CEO REPORT

Larry McHugh

It has been an interesting start to the 2021 season, with a strengthening Australian dollar, ongoing COVID-19 and a late start to the NSW harvest due to rain.

Deliveries of the 2021 crop are ramping up and processing is well underway in our Australian factories. As of late May, we have received approximately 5,500MT* of NIS at each factory.

Market outlook

This year, Marquis Marketing will sell approximately 12,000MT* of kernel, including the kernel sold as NIS. This level of sales requires our Marquis team to expand our existing list of customers by opening new markets and delivering our Marquis branded products to new customers.

The sales of the 2021 crop are progressing well, and we expect the majority of the crop to be contracted within the next six weeks. Sale prices have seen more movement than in prior years, with many customers choosing to contract sufficient product to meet their needs for shorter periods, when compared to previous years. This is a direct result of the frequent lockdowns many locations have experienced as COVID-19 has disappeared and then reappeared in countries around the globe.

The global demand for tree nuts, including macadamias, is beginning to recover from the impact of COVID-19, and we expect this trend to continue as we progress through the year.

Bulk sales are the core of our business and will remain so; however, product development is an important contributor to both attracting new customers and ensuring the best returns for our products. There can be long lead times to develop an idea into a product on a supermarket shelf, but this action is part of our long-term strategy to sell our ever-increasing crop. And we will keep our growers updated on new products as they are developed.

Bundaberg expansion

The area under crop in the Bundaberg region is growing rapidly, and several years ago we identified the need to expand our Bundaberg factory to

May 2021

ensure sufficient capacity to meet future processing requirements. We have recently submitted a Development Application to Bundaberg Council to increase the processing capacity from 15,000MT* capacity to 30,000MT*. The proposed expansion includes large increases in NIS storage capacity and a new finished product warehouse.

I am pleased to advise the Queensland Government approved our application for a grant to assist us with this project, and the Queensland Treasurer, Cameron Dick, recently visited our Bundaberg factory to announce the funding with a press conference and factory tour.

Cameron Dick (QLD Treasurer) and Tom Smith (Bundaberg MP) at Bundaberg factory with Larry McHugh

Marquis Macadamias Africa

We recently announced that Global Macadamias, 50% owner of Marquis Marketing, has changed its name to Marquis Macadamias. This company is 100% owned by South African growers and is a separate company to Marquis Macadamias Australia. This change of name is a further step forward in maintaining our Marquis brand as the leader in the world macadamia industry. Visit marquis.com to see our updated website.

Voluntary Marketing Fund

I am pleased to report the Australian Voluntary Marketing Fund has been well supported by Australian growers who have provided sufficient funding to finalise the establishment of the World Macadamia Organisation (WMO). The WMO is critical in building global demand for macadamias as the world crop doubles over the next few years, and triples by 2030.

Jillian Laing, CEO of the WMO, and I have recently been meeting with macadamia industry leaders in most of the world's growing regions to finalise their involvement. We will be holding preparatory meetings with interested regions in May, June and July with a plan of being fully established in early August. Following completion of this phase, planning for the proposed marketing campaigns will commence with programs being rolled out by Q1 of 2022.

I encourage all growers to contribute to the Australian Voluntary Marketing Fund to ensure the long-term profitability of the industry.

Better Homes & Gardens visit the Lismore factory

The Better Homes & Gardens crew recently visited the Lismore factory to film a story on the macadamia industry in the Northern Rivers of NSW. The crew filmed at the factory before moving on to Andrew Leslie's farm, where they prepared a panforte dessert using our macadamias. On behalf of the Marquis Group, I would like to acknowledge and thank Andrew and his family for the time and effort they put into making the day a success. Watch this episode due to air on Channel 7 at 7pm on Friday, 28 May.

Better Homes & Gardens presenters Johanna Griggs & Fast Ed at Andrew and Ann Leslie's farm

*All figures at 10% moisture.

MARKETING REPORT

Charles Cormack, General Manager

There is no doubt that 2020 was an interesting year for the macadamia industry with the onset of COVID-19 creating a great deal of global volatility. There were certainly some highs and lows in macadamia demand across various geographies and food sectors, but on balance macadamias performed well on the back of being a healthy and slightly indulgent snack.

With major retail chain stores staying open throughout COVID-19, demand for snack styles (wholes and large halves) remained buoyant, but demand for the smaller ingredient styles (especially chips) was negatively impacted by extensive lockdowns in the food service, hospitality and convenience sectors in many markets. This put some downward pressure on ingredient style pricing in the back end of the year.

As the 2021 harvest has started in all southern hemisphere growing regions, it is becoming apparent that the global supply of macadamias into this season will not be as large as was being predicted 4-5 months ago. Australian forecast modelling originally predicted a crop of 50,700MT*, but based on feedback from our 370 growers, who make up nearly 50% of the Australian crop, we believe this will now be closer to 48,000MT* and only marginally up on the 46,900MT* of last year. Patchy flowering in the Bundaberg region, the lingering effects of previous droughts and late heavy rain in the southern growing regions have all negatively affected yields.

Meanwhile in South Africa, the early forecast of 57,000MT* now seems very optimistic, and our growers in this region are indicating this is now more likely to be only marginally over 50,000MT*. The Beaumont variety, which makes up 60% of the South African crop, is well down on initial estimates with smaller nuts reducing kernel recovery and, therefore, kernel production.

At the recent INC conference, Kenya estimated their 2021 harvest to be around 30,000MT* due to less-than-ideal growing conditions. This is well down on the 38,000MT* of 2020.

Overall, we expect the global crop this season to be only marginally up on a modest 2020. Good demand for macadamia NIS in China, helped along by a strong recovery in other nut prices, will likely also reduce the production of kernel worldwide.

Regarding kernel demand, there is no doubt COVID-19 will continue to play a major role, but unlike 2020, this year the retail and food industry knows what to expect and is well prepared for it. With most of the major kernel consuming markets in North America, Europe and Asia now making excellent progress with vaccination roll-out programs and easing lockdown restrictions, there are already signs of demand strengthening.

Macadamias used as an ingredient in ice cream

At Marquis, we have seen a higher than usual volume of contracts being signed during the first five months of the year, and our sales have already exceeded those of 2020. We expect this trend to continue as the year progresses. We have also seen renewed interest in the ingredient styles and increased activity in new product development, which will build demand for these styles in the medium and longer term.

*All figures at 3% moisture.

FACTORY OPERATIONS

Steven Lee, Chief Operating Officer

The 2021 harvest is now well underway with nut deliveries ramping up at both Marquis Macadamias factories over the last few weeks. Initially, the majority of crop was coming from the Bundaberg region where nut drop, although slightly later than usual, was still well ahead of the Northern Rivers.

The Bundaberg region has experienced short interruptions due to rainfall events, whereas the Northern Rivers and Mid North Coast regions have been very wet with both areas receiving in excess of 1,000mm of rainfall by mid-April. Fortunately, there was not a lot of crop down when some of the bigger falls and flooding occurred, so hopefully there wasn't too much crop lost. There were some localised storm cells that caused severe damage to trees, orchards and crop loss. A positive side to all of this rain is that the soil moisture profile will be full heading into winter.

The wet weather has also meant the crop delivered into Lismore has been quite wet with little in field drying. The YTD average moisture content is 22%, which has resulted in some extended sample drying times. With the weather improving, we are now seeing drier nuts delivered and shorter evaluation times for consignment samples. We understand how important consignment quality information is to our growers in assisting your on-farm management practices, and we'll be continuing to provide quality reports as quickly as possible.

Both factories have commenced cracking the 2021 crop. With new colour sorting technology installed in our main kernel processing lines at both factories, we are expecting to see improved sorting efficiency. The new retail packing machine in Bundaberg is meeting our expectations with improved pack rates and efficiencies. With the return to more favourable growing conditions, we are expecting the 2021 crop to be better in quality than the drought-affected crop of 2020.

Delivery Bookings: Delivery time slots are at a premium this time of year, and consignments being delivered on time maximise the efficient use of our facility. Please continue to ensure your deliveries are on time to avoid our receivals system sitting idle.

2021 SEASON OPENING

Mark Whitten, Grower Liaison Officer

Our season opening events at Lismore and Bundaberg included demonstrations of new machinery options available to assist growers. In Lismore, these included a spray drone from Skytech Solutions, a sweeping mulcher from local grower Lance Emery and a combined dual headed harvester and mulcher by local grower Trevor Martin. In Bundaberg, Utopia Orchard Services demonstrated their tree shaking and harvesting services now available on a contract basis.

Marquis also donated $1,500 to the Westpac Lifesaving Helicopter, in addition to $265 from the Toro Challenge funds.

Peter Duncan (Westpac Helicopter Rescue) and Kevin Quinlan (Marquis)

Toro Challenge winner Dennis Whitney with Matt Eather from FarmMoto Lismore, sponsors of the Toro Challenge who kindly donated the Toro Personal Paced Mower prize

Spray drone

Skytech Solutions demonstrated one of their drones spraying macadamia trees. Company co-owner Scott Fisher stated, "We've been operating in and around the Northern Rivers NSW for three years now using our drones to effectively spray crops such as tea tree, sugar cane, soybean, rice and pastures. Recently, we've had a lot of interest from tree crops and so we're now beginning to offer our services to the macadamia industry". When asked about the technical details of his operation Scott said, "To cover the large areas of ground, we've updated to DJI Agras T16 drones. These boost our capacity and efficiency". Features of the DJI Agra T16 include:

- 16L spray tank
- 4.8L/min output spread across 8 nozzles
- 5m spray swath
- Battery life ~15mins
- Dual beam forming radar capable of detecting an object as small as 5mm from 15m away
- Auto obstacle avoidance for safety
- IPX67 water rating

Regarding drone spraying in macadamia orchards, Scott said, "Our drone spraying won't suit all applications or situations in macadamia orchards, and there are some chemicals that can't be used aerially; however, our big advantage is accessibility. Regardless of how wet the ground is, we can operate". With application rates generally varying from 30L – 100L/ha, it is advisable to ensure you check with your consultant or chemical manufacturer about a product's suitability for drone application.

Skytech's spray drone

One promising application for the use of spray drones is for late season monitoring of fruit spotting bug (FSB). This involves applying an insecticide via a drone to a small number of trees and counting the insects that are found on a drop sheet placed under the trees. Marquis Grower Liaison Officer Mark Whitten said, "The macadamia industry has struggled to find a reliable late season FSB monitoring tool. While the use of drop sheets is still in the early stages of development, their use is showing real potential. The industry is still trying to determine the required number of drop sheets per area and distribution of these in a block, but it is good to see there is a big step forward in monitoring late in the season. In trials undertaken so far for late season monitoring, growers have been using traditional air-blast sprayers. However, with the low volumes required for spraying discrete individual trees, spray drones are ideally suited and would make the operation much more efficient. Also, through the trial work we've done with Skytech, I'm confident that the spray coverage we achieved will be adequate for monitoring".

Asked about the 'where to next' for Skytech, Scott said, "The advances in drone technology are so rapid. Soon we will be looking to upgrade our fleet of drones

again to ones with a 20L payload, which will further increase our capacity and efficiency".

Scott also has other drone services that he provides, such as a survey drone. "We are also busy researching agronomic applications for the detailed imagery we are getting from our Phantom 4 RTK survey drone and our Phantom 4 multi spectral sensor. We know we can use it to measure things like the volume of mulch in a pile or the size of a dam, but as there are so many sensors available, we believe there is so much more we could do".

The charge rate for a spray drone is $165/ha (incl GST) and is based on spraying 100L/ha. For orchard spraying, around 1ha/hr is able to be covered.

For more information, contact Scott at Skytech Solutions on 0458 486 856 or email enquiries@skytechsolutions.com.au.

Sweeping mulcher

With necessity being the driver of innovation, local grower Lance Emery in partnership with Dave Hunter, has designed a sweeping mulcher. The idea behind the implement came from Lance's need to effectively mulch the orchard floor but maintain ground cover. Lance said, "In the early days of managing Macadamia Seed Weevil (MSW), mulching the infected nut was a critical operation. However, I've got pretty steep country and I need all the ground cover I can get to minimise erosion. To protect the orchard floor, I couldn't risk lowering the mulcher too much, but that meant I would miss a lot of nut and stick. I knew there had to be a way to get the best of both worlds".

Lance's solution was to retrofit a road broom to the mulcher unit, behind the mulching head. "This way, I don't have to lower the mulcher down to the ground, because the broom will sweep everything up into the mulcher. With this unit, I can clean the orchard floor and still retain a 2-inch grass layer," Lance said.

The addition to the mulcher Lance has made is available for purchase. The design of the broom attachment is a bolt-on system and does not interfere with the mulcher's operation, and as a result does not void the warranty of the machine. The broom can be lifted or lowered to suit orchard conditions via a set of bolts.

Lance said he had used the mulcher for his entire 2021 pre-harvest clean-up, and it performed well. "I like to use light machinery to allow me to access my farm soon after rain. I found it worked well on my reversable tractor, and it handled the extra weight fine", Lance said.

The demonstration at the opening day used a Berti Lands 2.3m wide high body mulcher with a 400mm diameter broom with 'Y' blades on the mulching head. Lance mentioned they were also working on a smaller 2m unit.

To find out more about the mulcher and for pricing, contact Lance Emery on 0421 034 281.

Dual headed harvester and mulcher

The last innovation to be demonstrated was a dual headed harvester with mulcher developed and designed by local growers Trevor and Barbara Martin in partnership with Lismore Engineering. When asked about the motivation behind the concept Trevor said, "Barbara and I are focused on continual improvement and improving efficiency in every part of our farming system, and we identified our harvesting system needed improving".

Previously, Trevor and Barbara would do two harvester passes and then run a mower down his rows. Using this system meant it took around 10-14 days to complete a harvest round. As the Martins like to maximise the quality of nut they supply, the length of a harvest round meant they were continually harvesting and mowing.

"We're not getting any younger, so we needed to reduce the workload while ensuring whatever machine we used was reasonably comfortable to work in," Trevor said. Their solution was a dual headed harvester with a trailing mulcher. Trevor explained, "I approached Lismore Engineering with the concept and after 3-4 months of working through different designs, we came up with this machine. It's not an off-the-shelf harvester, so the number of considerations and issues we had to tackle was enormous". The end product included:

- 2.5m dual head with mid-size finger wheels
- Dual sweepers
- Admac de-husker
- Faustini 2.4m mulcher with flail or Y blades
- Fent 110hp closed cab tractor with front linkage, front PTO and Vario transmission

When asked about its performance, Trevor stated, “We’ve used it for a season, and we’re really happy with it. It has reduced our harvest rounds to 5-6 days. It does a great job at picking up nuts. We have set the mulcher at the rear to around 45mm off the ground, and it shreds any leaves and sticks that are there and cuts the grass down, while leaving any nuts that the wheels didn’t get. As a result, with one pass it’s ready for the next harvest”.

Trevor Martin’s combined dual head harvester and mulcher

True to form, Trevor and Barbara have been busy on further enhancements. “It’s working really well, but we just want to make it even better by doing some fine tuning. We’ve improved the pickup rate further by changing the front wheel packs to white and the back to black to reduce jamming. We’ve also added weights on the back wheel packs to keep them turning. The sweeper angle has also been reduced and brushes have been extended. This means there’s minimal disturbance to the orchard floor. Now, we are trialling different ejectors,” Trevor said.

Bundaberg Demonstration

Utopia Orchard Services demonstrated their Orchard-Rite tree shaker and AMB Rousset harvester. Manager/Director of Utopia, Nic Pitura, was on hand to give an overview of the services they offer.

The tree shaker by Orchard-Rite is a side boom machine able to have different settings programmed into it to allow it to be set up to perform shaking of macadamia trees. These settings include but are not limited to the shake time, intensity of shake and clamping pressure. Once these are set, the operator drives up to each tree, extends the boom and once the tree is clamped the machine automatically carries out the pre-set shake. This service will be available to growers in the Bundaberg region this season as a contract service with rates similar to other competitors in the market.

The Orchard-Rite tree shaker in action provided for contract services by Utopia Orchard Services

The AMB Rousset sweeper harvester was also demonstrated. This harvester uses two front-mounted sweepers to bring the nuts into a windrow and then a drum style sweeper to pick the nuts up onto a conveyor system. The conveyor system has installed a fan to remove light trash, such as grass and leaves from the product. As a contracting service, Utopia Orchard Services will be available to any grower requiring contract harvesting. For rates and availability, contact Simon Andreoli at Marquis Bundaberg on 07 4155 9377.

Conclusion

The innovation and improvements continuing to be seen in the macadamia industry indicate a bright future ahead. Marquis Macadamias would like to thank Skytech Solutions, Lance Emery and Trevor Martin for showcasing their innovations in Lismore, and Utopia Orchard Services for the tree shaker and harvester demonstrations in Bundaberg. If you would like more information on any of these demonstrations, don't hesitate to contact the Marquis Grower Services Team.

MANAGING PHYTOPHTHORA IN MACADAMIAS

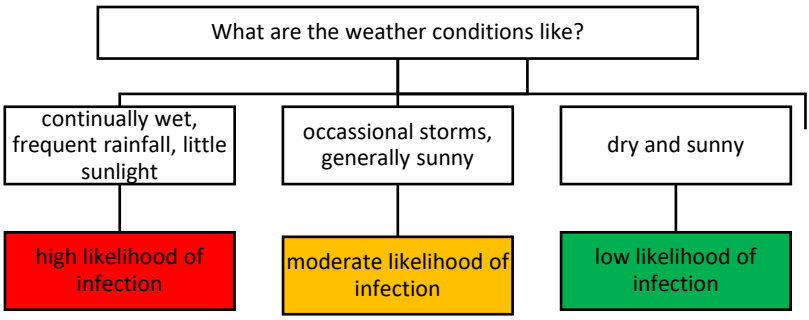
Grower Services Team

Key points

- Phytophthora decline is often a symptom of poor soil health and orchard floor conditions, including lack of topsoil, poor drainage and low organic matter levels.
- Improving soil health by adding mulches rich in organic matter to favour root growth will significantly reduce the effect of Phytophthora in orchards.
- Phosphorous acid applications, after the spring and autumn flushes have matured, can help rejuvenate affected trees.
- Purchasing high health nursery trees free from Phytophthora is critical to limit the potential impacts of Phytophthora.
- When severe symptoms of infection are apparent, it will take at least two years to bring tree health up. This makes management practices that maintain and prevent decline in tree health the best form of defence.
- Prolonged periods of wet weather favour Phytophthora infection; however, the symptoms will be expressed more strongly in dry periods as there is insufficient root mass to supply the moisture demands of the tree canopy.

Introduction

With rainfall in Northern NSW and parts of SEQ well above average for the last three months due to La Nina, conditions are favourable for Phytophthora infection. Disease infection and damage occurs during periods of prolonged rainfall, which leads to temporary waterlogging, allowing spores to swim to and infect roots. During these periods, careful attention should be paid to monitoring and treating trees that are highly susceptible to prevent infection. The below figure provides a simple guide to assess if the weather conditions are favourable to infection.



Weather conditions and Phytophthora infection likelihood

What is Phytophthora?

Phytophthora species are water moulds that thrive in cool, damp soil conditions. Phytophthora cinnamomi is the most studied species affecting macadamia; however, more than one Phytophthora species may attack macadamias.

Phytophthora is widely distributed in macadamia producing areas and although macadamias are considered tolerant of this disease, it can still cause significant crop loss. The cost to the Australian macadamia industry is estimated to be at least $20 million annually.

How does Phytophthora affect macadamia trees?

Phytophthora damages the roots, base and trunk of macadamia trees, causing a gradual tree decline. Excessive leaf drop, trunk cankers and/or sap bleeding

(gummosis), suckering on trees with trunk symptoms and root rot are common symptoms. Cankers can also progress from the trunk into the limbs. Leaves on trees can become chlorotic (yellow) and may drop. The excessive drop of leaves results in a sparse canopy.

Correctly identifying the cause of tree decline is critical to ensuring the management strategies employed will address the issue. Like roots, Phytophthora requires oxygen and does not like soils that are continually waterlogged. Tree decline in areas with extended periods of waterlogging are most likely suffering from root asphyxiation (drowning) and not Phytophthora attack. In these areas, addressing the drainage issues is critical.

Damage to root systems increases moisture stress during all crop stages. Symptoms of severe Phytophthora infection, such as excessive leaf drop, are often expressed in dry weather due to the reduced root volume, which reduces the ability of the tree to supply its water requirements.

A sparse chlorotic canopy (L), trunk cankers (M) and suckering (R) are signs of Phytophthora infection

How does Phytophthora spread in orchards?

Phytophthora produces several different spore types, which can survive a few weeks to years. Spores spread through the orchard via running water and in infested soil attach to machinery, vehicles, animals or boots.

Infection occurs through trunk wounds, damaged surface roots and healthy roots in temporarily waterlogged soils. When Phytophthora infects a host, it grows by producing microscopic threads called mycelium, which attack and destroy the roots. Excessive soil moisture levels from heavy rain events promotes Phytophthora infection and root loss. If this is followed by dry conditions, trees can struggle to replace damaged roots. Therefore, symptoms are often seen during prolonged dry weather. The mycelium can also spread from one macadamia tree to the next through intertwined roots.

How can Phytophthora be managed in macadamia orchards?

An integrated approach that uses a combination of methods is the best way to manage Phytophthora. This should focus on addressing soil and orchard floor constraints by:

- Managing waterflows in orchards to improve drainage
- Improving soil health
- Covering roots through applications of mulch, manure and compost
- Reducing root and trunk damage during orchard operations

The use of agricultural chemicals is seen as a short-term solution to help return trees to health, until soil and orchard floor constraints are addressed.

The 'snap' test is a simple diagnostic tool to assess macadamia root health and assists with determining the best treatment strategies to employ.

1. Clear a small section of grass or mulch from the soil surface under the tree canopy.
2. Push a small fork, at a slight angle, into the top few centimetres of soil and push the handle downwards.
3. The sound of multiple roots snapping indicates a healthy root system.
4. No snapping sound and few visible fine feeder roots indicates a poor root system.

The below table provides a simple way to assess the severity of the roots and canopy health, along with the most commonly used management strategies to address Phytophthora decline in orchards. Note that both cultural and chemical management strategies are important.

Disease Severity	Plant description		Management strategy	
	Roots (snap test)	**Canopy health**	**Cultural**	**Chemical**
None	Abundant feeder roots	Healthy, dark green canopy	Continue good cultural practices	None
Low	Moderate level of feeder roots	Low leaf density, little or no flush when healthy trees nearby flush	Improve cultural practices	Apply to stimulate root and shoot flushes and to protect roots until root density increases
Moderate	Low level of feeder roots	Dead branches and sparse canopy	Apply significant amounts of organic matter	Apply to stimulate root and shoot flushes and to protect roots until root density increases
High	Sparse feeder roots	Dead (sticky) tops	Apply significant amounts of organic matter	Apply to stimulate root and shoot flushes and to protect roots until root density increases

Cultural practices

1. Exclusion and sanitation

Prevention or exclusion are the best management strategies for all pests and diseases. This is difficult as few established macadamia orchard sites are free from Phytophthora. New trees should be purchased from nurseries produced under the following conditions.

- Potting mixes should be:
    - Free of soil as soil can introduce diseases like Phytophthora to potting mixes,
    - Pasteurised or composted to ensure they are pathogen free,
    - Stored off the soil to avoid contamination.
- Water from dams or tanks used in nurseries should be treated. Water from a bore of the use of 'town water' does not require treatment.
- Planted bots or bags should be on a free draining surface (e.g. gravel) or on benches.

2. Organic matter application

Phytophthora appears to be suppressed in rainforests by healthy soils with high levels of organic material. Growers can replicate this in macadamia orchards by mulching and covering exposed roots, by reprofiling interrow or with organic matter. Organic matter stimulates beneficial soil microbial activity and improves the structure and biological and chemical components of orchard soils. Animal manures in mulch mixes provide nutrients for plant and microbial growth.

Example of good organic matter coverage under macadamia trees that will assist in suppression of Phytophthora

As well as helping manage Phytophthora, organic amendments and mulching in macadamia orchards does the following:

- Improves soil structure,
- Promotes root development in oxygen rich environment,
- Increases nutrient uptake and recycling,
- Decreases evaporation from the soil, maintaining soil moisture levels during drought conditions.

Organic matter breaks down slowly and nutrients are released over time in a plant-useable form. The

residual organic matter also stimulates competitive and antagonistic micro-organisms in the soil that can compete with Phytophthora.

Gypsum reduces spore production in Phytophthora, but its use is only recommended if your soil pH is within the optimum range and you require calcium and sulphur in your soil. Gypsum also helps build soil structure, improving drainage and reducing waterlogging.

Chemical treatments

Two chemicals are registered to help manage Phytophthora. These are best used as part of a long-term protection and prevention strategy like mulching to improve soil health and ensure good orchard drainage.

**Important note: Always check the label and product information prior to use. Apply chemicals as directed by the label and follow all safety precautions. Check the APVMA website to confirm the product has a current label registration or permit* (https://apvma.gov.au/node/10831).

If the information you need is not on the label or safety data sheet (SDS), contact the reseller or manufacturer for the information. Remember that physical compatibility does not equal chemical compatibility. Ensure the appropriate personal protective equipment is worn when mixing. All products listed are correct at the time of publishing.

1. Phosphorous acid:

   Application timing is critical as phosphorous acid, commonly referred to as 'phos acid', accumulates in the part of the plant that is the most actively growing at the time of application. To effectively manage Phytophthora, phos acid must accumulate in the roots.

   Macadamia roots flush at different times to leaves, usually after a leaf flush has matured. When leaves are flushing, the bulk of the tree's nutrients are moving to these new shoots, so if phos acid is applied at this point it will accumulate in the leaves. When the flush has matured or hardened (as shown in the image below), carbohydrates and other products produced by the leaves start moving down the tree promoting a root flush. This is the best time to apply phos acid to ensure it accumulates in the roots. Phos acid does not reduce the level of Phytophthora in the soil but stimulates the plant's natural defence responses and allows root development without loss to Phytophthora.

   Phos acid can be applied as either a foliar spray or a trunk drench. Trees need to be fully hydrated for good phos acid uptake. Do not apply to trees under severe stress or during hot weather.

   It's important to note there are multiple products containing phos acid. Make sure you apply the correct rate based on the concentration of active ingredient (g/L) in the product.

- Foliar applications:

  Only use the label rates recommended for macadamias. Higher rates can cause severe leaf burning. Do not apply phos acid within two weeks of copper sprays to avoid phytotoxicity from copper burn.

Mature flush at the correct stage for phos acid applications (L), immature flush too early for phos acid application (R)

- Trunk applications:

  For successful trunk applications, a bark penetrant such as Pulse® at a rate of 2% must be added to the mixture. The solution must be continually agitated to ensure proper mixing. There is potential for gelling of solution without adequate agitation. Apply to the point of run-off to all sides of the trunk, up to 1m above soil level. Do not apply the phos acid/penetrant mixture to leaves as it will burn them.

2. Metalaxyl

   Metalaxyl, a systemic fungicide with preventative and curative effects, is registered as a soil drench to help manage Phytophthora in macadamias. Soil

organisms that break down metalaxyl build up quickly after application and reduce its efficacy, so it can only be used once or twice before it is no longer effective. Metalaxyl has a withholding period of four weeks and should not be applied during harvest.

Conclusion

Macadamia orchards are being increasingly exposed to weather extremes (severe drought, heat and flooding rains) due to climate change. These conditions will increase the susceptibility of macadamia trees to pests and diseases, such as Phytophthora cinnamomi.

An integrated approach, including improving orchard floor and drainage to reduce erosion and cover roots, better soil health through mulches and compost applications and well-timed chemical applications, should be used to effectively manage Phytophthora. For more information on Phytophthora management, reach out to our Grower Services Team.

RAT MANAGEMENT IN MACADAMIAS

Grower Services Team

Key points

- Rats can cause up to 30% crop loss when present in high numbers.
- Rats are present all year round and live in non-crop habitats, burrows or nests in trees within the orchard.
- Rats can also store nuts in their burrows to provide a year-round food source.
- Rat numbers can build rapidly making it critical to commence control when activity is found.
- Effective management involves modifying the environment to be unsuitable for rats (e.g. mown headlands), monitoring and controlling outbreaks as soon as they occur.
- Understanding rat behaviour can allow you to exploit this and gain more effective control.

Rats can cause significant damage in macadamia orchards with reports of up to 30% crop loss if left uncontrolled. The common black rat (*Rattus rattus*) is responsible for more than 95% of damage in macadamia orchards.

Exploiting rat behaviour – the key to successful control

An understanding of rat behaviour will allow you to exploit their natural traits to achieve better control. The following is a summary of critical rat behavioural traits and its importance within a control program.

Rats reach sexual maturity in under three months, have an average litter size of 10, a gestation period of 22 days and can have up to six litters a year – so numbers can build rapidly. This makes monitoring and early intervention, before numbers escalate, critical for successful control.

When nuts are available, rats will feed within the orchard and may move nuts to habitats outside of the orchard to ensure a year-round food supply. This makes off-season control and eradication from orchards critical.

Rats are agile, active climbers. When there is a continuous food source, they may nest within trees or in burrows in the orchard all year round as they don't need to forage as much in habitats outside of the orchard. Removing food sources through regular harvest intervals and conducting an end of season orchard clean-up is critical.

Rats are nocturnal animals that feed at night. During the day, they rest within burrows or nests. This means fumigating burrows during the day will ensure they are within the burrow network and produce best results.

Rats fear predation – they do not like moving across large open spaces and prefer dense, thick habitat that provides protection from predation.

Rats are shy of new food sources. They have good hearing and a strong sense of smell. When introducing new baits, it is best to use a non-baited food source to encourage feeding and then switch to a baited food source. Keeping bait fresh and improving its attractiveness when other food sources like nuts are

plentiful will encourage them to switch to a new food source like baits.

Managing rats

The most effective long-term strategy to manage rats is to integrate mortality approaches with cultural management practices. A key aspect of this approach is to make the environment less favourable for rats and monitor for activity, intervening as soon as activity is detected.

Mortality-based approaches have traditionally been used to reduce rat numbers in macadamia orchards, including baiting, burrow fumigation and trapping to kill rodents. Relying solely on these approaches may provide only limited control.

Cultural management practices include modifying the habitat to make it less attractive to rats, resource management to limit the presence of food sources in the off-season and burrow management. It has been found that maintaining mown headlands at least 10m wide and not leaving nuts on the orchard floor at the end of the harvest season are critical aspects of cultural management.

Monitoring

Monitoring for rat activity, looking for nests, burrows or rat eaten nuts, should be incorporated into routine orchard management activities. Bait stations should be checked every 7-14 days, with more frequent checks when rat activity levels are higher. Rat damage is often focused on the orchard edge and, like many pests, occurs in hotspots. Monitoring the perimeters of an orchard is a critical aspect of an effective monitoring program.

Habitat modification

Riparian zones, headlands, property boundaries and windbreaks adjacent to orchards are common rat habitats. The weedy non-crop vegetation, particularly long grass, provide food, refuge and nesting resources. Rats are shy animals wary of predation and they prefer dense habitats, such as lantana infested land. Management of habitats to reduce dense vegetation that provides good cover can significantly reduce rat pressure in the orchard.

Weedy headlands and property boundaries provide a good rat habitat

A clear headland of 10m+ is recommended to reduce rat movements from areas outside of the orchard into the orchard. Slashing and clearing areas like headlands will provide an area where rats do not like to be as they are highly susceptible to predation from animals like birds of prey.

Skirting trees is another habitat modification strategy. It creates clear space on the orchard floor for predator access and reduces areas for rats to hide. In addition to skirting, placing guards that rats can't climb around the trunks of trees will also limit the rat's ability to access the canopy.

Interrow plantings may harbour pests like rats; however, studies have shown that monitoring and targeted management of areas where the rats are found can effectively mitigate this issue. This combined with general maintenance to limit food resources like grass seed, and allowing access for predators such as owls, is recommended if you have interrow plantings.

If revegetating an area, try to create an area that is unfavourable to rats by selecting plant species not known to harbour or provide out-of-season food for rats. Also, consider providing an environment for rat predators to nest like perching points and nesting boxes.

Resource management

Nuts are the primary resource for rats in the orchard. Orchards should be harvested regularly to minimise nuts on the ground. Tools like ethephon and tree shakers can reduce sticktight nuts in orchards and therefore food resources. Cleaning up the orchard floor by mulching any fallen nuts as soon as possible after the last harvest will also reduce food resources.

Thinner shelled macadamia varieties like 816 and A4 are more attractive to rats and will often lead to higher levels of damage. Blocks that contain these varieties should be monitored more frequently and control methods like baiting should be focused here to limit rat migration into the rest of the orchard.

Baiting

Monitoring rat activity will help you devise the most effective baiting strategy. Like other pests, rat damage often occurs in hot spots. Farm management apps are a good way for growers to map these hot spots and implement a baiting program. Avenza Maps is a system used by several growers. Avenza can have a base map uploaded and allows multiple users to access the maps and record information by location. Commonly, growers have used a tree location map provided by GIS mapping services as part of a drainage management plan as the base map.

Rats are shy feeders on new food sources. When starting your baiting program, introduce baits made without a rodenticide initially, and then once feeding starts introduce a rodenticide to encourage rats to feed on baits resulting in a higher mortality, compared to starting your baiting program with a rodenticide. Continual feeding on baits indicates there is something wrong with the program.

Baiting can be used for not only control but also for monitoring. Placing bait stations strategically around the orchard to monitor for rat activity and then concentrating additional bait stations in areas of high activity can improve the effectiveness of control strategies. Concentrating bait stations in areas of high activity is important to produce effective control in response to spikes in rat numbers.

Rats have a strongly developed sense of smell and having baits that are enticing to rats is critical for success, especially when food sources (such as nuts) are plentiful. Changing baits every two weeks, removing rat droppings from stations, and adding linseed oil to a bait mix are all ways to encourage feeding and give your program the maximum chance of success.

In an orchard, bait stations are legally required, and you cannot throw bait into trees or on the ground. Bait stations also increase bait effectiveness and life because of the protected environment they provide. Using bait stations reduces the chance of negatively affecting non-target species like owls and dogs. Orientating your bait stations perpendicular to rows so they can be checked for the presence or absence of baits without having to get off your farm machinery will improve monitoring efficiency. Bait stations need to be kept clean and droppings and spilt bait should be removed from the station.

An example of a rat bait station used by Bob Maier in the Nambucca region. Portions of bait are added to small takeaway sauce containers to transport to the bait stations. The lid is removed, and the bait placed in position and held in place by a wire peg.

Rats feed in the trees early in the season, so bait stations should be safely secured in trees and baits safely secured within the bait stations. Once nut drop has commenced, baiting programs should continue in trees and in addition also focus on the orchard floor. Racumin® and Selontra® are currently registered for use in orchards.

Racumin® is an anticoagulant and rats must feed on the bait several times to receive a lethal dose. Often,

after a lethal dose has been ingested, the rats continue to feed on this bait. As a result, the biggest and most dominant rats continue to feed, and less dominant rats do not ingest a lethal dose. Continuing to place Racumin® baits out until feeding stops is critical for success.

Selontra® rat bait is a form of vitamin D3. Once a lethal dose of Selontra® has been consumed, the rats will stop feeding on both the Selontra® baits and also other non-bait food sources. This means less-dominant rats feed on the bait sooner and less Selontra® bait will be taken than with Racumin® bait. This is not an indication that Selontra® is not working, it is just a function of the active ingredient.

Rat bait mixture of Racumin® and reject macadamia nuts

*<u>*Important note:</u> Read the Racumin® label, and use appropriate PPE, including gloves and a respirator when preparing, mixing and using agricultural chemicals.*

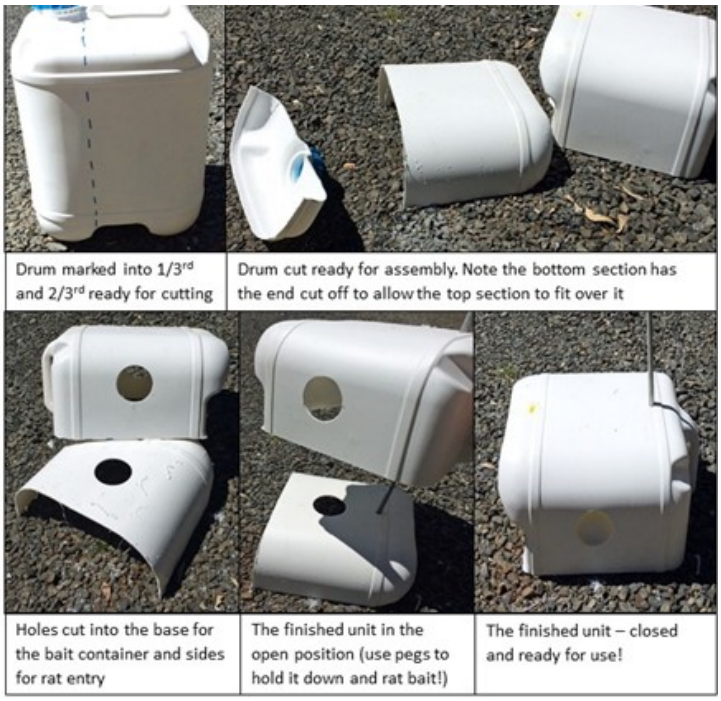
Always check the label and product information prior to use and strictly comply with all label conditions and directions. If the information you need is not on the label, either contact the reseller or manufacturer for information. Ensure only registered and permitted products are used.

1. To make 1kg of bait, mix 900g of bait nut with 50mL of linseed oil and 50g of Racumin® paste in a container with a lid. Securely close the lid and shake to mix.
2. Add mixture to bait stations as per label instructions. Replace baits every two weeks as nuts will go rancid, making the bait less attractive.

**An example of a rat bait station for use on the orchard floor made from old, triple-rinsed chemical drums developed by Eureka Macadamia Management*

Burrow management

If possible, rats should be eradicated from burrows before burrows are filled or ripped. Eradication can be undertaken through fumigation with carbon monoxide, trapping or baiting.



Carbon monoxide is a humane way to euthanise rats within a burrow network. Using a small engine powered machine, such as a Cheetah, has been found by growers to be effective in eradicating rats from burrows in orchards. Cheetah fumigation devices are available for purchase from Marquis Macadamias.

Phil Bevan using a Cheetah for rat control [Image source: NSW DPI]

The removal of rat burrows within orchards is an effective way to remove the resident population of rats within an orchard and means you can concentrate your management program on the orchard perimeter and limit incursions into the orchard.

Nest control

The removal of rat nests from within trees is akin to burrow management. The most effective way is to remove the nests by pulling them from trees. Although slow and difficult, removing nesting from trees and baiting is the best form of gaining control.

Other management tools

Tree guards that prevent rats from climbing trees is an alternative option. Grower Rick Paine at Alstonville has used these successfully to stop rats climbing into the trees and nesting. Plastic, hall carpet protector is stapled to trees using a hammer tacker (stapler) and stainless-steel staples. Aluminium caps are also placed over star pickets to stop rats climbing irrigation lines.

Plastic tree guards on Rick Paine's farm stop rats climbing trees

Summary

As with most orchard pests, an integrated approach is required for the successful management of rats in macadamia orchards. Reducing orchard and non-orchard habitat suitability, harvesting regularly, mulching old nut at the end of harvest and monitoring damage to apply control measures before numbers build, will all help to control rats in orchards.

ENROLL NOW: MACADAMIA PRODUCTION COURSE

22 June – 18 August

Marquis is pleased to announce that with the easing of COVID-19 restrictions, we will once again be able to run the Macadamia Production Course in conjunction with Alan Coates. Over the years, there has been positive feedback from all participants in the course, and we look forward to facilitating it again as we believe it is extremely valuable for our growers and industry to have a course of this calibre available.

The course will cover all aspects of macadamia production – from selecting a site and planting it out, right through to managing older orchards. As all of you have your farm work to complete, we have split the sessions up to minimise the impacts upon farm operations. This will also make it possible to have field visits that cover most aspects of macadamia production – harvesting, dehusking, flowering and nutset, early nut development and major orchard works, such as soil profiling and pruning.

This year the course will comprise of:

- Six sessions held as three blocks (two days each with each block a month apart).
- Each day will be a blend of theory and practical with all sessions being held on Tuesdays and Wednesdays.
- Classes will commence at 8:30am and finish at 4pm. Each session will typically be a morning of theory and an afternoon of practical in the field. The class dates and topics are listed below. Please note the order of topics might change depending upon the weather.

This course is being offered by Marquis at a cost of $200 (incl GST) per person. This is a significantly discounted price, and the fee covers the cost of lunches and transport to and from farms in the afternoon.

As places are limited to 25 people per course, we ask that you contact Jodie at Marquis Lismore reception via phone 02 6624 3900 or reception@marquis.com to sign up. If there is sufficient demand, a second course will be arranged.

This course is offered to all growers in the industry, not just Marquis suppliers. If you know a grower who might like to do the course, please let them know.

2021 Course Dates:

Session 1

- 22/06/2021 – Course outline, industry background and progress, tree characteristics, varieties, site selection, orchard design
- 23/06/2021 – Nut quality, nut maturity, nut harvesting, storage and processing, marketing, kernel recovery determination

Session 2

- 20/07/2021 – Pest and disease management, sprayer set up and coverage
- 21/07/2021 – Young tree establishment, management and pruning

Session 3

- 17/08/2021 – Tree nutrition, soil health and fertiliser programs
- 18/08/2021 – Orchard floor, erosion and canopy management, older orchard management

FOR SALE

MULCHER

Italian Berti TFB "M" Series 220 heavy duty mulcher with PTO shaft (*tractor not included)

Height adjustable roller with scraper, double-walled, collecting rakes, counter blades, free-wheeling gearbox. Rear-mount, 540RPM gearbox. For tractors 70-150HP.

Manoeuvrable 2.2m width, 980Kg

Price: $11,000 (incl GST) *negotiable

Location: Lismore NSW

Contact: David 0418 474 411

HARVESTER

Carraro Harvester (*tractor not included)

Harvester parts designed for a Carraro tractor, includes a 3.9m head, 20-wheel packs, auger and tipping bin. Bolts, frames and some hydraulic lines also included.

Price: POA

Location: Lismore NSW

Contact: Luke 0437 287 526