During this work Dr Brad Howlett and his team detail a very simple method of determining whether there is a pollinator deficiency in your orchard, i.e. by using glass tubes to manually transfer pollen from one variety to another you can mimic the work of bees. If you can induce a higher nut set by doing this it means your orchard is under pollinated.

This current research also confirmed what all the previous research I had read concluded. Macadamias are predominantly cross-pollinated and bees are the most efficient and effective pollinators. Growers developing new orchards also have an opportunity to benefit from this research by optimising cross pollination through thoughtful planting design and variety selection.

If I were a grower, the only debate I would be having is "How under-pollinated is my orchard and what am I going to do about it?".

Cross-pollination: another option?

Cliff James, macadamia consultant, Ballina

Why worry about pollination and nut set when we see thousands of nutlets on the ground during November and December?

Obviously, the tree has set excessive nuts, through hormonal activity, inadequate soil moisture or poor nutrition, and has decided to abort the excess.

The question that to my knowledge has not been answered is, why do we get 3 t/ha one year and 4.5 t the next without any apparent reason?

Maybe the answer is cross-pollination, something that is described in detail in research documented in 1989 by Margaret Sedgley et al on self- and cross-compatibility and research by Tim A. Heard described in the *Journal of Apiculture Research*.

Many tree species benefit from heterogeneity or crossbred vigour. This is a feature that the animal industry has been using for years in their program of producing crossbred females (F1 and F2) to enhance meat deposition and feed conversation. Why not apply the same principle to macadamias?

My first block in 1981 had 1,500 trees (246 variety) alongside a block of 1,000 H2s. As we handpicked nuts in the block during the 1980s, it became obvious the rows beside each cultivar produced more nuts than several rows back.

As a consultant, I recommended that four rows per cultivar be planted with a like-by-like flowering pattern. In discussion with Dr Cameron McConkey, he suggested that an eight-row regime could be planted. I would suggest that this would depend on the distance between the rows.

Pollinating using European and native bees has been discussed for many years. I believe Frank Adcock, after many years of excellent study found that the macadamia flower is not very friendly to a bee.

So, what do we have to promote cross-pollination?

There are numerous insects in the orchard that will help with cross-pollination. The issue is, how do we assess their numbers and ability, particularly where we are spraying insecticides that may well kill them off?

I recently visited Colombia and Guatemala where biological control is very high on the agenda because of the mountainous terrain where macadamias are planted. They have a management program to identify and assess the number of insects by placing a white groundcover under several trees in the orchard and spraying about a quarter of the trees each month. They are then able to identify the number and species of insects in the orchard. I would suggest Australian growers could do the same.

I have been informed that the South African farmers do something similar.

As we spray our orchards with insecticides potentially killing the very insects we hope will pollinate the flowers, what could growers do to intervene with a management practice that may help with cross-pollination of flowers in the orchard?

My suggestion is to visually assess the optimum times to cross-pollinate the orchard and then use an air blast sprayer to force air through the orchard. If as, the research suggests, hybrid nuts have a higher retention rate than self-pollinated, you could increase your production through more nuts per raceme.

You may have to force air twice through the orchard during the season because there are often two flowerings. You could travel at, say, 6 km/hour along each third row to obtain the desired result.

More Information
For more information on this topic please contact Chris Fuller at info@nativebees.com.au Cliff James at Clifford.james@bigpond.com, visit the Australian macadamia industry website www.australian-macadamias.org/industry or contact the Industry Development Manager at the AMS on 1800 262 426.

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