AMS Information Sheet

HARVEST STRATEGY QUICK TIPS & GROWER EXPERIENCES

AUSTRALIAN MACADAMIA SOCIETY

INTRODUCTION

The AMS has compiled the following tips for different aspects of the harvest process. In addition, grower comments, ideas and experiences from the December 2016 MacGroups were captured and incorporated into this information sheet.

Please read this document in conjunction with the AMS Information Sheet 'Harvest Strategy'. You can also visit the AMS website australian-macadamias.org/industry for links to a range of macSmart and NSW DPI harvesting focussed video case studies showing the modifications that growers have made to their harvesters and harvesting systems.

1. Orchard set up and maintenance for harvest season

Quick tips:

- Implement an IOM program and make sure you cover any exposed roots prior to the harvest season, in line with the IOM principles.
  - Exposed roots drastically reduce harvest efficiency and increase harvest repairs and maintenance costs.
- Due to the waxy layer on macadamia leaves they do not break down readily until they have been cut. It is recommended to mulch and/or mow leaves regularly to prevent leaves causing excessive jam-ups.
- The orchard floor needs to be harvest ready during the harvest season.
  - This may involve extensive and ongoing mowing during and just prior to the harvest season and directly after a harvest round.
- Ensure you have suitable machinery access.
  - Remove limbs that may obstruct access, ensure there is adequate turning room on headlands and prevent excess build-up of organic matter in the interrow area where machine wheels operate.
  - This applies to all machinery entering your orchard, whether it is your machine or a contractor machine.
- Set your orchard up for wet weather access where possible.
  - Where possible increase light onto the orchard floor in wet areas to aid in drying the orchard floor after a rain event and to help grass to grow. This will also aid in machinery traction and early machine entry after a wet weather event.
- Monitor the maturity of fallen nuts to guage when to start the harvest season. Send samples to your processor to assess maturity.

Grower comments and ideas:

"Orchard floor preparation is the key to it all. Good orchard floor conditions improves harvest efficiency beyond belief."

"I make sure I keep the grass down low during harvest season. If it gets too high I can't pick up all of the nut. I like to keep it under 50mm high throughout the harvest season. (Bundaberg grower)."

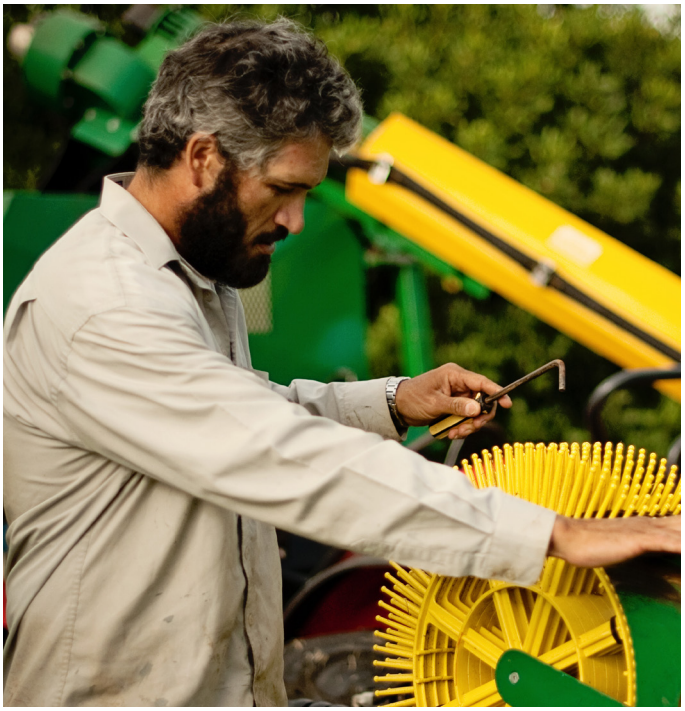
"I make sure we don't let a ridge build up on the orchard floor. It can easily happen under the trees where the grass starts to grow (on the edge of the spray line). We do a light profile during the harvest season if needed to make sure we have a smooth and uniform orchard floor." (Bundaberg grower)

"We want grass on our orchard floor, but it is frustrating during harvest time. To help get the grass down as low as possible we use "Y" shaped scarifying blades on our mulcher. These blades meant we could get the grass down very low without killing it (as the scarifying blades left strips of grass un-mulched, whereas the standard "T" shaped hammer blades mulch the entire area). We found this really helped with harvesting especially from sweet smother grass."

2. Harvester set up and maintenance

Quick tips:

- Ensure there are no bent, worn or missing finger wheels. If in doubt, replace them with new ones.
- Ensure the pickup fingers on sweeper styled harvesters are not bent, worn or missing. If in doubt, replace them with new ones.
- Wheel frames need to be straight and mounted correctly. Incorrect installation will result in poor harvest efficiency, even with new finger wheels.
- Finger wheel axles and bushes need to be firm and not worn. If in doubt, replace them with new ones.
- Ejector fingers need to be straight, not worn, and maintain correct positioning to eject into the auger whilst in the orchard (through undulating conditions). If in doubt, replace them with new and/or more suitable ones.
- Wheel pack assembly MUST be correctly installed. Incorrect installation will result in poor harvest efficiency even with new finger wheels.



Regularly inspect harvest machinery for damage and wear.

Grower comments and ideas:

"I didn't realise how big a difference good quality finger wheels made. The demonstration during the MacGroup was incredible. I have had the same finger wheels on my harvester for the past three seasons. I am going to go get some new ones this season!"

"I am anal about my finger wheels, I want them to be in perfect condition. If they are bent, worn or broken I will replace them. I often go through a couple of sets in a single season. It is a great investment in my opinion. The increased pick up efficiency with high quality finger wheels meant we could do one less harvesting pass per round. Across my orchards I worked out that labour saving alone by doing one less pass covered the cost of the finger wheels. It is a no brainer."

"We use a hot water bath to straighten wheel packs. It is the first job of the day. We cut a 44 gallon drum in half, lay it horizontal, fill it with hot water and then set up a make shift axle that we connect the finger wheel packs on. We can then spin them through the hot water, get consistent heat through them and straighten any bent ones. It helps to get that little bit extra life out of the wheels."

"If I spot a bent finger wheel during the day while I am harvesting I stop, heat it up with a little heat gun and then straighten them using a little piece of pipe. It takes a little time, and a bit of experience to know when to stop heating them (so you don't melt them) but it is well worth it."

"We put firm compound finger wheel packs in the middle of our head to help improve pick up out of the grassed interrow, and we put softer compound finger wheel packs on the side of the harvester head that runs under the tree row. As we still have some exposed roots and we found the softer compound wheels handle those conditions much better."

"We fitted some diving weights to our wheel frames to improve harvesting from grass, it helped but it added a lot of weight to the head. We now use elastic straps to get the same downward pressure on the wheels with hardly any increase in weight on the head. It makes it so much easier for my small tractor, and that extra downward pressure really helps harvest out of grass."

"We incorporated a little glide plate at the end of the cross auger, to avoid cracking nuts during that transition from the cross auger to lift auger."

"We modified our ejector fingers to make sure we had really good ejection in both light and heavy nut drop conditions. We made the ejector fingers longer with less of an angle to help eject nuts in heavy nut drop conditions."

3. Sweeper and blower set up and maintenance

Quick tips:

- Worn brushes and brush covers on sweepers should be replaced or rotated.
- Sweeper angle, tilt and height needs to be set up for minimal floor disturbance and optimum nut movement.
  - *The correct set up will likely vary from orchard to orchard, block to block and potentially row to row. Having an adjustable sweeper arm is very beneficial.*
- If the sweeper has variable speed, it should be set to suit crop load, orchard floor conditions and harvester speed.
- Blower discharge shoot should not be bent or damaged.
  - *It is beneficial for the blower discharge to be pointed slightly forward, to aid in nut movement.*
- Blower angle and position (if adjustable) should be set for crop load, orchard floor conditions and harvester speed.

Grower comments and ideas:

"We set our blower up pointing slightly forward, maybe somewhere around 45 degrees from front of the harvester. We find this helps to get the nuts out from the back side of the tree."

"We are pedantic about our blower set up. We make sure we check it a couple of times a day, checking for any damage or obstructions. We set it down low to the ground and try to get the air to blow across the orchard floor (horizontal blowing) and move nuts with minimal soil disturbance."

"I set up my sweeper so that it can run both directions. This helped to make it easy to adjust sweep direction to the slope of the orchard. (AMS comment: Many growers stated that a simple and low cost method of reversing the sweeper is to swap hoses on the hydraulic motor on the sweeper. The AMS recommends growers talk to the manufacturer of their harvester before making any major changes)."

"I set my harvester up to have two sweepers, one on either side of the head. That way I could choose which side to sweep depending on nut drop, orchard slope and conditions on the day."

(Sweeping in grass) "I put a bicycle tyre over the top of sweeper arms. I find this helps to avoid the sweeper wanting to wrap itself around a tree if I get a little too close to a tree and it helps to make the sweeping brushes more upright which results in a more aggressive sweep. We have found that aggressive sweep helps move nuts in grass."

(Sweeping in mulch and dirt) "I set my sweeper up to make sure it lays very flat on the floor. This enables the majority of the sweeper to be touching the floor, and run at a low speed. It means that I can roll the nuts across the orchard floor without disturbing the dirt or mulch."

4. Dehusker set up and maintenance

Quick tips:

- Dehusker cage and auger should not be bent or worn. If in doubt, replace them with new ones.
- Dehusker set up should be for current seasons nut size and varieties harvested.
  - *Rubber spaces need regular monitoring for wear. If in doubt, replace them with suitable ones for current nut sizes.*
  - *If multiple varieties (and multiple nut sizes) are being harvested together, set dehusker to avoid cracking nuts.*
- Auger cages should not be bent or worn. If in doubt, replace them with new ones.
- Consistently monitor for cracked nuts coming out of the dehusker, and modify promptly if needed.

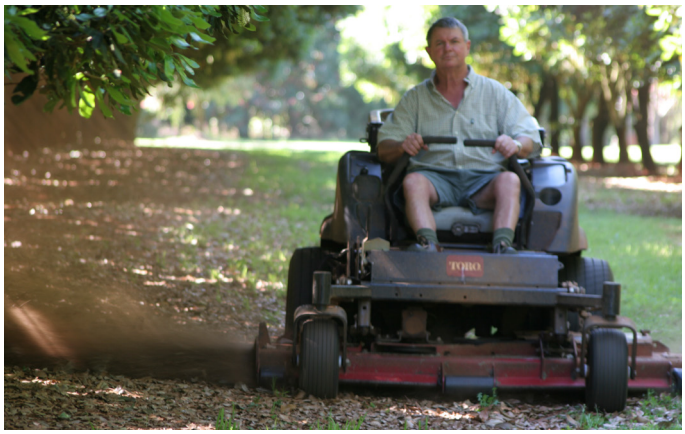
Grower comments and ideas:

"We try to dehusk only 50-60% of the nuts in the field. If we chase any more than that we usually end up cracking good nuts. Especially with the spread of varieties and nut sizes we have on our orchard. We get the remaining 40-50% of the nuts dehusked back at the shed. It is amazing how that little head start (of 50-60% dehusk) in the field makes it so much easier in the shed."

5.Harvester operation

Quick tips:

- Harvest speed needs to suit crop load and orchard conditions.
  - *Too slow a speed can be more inefficient than going too fast. A slow speed tends to cause jam ups and excessive damage to the orchard floor.*
  - *Indicators of the correct speed are:*
    1. *Minimal finger wheel blockages*
    2. *Minimal crop left behind*
    3. *Augers not at full capacity.*
- Harvest width should match crop load and machine capacity at optimum speed.
  - It is preferable to reduce harvest width whilst operating at optimum harvest speed during heavy crop load harvesting, instead of maintaining full width at a low speed.
- Single pass harvesting is more suitable in wet weather conditions, enabling bulk pick up across the majority of the orchard with minimal orchard disturbance.
  - *Single pass harvesting can also be beneficial in the lead up to wet weather, to enable bulk pick up.*



- For orchards with grass on the orchard floor and/or leaf drop, the crop harvested in a single period should not exceed mowing capacity.
  - *Don't harvest more than you can mow in the required period. Mowing directly after harvesting makes the next harvest round more efficient.*
- Early morning dew reduces harvest efficiency dramatically. Ideal conditions are when the orchard floor and nuts are dry. Mid-morning through to early evening may be more suitable harvest timings. (Ensure you operate within your local council's sound restrictions).
- Crop harvested needs to be complimentary to your transport and storage systems.
  - *Try to unload the harvester at the end of rows (even if not full) to avoid backtracking or driving over nut in the case of the harvester bin filling half way down a row.*
- *- In dry weather conditions avoid harvesting more than your transport and storage capacity, as it will increase the risk of nuts deteriorating. Dry or ideal conditions may warrant shorter on-farm logistical timeframes, to enable the harvester to continue to harvest. (In ideal conditions, it may be beneficial to send nuts to your processor as quickly as possible – provided you have communicated this with your processor and they have capacity to receive them).*

- Develop strategies to avoid excess foreign material from entering the sorting shed (sticks, rocks, snakes etc). A range of options are currently being employed across the industry, in both the field and at the receival part of the sorting shed including: shaker tables, trash belts, mesh in hoppers and hopper modifications.
- On orchards with heavy grass cover, it is beneficial to utilise a machine to assist in flicking nuts up and out of the grass between harvest passes. Machinery currently used across the industry includes: a sweeper (road sweeper or modified harvest sweeper), dragging mesh across the orchard floor and/or harrows that are turned upside down.

Grower comments and ideas:

"We want to pick up every nut we grow. I hate leaving crop behind."

*"I spray the finger wheels and the wheel frames with a lubricant when harvesting. This helps to make sure the wheels move easily and it helps to avoid the wheels from jamming (*growers stated they used a range of lubricants ranging from; Lanox, vegetable oil and WD40). We continue to lubricate them all day during operation."*

"We spray the finger wheels with a lubricant first thing in the morning. We find this helps to warm the machine up and get it picking efficiently as quickly as possible."

"Every orchard and set of machinery has a sweet spot. It is basically the point at which a whole range of harvesting aspects compliment each other. Basically it is when the amount of crop on the ground can be easily and efficiently harvested by the harvester, that harvested crop can be easily and efficiently transported across the orchard where it can then be easily and efficiently dehusked and sorted, where it can then finally be sent off to the processor. No bottlenecks, and the entire system working together, that is the sweet spot. We found the sweet spot changes depending on the harvester and the orchard, but we also found that every orchard and every harvester has a sweet spot. It is just a case of searching for it."

"We start our harvesting round before we think we need to, because nuts keep falling as you are harvesting and when you reach the end of the harvest round there are always more nuts on the ground than at the start of the round. We always start before we think we need to, to make sure we operate in that sweet spot throughout the entire harvest round."

"We use both finger wheel harvesters and sweeper harvesters. We find that the machines have different ideal conditions, or sweet spots. If we have heavy leaf drop and/or excessive grass growth we send out the sweeper styled harvester. But if we have ideal conditions we will send out the finger wheel harvester. It is a case of assessing the conditions and making a decision on which machine will give us the greatest efficiency."

"When harvesting in grass, we harvest in both directions. Our first pass may be down the row, and then we turn around and drive across the same part of the orchard in the opposite direction. We found it helps to get nuts out from under blades of grass that may have been laid over in the first pass."

"On a part of our orchard we cross harvest. Where the skirt is high enough, we drive through the tree rows with the small harvester we have. We find it helps to pick that extra little bit of nut that we couldn't get by going up or down the rows."

*"At the end of the season I could still feel nuts on the orchard floor but my harvesters could not get them, it really bugged me. So I pulled the road broom out and ran it across the orchard. This helped to flick the nuts up out of the grass. I ran a sweeper styled harvester across the orchard and picked up another 4 tonne! (*or approx 200kg/ha). The road broom paid for itself right there and then."*

"We make sure that we travel at a higher speed (7-9km/hr) to make sure we have minimal finger wheel jams. If it's a heavy nut drop, or we've been delayed by rain, we take half or 2/3 of a head width to make sure the cross auger can handle the load at the same speed. We've found it to be much more efficient operating at a consistent high speed and avoiding finger wheel jams."

"I sweep with the slope of the land, not necessarily into the harvester head. If the harvester is on the top side of the slope, I reverse my sweeper to sweep the nuts down the hill into the next row. It is so much easier working with gravity rather than against it!"

"We recently bought our orchard and it has exposed roots. We'll fix them over time but it was a challenge this last harvest season. We finished our first harvest a few months ago, as we found the harvester wasn't picking up anymore nuts. The exposed roots and leaf drop caused all sorts of issues for the harvester. We knew there was still nut on the ground, so my wife and I spent 2 weeks doing some hand harvesting, using the little nut cylinders (cylinders on the end of a wooden handle, the length of a broom – www.nutharvester.com.au). We picked up another 2 tonne of NIS in those 2 weeks, over $10,000 in 2 weeks!"

"When we purchased our orchard it came with a big cumbersome harvester. It was so frustrating to use, conditions had to be just right for it to work. After a few years we decided to buy a smaller finger wheel harvester, and it has made life much more enjoyable. We can get out into the orchard quicker after rain, we can get closer to the trees where the nuts are, we have less wheels jamming and it much easier to operate. I reckon we pick up more nuts with it too."

"Our harvester used to have a big 4m head on it. It was cumbersome and frustrating to use. We have since cut it down to a 2.8m head and it is a completely different machine to use. Even though it is thinner, we find it is actually more efficient across the harvest season."

6. Logistics and communication

Quick tips:

- Regular communication throughout your supply chain is crucial. Communicate regularly with your:
  - *Processor (are they aware of the volumes and timing of your deliveries to the factory?)*
  - *Transporters (are they aware of the volumes and timing of your deliveries to the factory? Have you made any minor changes?)*
  - *Contractors (eg.contract harvesters/dehuskers).*
- Identify the bottlenecks in your system and develop at least two solutions/options for each bottleneck.
  - *Whatever stops your harvester when you don't want it to stop is a bottleneck.*
  - *Having two ready to act upon options provides immediate plans of action in the event of a bottleneck occurring.*
  - *Machinery will always break down at some stage during a harvest season, you need a 'fall back' plan.*
- Develop a harvest strategy plan that is proactive and flexible. It's better to adjust a plan then to have no plan at all.
  - *Something will always go wrong during the harvest season, having a flexible and proactive plan will place you in a strong position when the inevitable occurs.*

Grower comments and ideas:

"We figured out we were spending way too much time driving the harvester around the orchard to drop off harvested nut. We tried using tractors and trailers but this often resulted in unskilled drivers jack knifing them when trying to back into hopper, and at best they were only driving approx 5-10km/hr through the orchard. For approx $3,000 we bought and fitted a tipping body for our 4wd utes. It has really opened up a bottleneck. They can meet the harvester anywhere in the orchard to collect harvested nut, they can drive through the orchard at 15-20km/hr and anyone can back them into the hopper. They were a great investment."

Further information:

For more information on this topic, contact the Macadamia Industry Productivity Development Manager Robbie Commens and/or your harvest consultant.

This information has been compiled by the Australian Macadamia Society as part of the industry innovation and adoption program 'MC15004' and the industry communications project 'MC15003' which have been funded by Horticulture Innovation Australia Limited using the macadamia industry levy and funds from the Australian Government.

Horticulture Innovation Australia

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