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Contents

1	Acknowledgments	4
2	Executive summary	5
3	Background.....	6
4	Objectives	7
5	Methodology – Detailed Trip Report	8
5.1	Meeting with John Lim	8
5.2	Secretary, Singapore Fruits & Vegetables Importers and Exporters Association	8
5.3	<i>Brismark: Brisbane Wholesale Markets</i>	9
6	Impacts	25
6.1	Scientific impacts – now and in 5 years	25
6.2	Capacity impacts – now and in 5 years	25
6.3	Community impacts – now and in 5 years	25
6.4	Communication and dissemination activities	26
7	Conclusions and recommendations	27
7.1	Conclusions.....	27
7.2	Recommendations	27
8	Appendix – Some Tour Photos.....	28

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- Australian Mango Growers – For allowing the tour participants into their sheds and farms and willingly explaining their production and handling processes and readily answering all the curious questions that came from the participants
- Australian Mango Industry Association (AMIA) – For hosting the participants and explaining to them how the mango industry is set up and run in Australia. It was a very valuable exposure and hopefully lessons learnt from the session shall be useful in a future All Philippines industry association. Special thanks to Trevor Dunmall, the AMIA Industry Development Manager, for giving the participants the special audience.
- Market and Processing Outlets – For enabling the participants to visit their sites, learn from their operations and have all their curious questions listened to.
- All Others – Who contributed or facilitated the study tour in one process or another. Your contributions to the success of the tour are also hereby gratefully acknowledged.

2 Executive summary

This is a Final Trip Report for a Small Research Activity (SRA) involving a study tour for mango growers from Samal Island in the Philippines who visited Queensland to study the Queensland mango industry from November 5 to 18, 2010.

The Study Tour used the “Walking the Chain” approach, where participants went through the mango supply chain from markets back to the fields. This started from the exports markets in Singapore to see what quality of fruits end up in these markets, then proceeded to the domestic markets in Brisbane to learn from key stakeholders the processes involved in fruit handling from growers to consumers in both domestic and export markets

Visits were also made to key processing and fruit handling outlets within the metropolitan area of the Brisbane market and to some key supermarkets to learn first hand the handling and retailing of mango fruits.

The tour then proceeded to some mango farms in the key production regions of north Queensland that account for more than half of the Australian mango production. In these farms, participants interacted with growers and learnt first hand from them what it takes to grow mangoes, how the commodity is harvested, processed in the shed, and packaged for the various markets.

Visit were also made to key research stations of the Department of Employment, Economic Development and Innovation (DEEDI) where research experts at the stations working on various aspects of mango improvements, presented their research processes and some of the key research findings in recent years.

The study tour ended with the participants having a concluding briefing session during which they reflected on all the learnings from the tour and agreed on a re-entry plan of action to put into practice some of the key things they had learnt from the tour.

3 Background

Samal Island near Mindanao has a developing mango industry which is currently an important part of the ACIAR Fruit Value Chains Program. Samal Island is being developed as a mango value chain model. The growers have formed into an association – the Samal Island Mango Growers Association (SIMAGA) and are taking a co-operative approach to production, marketing and research. They have obtained land and resources for a research centre and are looking at the development of co-operative facilities for the disinfections and marketing of mangoes. The growers, industry leaders and R&E staff are very enthusiastic and are rapidly taking up the technologies that we are researching there. The study tour to Australia allowed them to:

- Study technologies used by Australian growers
- Learn best practices that are used in Australian operations
- Observe and learn from co-operative approaches to production and marketing in Australia
- Observe Australian harvesting practices
- Study mango nursery propagation and other skills.

The Island Garden City of Samal (official name, but more generally referred to as Samal Island) is a group of islands in the heart of Davao Gulf. At its closest point, it is 900 meters east off the coast of Davao City and 10 kilometers west of Compostela Valley Province. It has a stretch of over 116 kilometers of continuous coastline, with a total land area of 30,130 hectares. The island is endowed with an extensive mountain range at the eastern coast, a number of isolated hills and an uneven distribution of lowlands. The city enjoys a mild pleasant climate with no pronounced dry or wet season, and is typhoon-free. Its soil is calcareous, making it most suitable for mango production. Access to the island is only via a car ferry system or small boat. This inaccessibility has the benefit of being a natural biosecurity barrier for mango pests and diseases.

Out of the total land area of 30,130 hectares in Samal Island, 4,533.5 hectares are currently planted to mangoes. This comprises about 15% land utilization. There are about 212,097 mango trees planted and 50.20% of this, or equivalent of 106,493 trees are at bearing stage with annual production of 17,094MT from 46 Barangays - villages (CAGRO data, 2007). About 85 % of the island areas that are planted to mangoes are owned by small farmers with farm sizes ranging from 1 to 3 hectares. Those operating in 4 hectares farms and above constitute 15%.

4 Objectives

The main study tour objectives were:

- Study technologies used by Australian growers
- Learn best practices that are used in Australian operations
- Observe and learn from co-operative approaches to production and marketing in Australia
- Observe Australian harvesting practices
- Study mango nursery propagation and other skills.

5 Methodology – Detailed Trip Report

Singapore:

Meeting with John Lim and visits to the retail sector

The group departed Davao on the afternoon of Thursday November 4 and arrived in Singapore at 6.30pm and transferred to the hotel accommodation. That evening the group walked to the Indian quarter, had a meal and walked back.

5.1 Meeting with John Lim

5.2 Secretary, Singapore Fruits & Vegetables Importers and Exporters Association

Venue: Café at Hotel Royal@Queens, Singapore

Friday 5 Nov 2010; Time: 10.30am – 12noon

SIMAGA Participants: Ana Notarte, Juliet Zambrano, Lourdes Cesar, Jorge Virtucio, Jun Lozada, Jerry Alino, Michael Ninte, David Palconit, Nestor Asido, Norbert Sale, Allan Siano, John Oakeshott (Chair)

John brought some Honey Yellow Mangoes (produce from Thailand and Malaysia) for the group to look at. These mangoes are popular in the supermarkets and food service sector. Introduction was given by Ana Notarte on background of SIMAGA and the purpose of the study tour, followed by individual introductions.

John Lim: Doesn't trade much mango, but deals closely with the Food Service Sector (hotels and restaurants) in fresh produce. Previously, in the 1990s, most mangoes were imported from India and Pakistan, but now mainly coming from Thailand. This is due to transportation cost factors and the ease of transporting by truck from Thailand. The Thais are sending mainly the Honey Yellow variety. Trucks are coming into the wholesale markets everyday except Sunday. Everyday the Wholesale Market would receive about 15 trucks of produce from Thailand of missed produce; of course, they receive much more from other regions as well. Recommends the group look closely at the Chinese mango market with entry possibly through Hong Kong or into the 30million people Shanghai market. The Japanese market is also good but requires high quality and VHT to access the market – whereas VHT is not required for the Chinese market. Currently there is only one Singapore importer of Philippines mangoes. R2E2 from Australia is the benchmark mango preferred by the consumer in Singapore. The Philippine caribou mango is popular in the food service sector – it tends to retain its colour well. The only way for mangoes to come to Singapore would be by airfreight. This would make it not price competitive with the mangoes being freighted overland. Again, shipping to Hong Kong may be a better option. Thinks about 2t/wk of mangoes from the Philippines comes into Singapore. At the moment mangoes are selling for between \$2-3 Singapore/kg at the wholesale level. Thailand dominates the fruit market in Singapore – produce is good and the government supports with subsidies on the freight costs. Previously Singapore was getting good mangoes from India – but these are now going to London where they are getting better prices. Mangoes are coming into the Singapore all year round. Singapore is a price conscious market (John's opinion as a wholesaler). John is working with the South Australian government on a sweet potato project in Vietnam.

Afternoon: visits to the Jason Marketplace green grocer in the Raffles City shopping area and also to Carrefour. At Carrefour, Mambuloo R2E2 were on sale for \$Sing8.50 and also KP \$Sing6.50. Other Thai, Indonesian and Indian mangoes were selling for around \$3.00 Sing.

Key points:

Singapore

- Premium price were based around the R2E2 Australian variety – good blush and large size.
- Potential for Food Service Sector for the Carabao variety
- Need for consumer research because of the many mango varieties in the market
- Phil has a potentials to Singapore (but trader didn't recommend it as a target market)
- Import restrictions are not as stringent as Singapore
- Lots of mango promotions paid for by the Australian industry
- Singapore is a price conscious market (traders comment that conflicts with point 1)
- Mangoes are only sold on consignment into Singapore market (traders comment)

Brisbane

Sat and Sun 6 & 7 November 2010

Arrived in Brisbane on Saturday morning and met at the airport by Chrys Akem. The group walked through the retail sector in Queen St. to view mangoes on sale and the offer (quality and price). Sunday walk through the Southbank public markets.

Monday 8 November 2010

5.3 Brismark: Brisbane Wholesale Markets

Visit to the Brisbane Markets. Queensland's main wholesale fresh fruit and vegetable market and one of six Central Markets found in Australia. Brisbane Market Limited (BML) is the owner of the Brisbane Markets, and is responsible for the ongoing development and management of the site. It operates on a commercial basis as an unlisted public company, with in excess of 150 predominantly industry-based shareholders, including growers, wholesalers, secondary wholesalers, retailers and the industry organization - Brismark. Our tour guide was Vanessa Kennedy, the Communications Manager for Brismark. Under the new Horticulture Code of conduct for the industry, the merchants and agents first need to declare how they are representing the farmers in the market and then if they act as a merchant they pay farm gate price. However, with mangoes, because different customers require different levels of mango fruit maturity, the markets and traders offer a storage and ripening facility where they can store the fruit and release it into the market system – and at that time it has been agreed that this is the same as farm-gate which determines the farmers price. This is also done with avocados which can be stored in a similar way and in effect control the supply of produce going into the market system.

Contracts are signed but not adhered and there is no insurance available – the whole system works very much on relationships and trust.

Vanessa provided an example of how the Supermarkets manipulate the market. The Supermarkets will determine that they need 50,000 trays of tomatoes. They will go to 7 farmers and ask them to produce 10,000 trays each. So now they have too many. So they can now reject and only take the very best. All the rejected produce will then come to the markets – and the markets are legally obligated to take all the produce. The market will then get too much poor quality produce and the market prices drop, but, the supermarkets benchmark their prices against the market prices. So effectively, the supermarkets get the best quality fruit but are paying the lower quality price. A real example of this happened recently when the Australian tomatoes went up to \$36/box. The supermarkets cancelled their Australian orders and then went sourced NZ tomatoes. The Australian price went down to \$10/box. Then the supermarkets came to the markets to source the cheaper tomatoes. So the supermarkets are manipulating the market prices continually. Therefore, the markets promote the local greengrocer – they believe they know their produce better than the big supermarkets and can provide better quality produce to the consumer at a fair price.

Farmers need to have Freshcare certification to be able to supply to the Supermarkets. Freshcare was originally a Government initiative for on-farm quality assurance. Now it is a private organisation. The traders in the market also have to be Quality Assured. They have QA staff responsible for storage of produce. As far as food safety goes the QA system starts at the farm, goes through the trucking companies and also into the markets.

Biggest QA issue has been imports from China which at times has been as high as 16% over the Australian limit for biological contaminants (ie raw sewage contamination which has been used instead of fertiliser in production).

In the market there are primary and secondary wholesalers. The primary wholesalers accept produce directly from farmers. They then sell some of this onto one of the two types of secondary wholesalers. One type of secondary wholesaler will buy some better quality produce and sells onto food service sector like hospitals etc. The other type of secondary wholesaler will buy poor quality produce and this mainly goes to the Asian restaurant or food sector where the visual quality is not important. A lot of this is also sold at the weekend markets as well.

Mangoes coming down from the Northern Territory in Australia will take 5 days to be delivered to the Brisbane markets. Mangoes from North Queensland will take 2 days from Mareeba and from the Burdekin it can be delivered overnight. The mangoes can be held in storage and released for sale for as long as two weeks without losing quality. Saw fruit from the NT that had been in the market for 8 days and had taken 5 days to deliver. Therefore, 13 days after harvest the quality was still very good. The group was impressed by the post harvest cool chain and disease control. In the Davao region, fruit will only last 3 days before it becomes inedible due to disease and post harvest breakdown. Fruit is transported at 13 degrees and then held in a room in the markets at 15 degrees and importantly at high humidity.

All the mango boxes are Mod 8 design and hold 7kg. The mango count/box changes due to size of the produce. The Mod 8 design box has 8 boxes per layer on a pallet and 16 layers high. These are held together with 3 plastic straps. Growers also use different boxes for different market segments.

Only 3 VHT plants in Australia for produce going to Japan. THE Export market only represents about 5% of the Australian production – not big – the rest all goes onto the

domestic market. The mango season in Australia goes from October to March. Then the rest of the year the markets are supplied with mangoes mainly sourced from Mexico. Labour in Australia is costing \$17/hr (about Php428).

In the market mango storage areas, the rooms are kept between 14-16 degrees. However, over winter, the rooms can be heated up to 26 degrees to speed up maturation. Chain stores want fruit that is ready for sale so it needs to be held until it is ripe. Most of the wholesalers don't use ethylene gas rooms for ripening because they are aware that many farmers are using this practice and a double dose will 'explode' the fruit. If any temperature drops – backup generators (x2) and alarm system is already in place. Trucking cool temperature are running at between 15-20 degrees.

4,000 trees can support family and 2 permanent workers. Graded trays are Premium, Class 1 and Class 2. At Lindt & Sons, traders saw Jade farm mangoes that had Premium and Class 1 trays. The storage area at the warehouse was only for holding as pre-cooling and ripening had been done on the farm. Harvesting and storage follows closely the six colour stages (refer to the colour chart booklets). Air forced cooling is often used so harvesting temp of fruit can be as high as 36 degrees and using air forced cooling can bring rapidly down to 20 degrees.

All trays have a barcode. However, once in the supermarket, each mango gets a Price Look-Up (PLU) which assist in identifying at the check-out between the different varieties and sizes on sale. Australia doesn't have a good forecasting system for mango.

We also visited the trader Heathers who were looking after Mambuloo mangoes and many other brands.

Key points:

- Relationships are important
- Quality Assurance of the product to the consumer
- Traceability
- Cool chain throughout, immediately after harvest (quality maintained for 30 days)
- Well organized system
- Growers have no guarantee on price
- Assurance that all produce are brought and accepted in the Brisbane Market but the prices will depend on the quality of the produce.

La Manna

La manna is a wholesaler that provides ripening rooms at Brismark for mangoes, bananas and avocados. They use ethylene gas and cool storage system. This assists the grower who is supplying to a customer who requires a ripened product. LaManna have ripening facilities in every major city in Australia. It is mentioned that during the Australian off-season, they receive mangoes from Mexico which are very poor quality. LaManna has been in business for 87 years. In one ripening room, they can fit 22 pallets. For the mangoes, LaManna offers the service of ripening – so growers send mangoes to LaManna to ripen, LaManna sends the mangoes to the retailers when ready. The retailers pay the growers and then the growers pay LaManna for their ripening service.

Retail Distribution Centers , Supermarkets and fruit shops

Fruity Capers (specialist grocery retailer)

Customers are always choosing mangoes with perfect color, with no blemishes and has a perfect blush. However, these are not always the sweetest. Suggest the customers to look for the sugar spots (lenticels coloured) that indicate sweetness. One example is the Calypso mango which looks perfect but doesn't have the taste of the Kensington Pride and R2E2 varieties. However, the manager was not stocking any Calypso because he didn't like the taste and believed he had a good knowledge of his customers to know they would prefer a good taste above the good looks. The retailer is very conscious of waste usually, they get about one or two mangoes in a box that the customers won't purchase. The retailer would like this waste to be reduced. Everyone in this shop is looking for the Bowen mango, which is a KP, but they think it is its own variety. Usually they buy two pallets of mangoes/day – ripe ones will go on the shelf and some are held back which aren't quite ripe and it is put on the shelf the next day. They do have a small cool room storage area, but they rely on restocking and a fast turnover. They rely on the regular repeat buyer customers and service these people with good advice. It is interesting to note that the fruit was more expensive and the turnover was higher than the Coles supermarket which was right next door. An example of how good customer service can generate repeat and loyal buyers.

Coles (Toowong Shopping Centre)

Type of mango changes throughout the season and customers are aware of the changing varieties. The customers are looking for fruit that isn't marked, not soft and not with a smell that is too strong. It's a luxury item and is sold by the individual fruit – not a staple like bread, rice or milk. Try to make sure there is a mix of fruit on the shelf (on display) – some are already ready today, tomorrow and a few days later.

Debriefing in Toowong

Discussing with the activity for the day where focus on the mango prices in different retailer and wholesaler store, customer choices and the quality. Many farmers don't come down to the markets and look at the quality and prices of the mangoes; therefore, they are not aware of the value and negotiation ability they may possess, with this kind of farmers they only accept the price gave to them without any question. The farmers that do go out and learn about the markets can make good money. There are farms in Australia that are selling mangoes to the Japanese, Korean and Chinese markets and sell a tray of mangoes (7kg) for \$52 Aus. That's a take it or leave it price and the customers are buying, since the quality is very good – the color stage is a consistent 3-4 and has a very low level of defects. Every box is guaranteed a net weight of 7kg. What we've seen today is how the mangoes are picked, and that is hard and green, then someone ripens the fruit for the markets/consumer. This is something that the Samal Island growers should be considering – the intermediate step from harvesting to retail requires a ripening stage to produce the fruit that the retailers and consumer want. Somebody in the supply chain needs to ripen and condition the mangoes coming from Samal Island. This ripening process will also require an understanding of the consumer requirements in the target markets – Manila, Japan, China or Singapore.

The Samal Island mango growers need to question themselves – are they happy with the prices they have got now? If not, then something needs to change, and they need to think about where these changes are required. How is the group going to apply the learnings from the tour into their own situations? There is a realization that the group must require a

packing shed and cool room – important and expensive infrastructure that can be used to improve the product.

There is also a question hanging over the current ACIAR funded R&D program. Anthracnose and thrips this season were the worst they have ever been. The R&D program is supposed to be making recommendations for control and management of these pest and diseases. Its obviously not working and some radical rethinking must be done on behalf of the researchers is urgently required since its been close to six years of work without success.

Because of the wet-tropic conditions and higher humidity, high disease problem is very prevalent, so producing organic mangoes is impossible. The management approach needs to be focused on sustainable and environmentally responsible approach. Small growers should set down and agree in what to do in managing diseases. Another is to talk those farmer whose mango is not yet bearing to correct cultural management and disease management.

Samal Island has a strength in being an island (biosecurity) and having 5,000 acres of mature mango trees. However, its important to get all the farmers within SIMAGA to follow the GAP for quality mangoes and improve the overall quality and volume from the island.

Tues 9 Nov 2010

Tropico Fruits

Tropico Fruits Pty Ltd was established in 1984 and has become one of Australian's leading manufactures of aseptic tropical fruit purees and juices packaged under the "Tropico banner". The buying Farmgate price of 65c/kg for Kensington Pride and 55c/kg for others and were taking all mangoes. KPs are harder to grow and growers are knocking them out and replacing them with other mangoes which aren't as well suited for processing but can give them a higher yield. No growers are under contract – and the price is a farm-gate price, so Tropico bears the cost of transportation, provides the cages to the growers – they organize everything for the growers so they can focus on their mango farm product. Tropico uses a local trucking company. Growers say that 65c/kg farm-gate sale is equivalent to \$18/7kg tray in the markets. If growers get less than \$18, they won't send mangoes anywhere or won't harvest. Different varieties have a different price. Tropico generally wants KP, but the volume of KP grown isn't available. KP is the preferred variety due to its strong 'mango flavor' that is retained after juicing. They make a pure KP product as well as a mix of various mango varieties with some KP for the flavor. This system has no waste. The fruit is juiced and the seed and skin is used for cattle feed. Birdwood Nursery and other mango nursery propagators were collecting seeds for poly-embryonic culture. They collected 15,000 seeds per season. The processed mango goes into products like Berri Fruit Juice etc. At the time of the visit, they are receiving mangoes from Katherine (NT), Burdekin (Qld) and some from WA. They produce an aseptic product of mango puree that has a 24 month shelf-life and can be stored in drums and left outside at ambient temperatures for up to 18 months without affecting the product quality. Currently, Tropico don't export and can't meet the Australian demand. Tropico is the biggest processor in Australia, and there are two others also doing mangoes (ie Golden Circle).

This year, Tropico is also going to do mango 'cheeks' and 'fingers'. Coles and Woolworths have approached them to do a retail pack for the freezer section which they will also do this year. They also do juice, puree, frozen and process papaya, pineapple, strawberries, guava and other fruits.

In 2009, they processed 6,000 tons of mangoes. In 2010, they are expecting 4.5-5,000 tons to be processed. This year, they don't expect the volume of mangoes to be available for processing.

Also, people from Birdwood Nursery were there collecting seed. They were cutting up mangoes received from Katherine where there is less chance of Mango Seed Weevil getting into the seeds. They remove the seed from the husk and get better germination.

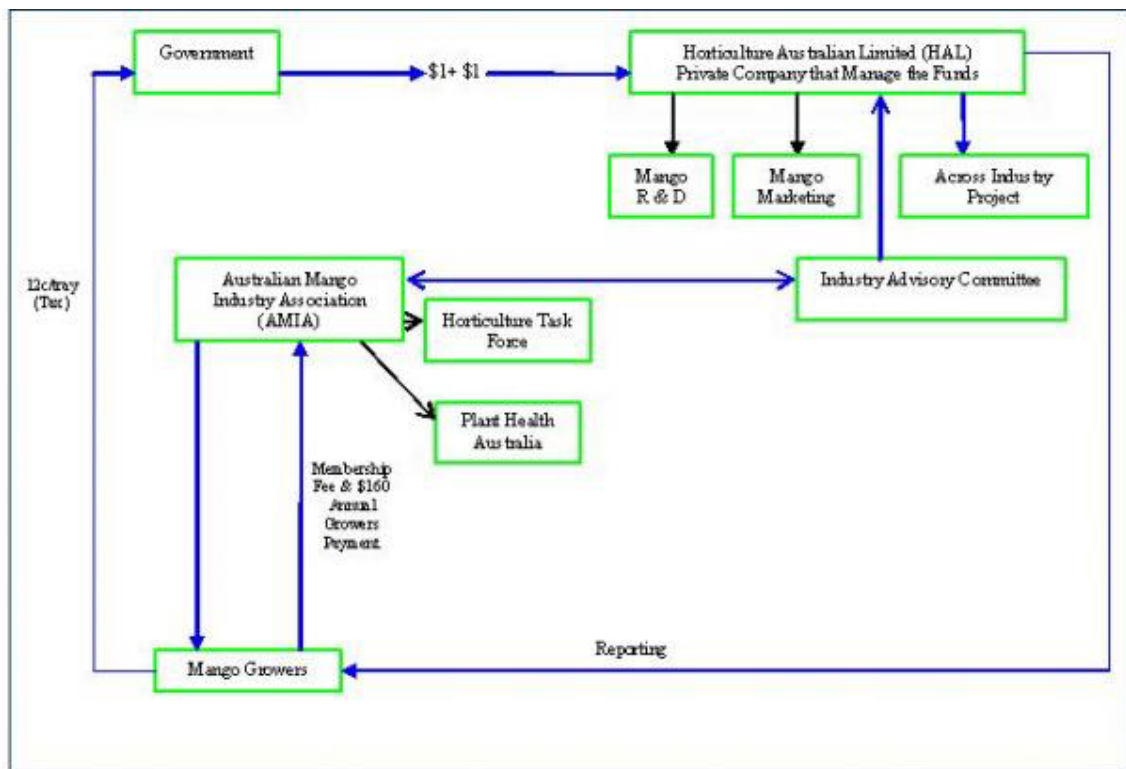
Steritech Queensland

Gary Cook, Operations Supervisor, gave a guided tour of the facilities. The product is received into a warehouse on one side of a gated section. Each pallet is given a bar code with all the Customs information. Most products being treated at 5 Kilograys and will take about 3 hours to go through the treatment. This type of treatment has the potential to increase as the interstate trade is now facing a ban on Dimethoate for fruit fly control. This may become a viable alternative for the industry. Only a small dosage is required for mango fruit fly control. Also, receiving product from other countries for treatment and then re-export (i.e. fruit juice packaging from NZ) was being treated and will be exported to Asia and Africa. Not large volumes of imported materials are being treated. The irradiation source is Cobalt 60 (half life of 5.5 years) and the annual replacement costs for the Cobalt 60 'pencils' is around one million dollars (AU). The Cobalt 60 is kept in a 7m deep pool of water, raised when needed and lowered when not in use. Under water, the live pencils will be black and 'dead' pencils will be normal silver color. If a person was in the chamber when the Cobalt 60 racks were in the up position, they would receive a fatal dose within 8 seconds. The products they are currently treating can't yet be used or go into food products in Australia.

Australian Mango Industry Association (AMIA)

Met with Industry Development Manager, Trevor Dunmore, who explained the industry, association and how the organization was linked to Horticulture Australia with access to levy funds. All farmers must pay a 12c/tray levy on their mangoes. The Government allocated budget for mango industry equivalent to the total amount of levy collected from the growers. The one to one ratio budget will be then used for any development project for mango industry. Horticulture Australia then works closely with the mango industry (via AMIA) to establish the research priorities.

Diagram: Flow of funds and information for Australian mango R&D and marketing



Mango levy

Debrief at Diana Plaza Hotel:

- Should SIMAGA start their own nursery (grow Carabao and public varieties like KP, R2E2)? Currently, the mangoes being purchased from the nursery growers are not the varieties that growers want – non-carabao varieties being sold as carabao. First thing to do is to visit the gene bank on Guimaras Island and see the varieties currently available in the Philippines.
- Everything that the group has seen in Australia needs to be adapted and put into a plan...can't do everything all at once. One needs to set the priorities and set a time table for do-able activities with achievable goals.
- Regarding the irradiation; the technology is good, however, for the Philippines, the cost is too high and not really appropriate at the moment. Maybe in the future, the cost benefit of the irradiation may make the process a better option.
- Samal Island can monitor the trucks taking mangoes off the island. Therefore, there is the potential to collect a levy from the growers (if they agree) and use it as an industry development fund. Establishing a levy for R&D is very difficult and requires a lot of consultation with all the growers to get it approved and supported

(growers should vote on whether or not to have a levy implemented). Any vote should also be based on one grower and one vote (not on size of plantations etc.). Could SIMAGA think about collecting a levy from the growers and then ask government to match it?

- SIMAGA is working with the local government on Samal Island to develop a Mango Code for the Island. However, SIMAGA has not been updated with the draft Codes that are being discussed. Ana Notarte has a copy of the draft and will supply it to the SIMAGA Board of Trustees.
- Plant Health Australia (<http://www.planthealthaustralia.com.au/>) is also a concept that captured the interest of the growers. This provides a National system for growers to identify pests and diseases. New 'exotic' pests and diseases that move into a new region will then make growers who are affected eligible for government assistance. However, firstly, SIMAGA could benefit from closer pest and disease management on the island and maybe this could be a function of government?
- Communications system of AMIA like biannual conference, mango matters magazine, monthly email updates and regional forum really a great help for the members. This is coordinated by Trevor Dunmall who is the full time Industry Development Manager for the Australian Mango Industry Association Ltd. It is a good model but it is costly. However, some of these costs could be off-set by commercial companies (Suppliers, Chemical, Distributors etc) who could advertise in any of the SIMAGA publications.

Had dinner in Southbank at a Turkish Restaurant, where the group was joined by Irene Kernot (Qld DEEDI, who heads the Qld team in the ACIAR-PCARRD South Philippines Program) and Roger Broadley (Qld DEEDI Acting Science Leader)

Wed 10 November 2010

Qld DEEDI at Boggo Rd

This is a brand new facility that DEEDI staff is moving into at Boggo Road.

Had a presentation from Tony Cook, who presented a history of the development of Qld DEEDI and the move from Indooroopilly to Boggo Road, and also a presentation on some other tropical fruit production work being done in Queensland on passionfruit, lychees, avocado and beetroot. The group then took a tour of the new facility of Qld DEEDI at Boggo Road. Tony is a plant pathologist and provided a briefing of the processes they use. They described how a recent outbreak of Eucalyptus Rust (Myrtle Rust) was causing a lot of concern currently in Australia after being identified in NSW.

This season, the mangoes in SE Queensland, the flowering of the mango trees was very poor – still hypothesizing on why this occurred.

Rowland Holmes gave a short presentation on how the industry was changing from a supply driven to a demand driven supply chain. Australia has a specific climatic mango season – unable to induce the mango crop with any consistency because its too far from the equator. Mareeba and Dimboola, where we'll visit are about 1000m altitude and hence one of the last areas to be harvested. Darwin is the first area to start harvest. Australia has a wide spread of issues in each area – in Darwin, its stopping the trees from vegetative growth and developed fruit (due to the heat); whilst in the southern regions have trouble getting vegetative growth and also has colder weather to deal with. Also this season, one grower in the Dimboola area, where it was dry only put on 3 sprays for the growing season, whereas another grower in a wetter area applied 16 sprays (which is excessive). Its almost a 10-15C between the northern and southern growing regions. In the northern regions, the yields are very low – about 2-3t/ha and require a higher price. However, in the south, the yields can be as high as 15-20t/ha. but the south miss the early markets. The market for mango is all in the south – biggest is in Sydney, followed by Melbourne. It takes about 2 days to travel by road to get to the markets and the distance is a real problem. Also, in the north, many people have mangoes in their own yards and grow their own. About 70% of Australian production goes onto the domestic market. Labor costs are very expensive in Australia (\$17/hr) so systems are being developed to minimize labor costs. However, maybe the Philippines' model hasn't got the same labor concerns and can focus solely on the quality aspects. Big problems with anthracnose, stem end rot and sap burn. Two harvesting systems are used in Australia;

- Harvested with the stems attached; then stems removed in the packing shed and the mangoes allowed to bleed the latex for 20-30min on racks and then packed. This system is avoiding sap contact with the fruit.
- Stems are removed in the field and is immediately sprayed with an alkaline chemical solution which neutralizes the sap. This system allows the contact, but neutralizes the sap immediately. Fruit needs to be washed for 1-2 min in the alkaline solution – it's the oil within the sap that causes the burn and that is released once the stem has been removed.

Due to the use of cherry pickers and picking sticks in the field, some of which can reach up to 8m high, the limits on tree height is now on how high the spray rigs can get adequate coverage. However, most orchards are still around the 3m height.

Have also discussion on how the industry in Australia has managed to control anthracnose, which then leads to Stem End Rot coming to the forefront. When this problem was controlled, the industry is again faced with another suspected new variation of the Stem End Rot disease, Dendritic Spot, that is speckling the fruit skin – but not rotting the fruit. This making the appearance of mango not acceptable for consumers. The theory, is anthracnose is very circular symptoms, but the new symptoms of Dendritic spot is very angular. The symptoms appear very quickly and suspect the causal organism is the same as anthracnose/stem end rot; but the symptom expression is different as the Dendritic spot is appearing on fruit that has been held in storage for longer times.

The supply chain for mangoes in Australia has problems with information being filtered back down to farmers. Therefore, the growers also need to talk to the customers and

consumers. Possibly, one way is to utilize some of the new technology – such as Facebook – to bring them closer to their markets. As a mango farmer, they would be able to talk directly to their consumers. You can notify all the consumers that you're harvesting and where and when the fruit will be available – without e-mailing everyone, by just entering onto Facebook and consumers will get automatic feed. Also, they could use it to take pictures of produce that leaves the farm and then place in a blog and then get someone to take and upload a picture on arrival. It is important to understand where the fruit is going and how it is being sold. Know what the consumers want and how to deliver it.

The group took a tour of the new Boggo Road facilities. They have first class facilities for research, including quarantine glass houses. Anthony Young, (ex VegC3 member) guided the tour.

Then, we flew to Townsville and drove to Ayr (80kms south of Townsville) and booked into accommodation at the Ayr Parkside Motel.

Townsville and Ayr

Thurs 11 Nov 2010

Ayr Research Station

Chrys Akem and Rowland Holmes gave presentations. The goal is to increase yields and reduce production costs. Looking at genetic resistant varieties, the station also holds the mango gene bank. There was also a discussion about Calcium Carbide that is being used for ripening fruit in the Philippines but has been banned in Australia and other countries.

Rowland Holmes discussed and explained the 5 key area of successful supply chain. First is focus on consumers , second is look for effective logistics and distributors that could help in your product, third is to produce and deliver the right product (doing this by improving the knowledge and practice ,that is what we are doing now),fourth is to create and share value and the fifth is the effective communication and relationship. Rowland emphasized that there should be an influential captain to lead the chain that drive and guide to do the things to make it successful. And this could be the technician.

Fri 12 Nov 2010

Alex Johnson's Farm

Visit to Alex Johnson's Farm. We viewed assisted harvesting aids operating in his orchard and the packing shed. Harvesting aids were for labor efficiency (self-propelled cherry pickers). De-sapping method using the lime wash (1kg lime in 100l of water). The pH of the de-sapping mango wash is 11 – very high and workers need to wear protective clothing. It is registered as a food product so it is environmentally not a problem. They aim to have a minimum time of 90 seconds for each fruit to be immersed in the wash, in this farm they spray continuously the picked fruit. This farm has a high premium pack-out: 30-40% is being packed a premium grade, 20-30% Class 1, and 40-50% processing and/or reject. Cultural management using paclobutazol is being used yearly for 5 years and then takes one year to rest of the plant (1ml/sqm) (in the Philippines it is used once every 2 years)...however, Alex is using width by height to calculate the amount. However,

in the Philippines, it is under the canopy area (diameter). He also had a packing shed that could potentially be adapted to a small producer in the Philippines.

Note that the mango wash used in the field is different from the detergent that is used in the shed. The mangoes after treatment with the high pH mango wash will dry very quickly. The detergent in the shed will physically remove the oil, whilst mango wash will neutralize it. If the fruit stays wet, then other diseases will get into the fruit. Therefore, using a fast drying mango wash in the field to neutralize the sap in the field is used, so fruit dries quickly and sap is neutralized, then a soap or detergent wash is used in the packing sheds to physically remove any oils or sap to stop further damage. In the sheds, the fruit can also be fan dried.

For SIMAGA, harvest with the stem attached, remove the stems and then immediately drop it into a water bin containing a lime wash, maybe enough to stop the sap burn.

Alex was harvesting about 15t/ha (note trays per tree translates closely to tonnes/ha) and is spacing his KP trees at 12mx12m. R2E2 are being planted as close as 9mx4m in some places.

Alex also has about 1,000 trees on the local golf course that he manages.

In Alex's packing shed, the mangoes go through washing (water spray to get off dirt), and then a hot dip (about 52C with a fungicide Scholar, and fruit has 5min in this dip – for disease control), drying and brushing, then size grading and packing. The grader works on counter weight – heavy fall off first and lighter fruit go to the end.

Note that VHT requires pulp temperature for fruit fly - must raise pulp temperature to 47C for 15minutes to kill the fruit fly. Note that this is very different to the disease control which only requires the water temperature of the fruit dip to be 52C (not the pulp).

The group was interested in getting Alex Johnson over to Samal Island to assist and advise them on setting up a small packing shed. Alex shed cost about \$100k to establish and was build using KW Engineering. The Group suggested that we should explore a Crawford Fund grant for Alex Johnson and Rowland Holmes.

Ayr Research Station – Mango Gene Pool

Then back to the Ayr Research Station to look at the mango gene pool. Chrys Akem led a walk through the orchard where participants could taste some of the ripe fruits from the 384 different mango varieties. They are transferring varieties to South edge and then to Walkerie, a transfer which will happen over the next 5 years. SIMAGA is interested in getting some scion wood of the public varieties like KP and R2E2. However, there is a farm in Digos that is growing R2E2.

Manbulloo – orchard, packing shed and VHT facilities

Then, the group visited Manbulloo Farm operations in Ayr – orchard, packing shed and the VHT facility. It's a highly mechanized operation and emphasized on recording, information, QA, and traceability system. There was a full time Japanese QA (fruit fly VHT) inspector on site checking the mangoes for export to Japan. Following VHT, the mangoes are packed and covered by a fruit fly net inside the box. Interestingly, the Korean inspectors insist that the netting should be external as they believe the fruit fly can pierce through the net onto the fruit if its internal. The packing area for the VHT is a restricted area.

Sat 13 Nov 2010

We drove to Townsville and saw the harvesting of R2E2, it is being harvested at the Townsville Mambuloo Farm. We saw the operation of a harvest aide and picking sticks.

We had lunch at Chrys Akem's house and then met Agnes Sale (wife of Norbert) when she arrived at Townsville airport. The group travelled by bus to Cairns. Chrys Akem and Ana Notarte stayed overnight in Townsville to assist Agnes establish (they rejoined the group on Sunday).

Cairns and Mareeba

Sun 14 Nov 2010

Early breakfast in the zoo. The participants had a chance to pat a koala and feed kangaroos. A discussion ensued on the importance of environment and fauna conservation that is legislated in Australia. Growers were surprised to learn that fruit bats (and other native Australian species) in Australia are protected and the Australian farmers can only aim to get fruit picked as soon as possible to avoid damage. They often lose large sections of their crops to fruit bat and other wildlife. Could this environmental fauna & flora protection be promoted within SIMAGA?

Mon 15 Nov 2010

Mareeba Research Station

The Mango researchers made presentations to the group

Mango Breeding – Ian Bally

Interesting, in China they are taking the name of Mareeba and branding product for quality. After 1960s, systematic selection was commenced. In 1990, R2E2 was released, the second most widely grown variety in the region. 1996 (B74 variety), calypso was released under plant breeders rights. Australian national Breeding program commenced in 1994 – with now only two partners Qld and WA.

Commons or turpentine types are green skinned and fibrous. This is the Kensington Pride type which entered through the port of Bowen and hence took the regional name. Breeding started by mono embryonic selection in the late 70s and 80s. Lots of Florida varieties are mono-embryonic. R2E2 was a success out of this process of planting a large number of open pollinated seedlings. Lots of pollen of different types are floating around in a small area. However, they found out that this wasn't generating enough diversity, a lot of self-pollination, a little variation and lots of seedlings required, low reward for large effort. Then, tried poly-embryonic selection – tried capturing the diversity within the KP before out crossing with other varieties. We Found a lot of variation was due to environment (phenotypic); and there wasn't enough genetic variation within the KP. So, they realized that they needed to start a cross-breeding program. They Started to control Open Pollination breeding. They put preferred pollen parents around a selected female parent and enclose the area. However, high % of self pollination, and uncertainty of pollen parent limits analysis of segregation. B74 calypso was bred this way. Now, they have adopted the Controlled Hand Pollination. It was first used in 1994. It can get a low success rate and require a lot of skill. However, the suitability of the hybrids out of the crosses is very high. (3 out of 1800). The national mango breeding program has generated 3,000 hybrids, evaluated 1,800, have released recently 3 more hybrids, and

uses the Hand Pollination techniques. New release is hybrid 1243 and it's a very early variety (2-4 weeks earlier than KP). Hybrid 1201 has similar timing to KP, higher yielding and firmer variety (travels better than KP). Hybrid 4069 – again similar to KP and higher yielding and firmer and good for export.

They have also bred one hybrid that can produce 6 fruit after one year – however, it does not have a good quality. However, a dwarf with early production is an exciting development. Anthracnose is causing problems globally for mangoes and the program is looking at breeding in some resistance. *M. laurina* is showing some resistance to Anthracnose. This resistance has been tried to capture and this has been crossed with an advanced breeding line that is very susceptible to anthracnose. Being crossed with a 4046, which is a heavy yielding semi-dwarf tree. Also looking at metabolomics within mangoes – trying to look at specific molecules that can assist in health etc.

Genomic Breeding Tools – using microsatellite markers (SSR markers). Look at the DNA of any particular mango and identifying traits and parents.

Basically, the new hybrids are crosses between the Florida group and KP group of mangoes.

Think that a Caribou could be a cross between a Caribbean and an Asian variety, possibly.

Using molecular markers and an open pollination system, selecting at the two/three leaf stage will be a cost effective way to continue breeding. They have also started a dwarfing program (identifying), a lot of effort, but at an early stage.

The breeding program takes about 10 years to select a variety, then about another 5 years to test it, and another 5 years for the market to accept it. So it can take 20 years for a new mango variety to be accepted by the consumer – very difficult and slow.

Action: Ian Bally would be interested in the prospect of doing some work in the Philippines to assist them establish a breeding program during his study leave – possibly, make the Australian Mango Breeding Program an international program and link with the Philippines to have them come and utilize his current program to make selections, then trial these selections back in the Philippines. This would assist the Australian program to continue (new investor) and assist the Philippines as a cost saving method to get the new varieties (not having to pay for an expensive long term breeding investment). Follow up with PCARRD, DEEDI, ACIAR, BPI, Philippine NAT, and the Philippine DA. Visit the Philippine National Mango Research and Development program.

Entomology - Ian Newton & Stef DeFavri

Main pests are fruit spotting bug, mango scale, fruit fly, and a range of thrips, flatids, mealy bugs etc., leafhoppers and recently incursion in NT mango Fruit Borer. We do have mango seed weevil here which is similar to the pulp weevil that is found in Palawan.

Endosulfan, which is banned, was the control for fruit spotting bugs. Working on semiochemicals – pheromones and attractants. Some work on biopesticides starting.

Mango seed weevil is trying to be controlled within the field with Thiamethoxam (Actara). Also, looking at plant resistant. Looking at semiochemicals (Andrew Hayes). Also, microbiological control – novel use of mango bands. It's only a minor production pest – flesh spoilage, and the egg laying on the surface of the fruit causes problems. It is a trade barrier and extremely difficult to control. Actara – is a neonicotinoid insecticide similar to

Confidor and is systemic. They have also been getting some control of mealy bugs with Actara. Actara is injected into the root zone and then taken up by the plant – but its effect is generally on one side of the tree only. It doesn't work on clay. It also doesn't seem to be effective on loam soils compared to the sandy soils. It does seem to have an effect on flatids (plant hoppers), mango scale, and mealy bugs. Some varieties seem to have some genetic tolerance – KP is highly susceptible.

Fungal bands: seed weevils crawl up the trunk and reinfest the same plant. If a band is placed across it, then the bugs get infected by the fungus. Fungal endophytes – *Beauveria bassiana* grows throughout the plant and could provide protection by growing within the plant – it has been trialled in Cavendish bananas where it was successfully colonised but it disappears overtime.

Mango scale

Pink spotting on the surface degrades the fruit – female scales attract the males in a type of colony. Ladybirds will feed on male scales. Encarsia (wasp) is a generalist parasitoid that gets into many scales – lays eggs inside the eggs and is controlling about 20-40% of the scale. Aphides is an external parasitoid of scale – its not in Australia and has been very effective in South Africa – is in quarantine in Australia and hopefully released soon – up to 80% control and works well with Encarsia. The insecticides registered in Australia for mango scale are Applaud, Admiral (both growth regulators), Petroleum Oil, Movento. The very harmful are Supracide, Lorsban and Carbaryl will knock out all the beneficial and deadly.

Plant hopper (flatid) : Supracide will control this but is being removed from the market. Hoping that Actara will fill the void once Supracide has been removed.

Fruit fly: protein baits are used, which contain a toxin that kills the fly. it's sprayed in a band, not on the whole tree – however, it does cause some burn on the tree. The toxin is also dimethoate which again is a broad spectrum. Again, this is being removed from the market. Also using lures. Using lures every 200m to kill the males and also protein bait sprays to kill the females.

Australia has a beneficial that predates on thrips. It is not a big issue in the Australian production system.

Extension - Mathew Weinert

There are lots of R&D in mangoes but lack adoption. Also, the information is not being presented in a way that growers can use. Research data – Information – knowledge – commercial advantage. Delivering mango technology project (Deliverance) has used on-farm research, workshops etc. Australia has a generally low production and high variability – boom and bust cycle – and trying to average this cycle out. Disease breakdown, sapburn and skin browning are very big issues. Australian production is trending upwards and in 2006/07 was 80,000 tons. Aust growers are terrified of N applications – it can effect the skin colouring. If too high or mis-timed, then the fruit won't get the blush, green fruit, and other disease issues. However, the tree needs the N for the leaf production which is required for fruit production. Just before flowering a leaf analysis is taken. N can also impact on other nutrients. So, manage the trees around what the trees are doing – flush, dormancy, flowering, fruiting, harvest and flush. These stages are difficult to predict in Australia and makes the management difficult. N is the driver to also assist the uptake of other minerals. It was a correlation between the leaf N and a spad meter (rapid N test) – however, it needs calibration for each orchard and each variety. Stem end rot seems to be coming in when the trees are under some kind of stress – water

or nutrition. Dendritic spot seems to be a form of stem end rot. After harvest, there is a hot dip with a chemical called Scholar at temp of about 52 degrees for 5 min to control disease. Looks like there is a lot less pest activity within pruned trees – inoculums and pest reduction – removing and opening up the centre of the tree is a good management tool. If not measuring, then you're guessing – this applies to all inputs into the orchard. The hot dip and a hot spray are almost the same result, wise for post harvest disease control. Sap burn and skin browning are issues at picking – controlled by using a chemical to denature the sap – in the shed want to protect the fruit from the sap, the first 30 seconds is most important so detergents and surfactants. In the field, it is neutralized by using a caustic wash like lime etc. The industry has developed a mango quality assessment manual that is being passed out to all actors in the mango chain so that they can refer to the same quality specs.

Shed and Farm Visits

Packing shed of Tosoni in Dimbullah.

Growers night spray due to reduce drift and cooler temperatures to reduce the chemical burns on leaf. Also, the insects are more active. In his packing shed, he was letting the sap leak out after de-stemming. Back-packers were on Working Holiday visas which is a good program and a possible good training program for the Samal island technicians. Hands on training during a season and the experience would be invaluable for the Samal Island development.

Shed and picking of mangoes at Alvis Brazzale.

Periodic pruning and maintaining distance between trees. Sanitation in the orchard was important. Regular pest/disease management. Picking poles were used at harvest and trees were maintained at a small size. Fertigation and correct nutrient management. He cares greatly about what is being picked and his wife is firm on what gets packed in the sheds. His attitude towards mango farming was 100% dedication to his trees – totally committed.

Tues 16 Nov 2010

Mareeba Research Centre

Final wrap up meeting. Participants split into three groups; Marketing, Visits (not Mareeba), and Mareeba visits.

That afternoon visited Farm and viewed a pruning machine in operation

Key results and discussion

Key opportunities and actions to be pursued by SIMAGA

1. Plan to establish packing shed (Branding) – It was agreed that on return, the group will explore ways and means to establish a mango packing shed at a centralised location on Samal Island where growers would be encouraged to process all fruits harvested on the Island for domestic and export markets as well as for processing into various products.

2. Find some money for consumer research and other infrastructure – The Local Government Unit (LGU) staff that were part of the study tour were to approach the Provincial and local district government officials to request for funds to enable them undertake consumer research to improve mango production in the Island. They were also to request for additional funds from the Provincial Government to establish a suitable research and extension facility on the piece of land already secured for this purpose. Such infrastructures would include seminar rooms, training classrooms, a small processing unit and associated cool rooms.
3. How to improve current relationships with Nakashin and Diamond Star – Nakashin and Diamond Star, being the current key purchasing agents for which Memorandums of Understanding have already been signed with SIMAGA will continue to be important partners to the industry on the Island for the marketing of mango fruits for both fresh exports and processing into various value added products. Current relations with these 2 companies will be strengthened by involving them in all discussions and decisions on the future plans of the industry on the Island
4. Look at processing opportunities – Currently, the volumes of fruit from the Island to the various markets contains a lot of low-standard fruits. To improve the situation and encourage better prices, there is a need to consider processing of low grade fruits so that only high grade quality fruit is packed for the different markets. This will mean exploring all processing options including mango drying on a commercial scale and production of frozen products such as purees that can be used to supply fruit juices all year round.
5. Relationships, quality and traceability – An important aspect to improve the marketing of fruits from the Island will be to build relationships with key supermarkets in the Davao region so that they can recognise the Samal Island brand of mangoes because of its quality. It will also be important to explore traceability factors so that fruits can be traced back to the orchard of production, in case needed because of any issue at the market end.

6 Impacts

6.1 Scientific impacts – now and in 5 years

Scientific impacts will only be possible when and if funding is secured from the local and provincial government units to undertake some of the research activities identified during the study. These include improvements in pest and disease management; improvements through the supply chain in fruit harvesting, packing and handling.

6.2 Capacity impacts – now and in 5 years

Extra capacity of the LGU staff will be enhanced through the application of the processes learned during the study tour. They will be able to pass these to the growers on the Island through the regular training exercises undertaken during the production seasons. This will greatly improve the knowledge base of the growers and enable them produce more quality mangoes that demand higher prices.

6.3 Community impacts – now and in 5 years

There is a plan to position the different tour participants as local leaders for mango production in their different Barangays. This will be a process that brings together community members to discuss how mango productivity and handling could be improved. This will also be an avenue to discuss other community building issues including social amenities, welfare, health and education.

6.3.1 Economic impacts

Improvements in mango productivity and fruit quality will result in better prices through the established buyers and will impact on the economic livelihood of the grower communities.

6.3.2 Social impacts

Barangay groupings will identify social needs within each community that could be addressed through committees for the betterment of the growers in the various communities. Social interactions will create better relationships among the community members.

6.3.3 Environmental impacts

Using all the various pest management practices that are environmentally friendly shall result in cleaner environments. These shall mainly be from the training classes conducted by the LGUs on improved pesticide handlings and judicious use based on crop monitoring and other decision making tools

6.4 Communication and dissemination activities

One of the plans or objectives of the study tour was for the participants to hold a series of regional workshops with mango growers in various production regions of Mindanao to share their experiences and findings.

These were scheduled to start during the 2011 mango production season.

The participants left Australia with various research and extension brochures which could be used directly or formatted to suit the Filipino industry.

The LGU agents who were part of the study tour are planning to produce brochures summarising various mango supply chain processes to distribute to growers and other industry stakeholders

7 Conclusions and recommendations

There was general satisfaction from all the tour participants, and they remain grateful for the chance and opportunity they were given to gain valuable experiences through their participation in such an informative learning tour.

7.1 Conclusions

This SRA was a unique way of engaging the growers directly and impacting them on improvements in the value chain system. More of this should be built in and budgeted as part of extension activities in future projects

7.2 Recommendations

Other mango production regions in Southern Philippines are keen to also undertake such a tour. It would be nice if funds could be made available so that more growers from the different production regions are also given the chance to study first hand mango production, handling and marketing in a quality focused industry such as the one in Australia.

Because of the incident that happened with one of the participants detailed in the Trip Report, it is strongly recommended that additional insurance coverage be considered for all future tour participants as the travel insurance has some limitations and do not cover major incidences.

8 Appendix – Some Tour Photos



Figure 5: Tour Group at Davao Airport (l to r): David Palconit, Jerry Aliño, Juliet Zambrano, Lourdes Cesar, Jorge Virtucio, Norbert Sale, Ana Notarte, Michael Ninte, Nestor Asidoy, Pastor Lozada, John Oakeshott, (Allan Siano joined group in Singapore)



Figure 5: Tour Group at Ayr Research Station, Qld (l to r): Allan Siano, Pastor Lozada, Lourdes Cesar, Nestor Asidoy, Juliet Zambrano, David Palconit, Jorge Virtucio, Chrys Akem, Michael Ninte, John Oakeshott, Jerry Aliño



Figure 5: Touring Tropico Fruits Pty Ltd



Figure 5: Rowland Holmes (centre) and Chrys Akem Qld DEEDI, discussing mangoes at the Brisbane Markets



Figure 5: Meeting with John Lim, Singapore Fruits & Vegetable Importers and Exporters Association