

# Lessons from the drought for macadamia growers

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The NSW north coast has a large proportion of the countries' macadamia farms. It is normally lush, green and beautiful, but during 2019, it turned brown, dry and smoky. With very limited rainfall, dams were getting low and fires were burning almost everywhere.

This scenario continued for months, not just days, leaving growers anxious about the fires yet somewhat helpless as well because most of the everyday macadamia activities, such as spreading mulch and applying nutrition, rely on having moisture in the soil, which was not there.

The prolonged drought and intense fire season provided us with a good opportunity to work out strategies to enhance the resilience of our macadamia trees to give them a better chance of surviving a drought. These strategies can be applied not just whilst enduring drought, but before drought conditions set in.

Most of this information has come directly from growers who experienced these conditions. Interestingly, one of the main outcomes is that it is not the drought stress that kills the trees, but rather, the more serious secondary pest and disease infestations in the following years.

Hopefully, by implementing some of these strategies, you will be able to make your farm more resilient for the next drought and more 'climate-ready'.

## Retaining soil moisture

### Grass

Depending on the time of year, keeping the grass in the inter-rows longer by mowing less frequently will help with moisture retention. For instance, during spring and summer (September–January) leaving the grass long can be beneficial by reducing evaporation.

However, after January when the orchard floor is being prepared for harvest, it is better to reduce the grass height to help with harvest operations yet still maintain adequate soil moisture. One of the concerns growers had with this was that the longer grass would be a corridor for rats. However, by implementing an 'alternate row mowing' system whereby growers would mow a row and leave a row (Figure 1), 'rat highways' were prevented from establishing.



Figure 1. A tree-to-tree alternate row mowing system. Photo: Paul O'Connor.

### Mulch

Mulching is excellent for retaining soil moisture and is most effective when it is at least 10 cm deep, especially around the trees. Regularly re-applying mulch to keep this thickness provides the best results.

Applying mulch to dry, bare soil will not assist with retaining moisture. If you are fortunate enough to have irrigation or a system for delivering moisture to the soil, then this could be used to break down the mulch and assist in further retaining moisture.

As well as moisture retention, mulch also builds soil organic matter and cation exchange capacity (CEC). Organic matter causes soils to clump and form aggregates, which improves soil structure, while the CEC influences how the soil retains essential nutrients and provides a buffer against soil acidification.

A 1% increase in soil organic carbon (SOC) equates to about a 2% increase in water holding capacity. Therefore, soil with a water holding capacity of 200 mm will hold an additional 4 mm of water, although this assumes the increase in SOC is consistent for the profile of interest (Edwards 2019).

An increase in SOC is especially important during dry spells such as the dry springs which have been occurring lately. While these dry spells are not classed as drought, they effectively call on moisture resources for the plant to provide energy for cell structure development, i.e. nut sizing. This additional water holding capacity will allow the plant more resilience in these extended dry times.

Additionally, run-off and erosion are minimised when the soils are protected by mulch compared to being left bare. Therefore, applying mulch should be a routine practice (Figure 2).



Figure 2. Applying mulch in macadamia orchards should be a routine practice.

### The inter-row

Macadamia tree roots extend into the inter-row (Figure 3) so it is important to build up the organic matter in this area. An easy way to do this is to leave any organic material out in the inter-row instead of broom-sweeping it back

in under the tree, then regularly bring in more mulch or compost to place under the tree. If this mulching is done early enough, the fine roots will grow up into the previously spread mulch and hold it firmly in place.

For orchard floor clean up just before harvest, it may be necessary to sweep any material that may compromise harvest efficiency in under the tree. It might seem like a bit of a balancing act between keeping sufficient mulch in the right areas but at the same time not hindering harvest.



Figure 3. Macadamia tree roots extend into the inter-row so it is important to build up the organic matter in this area.

### Managing phytophthora

According to Dr Femi Akinsanmi, Associate Professor at the Centre for Horticultural Science at the University of Queensland, one of the core principles that should be entrenched in standard orchard practice is that of 'good soil health equals good tree health'. Dr Femi has written many great articles for us over the years and has mentioned numerous times that growers and industry should be concentrating their efforts on building organic

matter within the soil. This provides the trees with more resistance and resilience to phytophthora and ultimately builds orchard resilience for the next dry period or drought.

**“good soil health equals good tree health”**

To determine the strength of your soil and thus tree root structure, you can conduct a simple ‘snap test’. This involves pushing a shovel into the soil and if the soil does not ‘snap’ with the shovel entering it (the ‘snap’ being the breaking of fresh roots), this could indicate insufficient root structure in the soil. These are the roots that need to get the moisture from the soil, and if they are not structurally sound, then it is highly likely that the trees will probably go into decline relatively quickly when put under severe moisture stress. This snap test (Figure 4) can also be used to determine whether the root structure is sufficiently robust to resist pathogens such as phytophthora.



Figure 4. Dr Femi Akinsanmi explaining the snap test.

### Pruning

Macadamia trees are usually pruned as part of normal orchard maintenance (Figure 5). However, the trees should not be pruned when they are stressed, including during dry periods as the trees will be water-stressed. The exception to this is if you need to prune out dead or diseased limbs to prevent further

disease spread (Figure 6). Commonly these limbs will harbour bark beetles (Scolytidae beetles) and possibly *Botryosphaeria*, so you should ensure dead and dying branches are cleaned out annually.

Pruning for rejuvenation should not be done when there is limited moisture availability because the tree will not be able to support new flush. It is better to have an effective pruning program that builds resilience and provides a good structure to help the trees withstand stresses such as drought.



Figure 5. Macadamia trees that have not been pruned, showing dead and dying branches that need removing.



Figure 6. Dead wood can be taken out in dry times.

## Nutrition

During drought, and especially when there is no irrigation, it is often not practical to apply fertiliser to the ground. Unfortunately, the nutrition program will need to be stalled during this time.

Growers with irrigation should consider reducing their nutrient application so they can still supply adequate nutrition to support nut production but not enough to encourage new flush as this will create a competitive pull for resources from the flower and developing nut.

Another problem that can arise from prolonged fertiliser application without irrigation or rainfall is that the level of salts in the soil can build up because they are not flushed through the soil. These excessive salts can contribute to root burn and potential disease.

## New plantings

When planting new trees in 'normal' conditions, ensure that the soil is of reasonable depth and has sufficient organic matter to give the trees the best possible chance.

Planting new young trees should be delayed where drought is probable. On many occasions during this current drought we have seen some very quick tree decline. Further investigation revealed that most of the trees were planted on very shallow soil with underlying rock shelves (Figure 7). This meant that the plants were struggling to find adequate moisture to support themselves. Once the soil moisture was depleted, the trees shut down, making them susceptible to bark beetles, which attacked the trees and quickly put them into decline.

## Summary

The extreme conditions experienced over the last few years have revealed the macadamia industry to be remarkably resilient. The important lessons presented here from growers, consultants, researchers and NSW DPI staff will hopefully help the industry to prepare their orchards to be more resilient to drought, or perhaps even become 'climate-ready'.



Figure 7. Trees originally planted on shallow rock shelf suffered from water stress during drought.

## Reference

Edwards T. 2019. Soil organic matter - frequently asked questions (FAQs). Department of Primary Industries and Regional Development, Western Australia. Available at <https://www.agric.wa.gov.au/soil-carbon/soil-organic-matter-frequently-asked-questions-faqs>

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