## Horticulture Innovation Australia

**Final Report** 

# Study groups enabling industry adaption to pineapple market changes (V)

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The Department of Agriculture and Fisheries (DAF)

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#### PI13006

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## **Summary**

Although the Australian pineapple industry is one of the most efficient in the world it must compete with imported processed fruit produced in countries where labour costs are a fraction of Australia's. Fresh fruit imports are permitted from a number of countries and although very little is currently brought in the situation could change especially if local costs of production force prices up and local fruit is not perceived to be safe and produced in a sustainable manner. Pineapple must also compete on price and quality with other fresh fruit on the market.

In order to remain viable the Australian industry must continuously strive to improve fruit yield and quality, drive down costs of production and ensure that the fruit produced is safe to eat and produced in a sustainable and socially acceptable manner.

This project was directed at growers and its aim was to lift productivity, fruit quality and sustainability across the industry by facilitating the sharing of information and the creation and maintenance of high quality information resources.

The strategies employed by the project were to bring growers and other stakeholders together on a regular basis at on-farm workshops, publish a practical field guide to help growers identify and manage crop disorders, keep the growers' Best Practice Manual up to date, test the suitability of short 'how to' videos as a way of transferring information, and take a closer look at some production costs. To assist industry leaders with planning, the project also produced regular crop forecasts and production estimates.

A total of 22 regional workshops or tours were held (three of which were combined meetings), six for each of the four regional grower study groups of North Queensland, Central Queensland, Wide Bay and South East Queensland.

"The Pineapple Problem Solver Field Guide" was completed, published and distributed to all growers. The 224 page guide illustrates and describes 77 disorders of pineapple in Australia and provides advice on their identification, prevention and management. It also describes 35 weed species and 5 high risk exotic pests and diseases.

Seven chapters of the Best Practice Manual covering topics where significant changes had occurred were updated, printed and distributed to each grower.

Three 'how to' YouTube videos were produced and made available to growers, "Pests and diseases affecting pineapple root health", "Leaf sampling pineapples for nutrient analysis" and "Leaf sampling pineapples for flower induction".

Growers were surveyed for production and production forecasts six times over the life of the project and this information summarised and presented to industry.

An evaluation survey conducted at the conclusion of the project was completed by 50% of all growers and showed that all parts of the project were highly rated. The feedback can be summarised as follows:

- 74% of growers attended 4 or more of the 6 workshops in each region and gave the different aspects of the study groups an average rating of 8.7 out of 10.
- Growers considered videos an effective way of providing information and training, and they would like more to be made.
- Growers wanted the Best Practice Manual kept up to date and also wanted to be kept up to date with production information and forecasts.
- Growers found the "The Pineapple Problem Solver Field Guide" a useful tool.
- Growers were asked, as a result of participating in the project, if they had made changes to each of 10 different areas of production (e.g. fertilising, pest and disease control etc). Positive responses ranged from 35% to 85% for each of these 10 areas, averaging 62% overall.
- One survey respondent summed up the project as follows: "This project has underpinned the pineapple industry when major commercial stakeholders withdrew their historical support. Due to this program our industry is very open and immense help is shared amongst all that are involved in growing their respective businesses."

It is recommended that opportunities for growers to share ideas and visit other farms be continued, more videos be made, the Best Practice Manual be kept up-to-date, crop forecasts be made and other ways to boost the competitiveness of the Australian pineapple industry be found.

## **Keywords**

Pineapple, extension, production, field guide, video, best practice, workshops, growing manual

## Introduction

The Australian pineapple industry is recognized as one of the most efficient in the world however it continues to be faced with significant changes and challenges. It must compete directly with both processed and fresh pineapple imports from countries with very low labour costs. In recent years it has gone through some significant changes. The processing industry, dominated by Golden Circle Ltd, used to provide horticultural services (with three full time agronomist providing one-to-one on-farm advice), research and a wide support base for the industry. However this support base was withdrawn and this project together with the four phases preceding it undertook to equip growers with the skills to take greater ownership of the industry through leadership training, provide forums for better communication and information exchange, and develop information resources.

In recent years the industry has changed from one dominated by the processing sector to one dominated by the fresh fruit sector. The processing sector has shrunk from approximately 130,000 tonnes per annum in the 1990s to 28,000 tonnes per annum now with a farm gate value of only about \$12m, whilst the fresh fruit sector has grown from about 35,000 in the 1990s to 47,000 tonnes now with a farm gate value of \$56m. At the same time the number of growers has halved from over 150 in the 1990s to an estimated 76 growers now.

This project aimed to address Objective 3 in the industry strategic plan that was current when the project submission was prepared. "Ensure that the Australian pineapple industry is resourced and aligned to lead and facilitate evolving supply".

## Methodology

The project consisted of a number of components.

#### Study group meetings

For the purposes of the grower study group meetings the industry was split into four separate production regions, North Queensland and Northern Territory (10 businesses), Central Queensland (14 businesses), Wide Bay (22 businesses) and South East Queensland (30 businesses). Two meetings per year were organised for each of the four study groups over the life of the project. A total of 27 days of 22 separate meetings were held. In addition growers were encouraged to travel to other regions so some joint meetings and a tour were organised. One of these occasions involved growers from other regions travelling to Central Queensland to support growers and offer advice following Cyclone Marcia in 2015.

Most meetings were held on pineapple farms but some activities took growers to the Brisbane markets, Woolworths Distribution Centre in Brisbane, a banana farm in NQ, a mixed tropical fruit farm near Yeppoon and in the NT mango, passionfruit, asparagus and melon farms as well as a research station.

Typically a semi-formal session was held in the farm shed which included input from the local industry representative of Australian Pineapples and the Pineapple Industry Development Officer (IDO) updating growers on industry matters. Then presentations were made by agronomists, researchers and other guest speakers. Particular topics such as weed control and nutrition practices were also workshopped with growers too and the information recorded. Following this session the host grower gave an overview of his operation and then led a farm walk. Before heading into the field a grower was nominated to be particularly observant during the farm tour and then after the walk deliver a positively framed appraisal or critique of the operation during the 'happy hour'. Feedback about the workshop itself (positive and where improvements could be made) was sought vocally from attendees.

The project leader facilitated the meetings and took photographs and notes during the event and afterwards produced detailed illustrated minutes which were distributed to growers in all regions via email or hardcopy (as nominated by each

grower). These minutes served as a reference, to clarify and reinforce key points, to inform and educate and to allow growers who weren't able to attend to benefit from what was seen and discussed. Considerable time was spent preparing these minutes, using a writing style appropriate for the audience and ensuring that they clearly explained, described and illustrated what was covered in the meeting. They were also formatted to encourage growers to read them, using plenty of photographs and including features such as short dot point 'Take home messages' on the first page. Copies of any MS PowerPoint presentations were also disseminated. As well as being distributed to each grower the minutes were also made available on the Australian Pineapples industry website <a href="http://aussiepineapples.com.au/">http://aussiepineapples.com.au/</a> hosted by the industry's peak industry body, Growcom. During the project 22 sets of minutes were produced. Two examples of these minutes can be found in Appendix V.

#### "The Pineapple Problem Solver Field Guide"

To complement the Best Practice Manual and provide a more complete reference library for growers, agronomists and researchers an illustrated guide was completed to assist growers to identify disorders in pineapple plants and provide recommendations to prevent or manage these problems. Obviously being able to correctly identifying a disorder will mean the grower has an infinitely better chance of taking the appropriate management steps to rectify the issue, not waste resources and not add inappropriate pesticides to the environment. It is A5 sized so it can fit in the ute glove box, has a Spiro binder allowing it to lay flat when opened and splash proof pages so it can be used in the field. It consists of 224 pages and 418 colour photographs, describes 77 disorders of pineapple in Australia and provides advice on their identification, prevention and management. It also describes 35 weed species and 5 high risk exotic pests and diseases. The latter to increase awareness of these exotic disorders so there is a better chance of them being recognised should they arrive in Australia.

The hardcopy guide, which was commenced in the previous project, was completed, published and distributed to all growers, agronomists and key researchers at no cost. This meant that even those who may not have been prepared to buy the product, received one and could benefit from it. Hardcopies of the guide can be requested by emailing <u>simon.newett@daf.qld.gov.au</u>.

#### YouTube videos

In recent years short videos have become a popular way of providing instructions of how to do things. Three short 'how to' videos were produced for growers in order to test this form of information transfer amongst pineapple growers. The topics chosen were monitoring for pests and diseases in the root system and monitoring growth and nutritional status of plants. The YouTube videos produced were "Pests and diseases affecting pineapple root health", "Leaf sampling pineapples for nutrient analysis" and "Leaf sampling pineapples for flower induction".

They were made available to growers via emailed links and also posted to the industry website <a href="http://aussiepineapples.com.au/">http://aussiepineapples.com.au/</a>. They were also played at study group workshops and the annual field day. The videos were made in conjunction with the DAF HortSmart team.

#### **Production data and forecasts**

Like any other farming commodity the Australian pineapple industry needs current and forecasted production data for planning purposes.

Since production is regularly affected by the vagaries of the markets and seasons (as happened with Cyclone Marcia in 2015) growers were surveyed twice per year. The method used was to conduct as comprehensive a survey of all growers once per year and follow this up six months later with a survey of the larger growers in each region to get an indication of any changes. Data for the survey was also sought from The Kraft Heinz Company (formerly Golden Circle Ltd) of actual total tonnage processed and forecast by their cannery and this data was compared with estimates of processing fruit provided by growers.

A confidential spreadsheet was maintained with data from every grower. An attempt was made to contact every grower for the comprehensive survey. To try and make it easier for the grower his previous data was assembled and sent to him ahead of a phone call from the project leader. The data collected in the comprehensive survey included the previous year's actual production split into tonnage sent for processing and to the fresh fruit market, the forecasts of this split for the next year, the actual % ratooned and the intended % ratoon for the next year, average planting density, actual numbers of pineapples

planted split into Smooth Cayenne and Gold varieties and forecast planting numbers for the next season and finally any intended expansion or reduction of their operation in two years' time. Data was summarised for each of the four production regions and provided to Australian Pineapples. No individual farm data was released. The summary was also provided to growers in presentations at study group meetings and in the industry newsletter the 'Pineapple Press'.

Up to 73 of the then 77 growers have provided data for the comprehensive production survey, these growers producing 99.6% of the crop. In the follow up survey six months later growers producing up to 96% of the crop were contacted.

#### **Best Practice Manual updates**

The 35 chapter Best Practice Manual was written in 2006 following the withdrawal of agronomists employed by Golden Circle Ltd. With this one-to-one advisory service no longer available there was a need for a reliable, accurate and comprehensive source of best practice information for growers. Copies were provided to every grower at no cost and new growers also receive a copy. However for this publication to remain relevant it needs to be kept up-to-date. Seven chapters were updated during the life of this project. They were published and distributed to all growers in hard copy form. These chapters were:

- Chapter 7 Fresh fruit varieties updated by Dr Garth Sanewski (11 pages)
- Chapter 13 Weed management (10 pages)
- Chapter 17 Nematodes (6 pages)
- Chapter 18 Symphylids (6 pages)
- Chapter 19 White grub and black beetle (4 pages)
- Chapter 27 Ethephon ripening (8 pages)
- Chapter 34 Registered chemicals and using them effectively (14 pages)

The decision to update the chapter on fresh fruit varieties was based on the release of another variety from the Australian breeding program (Aus-Festival) and on what has been learnt about some of the newer varieties since the last update in 2009.

The decision to update the other chapters was based largely on changes to pesticide registrations. These include new restrictions on the use of the main weedicide diuron and the withdrawal of lindane and fenamiphos from use.

These chapters were printed and sent to every commercial grower in the industry.

Appendix III is the current contents page of the manual which also shows when each chapter was last updated. Some chapters such as 'Fresh fruit varieties' and 'Registered chemicals and using them effectively' have been updated more than once. Australian growers can request electronic or hardcopies of the manual or individual chapters by emailing simon.newett@daf.gld.gov.au.

#### **Production costs and practices**

A closer look was taken at some of the production cost data collected previously to find useful information and present it to growers. The expenditure on pineapple nutrition was used in the study. The aim was to draw attention to the variation in expenditure. Data was presented and discussed at study group meetings.

#### IT training

It was intended to provide training to a small group of growers that didn't have email or the skills to use the Internet however by year three of the project all these growers, with the exception of some about to retire or not interested, were using this technology so no training was undertaken.

## **Outputs**

#### Study group meetings

The project worked with growers through four regional study groups, two workshops were offered per year to each of these groups. These regions were North Queensland (catering for growers from Mackay to Mareeba and including the farm in the Northern Territory), Central Queensland (Yeppoon, Cawarral and Bungundarra), Wide Bay (Maryborough, Hervey Bay, Childers and Bundaberg) and South East Queensland (Dayboro to Gympie). Growers were also encouraged to attend workshops in other regions and three of the workshops were organised as joint meetings for two or more of the groups. A total of 22 separate workshops and tours were held over 27 calendar days including a tour to the new pineapple farm in the Northern Territory and farms producing other horticultural commodities. Total attendance was 416 growers (averaging 19 growers per meeting) and 216 non-growers (averaging 10 non-growers per meeting). Detailed illustrated minutes were produced after each event, distributed by hardcopy or email to all growers and uploaded to the pineapple industry website http://aussiepineapples.com.au/. Some of the photographs taken during workshops also provided valuable material for use in the "Pineapple Problem Solver Field Guide". Details of each workshop listing date, venue, topics, guest speakers and attendance can be found in Appendix I.

#### **Pineapple Problem Solver Field Guide**

This guide was designed for practicality of use in the field. It consists of 224 pages and 418 colour photographs and is arranged in symptom order to facilitate an intuitive approach by the grower to identify a problem. The guide illustrates and describes 77 disorders of pineapple in Australia and provides advice on their identification, prevention and management. It also illustrates and describes 35 weed species and 5 exotic pests and diseases identified as high risk for the Australian industry.

The guide was published and distributed free to all growers, agronomists and key researchers associated with the industry. Hardcopies of the guide can be requested by emailing <u>simon.newett@daf.qld.gov.au</u>.

#### YouTube videos

Three short 'how to' videos were produced in conjunction with the DAF Hort Smart team. The topics addressed were chosen to encourage growers to undertake more monitoring of their crops, the topics were also chosen on their suitability for delivery by video.

Pineapples have a weak root system that is prone to attack by various pests and diseases and this is a major cause of yield losses in the industry. The first video outlines how to monitor root health to identify the presence of the six most important pests and diseases of pineapple roots in order to take timely action to manage them. These six are Phytophthora root rot, butt rot, root knot nematode, cane grub, symphylids and mealy bug wilt. The second two videos show how and when to sample pineapple leaves for the purposes of (a) monitoring the nutrient status of the crop and (b) plant growth rates primarily to help growers know when they should be artificially induced to flower.

- 1. "Pests and diseases affecting pineapple root health" 7 minutes duration. Link: https://youtu.be/79fAigfXE3k
- 2. "Leaf sampling pineapples for nutrient analysis" 3 minutes duration. Link: <u>https://youtu.be/Yv77R9tiZtM</u>
- 3. "Leaf sampling pineapples for flower induction" 4 minutes duration. Link: <u>https://youtu.be/PibRBsbEarl</u>

The videos can also be accessed from the pineapple industry website <u>http://aussiepineapples.com.au/</u>.

#### Pineapple industry production forecasts

Six separate forecasts were produced from data provided by individual growers. The reports summarised the information by the four production regions and split the tonnage into fruit destined for the fresh market and fruit that was consigned for processing. It included actuals and forecasts of tonnage, planting numbers, average planting densities, estimate of the % of plant crop that would be ratooned for a second harvest and splits into Smooth Cayenne and Gold varieties. Summaries were provided to the industry for planning purposes and also shared with growers.

Growers were surveyed about production and production forecasts six times over the life of the project.

Factors affecting the amount of crop harvested and sold included drought, flood, the heat wave conditions in late 2014 and Cyclone Marcia which struck the Central Queensland area in February 2015. Environmental factors affect not only the tonnage

produced but the proportion of fruit good enough to market. The forecast increase in 2017 for SEQ and WB of fruit to be sent for processing and the decrease in fresh fruit for these two regions is likely to be the direct result of a significant increase in price offered by the main processor.

	2014	2015	2016	2017
Forecast process		27,213	26,600	27,800
Actual processed *	26,156	20,207	25,498	
Forecast fresh		51,148	53,573	46,850
Actual fresh fruit sold	44,167	46,946	47,486	
TOTAL FORECAST		78,361	80,173	74,650
TOTAL SOLD	70,323	67,153	72,984	

Table 1. Forecasted and actual crop harvested and marketed from 2014 till 2017

\* excludes fruit sent for processing but classed as 'reject' by cannery





As can be seen in Table 1 and Figure 1 crop forecasts by growers are typically optimistic.

Figure 2. Estimated tonnes by region of pineapples grown and sold for <u>processing</u> in Australia from 2014 - 2016 and the forecast for 2017



*Figure 3. Estimated tonnes by region of pineapples grown and sold for the <u>fresh market</u> in Australia from 2014 - 2016 and the forecast for 2017* 



#### **Pineapple Best Practice Manual chapter updates**

Seven chapters in the Best Practice Manual were updated. This manual was first published in 2006 in an earlier phase of this project and chapters have been updated at intervals since as required. The chapters updated during this project were as follows.

- Chapter 7 Fresh fruit varieties updated by Dr Garth Sanewski
- Chapter 13 Weed management
- Chapter 17 Nematodes
- Chapter 18 Symphylids
- Chapter 19 White grub and black beetle
- Chapter 27 Ethephon ripening
- Chapter 34 Registered chemicals and using them effectively

Hard copies of each updated chapter were sent to every commercial grower in the industry and various other industry stakeholders. Australian growers can request electronic or hardcopies of these chapters by emailing <a href="mailto:simon.newett@daf.qld.gov.au">simon.newett@daf.qld.gov.au</a>.

#### **Production costs and practices**

A closer look was taken at some of the production cost data collected previously to find useful information and present it to growers. The expenditure on pineapple nutrition was used in the study. The aim was to draw attention to the variation in expenditure and apparent outcomes. Data was presented and discussed at study group meetings.

As part of the undertaking to identify more efficient production practices, data on fertiliser rates used by eight growers were analysed. This data is presented in Appendix II. It shows that there is a considerable range in rates and expenditure by different growers. Compared to the rates recommended in the pineapple industry Best Practice Manual the average rates used by the eight growers are generally slightly higher, but amongst some individuals the rates (and expenditure) are significantly higher.

In trials conducted by DAF officer Zane Nicholls (personal communication, 2016, Project # AOTGR1-218) it was shown that controlled release fertilisers, used at 70% of the rate of conventional fertilisers, produced similar yields to those of the conventional fertiliser applications. (One to three side dressings are used by some growers until plants are considered big enough to absorb sufficient nutrients from foliar applied nutrients).

Variations from farm to farm in soil types and soil chemistry may explain some of these differences but it is likely that there is scope for growers to experiment with lower rates. Please refer to Appendix II for more detail.

## **Outcomes**

As a consequence of the study group meetings organised and facilitated by this project and by the phases preceding it, excellent communication has been maintained between growers, regions, administrators and research and development staff and this has contributed in a major way to keeping the industry cohesive and maintaining and nurturing a culture of sharing. The meetings have been an ideal means of extending best practice growing methods and allowing growers to learn about more efficient and effective growing practices both from presentations and each other. The study groups have also provided social and mental health benefits by providing the means for growers to get together and discuss common issues not directly linked to production.

Communication between different regions has been an additional focus of this project, encouraging growers to attend study group meetings and tours that take them to different production areas. This has enabled them to get to know others in the industry and be exposed to different farming practices. Half of all evaluation survey respondents reported travelling to other production regions and 95% of these report the participation as being very worthwhile.

The information resources delivered by this project have provided growers with sound, reliable and scientifically based material on which to base management decisions and to help them become more self-reliant. These resources include the Best Practice Manual, The Pineapple Problem Solver Field Guide, YouTube videos, costings for some farming practices and crop forecasts. These resources have also been invaluable to industry administrators, agronomists, researchers, chemical manufacturers and re-sellers. Whilst some of the chapters in the Best Practice Manual will need to be updated from time to time, the Pineapple Problem Solver Field Guide and the videos should provide a valid and valuable reference for many years.

The crop production and forecast data generated has been useful to industry leaders and administrators for planning purposes and for decisions on investment of research, development and promotional levy funds; it is the most reliable and accurate source of this type of data available to them and they currently rely on it.

Whilst the trend for growers to leave the industry has continued in the past three years with approximately 11 growers leaving (albeit six of them being very small producers), there have also been for the first time in many years a significant number of new growers, approximately nine including one corporate entity. In addition one major player has established a production unit in the Northern Territory to expand their company's pineapple production supply to 12 months of the year. The project has been able to encourage and educate these newcomers by inviting them to study group workshops to meet other growers and inspect farms, provide comprehensive growing guidelines and problem solving through the Best Practice Manual, Pineapple Problem Solver Field Guide and videos, and provide cost of production guidelines and production trends.

Since the commencement of the five phases of this project growers now play a much more direct and pro-active role in the direction of the industry. Communication and sharing of information has improved significantly and growers now have access to a number of information resources. The growers formed their own active representative group, Australian Pineapples, lobbied for and were successful in implementing national R&D and marketing levies and take far greater ownership of their industry. This project was designed to continue to support and extend this situation. All five of the growers and consultants on the pineapple Strategic Investment Advisory Panel attended one of the three leadership training courses arranged by earlier phases of this project as did each of the current representatives from the four production regions on the Australian Pineapples committee.

The five phases of the project aimed to help keep the Australian pineapple industry viable and prosperous by continuing to facilitate open sharing of information amongst producers, provide agronomic support, leadership training and development and support of the pineapple community. An ongoing expansion in the fresh fruit sector of the industry and recent increases in intake of processed fruit reflect modest growth and increased confidence in the industry and this project has supported the industry along this journey.

## **Evaluation and discussion**

An on-line evaluation survey conducted at the end of the project was completed by 50% of all growers (38 out of a possible 76). A summary of results from this survey and other means of evaluation are presented below. Full e-survey results can be found in Appendix IV. Where scores are quoted they are weighted averages out of the highest possible score of 10.

#### Study group meetings

The study group meetings have continued to be well attended and attendees satisfied. Attendance records show that total attendance over the three years of the project were 416 growers and 216 non-growers. Average attendance of growers at each workshop in NQ, CQ, WB and SEQ were 18, 18, 20 and 21 respectively which illustrates that these meetings were highly valued given that there are 10, 14, 22 and 30 pineapple businesses respectively in these regions.

The number of workshops each grower attended:

•	Attended all 6 meetings in their own region	29%
•	Attended 5 meetings in their own region	21%
•	Attended 4 meetings in their own region	24%
•	Attended 3 meetings in their own region	16%
•	Attended 2 meetings in their own region	5%
•	Attended 1 meeting in their own region	5%

Popularity of different aspects of the study group meetings (scored out of a possible 10):

•	Technical presentations	8.9
•	Seeing other farms and how they do things.	8.8
•	Looking at on-farm trial sites	8.8
•	Illustrated minutes from meetings in your region	8.8
•	The opportunity to catch up with others.	8.6
•	Being updated on industry news and developments	8.6
•	Illustrated minutes from meetings from other regions	8.4
•	Opportunity to raise issues with industry representatives	8.2

Growers believed that . . .

•	The meetings and minutes helped to maintain good communications across the industry	9.1
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• Meeting minutes were useful to growers if they weren't able to attend workshops 8.7

8.7

50% of respondents participated in tours or study group meetings to regions other than their own.

The usefulness of attending tours or meetings in other regions

#### Videos

Each of the three videos had been watched by between 76 and 82% of respondents.

Respondents scored the usefulness of each video as follows:	
"Leaf sampling pineapples for nutrient analysis"	9.1
"Leaf sampling pineapples for flower induction"	9.0
"Pests and diseases affecting pineapple root health"	8.9
Videos considered as a way of providing information	8.8
Videos considered as a way of training staff	8.6

97% of respondents said they would like to see more videos made.

Grower suggestions for future videos:

- "Using compost and use of different types of cover crops to control pests and diseases"
- "Gauging fruit maturity"

- "Transfer critical parts of the growers' manual that lend themselves to video to highlight best practice, and key things to get right, or mistakes to avoid"
- "Soil sampling techniques"
- "Best practice planting method for different types of planting material"
- "Selecting the best nozzles for spray rig applications"
- "Weed control"

**Best Practice Manual updates** 

Growers were strongly in favour of keeping chapters in the Best Practice Manual up-to-date. This question scored 9.4.

#### **Production estimates and forecasts**

95% of respondents were interested to know where the industry was headed in terms of production, and in details such as the relative size of the fresh vs processing market, total intended planting numbers and the split of Smooth Cayenne compared with Gold varieties. Comments:

- "Helps with planning"
- "Good information for planning"

#### "The pineapple problem solver field guide"

The usefulness of "The pineapple problem solver field guide" scored an average of 8.8 and growers found the guide either easy or very easy to use.

What the guide was used for:

•	Identifying problems	71%
•	Information on weeds	71%
•	Managing problems	53%
•	Learning about potential problems	38%

• Information on exotic pests and diseases 32%

Roughly how often growers used the guide:

•	Every three months	44%
•	Monthly	26%
•	Every 6 months	18%
•	Yearly	12%
•	Weekly	0%

Comment: "A great publication and a useful tool".

#### Use of industry website

Study group meeting minutes and the YouTube videos are uploaded to the pineapple industry website hosted by Growcom. 58% of respondents had visited the website and all found it easy to use.

Only 18% of growers had used the website to access back copies of study group meeting minutes (probably because individual copies had already been sent directly to them) but 72% of growers had used the website to access the videos.

#### Impact of the project

Growers were asked, as a result of participating in the project, if they had made any changes to their farming practices, and if so in what area of the production process.

They were also asked to try and select from a range of dollar values what the financial benefit of the changes had been to them. The categories to choose from were:

- Less than \$500
- \$501 to \$2,000
- \$2,001 to \$5,000
- \$5,001 to \$10,000
- Greater than \$10,000

For the "Greater than \$10,000" category a value of \$12,500 was used in the calculations below. This value could have been a lot more so may result in a significant under estimation of the value of changes made.

It was acknowledged that the value would be very difficult to estimate but nevertheless the question was asked. 34 of the 38 respondents attempted this question.

Area of production	% of respondents who made changes in this area	Approximate value of benefit to respondents
Pest, disease & other disorder management including pesticide registration changes	85%	\$110,000
Monitoring plant health	82%	\$107,500
Erosion control and drainage	74%	\$88,250
Weed control	65%	\$94,500
Workplace health & safety, health & well-being of self & staff	62%	\$50,250
Fertilising	58%	\$100,000
Land preparation including fumigation	56%	\$83,750
Variety selection, planting and planting density	56%	\$106,500
Flower induction, natural flowering, ethrel ripening	47%	\$52,750
Harvesting, packing and post-harvest management	35%	\$45,000
TOTAL		\$838,500

Thus, growers reported that most of the changes they made as a result of the project were in pest, disease, disorder and weed management. Erosion control was the topic mentioned the most after these.

#### Other comments by growers about this project

- "This project has underpinned the pineapple industry when major commercial stakeholders withdrew their historical support. Due to this program our industry is very open and immense help is shared amongst all that are involved in growing their respective businesses."
- "I think this project has been of enormous value to growers and it'd be great if future projects could be funded in
  order to help growers improve farming practices, crop growing etc. Any information is always appreciated by all of
  us."
- "Great project, needs to continue to enable the industry to keep moving forward."
- "New grower so everything new, and very useful to learn from others in the industry."
- "Similar or same projects a must-have for industry."
- "Extremely helpful."

#### Some comments from overseas horticulturists about "The Pineapple Problem Solver Field Guide".

"The guide fully met my expectation of a high quality, world-class trend-setting extension publication, on the lines of the highly successful and extremely useful Avocado Problem Solver Field Guide." Professor Emeritus Nigel Wolstenholme, University of Kwazulu Natal, South Africa.

"I think it's a great publication, well organized for a user and it is unique in that it provides a contrast in diseases and disorders between Smooth Cayenne and another cultivar (73-50). It's a marvellous product. I particularly commend you for the frequent diagnostic references to pigmented vs unpigmented cultivars. Would you be able or willing, or both, to announce its publication in Pineapple News and will it be sold outside of Queensland?" Duane P. Bartholomew, PhD, Emeritus Professor Dept. Tropical Plant & Soil Science, Univ. of Hawaii at Manoa, Honolulu, Hawaii.

"I just received your book and I read through to have a quick overview of the content and I saw that it is an excellent and useful tool for agronomist, student and farmers. Thanks a lot again for sending me this book that will travel along with me on my next missions on the field." Alain SOLER, CIRAD - UPR Systèmes bananes et ananas, Campus Agroenvironnemental Caraïbe, BP 214 - 97285 Le Lamentin Cedex 2, Martinique Based on the levels of participation of growers in the project and the positive feedback provided via the evaluation survey and informal ways, it is believed that the project has had a positive effect on the direction and viability of the industry and the wellbeing of the growers.

Please refer to Appendix IV for full results of the project evaluation.

#### Recommendations

The high-level of openness, sharing, collaboration and support found between stakeholders in the pineapple industry is quite unique. This was clearly demonstrated by the 12 growers who travelled from each of the other regions to support the Central Queensland growers at a study group meeting on 6 March 2015 after it was struck by Cyclone Marcia. Another example is the encouragement, advice, provision of planting material and loan of machinery to new growers by experienced growers. To foster this valuable situation it is important to continue to provide regular opportunities for industry members to get together and exchange ideas and information and support each other to help maintain a positive, sharing and cohesive industry.

Growers need further encouragement to monitor their crops more carefully and regularly to discover problems earlier and thus reduce losses.

Growers gave an 'importance' score of 9.4 out of 10 for keeping the chapters of the Best Practice Manual up to date so it is recommended that this industry reference resource should be kept current.

Crop production and forecast data needs to be continue to be collected in some way on a regular basis.

The industry's website should continue to be developed and growers encouraged to make more use of it.

97% of survey respondents wanted to see more videos made so it is clear that this method of information transfer is a popular approach, however only topics that lend themselves to this type of media should be done.

## Scientific refereed publications

Newett, S., 2014. Leadership training and regular communication identified as key strategies for the development of the Australian pineapple industry. 29<sup>th</sup> International Horticultural Congress 17-22 August 2014. In: Drew, R., Fitch, M., Sanewski, G., Ko, L., Smith, M., Bartholomew, D. and Honsho, C. (Eds.), Proceedings of the IV International Symposium on Papaya, VIII International Pineapple Symposium, and International Symposium on Mango. Published by ISHS, February 2016, Belgium, pp. 177-180.

### **Other publications**

Newett, S., Rigden, P., 2015. The pineapple problem solver field guide. 224 pp. Published by the State of Queensland.

## Intellectual property/commercialisation

'No commercial IP generated'

## Acknowledgements

The project leader would like to acknowledge the following individuals and organisations that provided valuable assistance with this project.

Mr Peter Rigden for assistance with the "The Pineapple Problem Solver Field Guide".

Agronomists Col Scott (Tropical Pines), Doug Christensen (formerly with Piñata Marketing), and Tim Wolens (Agri Supply Global P/L) for assisting with the project in many ways.

Mr Doug Jones (Grower integration manager - Northgate, The Kraft Heinz Co) for his support of the project and the supply of production data for the processing sector.

Dale King and Georgie Townsend who filled the role of Industry Development Officer (through Growcom) during the three years of this project, both of whom assisted with the planning and conduct of the study group meetings.

All growers for participating in and supporting the project, especially those who hosted study group meetings and participated in the production of the videos.

This project has been funded by Horticulture Innovation Australia Limited using the pineapple research and development levy with co-investment from the Queensland Department of Agriculture and Fisheries and funds from the Australian Government.

## **Appendices**

Appendix I. Summary of study group meetings

Appendix II. Nutrient rates used in the industry

Appendix III. Contents page of the Best Practice Manual as at January 2017

Appendix IV. Results from the evaluation survey conducted at the end of the project

Appendix V. Two examples of study group workshop minutes (separate PDF files)

#### APPENDIX I. SUMMARY OF STUDY GROUP MEETINGS

#### There are an estimated 76 growers in the industry, distributed as follows:

14

30

- North Queensland and Northern Territory 10
- Central Queensland
- Wide Bay 22
- South East Queensland

Study	Date	Main topic(s)	Guest speaker(s)	Venue(s)	Attendance
0.000					Growers + others
NQ 1 <sup>st</sup>	Wed 9 – Thu 10 July 2014	Pests and diseases, R & D update.	John Leonardi (DAF Qld)	Ottone & Sons farm, Bilyana. Mackay Estates Davidson Rd banana farm	11 + 2
2 <sup>nd</sup>	Thu 29 January 2015	Nutrition practices. Flower induction practices. Soil pests and diseases.	Dale King (Growcom), Simon Newett (DAF QId) and Col Scott (Tropical Pines)	Pace's farm, Rollingstone.	12 + 5
<b>3</b> rd Combined meeting between NQ and Yeppoon	Thu 14 and Fri 15 May 2015	Cyclone recovery Inspect 6 farms, discuss practices compared to North Queensland Pineapple production in Latin America. Production of the variety 73-50 in Hawaii.	Simon Newett (DAF Qld) Col Scott (Tropical Pines Ltd)	<b>Two day CQ tour</b> Farms at Bungundarra, 2 farms at Tanby and 1 farm at Cawarral in Yeppoon region.	22 + 7
<b>4<sup>th</sup></b> Combined meeting NQ	Thursday 29 and Friday 30 October 2015	Soil health. Two pineapple packing operations.	Diana O'Donnell (NQ Dry Tropics)	Two day NQ tour Pineapple pack sheds at Mutarnee and Mareeba. Four farms at Rollingstone,	21 + 5

and SEQ		Visit four farms at Rollingstone, Mutarnee, Bilyana and Mareeba.	Steve Tiley (Growcom) Sam Spina (QRAA)	Mutarnee, Bilyana & Mareeba.	
<b>5<sup>th</sup></b> NQ meeting with participants from all regions.	Wednesday 22 till Friday 24 June 2016	Horticultural research by NT DPI. On-farm biosecurity. Pineapple, mango, asparagus and melon production in the NT.	NT DPI: Cameron McConchie, Bob Williams, Peter Hopp. Piñata: Gavin and Stephen Scurr Asparagus farm: Andrew Dalgliesh Melon farm: Mick Jacob	Three day Northern Territory tour Coastal Plains Research Station Piñata pineapple farm, Humpty Doo Katherine: Piñata mango farm, Dalgliesh asparagus, Red Dirt melon farm	32 + 4
6 <sup>th</sup>	Thursday 6 October 2016	The potential use of remote sensing in pineapples	Jeremy VanDerWal, Yvette Everingham, Andrew Krockenberger & Alex Olsen (James Cook University, Townsville)	Pace Farming, Rollingstone	10 + 14
Yeppoon 1 <sup>st</sup>	Thursday 7 August 2014	Update on pineapple R&D. Flower induction. Pineapple marketing	John Leonardi (DAFF Qld), Joe Craggs (Tropical Pines)	Sherriff's pineapple farm, Tanby, Yeppoon	15 + 5
2 <sup>nd</sup>	Friday 6 March 2015	Cyclone Marcia recovery.	Included growers from NQ with cyclone experience plus agronomists.	The three farms at Bungundarra (Valley Syndicate, Brooks and Stevens)	29 + 7
<b>3<sup>rd</sup></b> Combined meeting between NQ	Thu 14 and Fri 15 May 2015	Cyclone recovery continued. Inspect 6 farms, discuss practices compared to North Queensland Presentations from World Pineapple	Simon Newett (DAF Qld) Col Scott (Tropical Pines Ltd)	Two day CQ tour 3 farms at Bungundarra, 2 farms at Tanby and 1 farm at Cawarral in Yeppoon region.	22 + 7

and Yeppoon		Symposium in Brisbane 2014 including: Production of the variety 73-50 in Hawaii, and pineapple production in Central America			
4 <sup>th</sup>	Fri 11 September 2015	De-topper harvesting Effects of Cyclone Marcia Pests, diseases and chemical toxicity	Sylvia Buckman (Growcom) Matt Stein (AGAS Rural) John Leonardi (DAF)	Jake and Ryan Brooks' farms, 117 Bungundarra Road and Ingrey Road Farm	9 + 8
5 <sup>th</sup>	Thu 3 March 2016	Chemical registration work update Planning for Annual Field Day, tour to NT and International Symposium in 2017 Salt damage Cyclone damage	John Leonardi (DAF) Stephen Pace	Sherriff's farm, Tanby	25 + 9
6 <sup>th</sup>	Fri 4 November 2016	Packing shed fruit sorting system	lan and David Groves	Groves' fruit farm, Yeppoon	7 + 1
Wide Bay 1 <sup>st</sup>	Fri 17 October 2014	Pineapple marketing. Update on pineapple R&D. Men's health (prostate cancer).	Todd Parker (FAVCO Brisbane), John Leonardi (DAF Qld), Ros Male (Prostate Cancer Foundation of Australia)	Petersen's pineapple farm, Hervey Bay	25 + 8
2 <sup>nd</sup>	Friday 6 February 2015	Employee rights and responsibilities. Use of Bromacil. Soil pests and diseases.	Annabel Hutch (Growcom), Jake Sullivan (Adama), John Leonardi (DAF) and Col Scott	John Steemson's farm, Yandaran	24 + 15

			(Tropical Pines)		
3 <sup>rd</sup>	Friday 17 April 2015	R&D update Weed control practices workshop Skin checks for cancer "Stone wall" anti-erosion treatment.	John Leonardi (DAF, Qld) Georgie Townsend (Growcom) Simon Newett (DAF, Qld)	John Maragna's farm, Tinana via Maryborough	15 + 8
4 <sup>th</sup>	Friday 20 November 2015	Chemical registration work update Protecting fruit from sunburn Video – "Pests and diseases affecting pineapple root health"	John Leonardi (DAF, Qld) Simon Newett (DAF, Qld)	Jay Hubert's farm, Bundaberg	14 + 9
5 <sup>th</sup>	Friday 12 February 2016	Pineapple pest & disease research in Hawaii Chemical registration work update	Glenn Taniguchi (University of Hawaii) John Leonardi (DAF, Qld)	Fenn and Scott Nielsen's farm, Hervey Bay	21 + 12
6 <sup>th</sup>	Friday 14 October 2016	R & D update Diuron accreditation training Erosion protection	John Leonardi (DAF, Qld)	Peter Maywald's farm, Childers	20 + 12
SEQ 1 <sup>st</sup>	Fri 10 October 2014	Diuron weedicide survey, update on pineapple R&D. Plastic mulch and living mulch trial. 'Weed seeker' technology.	John Nagel, John Leonardi & Suzette Argent (DAF Qld), Danny (David Evans Group).	Wayne and Craig Moffat's pineapple farm, Glasshouse Mtns	16 + 13
2 <sup>nd</sup>	21 November	Tour of Brisbane Produce Markets and Woolworths Distribution Centre,	Donna Mogg (Growcom), John Leonardi (DAF), Col Scott	Brisbane Produce Markets, Woolworths Distribution Centre, Larapinta and	21 + 11

	2014	Larapinta. Soil pests and diseases. Pineapple breeding.	(Tropical Pines), Garth Sanewski (DAF)	Fullerton Farms, Elimbah	
3 <sup>rd</sup>	Friday 29 May 2015	Calcium nutrition for control of natural flowering Use of Zeolite to control fertiliser release BMP water quality project R&D update and pesticide issues Biofilm	Garth Sanewski, John Nagle and Suzette Argent (DAF, Qld) Anna Geddes and Rowena Beveridge (Growcom) Doug Christensen (Piñata) James Watson	Les Williams' farm at Elimbah	23 + 15
<b>4<sup>th</sup></b> Combined meeting between NQ and SEQ	Thursday 29 and Friday 30 October 2015	Soil health. Two pineapple packing operations. Visit four farms at Rollingstone, Mutarnee, Bilyana and Mareeba.	Diana O'Donnell (NQ Dry Tropics) Steve Tiley (Growcom) Sam Spina (QRAA)	Two day NQ tour Pineapple packing operations at Mutarnee and Mareeba. Four farms at Rollingstone, Mutarnee, Bilyana and Mareeba.	21 + 5
5 <sup>th</sup>	Tuesday 16 February 2016	Pineapple pest & disease research in Hawaii Chemical registration work update Update on industry matters and staff training New pineapple factory intake agreements for 2016	Glenn Taniguchi (University of Hawaii) John Leonardi (DAF, Qld) Rachel McKenzie & Michelle Templin (Growcom) Doug Jones (Kraft Heinz Golden Circle) Ian Layden (DAF) Susie Chapman (SEQ	Murray and Sam Pike's farm at Glasshouse Mtns	26 + 29

		Denitrification bioreactor Use of 'Stonewall' against erosion	Catchments), Carlos Mira (Vital Chemicals) & Sam Pike		
6 <sup>th</sup>	Friday 11 November 2016	Use of LIDAR for mapping farm with the objective of reducing soil erosion	Bob Howard, GES property mapping NSW Michelle Templin, Growcom on training opportunities	Tony and Irina Polsoni's farm, Wamuran	18 + 17
Total of 22	2 separate meeti	ngs held over 27 days of which two were join	27 days	416 + 216	

#### APPENDIX II. NUTRIENT RATES USED IN THE INDUSTRY

				<u> </u>										
		PREPLANT			POST PL	ANT, PLANT	CROP	POST PLANT, RATOON CROP				TO	TAL FOR CY	CLE
	N	Р	к		Ν	Р	к	N	Р	к		Ν	Ρ	
Average of 8 growers	126	29	133		465	30	548	353	27	418		944	86	
Range of 8 growers	78-178	0-77	71-209		322-560	21-41	287-749	201-488	27	246-681		820-1144	13-90	74
Range of fertiliser material cost	F \$468 - \$2,340				\$1,	319 - \$3,140	)	\$1	.,233 - \$2,483	3		\$	3,588 - 7,55	54
Recom- mended range in Best Practice Manual	120 As recommended using soil nutrient analysis results			450-480	Up to 25 on P fixing soils	475-535	300-340	Up to 25 on P fixing soils	160-280		870-940	50-100	93	

К

1099

749-1501

935-1120

The data below was sourced from eight leading growers across the industry.

#### APPENDIX III. CONTENTS PAGE OF BEST PRACTICE MANUAL AS AT JANUARY 2017

No.	Chapter	Version	Issue date
-	Shell colour stages colour chart	1	1 Feb 06
01	The pineapple	1	31 Aug 09
1	Site selection	1	1 Feb 06
2	Layout and drainage	1	1 Feb 06
3	Ground preparation, fallow and bed formation	1	1 Feb 06
4	Management of erosion and sedimentation	1	1 Feb 06
5	Different plant and ratoon cycles	1	1 Feb 06
6	Smooth cayenne processing clones	1	1 Feb 06
7	Fresh fruit varieties	3	31 Jan 17
8	Planting material	1	1 Feb 06
9	Plant density and planting	1	1 Feb 06
10	Essential pineapple nutrients	1	1 Feb 06
11	Pre- and post-plant nutrition	1	1 Feb 06
12	Irrigation	1	1 Feb 06
13	Weed management	2	31 Jan 17
14	Monitoring for root health and nutrition	1	1 Feb 06
15	Soil fumigation	1	1 Feb 06
16	Phytophthora root rot and heart rot	2	31 Aug 09
17	Nematodes	2	31 Jan 17
18	Symphylids	2	31 Jan 17
19	White grub and black beetle	2	31 Jan 17
20	Pineapple mites	1	1 Feb 06
21	Mealybug wilt	1	1 Feb 06
22	Fruit nitrate management	1	1 Feb 06
23	Other disorders	2	31 Aug 09
24	TSS (brix) management	1	1 Feb 06
25	Minimising natural initiation	1	1 Feb 06
26	Flower induction	1	1 Feb 06
27	Ethephon ripening	2	31 Jan 17
28	Harvesting	1	1 Feb 06
29	Keys to good ratoons	1	1 Feb 06
30	Postharvest management and packing	1	1 Feb 06
31	Golden Circle Ltd approved supplier program	1	1 Feb 06
32	Golden Circle Ltd fruit specifications	1	1 Feb 06
33	Fresh fruit specifications	1	1 Feb 06
34	Registered chemicals and using them effectively	4	31 Jan 17
35	Pesticide safety and handling	1	1 Feb 06



#### Q1 In your region how many study group meetings did you attend over the three years of the project?

Answer Choices	Responses
1	<b>5.26%</b> 2
2	<b>5.26%</b> 2
3	<b>15.79%</b> 6
4	<b>23.68%</b> 9
5	<b>21.05%</b> 8
All 6	<b>28.95%</b> 11
Total	38

#### Q2 Please rate how useful the different aspects of the study group meetings were to you.

Answered: 38 Skipped: 0

	N/A	1 (not useful)	2	3	4	5	6	7	8	9	10 (very useful)	N/A	Total
a. Seeing other farms and how they do things (e.g. farming practices, machinery etc)	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> O	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>5.26%</b> 2	<b>7.89%</b> 3	<b>10.53%</b> 4	<b>23.68%</b> 9	<b>50.00%</b> 19	<b>0.00%</b> 0	38
b. The opportunity to catch up with other growers , technical people, sales reps etc	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>13.16%</b> 5	<b>21.05%</b> 8	<b>13.16%</b> 5	<b>47.37%</b> 18	<b>0.00%</b> 0	38
c. Being updated on industry news and developments (e.g. import risks, WH&S, industrial relations etc)	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> O	<b>2.63%</b> 1	<b>0.00%</b> O	<b>5.26%</b> 2	<b>34.21%</b> 13	<b>13.16%</b> 5	<b>42.11%</b> 16	<b>0.00%</b> O	38
d. Technical presentations (e.g. by Doug Christensen, John Leonardi, Garth Sanewski, Col Scott, Glen Taniguchi etc)	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>7.89%</b> 3	<b>13.16%</b> 5	<b>23.68%</b> 9	<b>50.00%</b> 19	<b>0.00%</b> 0	38
e. Looking at on-farm trials	<b>2.63%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>5.26%</b> 2	<b>10.53%</b>	<b>18.42%</b>	<b>7.89%</b> 3	<b>55.26%</b> 21	<b>0.00%</b> 0	38
f. Opportunity to raise issues with industry representatives	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>7.89%</b> 3	<b>10.53%</b> 4	<b>21.05%</b> 8	<b>13.16%</b> 5	<b>39.47%</b> 15	<b>0.00%</b> 0	38
g. Illustrated meeting minutes from meetings in your region	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>10.53%</b> 4	<b>13.16%</b> 5	<b>23.68%</b> 9	<b>47.37%</b> 18	<b>0.00%</b> 0	38
h. Illustrated meeting minutes from meetings in other regions	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>5.26%</b> 2	<b>10.53%</b> 4	<b>7.89%</b> 3	<b>10.53%</b> 4	<b>15.79%</b> 6	<b>47.37%</b> 18	<b>0.00%</b> 0	38
i. Do you feel that the study group meetings and minutes help maintain good communications across the pineapple industry?	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	0.00% 0	<b>2.63%</b> 1	<b>2.63%</b> 1	5.26% 2	<b>5.26%</b> 2	15.79% 6	<b>65.79%</b> 25	<b>0.00%</b> 0	38

j. If you haven't	5.26%	0.00%	0.00%	0.00%	0.00%	2.63%	0.00%	7.89%	13.16%	15.79%	55.26%	0.00%	
been able to	2	0	0	0	0	1	0	3	5	6	21	0	38
attend some of													
the study group													
meetings, to													
what extent													
have the													
minutes been													
useful to you?													

#	Any further comments/feedback regarding the study group meetings?	Date
1	Well done, continued meetings will be of value.	3/23/2017 12:04 PM
2	Great. Must keep going!	3/15/2017 3:07 PM
3	Excellent source of information and opportunity to see different farming operations	3/14/2017 9:24 PM
4	no	3/14/2017 9:09 PM
5	Simon was an excellent facilitator.	3/14/2017 6:34 PM
6	well run.	3/14/2017 2:19 PM

## Q3 Did you attend any study group meetings in other regions or join one of the tours (NQ/Yeppoon/NT)?



Answer Choices	Responses	
Yes	50.00%	19
No	50.00%	19
Total		38

Q4 Please rate how worthwhile the other region visits were to you.



	1 (not useful)	2	3	4	5	6	7	8	9	10 (very useful)	Total
Rating	0.00%	0.00%	5.26%	0.00%	0.00%	0.00%	5.26%	26.32%	21.05%	42.11%	
	0	0	1	0	0	0	1	5	4	8	19

#### Q5 Have you watched these videos?



	Yes	No	Total
"Pests and diseases affecting pineapple root health"	78.95%	21.05%	
	30	8	
"Leaf sampling pineapples for flower induction"	81.58%	18.42%	
	31	7	
"Leaf sampling pineapples for nutrient analysis"	76.32%	23.68%	
	29	9	

38

38

38

#### Q6 Please rate each of these videos on their usefulness to you and your staff.

Answered: 38 Skipped: 0

	1 (Not useful)	2	3	4	5	6	7	8	9	10 (Very useful)	N/A	Total
"Pests and diseases affecting pineapple root health"	<b>2.63%</b>	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>7.89%</b> 3	<b>15.79%</b> 6	<b>18.42%</b> 7	<b>39.47%</b> 15	<b>13.16%</b> 5	38
"Leaf sampling pineapples for flower induction"	<b>2.63%</b> 1	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>2.63%</b> 1	<b>10.53%</b> 4	<b>13.16%</b> 5	<b>15.79%</b> 6	<b>39.47%</b> 15	<b>15.79%</b> 6	38
"Leaf sampling pineapples for nutrient analysis"	<b>2.63%</b>	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>0.00%</b> 0	<b>13.16%</b> 5	<b>13.16%</b> 5	<b>10.53%</b> 4	<b>44.74%</b> 17	<b>15.79%</b> 6	38

#### Q7 How do you rate the potential of videos for:

Answered: 38 Skipped: 0

		1 (not useful)	2	3	4	5	6	7	8	9	10 (very useful)	Total
a. Providing infor	rmation	2.63%	0.00%	0.00%	0.00%	0.00%	0.00%	18.42%	15.79%	26.32%	36.84%	
		1	0	0	0	0	0	7	6	10	14	38
b. Training for you and your staff		2.63%	0.00%	2.63%	0.00%	0.00%	7.89%	10.53%	15.79%	23.68%	36.84%	
		1	0	1	0	0	3	4	6	9	14	38
#	Other purposes (please specify)											
	There are no respon	ses.										

#### Q8 Would you like to see more short videos made?



Answer Choices	Responses
Yes	<b>97.37%</b> 37
No	<b>2.63%</b> 1
Total	38

#	Please list any topics for future videos.	Date
1	Using compost and use of different types cover crops to control pest and diseases	3/22/2017 12:10 PM
2	gauging fruit maturity	3/16/2017 11:06 PM
3	Transfer critical parts of the growers manual that lend themselves to video to highlight best practice, and key thingsto get right, or mistakes to avoid	3/15/2017 3:09 PM
4	Soil sampling techniques	3/14/2017 9:40 PM
5	Best practice planting method for different types of planting material, Selecting the best nozzles for spray rig applications	3/14/2017 3:17 PM
6	weed control.	3/14/2017 2:21 PM
7	Root health assessment	3/14/2017 11:11 AM

#### Q9 How important is it to you that chapters in the Best Practice Manual are kept up to date?



	1 (not important)	2	3	4	5	6	7	8	9	10 (very important)	Total
Rating	0.00%	2.63%	0.00%	0.00%	0.00%	2.63%	0.00%	13.16%	5.26%	76.32%	
	0	1	0	0	0	1	0	5	2	29	38

## Q10 Is it of interest to you as an individual producer to know where the industry is heading in terms of production, fresh vs processing, intended planting numbers etc?



Answer Choices	Responses
Yes	<b>94.74%</b> 36
No	<b>5.26%</b> 2
Total	38

#	Comments	Date
1	Helps with planning	3/15/2017 3:10 PM
2	Good information for planning	3/14/2017 9:42 PM

#### Q11 Did you receive a copy of 'The Pineapple Problem Solver Field Guide'?



Answer Choices	Responses
Yes	<b>89.47%</b> 34
No	<b>10.53%</b> 4
Total	38

#### Q12 Please rate how useful this book has been to you.

Answered: 34 Skipped: 4 Rating 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% 1 (not useful) 2 3 4 5 6 7 8 9 10 (very useful) 

	1 (not useful)	2	3	4	5	6	7	8	9	10 (very useful)	Total
Rating	0.00%	2.94%	0.00%	0.00%	0.00%	2.94%	5.88%	26.47%	17.65%	44.12%	
	0	1	0	0	0	1	2	9	6	15	34

#	Comments	Date
	There are no responses.	

## Q13 Have you found it easy to use? i.e. has it been easy to find what you were looking for with respect to layout, order, index, contents pages etc?



Answer Choices	Responses
Very easy	<b>55.88%</b> 19
Easy	<b>44.12%</b> 15
Tricky	<b>0.00%</b> 0
Difficult	<b>0.00%</b> 0
Total	34

#	Comments	Date
1	a great publication and a useful tool	3/14/2017 12:50 PM



Q14 What have you used it for? (tick one or more)

0%

Answer Choices	Responses	
Identifying problems	70.59%	24
Managing problems	52.94%	18
Learning about potential problems	38.24%	13
Information on weeds	70.59%	24
Information on exotic pests and diseases	32.35%	11
Total Respondents: 34		



#### Q15 Roughly how often do you use it?

Answer Choices	Responses
Once per year	<b>11.76%</b> 4
Once every 6 months	<b>17.65%</b> 6
Once every 3 months	<b>44.12%</b> 15
Monthly	<b>26.47%</b> 9
Weekly	<b>0.00%</b> 0
Total	34

#### Q16 Have you visited the website?



Answer Choices	Responses	
Yes	57.89%	22
No	42.11%	16
Total		38





Answer Choices	Responses	
Yes	100.00% 2	2
No	0.00%	2
Total	22	

#### Q18 Have you accessed back copies of study group minutes via this website?



Answer Choices	Responses
Yes	<b>18.18%</b> 4
No	<b>81.82%</b> 18
Total	22





Answer Choices	Responses
Yes	<b>72.73%</b> 16
No	<b>27.27%</b> 6
Total	22

Q20 Have you made any changes, directly or indirectly to your business as a result of participating in this project (attending study group meetings, using the Problem Solver Guide, watching the videos, consulting the Best Practice Manual? etc.) Please identify in which areas you have made changes and try and allocate an approximate value per year it has been to you.

Yes/No				
	Yes	No	Total	
Land preparation including fumigation	55.88%	44.12%		
	19	15	34	
Erosion control and drainage	73.53%	26.47%		
	25	9	34	
Variety selection, planting and planting density	55.88%	44.12%		
	19	15	34	
Fertilising	57.58%	42.42%		
	19	14	33	
Monitoring plant health	82.35%	17.65%		
	28	6	34	
Pest, disease & other disorder management including pesticide registration changes	85.29%	14.71%		
	29	5	34	
Weed control	64.71%	35.29%		
	22	12	34	
Flower induction, natural flowering, ethrel ripening	47.06%	52.94%		
	16	18	34	
Harvesting, packing and post-harvest management	35.29%	64.71%		
	12	22	34	
Workplace health & safety, health & wellbeing of self and staff	61.76%	38.24%		
	21	13	34	
Production costs	0.00%	0.00%		
	0	0	0	

ə/yı							
	< \$500	\$501 - \$2,000	\$2,001 - \$5,000	\$5,000 - \$10,000	> \$10,000	N/A	Total
Land preparation including fumigation	25.00%	7.14%	7.14%	10.71%	14.29%	35.71%	
	7	2	2	3	4	10	28
Erosion control and drainage	15.63%	25.00%	6.25%	18.75%	6.25%	28.13%	
	5	8	2	6	2	9	32
Variety selection, planting and planting density	12.90%	12.90%	9.68%	6.45%	19.35%	38.71%	
	4	4	3	2	6	12	231
Fertilising	6.90%	20.69%	6.90%	10.34%	17.24%	37.93%	
	2	6	2	3	5	11	29
Monitoring plant health	24.24%	6.06%	9.09%	12.12%	15.15%	33.33%	
	8	2	3	4	5	11	33
Pest, disease & other disorder management	21.21%	15.15%	6.06%	18.18%	12.12%	27.27%	
including pesticideregistration changes	7	5	2	6	4	9	33
Weed control	22.58%	9.68%	12.90%	16.13%	9.68%	29.03%	
	7	3	4	5	3	9	31
Flower induction, natural flowering, ethrel ripening	18.52%	14.81%	14.81%	3.70%	7.41%	40.74%	
	5	4	4	1	2	11	27
Harvesting, packing and post-harvest management	12.00%	20.00%	12.00%	8.00%	4.00%	44.00%	
	3	5	3	2	1	11	25
Workplace health & safety, health & wellbeing of self and	22.58%	12.90%	3.23%	6.45%	6.45%	48.39%	
staff	7	4	1	2	2	15	31
Production costs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
	0	0	0	0	0	0	0
	1		1	1	1	1	1

#### Q21 Any other comments about this project or future projects?

Answered: 9 Skipped: 29

#	Responses	Date
1	no	3/25/2017 6:18 PM
2	Keep going	3/22/2017 7:19 AM
3	I think this project has been of enormous value to growers and it'd be great if future projects could be funded inorder to help growers improve farming practices, crop growing, etc. Any information is always appreciated by all ofus. Lastly many thanks to Simon for his hard work and dedication, a lovely man and real gentleman who'll be missed by us all.	3/21/2017 7:46 PM
4	Extremely helpful	3/16/2017 11:15 PM
5	No	3/15/2017 4:03 PM
6	New grower, so everything new, and very useful to learn from others in industry	3/15/2017 4:00 PM
7	Similar or same projects are a must have for industry	3/14/2017 9:53 PM
8	great project, needs to continue to enable the industry to keep moving for	3/14/2017 9:15 PM
9	This project has underpinned the pineapple industry when major commercial stakeholders withdrew their historical support. Due to this program our industry is very open and immense help is shared amongst all that are involved in growing their respective business.	3/14/2017 11:04 AM

\$/yr

#### North Queensland Pineapple Study Group Meeting

#### Pace's farm, Rollingstone

#### Thursday 29 January 2015

#### Take home messages

#### There is a wide variation in overall fertiliser rates between growers

Dig up a few plants on a regular basis to find and treat any soil pests and diseases at an early stage, relying on above ground symptoms can be too late for treatment and result in expensive losses

There was a serious fruit quality problem in 73-50 at the end of the summer harvest period in NQ

Phytophthora control begins with good drainage

The annual industry field day for 2015 will be held in the Hervey Bay area in mid-July (dates to be confirmed)



Checking the root system and soil for pests and diseases

"Whilst every care has been taken in preparing these minutes, the Department of Agriculture, Fisheries and Forestry Qld, accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in these minutes. The views and recommendations of the speakers are not necessarily endorsed or supported by DAFF Qld."

#### Present (12+5) = 17

*Growers (12):* Rod & Tony Accorsini, Mario Berra, Michael & Peter Ottone, Jeff, Robert & Stephen Pace and Peter Malone and Hayden, David & Cheryl Zunker

*Non-growers (5):* Dale King (Growcom), Simon Newett (DAFF Qld), Rob Richardson & Val Bowen (Paradise Pines), Col Scott (Tropical Pines),

Apologies: Chris Berra, Doug Christensen (Piñata), Glen Hughes, Trevor Jenvey & Merrilyn, Stephen Scurr, John Leonardi (DAFF), John Zelenka.

#### PROGRAM

#### <u>Thu 29 Jan</u>

- Lunch at Pace's farm, midday sponsored by Paradise Pines
- Plant nutrient deficiencies Dale King
- Comparison of fertiliser rates used
- Soil pests and diseases and their control Col Scott
- Overview of farm Stephen Pace
- Appointment of critique discussion leader
- FARM WALK Pace family
- Question and answer session with Col Scott
- Comparison of flower initiation practices used
- Industry affairs update
  - o Biosecuruty
  - o Ekka and Royal Sydney Easter Show
  - Update on chemical permits
  - Plans for industry field day 2015
  - "One voice" horticulture industry representation in Canberra
- Industry production statistics and forecasts
- Farm critique discussion
- Plans for next meeting
- Thanks

#### AusSuper

Anthony from AusSuper introduced himself briefly to the group. AusSafe is helping to sponsor the field day this year.

#### **Nutrition discussion - Dale King**

#### Nitrogen

For canned pineapple excess nitrogen and applying it at the wrong time can cause de-tinning of the can by nitrates. The levels that cause de-tinning are still very low compared with typical nitrate levels found in fruit such as strawberry. This is not a problem for fresh fruit.

#### Potassium

Important role in regulating moisture in the plant

#### Phosphorus

Important role in cell division and transfer of energy within the plant. If phosphorus is deficient it can result in stunted plants and poor suckering. A dose of MAP applied in the last quarter of growth (a few months prior to induction) can improve sucker development and give a general boost to growth. In varieties containing anthocyanin (excludes MD2) phosphorus deficiency also shows up as pink/purple leaves. Deficiency can occur in soils containing apparently sufficient phosphorus levels but which are tied up for example by high iron and clay content, to overcome this phosphorus can be applied in a narrow band and/or in foliar sprays.



Example of magnesium deficiency symptom. The parts of the leaf in direct sunlight turn yellow whilst the parts of the leaf that are shaded remain relatively green. The main leaf in the photo (left) running from top to bottom in the picture is moved aside (right) to reveal the green band on the leaf lying below it where it was shaded.

Please refer to Dale's handout for more detail on nutrition.

## Comparison of fertiliser practices and rates – Simon Newett

#### 1. Pace

	Pace	Kg elements/ha
	Density 52,000/ha	
PLANT CROP		
Preplant (tops up	300 kg/ha (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	60 + 54 N = 114 N
what is already in	300 kg/ha DAP	60 P
the soil)	400 kg/ha K <sub>2</sub> SO <sub>4</sub>	164 K
	Applied prior to hilling up.	
Calcium nitrate	50 kg/ha Ca(NO <sub>3</sub> ) <sub>2</sub> x 2	16 N
foliar sprays	(15.5% N, 18% Ca)	18 Ca
Regular foliar	Commence when plants start to grow	Applied in 8 sprays:
sprays	rapidly, about 3 to 4 months after	
	planting. Applied every 3 to 4 weeks. 7 to	
	8 sprays on plant crop.	
	Per 5,000 L tank (which does 1.5 ha):	
	100 L Easy-N (42% N) = 28 N/ha	224 N
	8 bags K <sub>2</sub> SO <sub>4</sub> (41% K) = 55 K/ha	440 K
	75 kg MgSO <sub>4</sub> (10% Mg) = 5 Mg/ha	40 Mg
	Total in all plant crop foliar sprays:	
	25 kg Fe SO <sub>4</sub> (20% Fe) = 3 kg Fe/ha	3 Fe
	12.5 kg ZnSO <sub>4</sub> (22% Zn) = 2 kg Zn/ha	2 Zn
Induction	140 L Easy-N/ha x2 = 118 N/ha	118 N
	7 kg borax/ha x2 = 1.4 kg B/ha	1.4 B
Total plant crop		472 N
		60 P
		604 K
		18 Ca
		40 Mg
		3 Fe
		2 Zn
		1.4 B
RATOON CROP		
Side dress	50 kg/ha MAP immediately after plant	7 N
	crop harvest for sucker development	11 P
Calcium nitrate	50 kg/ha Ca(NO <sub>3</sub> ) <sub>2</sub> x 2	16 N
foliar sprays		18 Ca
Regular foliar	Foliar sprays applied about every 3 to 4	Applied in 5 sprays:
sprays	weeks.	140 N
	About 5 sprays on ratoon.	275 K
		25 Mg
		2 Fe
		1 Zn
Induction	140 L Easy-N/ha x2 = 118 N/ha	118 N
	7 kg borax/ha x2 = 1.4 kg B/ha	1.4 B
Total ratoon crop		281 N
		11 P
		275 К
		18 Ca
		25 Mg, 2 Fe, 1 Zn, 1.4 B

#### 2. Accorsini

	Accorsini	Kg elements/ha
PLANT CROP		
Preplant	Same as Paces but applied after hilling up	60 + 54 N = 114 N
	onto bed.	60 P
		164 K
Calcium nitrate	50 kg/ha Ca(NO <sub>3</sub> ) <sub>2</sub> x 2	16 N
foliar sprays	(15.5% N, 18% Ca)	18 Ca
Regular foliar	Commence when plants start to grow rapidly,	Applied in 8 sprays:
sprays	about 3 to 4 months after planting. Applied	
	every 2 to 3 weeks. 7 to 8 sprays on plant	
	Per 3.000 L tank (which does 1 ha):	
	70 L/ha Easy-N = 29 N	232 N
	100 kg/ha K <sub>2</sub> SO <sub>4</sub> = 41 K	328 К
	Alternate 25, 50 kg/ha MgSO <sub>4</sub> = ave. 4 Mg	32 Mg
	12.5 kg/ha FeSO4 (single spray) = 2.5 Fe	3 Fe
	12.5 kg/ha ZnSO4 (single spray) = 3 Zn	3 Zn
Induction	$120 \text{ L Easy-N/ha} \times 2 = 100 \text{ N/ha}$	100 N
Total plant grop	10 kg borax/na x2 = 2.2 kg B/na	2.2 B
Total plant crop		402 N
		492 К
		18 Ca
		32 Mg
		3 Fe
		3 Zn
		2.2 B
RATOON CROP		
Post plant crop	25 kg/ha MAP immed after hvst for sucker	3 N
narvest side	development	6 P
Calcium nitrate	$50 \text{ kg/ha} Ca(NO_a)_a \times 2$	16 N
foliar sprays		18 Ca
Regular foliar	Foliar sprays applied about every 2 to 3	
sprays	weeks. 4 sprays on ratoon crop.	
	70 L/ha Easy-N = 29 N	116 N
	$50 \text{ kg/ha } \text{K}_2 \text{SO}_4 = 21 \text{ K}$	84 K
	50 kg/ha MgSO <sub>4</sub> = 5 Mg	20 Mg
	$12 \int ka/ha \int a \int O (cingle correct) = 2 \int \int a$	2.50
	12.5 kg/ha FeSO <sub>4</sub> (single spray) = 2.5 Fe 12.5 kg/ha ZnSO (single spray) = 2.7 h	3 Fe 2 7n
Induction	$1201$ Fasy-N/ha $x_2 = 100$ N/ha	100 N
maaction	10  kg borax/ha x2 = 2.2  kg B/ha	2.2 B
Total ratoon crop		235 N
		6 P
		84 K
		18 Ca
		20 Mg, 3 Fe, 3 Zn, 2.2 B

#### 3. Ottone

	Ottone Density 50,000/ha	Kg elements/ha	Best Practice Manual guidelines
PLANT CROP			
Preplant	Broadcast then incorporated: 430 kg/ha Nitrophoska (3.5 x 50 kg bags/acre) 150 kg Single Super/acre = 370 kg/ha	52 N 22 Ca 22 P 5 Mg 61 K 0.6 Fe 33 P 74 Ca	
Side dress	At 4 to 5 months 430 kg/ha Nitrophoska	52 N         22 Ca           22 P         5 Mg           61 K         0.6 Fe	
Regular foliar sprays	Sprays applied every 3 weeks. Total 7 to 8 sprays to plant crop. Per 3,000 L tank which does 1.5 ha: Urea 75 kg = 50 kg/ha $K_2SO_4$ 150 kg = 100 kg/ha MgSO_4 25 to 50 kg = ave. 25 kg/ha FeSO_4 2 kg = 1.3 kg/ha ZnSO_4 3.5 kg = 2.3 kg/ha	Applied in 8 sprays: 184 N 328 K 20 Mg 2 Fe 4 Zn	
Induction	100 kg urea/ha x2 = 92 N/ha 5.3 kg Solubor/ha x2 = 2.3 B/ha	92 N 2.3 B	
Total plant crop		380 N 77 P 450 K 118 Ca 30 Mg 3 Fe 4 Zn 2.3 B	
CROP			

#### 4. Zunker

	Zunker (Roughs)	Kg elements/ha	Best Practice Manual guidelines
PLANT CROP			
Preplant	Nitrophoska 1 t/ha	120 N	
		52 P	
		141 K	
		50 Ca	
		12 Mg	
		1.5 Fe	
Plant crop side	At about 6 months of age 500 kg	60 N	
dress	Nitrophoska/ha	26 P	
		70 K	
		25 Ca	
		6 Mg	
		1 Fe	
Foliar sprays	1 tank does 1 ha. Applied 7 to 8 applications	Applied in 8 sprays:	
	per plant crop and same for ration crop.		
	Urea 80 kg/ha	294 N	
	$K_2SO_4$ 175 kg/na	574 K	
		some Mg	
	Plant crop may receive an additional 120 kg	55 N	
	urea as a foliar spray if needed (not ration)		
Induction	Assume about the same as others	100 N	
		2 B	
Total plant crop		574 or 629 N	
		78 P	
		785 K	
		75 Ca	
		18+ Mg, 2.5 Fe, 2 B	
RATOON CROP			
Foliar sprays	1 tank does 1 ha. Applied 7 to 8 applications	Applied in 8 sprays:	
	per plant crop and same for ration crop.		
	Urea 80 kg/ha		
	K <sub>2</sub> SO <sub>4</sub> 175 kg/ha	294 N	
	MgSO₄ occasionally	574 K	
		some Mg	
Induction	Assume about the same as others	100 N	
Tatal and		2 B	
i otal ratoon crop		594 N	
		S74 N	
		2 B	

## Comparison (units are kg of element per hectare)

	Pace	Accorsini	Ottone	Zunker	BPM guidelines for summer plant crop
					of Smooth Cayenne
PLANT CROP					
Preplant	N 114	N 114	N 52	N 120	Apply sufficient to
	P 60	P 60	P 55	P 52	bring soil levels up
	К 164	К 164	K 61	K 141	to:
			Ca 96	Ca 50	N 120
			Mg 5	Mg 12	P 50 - 100
			Fe 1	Fe 1.5	K 300
Plant crop side			N 52	N 60	
dress			P 22	P 26	
			K 61	К 70	
			Ca 22	Ca 25	
			Mg 5	Mg 6	
			Fe 1	Fe 1	
Foliar sprays	N 240	N 263	N 184	N 294 (+55)	Applied in 8
	K 110	K 278	K 278	K 574	upplications
	$C_{2}$ 18	Ca 18	K 520	K 374	
	Mg 40	Mg 32	Mg 20	Mg some	
	Fe 3	Fe 3	Fe 2	ing some	
	Zn 2	Zn 3	Zn 4		
Induction	N 118	N 100	N 92	N 100	N 101 (for 2 sprays)
	B 1	B 2	B 2	B 2	B 1.5
Total plant crop	N 472	N 462	N 380	N 629	N pre-plant+450
	P 60	P 60	P 77	P 78	
	К 604	К 492	К 450	К 785	K pre-plant+460
	Ca 18	Ca 36	Ca 118	Ca 75	
	Mg 40	Mg 32	Mg 30	Mg 18+	Mg pre-plant+11
	Fe 3	Fe 3	Fe 3	Fe 2.5	
	Zn 2	Zn 3	Zn 4		
	B 1	B 2	B 2	B 2	B 2
RATOON CROP					
Side dress	N 7 P 11	N 3 P 6			
Foliar sprays	N 156	N 132		N 294	Applied in 7
i onai oprayo					applications
	К 275	К 84		К 574	
	Ca 18	Ca 18			
	Mg 25	Mg 20		Mg some	
	Fe 2	Fe 3			
	Zn 1	Zn 3			
Induction	N 118	N 100		N 100	N 101 (for 2 sprays)
	B 1	B 2		B 2	B 1.5
Total ratoon crop	N 281	N 235		N 394	N 310
	P 11	P 6			
	К 275	К 84		К 574	K 160
	Ca 18	Ca 18			
	Mg 25	Mg 20		Mg some	Mg 4
	Fe 2	Fe 3			
	Zn 1	Zn 3			
	B 1	B 2		B 2	B 1.5

#### Soil pests and diseases - Col Scott

"The main aim during the cultivation of pineapples is to maintain good root health"

#### Symphylids

Symphylids can't burrow themselves so require a soil with plenty of air spaces (or burrows made by other soil organisms such as worms) to move around in order to forage, for example a soil with good crumb structure, a soil with crop trash or a soil high in organic matter and not compacted. Symphylids are also blind. Lindane, now banned, was very effective against symphylids and had a long residual action. We now have chemicals such as bifenthrin (Talstar<sup>®</sup>) which are effective but must be managed well.

Symphylids tend to occur in patches in a field and if possible infected areas should be spot treated although this can be difficult from a practical point of view.

An infestation of symphylids can severely impede growth; Col has seen an infested 3 year old patch of pineapples that is only 30 cm (1 foot) high.

In pineapples when roots are chewed back to their stumps they can't re-shoot but root primordial high up the stem will develop into roots, if infestations are heavy enough it is possible to find them in lower leaf axils above ground level attacking aerial roots.



Symptoms caused by a foliar fertiliser solution that sat in the heart of the plant a few weeks previously. Mild burn (left) which has burnt off leaf trichomes leaving a polished band. More severe burn (right) has resulted in the leaf being cut through and in some cases caused heart rot.

#### White grubs (several species)

White grubs were a very serious problem in Yeppoon some years ago and even knocked some growers out of business. The grubs became resistant to some of the pesticides.

White grubs have a one or two year life cycle depending on the species. In spring/summer the beetles emerge from the soil, often after rain, and fly to feeding and mating sites. After that they fly

a little further usually stopping at the first obstacle where they fall to the ground and lay their eggs. There are three stages of the larvae (grubs), the first stage only feeds on organic matter in the soil but the next two stages (2<sup>nd</sup> and 3<sup>rd</sup> instars) can feed voraciously on pineapple roots and can wipe out a crop. Once the roots have been badly damaged it is hard to recover the crop, the presence of the grubs need to be detected early on. When you see beetles flying to lights at night it is time to apply high volume sprays to the soil; eggs are generally laid about 1cm deep in the soil so a good drenching with a registered insecticide is needed to reach them. At times a spray every 3 months is required. However it is important to stick to the recommended rates because at higher rates the insect can detect the presence of the chemical and will avoid treated areas thus escaping control.

Suscon<sup>®</sup> does not work well for white grub in pineapples because it is hard to know where to place it, it is better to treat the whole paddock with one of the registered products for pineapple.

White grub damage results in whole roots being eaten off whilst symphylid damage results in partially chewed roots that then tend to branch.

It is important to note that different species of white grubs feed at different depths in the soil. Some species feed as deep as 1 metre.

#### African black beetle

It is the adult (beetle) that causes the damage to pineapples not the larvae as in white grubs. African black beetle tends to burrow into the lower stem of the pineapple plant. It also attacks golf courses and ginger.

#### Nematodes

The main nematode pest for pineapples in Australia is Root Knot Nematode (RKN). Nematodes were not a major concern whilst the industry had access to EDB but require more careful management with the pesticides we now have available to us. These include Nemacur<sup>®</sup> and some fumigants. Nemacur<sup>®</sup> is very effective but we are likely to lose it in a few years' time.

The best time to assess your potential nematode risk is when they are present in highest numbers and this is most likely to be just prior to knocking out old ratoons. Cultivation and fallowing will knock back nematode populations to almost zero but they will build up again in the subsequent crop, peaking about 9 to 12 months after planting. For this reason the next time to sample is 6 months after planting and again just before initiation.

The problem with Nemacur<sup>®</sup> is that if applied 6 weeks or less prior to induction it can interfere with induction. Once the nematodes are controlled the plant responds with a flush of vegetative growth and this acts counter to induction.

The fumigant Telone<sup>®</sup> (VD) is effective but expensive and we don't often get the right conditions to apply it. Metham<sup>®</sup> is good against symphylids and Phytophthora but not very effective against nematodes.

If you don't want to sample for nematode testing then dig up your ratoons and inspect for root galls.

The decision to use pesticides to control nematodes is not to be taken lightly and you need to monitor in some way.



Examples of galls on roots caused by root knot nematode at Paces farm

#### Phytophthora rot

Heart rot is more common in younger plants whilst root rot is more common in older plants.

You need to put a program in place and adhere to it. Timing must be good.

Free water in the soil is needed for Phytophthora to spread so the first thing you need to address is drainage, both surface and subsurface. Dips and hollows in the field where water collects must be eliminated and you need to ensure that rows have sufficient but not excessive slope to carry surface water away. Aim not to have free water standing in the paddock for more than 24 hours, less is better. Hilling is standard practice of course but deep ripping should also be standard practice in most situations too. Note that "wet feet" can be just as bad as Phytophthora and invariably leads to root rot too.

Col reported that in Honduras they had a big problem with Phytophthora until they started deep ripping to 1m depth, only then did they get a response to fungicides. In Costa Rica when the Australian study tour visited there in 2007 the only Phytophthora problem seen was where the preplant drainage works were incomplete.



Healthy root system (left) compared with root system (right) thought to be moderately affected by Phytophthora root rot (note less volume of roots and lack of fine roots)

Phosphorous acid acts in two ways (a) it boosts the plant's own auto-immune system and (b) it stops the pathogen growing (although does not kill it).

The variety 59-656 is quite resistant to Phytophthora, the plant will stop the disease spreading up the roots and the plant will develop new roots to replace the ones that are damaged. Unfortunately this variety does not produce a good fruit but its genetics would be useful in breeding programs.

The proposed use pattern which the industry is working on for registration will be:

- Dip planting material in 0.5% phosphorous acid solution prior to planting in order to ensure phos acid levels in developing roots are high enough to suppress Phytophthora development.
- Follow up about 3 months later (when phos acid levels in the roots start to drop) with three monthly 0.5% foliar sprays of phos acid to boost root levels and maintain them above the necessary threshold.

If planting slips then a spray of 0.5% phos acid on the plants prior to slip collection will be very effective (as an alternative to dipping) but this can only be done after fruit have been harvested (otherwise MRLs in the fruit are likely to be exceeded).



Field of MD2

#### **Overview of Pace Farming pineapple operation**

Annual planting numbers:

Smooth Cavenne	650,000
enne eayenne	000,000

73-50 600,000

MD2 100,000

Roughs 100,000

TOTAL <u>1.45m</u>

The pineapples are planted on several farms in the area across a range of soil types.

Nematodes are the worst problem but Phytophthora, symphylids and white grub are also present and this year red mite has been an issue.

Smooth Cayenne and Roughs are packed in the field but the Gold varieties go to the Paradise Pines packing shed.

#### Farm walk

The first stop was a paddock near the main shed where Fumig8or<sup>®</sup> sorghum, and Metham<sup>®</sup> at the full and half rate had been trialled. There was no apparent difference between the treatments, they all looked healthy.

Fertiliser burn from iron sprays was present on some leaves.



Examples of leaf burn from foliar iron sprays

There were some Bromacil toxicity symptoms (yellowing) on a young planting where an infestation of nutgrass had to be dealt with (4 applications of Bromacil each at 2.2 kg/ha were applied). If herbicide yellowing on leaves is suspected do not be tempted to "colour them up" with iron sprays because it will be counterproductive and result in leaf burn.



Good example of herbicide poisoning. In this case Bromacil had been applied over the plants to control an infestation of nutgrass

#### Question and answer session with Col Scott

Tony Accorsini raised the serious fruit quality issue that has just occurred at the end of the NQ summer harvest. It affected 73-50 and was characterised by green but soft fruit that bruised very easily. It is a consistent problem at this time of the year but was worse this year and led to significant losses. Robert Pace wondered if it was only a problem in NQ? Stephen Pace believes it is associated with the hot wet weather.

Col pointed out that in summer the levels of ascorbic acid in pineapple fruit flesh is at its lowest levels and this is associated with internal browning. It is worse in 73-50. He believes that the main cause is environmental. He pointed out that everything has been late this year. There is no 'silver bullet' but driving potassium levels up can result in higher acid levels. Robert Pace felt it was important to get the field heat out of the fruit as soon as possible after it has been picked in order to get sufficient shelf life but pointed out this was more difficult to achieve with porous fruit. The problem is worse in plant crops and worse in bigger fruit. Could high nitrogen levels contribute to the problem?

There was interest amongst some of the growers to contribute funds to get someone to investigate the issue. It was suggested that using irrigation to keep moisture levels more consistent might help. One plan of action would be to grow more Smooth Cayenne for the summer harvest and less 73-50.

When 73-50 was first selected Duane Bartholomew predicted that internal blemish would be an issue because of the low acid levels.

The growers asked Col if he would consider what treatments could be considered for inclusion in a trial to learn more about the issue.

#### Ethrel discussion – Simon Newett

A spring plant crop of Smooth Cayenne was nominated for discussion; this crop is normally induced in about April. Dave Zunker hand applies an ethrel solution into hearts of plants individually.

	Paces	Accorsinis	Berras	Ottones	Best Practice
					Manual auidelines
Leaf weight	Based on plant	Based on plant	Based on plant	Based on plant	Plant crop 75g
/plant size	size and age	size and age	size and age	size and age	Ratoon crop 70g
Time of day	After 4pm until	After 4pm until	After 5 or 6pm,	Late	
induction	6pm	8pm	sometimes as	afternoon,	
sprays			late as 8pm if	from about	
applied			very hot	4:30pm	
Ambient	Low to mid	About 20 to	Use an infra-		<28°C ambient
temperature	20°Cs	25°C	red		
guidelines			temperature		
used			gun to test the		
			temperature		
			of the plant		
			hearts.		
Number of	Two sprays	Two sprays	Two sprays	Two sprays	Two sprays
sprays and	about 5 to 7	about 7 days	about 7 days	about 7 days	about 5 to 7
interval	days apart	apart	apart	apart	days apart
Ethrel rate	2.8 L/ha	4 L/ha	2.5 L/ha	Label rate	2.4 L/ha
(720 g/L			(sometimes		
product)			higher if plants		
			are growing		
			vigorously)		
Boron	Borax at 6 to 8	Borax at 10	Borax at 12	Solubor at 5.3	Borax at 12.5 to
	kg/ha	kg/ha	kg/ha	kg/ha	15 kg/ha
					0*
					Solubor at 6 25
					to 7.5 kg/ha
Nitrogen	Easy-N at 140	Easy-N at 120	Easy-N at 80	Urea at 100	Urea at 125 to
	L/ha	L/ha	L/ha	kg/ha	150 kg/ha
Spray	3,900 L/ha	3,500 L/ha	2,500 L/ha	2,000 L/ha	2500 to 3000
volume used					L/ha
Other notes	2 <sup>na</sup> round	Same as Paces		Use lower	
	applied at			rates (about	
	taster ground			1/3 of normal	
	speed			rates) of	
	effectively			nitrogen in last	
	reducing all			two foliar	
	rates per ha by			fertiliser	
	about 25%			applications	

Col reminded everyone to include the nitrogen applied as part of the induction sprays in the crop's nitrogen budget especially as the amounts used are quite significant.

Col spoke about the difference between Ethephon and ANA as induction agents. These two chemicals have different modes of action. ANA stimulates the plant to produce its own ethylene whilst Ethephon supplies ethylene itself. ANA takes longer to take effect and repeat sprays are spread out further (14 to 21 days apart). ANA gives a more spread out harvest whilst Ethephon gives a much sharper harvest peak.

#### **Industry business**

Following the recent re-structuring of HAL into HIAL there is no longer any Federal funding for industry meetings but Australian Pineapples still wants to hold two meetings per year. Total costs for each meeting amount to about \$4,000, the industry needs to find these funds from somewhere.

#### Ekka

Growcom and Australian Pineapples are still negotiating with Ekka management.

#### Sydney Royal Easter Show

There is no charge for the stand at this show and Australian Pineapples plans to be there however individuals need to fund themselves to be there. The pack sheds have been very generous with personnel and fruit promised for this event.

#### Annual industry field day

This year it will be held in the Wide Bay area, tentatively on 16 and 17 July on the Petersen's farm and include farm visits to the Petersen's, Atkinson's and Maxwell's farms. The gala dinner will be on the 16<sup>th</sup>.

#### Farm critique

The discussion was led by Rod Accorsini. He said that the farm was hard to fault, plants were healthy with a good colour. The only thing that he suggested may help was to consider grading planting material in order to get more even growth and plant sizes in a paddock. He added that there was evidence of some nematode damage and a little fertiliser burn.

#### Acknowledgements

Many thanks to the Pace family for hosting the meeting and farm walk and providing the evening BBQ. Thanks also to Paradise Pines for providing the lunch.

#### Next meeting

Tentatively in August, either a visit to Mareeba or a tour to the Yeppoon pineapple farms.

#### Handouts provided on the day

- Macro and micro nutrients Dale King
- Current pesticide permits for pineapples
- Article on spray drift

If you weren't in attendance and would like any of this material it will be available on the Australian Pineapples website at:

#### www.australianpineapples.com.au

Use the "User name': growers and the 'Password': pineapples123.

If you don't have access to the Internet please contact the IDO to obtain a printed copy.

#### Dale King and Simon Newett



#### Wide Bay Pineapple Study Group

#### 6<sup>th</sup>workshop: Peter Maywald's farm, Sims Rd, Childers

#### Friday 14 October 2016

#### Take home messages

The diuron replacement on-farm trials will take approximately two more years to complete, and if results are positive then application will be made to APVMA to get registration(s). In the meantime there is a permit in place till March 2019 to allow restricted use of diuron in the pineapple industry, please refer to Permit Number 81856.

The "potato trap" is a simple and effective way of monitoring for the presence of symphylids that growers can use.

Taking steps to limit the weed seed-bank pays off. This involves controlling weeds before they go to seed or if they have already gone to seed plants must be physically removed from the paddocks and headlands and burnt.

Crop forecasts show a significant increase in crop this year vs. 2015 both in the cannery and fresh markets. The fresh market is currently divided equally between SmoothCayenne and Gold varieties. Plantings of Gold varieties continue to increase.

The next YouTube video to be produced for the industry will deal with leaf sampling.

Is some of the pre-plant fertiliser traditionally applied really necessary?



"Whilst every care has been taken in preparing these minutes, the Department of Agriculture and Fisheries Qld, accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in these minutes. The views and recommendations of the speakers are not necessarily endorsed or supported by DAF Qld."

#### Present (20+ 12 = 32)

Growers (20): Kepler Atkinson, Robin & Debbie Barlow, Oscar & Leanne Ciprian, Owen Cronau, Col Hawken, Jay Hubert, Col Matthews, Peter Maywald, Ellison and Scott Maxwell, Harry Milbank, Adam Payne, Ashley & Leyton Petersen, Phil Smith, John & Linda Steemson, Tim Wolens

Non-growers (8): John Leonardi & Simon Newett (DAF Qld), Col Scott (Tropical Pines), Georgie Townsend (Growcom), James & Joseph (EE Muir & Sons), John & Jason (JAT transport).

Apologies: Jeff Atkinson, John Maragna, Leone Maxwell, Fenn & Scott Nielsen, Daniel Steemson

#### AGENDA

12:15 pm BBQ Lunch

- Diuron Training for those who have signed up to do their accreditation (45 minutes) Georgie Townsend, Growcom
- Discussion on Research and Development Trials in the Pineapple Industry Bayer, Phos Acid, John Leonardi's trials John Leonardi, DAF
- Update from Growcom Georgie Townsend, Growcom
- Information from the latest pineapple production forecasts -Simon Newett, DAF
- Discussion on topic for next YouTube clip for Pineapple Industry Simon Newett
- Chapters in Best practice Manual to be updated Simon Newett
- Satellite imagery project Simon Newett
- Australian Pineapples Update John Steemson, AP

Farm Walk and Critique

#### MEETING

#### John Leonardi's report

#### Phos acid

The growers present agreed that the industry should pursue registration for the proposed new use pattern for phosphorous acid, namely dipping planting material and applying more sprays through the growing period. If a label is not possible then at least a permit should be pursued.

#### Diuron replacement trials

Bayer has funded some of this work and is fully committed to it. There are 8 trial sites in total, some already in place and others yet to be planted. One of these trials is on John Steemson's farm, this one is expected to take another 2 years to get all the data. Another is on Fullerton Farms in SEQ and there may be an opportunity to visit this site during the 2017 annual field day which will be in SEQ.

John Leonardi provided a report that appears in the September edition of the 'Pineapple Press'. Some of the treatments include mixtures of various candidate herbicides, some of these combinations reduced plant growth. The trials included a 'Control' treatment with no weedicides and a standard bromacil treatment for comparison.

Some of the treatments led to leaf burn but never affected the growing hearts.

John plans to check the trials for any natural flowering which may be induced by some of the treatments that are phytotoxic.

#### Nemacur no longer registered

Fenamiphos (Nemacur) can no longer be used. Work continues at finding a replacement. There is one possibility, Nimitz, but this is a contact pesticide and not systemic like Nemacur and it also breaks down quicker in the soil. It may be sometime before a new pesticide is registered; in the meantime it is only the fumigant Telone that can be used against nematodes.

#### Mealybug

John has worked out a system to produce mealybug-infected pineapple tops upon which to test various candidate pesticides.

#### Symphylids

John has had success with an easier way to discover whether or not you have symphylids in a field. He uses the "potato trap". A 500 mL planter pot with extra holes drilled in it, ¾ filled with moist soil, a piece of cut raw potato added then the pot filled up with soil to the top and buried so that the top of the pot is roughly flush with the surface of the soil. Come back in a couple of days and empty the contents of the pot onto a piece of black plastic and look for symphylids which are most likely to be found feeding on the potato. Note: if the field is very dry then symphylids will have moved deeper and may not be picked up with this method until there is more moisture in the soil.

#### John Leonardi's project due to finish up end of November this year

John's project finishes 30 November and unfortunately John will be leaving the industry. There was discussion about investigating whether there was any chance of extending the project and John's position to allow all the data to be collected and the work completed.

Two points were made:

- 1. You need more than 2-3 years to conduct research in pineapple.
- 2. It takes a few years for someone new to the industry to learn about pineapples since it is quite different from most other crops.

#### Abamectin label

Surprise was voiced about the sudden appearance of Permit 81805 that allows abamectin to be used against red mite. No one present was aware of any trial work done with it on pineapples.

#### **Diuron training**

Georgie conducted a session for those requiring diuron training.

#### Hort 360

Growcom officers Rowena Beveridge and Anna Geddes are conducting this project which tackles whole of farm planning. Hort360 is a computer based risk assessment tool, which is designed to give you a 360 degree view of your farm business operations. The objective is to assist the grower to identify potential risks, capitalise on business opportunities and highlight unnecessary farm expenses. It is a whole of farm business approach.



Close up of recently established pineapple plants planted in walkway to reduce soil erosion



A general view of part of Peter's farm looking north

#### Pineapple production and forecasts – Simon Newett

Simon gave a presentation that summarised recent crop forecasts for the Australian pineapple industry from data supplied by growers.

Table 1: Actual	and forecast	tonnage	(calendar	years)
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	2014 actual	2015 actual	2016 forecast
Cannery	22,224	20,207	25,150 (25% more than 2015)
Fresh market	44,197	46,946	52,518 (12% more than 2015)
Total	66,421	67,153	77,668 (16% more than 2015)

Table 2: Regional split of production forecasts for 2016 calendar year

	Cannery	Fresh market	Total	%
NQ/NT	-	11,763	11,763	15%
CQ	3,350	8,593	11,943	15%
WB	9,844	10,212	20,056	26%
SEQ	11,956	21,950	33,906	44%
Total	25,150	52,518	77,668	
Estimated value	\$10.8m	\$63m	\$74m	

Table 3: Planting numbers (millions)

	2015 actual	2016 forecasts	2017 forecasts
Smooth Cayenne	21.7	22.2	20
Gold varieties	26.7	28.2	30.5
Total	48.4	50.4	50.5

Table 4: Fresh market split

Smooth Cayenne	50%
Gold varieties	50%

#### Remote sensing project

Simon has been successful in getting an 'innovation grant' from the Queensland Department of Agriculture and Fisheries to investigate the potential of remote sensing in pineapples for such things as detecting the presence of pests and diseases and estimating crop yields, this is a short term project and will be complete by mid-2017. He plans to conduct this project in the Wamuran growing area which has a range of farms within a small area.

#### Next YouTube video and Best Practice Manual (BPM) updates - Simon

Simon explained that the next video would be a "how to" for collecting leaf samples for measuring D-leaf weight and for nutritional analysis. There was a suggestion to put the link on Facebook once it was completed.

He also outlined plans to update certain chapters in the BPM before the current extension project finishes in a few months time.

#### FARM WALK

Peter Maywald gave a brief overview before we ventured into the field. Peter grows watermelons and zucchinis in addition to pineapples.

1.1 to 1.2 million pineapples are planted each year and these are mostly Smooth Cayenne. He has backed off the Gold varieties because of the high levels of natural flowering. About half the fruit goes to the fresh fruit market and half to processing. Density ranges from 50 to 80,000 plants/ha.

The original farm was started 16 years ago and the adjoining newer farm first planted 10 years ago. There is a wide range of soil types across the two properties from heavy clay through to very sandy soils and with these different soil types a wide range of pests and diseases occurs.



Peter's trickle tape irrigation

**First stop** was a field where the previous crop had been devastated by symphylids which had devoured the roots and as a result there was no fruit. Peter is now experimenting Lorsban and Talstar every three months through the trickle irrigation. John Leonardi suggested that this approach (pesticides through the trickle tape) might be suitable for a contact nematicide such as Nimitz should it be registered.



Trickle tape being used in a field affected by symphylids



Root system of a plant that was badly affected by white grub making a recovery after treatment with pesticides

**Second stop** inspected a field that had been badly affected by white grub. The field was treated with Lorsban which was irrigated in. The roots are growing back but they may be being nibbled by symphylids – a good site to insert some symphylid potato traps to see if they are present.



Field affected by white grub. Roots starting to grow back after treatment with Lorsban

#### Third stop

A fertiliser trial testing different pre-plant treatments:

- Standard pre-plant treatment of 500 kg/ha of 78S
- 78S and slow release nitrogen
- Israeli slow release nitrogen
- No pre-plant fertiliser

Peter said that he might consider no pre-plant fertiliser in subsequent plantings as there appeared to be no difference between treatments. Previously rockmelons were grown here; perhaps residual fertiliser from this crop has carried them through.



Pre-plant fertiliser trial which showed no advantage over the treatment with no pre-plant fertiliser

**Fourth stop** – sandy erodible soil. Peter is using barley as a living mulch which is sprayed out before it goes to seed using 4.5 kg Hyvar and 4.5 kg Ametrex in 4,000 L spray volume/ha. He added that barley is easier to kill than oats. Peter also uses silt traps.

Peter plants what he calls 'wash-out' plants across the walkways to reduce soil erosion. The longer the rows, the closer together these 'wash-out' plants are established. He said that it adds about an extra 5,000 plants/ha. They are a 'pain' to plant but worth it, they add an average of 3,000 extra marketable fruit to the yield – more than this in a dry year and less in a wet year.



'Wash-out' plants are established across the walkways to reduce erosion and many of these yield marketable fruit.

**Fifth stop** – A symphylid problem has been caused by deep ploughing – it brought loose gravel to the surface layer which allows symphylids to move around.

**Sixth stop** – the 'gravel pit' block. What started as a bit of a dare some years ago is still growing pineapples. Peter planted pineapples in the base of an old gravel pit where the soil was salty, deficient in just about everything and the pH initially 3.9. He expects 60 t/ha in the ratoon harvest. The block does not suffer from nematodes or symphylids.

The next block we looked at had had a bad white grub problem but interestingly there was none over the road.

#### Farm critique – Kepler Atkinson

- Phenomenal ratoons
- Good erosion control measures
- Interesting to see the crop growing in the gravel pit
- Peter is doing a great job in managing the different pests and diseases that occur in the wide variety of soil types that occur on the farm.
- Good weed management. Peter commented that the farm was native timber when he moved there and he put a lot of effort into keeping weeds and weed seed bank under control and this included some hand weeding. Peter uses the label rate of Hyvar.

#### Fourteen years of study group meetings - Simon Newett

This was the last round of study group meeting that Simon will be directly involved with. The meetings started in 2002 and since then 186 such meetings and domestic tours to other regions have been conducted. Simon would like to thank all the growers for their participation, all the IDOs for their support - Alison Chapman, Julie Moore/Petty, Margie Milgate, Cherie Gambley, Lana Baskerville, Michelle Hobbs, Dale King and Georgie Townsend, support from Doug Jones from Golden Circle, support from agronomists Col Scott, Tim Wolens and Doug Christensen, and to the many other contributors too numerous to mention for their support in making the gatherings a success.

The study group meetings will continue next year as part of the Growcom IDO project run by Georgie Townsend.

#### Acknowledgements

Very many thanks to Peter Maywald and Bernadette for hosting the day including a very interesting farm walk. Thanks also to James and Joseph from EE Muir & Sons for supplying and cooking the BBQ and to John and Jason of JAT transport for providing the drinks.

Simon Newett & Georgie Townsend







