

Horticulture Innovation Australia

Final Report

Development and publication of the macadamia industry “Integrated Orchard Management” Booklet

Jeremy Bright
NSW Dept of Primary Industries

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MC14007

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Tel: (02) 8295 2300
Fax: (02) 8295 2399

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Summary

The Macadamia Industry benchmarking project (MC15005) has indicated that industry average nut in shell (NIS) production at 10% moisture is around 2.8T/ha, however this figure fluctuates dramatically between farms and within regions. The top 25% of growers in the benchmarking report produce around 4.5T / ha NIS 10% while the bottom 25% produce a mere 1.2T/ha. This significant variation became a driving force for industry to attempt to gather information to develop consistent production across the board.

In 2014 the Australian Macadamia Society (AMS) commissioned a study tour to visit farms that consistently over time fell within the top 25% bracket. Learnings from these farms would then be reported to industry. It was thought that an understanding of what it is the good growers do would give industry the information it required to develop a stronger production base.

From this study tour the investigative committee brainstormed an intricate production model incorporating the three pillars of macadamia production being, orchard floor, canopy and drainage management.

Production decline indicators were established and categorised as “Red flags”. These Red flags would act as a grower self-assessment tool. Pillar toolkits were developed for maintaining and amending the orchard pillars that were in decline.

As a result the publications “Integrated Orchard management practice guide 2016 “ and “Integrated Orchard management case study 2016” booklets were produced.

Distribution in conjunction with field days, MacGroups, seminars and conferences were achieved.

Further to the above publications, “Integrated Orchard Management drainage 2017” booklet has been developed as a result of a lack of understanding regarding this pillar. This publication is due for release in July 2017 using current project funds.

Keywords

Integrated orchard management; macadamia, three pillars; canopy management; orchard floor management; drainage management; red flags; pillar toolkits; slope specific management;

Introduction

Traditional orchard practices of the Australian macadamia industry were looked at as separate operations within the farming system. Canopy management, orchard floor management and drainage management were seen to be tasks that required attention over time. There was an obvious disconnect between the relationship of each of these practices. At times research was alluding to the associations between these practices, for example canopy management research described “non production benefits” of canopy management through improved light to the orchard floor thus encouraging ground cover and less erosion. The benefits of ground cover to industry have only recently been highlighted through work performed by Kevin Quinlan et al in 2008, with the introduction of smother grass. Drainage management has never really been fully understood and utilised by industry as can be seen with typical steep orchard lay-out across the northern rivers and surrounding areas and the stop gap methods of attempting to prevent further soil erosion which really have just shifted the problem elsewhere within the orchard.

In November 2014, the Australian Macadamia Society (AMS) organised a study tour comprising growers, consultants, processors, government agencies and other stakeholders to visit several high producing orchards in all of the major macadamia growing regions. The purpose of the study tour was to identify orchard management practices that individual growers focused on to achieve consistently good production. From this tour, the group identified three key pillars that make up a highly productive orchard, these being:

- canopy management
- orchard floor management and
- drainage management.

As mentioned, up until now, the research conducted by the agencies, growers and consultants etc has generally addressed just one aspect of the production system, be it canopy, pest and disease control, soil management etc. The results from these research projects are generally presented as a focused outcome. The industry has tended to concentrate on specific topics within the orchard. The study tour helped to highlight the importance of all three pillars in successful orchard management, and that changes to one of these pillars will have knock on effects to the other two. Therefore, effective orchard management required a holistic approach.

The Integrated Orchard Management (IOM) guide was initially commissioned under the pretense to follow the orchard through its stages from being a new planting (stage 0) to a highly productive orchard (stage 2) to an orchard in decline (stage 3 and 4). It was not until well in to this project that we determined that it was too broad to describe the whole orchard at a specific stage. We developed the concept of describing each of the pillars at a specific stage, and that each of these pillars could be at different stages. This was key to the whole IOM principle working. It allowed for industry to be able to prioritise practices according to the urgency of the stages for each of the pillars. At a farm level this allowed the grower to prioritise his practices depending on what stage his pillars were at. As an orchard gets older, the management of each of the pillars will change too. Our focus will naturally be drawn to the most obvious and drastically changing pillar, in most cases being the orchard canopy, while the less obvious changes in the orchard floor and drainage may be overlooked. Over time the less obvious will become more obvious, and if left unattended, the decline in orchard productivity due to factors such as declining soil health, exposure of bare soil and deep channels and exposed roots will become more difficult and costly to address. It is important to avoid this situation.

Methodology

The process of developing the Integrated Orchard Management practice guide involved complete transparency with all of the stakeholders. In addition to the Project Steering Committee (PSC), the project sort comments, suggestions and inputs from over 100 key industry consultants, growers, state agencies and associated macadamia industry support networks at the annual pest consultants meeting held in Brisbane, 10th and 11th of July 2015. It was important to have them all feeling as though they had the opportunity to give input into the guide. We could not afford to have a sector disagreeing with the key principles within the guide, otherwise the uptake for industry would have been compromised. There were several occasions where opportunities were given to this group to provide feedback before the publication of version 1.

The Macadamia Integrated Orchard Management (IOM) Guide (version 1) was officially released on the 6th of July 2015 after extensive reviews from the Project Steering Committee (PSC).

Immediately after the release of Version 1, a series of training workshops were held via the network of MacGroups (MC15003). There were 6 workshops held in each of the major macadamia growing regions of Australia, being Mid North coast NSW, Northern Rivers NSW (x2), Glasshouse Mountains QLD, Gympie and Bundaberg QLD. Over 400 participants attended these workshops, representing over 50% of industry.

Mid North Coast NSW	07 July 2015
Northern Rivers	09 July 2015
Northern Rivers	11 July 2015
Northern Rivers	11 July 2015
Glasshouse	14 July 2015
Gympie	15 July 2015
Bundaberg	16 July 2015

Table 1. Dates of IOM MacGroups for each macadamia growing region.

A second print run of the guide was necessary due to the high demand for this publication. The initial print run was determined by the number of Australian macadamia growers and support bodies including processors, farm hands, rural stores etc. The 1200 copies were exhausted quite quickly and there was still further demand for more copies to be made available. The second print run of 500 copies was released in September 2015. On issuing the guide it was made quite clear to industry that this was version 1 of the guide and that everyone involved with the macadamia industry had the opportunity to provide feedback for the impending version 2 of the IOM guide due for release in July 2016.

All feedback received over this period was positive. However the editorial team of Jeremy Bright and Stephanie Alt did include further key practices that were omitted from Version 1.

Positive feedback for the IOM guide drove industry into using the terminology provided which was becoming an acceptable common language through industry. New growers were discussing their orchards in stages eg “We have a canopy at stage 3”. It became apparent that the common language sort through producing this publication was being fully accepted by industry. Example of industry feedback are included in Appendix 2.

The Case studies

Within the Horticulture Innovations Australia Ltd project proposal it was anticipated that there would be 6 case studies performed relating to the implementation of the IOM principles on farm over the 5 macadamia growing regions. These case studies would be presented in editions of the Macadamia Bulletin. Having published articles in the Macadamia Bulletin and then later attempting to track previous published article in the Bulletin years later, it was becoming clear to me that the information would probably only be “useful “ for the current period of the specific issue of the bulletin. For example having 2 case studies in the Bulletin for July 2016 would only have value until the November Bulletin. It would then be lost in the backlog of previous issues. It was thought a much better idea was to have the detailed case studies together in a booklet format where they could be easily sourced. It was also thought that a better representation of the case studies would require 2 studies per region which would equate to a total of 10 case studies.

The “[Integrated Orchard Management case studies 2016](#)” was released with the “[Integrated Orchard Management practice guide 2016](#)” in August 2016.

Releases of these publications were through the macadamia processors, rural stores, Local Land Service offices, NSW DPI offices, AMS and included in a mail-out with the Macadamia Bulletin. The postal distribution was not absorbed by the “National macadamia growers communications program” MC15003 which was a disappointment. Overall cost was around \$1200. Since then I have approached macadamia industry processors who have committed to mail distribution to all of their growers at no cost to the project.

Further to the production of the case study guides, YouTube style videos were produced with stories relating to the growers success in implementing the IOM principles on farm. These videos are available on the password protected MacSmart websites and are titled:

- “Orchard rejuvenation in Bundaberg”
- “Productivity gains through increased investment”
- “Maximising productivity through orchard floor management”

Once version 2 of the IOM practice guide and the case study booklet were released I was approached by a few participants of the Project Steering Committee who suggested to me that all of the principles are very well accepted and understood especially for canopy and orchard floor management. However when growers are dealing with drainage management, the first question they ask is “Where do I start?” It is for this reason this project has developed, with Stephanie Alt, Bob Howard and Kel Langfield, the “Integrated Orchard Management Drainage 2017” guide. It details to growers the processes to follow in addressing their drainage issues on farm. The drainage booklet brings together:

- the different components of an effective drainage system
- where to start or what to do next - depending on the current state of your orchard
- introduces the term “slope specific management” and outlines the guidelines required to practice this for macadamias
- how LiDAR mapping can help refine drainage within an IOM framework.

It will give growers the confidence to plan and develop drainage systems within their orchard and further focus on canopy and orchard floor to compliment this.

The drainage guide, draft has been distributed to the macadamia consultants group, which is the process used for IOM practice guide Draft 1. The group is a mix of processor representatives, consultants and resellers who all have the reach of every macadamia grower in the country. This group was given 1 week to present feedback and suggest changes to the drainage guide. We have incorporated the relevant changes. The release to industry will be July 2017 with a round

of IOM drainage field days across all growing regions, due in September 2017. The drainage guide has been produced using existing funds available from project MC14007.

Outputs

- [“Integrated Orchard Management case studies 2016”](#) Publication hard copy and pdf version.
- [“Integrated Orchard Management practice guide 2016”](#) Publication hard copy and pdf version. Hard copy will require further print run.
- “Macadamia Integrated orchard Management drainage 2017” (in press) Publication hard copy and pdf version.

Outcomes

Industry has embraced the Integrated Orchard Management principles. Through personal communications with the relevant processors in Qld and NSW I have been advised that there is a big push throughout the macadamia growing regions of implementing canopy, orchard floor and drainage management to achieve optimal production. Processors and consultants have described to me how they have “walked the orchard” with growers to identify “red flag” zones within the orchard. Advice on rectifying the red flags through the use of the pillar toolkits has been heeded in many cases. I have been advised that contractors for tree removal and mulching etc are booked solid. IOM terminology is now commonly used within industry publications and at field days. The association between the three pillars is now well understood by industry.

The complimentary work involving National Heritage Trust grants through the LLS has resulted in one case of an orchard receiving \$750 to map the orchard and drainage hot spots with LiDAR and then spending a further \$80000 to address the red flag issues and have the orchard in a state that will over time bring it back to stage 2 for each of the pillars.

The Australian macadamia society surveyed the pest consultants group at the recent meeting held in June 2017 in Brisbane. The survey (appendix 2.) revealed that in all aspects of IOM there is an overwhelming positive attitude towards focussed canopy management, orchard floor and drainage management. According to the survey, there is not just knowledge change but action on ground and attitude change and ultimately practice change. The consultants group has a reach of the whole industry.

The definitive outcome from the IOM cannot be measured as a single yield per hectare output ie increased production. It has evolved to give many benefits being productive and non-productive. A healthier orchard system with less soil loss and cleaner catchments as well as more manageable orchard systems with healthier pillars and higher production are some of the benefits.

Industry has since moved on to “Integrated Nutrition Management” after the success of Integrated Orchard Management. This speaks volumes for the success of not only delivering the IOM practice guide and IOM case study booklet but also delivering workshops and field days relating to IOM. It reinforces the value of the work performed and sets it up to be a commonly referred to publication for many years to come.

Evaluation and discussion

In developing the publications through the use of the collaboration of the 100 plus participants at the annual pest consultants group meeting, we were able to establish a form of ownership within this large group of the information provided. The opportunity to provide feedback proved very valuable to this group. This allowed them to fully comprehend some of the newer concepts such as “orchard stages”, “red flags” pillars and pillar toolkits. They have become fully conversant with the guide and are confident to deliver it to their growers in such a way that they were able to educate the growers about the guide and how it could be utilized to address problems within their own orchards. This resulted in a very quick uptake of the information to industry and as a result a significant shift in rejuvenating older, low production orchards.

The subsequent case study booklet was developed to reinforce to those growers sitting on the fence as to whether or not they would make the investment to rectify their orchard. The case studies were developed with each district in mind which would mean that all growers could relate to specific case studies. It looked at various reasons for instigating change, be it production or non production focused. The case studies provided good information from other growers regarding IOM practices. They had generously made their contact details known to industry so that growers considering changes within their own orchard could discuss the changes with the case study growers first. This was then followed up with the delivery of MacGroups on case study properties. Growers were able to walk the orchard and see for themselves the changes that were occurring and witness the results of those changes. Growers that attended the field walks all went away with a developed plan in their heads regarding what they would do next as far as pillar management was concerned.

A survey, appendix 1, was performed after each of the Macgroups. The survey was developed to try to understand whether growers were making changes to their orchard system as a result of the IOM series. The surveys showed that growers were significantly more confident in recognizing priority areas within their orchard that required change. There was a clear shift to increase their investment into their property to modify the pillars to deliver better outcomes for the orchard system.

Appendix 2 details the survey performed at the pest consultants meeting June 2017, 2 years after the delivery of the Integrated Orchard Management practice guide version 1. These participants as a group have access to influence all of industry. They are the most effective tool we have for extension delivery to get our message out to industry. The recent survey clearly shows that the participants believe the IOM series is delivering positive changes in practice at a very high rate of participation within the industry.

The IOM series has assisted growers recognize their Red Flag areas clearly. The IOM series has created practice change in canopy management as growers start to develop pruning management strategies such as limb removal. Similar can be said for orchard floor and drainage management.

When asked whether IOM had assisted growers in increasing production, 85% said yes it had. This represents a shift in industry attitudes from three years ago of regarding tall trees and bare inter rows on steep slopes being the norm to reducing tree height and allowing ground cover back onto the orchard floor. The industry is at a transition stage and the IOM series had developed an industry maturity with regards to a common language and a good understanding of the integrated orchard system. As new growers enter the industry, they are now provided with a concept through the IOM series that allows them to navigate a pathway to a better managed orchard system that will yield good production and be more sustainable.

Recommendations

Over time new practices that have not been reported in the IOM practice guide may be researched and accepted by industry. As these new practices become entrenched within industry it will be important for the IOM practice guide to incorporate them into the “tool kit” section of the guide. This was made very clear from the time between version 1 of the practice guide and version 2. New practices were becoming more accepted by industry and were therefore included in the 2nd version. I believe this publication should be reviewed at least every 5 years so that we do not miss these new practices but also so that we may drop out practices that are shown to be detrimental to the orchard system over a longer period of time.

There are hundreds of further case studies we could collate and present in an IOM case study volume 2 booklet. This could be made in to a series of case studies over time, funding pending.

Although the MacSmart project (MC09002) has terminated, the website remains active. Case studies of IOM are continually being added to the website. I have recently recommended to the MacSmart team (of which I am a member) to add IOM as a category on the toolbar for ease of navigation to this information. This will be a significant resource especially for the many new growers currently entering this industry.

As mentioned there is was an obvious gap in the link between drainage management and where to begin on farm. This was identified late in this projects life after industry had time to digest the two publications. We have developed the drainage guide and will produce the 24 page guide by July 2017. This will be a valuable resource for industry in completing the story relating to Integrated Orchard Management. This is achievable with the available funds within project MC14007.

Scientific refereed publications

<Provide a list of all **refereed scientific publications** published during the project that can be attributed or partly-attributed to the project. Use the format described below for journal publications, books and chapters in a book. Enter 'None to report' if there are no refereed scientific publications to report. Other publications such as magazine articles should be included in the Outputs.

None to report

Intellectual property/commercialisation

'No commercial IP generated'

References

Quinlan, K., Wilkie, J., O'Hare, P. (2008) Establishing and managing Smothergrass on macadamia orchard floors. NSW DPI management guide.

Acknowledgements

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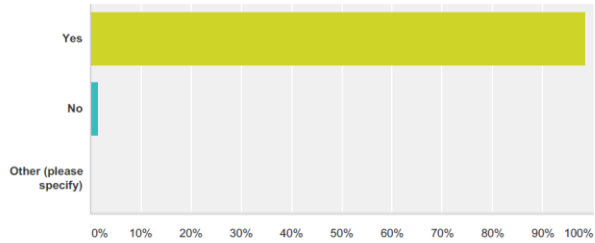
Appendices

Appendix 1.

MacGroup evaluation of IOM, 2016.

Q4 Was the topic (Integrated Orchard Management) of interest and benefit to you?

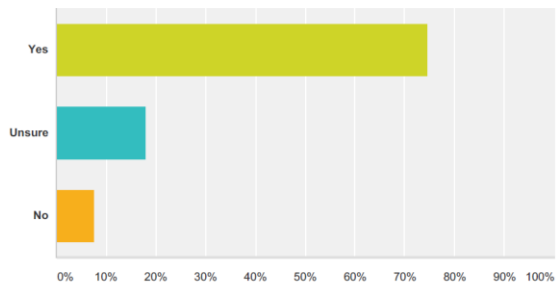
Answered: 68 Skipped: 21



Answer Choices	Responses	Count
Yes	98.53%	67
No	1.47%	1
Other (please specify)	0.00%	0
Total		68

Q5 Will you make a positive change in your business/orchard/management practice as a result of something you learned at this MacGroup?

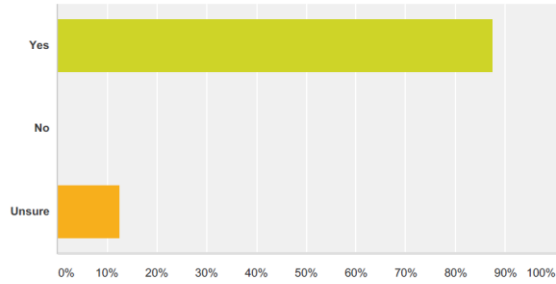
Answered: 67 Skipped: 22



Answer Choices	Responses	Count
Yes	74.63%	50
Unsure	17.91%	12
No	7.46%	5
Total		67

Q7 Based on the information presented at this MacGroup (IOM booklet etc), do you feel more confident to identify the highest investment priority for your orchard from drainage, orchard floor or canopy?

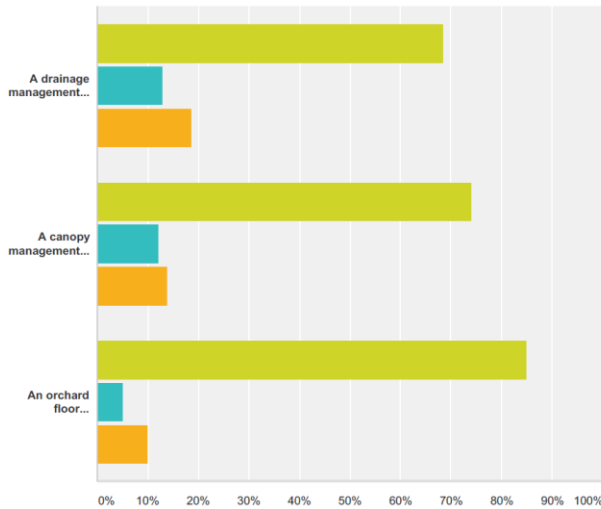
Answered: 64 Skipped: 25



Answer Choices	Responses	Count
Yes	87.50%	56
No	0.00%	0
Unsure	12.50%	8

Q8 Based on the information presented at this MacGroup and in the IOM booklet, are you likely to increase your investment into

Answered: 60 Skipped: 29



Appendix 2. Pest consultants meeting survey June 2017. 100 consultants surveyed.

1. Do you think the IOM initiative (handbook, field days etc) has assisted growers to identify the highest priority area to invest in on their orchards?

98% yes. 2% no

2. Have your growers (or you) undertaken any limb removal in the last 4 years?

96% yes 4% no

3. Trends canopy management

- More limb removal and less hedging
- Less hedging more row removal
- Less hedging more limb removal
- Tree height reduction
- More limb removal and less hedging
- Less interest in mechanical pruning but more interest in selective limb removal

4. Have your growers undertaken any orchard floor management in the last 4 years?

96% yes 4% no

5. Trends – Common actions.

- Trees removed from gullies and grassed waterways
- Diversion drains
- Increased ground cover in interrow
- Diversion drains
- Reduced herbicide use
- Reduced herbicide spray area under tree row
- Limb removal to encourage grass on the orchard floor
- Sub-surface drains

6. In the last 4 years have your growers invested in measures to minimize erosion within the orchard?

98% yes 2% unsure

7. Do you think the IOM initiative has assisted your growers and consequently the industry, to increase production?

85% yes 13% unsure 2%no

Appendix 3. Industry quotes regarding IOM.

Chairman's report Richard Doggett in the Australian Macadamia Society Ltd Annual report 2015 reads *"There have been some great tools developed over the last year to help members. The Integrated Orchard Management Booklet, a great team effort by the AMS, NSW Department of Primary Industries (NSW DPI) and a wide group of processors, rural traders, consultants and growers has been one of the best received research inputs in my memory. It is a great example of the whole being greater than the sum of the parts, both with respect to the usefulness of individual research projects and the knowledge of industry experts. Congratulations to all involved, especially Robbie Commens (AMS) and Jeremy Bright/Stephanie Alt (NSW DPI)."*

Ross Burgess – Grower Liaison NIS Purchaser, **Macadamia Direct**

"The IOM guide has proved to be a great field tool... and very important when one considers the number of new growers entering the industry. With the demise of the Macadamia course at TAFE, it has been critical that the DPI has been able to produce a guide that provides growers with not only up to date information, but a high quality self-assessment booklet as well. I generally don't get to spend too much time (walking through the orchard) with growers, but am able to give them a broad overview of the areas that one should be paying attention to - at their particular farm site. I do

encourage growers to take the guide to read in their own time, and to date I have had very little call or need to explain any topic. So I think it is working very well. I believe I received 4 boxes, and have only half of one box left. I imagine there were around 60 copies per box... so I would have distributed around 200 to date”.

Graeme Flemming – (November 2016) Macadamia Consulting Services.

“About 200 guides issued and talked through with growers. Probably 30 I have walked through orchard with guide to highlight management issues.”

Open letter from Queensland Premier, Anastacia Palaszczuk to Macadamia industry conference held in Caloundra 2016.

I congratulate the Australian Macadamia Society for their strong focus on increasing exports to Asia and making the most of our proximity and clean and green reputation in this fast growing market. The macadamia industry is an example to others in embracing innovation and applying it quickly to achieve results. The Australian Macadamia Society’s Integrated Orchard Management manual, which distills years of research, grower experience and consultant knowledge, is one of the best examples of horticultural extension produced in the world.

I wish you all an enjoyable and productive conference and I hope you take the opportunity to experience as many of Queensland’s attractions as possible.



**ANNASTACIA PALASZCZUK MP
PREMIER OF QUEENSLAND
MINISTER FOR THE ARTS**