

# **Developing a crop forecasting system for the Australian Mango Industry**

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Regional Development, Primary Industry, Fisheries  
and Resources

Project Number: MG05004

## **MG05004**

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## **MG05004 Final Report**

### **Developing a Crop Forecasting System for the Australian Mango Industry**



## **MG05004 – Developing a Crop Forecasting System for the Australian Mango Industry**

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### **Purpose**

This report documents the results of a three-year project.

### **Acknowledgments**

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The project was also supported by the many growers and packers as collaborators.

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## Definitions

Heat sum	The formula used to calculate timing of fruit maturity from flowering data.
Heat unit	The unit or figure that needs to be reached for the fruit to ripen.
Heat sums calculator	The spreadsheet which calculates the harvest date based on the heat sum formula.
Flowering survey	A survey sent to producers to collect flowering data and therefore estimate the timing of the harvest.
Volume survey	A survey sent to producers to estimate potential weekly fruit volumes for the season.
Flow survey	A survey sent to producers to record actual mango volumes for the season.

## Abbreviations

AMIA	Australian Mango Industry Association
DoR	Department of Resources
HAL	Horticulture Australia Limited
NT	Northern Territory
NTHA	Northern Territory Horticultural Association
NTMIA	Northern Territory Mango Industry Association
QLD	Queensland
WA	Western Australia

## **Media Summary**

Mangoes are a highly seasonal fruit with a fluctuating supply from one year to the next. The forecasting system developed as part of this project identifies peaks and troughs in supply assisting the mango industry in planning their harvest and marketing programs.

The crop forecasting system was designed by DoR in conjunction with the local NT Mango Industry Association (NTMIA). The system uses predictions based on flowering data provided by growers and the application of heat sum calculations to convert this flowering data into a harvest pattern.

The research component of the project, verifying the heat sums (the time taken from flowering to harvest based on temperatures) in different regions, was successfully carried out. The system was trialled for four mango varieties Kensington Pride (KP), Keitt, Calypso and R2E2 at different orchards in different regions. This confirmed that whilst the time until maturity differed between varieties, heat sums were consistent across the region.

As a logistics tool, the crop forecast proved especially useful in the NT. Yearly labour and transport forums allowed the industry to organise their supply of harvest labour and transport. However, the participation of Queensland (QLD) growers did not match that of the NT. This was addressed by extending the life of the project.

Feedback on the project was positive. The participation of growers in the system increased dramatically through the duration of the project. In addition, over 40 publications were produced and distributed to stakeholders during the project. They included the crop forecast, dry matter prediction dates, season overviews, a manual and a CD-based heat sums calculator for individual use.



## Technical Summary

The need to improve the quality and timeliness of information on harvest potential to all stakeholders has been identified in the past through a number of forums. The forecasting project aimed to produce a system that growers could use with confidence to predict harvest timing on their properties, establishing a model that would allow the industry to predict product flows to the marketplace as a whole.

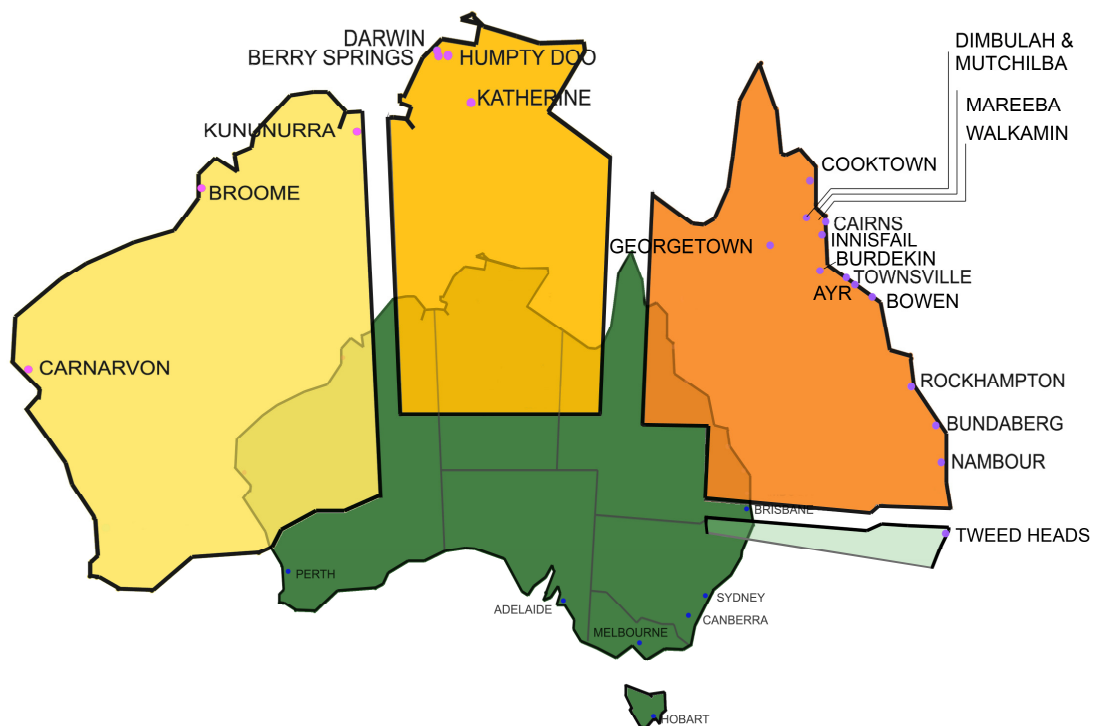
From previous research, the system utilised heat sums in an equation that used the cumulative daily minimum and maximum temperatures over the period from flowering to harvest,. The Crop Forecasting project utilised this equation along with collected flowering intensity data to develop a national sketch of the volumes and flows expected each season. The heat sums technology was tested in QLD on mango varieties, such as Keitt. As part of the trial, temperature data loggers were installed and flowering trees were tagged and monitored, and the fruit was later assessed for maturity.

As a whole, the project was successful, providing over 40 information publications to stakeholders during its life. They included the crop forecast, dry matter prediction dates, season overviews, a manual and a CD-based heat sums calculator for individual use. Feedback on the project was positive and grower participation in the system increased dramatically.

Although the participation of growers in the project increased in the NT, there were some problems with QLD growers. The problems were caused by a number of events, including a change in project leaders, differences in perspectives of project benefits for growers in the region, a change of ownership and management of participating farms and insufficient extension work in the region. These issues were addressed by extension of the project results for an extra season.

## Introduction

Mangoes are a seasonal fruit, grown across a number of regions in tropical and sub-tropical Australia (Figure 1). The distance to southern markets and the seasonal nature of the fruit means that coordination of logistics is a priority to ensure quality and profitability. The logistics in such an industry include the availability of harvest labour, refrigerated transport, floor space in the wholesale markets and appropriate timing for marketing campaigns. However, the harvest dates for mangoes depend on the temperature from flowering onwards. With about three to four months between flowering and harvest, depending on the time of the year and region, most growers make individual predictions as to when their harvest will occur. In the past, such information was provided to marketing outlets (where available) and to agents well in advance. There was no collective information on harvest time and many parts of the supply chain, including transporters, harvest labour companies and the markets themselves had no overall picture of when things were going to start in earnest. Over time, this led to a number of logistical problems, particularly in the NT. For example, at the start of one season, fruit arrived earlier than the markets were expecting it and hence had no floor space set aside for it. As a result, the fruit was kept outdoors in poor conditions, which led to its deterioration and subsequent disposal. In a separate incident, harvest and transport companies were given inaccurate information on the start of the harvest. This resulted in the absence of both harvest workers and refrigerated transport when they were needed, which led to poor fruit quality and low returns for all stakeholders.



**Figure 1.** Major mango growing regions of Australia

The absence of communication in the supply chain in the past led to dire consequences. To remedy the situation, DoR initiated the crop forecast project in association with NTMIA. When that was successful, the national project was proposed. The project aimed to determine heat sums in a number of mango varieties and regions. This was coupled with a large extension component aimed at encouraging involvement and communication between stakeholders so that by the end of the project, AMIA and the industry in general could adopt the system.

The aims of the project were to:

- Improve the quality of information throughout the supply chain.
- Produce a system that growers could use to predict harvesting time on their properties.
- Develop a national system of reporting on crop potential and harvesting time, which could be utilised by the industry.

## Materials and methods

### *Proofing the system*

Temperature data loggers were provided to seven collaborators in 2006 in Dimbulah, Mareeba and Townsville (Adrian and Joan Schincariol, Joe and Clare Visini, Carmini and Lorna Rantucci, Brian Schincariol, Sam and Kylie Collins, Ian Leighton and John Morton).

Data loggers were set up in each orchard to record daily minimum and maximum temperatures. Flowers were tagged in each orchard corresponding to early and late flowering for KP, R2E2, and Keitt trees. Fruit from the tagged panicles were assessed for harvest maturity near harvest by determining dry matter content manually. Data loggers were downloaded at the end of the season and heat sums for flowering dates were used to predict harvest dates. This was compared with the dry matter content and related maturity data of the fruit.

### *Dry matter testing*

The method for dry matter testing is available in *Information Sheet IS31: Dry Matter Testing of Mangoes* (Owens 2007).

“Average” fruit was sampled. The flesh of each sample was grated without the skin from both sides of the fruit (the dry matter of the cheeks may vary slightly due to exposure to the sun). About 10 g of grated fruit was weighed then dried in a drying oven at 65°C for 12 hours. The dried mango sample was then re-weighed and the moisture content calculated:  
 $\text{dry weight} / \text{wet weight} \times 100$ .

### *Heat sums*

For more in depth instructions refer to the *Mango Crop Forecast* manual.

The mango crop forecast is based on the following heat sum:

Daily heat units = [(daily max temp + daily min temp)/2] - 12

The flowering date at stage 6 (see Figure 2) marks the start of the accumulation of daily heat units, which continues until they reach the figure corresponding to a mature fruit. As such, this sum can be used to predict the timing of harvest given an initial flowering date, where maturity is defined as a dry matter of 14% (Diczbalis, Wicks and Landrigan 1999). The heat units required for maturity for a number of mango varieties were determined (Table 1)

**Table 1.** Heat units required for maturing mango varieties

Variety	Heat units required for maturity
KP	1600
Calypso	1680
Florida types	1680
R2E2	1800
Honey Gold	1800

### *The forecast*

The first component of the forecast was timing of harvest, based on the flowering survey results. A flowering survey form (see Appendix 1) was distributed at the onset of flowering in each region. The survey assessed the proportion of each orchard under stage 6 or stage 14 flowering over time as shown in Figure 2. This was sorted by tree count, variety and region. The survey was repeated regularly throughout each season to record sequential flowering.



**Figure 2.** Flowering stages for forecast

Using the tree count and the percentage of flowering, a region-wide table of harvest timing was developed. These dates were then used to generate the dates of maturity and dry matter testing. The first forecast was produced at the end of the flowering season, clearly indicating the timing of the predicted harvest and sample size (tree count).

The second component of the forecast was an estimated volume. Whilst flowering surveys were considered to be reliable predictors of timing, fruit-set and fruit abortion percentages provided a better indication of potential yields. All large growers and packing sheds were interviewed either over the phone or in person about their expected fruit yields (in terms of a percentage of the previous year's crop). Care was taken to identify those growers whose fruit was being packed by a third party in order to avoid double counting. This data was then used to provide an updated forecast, with yields overlaying the timing from the flowering data.

The heat sums used to predict maturity dates were based on historical average temperatures. As the crop takes three to four months from flowering to harvest, the forecast is updated periodically using that season's temperature data from the Bureau of Meteorology website ([www.bom.gov.au/](http://www.bom.gov.au/)).

Once the harvest was underway, a flow survey form (see Appendix 2) was sent to the main packers and growers. This survey identified the volume of fruit (by pallets) sent to market on a weekly basis, once again avoiding double counting. This information was used to provide an overview of the season and industry statistics. It was also used to check the accuracy of the forecasts and was distributed according to the forecast.

## Technology transfer

Since most of the project was extension-based, a communication plan was developed (Table 2).

**Table 2.** Simplified Bennett's log frame

Evaluation levels	Project description
Internal project factors	Activities: flowering surveys, volume surveys, flow surveys, seminars, workshops, seasonal overview reports, mango matters articles, Crop Forecast manual, heat sums calculator.
Direct effects	Minimum of three forecasts produced per year; QLD regions included in the second and third years.
Broader impacts	Improved industry logistics.
Outside project control	Survey participation, quality (difference between expected yield and actual pack-out), maturity at picking (i.e. growers may use a different dry matter, or pick based on economics).

Table 2 indicates the overall targets for the project as opposed to each aspect of communication and extension delivered throughout the project (Table 3).

**Table 3.** Extension channels and activities

Criteria	Activities
Grower visits	2006-2007
In the early stages of the project growers from Kununurra, Dimbulah, Mareeba and Townsville were approached to be part of the project for determining heat sums in their area. Two trips were made in 2006 to set up the equipment and then download the data.	
Flowering surveys (Appendix 1)	2005-2009 NT 2007-2009 QLD and WA
Regular flowering surveys were emailed and faxed out to growers, local industry bodies, such as NTHA and government agriculture staff in QLD and WA for further dissemination. Grower visits were also conducted on a one-on-one basis, or by telephone.	
Volume surveys	2005-2009 NT 2007-2009 QLD and WA
Large growers and packing sheds were surveyed either in person, or by telephone to record estimated volumes for each season.	
Flow surveys (Appendix 2)	2005-2009 NT
Surveys were emailed and faxed out to large growers and packing sheds. Grower visits were also conducted on a one on one basis, or by telephone. Due to the low numbers of participation in the Queensland region flow figures were not provided to the industry (as they would not be representative of the true figure).	
Forecasts (Refer to Appendix 3)	2006-2009
Twenty five forecasts were produced during the course of the project. These were emailed and faxed out to growers, packing sheds, local industry bodies, such as NTHA and government agriculture staff in QLD and WA for further dissemination. Forecasts were also available on the Internet at the DoR website.	

Dry matter dates forecasts (Appendix 4)	2006-2009 NT 2007-2009 QLD and WA
The predicted dates for testing dry matter were presented in tabular form and distributed in conjunction with the forecasts. In some of the later forecasts they were included in with the forecast itself rather than as a separate document. In 2008, the heats sums calculator was provided online instead of presenting multiple information sheets on dry matter dates. However, feedback suggested that the dry matter date tables or information sheets were the preferred option for most growers.	
Email list	2008 – 2009
A crop forecast email list was created to provide updates to industry as they became available. Feedback suggested this was the preferred mechanism, compared with checking the internet periodically. Over 60 individuals and corporations have signed on to the email list, including growers, packers, wholesalers, agents, transport companies, labour hire companies and government agencies. They cover WA, QLD and the NT, with 40% coming from either interstate or national industry members. Furthermore, the email list includes NTHA, which then forwards the email on to members.	
Regional meetings (Appendix 5)	2006 (actual dates unknown). Growers meeting in Dimbulah and Mareeba. 2006 (actual dates unknown). Flowering surveys presented in Burdekin by QDPI&F extension staff. May 2007 Dimbulah meeting. 05/09/2007 Honey Gold growers in Mareeba. 29/8/2007 (Berrimah Farm) Darwin x 2 consecutive presentations. 23/02/2008 (Palmerston library) Darwin. 09/09/2008 (Berrimah Farm) Darwin. 28/03/2009 (Palmerston Council Chambers) Darwin.
Key findings were presented to meetings at annual pre and post-harvest forums, where the audience included growers, packers, harvest labour companies and transport company representative. Attendance varied from year to year between 10- 30 industry members (including growers, packers, transport and labour hire companies). These meetings were held with varied participants in order to update on the projects progress, encourage participation, organise logistics and reduce bottlenecks.	
AMIA conferences (Appendix 6 for power-point presentation).	May 2007 AMIA Conference. 01-02/09/2008 AMIA workshop/ meeting (Airport Resort, Darwin) 26- 27/05/2009 AMIA Conference (Seibel Hotel, Cairns)-two workshops on consecutive days.
Key findings were presented at AMIA mango conferences and meetings. These presentations were similar to those presented at regional workshops, with a larger audience, including QLD and WA growers.	
Articles (Copies available through AMIA)	2006 AMIA Mango Matters: HAL Project updates. 2006 AMIA Mango Matters: Sharing Mango Technology newsletter, first edition. 2007 AMIA Mango Matters Sharing Mango Technology newsletter. 2008 AMIA Mango Matters article.
DoR Technical Annual Report / Annual Extension Report	2005-06 preliminary report. 2006-07 report. 2007-08 report.

	2008-09 Extension report
Season overviews (Appendix 7 for overviews).	2008 – 2010 Seasonal overview published (post- harvest) on the internet.
Overviews covered a range of information, including the forecast prediction and final volumes. Feedback from users suggests the email list had preference over the internet download.	
Products	2009 Crop Forecast manual. 2009 Mango heat sums calculator
The manual provides instructions on running the forecast and the heat sums required. The calculator allows growers to calculate their own harvest dates. Both products were made available at the 2009 AMIA mango conference in Cairns. Copies were also provided to HAL, individual growers (upon request) and department staff from QDPI&F, WA Ag and NSW Primary Industries.	
Satisfaction survey (Appendixes 8 and 9).	2009
A survey was provided at local meetings and through the email list.	



## Results:

### *Verification*

The system was verified on seven properties in QLD, on different mango varieties, KP, Keitt and R2E2, as well as on Calypso in the NT. Dry matter samples were tested progressively to determine the time it took to reach 14% dry matter as shown in Table 4.

**Table 4.** Dry matter tests for an individual collaborator

Sample	Wet weight (g)	Dry weight (g)	Dry matter (%)
1	10.49	1.49	10.54
2	10.17	1.62	12.04
3	10.89	1.73	12.18
4	9.21	1.55	12.56
5	9.9	1.77	13.97
6	9.27	1.77	14.87

The dry matter tests were used to corroborate the forecasted dates in these regions, proving the heat sums were an effective predictor of 14% dry matter maturity.

### *Surveys*

Table 5 shows participation in flowering surveys. Flowering surveys were presented to extension staff from QDPI&F 2006. Some harvest flow data was collected. However, the response was less than anticipated. Data loggers and flowering surveys were provided again to extension staff from QLD and WA in 2008. However, once again the response was less than anticipated.

**Table 5.** Participation in flowering surveys (through tree counts)

Year	Number of trees		
	NT	QLD	WA
2006	161 000	N/A	N/A
2007	281 500	124 000	108 600
2008	196 000	71 000	150 000
2009	301 161	253 238	0

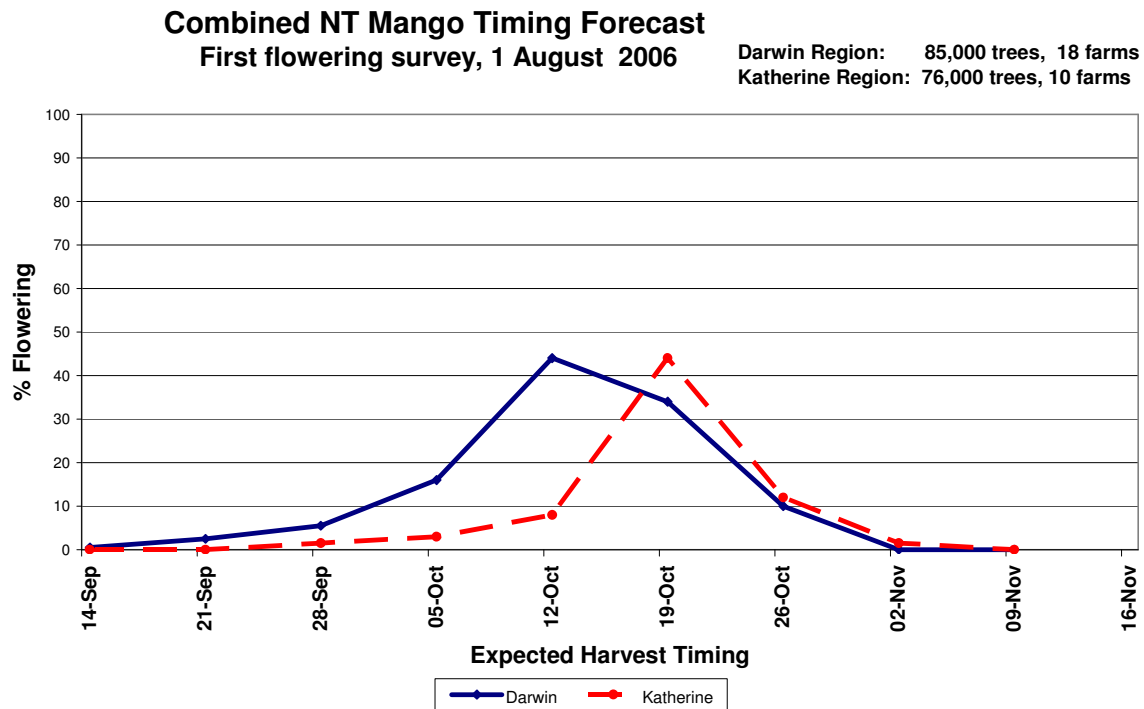
Uptake and participation amongst growers during the project was comparatively high in the NT and WA. The figures changed from year to year due to a number of factors including:

- In 2006 only the NT was included in the forecast to allow the model to be tested in QLD.
- Increased participation as growers became more aware and enthusiastic about the project and its benefits.
- Changes in ownership or farm management of participants.
- A change in project leader (2008) with the loss of the relationship that had been built between that individual and growers.

### *Forecasts*

In total 25 forecasts and 19 “dry matter date” information sheets were published over the course of the project.

Figure 3 shows the first year's forecast. This was only completed for the NT, whilst the heat sums were being tested in Queensland.

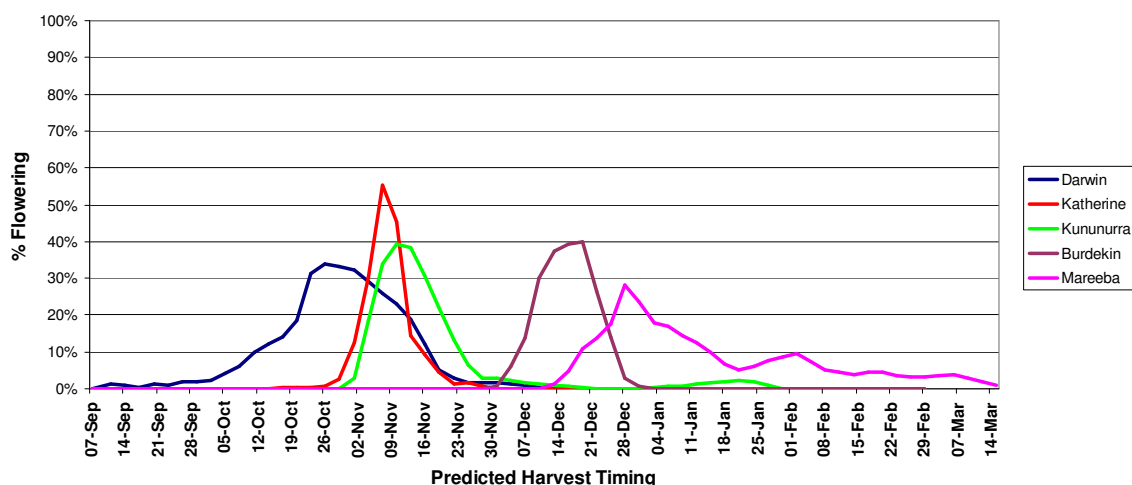


**Figure 3.** Forecast for 2006

During the second year, the forecast included WA and QLD. Tree numbers that were surveyed were not high enough (or there were not enough growers) in some areas. In that case the figures were grouped with the nearest region to maintain confidentiality. For example, Mataranka was always grouped in with Katherine. The forecast was expanded in 2007 to include all commercial ripe eating mangoes (green eating mangoes were not included).

## Combined Mango Timing Forecast Update 1 December 2007

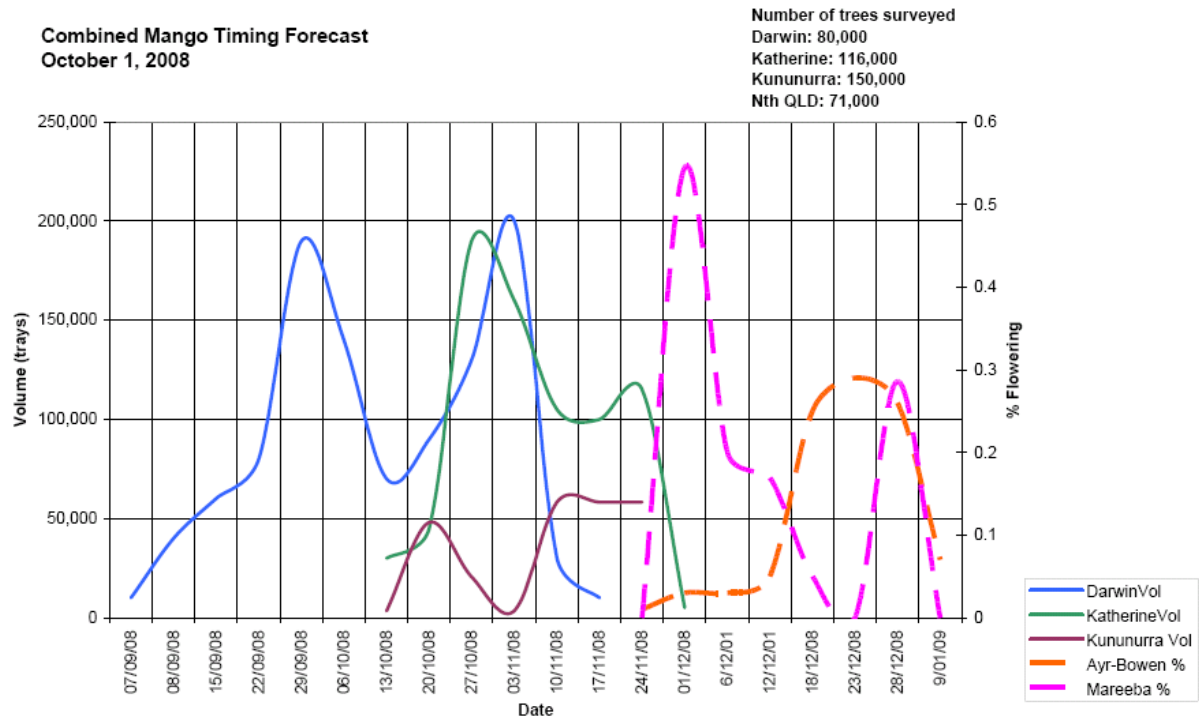
Sample size  
Darwin Region: 167,500 trees  
Katherine Region: 114,000 trees  
Kununurra region: 108,600 trees  
Burdekin region: 65,500 trees  
Mareeba: 58,500 trees



**Figure 4.** Forecast for 2007

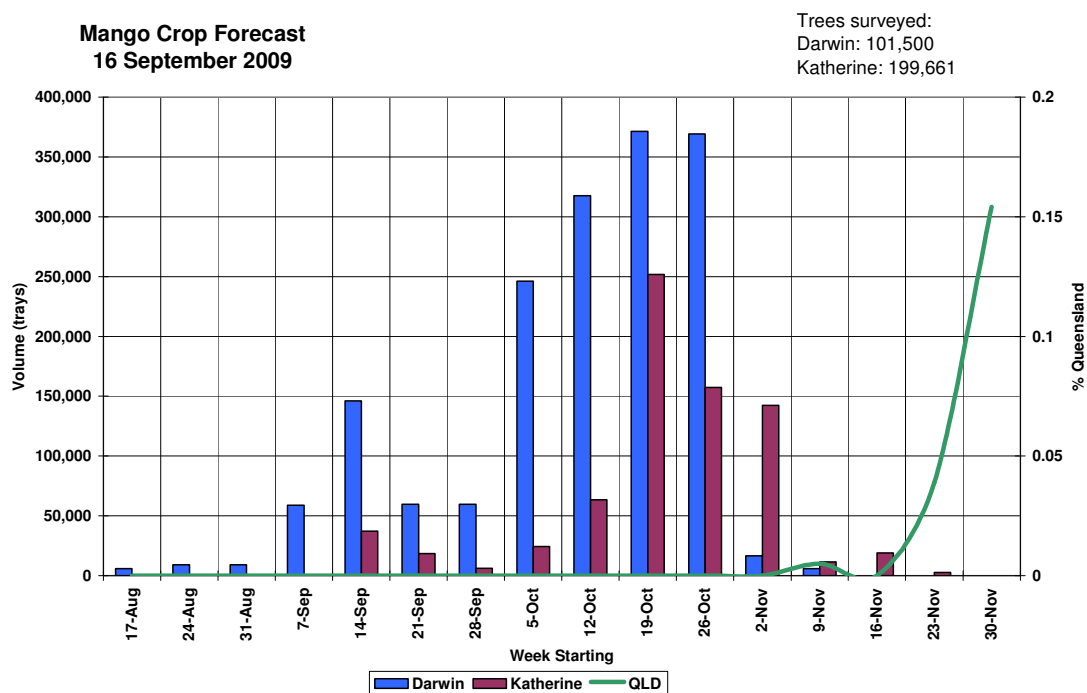
Once again, all three states participated in the forecast. Many of the original QLD growers had sold their properties or changed management. However, participation was increased in other areas, leading to a change in regions represented by the forecast.

## Combined Mango Timing Forecast – 1 October 2008



**Figure 5.** Forecast for 2008

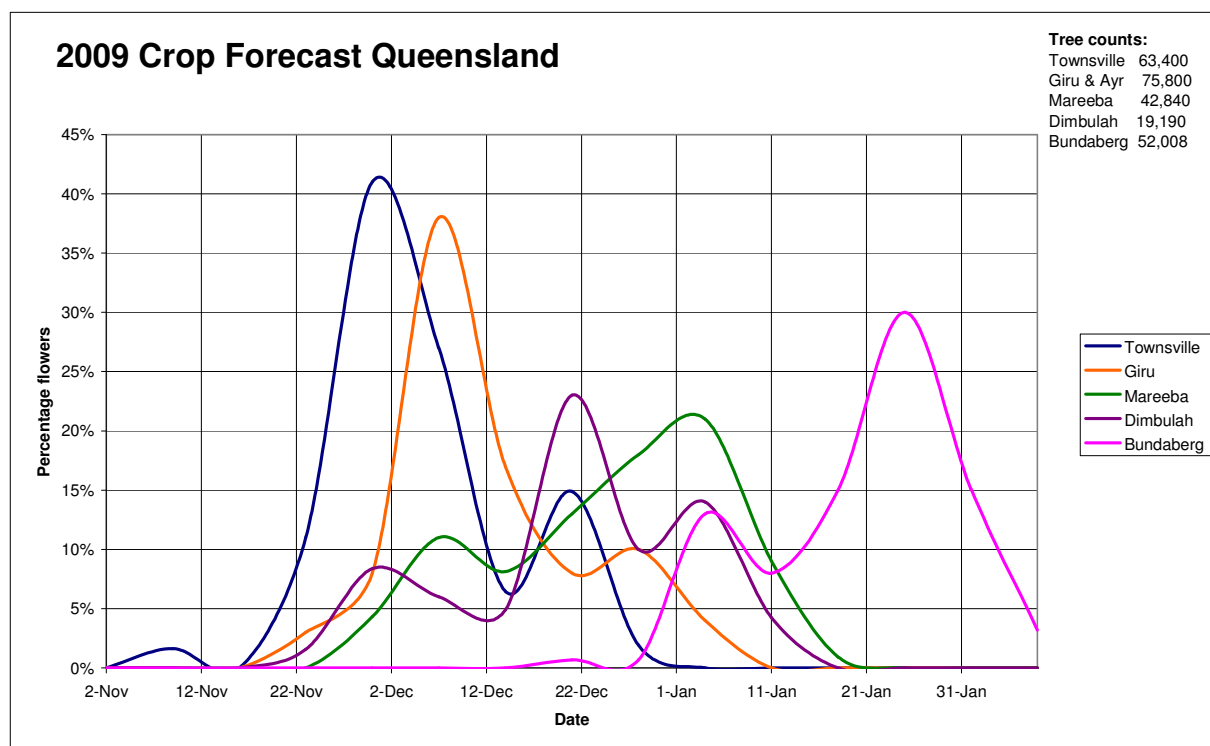
The project was due to finish in 2009, but because of under-representation of QLD regions in the forecast and the continuing need to establish an industry partner to carry the project forward, DoR continued the project during the 2009 season.



**Figure 6.** The NT forecast for 2009

QLD data for the 2009 season was gathered largely through an HAL-funded project led by Mr Ian Baker, who then provided the flowering and volume surveys to DoR for inclusion in the forecast.

The 2009 forecast was split into the NT and QLD seasons. Feedback suggested that the previous forecasts (with all of the regions in one graph) were too confusing and that a separation between the NT season (showing the onset of the QLD season (Figure 6) and the QLD season (Figure 7) was preferable.



**Figure 7.** The QLD forecast for 2009

## Discussion:

The research component of the project, verifying the heat-sum model in different regions, was successfully completed in the initial stages of the project. Four mango varieties (KP, Keitt, Calypso and R2E2) were studied at different sites in both the NT and QLD. This confirmed that while total heat units vary according to variety (Table 1), they are consistent across regions.

The crop forecast is based on the assumption that mangoes will be picked at 14% dry matter. When growers do not follow this rule, harvest timing will change. Some growers may not follow this rule of picking at the 14% dry matter. For example:

- Some varieties (particularly Keitt) can remain on the trees longer than others.
- Growers in some regions prefer to pick at a dry matter of 13%.
- Some growers pick according to market opportunities i.e. sell while prices are high, or get in before disease-prone regions supply the market and drop prices.

A large proportion of the Crop Forecasting project was extension-based, collecting and disseminating information between stakeholders. Over 40 information products were published during the course of the project, including 25 forecasts, 19 dry matter date information sheets, a heat sums calculator (on disc) and a manual. These were distributed through a variety of methods across all growing regions (Table 3). The informal feedback from individuals was both constructive and positive. Formal feedback is covered in the segment on “Evaluation of activities and outcomes” (see below).

The need for timely information and communication for all stakeholders in the supply chain has been raised time and again within the mango industry. The crop forecast was perhaps the first step towards formalising the flow of information throughout the chain. By the end of the project the list of companies and individuals requesting the forecast covered all aspects of the supply chain from growers, packing sheds, transport companies, harvest labour suppliers, marketing and market agents/wholesalers. An important aspect of the project’s success was that it ensured that everyone, especially contributors, perceived a benefit and that the flow of information was not solely one way. This was primarily achieved by providing the dates when appropriate dry matter content was expected and season overviews to contributors.

As a logistics tool, the crop forecast proved useful in the NT, as it allowed labour and transport suppliers to prepare themselves for the annual season. This helped to reduce the adverse effects of overlaps between regions (such as lack of transport and harvest labour) and ensured that markets were ready for the fruit. The NT mango industry has previously experienced problems in both of these areas with adverse results. Prior planning can inform harvest labour offices of when and where staff will be needed. If necessary, growers in the Katherine region can then arrange to store fruit for a period, or charter transport if necessary and markets will have adequate warning that shelf/floor space will be needed (ensuring that fruit is treated properly when it arrives at its destination).

Participation, distinguished by tree counts, fluctuated throughout the project. In general, the trend was upwards as the industry became more aware of the project and its potential benefits. However, some participants dropped out. In some cases, this was a reflection of changes in farm ownership and management during the project, particularly in regions with fewer growers. In some cases, after a year of adjustment the new management would become involved in the project, whilst in others, there was a lack of interest. In 2008 staff turnover resulted in a change of project leaders, coinciding with a drop in participation for that season. Feedback at the time

suggested that the relationship between the project leader and growers played an important role in their trust of the system. Some growers were concerned that the forecast might lack accuracy after the change and it was closely observed by the industry. Fortunately, participation increased once more in 2009, partly due to separate circumstances in QLD (see below), but also through a revival of participation in the NT.

Both the NT and WA benefit greatly from the forecast with regards to the timing of the market and foreseeing potential overlaps. About 30% of the industry is located in the NT alone, which comprises a large minority of the industry who utilised the project for the full term. However, the QLD industry position on the forecast is slightly different. QLD does not face quite the same logistics problems as the NT or WA, except in the smaller regional areas. Comprising the bulk of the industry, they drive supply and dominate markets. They have fewer logistical problems, being located closer to major markets and are able to access harvest labour readily through university students on holidays. Initially, only the smaller regional QLD growers perceived a benefit and supported the project with their data. This proved problematic when growers sold properties or there was a change in management. Towards the end of the project, interest was raised in a number of larger companies as a tool for managing the marketing and wholesale side of their business (as opposed to timing their harvest). Information was compiled largely as requested for this area. However, the proportion of participation in QLD never rivalled that in the NT.

In 2009 HAL and DoR agreed to continue the project for another season. This allowed QLD to increase its participation and gave the industry as a whole a chance to take ownership of the project. HAL contracted a third party (Mr Ian Baker) to collaborate with QLD growers to provide data to DoR for inclusion in the forecast. As a result of several trips around QLD regions by Mr Baker, the 2009 forecast included a record number of QLD growers.

Finally, an important aspect of the project was to ensure its continuation, if the industry found it useful. This was envisaged as a handover to AMIA, with staff training during the final season. Staff training was important not only to understand the process but to start to build the relationships and trust in the new caretakers. Due to time constraints, AMIA was unable to receive training during the 2008 season. To ensure that the system itself was not “lost” from corporate knowledge, a manual was published and distributed to WA and QLD agencies, HAL and AMIA. Following the negotiated continuation in 2009, AMIA published the forecasts and updates on its website and has since arranged for it to be available in the 2010 season for training.

## **Recommendations**

Whilst the development of the crop forecast model is effectively finished, the forecast's role as an extension tool to aid communication throughout the supply chain is very promising. The non-continuation of the forecast in this capacity would be disappointing. As such, DoR has come to an arrangement with AMIA to continue the project for the 2010 mango season. During this time, it is hoped that training of AMIA staff and adoption by industry will occur.

## **Evaluation of activities and outcomes**

The field testing of heat sums in QLD regions was achieved within the limitations of the 14% dry matter harvest date. Most regions conformed to this rule, with deviations generally occurring for financial reasons.

The extension outcomes were assessed via informal feedback in person and through email and through a survey. The informal responses were very encouraging, as was the uptake of the project and products not only by the increase in grower participation (as assessed by tree counts) but also by the increasing number of individuals and companies throughout the supply chain. The email list was an "opt in" option and currently contains over 60 individuals and companies spanning all aspects of the industry from farm to warehouse and marketing, harvest labour companies and transport companies. With communication between all stakeholders a key imperative of the project, this is an indication of the ability of the forecast to facilitate the process.

The formal survey received only a limited number of responses and as such, cannot be taken as a whole of industry perspective (see Appendix 9). All the respondents graded the project positively; many used the forecast multiple times in a season and all believed it should be continued. Interestingly, when questioned about who should fund it, they were split between government and industry, some believing that grower levies were a good source of funding, whilst others believed that the government played a useful role as a facilitator. The only aspect of the forecast which scored poorly in the surveys was the heat sums calculator, with respondents preferring to be provided with the tabulated dates rather than using the calculator. This was also reflected through informal feedback at grower meetings.

As discussed earlier, the participation of QLD growers did not match those of the NT. This was a result of a few key problems, including the change in project leaders, the sale of participating orchards, the lack of a contractual arrangement with QDPI&F to better support the project and the inability of DoR to compensate for this through increased extension to QLD growers. With funding from HAL, Mr Baker helped to rectify the situation through a number of visits during the season and the use of data-loggers as an enticement.



## Acknowledgments

The Mango Crop Forecast Project is facilitated by HAL in partnership with AMIA. It is funded by the mango industry levy and DoR.



The project was also supported by the growers and packers who collaborated and provided information, without which there would be no project.

Further thanks go to the growers who offered their orchards and fruit to ground-proof the system, including Anne and Haig Arthur, Adrian and Joan Schincariol, Joe and Clare Visini, Carmini and Lorna Rantucci, Brian Schincariol, Sam and Kylie Collins, Ian Leighton and John Morton.

## References:

Diczbalis Y., Wicks, C. and Landrigan, M. (1999). Heat sums predict fruit maturity  
*Mango Care* July edition; pp 2-3

Owens, G. (2007). Dry matter testing of mangoes DoR *Information Sheet*: IS31

## **Appendix 1: Flowering survey**

Flowering surveys were regularly emailed and faxed out to growers, local industry bodies such as NTHA. Grower visits were also conducted on a one-to-one basis, or by telephone. Data loggers and surveys were provided throughout the project to both QLD and WA extension officers for distribution to local interested growers. The survey had generally the same format, although the photos of the flowering stages were added later in the project.

## 2009 Mango Flowering Survey

Chelsea Moore, Industry Development Officer, DRDPIFR Darwin – July 2009

### Are your mangoes flowering?

The Northern Territory Government (RDPIFR) is currently running the flowering survey for the 2009 crop forecast. The information you provide will be used to predict the fruiting pattern for the 2009 Australian mango season, information that will benefit you and the industry as a whole. All individual information will be confidential and only regional information will be published.

**The first crop forecast will be available on the internet from August.**

If you would like us to email updates out to you please leave your email address:

.....



Stage 6



Stage 14

### How it works?

Fill out the information on the region your orchard is located in, the types of mangoes you grow and the number of trees. Since different regions such as Katherine and Berry Springs experience different temperatures this is important in determining which areas are flowering and when their season will start.

	Growing Area (ie Darwin, Mareeba)	Major Varieties	No of Trees	Flower Stage (6 or 14)
Farm 1				
Farm 2				

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### Flowering Pattern

You should count flowering at stage 6 when the bud is seen (see the photo on the previous page). However stage 14 – when there is a full panicle with around 2/3 open flowers - is easier to see and can be used instead. Remember to make a note of which stage of flowering you are basing your survey and enter it in the table on the previous page.

Guess the amount (%) of flowering that occurred. It doesn't have to add up to 100%. Fill in the following survey on a whole-farm basis, not for individual blocks. There is room for two separate farms if you manage a number of orchards.

	Variety	May		June		Total
		Early	Late	Early	Late	
<i>Example</i>	<i>Kensington Pride</i>	20%	15%	35%		70%
<b>Farm 1</b>						
<b>Farm 2</b>						

	Variety	July		August		Total
		Early	Late	Early	Late	
<b>Farm 1</b>						
<b>Farm 2</b>						

Please fax the completed survey back to DRDP/IFR Plant Industries office on (08) 8999 2049

Email [chelsea.moore@nt.gov.au](mailto:chelsea.moore@nt.gov.au)

Or complete the survey online at: [www.horticulture.nt.gov.au](http://www.horticulture.nt.gov.au)

Thank you for your assistance.

Chelsea

## **Appendix 2: Flow surveys**

Large-scale growers and packing sheds were surveyed either in person, or by telephone to record estimated volumes for each season. Originally the survey sheet included destination, but this information was considered surplus, leading to the current form.

## FACSIMILE

**TO:** Mango Flow Data Contributors

**FROM:** Chelsea Moore

**DATE:**

**PAGES:** 1

If any part of this transmission failed, or you have received this document in error, please telephone +61 8 08 8999 2284.

The information contained in this facsimile message may be confidential information, and may also be the subject of legal privilege, public interest immunity, or legal professional privilege. If you are not the intended recipient, any use, disclosure or copying of this document is unauthorised.

### SUBJECT:

Hello,

Thanks for those who have sent data in so far. If you haven't already, could you please fill in the total weekly number of pallets going out & the location of the shed (i.e. Katherine, Darwin etc) that would be wonderful.

<b>Farm/shed Location:</b>	
<b>Week starting</b>	<b>Total pallets dispatched for that week</b>
Before 8 September	
8 September	
15 September	
22 September	
29 September	
6 October	
13 October	
20 October	
27 October	
3 November	
10 November	

Cheers

Chelsea Moore

### **Appendix 3: Crop forecasts**

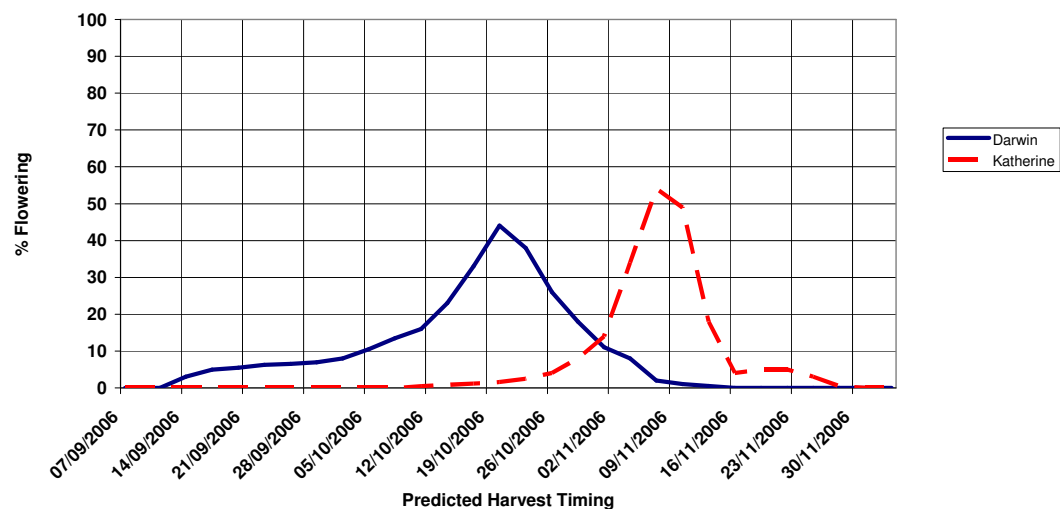
Twenty five forecasts were produced during the course of the project. These were emailed and faxed out to growers, packing sheds, local industry bodies such as NTHA as well as government agriculture staff in QLD and WA for further dissemination. Forecasts were also available on the internet at the DoR website. The following examples are the later forecasts for each season.

## Combined NT Mango Timing Forecast – 15 October 2006

Greg Owens, Senior Extension Officer, DPIFM Darwin

### Combined NT Mango Timing Forecast Second flowering survey, 15 October 2006

Darwin Region: 106,000 trees, 21 farms  
Katherine Region: 76,000 trees, 10 farms



### Key Points for the NT Mango Crop Forecast, 15 October 2006

- The fruit development in Katherine continues to be slower than normal from the unseasonal cool weather.
- Darwin volume is on track to peak in the second week of October.
- Peak in the first 2 weeks of November for the Katherine Region.
- Overlap between Darwin and Katherine regions is reducing as the cool weather spreads the expected harvest pattern.
- The fruit set has been affected by cold temperatures, there has been a significant fruit drop from the early July flowering.
- The crop will be spread over 8-10 weeks, 3-5 weeks longer than 2004.
- Early shed estimates put the NT 2006 mango crop at between 2.0 - 2.2 million trays. This was 0.5 million trays less than 2004.
- This may increase with the spread harvest and reduced overlap of Darwin and Katherine regions.
- No rain and better fungicide treatments in the Darwin region has meant very low level of rots so far this year.
- This is the last update for the 2006 NT Mango crop forecast.

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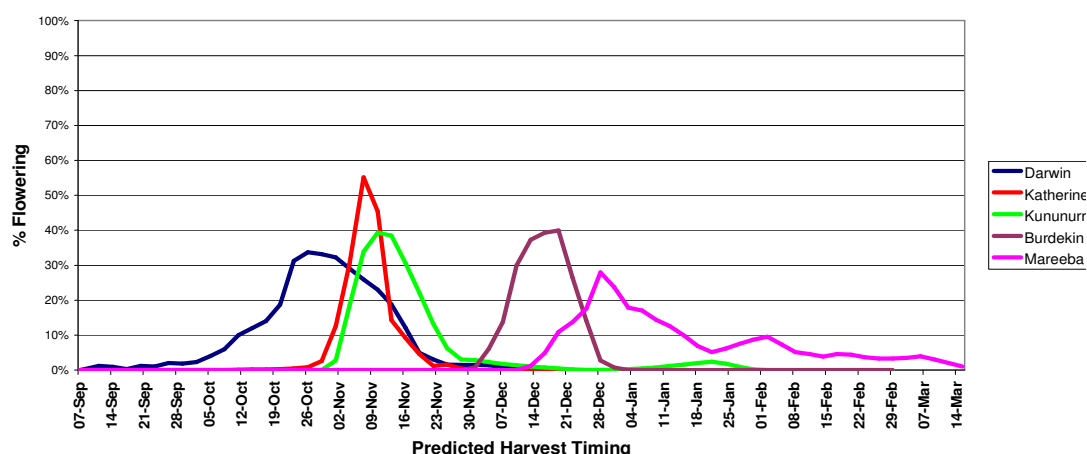


## Combined Mango Timing Forecast – 15 November 2007

Greg Owens, A/Principal Extension Officer, DPIFM Darwin

### Combined Mango Timing Forecast Update 15 November 2007

Sample size  
 Darwin Region: 167,500 trees  
 Katherine Region: 114,000 trees  
 Kununurra region : 108,600 trees  
 Burdekin region: 65,500 trees  
 Mareeba: 58,500 trees



#### Key Points for the National Mango Crop Forecast, 15 November 2007:

- The timing for the Burdekin crop has moved forward approximately 3 days due to the higher than average minimum temperatures.
- The Darwin crop is almost finished.
- The Katherine harvest is well underway and is on target with the timing forecast.
- The estimate of the Total NT crop was between 1.6 -1.8 million. The final total is likely to be slightly higher than this with 1.6 million trays already harvested up to 12 November.
- The NT main harvest season may run an extra week longer than the forecasted 5- 6 weeks, from 12 October to 23 November.
- The Kununurra harvest is on track to start in the first week of November with similar yields per tree, about 50-60% full capacity, as seen in the Darwin and Katherine KP and R2E2 crops.
- This pattern seems to be repeated in the major north Queensland regions. While most areas reported very strong flowering the final yields may not live up to early expectations.
- Mid and later mango varieties are well represented in the Mareeba data.

Next update 1 December 2007

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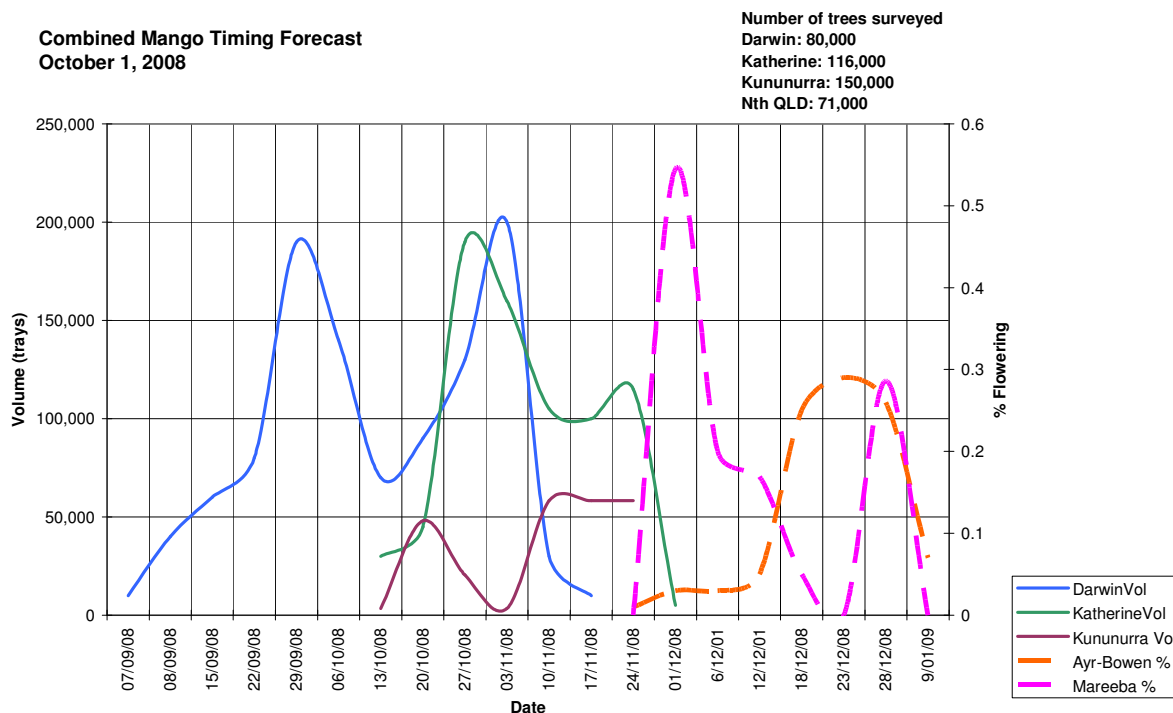
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## Combined Mango Timing Forecast – 1 October 2008



*Chelsea Hennessy, Industry Development Officer, RDPIFR Darwin*

### Key Points for the National Mango Crop Forecast, 1 October 2008:

- A long season compared to 2007
- Harvest is advancing in Darwin and starting in Katherine.
- Dates have not moved significantly.
- Queensland is set to start in mid to late November, although tree numbers for the Queensland area were not as statistically strong as the NT or WA.
- QLD prediction is based on flowering only, not volumes.
- Peak in mid to late October for the Katherine region.
- Overlap between the Darwin, Katherine & Kununurra regions
- Estimates place the Kununurra crop between 200,000- 300,000 trays for the season.

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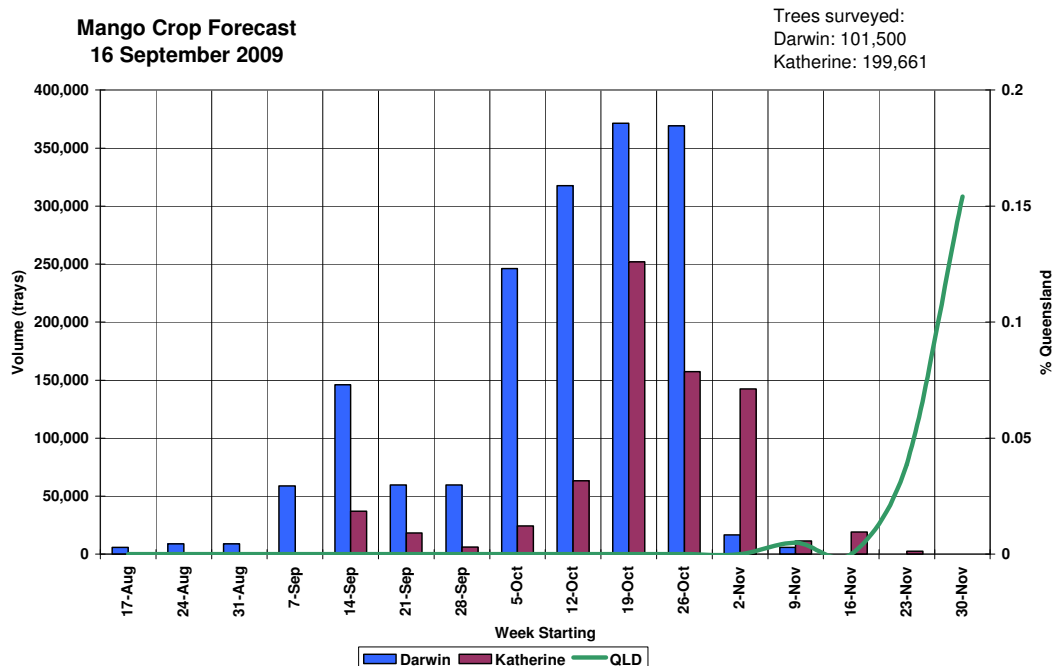
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## Mango Crop Forecast – 14 September 2009



### Key Points:

- Darwin dry matter dates have shifted by 1 to 2 days (see the dry matter info sheet for more details).
- The Darwin season has started, with small volumes moving out.
- The peak of the Darwin season will be in mid to late October.
- The Katherine season will most likely start in mid to late September, with a peak around the middle of October, running into November.
- Indicative volumes point to slightly higher (5 – 10%) levels than the 2008 season which saw 15,547 tonnes sold at an estimated \$38 million.
- It is still unknown whether the late fruit will hold on.
- The Queensland season will start in November (see next page for Queensland forecast).

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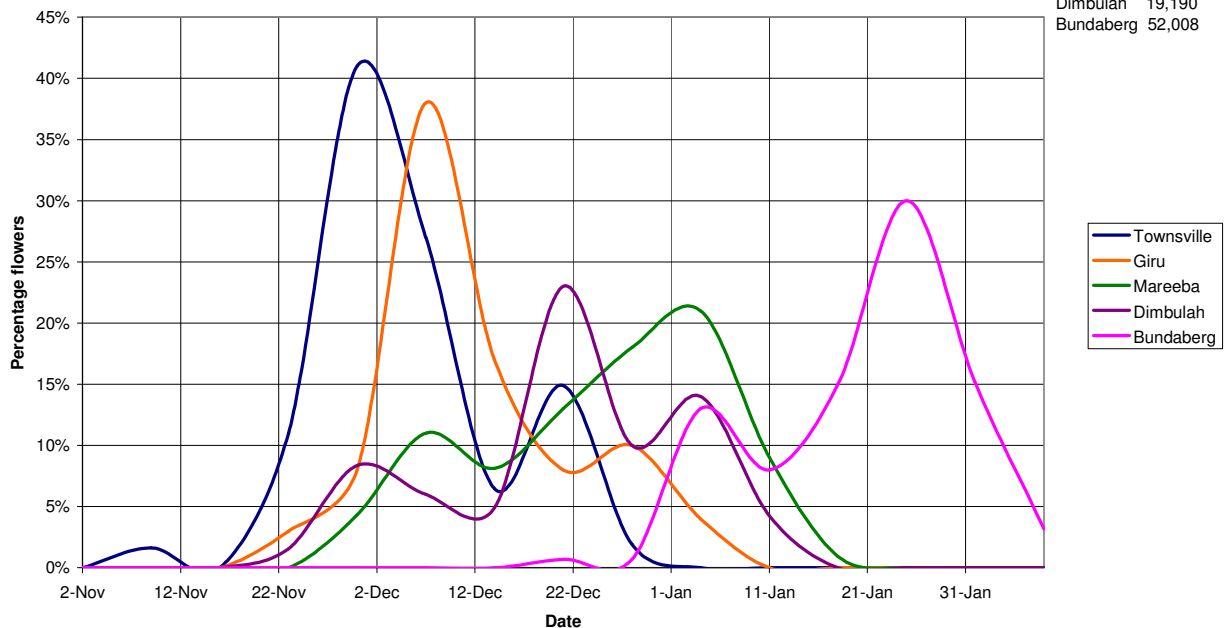
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## 2009 Crop Forecast Queensland



\*Queensland percentage flowers: where timing of flowering indicates timing of harvest and is indicative of production peaks but is not volume.

### Key Points:

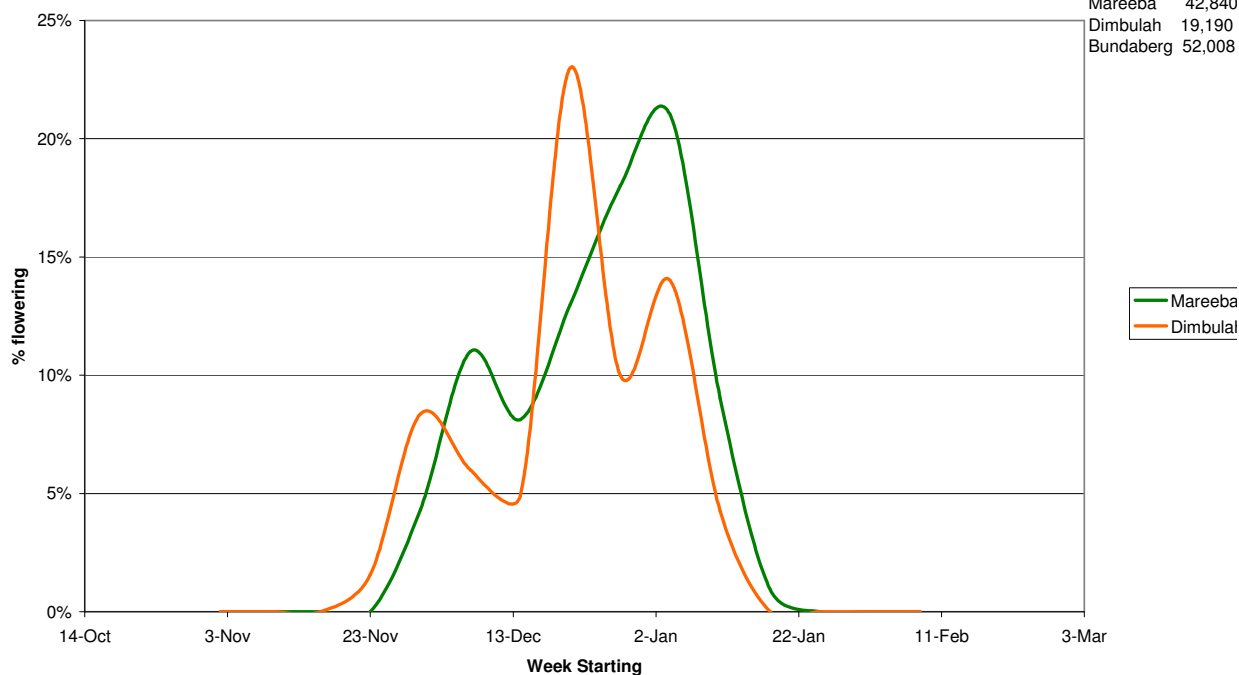
- The main Queensland season will start in mid to late November.
- The season will open with Townsville.
- The Ayr and Giru peak is in early to mid December
- The Mareeba and Dimbulah season is quite long peaking in late December / early January
- The Bundaberg peak is around late January early February.

These figures are based on a dry matter of 14, if your region picks at an alternative dry matter then the dates will be slightly different.

### Mareeba- Dimbulah

#### Tree counts:

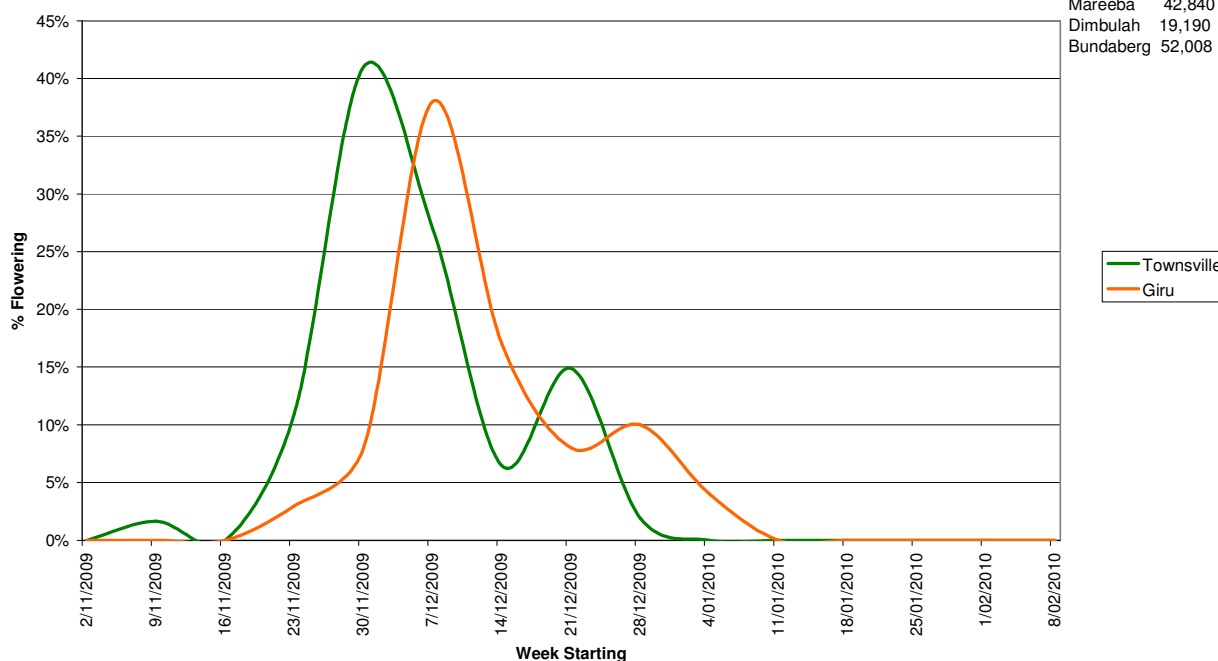
Townsville 63,400  
Giru & Ayr 75,800  
Mareeba 42,840  
Dimbulah 19,190  
Bundaberg 52,008



### Townsville - Ayr/ Giru

#### Tree counts:

Townsville 63,400  
Giru & Ayr 75,800  
Mareeba 42,840  
Dimbulah 19,190  
Bundaberg 52,008



#### **Appendix 4: Dry matter forecasts**

The predicted dates for testing dry matter were presented in tabular form and distributed in conjunction with the forecasts. These give an estimated date for growers to test their fruit for maturity (generally a week before they should harvest) and as such give an estimated harvest date. In some of the later forecasts, they were included in with the forecast itself rather than as a separate document. During 2008 the heats sums calculator was provided online instead of presenting multiple information sheets on dry matter dates. However, feedback suggested that the dry matter date tables or information sheets were the preferred option for most growers, which was then re-continued for 2009. Once again, samples are provided for each season.

## Predicted Dates for Dry Matter Testing 24 October 2006

*Greg Owens, Senior Extension Officer, Darwin and Debbie Rock, Project Officer,  
Katherine, DPIFM*

Regions	Flowering Dates				
	22 Jun	6 Jul	20 Jul	3 Aug	17 Aug
Darwin/Berrimah	9 Oct 06	20 Oct 06	29 Oct 06	8 Nov 06	18 Nov 06
Humpty Doo/Lambells Lagoon	17 Oct 06	25 Oct 06	2 Nov 06	11 Nov 06	20 Nov 06
Berry Springs/Darwin River	19 Oct 06	26 Oct 06	3 Nov 06	11 Nov 06	20 Nov 06
Batchelor	14 Oct 06	23 Oct 06	31 Oct 06	8 Nov 06	17 Nov 06
Katherine	24 Oct 06	31 Oct 06	6 Nov 06	12 Nov 06	19 Nov 06

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# Information Sheet

IS34[b]

## Predicted Dates for Dry Matter Testing - 27 August 2007

*Chelsea Hennessy, Industry Development Officer and Greg Owens, A/Principal  
Extension Officer, Darwin, DPIFM*

Regions	Flowering Dates					
	25 May	08 June	22 June	06 July	20 July	03 August
Darwin/Berrimah	17 September	28 September	08 October	17 October	26 October	05 November
Humpty Doo/ Lambells Lagoon	26 September	05 October	15 October	23 October	30 October	07 November
Berry Springs/ Darwin River	28 September	07 October	16 October	23 October	29 October	05 November
Batchelor	22 September	30-Sep	09 October	17 October	25 October	03 November
Katherine	06 October	12 October	19 October	24 October	28 October	04 November

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# Information Sheet

IS34[c]

## Predicted Dates for Dry Matter Testing for 2007 (WA).

*Greg Owens, A/Principal Extension Officer and Chelsea Hennessy, Industry Development Officer, Darwin DPIFM*

Regions	Flowering Dates					
	8 June	22 June	6 July	20 July	3 August	17 August
Kununurra	13 October 2007	20 October 2007	25 October 2007	30 October 2007	6 November 2007	14 November 2007
Carnarvon	12 December 2007	18 December 2007	23 December 2007	30 December 2007	5 January 2008	9 January 2008
Gingin	18 February 2008	20 February 2008	23 February 2008	25 February 2008	26 February 2008	27 February 2008
Broome	20 October 2007	26 October 2007	1 November 2007	7 November 2007	14 November 2007	21 November 2007

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## Predicted Dates for Dry Matter Testing for 2007 (QLD).

*Greg Owens, A/Principal Extension Officer and Chelsea Hennessy, Industry Development Officer, Darwin DPIFM*

Regions	Flowering Dates					
	8 June	22 June	6 July	20 July	3 August	17 August
Walkamin	9 November 2007	14 November 2007	17 November 2007	20 November 2007	25 November 2007	30 November 2007
Mareeba	1 November 2007	8 November 2007	13 November 2007	17 November 2007	22 November 2007	29 November 2007
Townsville	1 November 2007	6 November 2007	11 November 2007	14 November 2007	20 November 2007	27 November 2007
Bowen	25 November 2007	30 November 2007	4 December 2007	7 December 2007	14 December 2007	21 December 2007
Ayre	7 November 2007	11 November 2007	14 November 2007	17 November 2007	22 November 2007	28 November 2007
Bundaberg	16 November 2007	20 November 2007	23 November 2007	24 November 2007	28 November 2007	3 December 2007
Rockhampton	16 January 2008	18 January 2008	21 January 2008	22 January 2008	26 January 2008	3 February 2008
Nambour	22 January 2008	24 January 2008	26 January 2008	27 January 2008	29 January 2008	4 February 2008

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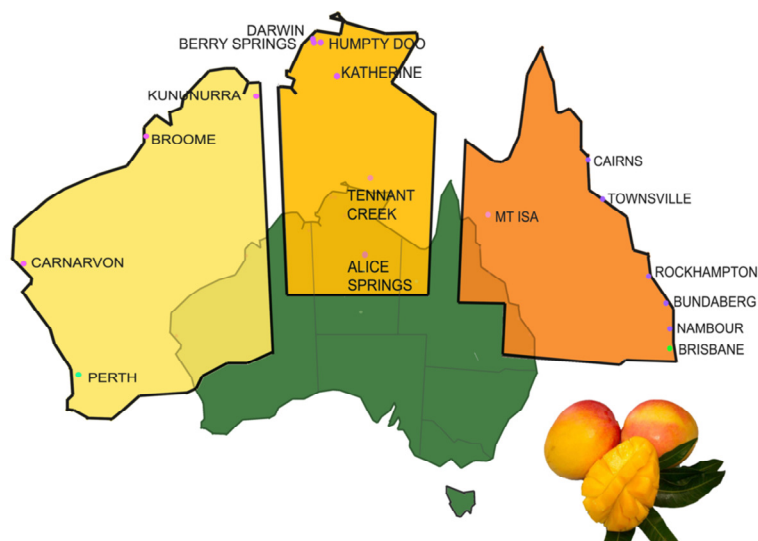
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## Information Sheet : Predicted Dates for Dry Matter Testing

7 August 2008

Chelsea Hennessy, Industry  
Development Officer, Darwin DPIFM



Regions	Flowering Dates						
	12 May	26 May	9 June	23 June	7 July	21 July	4 August
<b>Darwin</b>	30 August 2008	12 September 2008	24 September 2008	5 October 2008	16 October 2008	26 October 2008	6 November 2008
<b>Humpty Doo</b>	11 September 2008	22 September 2008	2 October 2008	12 October 2008	21 October 2008	31 October 2008	8 November 2008
<b>Berry Springs</b>	13 September 2008	24 September 2008	3 October 2008	12 October 2008	20 October 2008	29 October 2008	6 November 2008
<b>Batchelor</b>	6 September 2008	16 September 2008	27 September 2008	7 October 2008	16 October 2008	25 October 2008	3 November 2008
<b>Katherine</b>	24 September 2008	2 October 2008	9 October 2008	17 October 2008	23 October 2008	30 October 2008	5 November 2008
<b>Kununurra</b>	19 September 2008	27 September 2008	5 October 2008	14 October 2008	21 October 2008	27 October 2008	3 November 2008

Note: These dates should only be used as a guide for when to test for dry matter.

## Predicted Dates for Dry Matter Testing 2009

Chelsea Moore, Industry Development Officer, RDPIFR Darwin

These tables list the predicted dates for dry matter testing, which should occur 7 days before harvest

Region	Variety	Flowering date								
		4-May	18-May	1-Jun	15-Jun	29-Jun	13-Jul	27-Jul	10-Aug	24-Aug
Darwin	KP	28-Aug	11-Sep	24-Sep	6-Oct	16-Oct	27-Oct	6-Nov	17-Nov	28-Nov
	Calypso	3-Sep	17-Sep	29-Sep	11-Oct	21-Oct	1-Nov	11-Nov	22-Nov	3-Dec
	R2E2	10-Sep	24-Sep	6-Oct	18-Oct	28-Oct	8-Nov	18-Nov	29-Nov	10-Dec
Katherine	KP	19-Sep	30-Sep	9-Oct	17-Oct	25-Oct	2-Nov	9-Nov	17-Nov	25-Nov
	Calypso	22-Sep	3-Oct	11-Oct	20-Oct	27-Oct	3-Nov	11-Nov	19-Nov	27-Nov
	R2E2	29-Sep	9-Oct	18-Oct	26-Oct	2-Nov	9-Nov	17-Nov	25-Nov	4-Dec
Berry Springs	KP	2-Sep	16-Sep	27-Sep	8-Oct	18-Oct	28-Oct	8-Nov	16-Nov	28-Nov
	Calypso	7-Sep	21-Sep	2-Oct	12-Oct	22-Oct	2-Nov	13-Nov	23-Nov	3-Dec
	R2E2	15-Sep	28-Sep	9-Oct	19-Oct	29-Nov	9-Nov	20-Nov	30-Nov	10-Dec
Batchelor	KP	2-Sep	14-Sep	25-Sep	6-Oct	15-Oct	26-Oct	5-Nov	15-Nov	25-Nov
	Calypso	7-Sep	19-Sep	30-Sep	10-Oct	20-Oct	30-Oct	9-Nov	19-Nov	30-Nov
	R2E2	14-Sep	26-Sep	7-Oct	17-Oct	27-Oct	6-Nov	16-Nov	26-Nov	7-Dec
Kununurra	KP	11-Sep	24-Sep	4-Oct	13-Oct	21-Oct	28-Oct	5-Nov	13-Nov	21-Nov
	Calypso	16-Sep	28-Sep	8-Oct	18-Oct	25-Oct	1-Nov	9-Nov	17-Nov	26-Nov
	R2E2	23-Sep	5-Oct	15-Oct	23-Oct	31-Oct	7-Nov	15-Nov	23-Nov	2-Dec

### Key Points:

- Darwin rural (Berry Springs and Humpty Doo etc) have shifted by 1 to 2 days.
- Katherine has shifted by 2 days.

Region	Variety	8-Jun	22-Jun	08-Jul	22-Jul	12-Aug	31-Aug
Ayr	KP	20-Nov	27-Nov	3-Dec	9-Dec	19-Dec	28-Dec
	R2E2 & Honey Gold	4-Dec	10-Dec	17-Dec	23-Dec	1-Jan	10-Jan
Giru	KP	15-Nov	22-Nov	28-Nov	4-Dec	14-Dec	23-Dec
	R2E2 & Honey Gold	29-Nov	5-Dec	12-Dec	18-Dec	27-Dec	5-Jan
Townsville	KP	5-Nov	13-Nov	20-Nov	30-Nov	10-Dec	21-Dec
	R2E2 & Honey Gold	18-Nov	26-Nov	3-Dec	13-Dec	23-Dec	2-Jan
Mareeba	KP	13-Nov	21-Nov	29-Nov	8-Dec	19-Dec	30-Dec
	Calypso & Florida	19-Nov	27-Nov	5-Dec	14-Dec	25-Dec	5-Jan
	R2E2 & Honey Gold	27-Nov	5-Dec	14-Dec	22-Dec	2-Jan	13-Jan
Dimbulah	KP	17-Nov	23-Nov	29-Nov	6-Dec	16-Dec	25-Dec
	Calypso & Florida	22-Nov	28-Nov	4-Dec	12-Dec	21-Dec	31-Dec
	R2E2	30-Nov	6-Dec	13-Dec	20-Dec	29-Dec	8-Jan
Bundaberg	KP	17-Dec	22-Dec	28-Dec	4-Jan	11-Jan	18-Jan
	Calypso & Florida	23-Dec	28-Dec	3-Jan	10-Jan	17-Jan	24-Jan
	R2E2 & Honey Gold	1-Jan	6-Jan	11-Jan	19-Jan	25-Jan	1-Feb

### PLANT INDUSTRIES DIVISION

GPO Box 3000 Darwin NT 0801 Tel: 08 8999 2357 Fax: 08 8999 2049 Email: [horticulture@nt.gov.au](mailto:horticulture@nt.gov.au) Web: [www.horticulture.nt.gov.au](http://www.horticulture.nt.gov.au)

### Disclaimer

While all reasonable efforts have been made to ensure that the information contained in this publication is correct, the information covered is subject to change. The Northern Territory Government does not assume and hereby disclaims any express or implied liability whatsoever to any party for any loss or damage caused by errors or omissions, whether these errors or omissions result from negligence, accident or any other cause.

DEPARTMENT OF REGIONAL DEVELOPMENT, PRIMARY INDUSTRY, FISHERIES & RESOURCES

## Appendix 5: Regional presentations

The following references are for presentations referred to in Table 1 of the report. These cover a range of presentations to industry either providing information on the progress of the Top End Better Mangoes Project, or addressing fruit quality issues, particularly post-harvest diseases.

- Grower group meeting in Dimbulah for interested growers to begin the forecasting process and ground proof the heat sums formula for Nth Qld. 2006.
- Flowering surveys were presented to a Burdekin mango growers group by QDPI&F extension staff 2006.
- May 2007 Dimbulah meeting in conjunction with conference trip.
- Pre-season mango forums for labour and transport providers, presented by Greg Owens 29/08/2007.
- NTMIA pre-season meeting and AGM, Darwin, 29/08/07.
- Honey Gold growers meeting in Mareeba, 5/09/2007. After discussion, a set of photographs, designating an agreed flowering stage for recording, were chosen. These photos were then distributed to all Honey Gold growers to encourage their participation in the national crop forecast.
- 2006 season post harvest seminar, presented by Greg Owens in Darwin on 20/09/07 (DoR).
- 2007 season post-harvest seminar, presented by Chelsea Moore (DoR) in Darwin on 23/02/2008 (Palmerston Library).
- 2008 season post harvest seminar, presented by Chelsea Moore in Darwin on 28/03/2009 (Palmerston Council Chambers).

Greg Owens was the project leader in years 1 and 2, for which the records of regional meetings are limited to travel logs, some of which were dual purpose with another mango project. The trips were as follows:

- Cairns 13 March 2006.
- Cairns 13 June 2006.
- Cairns 29 August 2006.
- Cairns 27 November 2006.
- Cairns 3 September 2007.
- Kununurra 29 November 2007.
- Kununurra 23 October 2007.

Unfortunately, we have no other details of who he met while on this travel, as he no longer works for DoR.

## Appendix 6: AMIA Presentations

The following is a presentation by DoR at the 2007 AMIA conference in QLD, referred to in Table 1 of the report. Other presentations were given at AMIA conferences including the most recent in 2009.

## Making the Mango Crop Forecast Work!



Northern Territory  
Horticultural Association  
Incorporated

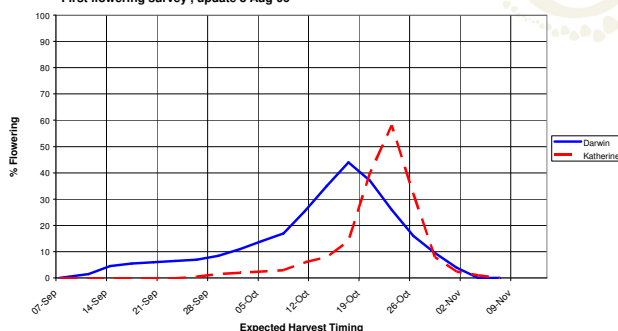


## NT Mango Crop Forecasts

- Graphs generated from Flowering Survey and heat sums.
- Early forecasts depend on historical average temperatures
- Later forecasts are updated as real temperatures replace historical averages
- Forecasts currently updated fortnightly
- Forecasts checked against fruit production patterns each year

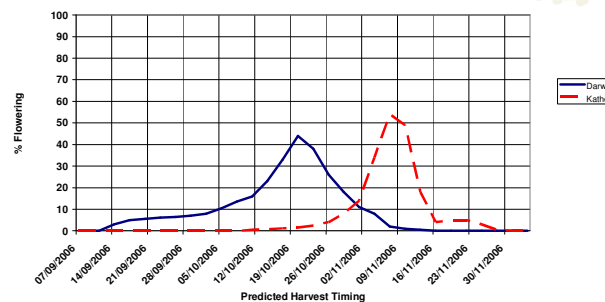
### Combined NT Mango Timing Forecast First flowering survey, update 8 Aug 06

Darwin Region: 106,000 trees, 21 farms  
Katherine Region: 76,000 trees, 10 farms



### Combined NT Mango Timing Forecast Second flowering survey, 15 October 2006

Darwin Region: 106,000 trees, 21 farms  
Katherine Region: 76,000 trees, 10 farms



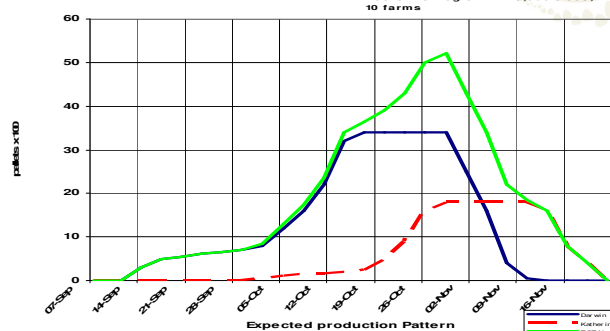
## Volume Forecasts

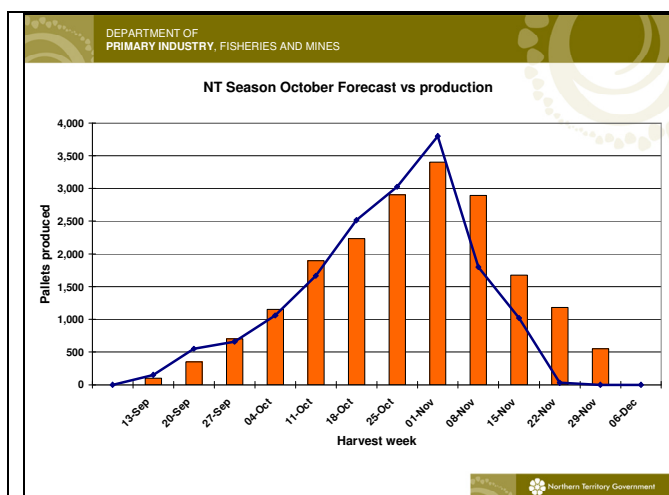
- Started in 2005
- Possibilities
  - % of previous year
  - Flower %
  - Tree counts
  - **Shed estimates**
- 2006
  - First published forecast of 2.5M reduced to 2.2M due to poor set then back to 2.5M
- 2007
  - 1 Sept 1.6-2.0M scenarios
  - Update with fruit set



### Combined NT Mango Forecast 1 September 2006 2.5 Million Tray Scenario

Darwin Region: 106,000 trees,  
21 farms  
Katherine Region: 76,000 trees,  
10 farms



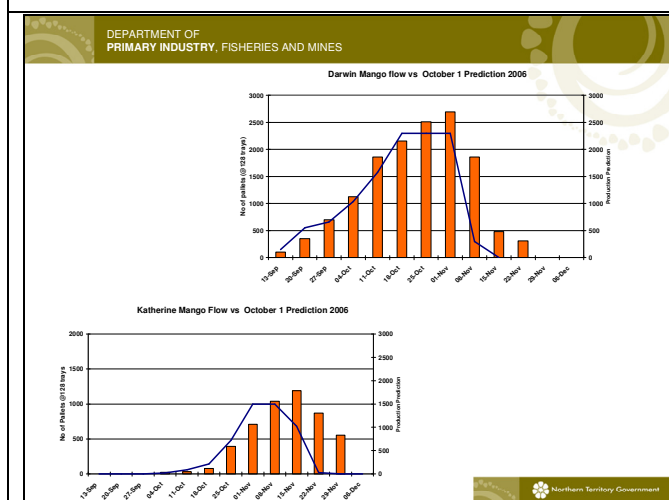


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PRIMARY INDUSTRY, FISHERIES AND MINES

**2006 Transport implications for 2.5 million tray scenario over 6 weeks**

2006	Syd	Melb	Bris	Adel	Other	Forecast	Actual	Forecast	Actual
Week ending	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Vans (20)	Vans(20)
To 13-Sept						200		10	
20-Sep						200		10	
27-Sep						200		10	
04-Oct						800		40	
11-Oct						2400		120	
18-Oct	Darwin	Peak				3200		160	
25-Oct						4400		220	
01-Nov	Kath	peak				5000		250	83 triples
08-Nov						3000		150	
15-Nov						600		30	
22-Nov						0		0	
29-Nov						0		0	
06-Dec						0		0	
TOTAL NT	11,000	4,000	3,000	1000	1000	20,000		1000	
% market	55%	20%	15%	5%	5%				

Northern Territory Government

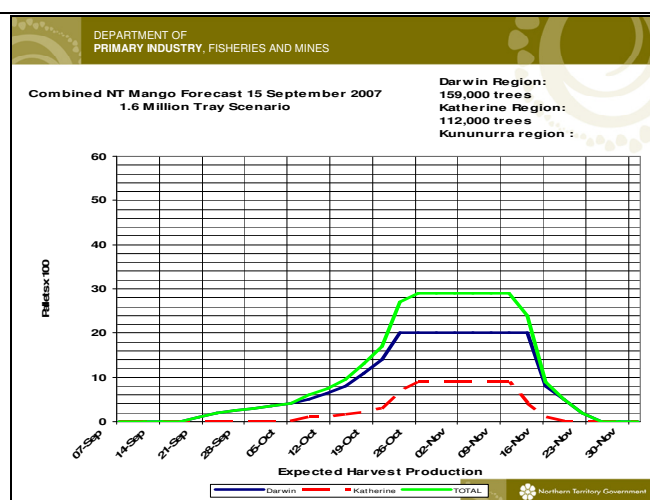
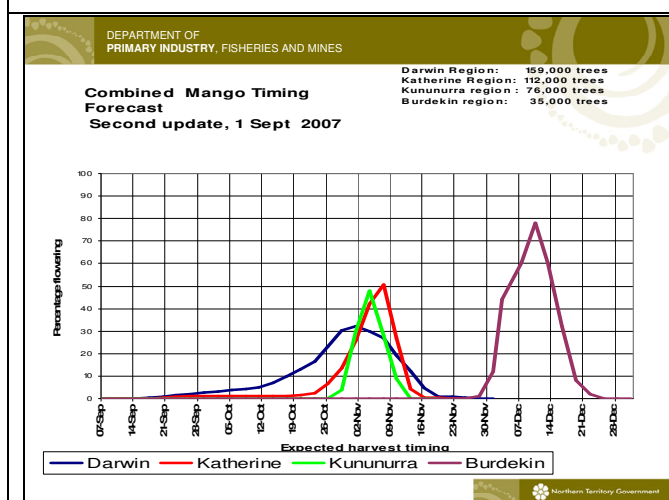


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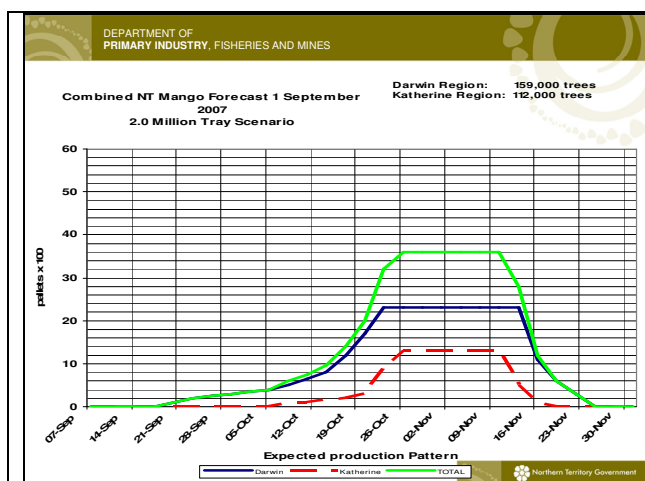
**2006 Transport implications for 2.5 million tray scenario over 6 weeks**

2006	Syd	Melb	Bris	Adel	Other	Forecast	Actual	Forecast	Actual
Week ending	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Vans (20)	Vans(20)
To 13-Sept						200	100	10	5
20-Sep						200	349	10	17
27-Sep						200	703	10	36
04-Oct						800	1151	40	58
11-Oct						2400	1896	120	95
18-Oct	Darwin	Peak				3200	2235	160	117
25-Oct						4400	2906	220	146
01-Nov	Kath	peak				5000	3400	250	170
08-Nov						3000	2895	150	145
15-Nov						600	1300	30	65
22-Nov						0	1182	0	60
29-Nov						0	553	0	28
06-Dec						0		0	
TOTAL NT	11,000	4,000	3,000	1000	1000	20,000	18,840	1000	942
% market	55%	59%	20%	15%	18%	4%	3%		

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**2007 NT Transport implications for 2.0 million tray scenario over 5 weeks**

2007	Syd	Melb	Bris	Adel	Other	Forecast	Actual	Forecast	Actual
Week ending	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Vans (20)	Vans(20)
To 14-Sept						0		0	
21-Sep						100		5	
27-Sep						300		15	
04-Oct						400		20	
11-Oct						800		40	
18-Oct						1,600		80	
25-Oct	Darwin	Peak				3,600		180	
01-Nov	Kath	peak				3,600		180	
08-Nov						3,600		180	
15-Nov						1,400		70	
22-Nov						200		10	
29-Nov						0		0	
06-Dec						0		0	
TOTAL NT	9,360	2,340	2,340	780	780	15,600		780	
% market 06	59%	15%	15%	4%	3%				
Estimate 07	60%	15%	15%	5%	5%				

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**2007 NT Transport implications for 1.6 million tray scenario over 5 weeks**

2007	Syd	Melb	Bris	Adel	Other	Forecast	Actual	Forecast	Actual
Week ending	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Pallets	Vans (20)	Vans(20)
To 14-Sept						0		0	
21-Sep						100		5	
27-Sep						300		15	
04-Oct						400		20	
11-Oct						800		40	
18-Oct	Darwin	Peak				1,400		70	
25-Oct						2,800		140	
01-Nov	Kath	peak				2,800		140	
08-Nov						2,800		140	
15-Nov						1,100		55	
22-Nov						200		10	
29-Nov						0		0	
06-Dec						0		0	
TOTAL NT	7,620	1,905	1,905	635	635	12,700		635	
Estimate 07	60%	15%	15%	5%	5%				
% market 06	59%	15%	15%	4%	3%				

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**2007 NT Labour implications for 2.0 million tray scenario over 5 weeks**

2007	Forecast	Labour		
Week ending	Pallets	Picking @5400t/w	Packing @1200t/w	Total
To 14-Sept	0			
21-Sep	10,000	100	20	8
27-Sep	40,000	300	75	33
04-Oct	50,000	400	93	42
11-Oct	100,000	800	185	83
18-Oct	200,000	1,600	370	166
25-Oct	500,000	3,600	926	416
01-Nov	500,000	3,600	926	416
08-Nov	500,000	3,600	926	416
15-Nov	180,000	1,400	334	150
22-Nov	25,000	200	46	21
29-Nov	0			
06-Dec	0			
TOTAL NT	15,600			Max -1342
Turnover 2.5w/person				Total 2684 persons

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**2007 NT Labour implications for 1.6 million tray scenario over 5 weeks**

2007	Trays	Forecast	Labour		
Week ending		Pallets	Picking 540t/w	Packing @1200t/w	Total
To 14-Sept		0			
21-Sep	10,000	100	20	8	28
27-Sep	40,000	300	75	33	108
04-Oct	50,000	400	93	42	135
11-Oct	100,000	800	185	83	268
18-Oct	180,000	1,400	333	150	483
25-Oct	360,000	2,800	666	300	966
01-Nov	360,000	2,800	666	300	966
08-Nov	360,000	2,800	666	300	966
15-Nov	150,000	1,100	259	117	376
22-Nov	25,000	200	46	21	67
29-Nov		0			
06-Dec		0			
TOTAL NT	1,600,000	12,700			Max 966
Turnover 2.5w/person					Persons 1932

Northern Territory Government

DEPARTMENT OF  
PRIMARY INDUSTRY, FISHERIES AND MINES

## Acknowledgements

- This project was facilitated by HAL in partnership with the Australian Mango Industry Association and was funded by the mango levy. The Australian Government provides matching funding for all HAL's R&D activities.
- This project relies on the in-kind contribution from the NT Government and the Northern Territory Horticultural Association to facilitate the contact with growers and to distribute the information via the NTG website and NTHA communication channels.
- The project team would like to thank the NT & Qld growers, packers, and allied industry members for their input and cooperation.

Northern Territory Government

## **Appendix 7: The 2007 and 2008 seasons' overviews**

The following reports are the season overviews, referred to in Table 1 of the report. These are made available on the Internet from around February the following year and are emailed out to a list including, NTHA which then forwards the report on to its subscribed growers, local and interstate growers, packers, agents, wholesalers, harvest labour companies and transport companies.

The overviews combine a number of different aspects of the season, including information from the Crop Forecast project, market prices and saleable life indexes (SLIs).

# Information Sheet

## 2007 Mango Season

*Chelsea Moore, Industry Development Officer, Plant Industries Darwin*

### Summary:

Due to the late season and bad weather disease loads were very high. Late Darwin fruit had a high incidence of Anthracnose. The Katherine fruit had a high incidence of SER, sap damage and skin browning. Both had handling damage & late fruit suffered from inconsistent grading/packing

Production reached 2.2 million trays or 1,600 pallets for the NT which is down from the bumper 2006 season.

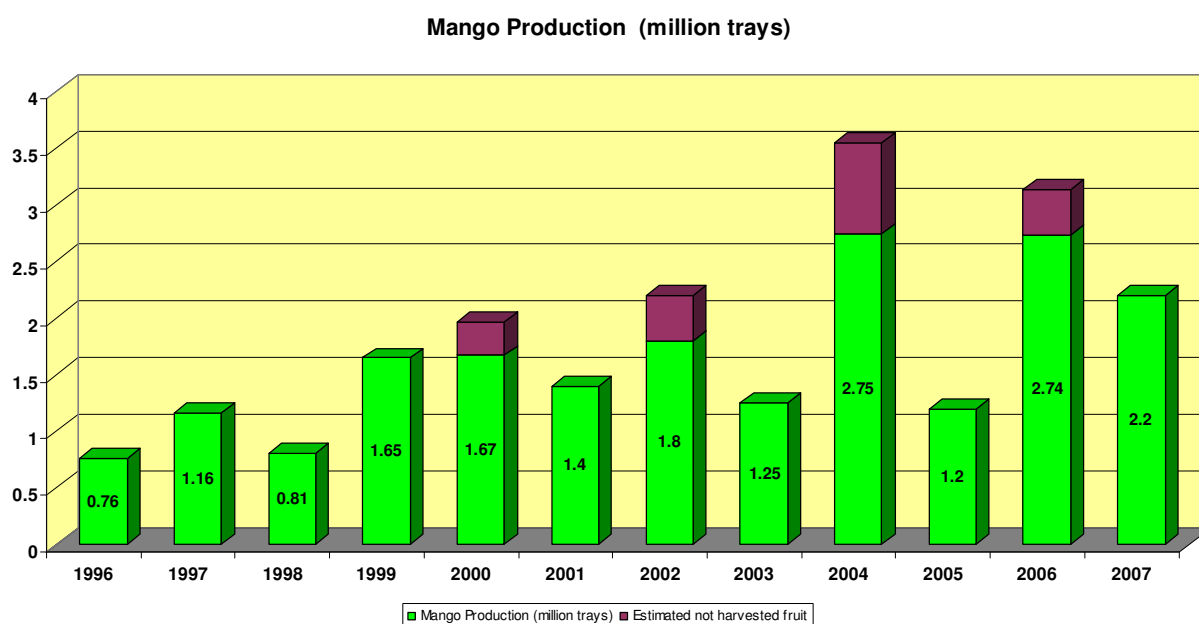
### Production:

	2007			2006		
	Tonnes	Trays	Value	Tonnes	Trays	Value
Darwin	9,100	1.3 million		14,700	2.1million	
Katherine	6,300	0.9 million		4,350	0.63 million	
<i>Total</i>	<i>15,400</i>	<i>2.2 million</i>	<i>\$37.8million*</i>	<i>19,200</i>	<i>2.74 million</i>	<i>\$47million</i>

\* (@ 17.20 per tray)

Production reached 2.2 million trays or 16,000 pallets for the NT which is down from the bumper 2006 season.

### Mango production over time:



## Mango quality

The Better Mangoes Project (funded by HAL) monitors temperature in mango consignments to southern markets from Katherine, Darwin and Kununurra. It provides report detailing the shelf life (SLI) and damage to fruit. The department also conducted a market trip to assess NT fruit quality at markets and on the shelves

### 2007 Saleable Life Index (SLI) ranges:

	Average	Max	Min
Darwin	5	8	2
Katherine & Kununurra	10	18	5

### SLI Ranges after rain events:

Week starting:	1 Oct	8 Oct	15 Oct	22 Oct	29 Oct
Darwin SLI		7		5	4
Rain events	0	1	2	3	4
Week starting:	22 Oct	29 Oct	5 Nov	12 Nov	19 Nov
Katherine SLI		10			6
Rain events	0	1	3	1	1

The 2007 season was predominated by weather effects, with rain providing a high disease incidence in fruit that far outweighed individual differences in performance. The benchmark was met early in the season in both Katherine and Darwin, but rain events corresponded to significantly reduced SLIs later in the season.



Stem End Rot



Skin Browning



Sap burn

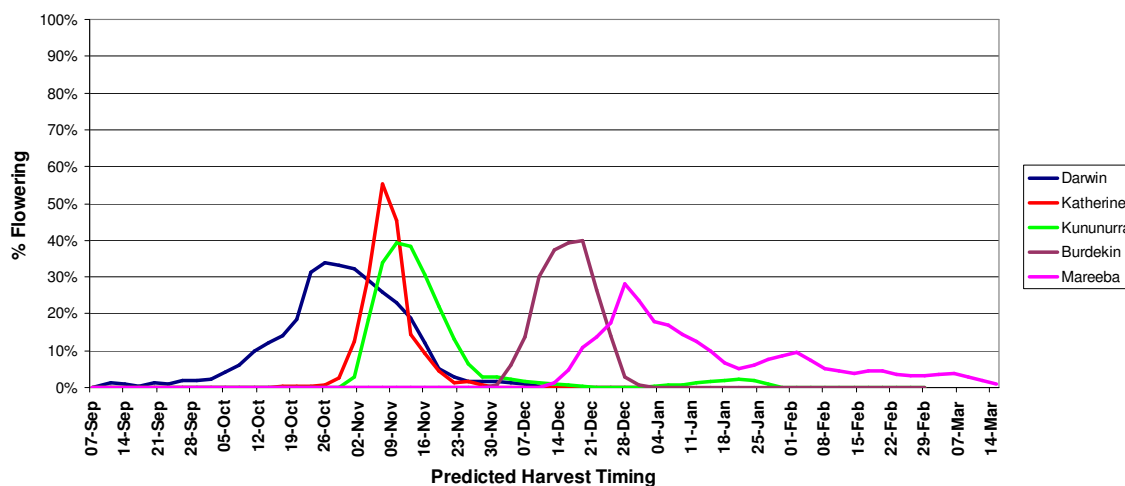


Anthracnose

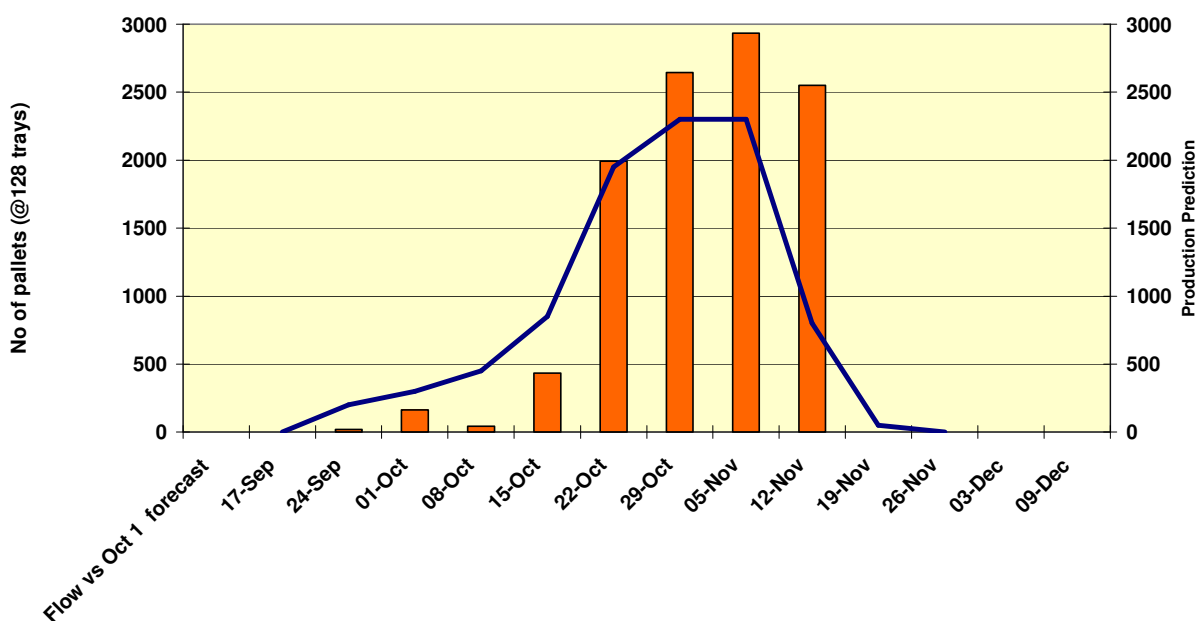
## Crop forecast:

### Combined Mango Timing Forecast Update 1 December 2007

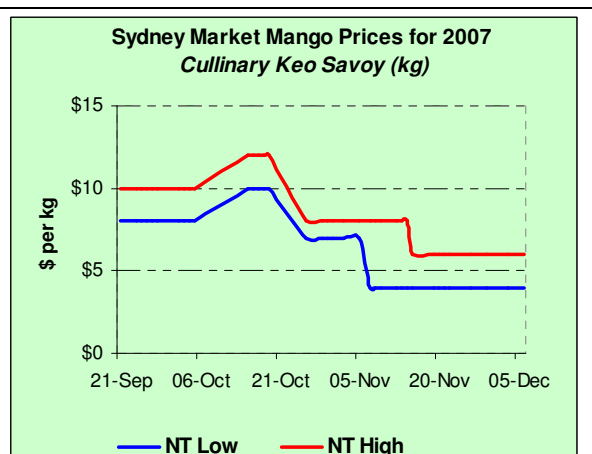
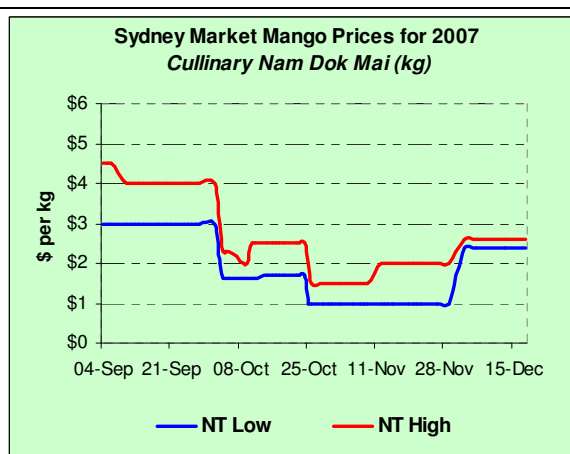
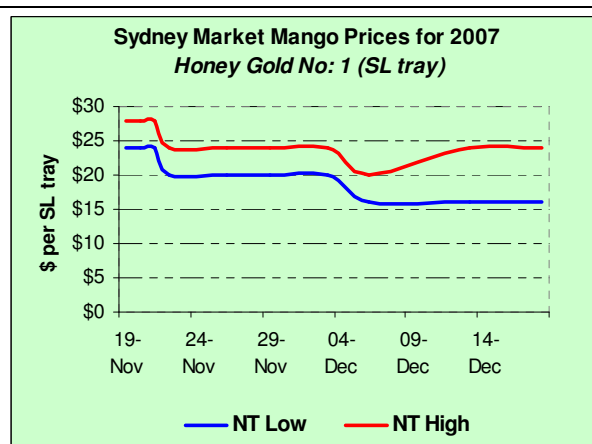
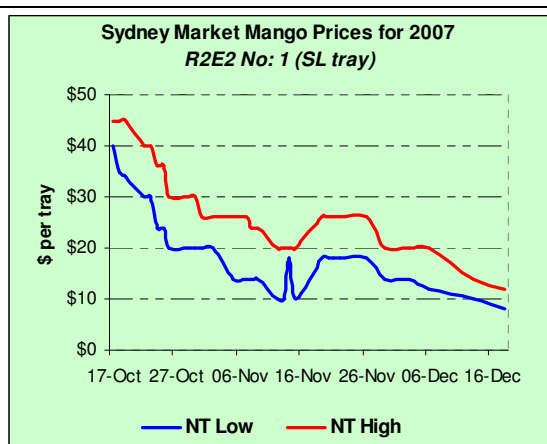
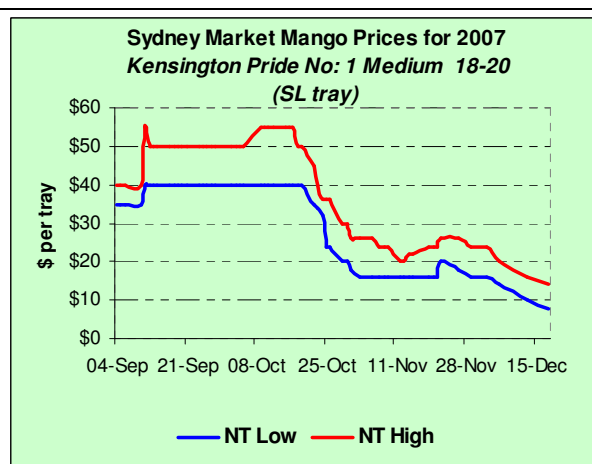
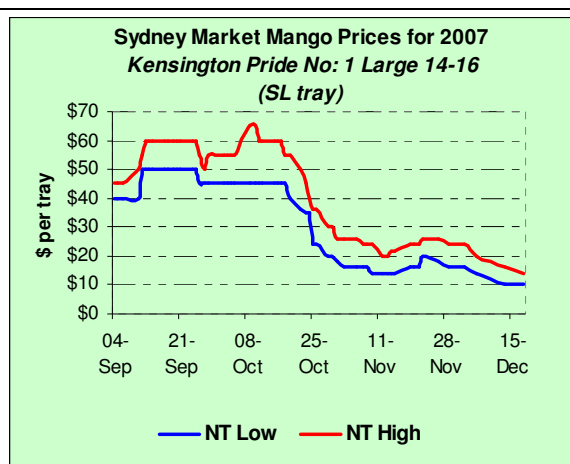
Sample size  
 Darwin Region: 167,500 trees  
 Katherine Region: 114,000 trees  
 Kununurra region : 108,600 trees  
 Burdekin region: 65,500 trees  
 Mareeba: 58,500 trees



### Darwin Mango flow vs October 1 Prediction 2007



## Market Prices:



From the graphs you can see a dramatic drop in prices for KP after 25 October- corresponding with the reduction in shelf life and increase in disease from rain.

### More Information?

Visit our website at [www.horticulture.nt.gov.au](http://www.horticulture.nt.gov.au)

Or Contact us on:

Phone: (08) 8999 2357

Fax: (08) 8999 2049

Email: [horticulture@nt.gov.au](mailto:horticulture@nt.gov.au)

Post: GPO Box 3000 Darwin NT 0801

Or visit us at:

1<sup>st</sup> Floor John England Building, Berrimah Farm, Makagon Road, Berrimah, NT.

### **Acknowledgments:**

*The Better Mangoes and Crop Forecasting projects, MG05004 and MG05005, were facilitated by HAL in partnership with the Australian mango Industry association. They were funded by the mango industry levy and by contributions from the NT Department of Primary Industry, Fisheries and Mines and from cooperating growers. The Australian Government provides matched funding for all HALs R&D activities.*

*Market data is compiled by Ausmarket Consultants and the report funded by AMCOR, AMIA and HAL on behalf of the Australian Mango Industry.*



# Information Sheet

## 2008 Mango Season

*Chelsea Moore, Industry Development Officer, Plant Industries Darwin*

### Summary:

The 2008 season was very mixed. In contrast to 2007, there was little or no anthracnose on the fruit because of the early harvest (before the onset of the rain, which is strongly linked to the disease). There were no specific quality issues; as a result the growers surveyed all reached the average 7 day Shelf Life benchmark.

There were multiple flowerings throughout all of the regions and in many cases poor fruit set led to sporadic results. Many growers had very low volumes, particularly in Katherine where the poor flowering was most evident, whilst others performed slightly better than 2007. The low volumes meant that the seconds moved well.

Production reached just over 2.2 million trays or over 16,000 pallets for the NT which is slightly up from the 2007 season.

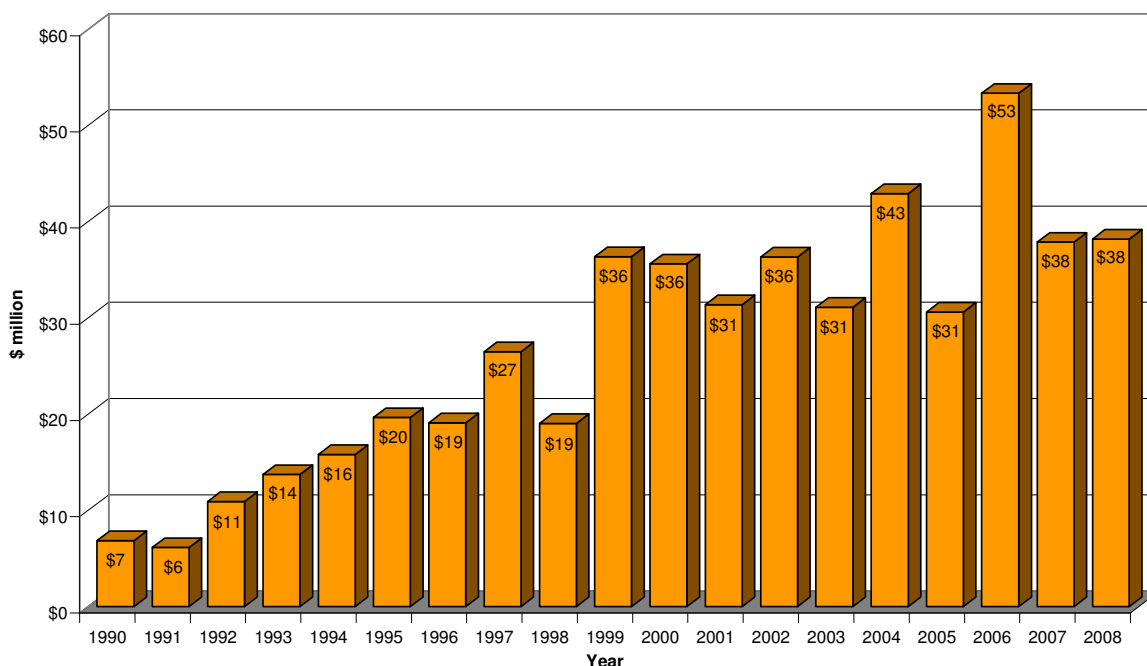
### Production:

	2008			2007		
	Tonnes	Trays	Value	Tonnes	Trays	Value
Darwin	11,506	1.6 million		9,100	1.3 million	
Katherine	4,041	0.577 million		6,300	0.9 million	
<i>Total</i>	<i>15,547</i>	<i>2.2 million</i>	<i>\$38million*</i>	<i>15,400</i>	<i>2.2 million</i>	<i>\$37.8million*</i>

\* (@ \$17.20 per tray)

Production reached just over 2.2 million trays or over 16,000 pallets for the NT which is slightly up from the 2007 season.

### Mango production over time:



## Mango Quality

The Better Mangoes Project (funded by HAL) monitors temperature in mango consignments to southern markets from Katherine, Darwin and Kununurra. It provides report detailing the shelf life (SLI) and damage to fruit. The department also received information from market agents on fruit quality for the NT season.

### 2008 Saleable Life Index (SLI) ranges:

	Av.	Max	Min
Darwin	7	11	5
Katherine	7	7+	6

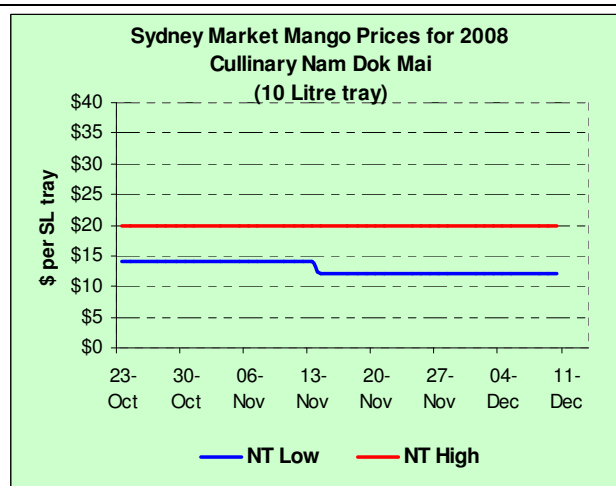
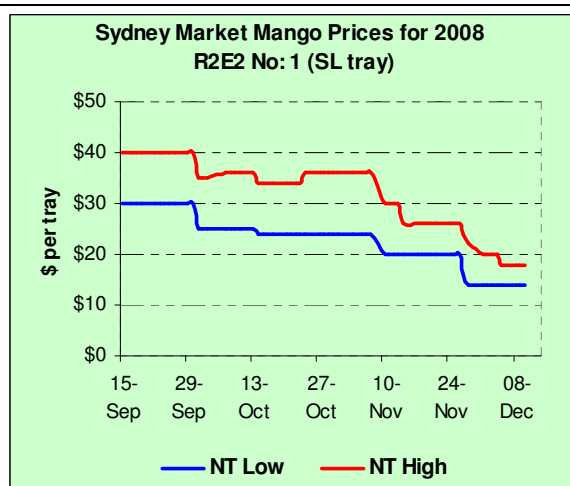
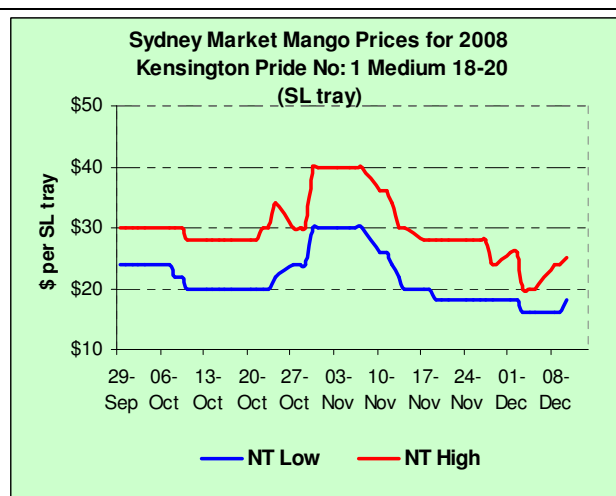
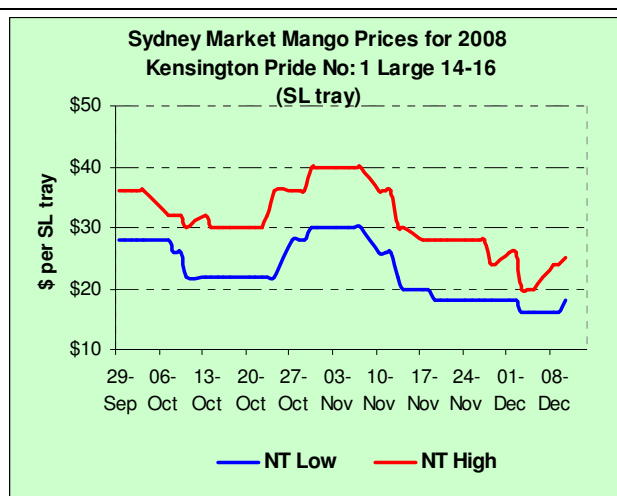
The 2008 season was earlier than 2007. The extremely early fruit was mature, but had some minor Stem End Rot issues. This early fruit also reduced the peak somewhat so that none of the infrastructure was overloaded.

There were never large volumes at the markets due to the multiple, sporadic flowering, however the low volumes meant that the seconds moved well and prices remained decent.

The earlier flowering led to a harvest largely untouched by rain events and anthracnose free. There were no real quality issues, although the fruit were not perfect with low to medium levels of skin browning and lenticel spotting. This was in stark contrast to the Mareeba season which was dominated by wet weather and high levels of disease.



## Sydney Market Prices:



2007 had both higher price peaks going above \$50 a tray, but it also had a steeper drop off to lower prices than 2008.

### More Information?

Website: [www.horticulture.nt.gov.au](http://www.horticulture.nt.gov.au)

Phone: (08) 8999 2357

Fax: (08) 8999 2049

Email: [horticulture@nt.gov.au](mailto:horticulture@nt.gov.au)

Post: GPO Box 3000 Darwin NT 0801

Or visit us at: 1<sup>st</sup> Floor John England Building, Berrimah Farm, Makagon Road, Berrimah, NT.

### Acknowledgments:

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*Market data is compiled by Ausmarket Consultants and the report funded by AMCOR, AMIA and HAL on behalf of the Australian Mango Industry.*

**This information would not be possible without the co-operation of the growers and packers who supplied data- Thank you.**

## **Appendix 8: The survey form**

### **Mango Crop Forecast Satisfaction Survey**

1. Have you used the Crop Forecast?
  - a. Yes/ No
  - b. If no- why not?
2. How often do you use the forecast?
3. How would you prefer to access the forecast?
  - a. Phone
  - b. Fax
  - c. Letter
  - d. Email
  - e. Internet
4. What parts do you use?
  - a. Start dates
  - b. Peak times
  - c. Individual calculator
  - d. Post season report
5. For what purpose do you use the forecast?
  - a. Harvest timing
  - b. Marketing
  - c. Transport or labour logistics
  - d. Other
6. Overall how easy is the forecast:
  - a. To use?
  - b. To find?
7. Do you follow the fortnightly updates or use only the initial forecast?
8. Do you think the project should be continued?
  - a. If yes, how do you think the project's continuation could be funded?
  - b. If no, why not?
9. How satisfied are you with the forecast?

Please rate from 1 to 5, where 1 = poor, 5 = good.
10. What improvements (if any) would you like to see?
11. What region are you from?

12. What part of the industry are you from?

- a. Grower
- b. Packing shed
- c. Marketing
- d. Market agent
- e. Transport
- f. Harvest labour
- g. Other

13. If you are a grower, approximately how many trees do you have?

14. Did you contribute to the flowering surveys in previous years?

Thank you for your time.

## Appendix 9: Survey results

Question	Results							
1     Use	Yes 8	No						
2     Frequency	Once	Twice	3 times 3	frequently 5				
3     Preferred access	Phone	Fax	Letter	Email 6	Internet 4			
4     Segments used	Start date 2	Peak times 2	Calculator	Overview	The lot minus calculator 6			
5     Purpose	Harvest timing 1	Marketing 2	Logistics	Other Logistics	The lot 4			
6     Ease of use	Easy 7	Difficult						
6b    To find	Easy 6	Difficult 1						
7     Updates	Fortnightly 7	Initial 1						
8     Continue Project	Yes 8	No						
8b    Funded by	Industry 3	Government	Unsure 3					
9     Satisfaction	1	2	3 3	4 1	5 4			
11    Region	NT 6	WA	QLD 1	All 1				
12    Industry area	Grower 5	Packer 4	Marketing 4	Agent 1	Transport	Labour 1	Other	
13    No. of trees	28,000	30,000	28,000	20,000	1,200	400		
14    Contributor	Yes 6	No						
10    Improvements:	More regions & better volume predictions Better grower involvement							

Number of responses: 8

\*Note: Respondents were allowed to choose more than one answer where appropriate.