

Horticulture Innovation Australia

Final Report

Building capacity in the NT Mango Industry using small-group extension

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Summary

This project sought to test small-group extension as a tool for driving innovation in the Northern Territory mango industry.

The project was premised around the following set of principles:

- To be responsive to the NT mango industry's needs.
- To promote a productive learning environment and culture of advancement amongst participating NT mango industry stakeholders.
- To develop and maintain a communication pathway between research and development service providers and stakeholders.
- To further develop the human capital of the NT mango industry.

The small-groups pilot ran from 2012-2015 and involved up to 20 NT mango businesses and affiliated agribusiness services people from two growing regions i.e. Darwin and Katherine. It was based around a self-directed learning process where participants in collaboration with professionals from DPIF, jointly identified priority areas for research or learning activities.

Growers found the small-group process informative, open and friendly, and participants believed it has begun to foster a sense of community amongst participating businesses. The small-groups enabled growers to give their opinion and ask questions of each other and service providers or presenters. Most growers felt comfortable sharing information in the small-group environment. Growers were also empowered as a consequence of their ability to control the content, which ensured they retained a strong level of ownership over the process. This was reflected in growers' findings that the small-group process was very energizing, through enabling their input to be considered, put to use, or investigated. Service providers advised that research activities and workshops were useful as a capacity building exercise for the local industry. Knowledge change among growers tended to be quite high.

Key areas where knowledge increased revolved around business management (e.g. marketing), and practical research (i.e. it provided answers to problems). Insect and vertebrate pest management (the latter principally magpie geese) and disease management were the areas where growers had applied the most changes in practice.

Key challenges identified by respondents included maintaining consistent grower attendance at events, and continued support (financial and organisational) from stakeholders.

Key successes identified were:

- The provision of a forum for growers to network.
- Exchange of producer information and ideas.

- Empowering growers to feel that they had input into research and government priorities.
- Playing a key role in shaping the industry's research agenda in the NT and;
- spill-over benefits from the efforts of the groups to the wider industry.

Growers wanted to see the process continue, and in particular appreciated the ability for industry, government, growers and service providers to meet on a regular basis and identify issues of relevance to the sector.

Keywords

Agricultural extension, Australian mangoes, group extension, capacity building.

Introduction

The NT Department of Primary Industries and Fisheries (DPI&F) decided to test reinstating the process of small group extension in the NT Mango Industry in 2012. This was done through the raising of two pilot groups with growers in the Darwin and Katherine regions. The NT Mango Industry has been steadily expanding since the late 1990s, from around 1.1 M trays to 3.8 M trays valued at \$69m in the 2014 season. Around 50% of Australia's mangos are produced in Northern Territory. This expansion has been in both additional land area planted to mangoes, as well as the adoption of new and more highly productive varieties. The NT is now legitimately the premier mango production region of Australia, and its growth is likely to continue.

However, there is recent past evidence of failure in the adoption of best practices in a number of agronomic, pest management and post-harvest areas. In a study of the NT Mango Industry, White (2005) found that many producers at that time relied principally upon their own efforts in seeking out knowledge and information in farm practices. This was a consequence of the rundown of extension capacity affected in the Department in the early to mid-2000s. The survey also indicated that many producers were also resorting to the less than optimal method of their own 'trial and error' for testing out practices to resolve problems.

Currently it is only the larger corporate farms in the NT businesses that employ expert external consultants that also undertake applied research. Other private sector consultancy capacity in the NT is based principally around local sales agronomists where there is an absence of accompanying research support.

Furthermore, there were no institutional systems in place for succession of production knowledge and expertise.

Overall, White (2005) inferred that there



had been a level of public and private sector failure in terms of extension services. Therefore, the development of mango-specific extension capacity that could link back into applied research effort has become an industry and Government priority.

The extension literature shows interactive small-group processes are highly effective at delivering changes in practice in rural industries. Small groups enable farmers to have more control over the information that they need or want, and the way it is delivered. This way extension can operate by 'demand-pull' rather than 'science-push' forces (Crawford et al, 2007; Marsh and Pannell, 1999, 2000). The process of facilitating and empowering groups increases members' participation in the direction, planning and carriage of research and extension activities. It also provides stakeholders the opportunity to govern their own education and training needs based on their situation. This is a key principle for effective adult learning (Coutts et al., 2005; Hunt and Coutts, 2009).

The project was designed around the framework of Bennett's Hierarchy (Bennett, 1975), with a solid grounding in experiential learning principles (Kolb, 1984). Bennett's Hierarchy provides a system for designing, implementing and assessing the impact of extension programs. It can be applied to most programs that are aimed at changing behaviour through learning or training processes (Steel, 2005).

The project raised two small groups in the NT mango industry (one each in Darwin and Katherine regions). Group participation varied, but up to 20 businesses and 8 different service providers participated in the process. The process attracted industry participants of different scale, ranging from a small mango business constituting only 50 trees, to large corporates with in excess of 50,000 trees. Collectively the memberships represent substantial proportions of the total production of their respective regions. These two modestly sized groups have in their short timeframe played a key role in shaping the industry's research agenda in the NT.

Methodology

Structure

The project was designed around the Bennett's Hierarchy of change (Bennett, 1975), see Figure 1; and incorporated the principles of experiential learning as described by Kolb (1984) i.e. the process of reflecting, thinking, applying and experiencing new ideas or ways of doing things. The initiative was designed to actively involve participants in setting the direction of their learning. The project had a four-phase set of objectives:

- Phase 1. Benchmarking of participants production systems, management and experiences, and identification of practice or knowledge gaps.
- Phase 2. Identification of priority areas for learning activities.
- Phase 3. Implementation of learning activities (e.g. workshops, farm walks, and demonstrations or research trials etc.).
- Phase 4. Evaluation of participants' reactions, changes in knowledge, attitudes skills and aspirations, and the broader impact of the activities delivered in the program.

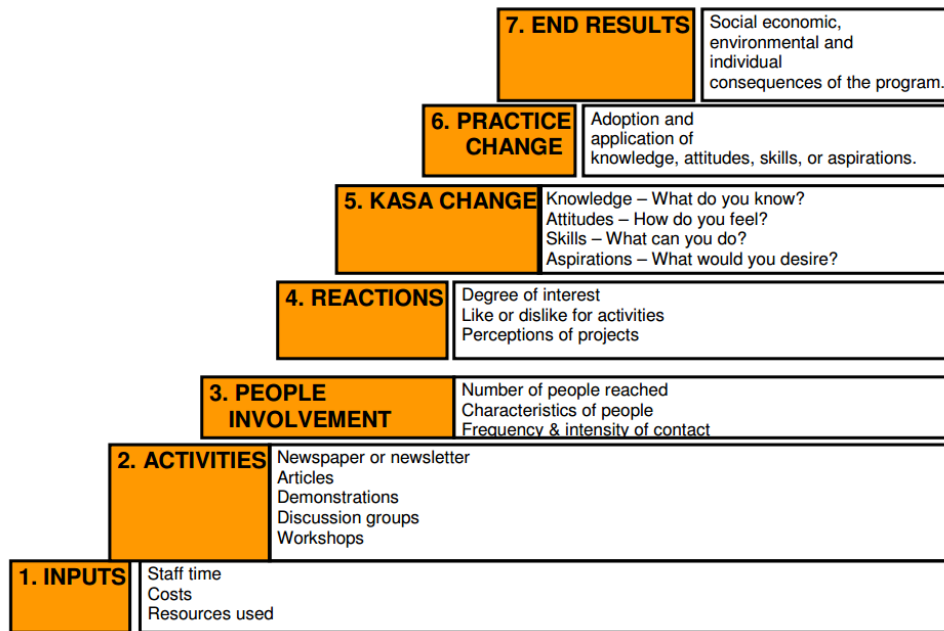
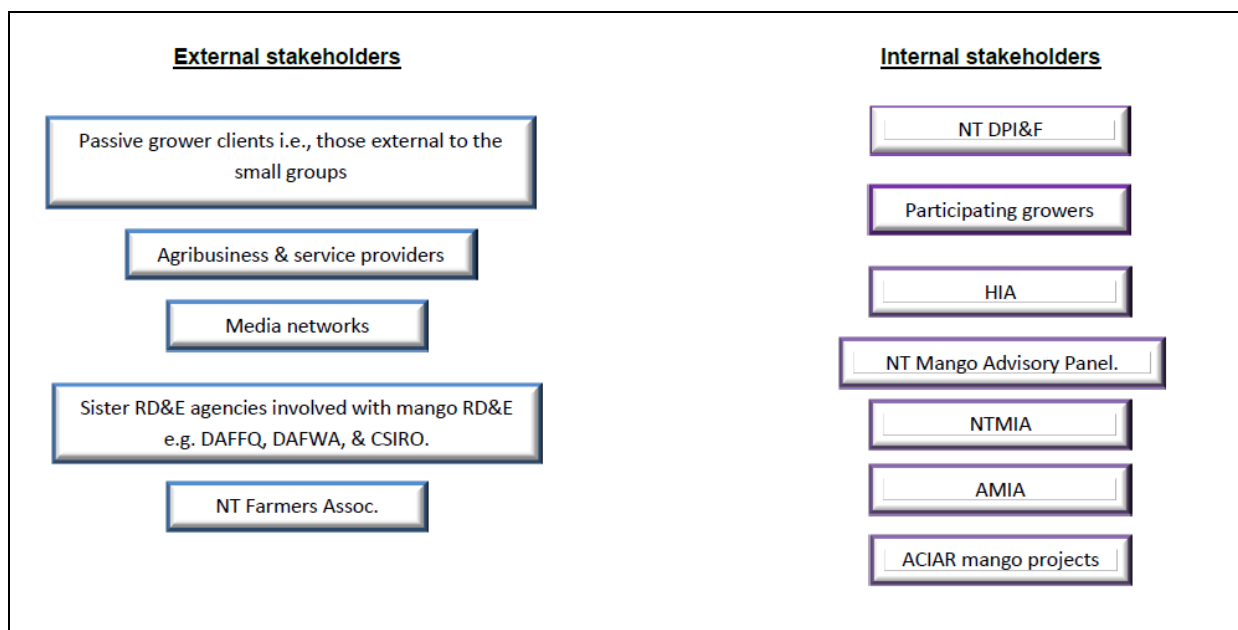


Figure 1. Bennett's Hierarchy (Bennett, 1975)

Stakeholder networks to the project

The project operators also identified the associated stakeholder networks, and how they related to the project. External stakeholders constituted those individuals or agencies that did not have a core investment in the exercise. Internal stakeholders were directly associated with investment, guidance or activity in the small-groups process.

Diagram 1.



Conduct

The group meetings were coordinated by the Project Leader with resources assistance sourced from technical experts both inside and external to the NT DPIF. Up to 20 mango businesses were involved in events over the course of the project. Attendance numbers typically varied from 4 to 15 businesses at a meeting dependent on timing the relevance of the topic for the region. Katherine was always expected to have lower participation to Darwin, as the total industry is represented by only around 12 commercial operations. Services sector participation was largely confined to the major commercial entities (e.g. Elders, Landmark , E. E. Muir and Sons, and the NT Farmers Association etc.).

Meetings were conducted in a cordial and friendly atmosphere and dialogue was actively encouraged. Meetings were largely held on farm in grower's sheds. The project leadership managed the project relationships and communications with the various bodies in the respective stakeholder groups.

Communication

Communication channels associated with the project included:

- The NT DPI&F Plant industries email database consisting of NT producing businesses & associated service agencies.
- Monthly Plant Industries NT E-Newsletter.
- E-Bulletins as required re: upcoming events.
- The Katherine Rural Review (quarterly E-Newsletter).
- The NT Farmers newsletter *Grow NT*
- Northern Territory ABC Rural Radio.
- Northern Territory ABC Television News.
- Australian Mango Industry Association - *Mango Matters* magazine (hard-copy quarterly).
- The NT News.
- HIA reporting.

Evaluation

The final phase in the process was the evaluation of the efficacy of the project. As discussed it was structured around Bennett's Hierarchy of change (Figure 1.). This was carried out by an independent evaluator (Roberts Evaluation), to provide adequate separation between the project leadership and group members and to prevent any particular bias being construed. The independent line of enquiry would enable full and frank expression of views from those involved in the conduct of the project with any fear of directly offending the project leadership.

The evaluation process followed the sequence of:

- Roberts Evaluation undertook an initial start-up meeting with the Project Leader to confirm approach, timing, participant contacts, contractual details, and to source any documents to provide background around the project.
- A review of key documents and affiliated secondary sources of information so gain an understanding of the scope of the project and topics dealt with.
- A series of semi-structured phone interviews with 14 stakeholders (10 growers and 4 service providers), involved in the small-group meetings across Katherine and Darwin. Not all project participants were able to be surveyed, though this survey number does represent a majority of the regular participants of the project. Questions were primarily based on levels 4, 5 & 6 of Bennett's Hierarchy, capturing the reactions, of participants in the small groups process, and the respective knowledge, attitudes, skills, aspirations and practice changes that were achieved.
- In addition to phone interviews a Roberts Evaluation staff member travelled to a small-group meeting in Darwin to conduct observations and unstructured interviews with attendees.
- An analysis of collected data was undertaken using quantitative and qualitative methods.

Outputs

Table 1. Calendar of extension and research effort from the Darwin and Katherine small-groups process

Activity	Target	Details of expert presenters	Time of delivery
Initial benchmarking of farm practices & priorities.	Darwin & Katherine groups		Pre-harvest 2012
Fruit quality seminars	Two events: <ul style="list-style-type: none"> • AMIA 2012 meeting at Berry Springs • Darwin regional packing sheds and transport operators. 	Rowland Holmes & Scott Ledger, Hort VC group. Chelsea Moore, NT DPIF Dr Cameron McConchie, NT DPIF	Pre-harvest 2012
On-farm research to investigate foliar calcium's influence in reducing lenticel spotting.	Darwin group	Dr Cameron McConchie, NT DPIF Dr Warren Hunt, NT DPIF Chelsea Moore, NT DPIF Chris Kelly, NT DPIF	Pre-harvest & harvest 2012
Briefings on NT biosecurity laws & regulations for bushfire mitigation between neighbours.	Darwin group	Stephen West, NT DPIF. Lee Humphries, Bushfires NT	February 2013
Mango leafhopper field-walk sessions (identification & current best-practice management).	Katherine group	Austin McLennan, NT DPIF	February 2013

Activity	Target	Details of expert presenters	Time of delivery
Workshop - IPM strategies for insect management & extension to growers.	Darwin group	Brian Thistleton, NT DPIF Austin McLennan, NT DPIF Dr Warren Hunt, NT DPIF Bob Sandery – commercial crop-protection advisor.	June 2013
Workshop to revise individual harvest maturity estimates using heat-sum calculations & dry matter estimates.	Darwin & Katherine growers	Dr Warren Hunt, NT DPIF. Chelsea Moore, NT DPIF. Dr Cameron McConchie, NT DPIF.	April 2013
Initiation of research to assess the causes of resin canal in mango.	Darwin region	Dr Cameron McConchie, NT DPIF Chelsea Moore, NT DPIF	March 2012 – March 2013
Initial discussions re: research program to assess the drivers, level of impact, distribution & timing of magpie geese damage on Darwin mango farms.	Darwin group	Grant Fenton, NT Farmers Association. Dr Anne Walters NT Parks & Wildlife Commission Dr Warren Hunt, NT DPIF Martina Matzner Acacia Hills Farm Han Siah AMIA Ross Maxwell NTMIA	February 2013
Investigations re: infrastructure suitability for horticultural exports out of Port of Darwin.	NT mango industry	Bob Williams, NT DPIF	February – March 2013
Distribution of Kensington Pride mango fruit maturity colour standards for in-field/shed use.	NT mango industry.	Dr Warren Hunt, NT DPIF	Pre-harvest 2013
Inspection of new National Mango Breeding Program (NMBP) varieties at Kunanurra.	Darwin & Katherine group members	Dr Warren Hunt, NT DPIF Dr Ian Bally, DAFQ Peter Johnston, DAFWA	Conditional on release timeframes.
Initiation of floral induction trials with participating growers.	Darwin & Katherine group members	Dr Cameron McConchie, NT DPIF Chris Kelly, NT DPIF	Ongoing from 2013-2017
2 nd year field trial research into foliar calcium impact on lenticel spotting	Darwin region	Dr Cameron McConchie, NT DPIF Dr Warren Hunt, NT DPIF Chelsea Moore, NT DPIF Chris Kelly, NT DPIF	October 2013
Mango Orchard nutrition workshops.	Katherine and Darwin regions	Ted Winston, Tropical Hort Consulting Dr Warren Hunt, NT DPIF	December 2013
Darwin group annual meeting Information delivered: <ul style="list-style-type: none"> • Resin canal disorder (RCD) research. • Mango floral induction manipulation trials. • GrowNorth CRC proposal. • New staff at DPIF and their roles. • Export development discussions. • Fruit fly market access research. • Fenthion update. • Magpie geese. 	Darwin region	Dr Warren Hunt, NT DPIF Dr Cameron McConchie, NT DPIF Bob Williams, NT DPIF Austin McLennan, NT DPIF Marije ten Nepal, NT DPIF Khamla Mott, NT DPIF Elford Smith, NT DPIF Peter Stacy, NT DPIF Andrew MacNish, DAFQ Trevor Dunmall, AMIA	May 2014

Activity	Target	Details of expert presenters	Time of delivery
Katherine group annual meeting Information delivered: <ul style="list-style-type: none"> • Resin canal disorder research. • Mango floral induction manipulation trials. • GrowNorth CRC proposal. • New staff at DPIF and their roles. • Export development discussions. • Fruit fly market access research. • Fenthion update. 	Katherine region	Dr Warren Hunt, NT DPIF Dr Cameron McConchie, NT DPIF Bob Williams, NT DPIF Austin McLennan, NT DPIF Marije ten Nepal, NT DPIF Khamla Mott, NT DPIF Andrew MacNish, DAFQ Trevor Dunmall, AMIA	May 2014
Top End Mango industry forum to address impact of Magpie Geese. Issues discussed included: <ul style="list-style-type: none"> • Lawful damage mitigation techniques against magpie geese for deployment by farmers in the immediate term. • Research into novel damage mitigation techniques. • Generating a research project proposal into the impact (including economic impact), geo-spatial distribution, frequency, and novel damage mitigation options of magpie geese populations. Note: A project was submitted to HIA in this regard is currently pending a decision. 	Darwin region	Dr Warren Hunt, NT DPIF Keith Saalfeld, NT DLRM Prof Michael Lawes, Charles Darwin University. Sgt Peter Ruzsicska, NT Police Inspector Mark Christopher, NT Police Sally Heaton, NT PWC Han Siah, Farmer, AMIA Director & Nuffield Scholar	July 2014
Ongoing farm-based research activities into mango floral induction with local collaborators.	Darwin region	Dr Cameron McConchie, NT DPI&F Chris Kelly, NT DPI&F	May - July 2014
Ongoing farm-based research activities into resin canal disorder (RCD) with local collaborators.	Darwin region	Dr Cameron McConchie, NT DPI&F Dr Warren Hunt, NT DPI&F Chris Kelly, NT DPI&F Paige Richter, NT DPI&F Chelsea Moore, NT DPI&F Khamla Mott, NT DPI&F Dr Andrew MacNish DAFQ	August-October 2014
Research project submission to HIA on determining regional mango industry magpie geese impact and evaluating novel damage mitigation strategies. Decision remains pending with HIA.	Darwin region	Dr Warren Hunt, NT DPIF Prof Michael Lawes, CDU	November 2014

Activity	Target	Details of expert presenters	Time of delivery
Katherine small-group meeting Issues discussed: <ul style="list-style-type: none"> • Update on resin canal disorder research. • Status of magpie geese research proposal and local damage mitigation activities by NT Field & Game Assoc. • Market Access advances. • Update on floral manipulation research. • Update on release of new NMBP varieties. 	Katherine region	Dr Warren Hunt, NT DPIF Dr Cameron McConchie, NT DPIF Austin McLennan, NT DPIF Michael Daysh, NT DPIF Marije ten Nepal, NT DPIF Khamla Mott, NT DPIF	March 2015
Darwin small-group meeting Issues discussed: <ul style="list-style-type: none"> • Update on resin canal disorder research. • Status of magpie geese research proposal and local damage mitigation activities by NT Field & Game Assoc. • Market Access advances. • Update on floral manipulation research. • Update on release of new NMBP varieties. 	Darwin region	Dr Warren Hunt, NT DPIF Dr Cameron McConchie, NT DPIF Austin McLennan, NT DPIF Michael Daysh, NT DPIF Marije ten Nepal, NT DPIF Khamla Mott, NT DPIF George Hennessy, NT F&GA Trevor Dunmall AMIA Prof Michael Lawes, CDU	March 2015

Outcomes (as per independent project evaluation)

Reactions to the project

All 10 of the grower businesses interviewed found the small-group learning enjoyable and useful. There were three main reasons given:

- The process is informative (8 respondents), allowing for growers to hear what other growers are doing as well as identifying common problems, particularly in regards to pest management (e.g. Mango Leaf Hopper and Magpie Geese).
- There is an open and friendly environment that allows for growers to give their opinion/input, as well as ask questions of each other and service providers.
- It facilitates networking with growers and service providers, particularly as the small-group meetings are the only time that most of the interviewed growers get together.

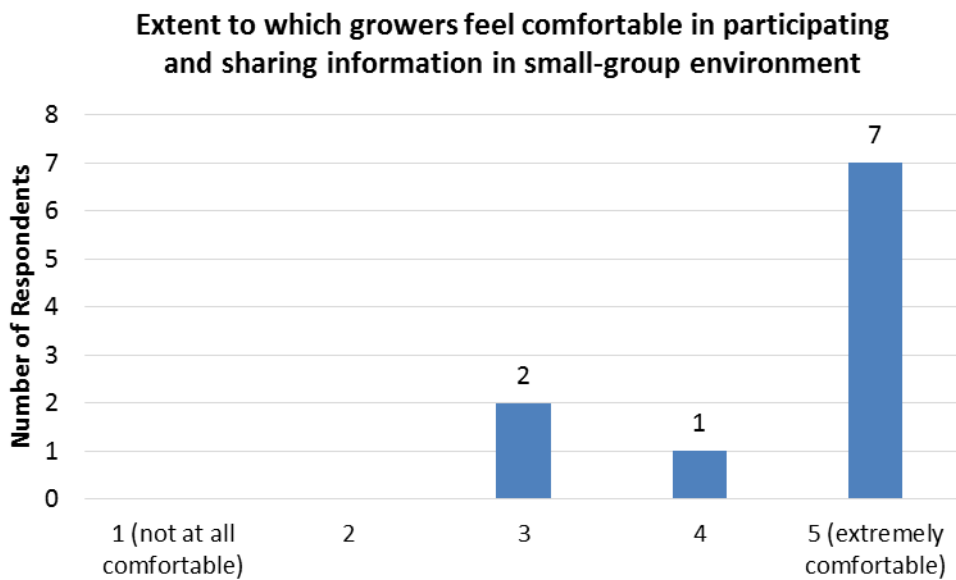


The ability for growers to own the agenda was valued.

"[If] there was an activity that we didn't like or wasn't useful, we would just drop it... We were in control of the topics. It was our fault if we didn't steer the activities and learning towards areas we wanted."(Grower respondent)

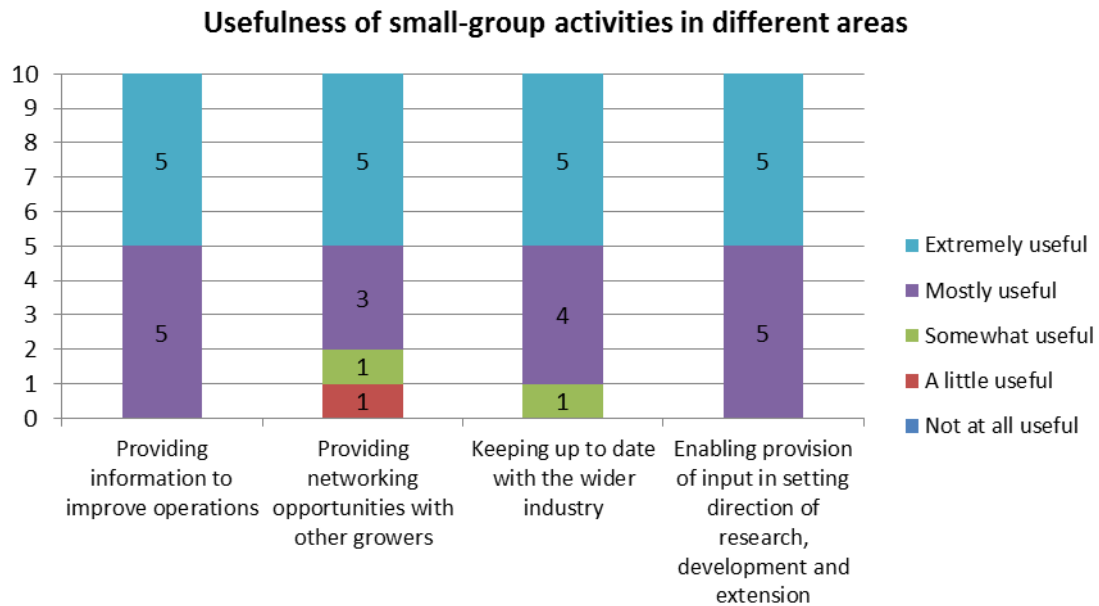
Comments indicated that more useful activities tended to focus on the practical, such as on-farm demonstrations, or meeting to discuss specific issues or topics of interests for growers at the time, such as Resin Canal Disorder (RCD), Magpie Geese and floral manipulation.

Figure 2: Extent that growers feel comfortable sharing in the small-group setting



Respondents were asked to consider the extent to which they feel comfortable participating and sharing information in small groups. As shown 7 out of the 10 respondents feel extremely comfortable participating in the small group setting. This reinforces earlier comments regarding the open and friendly environment of the small-group process which gives space for growers to contribute.

Figure 3: Usefulness of small-group activities in different areas

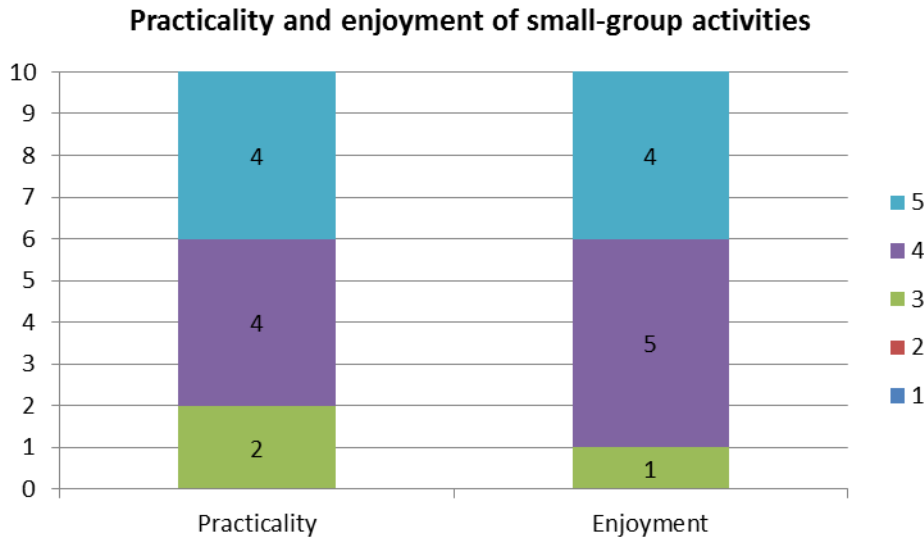


Respondents were asked to consider overall if program activities and information have been useful to them in four areas:

- Providing information to improve operations.
- Providing networking opportunities with other growers.
- Keeping up to date with the wider industry.
- Enabling provision of input in setting direction of research, development and extension.

In all four areas listed, respondents felt that the small-group activities were either extremely useful or mostly useful. Only in terms of providing updates on the wider industry did a single respondent rate the activities - somewhat useful; and in providing network opportunities - 2 respondents rated the activities somewhat useful and a little useful. There were no respondents who found the activities not at all useful.

Figure 4: Practicality and enjoyment of small-group activities



Respondents were also asked to rate the small-group activities overall in terms of their level of enjoyment and the extent of practicality on a scale from 1 (lowest) to 5 (highest). Eight respondents rated the activities 4 or higher for their practicality, and 9 rated them 4 or higher for enjoyment. The lowest rating was 3 which was only provided by 2 people – 1 for practicality and 1 for enjoyment.

Two grower respondents also provided comments which are quite telling of their positive perspective of the project and their desire to see the process continue into the future:

"I would like to see it continue. If it was to end, I don't think there would be a whole heap that would change. In the longer term you are getting the growers and government talking together which is very valuable to sharing/accessing information." (Grower respondent)

"[S]mall groups are very relevant and I would like to see it continue. Having the Department involved was fantastic; small grower meeting could be combined with industry meeting; these meetings are the glue between the farmers and the areas we need to work on." (Grower respondent)

Changes in knowledge, attitudes, skills and aspirations

Determination of outcomes is problematic to gauge in the relatively short time span of the project. Many of the reported impacts were associated with human capital aspects of the client group (i.e. improvements in knowledge or application of new practices etc.); as opposed to purely 'produced capital' metrics (i.e. volume or increases in revenue or productivity). The evaluation survey did reveal the relative level of adoption of changes in different topic areas and how those specific topics addressed through the small-groups process were addressed (Table 2).

Table 2: Growers reported changes in practice and relative value of the topic (1- 5 scale) across the two regions. Note: 1 represents a poor value and 5 high value.

Areas of small-group extension	Number of growers that changed a practice due to the small-group process	Rating of value to operation
Insect pest management	5	4.9
Disease management	4	4.8
Post-harvest handling of fruit	2	4.3
Determining fruit maturity for harvest	3	4.3
Adoption of new mango varieties	2	3.4
Adoption of new rootstock genetics	1	3.4
Mango tree nutrition & soil health	2	4.5
Irrigation	1	3.8
Assessing fruit maturity for harvest	3	3.9
Market access research and information	0	3.3
Changes in how you manage bushfire related risks with neighbours	0	4
Management of magpie geese incursions	3	4.6
Techniques/methods involved with post-harvest fruit quality	1	4.3

Table 3: Examples of stated practice changes by growers

Practice area	Examples of practice change
Insect pest management	<ul style="list-style-type: none"> • Adoption of improved pest management techniques resulting in reduced sprays. • Increased monitoring for insects (especially Mango Leafhopper).
Disease management	<ul style="list-style-type: none"> • Disease recognition and appropriate treatments (natural and non-natural).
Determining fruit maturity for harvest	<ul style="list-style-type: none"> • Integration of technology to assess fruit maturity e.g. Near Infrared (NIR). • Changes in paddock division (i.e. small zones rather than large paddocks).
Assessing fruit maturity for harvest	<ul style="list-style-type: none"> • Adoption of principles and technologies that were identified and discussed through the small-group meetings. • Properly assessing green mature hard fruit in order to reduce fruit fly infestation risk.
Management of magpie geese incursions	<ul style="list-style-type: none"> • Monitoring of damage caused by magpie geese to determine extent of losses. • Implementing different damage mitigation strategies learned through workshops (e.g. scaring and shooting practices).

The services sector survey responses rated the value of the different topics lower than the grower respondents – Table 4.

Table 4. Value of practice areas rated by service providers

Areas of small-group extension	Average rating
Insect pest management	3.3
Disease management	3
Post-harvest handling of fruit	3.7
Determining fruit maturity for harvest	3.7
Adoption of new mango varieties	3.7
Mango tree nutrition & soil health	2.7
Irrigation	3.3
Assessing fruit maturity for harvest	3
Market access research and information	3.25
Changes in how you manage bushfire related risks with neighbours	3
Management of magpie geese incursions	3.5
Techniques/methods involved with post-harvest fruit quality e.g. inducing early flowering in mangoes	3

Reasons for this are uncertain, but it could be that the respective agronomists felt they already were competent in some of the fields that the groups had identified for attention.

Broader impact on the industry

Growers and service providers were asked to reflect on the implications of the work for the broader mango industry. Service providers felt the main implication was that growers would be able to feedback and influence government and research priorities.

For growers, comments clustered around:

- The impact of managing migratory pests (i.e. magpie geese) across all mango regions of the NT and Queensland.
- The financial gains that come from improving mango quality, quantity and robustness. Improvements in these characteristics would greatly assist the industry in sustaining a higher level of future export market development.
- The wider industry is influenced by the stakeholders who are involved in the process, i.e. the industry service providers and government staff involved are overall better informed by the realities of grower needs, and as such can affect more influence change on the sector's principal issues. RCD, harvest maturity, and floral induction research, as well as the Magpie Geese pest issue were such examples. As a result the small-group process has become an engine room for ideas and guidance to research and extension providers.

Discussion

Roberts Evaluation determined that participating growers found the small-group process informative, open and friendly – thereby providing a safe learning environment for participants. The small-groups enabled growers to give their opinion and ask questions of each other and service providers/presenters. Most growers felt comfortable sharing information in the small-group environment.

Growers felt empowered over their ability to control the content, which in turn meant they felt a degree of ownership over the process. This was reflected in growers finding the small-group process very useful in enabling their input to be made use of. Service providers tended to find that specific research activities and workshops were more useful from their perspective than the general grower dialogue or information sharing.

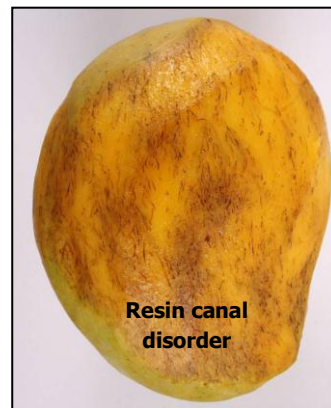
Overall, growers felt that the small-group approach was appropriate for most growers. The key consideration is the scheduling of events so that they do not clash with peak periods in the season. Growers were in favour of the opportunity for networking and sharing information with each other. The small-group process would appear to have started fostering a community among mango growers which seems appreciated and desired by respondents.



Effectiveness of the small-group process

Knowledge change among growers tended to be high, with the general attitude being that there are always things to learn. Key areas where knowledge increased revolved around business management (e.g. marketing), practical research (i.e. it provided answers to problems) and 'boutique' information (being things they would not normally consider relevant).

Key successes identified were the provision of a forum for growers to network, exchange information and ideas. Empowering growers to feel that they had input into research and government priorities was also noted. The small-groups became the engine room for ideas and a way to resolve a range of knowledge gaps and problems confronting the local industry.



Growers want to see the process continue, and in particular appreciated the ability for industry, government and growers to meet in the same room.

Improvements to the small-group process

Key challenges identified by respondents included grower attendance at events, continued support (financial and organisational) from stakeholders, and an overall improved awareness of the initiative and the timing of events amongst the rank and file of growers. Engaging of various sub-groups from non-English speaking backgrounds was cited as priority to address in future work. Specifically this relates to the Vietnamese and Cambodian growers in the Darwin region.

Recommendations

Continuation and expansion of the small-group process

Growers enjoyed and appreciated the small-group process and it is suggested that the process be continued to be supported by HIA and potentially expanded to increase the function and reach of the extension effort. There is a significant portion of the Darwin regional mango production (approximately 25%) comes from business with either a Vietnamese and Cambodian identity. With a few exceptions, cultural barriers have seen the two groups largely left out of this process. It has been proposed that HIA would support in an expanded project role, a specific dedicated individual with the cultural and linguistic abilities to be able to co-opt these growers into regular and effective extension activities. The project agent would require the ability to work across businesses from these diverse ethnic backgrounds.



Establishment of a grower-leadership group

To contribute to the sustainability and ownership of an expanded group extension approach, a Leadership and Advocacy panel drawn from the regions has been proposed in order bring other growers together and facilitate attendance.

Scientific Publications

Conference proceedings:

Macnish, A., Hofman, P., Campbell, T., McConchie, C., Hunt, W., 2014. Identifying factors that contribute to mango resin canal discolouration,' Northern Territory Mango Industry Forum, 21 March 2014.

Macnish, A., 2015. Mango resin canal discolouration,' 10th Australian Mango Industry Association Conference, 27 May 2014, Darwin.

McConchie, C., 2015. 'Flower Manipulation', 10th Australian Mango Industry Association Conference, 27 May 2014, Darwin.

Moore, C., & Hunt, W., 2013. 'The Effect of foliar calcium on reducing lenticel spotting and under-skin browning in mangoes', 9th Australian Mango Industry Association Conference, 14-17 May 2013, Cairns.

Hunt, W. 2015. 'What is the impact of Magpie Geese and what can be done about them?' 10th Australian Mango Industry Association Conference, 28 May 2014, Darwin.

Intellectual Property/Commercialisation

No commercial IP generated.

References

- Bennett, C. (1975). Up the Hierarchy. *Journal of Extension*, 13(2), 7-12.
- Clark, R. & Timms, J. (2001). *Achieving and Enabling Continuous Improvement and Innovation, the Better Practices Process*. Brisbane, Australia: Queensland Department of Primary Industries.
- Coutts, J., Roberts, K., Frost, F. and Coutts, A. (2005). *The Role of Extension in Capacity Building: What Works and Why?* Publication No. 05/094. Kingston: ACT, Rural Industries Research and Development Corporation.
- Crawford, A., Nettle, R., Paine, M. & Kabore, C. (2007). Farms and Learning Partnerships in Farming Systems Projects: A Response to the Challenges of Complexity in Agricultural Innovation. *Journal of Agricultural Education and Extension*, 13(3), 191-207.
- Hunt WD, and Coutts J, (2009). Extension in tough times – addressing failures in public and private extension, lessons from the Tasmanian wool industry Australia, *Journal of Agricultural Education & Extension*, 15 (1) pp. 39-55.
- Kolb, D. (1984) *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice Hall.
- Marsh, S. & Pannell, D. (1999). *Agricultural Extension - a Decade of Change*, Rural Industries Research and Development Corporation, <http://www.rirdc.gov.au/pub/shortreps/sr66.html>, (Accessed August 7, 2007).
- Marsh, S. & Pannell, D. (2000). *Agricultural Extension Policy in Australia: The Good, the Bad and the Misguided*. *Australian Journal of Agricultural Economics*, 44(4), 605-627.
- Roberts Evaluation (2015). *Building Capacity in the NT Mango Industry: Evaluation*. Melbourne.
- Steel, K., (2005). Chapter 20. *Evaluation of the New Zealand Farming Fund: A Work in Progress*. In: Brouwer, F., Ervin, D., Finn, J., Fraser, I., Heinz, I., Lehtonen, M., and Viaggi, D. (Eds), *Developing Agri-environmental Policies, Design, Practice and Results*. Canberra, Australian Capital Territory: OECD, 386 - 402.
- White, K. (2005). 'The Northern Territory Mango Industry – Findings of a Grower Survey', *Technical Bulletin No. 318*, Darwin: Northern Territory Government Press.

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