

# **Post Harvest Study Tour – UC Davis Fruit Ripening and Retail Workshop 2014**

Richard Clayton  
MacKay's Banana Marketing

Project Number: BA13701

## **BA13701**

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# **HAL Project Final Report – Study Tour**

**BA13701 (Completion Date 21/05/2014)**

## **Postharvest Study Tour – UC Davis Fruit Ripening and Retail Workshop 2014**

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**Service Providers: Horticulture Australia, MacKay's Banana Marketing**



*Horticulture Australia*



## **HAL Study Tour Project Number: BA13701 (Completion Date 21/05/14)**

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### **Purpose of Report:**

The aims of this study tour were to attend the UC Davis Fruit Ripening and Retail handling Workshop, which was held in Davis CA on March 25<sup>th</sup> & 26<sup>th</sup>, 2014. Also, to conducted a field tour of a ripening facility and supermarkets around the Sacramento CA area to gain insights that could be applied to develop ripening training within Australia. This document is the final project report which outlines outcomes from the study tour and implications for Australian Horticulture.

### **Acknowledgments:**

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### **Date of report:**

May 2014

### **Disclaimer:**

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## **MEDIA SUMMARY**

Research has shown that banana appearance and ripeness is important to consumers. Banana ripening is the process by which the fruit changes from a mature hard green state to a ripe state ready for consumption. Correctly managing the ripening process is therefore important in delivering bananas that offers consumers satisfaction.

Even though ripening is a very important part of the banana supply chain, the Australian Banana Industry relies on a relatively small group of people that have the skills to ripen quality bananas. Currently the industry has no recognised programs in place to provide ripening education and development. As the Australian banana category grows there is the risk that the already limited skills base will become further diluted and this could jeopardize the quality of bananas the industry offers to consumers. The Banana Industry will need educate ripeners and provide them the opportunity to acquire new knowledge.

Study tour project BA13701 attended the UC Davis Fruit Ripening and Retail Handling Workshop, which was held in Davis CA (March 25<sup>th</sup> and 26<sup>th</sup>, 2014). The project also included field tour of a ripening facility and supermarkets around the Sacramento area (March 27<sup>th</sup>, 2014) to gain knowledge about fruit ripening and insights into the ripening industry and retailing in the USA.

From our observations we determined that the Banana Industry in the USA faces the same shortage of technical knowledge and experience that we have in Australia. The recent introduction of ripening other fruit lines is placing further pressure on ripeners knowledge, not to mention limited capacity in ripening facilities. Retailers and Industry in the USA are also placing increasingly more emphasis on ripening to improve consumer satisfaction because of the way it impacts on fruit flavour and shelf life.

The study tour group observed that the Banana and Ripening Industry in the USA has responded to these pressures by working in conjunction with educational institutions such as UC Davis to provide the opportunity for ripeners to acquire technical knowledge. Due to the growth expected in the Australian Banana category, the industry is facing a potential shortage of skilled ripeners. Through investment and development in ripening training the aim would be to prevent a shortage of ripening knowledge in Australia, improve the offer from the Banana Industry to consumers and see sustainable category growth by increased consumption.

## EXPECTED OUTCOMES AND HOW THEY WERE ACHIEVED

The objectives of the study tour included:

- 1. Attend the 2014 UC Davis Fruit Ripening & Retail Handling Workshop (Davis CA, 25<sup>th</sup> & 26<sup>th</sup> March).**

Delegates from MacKay's Banana Marketing were nominated to attend the UC Davis ripening workshop (Appendix 1). These delegates were selected to represent a cross section of the business, from sales to ripening.

All delegates had previous banana ripening experience, ranging from the wholesale markets, ripening within supermarket distribution centres and third party supermarket service provider ripening.

- 2. Conduct a field tour of a ripening facility and supermarkets around the Sacramento CA area (27<sup>th</sup> March 2014).**

Delegates from MacKay's Banana Marketing participated in a field tour of a Raley's supermarket ripening facility and various supermarket stores around the Sacramento area.

A list of supermarket stores is found in Appendix 2.

The aim of the tour was to gain first hand insight into commercial banana ripening in the USA and also observe colour stage and presentation of bananas at retail level.

Each of the MacKay's Banana Marketing delegates (excluding Richard Clayton) that participated in study tour project BA13701 prepared a brief travel report. In the report the candidates were asked to answer the following questions:

- Describe what knowledge and insights they gained from attending the UC Davis fruit Ripening and Retail Handling Workshop.
- What were the key observations made from the field visits to the ripening facility and supermarket stores?
- How can the knowledge acquired from the study tour be applied to day to day business in order to grow the total banana category and in the long term be used to develop certified ripening training in Australia?

Individual reports are attached in this report (Appendix 2); however an overall summary of the study tour and collective insights is given in the Results and Discussions section below.

## **RESULTS OF DISCUSSIONS**

### **Overall Summary**

#### **2014 UC Davis Fruit Ripening & Retail Handling Workshop**

The UC Davis Fruit Ripening & Retail Handling Workshop ran over two days as a series of lectures given by different academic speakers and consultants from postharvest and retail fields. The workshop explained ripening as an important part of the process to meeting the needs of retailers and consumers. Because ripening impacts on flavour, texture and shelf life of fruit it therefore has a major impact on consumer satisfaction and retailer profitability. Different topics covered by the workshop included:

- Why we ripen certain fresh produce
- Basic biological principles in fruit ripening
- A general overview of how to ripen fruit with comment on equipment and the factors we manage during ripening
- Case studies used to explain ripening principles and procedures more specific to different fruit types
- Trends observed in fresh produce retailing in the USA
- To a lesser extent new technology that can be applied in ripening and postharvest fruit storage

Delegates found that the workshop focused mainly on the technical / theoretical knowledge of fruit ripening. It provided biological information to explain why and how fruit ripens and how we can control environmental conditions to manage this process. There was no practical ripening component to the workshop. This was not considered to be a weakness; instead the knowledge acquired in the workshop was intended to compliment the practical 'on-job' training methods used in the industry.

It was interesting to note the different backgrounds of attendees. The workshop brought together industry professionals from all points of the supply chain. Attendees included growers, shippers, wholesalers and retailers.

It was clear that the UC Davis workshop was catering for an industry need. Both UC Davis and the Fresh Produce industry in the USA have seen the necessity for education as the industry continues to develop in reaction to changing customer and consumer expectations.



## Banana Ripening in the USA

MacKay Banana Marketing gained certain insights into Banana ripening in the USA through discussion with industry members at the UC Davis Ripening Workshop and a field visit to the Raley's Family of Fine Stores Distribution Centre in Sacramento. Key observations of ripening include:

- Major retailers ripen the majority of bananas
- Ripeners know the fruit in their rooms
- Bananas generally ripened to a 6 day program (including 1 day stabilisation)
- Bananas are out-turned at a colour stage 3.5
- Ripening of other fruit is becoming more common

Similar to the Australian Industry, the Ripening industry in the USA also relies of a small group of people with the skills to ripen quality bananas. Ripening is conducted by different parties including producers, wholesalers and retailers. In the USA the retailers ripen the vast majority of bananas in the country. Ripening of bananas should involve an understanding of both technical knowledge and practical skills. As a result of current training practices in the industry, ripeners in Australia tend to have a better understanding of the practical skills involved in ripening and less detailed technical knowledge of bananas and the ripening process. Based on conversations with ripeners we would suggest that this is also the case in the USA. The difference we observed was the appreciation they have for their own knowledge gaps which we feel has in part aided the development of ripening and postharvest education programs.

Another observation was that ripeners in the USA work to the principle of 'knowing the fruit in their rooms'. Background information about bananas, such as packed on date, is not readily available. Similarly, the bananas they are ripening are grown in different locations or can be of varying age. To manage these issues the ripeners closely monitor the fruit during the ripening process and actively sort pallets to ensure out-turn at the correct colour stage. Despite the lack of information available to them, from this point of view they know their fruit.

With regard to specific ripening programs, bananas are generally ripened in the USA to a 6 day program. The main driver for a 6 day ripening program seemed to be limited availability of ripening rooms relative to fruit demand. In addition, ripening capacity is be put under further pressure by the move to condition other fruits.

Bananas are out-turned at colour stage 3.5 in the USA. This target is consistent throughout the whole industry from wholesale ripening to retailers. The primary aim for this is to maximize shelf life for both retailer and consumer. An added benefit is faster turnover of fruit through ripening facilities. Just how important colour stage and shelf life is to retailers is demonstrated by the fact that some retailers will not send bananas to store if they are a stage 4 or above.

Ripening of other fruit is becoming increasingly popular in the USA. Recent examples include avocados, mangoes, pears and melons. Industry and retailers have seen positive category growth by using ripening to improve quality and consistently in this fruit. This comes down to meeting consumer needs for improved flavour, texture and shelf life. This has been another factor that driven the need for increased ripening education in the USA. It's also placing further demand on limited ripening rooms.

## **Retail Observations in the USA**

Our tour visited a range of retail outlets around the Sacramento area. Some of these included Walmart, BelAir, Raley's Family of Fine Stores, Whole Foods and Trader Joes (tour itinerary shown in Appendix 4). In these stores we observed some differences, but many similarities with the way fresh produce is retailed in Australia.

Below are some of the interesting observations we made:

- High level of presentation
- Quality was comparable to Australia
- Most fresh produce was displayed loose
- Range of pre packed produce was similar if not less than Australia
- Unit sizing in pre packed produce was large
- Country of origin; high volume of fresh produce from Mexico (bananas, avocados, mangoes)

With regard to bananas, observations included:

- Colour stage 4 – 5 on display in store
- Quality was good with minimal minor defects
- Finger length between 23 – 28cm
- Bananas generally presented on stepped displays (shown in image 3 on page 7)
- PLU labels on clusters
- Off location displays commonly used for bananas around the store (shown in image 4 on page 7)
- Use of pre packed bananas was very limited

- Country of origin; higher volume of bananas from Mexico, lesser volumes from Costa Rica, Guatemala & Ecuador.

From our field visits to stores we made 2 key observations that are particularly relevant to banana ripening and the issue of ripening training. These observations related to shelf life and managing banana colour stage post ripening at store level.

Retailers in the USA are very focussed on banana shelf life. Not only does this minimise waste at store level, but we also understand that the majority of consumers in the USA don't buy bananas to eat the same day as purchase. To achieve the desired shelf life the retailers ripen bananas to a 6 day program and out-turned at colour stage 3.5. Store then receive bananas from colour stages 3.5 – 4 and are then able to manage the further conditioning of the fruit at store.

Retailers in the USA generally display bananas between colour stages 4 – 4.5. As mentioned above, the primary aim is to maximize shelf life. The stores actively manage banana conditioning at the back of store by employing processes such as air-stacking or using blankets to control fruit temperature. This raises the question about ripening training for people at store level. We would suggest that to successfully condition bananas for retail this way requires an understanding of banana ripening and handling.

## **IMPLICATIONS FOR AUSTRALIAN HORTICULTURE**

Study Tour project BA13701 provided the following insights relevant to growing the Australian Banana Category and developing ripening training:

- Sustainable category growth in fresh produce is being driven by consumption rather than production and consumer satisfaction is viewed as critical in growing consumption.
- Because ripening impacts on the flavour, texture and shelf life of bananas it is being viewed as having a major influence on consumer satisfaction and retailer profitability.
- Educational programs, such as the Fruit Ripening and Retail Handling Workshop offered by UC Davis, provide the opportunity for people in the industry to acquire theoretical knowledge that can be applied in banana ripening and postharvest handling.
- Practical ripening training is not easily offered by educational institutions. Industry and businesses will need to be more active in developing training programs that focus on practical aspects of banana ripening.

- Depending on the desired colour stage of bananas at retail level, an understanding of banana ripening and handling beyond the ripening centre at store level would seem necessary to achieve the best outcome.

## **HOW THE INFORMATION GATHERED WILL BE DISSEMINATED**

From study tour project BA13701 participant delegates from MacKay's Banana Marketing will utilise the knowledge and insight gained to help develop a certified practical ripening training program, which will be piloted within MacKay's business.

The potential is also for the Australian Banana Industry to engage with educational institutions to develop theoretical based training programs.

## **ITINERARY**

The program for the study tour is shown in Appendices 3 and 4. The UC Davis Fruit Ripening and Retail Handling Workshop was held on March 25th and 26th, 2014. The field tour of a ripening facility and supermarkets around the Sacramento area occurred on March 27th, 2014.

## **RECOMMENDATIONS**

Study tour project BA13701 provided a great opportunity for delegates from MacKay's Banana Marketing to attend the 2014 UC Davis Fruit Ripening & Retail Handling Workshop, followed by field visits to gain insight into the Ripening Industry in the USA and how we can apply this knowledge to address the skills shortage issue that the Australian Banana Industry potentially faces in the long term.

From our observations we determined that the Banana Industry in the USA faces the same shortage of technical knowledge and experience that we have in Australia. The recent introduction of ripening other fruit lines is placing further pressure on ripeners knowledge, not to mention limited capacity in ripening facilities.

Retailers and Industry in the USA are also placing increasingly more emphasis on ripening to improve consumer satisfaction because of the way it impacts on fruit flavour and shelf life. The Banana and Ripening Industry in the USA has responded to these pressures by working in conjunction with educational institutions such as UC Davis to provide the opportunity for ripeners to acquire theoretical / technical knowledge.

Short course educational programs such as the UC Davis Fruit Ripening Workshop may be effective in teaching theoretical information to industry people, but are not suitable in teaching the practical aspects of fruit ripening. Industry and business would still seem to be better positioned to achieve this through 'on-job' training methods.

With the expected growth of the Australian Banana category the industry is facing a potential shortage of skilled ripeners. The study tour group came to the belief that investment is required to educate ripeners and provide the opportunity for them to acquire new knowledge. Through investment and development in ripening training ultimately the aim would be to prevent a shortage of ripening knowledge in Australia, improve the offer from the Banana Industry to consumers and see category growth by increased consumption.

## **CONTACT LIST**

A total of 12 instructors and 54 delegates participated in the 2014 UC Davis Fruit Ripening and Retail Handling Workshop. The instructor and delegates list can be found in Appendix 5.

## APPENDIX 1

### Participant Delegates from MacKay's Banana Marketing in Study Tour Project BA13701

<b>Name</b>	<b>Organisation</b>	<b>Contact Email</b>
Richard Clayton	MacKay's Banana Marketing	Richard@mackaysmarketing.com.au
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Piet Fontyn	MacKay's Banana Marketing	Piet@mackaysmarketing.com.au
Brad Harvey	MacKay's Banana Marketing	Brad@mackaysmarketing.com.au
Matthew MacKay	MacKay's Banana Marketing	matthew@mpsco.com.au

## APPENDIX 2

**Name:** Piet Fontyn

**Organisation:** MacKay's Banana Marketing

**Describe what knowledge and insights they gained from attending the UC Davis Fruit Ripening and Retail Handling Workshop.**

It was interesting and encouraging to see a whole department dedicated to the post-harvest handling of fresh produce. There was a high level of technical data discussed in regards:

- Temperature management
- Controlling the effects of Ethylene
- Ripening facilities
- Correct design and set up of ripening rooms.
- Consumer satisfaction.

Detailed ripening processes and outcomes were presented on a variety of produce.

- Bananas
- Avocado
- Pears and Kiwi Fruit
- Mangoes and Papaya
- Tomatoes

Included in discussions were the why and how each climacteric reaction occurs.

Being presented both the technical effects and biology of Ethylene has led to a greater appreciation of the complete ripening process.

**What were the key observations made from the field visits to the ripening facility and supermarket stores?**

**Raley's Family of Fine Stores DC:**

Western seaboard of the USA uses tarpless rooms for all forms of ripening, and has many more years' experience than Australia in this form of ripening facility.





Ripeners in the USA gave a high level of importance to the regions and country's that their fruit arrives from. All countries have different climates, soils and length of sea travel before reaching the DC. All react differently and were expected to be handled accordingly.

DC's out-turned bananas a stage less than the accepted norm of Australia. No fruit was to be delivered to stores in any more than a stage 3.5 condition. It was expected that fruit was to be managed at store level after receipt. Avocados and mangoes have only just begun to be ripened over the last few years. Through correct post-harvest ripening processes they have seen high levels of customer satisfaction.



#### **Supermarkets (Sacramento area):**

The perception that the US stores were in front of their Australia counterparts seems incorrect with the majority of the stores featuring the same characteristics as Australian stores.





- PLU stickers were very prominent on fruit, especially any imported fruit. Country of origin was displayed on all POS.
- Majority of displays were stepped.
- High visibility of organic fruit with a high tendency to display local organic.
- Bananas were generally displayed between a stage 4 - 4.5
- High level of importance on shelf life and waste minimization.

**How can the knowledge acquired from the study tour be applied to day to day business in order to grow the total banana category and in the long term be used to develop certified ripening training in Australia?**

This course highlighted a gap that the majority of employees in the industry have in regards the correct handling and ripening of produce post-harvest in Australia. In Australia there seems to have been a lot of “hands on” training but no formal knowledge of the technical /physiological side of ripening. There has always been a perception of that’s how I was trained and that is how it has always been done, with little regard to the consumers final eating experience. Correct instruction of the post–harvest side will definitely benefit the industry in regards shelf life and consumer satisfaction.

There were a wide range of participants at the course that encompassed all areas of the industry from QA, ripeners, importers and growers. All were there because they understood the importance of correct management of post-harvest procedures.

Clearly there was found to be a need for this course in the USA. Short courses like this will be important to the Australian industry as it continues to grow. Training in the correct post-harvest processes will always be important in delivering the best possible product to the consumer.



**Name: Brad Harvey**

**Organisation: MacKay's Banana Marketing**

**Describe what knowledge and insights they gained from attending the UC Davis Fruit Ripening and Retail Handling Workshop.**

The UC Davis Fruit Ripening and Retail Handling Workshop presented technical / theoretical information regarding ripening and postharvest handling of different fruit. The level of information was detailed enough to outline the basic physiological processes that occur in fruit ripening. I believe this is important in developing a foundation of ripening knowledge and more so why fruit ripen and how they ripen.

Retailers and industry are becoming increasingly aware that category growth in fresh produce is being driven by consumption rather than production. Consumer satisfaction was highlighted in the Workshop as an important factor in growing consumption. Furthermore, it was explained to us that because of the effects of ripening on fruit flavour and texture, we should not overlook how critical the process is in achieving consumer satisfaction.

The Workshop had very little practical focus, which I didn't consider to be a weakness. My belief is that practical ripening training is still best achieved through 'on-job' training methods. The intention of the Workshop seemed to be to provide information that compliments knowledge that industry people already have through their day to day experience in ripening.

I felt the Workshop catered well to an industry demand, that being to provide ripening education in a way that was understandable, accessible and relevant. I would also suggest that programs of this nature are similarly beneficial to educational institutions such as universities because they allow them to tap into another market that the traditional more time demanding courses do not cater as well for.

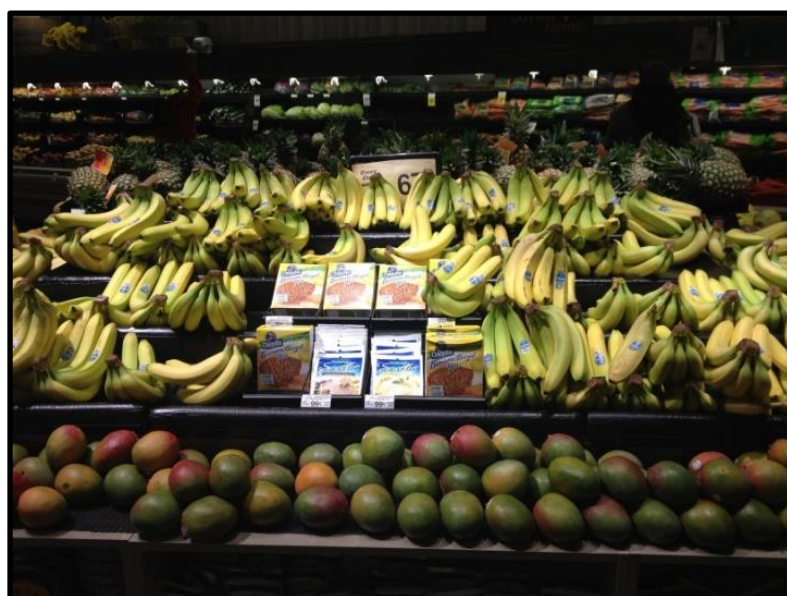
**What were the key observations made from the field visits to the ripening facility and supermarket stores?**

Ripeners in the USA are not provided with a high level of background information on the banana consignments they ripen. It's not uncommon for banana consignments to include fruit produced in different geographic locations or with different packed-on dates. Image 1 on the following page illustrates the limited



information presented on cartons and pallets. Without this information the ripeners need to monitor the bananas very closely during ripening and actively sort through pallets to ensure they are able to out-turn the correct colour. The impression I got was that ripeners in the USA need to know the fruit in their rooms.

Bananas are commonly retailed to consumers at colour stage 4 – 4.5 in the USA. This would seem to be largely driven by the retailers and consumers demand for shelf life. To achieve this ripeners out-turn bananas at colour stage 3.5. However, the observation was also made that to achieve this retailers are actively managing banana conditioning at the back of store by employing processes such as air-stacking or using blankets to control fruit temperature.





**How can the knowledge acquired from the study tour be applied to day to day business in order to grow the total banana category and in the long term be used to develop certified ripening training in Australia?**

Based on the experiences and knowledge gained from the study tour, I've come to the belief that a good banana ripener is one that is willing to educate them self.

Ripening training should include both theoretical and practical components. Short course educational programs such as the UC Davis Fruit Ripening Workshop are effective in teaching theoretical information to industry people, but are not suitable in teaching the practical aspects of fruit ripening. Industry and business is better positioned to achieve this through 'on-job' training methods, but more structure is required for this to be more effective.

Beyond a technical and practical understanding of banana ripening, it's important for ripeners to have a willingness to know more about the fruit they are ripening, monitor how it ripens and use this information to generate a better product for the end consumer.

Ripening inherently affects the flavour, texture and shelf life of bananas. All three of these factors are important when it comes to satisfying consumers. By investing in ripening training to prevent a shortage of ripening knowledge in Australia, the Banana Industry would see category growth through improved consumer satisfaction.

**Name: Daniel MacKay**

**Organisation: MacKay's Produce Solutions**

**Describe what knowledge and insights they gained from attending the UC Davis Fruit Ripening and Retail Handling Workshop.**

Internationally there is a more constant approach to banana ripening and therefore a good case for a training group to be established in Australia to gain consistence across the category.

Examples of what was learnt:

- All bananas respire and need to keep moisture to have good shelf life.
- Shortening the time of the ripening cycle for bananas can result in reduced shelf life.
- Good ordering practices are essential to allow for sufficient ripening time for bananas.

**What were the key observations made from the field visits to the ripening facility and supermarket stores?**

- Banana quality was generally good and comparable to Australian fruit.
- Green bananas at DC did have some issues such as mix ripe resulting from age and transit.
- The DC had tarpless rooms and looked very good. Staff gave a good insight to how they run.
- Quality of fruit at supermarkets was good. Backward condition to achieve shelf life seems to be a high priority.

**How can the knowledge acquired from the study tour be applied to day to day business in order to grow the total banana category and in the long term be used to develop certified ripening training in Australia?**

A training program of how fruit should be ripened would be very easy to put together. In addition to the basic principles of ripening and QC of bananas, the training program should also focus on different ripening rooms and particularly look at stock ordering / forecasting, as inaccurate forecasting of orders can put pressure on the time available to ripen the fruit. Ultimately I believe this can be done.

**Name: Matthew MacKay**

**Organisation: MacKay's Produce Solutions**

**Describe what knowledge and insights they gained from attending the UC Davis fruit Ripening and Retail Handling Workshop.**

The team from MacKay's Banana Marketing travelled to the US to attend the 2014 UC Davis Fruit Ripening and Retail Handling Workshop in Sacramento. One of the key learnings I took from the workshop was the importance of temperature management in ripening. Although, through my own ripening experience I was aware that temperature affects ripening, from the workshop I gained a better understanding of how and why temperature is so important in the ripening process.

The second key learning I took away from the workshop was a better understand about the role and action of ethylene in ripening. It was interesting to learn that more ethylene doesn't necessarily equal faster ripening.

Finally, as I have always been accustomed to MBM's ripening facilities, I was interested in learning how the different ripening rooms in the US work as it gave me a further understanding into how two different systems can produce the same outcome. The knowledge and insight that I acquired throughout the conference both broadened my knowledge of not only the processes that relate directly to us at MBM but also the greater industry in which our business operates.

**What were the key observations made from the field visits to the ripening facility and supermarket stores?**

Through visiting the ripening facility at Raley's DC, as well as doing store visits to local supermarkets such as Walmart, Trader Joe's, Wholefoods and Raley's, I found it interesting to draw comparison between Australian banana and bananas we saw in the ripening centre and these retail outlets in the USA.

My key observations from visiting the distribution centre include the following:

- The colour stage at which bananas are out turned at are 3.5 and no riper.
- Tarpless banana ripening rooms were new to me, so I was very interested in learning how these work.
- Mixed condition can be an issue probably due to the age of fruit from the long time in transit.

My key observations acquired by visiting the various supermarket stores include the following:

- The fruit quality was generally good in most supermarket stores.
- Colour stage in stores were commonly between 4 to 5.
- Off location displays seem to be used near checkouts and even down the grocery isles.

**How can the knowledge acquired from the study tour be applied to day to day business in order to grow the total banana category and in the long term be used to develop certified ripening training in Australia?**

Through travelling to the US, I have learnt information about banana ripening which is not in turn assists my day to day work. As the Australian banana industry grows, continual training and development courses like these are essential to learn the importance of correct fruit management and ripening to ensure that the Australian banana standards remain competitive on a global scale.



## APPENDIX 3

### UC Davis Fruit Ripening and Retail Handling Workshop, March 25 – 26, 2014

Time	Topic	Instructor
<b>Day 1</b>	<b>Tuesday, March 25, 2014</b>	
8.00AM	<b>Registration &amp; Breakfast</b>	
8.25AM	Welcome	Beth Mitcham, Department of Plant Science, UC Davis
	<b>Moderator</b>	<b>Beth Mitcham</b>
8.30AM	Consumer Preferences Trends	Christine Bruhn, Department of Food Science & Technology, UC Davis
9.00AM	Fruit Ripening and Quality Relationships	Florence Zakharov, Department of Plant Science, UC Davis
9.30AM	Why Are Ripening Programs Important?	Dennis Kihlstadius, Produce Technical Services
10.00AM	<b>Break</b>	
10.15AM	Ripening Temperature Management	Jeff Brecht, Horticultural Sciences Department, University of Florida
10.45AM	Fruit & Vegetable Cold Storage Disorders	Mikal Saltveit, Department of Plant Sciences, UC Davis
11.15AM	Biology of Ethylene Production and Action in Fruits	Beth Mitcham
12.00PM	<b>Lunch</b>	
	<b>Moderator</b>	<b>Jeff Brecht</b>
1.00PM	Ethylene Inhibition and Control	Marita Cantwell, Department of Plant Sciences, UC Davis
1.45AM	Ripening Facilities and Equipment	Jim Thompson, Postharvest Engineering LLC & Department of Biological Ag Engineering, UC Davis
2.30PM	<b>Break</b>	
2.45PM	What is Happening in Retail?	Dennis Kihlstadius
3.15PM	Breakout Demonstration Sessions	
3.15 – 5.00PM	Group 1: Fruit Tasting Group 2: Measurement of CO <sub>2</sub> , O <sub>2</sub> , Colour, Firmness, SSC, TA and Ethylene Control Methods	Florence Zakharov, Dennis Kihlstadius, Mary Lu Arpaia Beth Mitcham, Jeff Brecht, Bill Biasi, Jim Thompson
5.00 – 6.30PM	<b>Networking Reception</b>	

<b>Day 2</b>	<b>Wednesday, March 26, 2014</b>	
8.25AM	<b>Moderator</b>	<b>Deirdre Holcroft, Holcroft Postharvest Consulting</b>
8.30AM	Ripening Stone Fruit & Kiwifruit	Beth Mitcham
8.50AM	Ripening Melons	Marita Cantwell
9.10AM	Ripening Pears	Beth Mitcham
9.30AM	Ripening Mangos & Papayas	Jeff Brecht
9.50AM	Ripening Tomatoes	Marita Cantwell
10.10AM	<b>Break</b>	
10.25AM	Ripening Avocados	Mary Lu Arpaia, Department of Botany & Plant Science, UC Riverside
10.45AM	Degreening Citrus	Mary Lu Arpaia
11.00AM	Ripening Bananas	Mary Lu Arpaia
11.25AM	The Art of Ripening Bananas	Jim Merkel, Raley's Family of Fine Stores
11.45AM	Fresh Fruit Market Trends - 1	Roberta Cook, Agricultural and Resource Economics, UC Davis
12.30PM	<b>Lunch</b>	
	<b>Moderator</b>	<b>Maria Cantwell</b>
1.15PM	Fresh Fruit Market Trends - 2	Roberta Cook
2.00PM	Group Break Out Session Q & A about Ripening Protocols	
2.45PM	Break Out Session Reports	Dennis Kihlstadius, Moderator
3.15PM	<b>Break</b>	
3.30PM	Sensory Quality Measurements	Florence Zakharov
4.00PM	New Technologies and Equipment	Deirdre Holcroft
5.00PM	<b>Wrap Up, Course Certificates</b>	<b>Beth Mitcham, Director PTC</b>

## APPENDIX 4

### Field Tour, March 27 – 28, 2014

Time	Location	Moderator / Instructor
Day 1	Thursday, March 27, 2014	
8.30AM	Whole Foods - Davis	Guide – Richard Clayton
9.30AM	Raley's Ripening Centre and DC Visit	Jim Merkel, Raley's Family of Fine Stores
11.00AM	BelAir Store Visit	Guide – Richard Clayton
12.00PM	Lunch	Guide – Richard Clayton
1.00PM	Wall Mart	Guide – Richard Clayton
1.45PM	Super Wall Mart	Guide – Richard Clayton
2.30PM	Save Mart Supermarkets	Guide – Richard Clayton
3.15PM	Trader Joes	Guide – Richard Clayton
4.00PM	Whole Foods - Roseville	Guide – Richard Clayton

## APPENDIX 5

### Fruit Ripening & Retail Handling

March 25 & 26, 2014

#### Instructors

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##### Deirdre Holcroft

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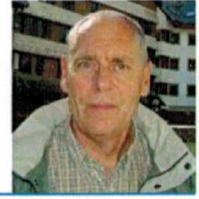
##### Dennis Kilstadius

CEO

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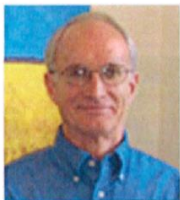
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