Hort Innovation

Final Report

The New South Wales Banana Industry Development Officer

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New South Wales Department of Primary Industries

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Content

Summary

The NSW banana industry comprises only 4% of the Australian industry but is important regionally where it supports several hundred small businesses, and nationally, where it provides an important supply when natural disasters or disease outbreaks reduce supply from north Queensland. The NSW industry has contracted substantially in recent years and the role of the Industry Development Officer was created to reinvigorate the industry. The NSW industry survey and supply chain mapping components of the project provide significant new information about the NSW industry and grower contact information for use in future projects.

Findings from surveys conducted during both the mid-term and final project reviews indicated that 90% of participants rated the project as very to extremely valuable. Linkages and networks with growers, service providers and wholesalers, built initially through the NSW banana growers associations and the Australian Banana Growers Council and then through social media, helped make the project a success. Continual contributions to industry media over the life of the project maintained and built on these linkages and helped with the delivery of project information and outcomes.

The project worked closely with other levy-funded R,D&E projects to ensure the delivery of up to date information and also helped these projects deliver their outcomes. As there is little recent production research and development information focused at subtropical growers, a series of grower trials were undertaken to generate this information. Some of this trial work has national significance with an aggregation pheromone lure commercially for banana weevil borer, a significant pest of bananas on the east coast, available in Australia for the first time, as a direct result of this project. The subtropical nutrition information package developed for New South Wales as a project output, was delivered to growers in Carnarvon as part of the National Banana Roadshow series.

Face to face links with growers were also important and through this the project strengthened linkages between the NSW production regions and has encouraged the entry of new, young growers into the industry.

The NSW banana supply chain is quite convoluted, with fruit sold through central markets in capital cities, local wholesaler/ripeners and local grower/ripeners and a significant amount of fruit sold through farmers markets from the Sunshine Coast to Newcastle. There is a definite demand for subtropical fruit within and outside the production region. Fruit quality and consistency and volume of supply remain the major limiting factors to reinvigorating the industry. Future projects should concentrate on;

- encouraging young growers into the industry and building links between these young growers within NSW and across the Australian industry,
- new plantings, of current or improved varieties that fit established supply chains to improve supply as well as niche varieties,
- developing and delivering information packages to improve fruit quality.

Keywords

Banana; extension, New South Wales; subtropical; communication; growers

Glossary of project titles

BA13004: National banana development and extension project

BA10020: Banana plant protection program

BA14014: Fusarium wilt Tropical race 4 research program

BA13003: Communications project for the banana industry

BA13001: Cause and management of crown rot of banana

BA16007: National banana extension project

Introduction

The NSW Banana Industry comprises only 4% of the total Australian production, however it is significant regionally and nationally and supports or helps support several hundred small regional businesses. The production areas can be grouped as southern (from Nambucca heads to Woolgoolga) and northern (from the Richmond River to the Queensland border). NSW provides a geographical spread of production for the Australian industry, as the major Australian production areas in north Queensland are vulnerable to extreme weather events, which can create major supply issues. It is important that the NSW industry remains a viable alternate supply region and better coordination at a local level is the key to this. Over the past 15 years, there has been a gradual decline in the area of bananas grown in NSW. In Coffs Harbour this decline is due to diversification into other crops such as blueberries, sale of properties, urbanisation or owner retirement. In the Tweed, Richmond and Brunswick regions, race1 and subtropical race 4 Fusarium wilt attacking Lady Finger account for much of the decline.

During this period there has been a trend towards more local sales such as roadside stalls and farmers' markets rather than through the central markets, however several local ripeners/distributors sell fruit to supermarket chains in the Coffs Harbour (Port Macquarie to Grafton), Ballina/Lismore and Tweed districts. Fruit is also sold into the central markets in Brisbane and Sydney. NSW bananas are well known for their excellent taste and eating qualities and are sought after by certain market sectors, especially high quality, excellent tasting Lady Fingers. Niche marketing opportunities, renewed interest by the chain stores in sourcing local fruit for a growing population along the NSW north coast and a core of young progressive growers in the industry provide a sound basis for the industry's future.

With little recent research targeted at the subtropics, apart from the new varieties work, to reinvigorate the NSW banana industry it was important to develop an understanding of and document the extent of production and distribution in the NSW banana industry supply chain by:

- providing a readily accessible contact person for growers, service industry and researchers
- conducting regular communication with all sectors of the industry
- improving grower capacity through increasing their level of knowledge through linkages to the banana R&D program in conjunction with the National Banana Extension Team from the Queensland Department of Primary Industries and Fisheries (QDAF)
- establishing trial demonstrations of superior germplasm from the Banana Plant Protection Program
- contributing regularly to the Banana Industry Communication Program.

The establishment of the national banana R&D and marketing levy in 2007 and the development of a strategic plan provided direction for the project to improve industry capacity and R&D adoption and demonstrate the benefit of levy investments. This project, BA13025: The NSW Banana industry development officer, was funded in part by these levies and commenced on 01/07/14 and finished on 08/0917. Matthew Weinert was appointed to the role of industry development officer and commenced on 07/10/14.

During the final two years of the project significant production increases occurred in the Australian banana industry with production approximately 30% greater than the Australian market can handle, resulting in prices for growers well below that of production. In NSW the production regions were also impacted severely by two east coast lows in 2016 and ex tropical cyclone Debbie which damaged the southern (Coffs/Woolgoolga) and northern (Tweed/Brunswick/Richmond) respectively. Recovery efforts, including an ongoing role on the Primary Producers Recovery Committee, for these events took a significant portion of the IDO's time and resulted in the postponement of the subtropical banana industry strategic plan and the non-completion of the NSW industry survey.

Methodology

Bananas are a year round crop and NSW banana growers as a whole are disengaged from their peak industry body, the Australian Banana Growers Council (ABGC). Local banana grower associations (BGAs) however are still strong, particularly in the Coffs Harbour and Nambucca regions. To develop an understanding of the NSW banana industry the IDO initially engaged with the local BGAs and attended all but one of the BGA meetings held during the project.

Project reference group

A project reference group (PRG) was established at the beginning of the project to provide guidance on topics and delivery strategies for extension and development activities and prioritise and approve the IDO workplan. The PRG met biannually and was essential for project monitoring and evaluation. The IDO kept the PRG informed on progress through a monthly report emailed to the PRG and the PRG provided input for the mid-term review of the project. An agenda was developed for all PRG meetings and all meetings minuted.

PRG members were:

- Stephen Spear (banana grower Taylor's Arm (Nambucca) and ABGC board member and Banana Industry Committee Trustee)
- David Pike (banana grower, Coffs Harbour and Coffs Harbour BGA representative)
- Paul Shoker (banana grower, Coffs Harbour and Coffs Harbour BGA representative)
- Peter Molenaar (banana grower, Mullumbimby and ABGC representative)
- David Perry (banana grower, Murwillumbah and Tweed BGA representative)
- Jay Anderson who was replaced by Rosie Godwin in October 2015 (ABGC R&D managers)
- Alison Anderson who was replaced by Bianca Cairns in January 2016 (HIA project managers)
- Myles Parker who was replaced by Mark Hickey in November 2016 (NSW DPI Horticulture Leader)
- Matt Weinert (NSW Industry Development Officer – bananas)

Linkages with other banana projects

Strong project linkages were built with other HIA and levy funded projects and funding sourced for trial work outside of the levy system during the project as detailed below:

- *BA13004: the National banana development and extension project*: undertook demonstration trials, helped organise and promote biosecurity workshops and the banana roadshows
- *BA10020: The Banana plant protection program:* organised field days at the new variety trial block at Duranbah and undertook trials of banana weevil borer pheromone lures
- *BA14014: Fusarium wilt Tropical race 4 research program:* co-supervised Yukmila Chooneea a coursework Masters of Science student at the University of Queensland and organised trial sites for inoculum reduction trials
- *BA13003: Communications project for the banana industry:* and from 2017, when the contract with Cape Media for subtropical banana media was discontinued, delivered communications outcomes for the NSW banana industry
- *BA13001: The cause and management of crown rot of banana:* fruit displaying crown rot symptoms sent for analysis to the project team
- *Market development of recycled organics in bananas and blueberries:* was successful with a grant to investigate the effects of recycled organics (compost) in banana and blueberry production and investigate different application methods, funded by the NSW Environment Protection Agency.

NSW banana industry survey

To develop an understanding of the changes to the current extent, demographics and grower issues of the NSW banana industry, a 17 question industry survey (see attachment A, Appendix 19) was developed in conjunction with the PRG and initially run online. The survey was sent on 02/11/15 and closed on 16/11/15 to 82 growers on contact lists provided by the BGAs, the previous HIA funded project *BA12000: Subtropical Market Development Implementation* and the Australian Banana Growers Council. The survey was also widely advertised but only 26 growers completed the survey online.

One-on-one telephone surveys were then undertaken for growers who did not complete the online survey. This had to be undertaken at night and during the winter months, as growers have no telephone or poor mobile reception on farm and often replied they were too tired to do the survey during the long summer days. The first part of the survey for the southern producing areas was completed in the first 12 months of the project. Two attempts were made to complete the survey for the northern production regions however severe damage from the east coast lows in 2016 and ex TC Debbie in 2017 and the associated recovery work meant this was never completed.

Field days and workshops

Field days and workshops were an integral component of the project, however the increased emphasis of on-farm biosecurity with the discovery of tropical race 4 (TR4) Fusarium wilt in Tully in 2015 and the limited distribution of race 1 Fusarium wilt in the southern producing regions meant running on farm workshops was difficult with workshops therefore conducted at off farm venues.

Subtropical banana nutrition workshop and booklet

The workshop was run on four occasions, in Woolgoolga prior to the Coffs Harbour BGA meeting, in Murwillumbah prior to the Tweed BGA, as part of the Tweed Soil Health Field Day and after a request from the Sweeter Banana Co in Carnarvon at the Banana Roadshow in Carnarvon in 2016. Dates for the workshops are included in appendix 7. Over 75 people attended the workshops, including a mix of growers and consultants and resellers. At the request of growers, the workshop was developed into the *Subtropical banana nutrition booklet*, published by *BA13004* in September 2016.

Leaf disease workshop

The leaf disease workshop was run only once on 03/11/16, prior to a meeting of the Coffs Harbor BGA. The workshop covered information on disease lifecycles, the importance of orchard hygiene and fungicide resistance strategies. The workshop was attended by 18 people, mainly growers.

Demonstration trials

A key component of grower learning is demonstration trials, with two significant demonstration activities run during the project.

Banana weevil borer pheromone trials

Banana weevil borer (BWB, *Cosmopolites sordidus*) was identified as the most significant pest of banana production in NSW banana production areas. In conjunction with BA10020 and Bugs for Bugs the NSW IDO undertook comparative field trials on two different commercially available aggregation pheromone lures and developed and compared prototype traps. As a result of these demonstrations and associated interest generated through the efforts of the IDO, this lure is now available commercially in Australia, however a trap design suitable for local conditions was not developed. Results of the trial work were presented at workshops, at the Australian Banana Congress 2015 in Melbourne and at the ProMusa conference in Montpellier, France in 2016.

New variety plantings

Eight separate plantings of new varieties, selected during *BA10200*, were established from tissue culture plants purchased from QDAF. Plantings included DPM25 and PKZ, both desert Cavendish types and Pacific Plantain, after repeated requests from growers for cooking banana types. Supply of planting material to meet the short spring/early summer planting window in NSW was difficult and in all cases plants were planted late summer. Dry weather conditions have slowed growth on the plantings, the performance of which will be monitored in the new HIA funded QDAF project *Improved plant protection for the banana industry BA16001*. Despite this, all plantings survived, with one of the initial plantings used as a mother block for a new planting. The tissue culture plants used were significantly larger than those used in north Queensland and in one planting were divided into 4-5 pieces which were then planted. All these pieces have grown well and this may demonstrate a new and economical way of using high health tissue culture planting material in NSW.

Communication techniques and media articles

A wide range of communication techniques were employed to initially develop a media profile for the project and communicate project outcomes, outputs and events to growers. Press releases were issued at the start of the project and for all major events. Through this the IDO built an excellent working relationship with the rural press in the area, especially ABC Rural and The Land.

The major events were also advertised and reported on through the Australian Banana Growers Council's eBulletin, the now discontinued bimonthly Australian Banana News and the quarterly Australian Bananas magazine. These events were also advertised through email lists. SMS was also used to promote events and proved to be very successful, with event RSVPs immediately increasing after an SMS promoting the event was sent.

The project developed a high media profile in both industry and mainstream media. The project produced or significantly contributed to eight articles in the Australian Bananas magazine, one in the (now defunct) Australian Bananas newsletter and 9 in the ABGC eBulletin.

Social media has become an important communication medium, particularly with young growers. PRG member and Coffs Harbour grower Paul Shoker established the Coffs Harbour Young Banana Growers Group on Messenger and with Colin Singh and Ethan McKeever, The Tweed Heads BGA, a closed group on Facebook. Discussions on both groups have been continual since their inception.

Outputs

Project reference group

The PRG met biannually during the life of the project. Meeting agendas were circulated prior to the meetings and all meetings were minuted, with the minutes circulated following the meeting. The PRG monitored project progress and approved the IDO workplan. The IDO also emailed monthly reports to the PRG highlighting key activities, until the intervention of ex TC Debbie after which monthly reports were no longer circulated due to recovery efforts. Examples of the PRG meeting agenda, minutes and monthly reports, are attached as appendices 1, 2 and 3 respectively.

NSW banana industry survey

Despite repeated attempts the project was unable to finalise the NSW banana industry survey. Three significant weather events, two east coast lows in 2016 and ex TC Debbie in 2017 meant growers in the northern region were unwilling to be involved in the survey as they recovered from these events. Growers in this region are also somewhat disengaged from industry organisations and can be unwilling to share information as they feel other growers may take their markets. Despite this, the survey did provide important information for the project including a focus for project events and trials, including the BWB trials, leaf disease and nutrition workshops and supply chain mapping.

The project was able to source information from the NSW Office Environment and Heritage (OEH) project, funded by the Australian Government Department of Agriculture and Water Resources, Horticultural Mapping to Improve Biosecurity Focus banana production in NSW, and it was hoped that this could be used to help complete the survey for NSW, however there are significant differences in the production area in the Coffs Harbour area between the mapping project and the industry survey (137.8ha for the survey vs 508ha for the mapping project), so this was not progressed.

A copy of the survey for the southern regions is attached as Appendix 4 and the summary data from NSW OEH project is attached as appendix 5.

Supply chain mapping

The NSW banana supply chain is quite convoluted, however in southern production regions, central markets remain the major destination for fruit. Local ripener/wholesalers are the next most important distribution method then followed by growers who ripen and distribute their own and fruit bought from other local growers. Farmer's markets account for the remainder of the fruit sold in these regions. Growers in the northern production regions were reluctant to complete the industry survey and supply chain mapping, however previous research indicated that 45% of fruit produced in this region was sold through farmer's markets and it is expected that this level has increased in recent years. The report on the supply chain mapping is attached as appendix 6.

NSW banana growers groups

The project has been instrumental in establishing two social media grower groups in NSW, the Coffs Harbour and districts young banana grower group (9 members), through Messenger and the Tweed BGA (26 members) a closed Facebook group. The Coffs Harbour group has met once for a face to face meeting, however discussions are daily through Messenger. The Tweed BGA Facebook page will be used to communicate with growers once the new BGA executive is installed in early September 2017. Social media channels appear to be the most reliable communication method for young growers.

Field days and workshops

Based on the responses to the industry survey, further discussions with growers and other supply chain members and results from soil health trials and soil analyses sent as enquiries, a series of workshops were developed and run as part of the project. A list of the workshops is attached as appendix 7.

Subtropical banana nutrition

This workshop was developed with help from international banana nutrition experts Associate Professor and retired Honorary Research Fellow, David Turner, the University of Western Australia, Dr. John Robinson, Du Roi Laboratories, South Africa, both of whom have extensive subtropical banana research experience and Dr. John Armour, retired soil scientist Queensland Department of Natural Resources and Mines. The workshop was run on four separate occasions. The workshop dates are included in appendix 7 and the workshop content is included appendix 8.

The success of the workshop lead to the production of *Subtropical banana nutrition – matching nutrition requirements to growth demands* which was published by *BA13004.* 500 hardcopies of the booklet were printed and distributed to growers in NSW and WA and the booklet is available for free download from http://www.dpi.nsw.gov.au/agriculture/horticulture/tropical/growing-bananas/sub-tropical-banana-nutrition.

Leaf disease workshop

Leaf diseases have a significant impact of productivity and fruit quality in banana plantations. Visits to plantations in NSW and grower enquiries showed the need for better information on leaf spot management. Leaf diseases have a significant impact on fruit quality and yield. A workshop was developed in conjunction with Lynton Vawdrey, Plant Pathologist, QDAF and project team members of *BA10020*. The workshop covered disease identification and lifecycles, management and managing fungicide resistance. A copy of the workshop content is attached as Appendix 9.

Tweed region soil health workshop

In conjunction with the Tweed BGA a half day event for growers in the Tweed region was held at the Burringbar Sports Club on 17/02/16. The event covered a wide range of topics including the new NSW biosecurity legislation, on-farm biosecurity, managing nematodes, understanding leaf and soil analyses and subtropical banana nutrition. The program for the day is attached as appendix 10. The event also included an exhibitors program for the banana bunchy top program, local agriculture resellers and consultants.

Tullera shed meeting

Banana production in the Richmond region is small and declining with only four growers remaining. A shed evening was held at the farm of Jeff Zanette on 11/12/16. Presentations on the night included the Fruit Salad, Action On The Ground project, the HIA funded Banana central American study tour and banana weevil trial work. A copy of the evening agenda is attached as Appendix 11.

New variety field days

In conjunction with *BA10020,* the project hosted two field visits on 13/08/15 and 25/05/17 to the new variety field trial site at Duranbah. On both occasions the Coffs Harbour BGA chartered a bus for growers from the southern regions. The days detailed the trial work undertaken and for the 2017 event the three 'best bet' varieties that will proceed to semi-commercial trials in *BA16001: Improved plant protection for the Australian banana industry.* Both events received significant press coverage. Images of the event and press clippings can be seen in appendix 13.

On farm biosecurity workshops

Following the detection of tropical race 4 Fusarium wilt (TR4) in Tully in March 2015, a four-module on farm biosecurity workshop was developed by QDAF as part of *BA13004*. A condensed version of the workshop was

delivered twice as part of this project prior to the Coffs Harbor BGA meeting on 2/11/2016 and the Tweed/Brunswick BGA on 9/11/2016.

Banana weevil borer pheromone trials

Two posters detailing the BWB trial work were presented at conferences during the life of the project. A poster titled *The weevil and the damage done* was presented at the 2015 Australian Banana industry Congress in Melbourne on 18-20 June 2015 and a second poster detailing further work on these trials titled *Comparing the efficacy of banana weevil borer traps and pheromone lures* was presented the 2016 ProMusa congress in Montpellier, France Oct 11-14 2016. Attendance at the Promusa congress resulted in the IDO being invited onto the scientific committee for the Promusa 2018 conference in Istanbul, Turkey with the theme of G*rowing and marketing bananas under subtropical conditions*. Presentations on the trial work were also given at several workshops and a copy of the workshop presentation is attached as appendix 12. Copies of the posters from these conferences are attached as appendices 14 and 15.

New variety plantings

Plantings of new 'best bet' varieties selected during *BA10200*, were established from tissue culture plants. Varieties include DPM25 and PKZ, both desert Cavendish types and Pacific Plantain after repeated requests from growers for cooking banana types. Supply of planting material to meet the short spring/early summer planting window in NSW was difficult and in all cases plants were planted late summer. All plantings survived with one of the initial plantings used as a mother block for a new planting. The tissue culture plants used were significantly larger than those used in north Queensland and in one planting were divided into 4-5 pieces which were then planted. All have survived and this may demonstrate a new and economical way of using high health tissue culture planting material in NSW. Dry weather conditions have slowed growth on the plantings, the performance of which will be monitored in *BA16001*. A brief outline and images of the plantings are included in appendix 16.

Communication techniques and media articles

The project was fortunate to attract a wide range of media interest through an excellent working relationship with the rural press, ABC Rural and The Land. Events were able to be advertised on the NSW north coast rural report, often with a live interview and reporters often attended events and filed stories following the events. Examples of press releases and print and radio stories are included in appendix 13.

The Australian Banana Growers Council, through their eBulletin, the discontinued bimonthly Australian Banana News and the quarterly Australian Bananas magazine, were also essential in promoting the project. Events were also advertised through email lists, however maintenance of email lists is difficult and time consuming, especially when growers change internet service provider.

The Coffs Harbour Young Banana Growers Group on Messenger and The Tweed Heads BGA, on Facebook will be an important way for young growers to interact and learn. Both groups are closed and moderated. The Coffs Harbour group has 9 members and the Tweed BGA group has 26 members. Discussion on both groups has been continual since their inception and with growers seemingly more likely to maintain social media accounts than email accounts, may prove more useful in the long term.

Other project linkages

The project also aimed to coordinate new project development. In 2015 NSW DPI was successful in their bid for a project titled M*arket development of recycled organics in bananas and blueberries* through the NSW Environment Protection Agency, *Waste Less, Recycle More Initiative.* The project examined the viability of compost blowers to spread recycled organics (compost) into difficult to access, hill slope plantations in NSW and also measured any effects compost may have on plant growth. Although the blower was found to be too

cumbersome and expensive, there were some positive outcomes including greater sucker growth with the compost treatments, parasitic nematode levels were reduced and leaf zinc and potassium – two important plant nutrients- levels were higher.

Factsheets and videos detailing the machinery and trial results are currently being prepared and will be promoted through *BA13003*. This trial work adds to the data from the soil health trials in *BA13004* on the benefits of compost and organic matter in banana plantations however finding ways to economically add these organic amendments to realise these benefits, especially on hillside plantations, remains elusive.

Project evaluations

Two evaluations of the project were undertaken, the first as part of the 'stop-go' clause, requested by one of the co-investors, which recommended the project continue for the full term and a second short evaluation at the end of the project which found the respondents overwhelmingly in support of the project with strong support for it to continue. These evaluations are attached as Appendices 17 and 18.

Future projects

The final evaluation of *BA13025* (Appendix 18) indicates significant interest in new varieties and it is expected that the IDO role will continue, with two days a week spent managing the subtropical variety component of *BA16001.*

Outcomes

The project successfully delivered its aims of reinvigorating the NSW banana industry with several young growers entering the industry as a result of project activities (see 'Dreaming big' Appendix 13). At the Tweed BGA AGM held on September 6, 2017, a new executive, comprised entirely of new young growers was elected, indicating the reinvigoration of banana production in this area. It built links with other levy funded projects, helping these projects deliver on their outcomes and through the involvement of the IDO in the recently funded *BA16001* and *BA16007* will maintain and build on these links.

Industry linkages

Strong linkages were developed with key industry groups, especially the NSW BGAs and through a commitment to *BA13004,* the IDO attended all but one BGA meeting held in NSW during the time of the project.

Strong working linkages were developed with key ripener/wholesalers in the region especially in Coffs Harbour. Linkages were also built between regions following the east coast low which severely affected supply of fruit from the Nambucca region in 2016. At a time of oversupply elsewhere, the IDO facilitated the supply of fruit from the Tweed region to a wholesaler from Nambucca, which allowed him to maintain his markets.

The project also built better linkages with growers in the northern and southern producing regions. One example linked young growers from the north with an experienced grower from the southern production region, which allowed the growers to source all their planting material for limited cost, letting them enter the industry.

The establishment of two social media groups has also increased communications within and between the different production regions, especially between young growers. Posts through the Tweed BGA Facebook page were responsible for several of the young growers committing to roles on the Tweed/Brunswick BGA, which had been slated for closure.

R&D linkages

The linkages established with other levy funded projects also allowed the project to deliver better pests and disease management options for the NSW and Australian banana industries. Through linkages with *BA10020* and Bugs for Bugs an aggregation pheromone lure for BWB is available commercially for the first time in Australia. This lure offers growers a biologically soft option to help manage this significant production pest. These linkages also allowed QDAF nematologists to identify increasing prevalence of new pest nematode species in NSW, research on these species will be conducted in the integrated pest and disease management (IPDM) component of *BA16001*.

Linkages with the new variety component of *BA10020* also resulted in the IDO assuming the role of managing the subtropical variety evaluation component of *BA16001*. This ensures this nationally and internationally important program will continue and give subtropical growers new and improved or access to niche varieties.

Workshop outcomes

It was initially planned to run more on farm field events during the project however with the limited distribution of race 1 Fusarium wilt in the Coffs Harbor region and then the detection of TR4 Fusarium wilt in Tully in 2015, the industry emphasis on biosecurity training meant the majority of workshops were run at off farm venues.

The nutrition workshop and booklet produced during the project had the most significant outcomes of the project with responses to the 12 month project survey and the final project survey indicating 13 out of the 14 growers that responded had changed production practices due to either attending the workshop or reading the book. Leaf and soil analysis has now become more common to better target fertiliser applications and reduce their environmental impact, a key aim of the Australian banana industry.

Better disease management through better plantation hygiene (deleafing) and fungicide resistance strategies were also mentioned by growers as outcomes of the leaf disease workshop.

Contributions to the National Banana R&D Program

The project worked closely with other levy-funded R,D&E projects and helped to deliver up to date information and also helped these projects deliver their outcomes. As there is little recent production information focused at subtropical growers, a series of grower trials were undertaken in *BA10020, BA13004* and *BA14014* to generate this information. Some of this trial work has national significance with an aggregation pheromone lure commercially for banana weevil borer available in Australia for the first time as a direct result of this project. The subtropical nutrition information package developed for New South Wales was delivered to growers in Carnarvon as part of the National Banana Roadshow series and the IDO contributed to inoculum reduction trials for Fusarium wilt on properties in NSW that form part of the TR4 infected plant eradication protocol. Provision of strategic advice to industry R&D committees was also an important component of the project.

Other project outcomes

Although not originally an aim of the project, the IDO was instrumental in undertaking damage assessments and writing damage reports which allowed growers in all regions to access category C disaster funding to repair infrastructure and replant damaged blocks following the severe weather events in 2016 and 2017. Comments in the final evaluation support this.

Evaluation and discussion

Monitoring and evaluation of the NSW Banana IDO project was integral to the success of the project. The project was well regarded by the PRG, demonstrated by their active involvement in the project, with all but one member present at all meetings. Clear communication via the monthly reports and biannual meetings with a clear agenda and minutes were key to this.

A review, developed to satisfy the 12 month 'stop-go' clause in the project was sent to all NSW banana industry members on the email distribution list. The review had 19 respondents, 15 of which were growers and the remainder represented various roles in the NSW supply chain. The review recommended that the project continue and a short summary of the review is detailed below and the full summary of the review is attached as appendix 17.

- 42% rated the project as 'extremely valuable' and 47% as 'very valuable'
- 10% rated the project of 'some value' or 'little value'
- 72% of respondents had made changes to their business as a direct result of the project, 6% said this was not applicable.

A Monitoring Evaluation Reporting and Improvement Plan (MERI) and Strengths Weaknesses Opportunities and Threats (SWOT) analysis were also completed. Copies of a summary of the review, the MERI plan and SWOT analysis can be found attached as Appendices 18 and 19.

Not all project events were evaluated, however workshop evaluations conducted indicate the workshop methodology and content were well targeted. An example is the Coffs Harbour leaf spot workshop. There were 18 workshop attendees and a summary of the evaluation is below.

- 28% of attendees said the workshop was 'extremely useful', 44% very useful and 22% 'useful', 5% did not answer
- 83% said the amount and type of information presented was about right
- 50% said they would change practices on their farm, including more deleafing to manage leaf disease and to rotate fungicides, 16% said they wouldn't change their practices, with the remaining 34% either not answering the question or responding it was not applicable.

Banana weevil borer (BWB) was identified as the number one production constraint by growers in the southern and Richmond growing regions. The trials undertaken in this project, in conjunction with *BA10020* and Bugs for Bugs lead to the commercial availability of an aggregation pheromone lure for BWB for the first time in Australia. Following the detection of TR4 Fusarium wilt in Tully in 2015 national interest increased in using the lures to manage BWB as the current technique favoured by growers, basal injections, and BWB itself have the potential to spread TR4.

The project did not meet several project outcomes. The NSW industry survey was initially sent as an online survey which only 26 growers completed, the remainder of the survey completed was undertaken as one-on-one telephone surveys. As many NSW growers do not live on their farms and mobile telephone reception is poor in many of the growing regions, the time to undertake the surveys was limited to the early evening in winter. The survey of the southern producing regions was completed in 2015. Two attempts to complete the survey for the northern regions in 2016 and 2017 were thwarted by the severe damage caused by two east coast lows in 2016 and ex TC Debbie in 2017 and a reluctance of growers to be involved. Better linkages have been established with growers in the northern region following the ex TC Debbie recovery efforts.

While the NSW BGAs were identified as a key conduit for information dissemination the majority of young growers either are not members of the BGAs or do not attend. Significant effort was then put into developing

linkages with these young growers and establishing and maintaining social media groups to maintain these linkages. The continual posts and interaction on these forums indicate that this is the preferred method of communicating for these growers. Other forms of social media, potentially a WhatsApp group as used by the NextGen group in north Queensland, should be investigated to create a young growers group for the whole of NSW in any future projects. Developing linkages between the Queensland and NSW young growers should also be investigated. Further evidence of this is a new executive of young, new growers elected to the committee of the Tweed BGA on September 6, 2017.

The NSW banana industry strategic plan was proposed for May 2017, however this was removed from the project as growers were still recovering from ex TC Debbie.

The linkages with *BA13004* were instrumental in increasing attendance at the Banana Roadshows in NSW with 41% of attendees at the Murwillumbah Roadshow responding that their attendance was because of the IDO. These linkages will be maintained as the IDO is a member of the *BA16007* PRG.

A six question final evaluation project evaluation was undertaken just prior to writing of this report. Twenty people responded to the survey, 13 were growers, one a researcher, one a ripener/wholesaler and four classed themselves as other. The project effect was rated well by respondents with 50% rating the project as extremely valuable, 40% very valuable, 5% said it was of some value and 5% of little value. Disaster recovery efforts were mentioned across several response categories in the survey as a positive outcome of the project.

Overall good communication and working with and encouraging new growers were seen as aspects of the project that were done well. Responses to what the project did well included:

- Increasing communication to and between growers and determining aspects/topics for improvement in subtropical banana production systems
- Lots of things - encouraged younger growers; leaf and soil analysis appreciation; work on disaster data was instrumental in getting disaster relief for growing areas; invigoration of Tweed BGA; general "go to" person for the subtropical industry;
- Communication with younger growers has been outstanding. Matt has engaged younger growers through a range of media especially social media, field days and individual farm visits. His communication skills are exceptional and he is achieving positive responses from all sectors of the industry.
- Encouraged younger growers to participate.

Areas the project could have improved were better prioritization of work areas and engagement with more growers particularly in the Tweed, with responses that included:

- Focus on fewer priority areas
- Needs to prioritise issues rather than attempting to be involved in everything; Survey of the industry; saying less when working with retired growers at BGA meetings;
- Perhaps more engagement with Tweed growers.

When asked what practices they intended to change on their farms as a result of the project, improved fertiliser regimes with a greater reliance on leaf and soil testing were the overwhelming response:

- We have learned a great deal for these seminar days and gained a wide variety of knowledge we are now on a path to become better growers and understand a lot more of the constant cycles that bananas constantly are going through especially through the subtropical banana nutrition booklet.

- Pay more attention to nutrition
- Yes nutrition changes with soil tests. Also would like to trial new varieties.

Areas any future projects should concentrate on showed further interest in plant nutrition and pest and disease management. A summary of the survey results are attached as appendix 18.

Recommendations

The successes of the project indicate that:

- The PRG was important in guiding the project and approving the project workplan. Comments in the final project evaluation suggest the PRG could help focus the project and prioritise project work activities
- Face to face workshops and field days still remain an important means of improving grower practice indicating there is a social aspect to learning. All workshops developed and presented during the project were well received. Several responses to the final evaluation of the project requested more of these events. Interestingly during the life of the project there were no requests to develop video material to the project team
- A separate position for an industry development role in the subtropics is important for the Australian banana industry. Interest in the nutrition workshop and booklet from the Carnarvon and southeast Queensland production region indicate the role of the NSW IDO should be extended to include all subtropical production regions. This role also provides important linkages into other levy funded R&D projects
- New varieties, with better pest and disease resistance and cold tolerance are important to sustain the NSW banana industry. It is important to continue the subtropical variety evaluation program which will need to source extra funding from mid-2020
- A wide range of communication techniques are required to maintain the linkages with industry. Subtropical growers seem less likely to use email notifications and email lists are difficult to keep current. SMS notifications sent through the ABGC and rural media seemed to be the best way of notifying attendees of project events. Links with the banana industry communications project therefore is vital to promote events. Social media has also become important and maintenance of linkages through targeted social media sites should be a priority
- Young growers are the future of the banana industry and encouraging new growers is vital to reinvigorate the subtropical industry. Future subtropical extension projects should maintain linkages with *BA16007* and develop linkages with the NextGen grower group in NQ
- Packing fruit that meets market standards is still a significant issue for subtropical fruit. Visits to farms, ripeners and enquiries during this project showed that some growers did not pack to standard and were confused by the cause of fruit downgrade. Reject and packed product analysis, to develop a database of information and images of the cause of fruit quality issues to be used to develop training materials and conduct demonstration trials to improve fruit quality, should be a focus of any future project. As shown in *BA13004*, small demonstration trials play an important role in the uptake of emerging or improved grower practices
- A strategic plan for the subtropical industry is still worth pursuing and should be included in any future projects targeted at the subtropical industry.

Several project aims were not able to be completed during the period of the project. Three severe weather events impacted on the NSW production areas in 2016 and 2017 and departmental requirements meant the IDO was pulled offline to undertake damage assessments and help in recovery efforts for these events. With these weather events predicted to become more frequent and severe in NNSW allowance for these recovery efforts needs to be included in risk analyses for future projects.

Scientific refereed publications

None to report

Intellectual property/commercialisation

No commercial IP was generated by the project.

Acknowledgements

This project would not have been possible without the support and willingness to provide input of the NSW IDO project reference group Stephen Spear, David Pike, Paul Shoker, Peter Molenaar, David Perry, Jay Anderson, Alison Anderson, Bianca Cairns, Myles Parker and Mark Hickey. Former Subtropical banana marketing project leader Geraldine O'Flynn provided significant help with industry contacts and also acted as a proxy at PRG meetings.

Support from the banana industry members who undertook the industry survey and the evaluation surveys and helped with project trials especially David Tate, Col Spagnolo, Brian Singh, Ian Simpson, Jeff Zanette and Mark Cowderoy was also important.

The support from the staff at the ABGC is also acknowledged especially Rhyll Cronin, Paula Doran and Sonia Campbell from the communications team and Rosie Godwin and Michelle McKinlay for R&D and policy support. Luke Roberts is thanked for his help promoting the project in its early stages.

Naomi King and Tegan Kukulies, project leaders of *BA13004*, and all the banana R&D community are acknowledged for their help in developing resource materials for the project.

David Turner, John Robinson, John Armour and Ted Winston were instrumental in making the nutrition workshop and booklet a success.

Andre Drenth, David Peasley and Mike Smith are thanked for their advice and information on the subtropical variety trials and assistance with on farm grower trials of promising new varieties.

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Appendices

Appendix 1: Example of PRG meeting agenda

NSW Banana Development Officer Project Reference Group Meeting

Location: **Coffs Harbour, NSW DPI Office**
(76 Harbour Drive, Suite 5 level 1)
Date and Time: **Wednesday 1 February 2016 3.30-4.30pm**

Dial in numbers: 1800 672 949 code 75390826 1222#

Agenda.

Items from last meeting

- Milestone variation underway
- Nutrition Booklet – published and some distribution
- Supply chain mapping continuing
- Baseline industry survey
- EPA project field day run
- Bagging trial
- Disaster relief scheme grants
- Meri plan written and submitted

New items

- NBEP final report due end April – new project?
- Strategic plan and Duranbah trial site visit planned for May 25
- EPA project final report due end June
- IDO final report due end June – new project?
- BA16001 – Improved plant protection for the banana industry
- Congress 22-24 June
- Coffs young grower's group
- Landuse mapping data

Project Milestones

Final 190 30/06/2017 $39,811.35 Final report received by Horticulture Australia Ltd
Achievement Criteria
All necessary reports complying with Horticulture Australia's requirements received and approved by Horticulture Australia Ltd

Matt Weinert **Mobile 0438 644 136**

Appendix 2: Example of PRG minutes

NSW Banana IDO PRG minutes 1 February 2017

Meeting started at 3.35pm.

In attendance: Matt Weinert (chair), Mark Hickey (minutes), Stephen Spear, Bianca Cairns, David Pike, Geraldine O'Flynn, Paul Shoker, Rosie Goodwin, Peter Molenaar

Actions arising from last minutes

1. **Milestone variation** is in progress – Bianca confirmed process should be complete by March.
2. **Nutrition booklet**, now published, copies are available at DPI in Coffs and Ag resellers in Tweed, only received 3 requests for the booklet from the ABGC banana eNews, one from Carnarvon, one from Townsville and one from Wayne Shoebridge! Feedback has been positive from growers who have used it.
3. **Supply chain mapping** has recommenced, it will be difficult to finalise the Tweed region.
4. **Baseline survey** has seen little progress since the PRG due to grower work commitments. One option is to try to finalise this in a new project. Growers are very busy at the moment. Some growers are not responding to requests to complete survey. Thirty growers yet to be contacted in Tweed. May have to draw a line under this component of the project if I am not able to get surveys completed.
5. **The EPA project** field day was run with a small turn out. We're currently assessing the trial in the Tweed and the demo site in Coffs has been abandoned due to damage from the east coast lows. The project field trial will be completed by the end of May with the final report due mid-June.
6. **Bagging trial** has been harvested and fruit rated. The fruit from the black bag ripened quicker and much more evenly, however fruit colour was poorer under the black bags. Ian Simpson who ripens and distributes his own fruit, said the even ripening was a benefit as fruit did not need to re-sorted before dispatch each morning and it may could also mean holding fruit in his ripening rooms for one day less. Some consistency with bag colouring would be very useful. Possibly heavy red bags for winter would be suitable. The remainder of the data is being analysed and it will be written up for the final report of the NDEP. Follow up trials from this work would fit well with the new extension project.
7. **Disaster relief scheme** for the east coast low on 1/6/16 has been announced. Applications need to be submitted by 8/5/17. Matt was informed by the NRAA that growers can use grant funds for fertiliser and props. Grants (up to $10,000) are paid on receipt of tax invoices from suppliers and growers are encouraged to contact the Rural Financial Counselling Service who can help with applications.
8. **The project MERI plan** was written, delivered and accepted by HIA

New items

National Banana Extension Project final report – write up on soil health work and banana bagging trial to be completed with the final report due end of April. Project final report draft is due by end of March. The new extension project will be written up as an RFP by Hort Innovation (Bianca Cairns) in the coming weeks. The RFP should come out later in February as an open procurement.

The EPA project final report and video detailing project outcomes is due end of June. Final report is one of three to be written before the end of the financial year.

IDO project final report – finalise supply chain mapping, industry survey, strategic plan – due end of June

- Supply Chain study – good understanding of Coffs/Nambucca supply chain, but less clear in the Tweed.
- Subtropical Banana Strategic Plan, will contract Jenny Margetts to help write the plan
- Propose to run it on Thursday 25 May after a field trial site visit at Duranbah. Coffs growers will have opportunity for input.

Rosie noted that a National Strategic Plan is currently being put together. Stephen feels that the Subtropical Plan needs to be put together first as a stand-alone plan, and then fitted in with the national plan.

Stephen requested the final report be sent to the PRG for comment prior to submission.

Action: Matt to send final report to PRG well prior to submission, for comment.

New IDO Project – Good support from Nambucca/other regions for the project. There is a high level of satisfaction with Matt's efforts. Alignment with the National Extension project will need to be ensured. Bianca raised the possibility of merging the IDO and National Extension projects. If two projects are contracted it will be important to make sure specific outcomes are clearly defined in each project. There was strong support amongst the PRG to have an IDO specific to the subtropics. Several committee members expressed concern of a risk that duties of the Subtropics IDO will get absorbed into a national program if all run under the National Extension Project.

Action: Matt and Tegan to discuss with Bianca the structure of the new national extension program.

BA16001 Improved Plant Protection for the Banana Industry. NSW DPI has been informed through DAF that it was successful with a 3 year component managing the subtropical varieties program of the project. Key points of note are;

- Matt will manage the program and David Peasley will continue in his current role. The project is expected to be contracted quite quickly
- The project now runs for 3 years and will focus on 3 key varieties (PKZ a Cavendish type, FLF a Ladyfinger replacement, and FHIA 17 as a dual purpose, cooking and fresh eating variety).
- Ripening and postharvest handling and consumer acceptance testing will be done as part of this project and conducted at the DPI facility at Ourimbah.
- Other new varieties will be included in the Panama disease race 1 testing site as they are released from quarantine.
- Included in the project is one day per week of salary for Matt until end 2019.
- None of the IPDM work for NSW was included in the final submission. This is of concern as it is expected there will be demands on Matt's time, particularly for the nematology work. Stephen commented that the IPDM component may still be funded in part, depending on outcomes of committee discussions.
- Paula Doran the ABGC communication manager visited the Duranbah site in January for a story on the progress as well as a story on Zack and Ethan McKeever, two new young growers from the Tweed. Stephen noted that Matthew had effectively taken on the subtropical banana communications role on top of his other project commitments after Luke Roberts contract was not extended.

The Banana Congress program is now close to final and notification on the program and associated events should go out shortly. The good news is that we have managed to get a science session into the congress, with 6 x 3 minute speed talks from researchers, plus a poster session. Most of the afternoon of the first day is dedicated to R&D. Committee members are keen to have young NSW growers attend.

A **Coffs Harbour young growers group** on Facebook Messenger has been established by Paul Shoker. Paul hosted the first BBQ for the growers on December 16 2016 and we hope to meet about every 3 months. There's a fair amount of lively chat on the group, with a good amount about bananas. A prize has been instigated, for the heaviest bunch that conforms to Coffs harbour show standards, for each of the Cav, Ladyfinger and Ducasse, of a free leaf test for the successful grower. Matt has been trying to build links between the Northern and Southern growers, but at this stage it is little more than providing contact details. There is potential for similar groups in the Tweed, or to incorporate with the Coffs group.

The **OEH Landuse mapping data** project draft report is available and a summary of the banana data was provided to committee members. Area under banana production in NSW 1453 ha, covering 507 plantations, average size is 5.3ha and there are 162 properties that have gone out of production since 2000. The project picked up a previously unknown (to DPI) farm at Taree. In the future LIDAR (a laser based remote sensing method) will be used which may enable distinguishing between Cavendish and Ladyfingers. Data from this project will be used to complete the industry survey.

Geraldine mentioned that the **Subtropical logo** is still in demand and requested approval to provide stickers to growers, which was supported. The ST sticker and management there of was undertaken to be managed by the current/future IDO, and data base/application form/complaint form are now in the hands of the IDO. A request has also been made to use the logo.

Action: Matt will work with Elisa King at Hort Innovation to make artwork available.

As this is the last PRG meeting Matt thanked the committee for their involvement and the support has helped the project to be the success that it is, noting that at almost all PRG meetings, the whole group, or a representative for the missing member had been present.

David and Stephen thanked Matt for his efforts.

Meeting finished at 4.40pm

Appendix 3: Example of IDO monthly report

Project Reference Group Monthly Report

Project activities April 2016 - Matt Weinert, NSW Banana Development Officer

Industry cohesion improved

1 Supply chain mapping interview Coffs Harbour

19 Supply chain mapping interview by telephone, ripener in Sydney

Linkages with banana levy programs and researchers improved

6 Panama disease discussion group, University of Queensland

7, 12, 13 Obtain planting permits and collect and distribute DPM25 tissue culture plants

Extension activities

7 Roadshow planning

8, 15, 18, 19 Edit nutrition booklet

20, 28 planning and press release for the Coffs harbour Panama Workshop

Other activities

1, 4, 14, 5, 28 EPA compost project trial planning and reporting

11 Met with environmental engineers and Anne Webster, Biosecurity NSW, conducting the Coffs harbour bypass environmental impact assessment about vehicle disinfestation

20, 21 Milestone 104 for IDO project

21, 21 Northern Rivers Food food tour guide

27, 28 report on BWB trials for Banana Plant Protection program final report

Future activities

3, 4 Nambucca and Coffs BGA meetings

4 Coffs Panama workshop

Continue industry survey and supply chain interviews

16-20 Leave

24-26 NSW DPI IDO workshop including project monitoring and evaluation workshop

Appendix 4: NSW Banana industry survey

NSW banana industry baseline survey 2015

Matthew Weinert, Industry Development Officer – Subtropical Bananas

November 2017

Introduction

The NSW banana industry has undergone significant changes in the past 15 years with many growers exiting the industry through, diversification into other crops, sale of properties, retirement and rural residential and urban encroachment.

Although small, at approximately 4% of the Australian industry, the NSW banana industry is strategically important as it provides a geographical spread for the Australian industry and a valuable source of fruit when cyclones reduce supply from north Queensland. To understand the NSW banana industry and ensure the industry remains viable, a survey to collect baseline data for the NSW industry was undertaken. Survey questions were developed in conjunction with the project reference group (PRG) for the HIA project, BA1400, the NSW banana industry development officer. Information collected included grower demographics, production statistics, preferred information delivery method and production constraints to develop strategies to ensure the viability of the industry.

The survey was conducted online and by telephone. A link to the online survey was sent to growers in June, July and August, removing email addresses that were no longer active and of growers who had completed the survey. New grower email addresses were added to the distribution list as they were obtained. Telephone surveys commenced on 29 June 2015 with the majority of surveys conducted during the evenings. The survey of the Nambucca, Coffs Harbour/Woolgoolga and Richmond production areas is complete and the survey of the Tweed production region is ongoing. It is expected the survey of the Tweed production area will be completed by the end of December 2015.

A copy of the survey questions is attached to this report as an appendix.

Baseline survey

As of 14 October 2015, survey results have been obtained from 75 growers. Response numbers from the different producing regions is: 11 from Nambucca, 9 from Richmond and 38 from Coffs Harbour/Woolgoolga and 17 from the Tweed. Growers in the Tweed Heads growing region have proven difficult to contact and the survey of this area is ongoing. Only 7 growers contacted across all production regions were unwilling to complete the survey.

As an incentive to complete the survey, a soil nutrient test was offered for one grower in each of the 4 banana production areas. As an extra incentive to complete the survey online, a full leaf nutrient analysis was offered to one grower. The winners of these tests will be drawn at random at the completion of the survey. Tests will be conducted through the NSW DPI Diagnostics and Analytical Services laboratory at Wollongbar.

Online responses

A total of 77 grower email addresses were collated from a series of databases provided to the NSW Banana IDO. Nineteen of these addresses were no longer active, highlighting the difficulty of maintaining grower contact databases. Of the remaining 58 addresses only one replied to say they no longer grow bananas. A further 11 email addresses were obtained from conversations with growers. In total 28 growers completed the online survey, however three of these responses were incomplete, including contact details, and the information collected was not used in the survey.

Telephone responses

Due to many growers not living on their farms and poor mobile coverage in many of the plantations these surveys were conducted during the evening, from 5.30-8.30pm. A significant proportion of growers do not know or have the production statistics requested by the survey on hand, requiring multiple telephone calls to complete the survey.

Mailed surveys

Three growers asked for a hard copy of the survey to be mailed to them so they could complete it manually, at the time of writing, despite repeat contact, none of these surveys had been completed and returned.

Grower contact details

A direct benefit of the survey is an updated grower contact database. Grower postal and email addresses and residential addresses were updated or confirmed. All growers contacted by telephone agreed that their contact details could be provided to the Australian Banana Growers Council. It is hoped that the high percentage of growers who have email address, 8/11 for Nambucca, 8/10 for the Richmond and 28/38 for Coffs harbour/Woolgoolga will increase the ease and ability for the banana IDO to communicate with the NSW banana industry.

Industry age profile

To collect the age profile of NSW banana growers, ages were aggregated into 10 year cohorts from 20 to over 70. The age profile of the industry shows a trend evident across rural industries, less growers and increasing grower age. The survey only asked for the age of the respondent not all employees of a business, therefore the age distribution of the growers may not be completely indicative of the NSW banana industry. Several businesses are family partnerships with sons taking a greater role within the family business.

Although only comprising 10% of the industry, growers less than 30 years old, are present in the Nambucca and Coffs Harbour/Woolgoolga regions.

Table 1. Grower age distribution by production region

Age cohorts	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
20-30	1	0	4	
30-40	0	0	2	
40-50	2	0	11	
50-60	4	4	15	
60-70	4	4	4	
Over 70	0	1	2	
Total growers	11	8	39	

Grower gender and business structure

Overwhelmingly, banana growers in NSW are male, indicative of the nature of the work. Only three female growers were identified during the survey, however 26 of the businesses surveyed were husband and wife partnerships and eight were family partnerships, indicating that women are more involved in than the question response allowed.

Table 2. Gender and business structure by production region

	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
Gender				
Male	11	7	37	
Female			2	
Both		1		
Business structure				
Husband and wife partnership	2	4	20	
Family partnership	1	1	8	
Sole trader	8	3	11	

Variety, area grown and production

Although Cavendish remains the major variety grown in the three completed regions (Table 3), plantings of alternate varieties, particularly Ladyfinger and Ducasse, are increasing. Both these varieties are susceptible to race 1 Panama disease. Panama disease is caused by the fungus *Fusarium oxysporum* f.sp. *cubense* and race 1 is widespread in the Tweed and Richmond production areas, has limited distribution around Coffs Harbour/Woolgoolga and has not been recorded in the Nambucca region. Growers however need to remain vigilant and follow strict on farm biosecurity protocols and ensure they source clean planting material, as race 1 Panama is slowly spreading around in the Coffs Harbour/Woolgoolga region with three new records of the disease in the last 12 months. Coffs Harbour/Woolgoolga has the greatest number of growers with two or more varieties with 14 of the 39 growers contacted growing two varieties, four growing three varieties and one grower growing four different varieties.

Production statistics are indicative only as a significant proportion of growers surveyed were unsure of or guessed their production statistics, many referring to numbers of cartons produced per year or an average per week. Carton figures were then converted to t/ha based on the carton types growers packed.

Total plantings of Cavendish are 234.2ha (Table 3) for the three completed regions. Planting sizes vary across these regions although average planting is almost the same for each region. Average yield varies across the regions with the lowest being 12t/ha in the Nambucca region, followed by 14t/ha in the Richmond and 15.9t/ha in the Coffs Harbour/Woolgoolga region.

Ladyfinger is the second most planted variety with 116.6 hectares in total planted across the three completed regions. The spread of race 1 Panama disease in the Tweed production region accounts for the increase in Ladyfinger plantings around Coffs Harbour/Woolgoolga. Production statistics for both traditional or tall Ladyfinger and the dwarf or Rossi Ladyfinger have been added together in table 3. Average yields for the two varieties, data not shown, suggest that the Rossi Ladyfinger out yields traditional Ladyfinger 10t/ha to 8.1t/ha. Rossi Ladyfinger is also easier to manage than the traditional Ladyfinger variety and, being shorter, has greater wind resistance also.

Ducasse is the third most planted variety with 51.8 hectares planted across the three completed regions. Ducasse is also susceptible to race 1 Panama disease and the limited distribution of this disease in the Coffs Harbour/Woolgoolga region and absence in the Nambucca region account for these plantings. Avergae yileds were much higher in the Nambucca region, 16.25t\ha than in the Coffs Harbour/Woolgoolga region, 9.1t/ha, in part because of new plantings just coming into production.

Smaller plantings of other varieties include Gold finger and some plantains. One grower in the Nambucca region grows bananas only for leaves, which are marketed in Sydney and Melbourne.

Table 3. Variety, area grown and production statistics by production region

	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
Cavendish				
Total area (ha)	48.4	48	137.8	
High (ha)	10	13	15	
Low (ha)	2	1	1	
Average area (ha)	6.05	6	5.9	
Yield (t)[1]	388.8	672	1857.9	
Av. yield (t/ha)[1]	12	14	15.9	
Lady Finger (includes Rossi dwarf ladyfinger)				
Total area	5.2[2]	2.4	109	
High	5.2	1.6	28	
Low		0.4	0.2	
Average	5.2	0.8	4.2	
Yield (t)		12	836.8	
Av. yield (t/ha)		5	9.1	
Ducasse				
Total area (Ha)	16.4	0.2[4]	35.2	
High	11.2		12	
Low	0.4		0.4	
Average	4.1		2.71	
Yield (t)	245		154.2	
Av. yield (t/ha)	16.25		9.1	
Other varieties (includes Goldfinger and plantains)				
Total area (ha)	1.6[3]		1.36	
High (ha)	1.6		0.8	
Low (ha)	1.6		0.16	
Average (ha)	1.6		0.45	
Yield (t)			32	

Av. yield (t/Ha)			10.6	

[1] area with yield data equals 32.4 ha, [2] area yet to come into production, [3] grower sells leaves only, not fruit, [4]no yield data

Employment statistics

A total of 143.6 people are directly employed in growing bananas in the three completed regions. Where a person was employed part time this was converted into a proportion of a full time employee. The majority of businesses use mainly family labour with 34.1 people from outside of the family business employed.

Table 4. Full time equivalent staff and employees other than family by production region

	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
Full time employees	21.5	16.2	72.1	
Employees other than family	6.7	7	20.4	
Total employees	27.9	23.2	92.5	

Grower planting intention

The NSW banana industry has seen a significant decline in growers over the last 15 years. Growers were asked if they intended to increase, maintain or decrease their plantings in the future. In two of the three completed regions, Nambucca and Coffs Harbour/Woolgoolga, the number of grower intending to or increasing plantings outweighed the number of growers reducing plantings, indicating that growers and particularly young growers do see a future in the industry.

Table 5. Grower planting intention by production region

	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
increasing	5	2	9	
maintaining	5	3	21	
decreasing	1	3	8	

Irrigation

Access to irrigation offers growers the opportunity to increase productivity, particularly during periods of little rain or extend supply throughout the year. Irrigation also offers the potential for better nutrient use efficiency, particularly through fertigation. The intent of this question was to determine the utility of irrigation workshops or information packages for the NSW banana industry. A minority of growers have access to irrigation however these don't appear worthwhile.

Table 6. Irrigation availability by production region

	Nambucca	Richmond	Coffs/Woolgoolga	Tweed
irrigate	3	5	10	
don't irrigate	8	3	28	

Production issues

Growers were asked to list, from most to least important, their three major production constraints. The information collected will form the basis of training workshops and information products developed during the life of the project.

In all three completed production regions banana weevil was the major productivity constraint. This justifies the emphasis by the NSW banana IDO on developing and optimising new technologies for banana weevil control during the first 12 months of the project.

The second biggest production constraint was weather events. This category includes east coast lows, hail storms, severe winds and drought. Although nothing can be done to stop these events, information on

preparedness and recovery from tropical cyclones, learned by the north Queensland banana industry may be of benefit to the NSW industry. With periods of dry weather also of concern to some growers it may also be worthwhile to provide information resources or training opportunities for growers with access to irrigation to optimise their systems.

A range of pests and disease were also listed as production constraints. Several of these, thrips, mites and scab moth, are the subject of research currently being undertaken in north Queensland and the results of this research will be presented to NSW growers when complete. Nematodes were also identified as a constraint by some growers and an information package, including identification and management, in currently being produced as part of the National Banana Extension Project.

Input costs were also identified as a production constraint. Further questioning identified these as fertilisers, pest and disease management chemicals including herbicides and props. A nutrition workshop has been run as part of the banana IDO project and a subtropical banana nutrition booklet is currently being written. Many NSW growers do not regularly conduct leaf and soil analyses to monitor and plan nutrient applications and the lack of a local, independent laboratory was identified as an impediment to this. This and a significant amount of growers not being able to provide information on yearly production, suggest an emphasis on farm benchmarking may be of use to the NSW industry.

Figure 1. Production constraints for the Nambucca production region

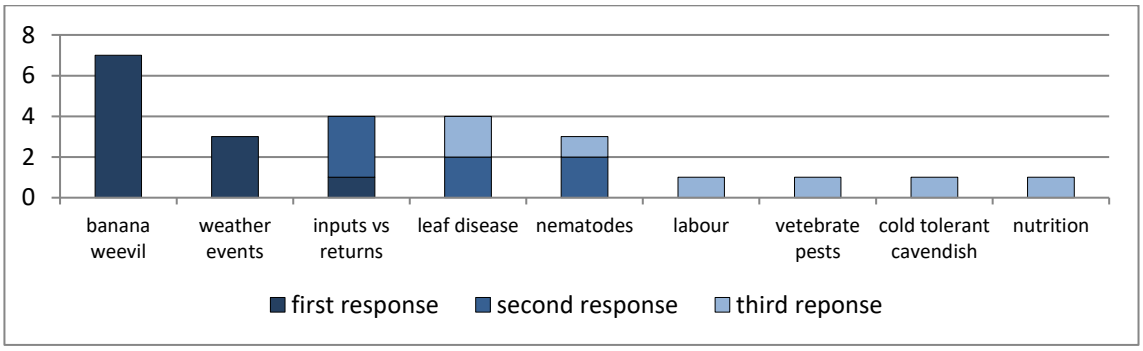


Figure 2. Production constraints for the Richmond production region

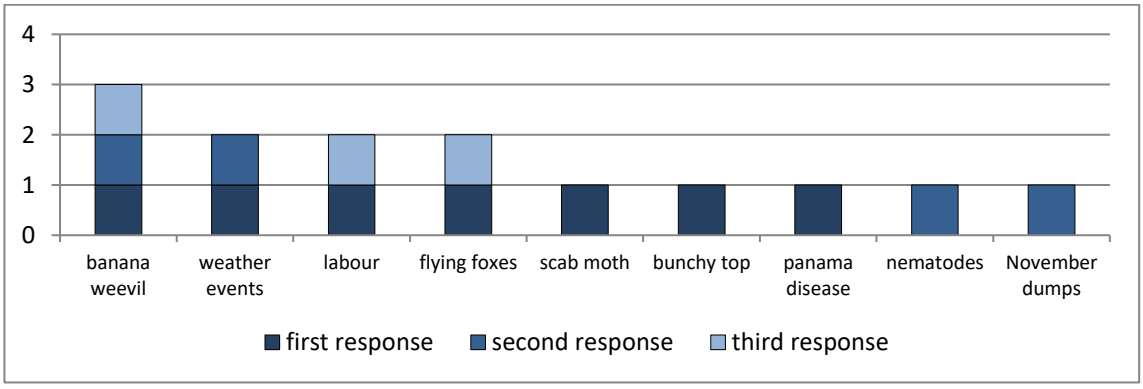
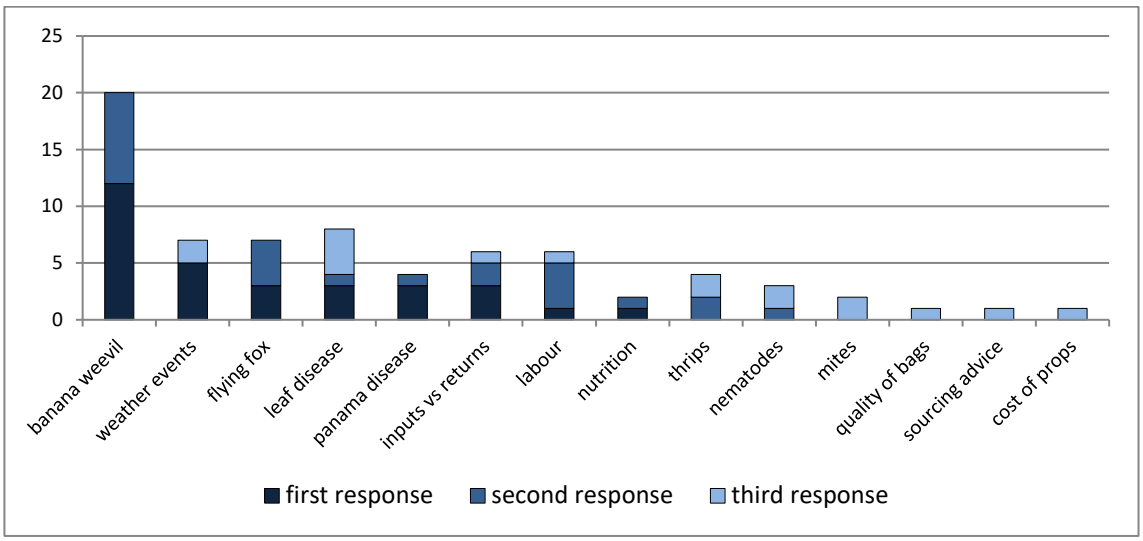


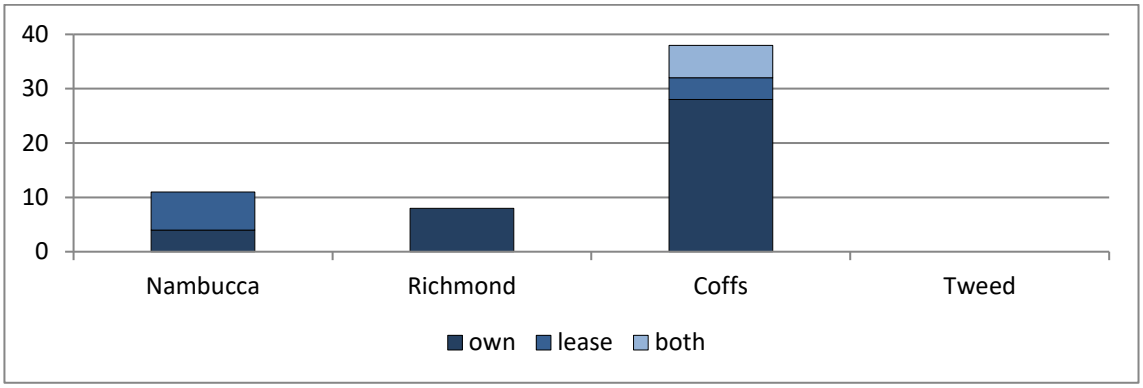
Figure 3. Production constraints for the Coffs Harbour/Woolgoolga production region



Plantation tenure

The majority of NSW growers own their plantations, with all growers in the Richmond region owning their plantation. Seven out of 11 Nambucca growers lease their plantations. In the Coffs region six growers use a combination of owned and leased plantations and four growers lease their plantations, with 29 growers owning their plantations outright. Several younger growers surveyed said that leasing an existing plantation is a way for them to enter the industry without significant capital resources or outlay.

Figure 4. Plantation tenure by production region



NSW banana supply chains

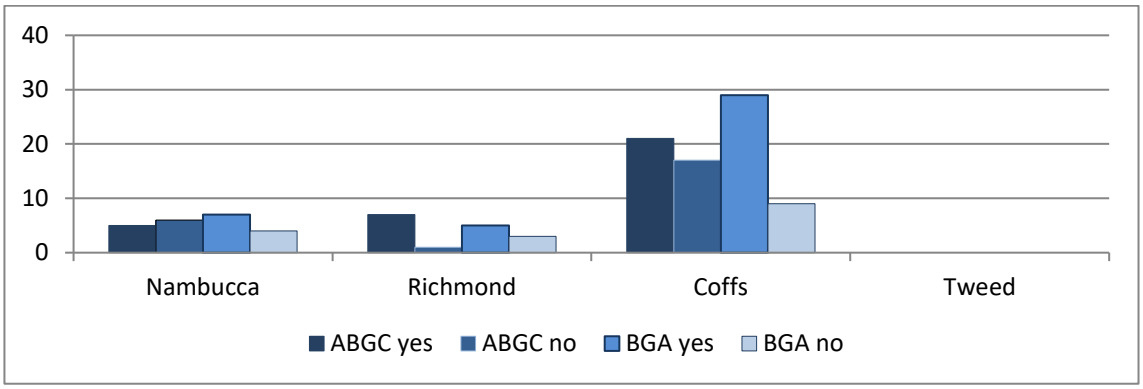
A detailed analysis of the NSW banana supply chain will be presented in milestone MS104 due 30/04/2016. Information collected during this survey shows a mix of distribution channels, particularly for Cavendish where fruit is sold to central markets, local ripeners, direct marketed and through farmer's markets. The supply chains for ladyfinger and Ducasse are generally simpler with the majority of fruit sent through central markets or to local ripeners.

Industry organisation membership

The survey asked growers about membership of industry organisations including the Australian Banana Grower's Association and either of the local NSW Banana Growers Associations (BGA). Grower reported membership of the Australian Banana Growers council is in the majority in the Richmond and Coffs Harbour/Woolgoolga production area, but in the minority in the Nambucca region. Despite 21 growers in the Coffs Harbour region saying they were members of ABGC, discussions with the ABGC indicate the figure is less than this. It is assumed that growers believe that if they pay levies they are ABGC members, which is not the case. Further education with growers in the Coffs region needs to be undertaken to explain the levy and fee process.

The local banana grower's organisations are also seen as a benefit as the majority of growers in each region said they were members. This may not be the case for the Richmond region where the majority of growers said they were members of the local BGA even though the BGA is not active.

Figure 5. Industry body membership by production region



Information delivery

Growers were asked to rank their preferred method of information delivery for growing information or industry issues in order of preference, for the seven options presented. Not all growers ranked or use all seven options.

When the top three preferred methods are added together, the post is the preferred method of information delivery in all three completed regions. During telephone surveys, a large number of growers commented that they prefer to read hardcopy materials instead of reading them on a screen.

Email is an important information delivery method in Nambucca, where it is the preferred first choice and Coffs Harbour/Woolgoolga. Current email addresses for 8/11 Nambucca growers, 8/10 Richmond growers and 31/39 Coffs Harbour/Woolgoolga growers were collected during the survey.

Workshops and word of mouth also rated highly when results from all responses were added together. With a push towards digital delivery of information the small number of growers and the ranking of their responses for the Australian Banana Growers Council website and even fewer growers who preferred government department websites is concerning. A strategy to overcome this would be to run training sessions at workshops or growers association meetings.

Figure 6. Preferred information delivery method for the Nambucca production region

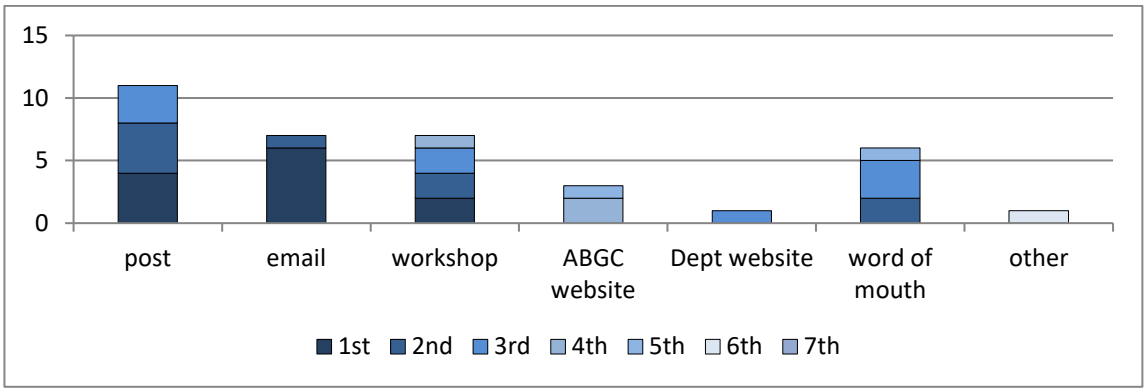


Figure 7. Preferred information delivery method for the Richmond production region

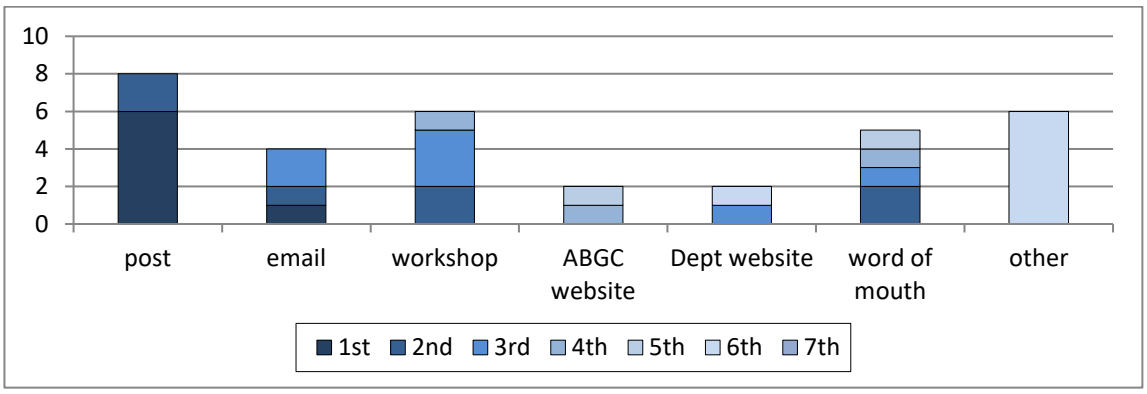
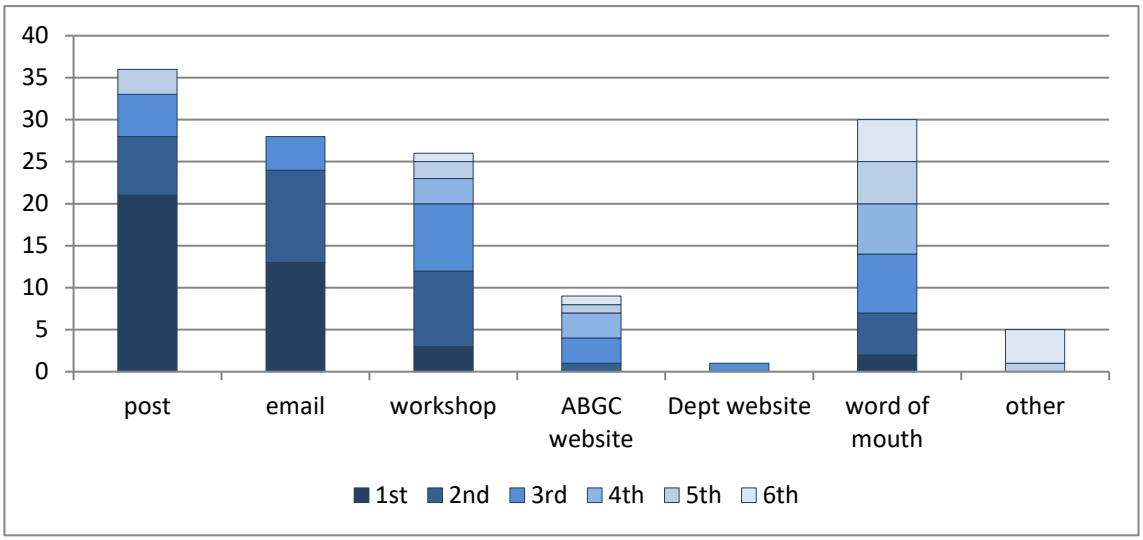


Figure 8. Preferred information delivery method for the Coffs Harbour/Woolgoolga production region



Summary

The information in this report provides a snapshot of the NSW banana industry in 2015. Although the industry may decline further, there is clear evidence of young growers entering the industry and increased plantings in all regions.

The number of growing producing varieties other than Cavendish, particularly in the Coffs Harbour/Woolgoolga and Nambucca regions, indicates the importance of test plantings of alternate varieties from the Banana Plant Protection Program. Cavendish is still important in each region and test plantings on grower farms of more cold tolerant Cavendish varieties are also needed.

The list of production constraints provides clear future priorities for research and development (R&D) for the NSW industry and the preferred information delivery method and form in which the R&D outcomes need to be delivered to reinvigorate the NSW banana industry.

More information

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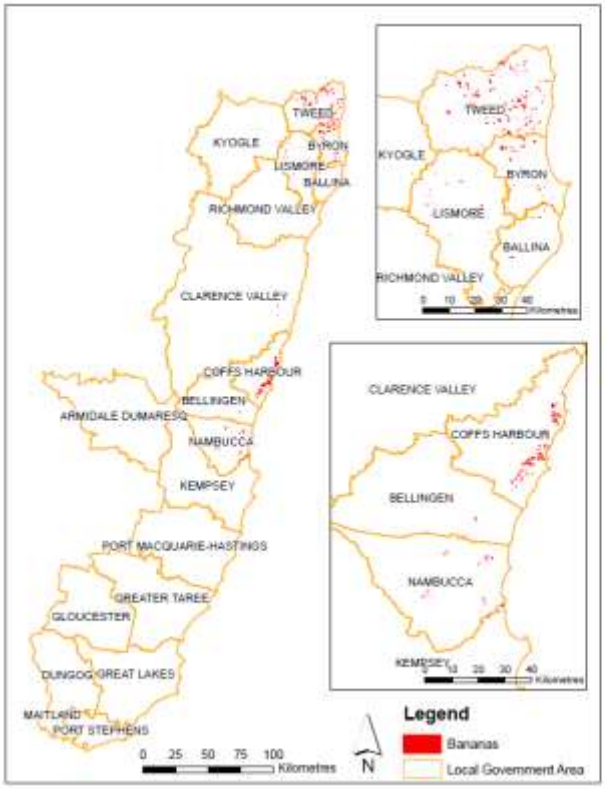
Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (November 2017). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser.

Published by the Department of Primary Industries.

Appendix 5: Department of Environment and heritage mapping project summary

Banana Plantations in NSW



Local Government Area	Number of Properties	Area ha
Tweed Shire	134	595
Coffs Harbour	111	508
Byron	32	130
Nambucca	17	79
Lismore	22	52
Ballina	14	41
Kempsey	8	24
Bellingen	1	12
Clarence Valley	3	9
Mid Coast (Taree)	1	3
Kyogle	2	0.5

Total Area of Production 1453 Hectares

507 Plantations mapped

344 Properties based on NSW GURAS* Property Layer

267 Properties with plantation size 0.5 hectares or greater

Largest Property 66.8 Hectares

Average size of plantation 5.3 Heactares (mapped plantations >0.5ha)

Additional 162 areas where it is likely that bananas have been grown on a commercial scale since 2000 but are no longer in production

Currency of mapped plantations 16/09/2014 - 11/08/2016 based on best available imagery - NSW Land and Property Information, Nearmap, Google Earth and extensive field validation

Mapped as part of the Horticultural Mapping for Biosecurity Matters Project
Joint venture between NSW Office of Environment & Heritage (OEH)
and Australian Bureau of Agricultural and
Resource Economics and Sciences (ABARES)

*GURAS - Geocoded Urban and Rural Addressing System. NSW Land and Property Information.
GURAS Property Layer combines Lot and Deposited Plans under single ownership into a property layer.

Appendix 6: NSW banana industry supply chain mapping

NSW banana industry supply chain mapping

Market destination

As part of the industry survey growers were asked how and where they marketed their fruit. As the industry survey was not completed, possibly because the growers found it too detailed or growers were not willing to provide the information, the supply chain mapping was also not completed. The data collected however does give a very good indication of where approximately 50% of NSW fruit is marketed. Results of the survey are listed in table 1 and a diagrammatic representation of the NSW banana supply chain is presented in figure 1.

Central markets in Sydney and Melbourne and to a lesser extent Brisbane remain an important destination for NSW fruit with 45% of growers from Nambucca growers, 50% of Richmond growers, and 36% of Coffs Harbour growers selling 90% or more of their fruit to central markets.

Local ripener wholesalers are the next biggest destination for fruit with 18% of Nambucca growers, 50% of Richmond growers and 26% of Coffs harbour growers selling their fruit this way. Direct marketing, into retail stores also occurs with 18% of Nambucca growers, 25% of Richmond growers and 5% of Coffs Harbour growers direct marketing.

Table 1. Market destination for NSW bananas from the Nambucca, Richmond and Coffs Harbour regions.

Region	Central Market		Local Ripener		Direct Market		Farmer's Market		Other	
	No. growers	% fruit	No. growers	% fruit	No. growers	% fruit	No. growers	% fruit	No. growers	% fruit
Nambucca	4	100	2	100	2	100	1	70	1	5
	1	95			1	30				
Richmond	2	100	1	100	1	100	1	10		
			1	90	1	70	1	30		
Coffs Harbour	12	100	9	100	2	100	1	80	1	15
	1	95	1	90	1	60	1	75		
	1	90	2	70	1	10	1	10		
			1	50			1	5		
			1	30						
			1	25						
			1	20						

Farmer's markets are often presented as a large outlet for NSW fruit however in the regions surveyed only 13% of growers said they marketed fruit through farmer's markets with 5% responding that they marketed 70-80% this way. The remaining 8% of growers marketed 30% or less of their fruit this way. The amount of fruit sold through farmer's markets is however thought to be much higher than this figure. For the Tweed region 45% of fruit was sold locally in a survey done by the industry in 2007 and it is expected that this level has increased significantly since then. An internet search identified 28 weekly farmer's markets in the region from the Gold Coast to Alstonville and NSW growers are known to sell their fruit from the Sunshine Coast to Newcastle.

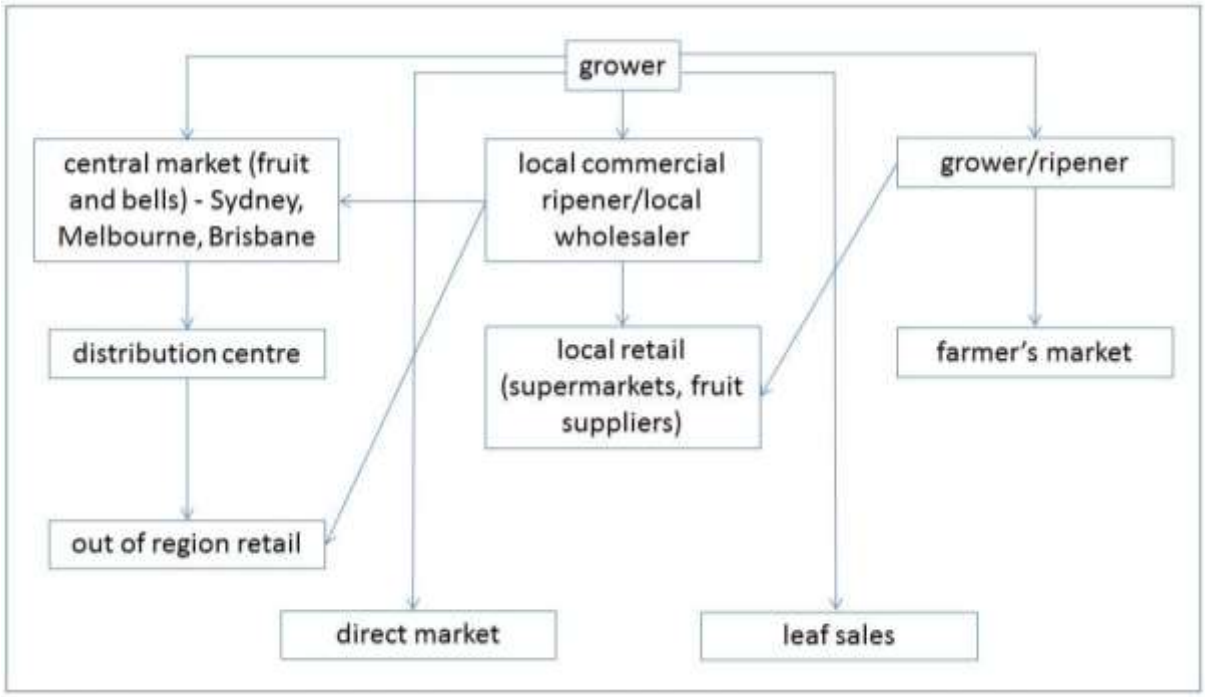


Figure 1. Diagrammatic representation of the NSW banana supply chain.

Juice bars, cafes and restaurants were the other way in which growers marketed their fruit. Of interest was one grower in the Nambucca region who sold only leaves through the central market in Sydney. Flower bells, particularly of the variety Ducasse were also mentioned by growers as a product they sold through central markets, however no data was collected on this.

Wholesaler interviews

Interviews were also conducted with a ripener/wholesaler in Coffs Harbour who sells both Cavendish and Lady Finger fruit, a grower/ripener from the Richmond region who sells only Cavendish and a ripener/wholesaler from Sydney who only sells Lady Finger fruit.

There was a definite demand for the small sweeter fruit produced in NSW, however a lack of consistency in supply volumes, especially through the winter months, was the key issue for both wholesalers interviewed. The Cavendish wholesalers had been forced to buy fruit from Bundaberg or the Brisbane central markets to ensure supplies of subtropical bananas to their retail outlets.

Seasonal variability in fruit quality of Cavendish fruit, particularly underpeel chilling sometimes made it difficult to sell NSW fruit into retail outlets as customers were reluctant to purchase the dull fruit. Uneven ripening of Cavendish fruit was an issue in both regions surveyed, with the Richmond grower/ripener forced to resort fruit each morning before dispatch to ensure his fruit met supermarket specifications.

Fruit quality of Lady Fingers from NSW was generally higher than that from north Queensland. Better quality fruit, described as unmarked and straight, was packed into whole hand packs which generally returned higher prices at market. Bent or marked fruit is packed into clusters with harvest damage and bird and bat scratches on the inner whorl the biggest issues with marking.

Table 2: Characteristics of fruit from plants that bunch during each season.

Bunch emergence	Fruit characteristics
Summer	Best fruit and greatest supply, essential for growers to bag on time
Autumn	Transitional fruit, hangs longest, requires early bagging
Winter	Best taste, however poor fruit colour, susceptible to ethylene damage at ripening
Spring	Issues with mixed ripe fruit, bacterial rots, cigar end and sap stain on the fruit

Table 3: Seasonal fruit defects of NSW banana fruit

Fruit harvested	Fruit defects
Summer	Double fruit
Autumn	Rust thrips, maturity bronzing
Winter	Underpeel discolouration, corky scab
Spring	Crown rot, thrips and spider mite damage

Packing fruit to specification was also mentioned as an issue in the Coffs Harbour region. Growers were sometimes unaware of what had caused a fruit quality issue or had didn't understand how fruit defects, not visible at packing became more visible during the ripening process.

Conclusion and recommendations

The NSW banana supply chain differs significantly from that in other states. Less than half of the growers market their fruit through central markets, however overall these markets still take the largest volumes of fruit with and local wholesalers or grower/wholesalers the next biggest proportion. Farmer's markets are an important outlet for fruit with 13% of growers from the Coffs region marketing the majority of their fruit through farmer's markets in the regions surveyed, however it is expected that this proportion is much higher especially in the Tweed. One grower who did not want to complete the one-on-one survey said he didn't want to share the information on where he sold his fruit as he feared other growers would come and compete and drive his prices down. These markets also provide an outlet for smaller and second grade fruit.

All of those interviewed said there is a definite segment in the NSW market for subtropical banana fruit. Encouraging new, young growers into the industry increasing supply volumes and fruit quality during winter and spring should be a priority. If new varieties were to be part of the solution all felt that these varieties should fit into the already established retail categories.

There is sometimes confusion over the cause of fruit downgraded at wholesale level and one of the wholesalers suggested running workshops on packed product analysis, where boxes of green and ripe fruit are anonymously unpacked to identify the cause of the downgrade and demonstrate this to growers.

Crown rot remains an issue and an extension effort, based on the outcomes of *BA13001: The cause and management of crown rot of banana* need to form part of any future subtropical banana extension project.

Information provided on the seasonal defects could provide the basis for a seasonal management calendar, aimed at young growers who are entering the industry.

Appendix 7: List of project workshops including date and topic

Nutrition

06/05/2015 Nutrition and BWB Woolgoolga

13/05/2015 Nutrition and BWB Tweed

23/06/16 Carnarvon Roadshow

New varieties

13/08/15 Duranbah field day and BWB lure trial

25/05/17 Duranbah field day

Mixed

9/12/15 Evening shed meeting Tullera

17/02/16 Tweed Soil health field day

Leaf spot

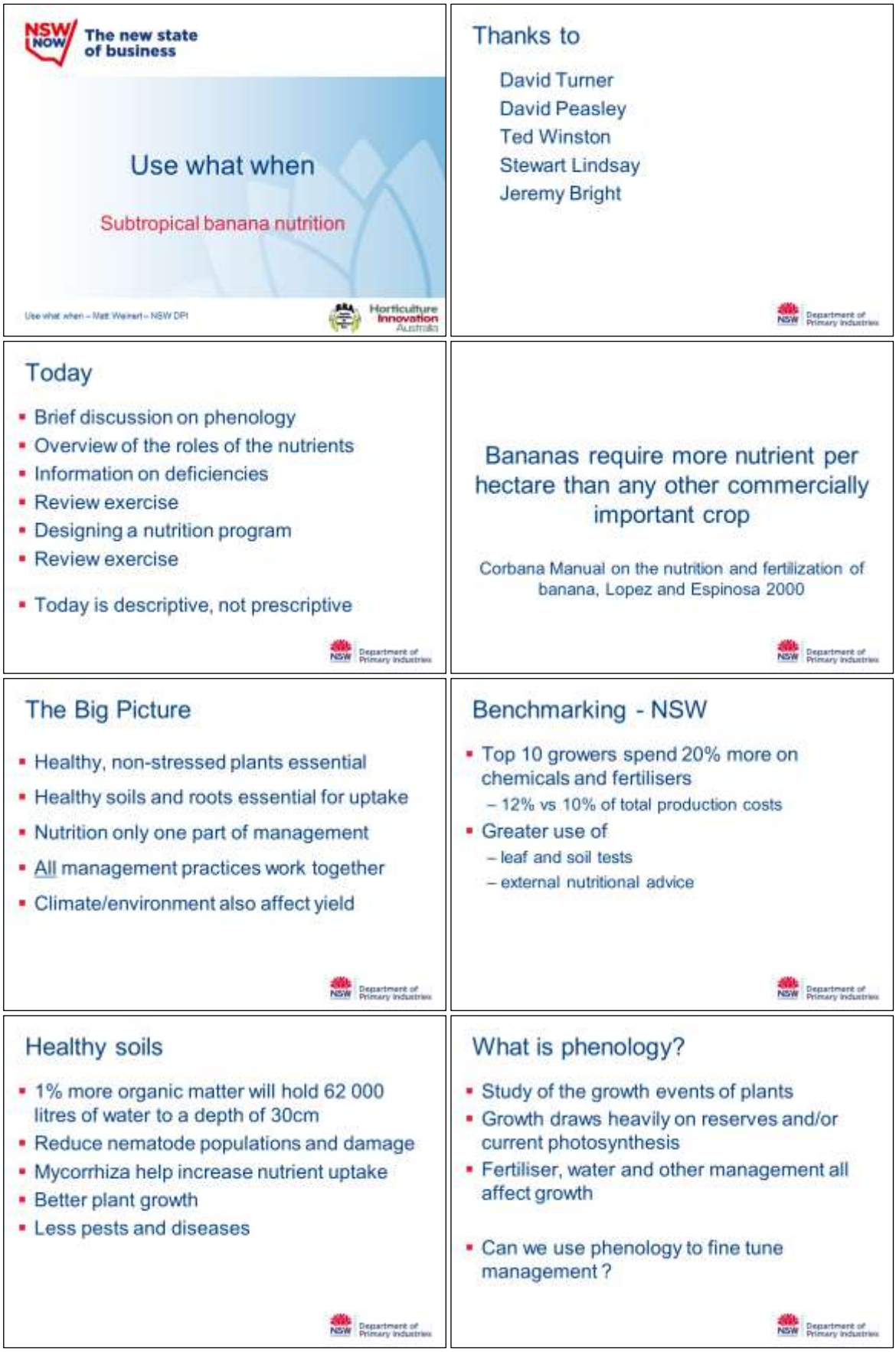
3/11/16 prior to Coffs Harbour BGA meeting.

Panama TR4

2/11/16 prior to the Coffs Harbour BGA

9/11/16 After the Tweed BGA meeting.

Appendix 8: Nutrition workshop content

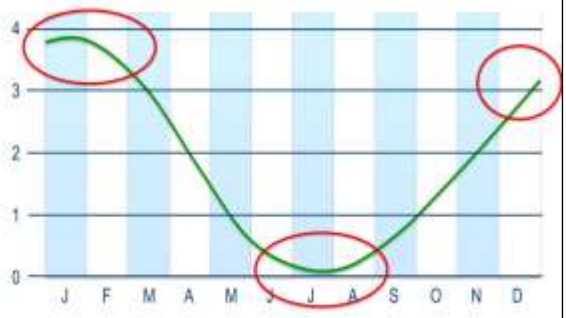


Major banana phenological events

- Leaf growth
- Root flush
- Flowering
- Fruit development

Department of Primary Industries

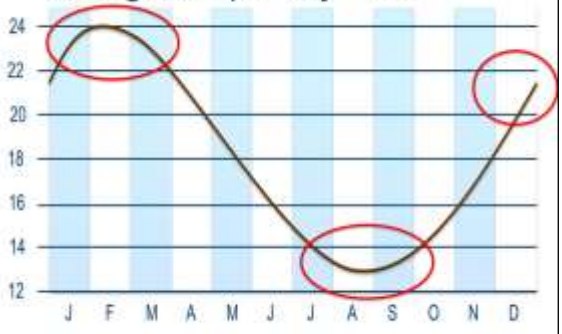
Monthly leaf emergence rate



Based on monthly temp averages Coffs Harbour

Department of Primary Industries

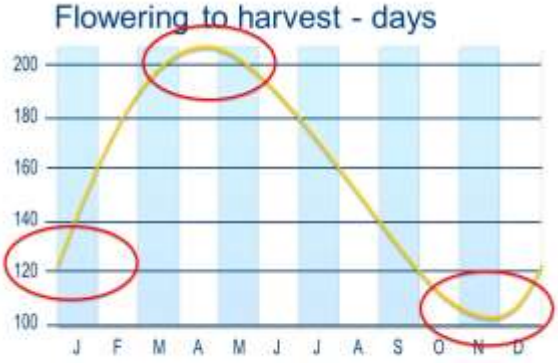
Root growth per day - mm



Based on monthly temp averages Coffs Harbour

Department of Primary Industries

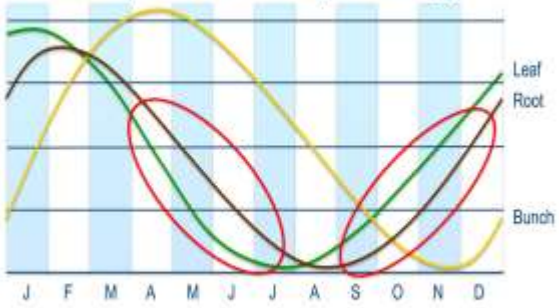
Flowering to harvest - days



Based on monthly temp averages Coffs Harbour

Department of Primary Industries

Subtropical banana phenology



Based on monthly temp averages Coffs Harbour

Department of Primary Industries

Phenology based management

- Intensify management when growth rates are highest
- Scale back when at their lowest

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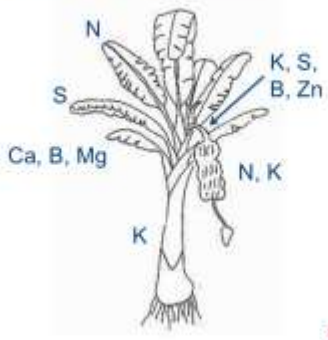
What element is where?



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POTASSIUM

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Potassium (K)

- The most important nutrient for bananas
- Most abundant cation in banana fruit
- Involved in;
  - photosynthesis
  - water regulation
  - movement of sugars from leaves to fruit
- Important for fruit size

Potassium

- Greatest need is during fruit development
- Very mobile in the soil and the plant
- Absorbed during later vegetative growth
- Reduced absorption after bunching
- K, Ca, Na, and Mg compete for uptake

Potassium deficiency

- Midrib curves to point towards plant base
- Orange-yellow colour of oldest leaves
- Rapid death of older leaves
- Reduced leaf area
- Slower cycling
- Reduced bunch size
  - fruit and hand size and number
  - 50% reduction in plant dry weight = 80% reduction in bunch size

NITROGEN

Nitrogen

- Affects all growth
- Nitrogen is a key part of;
  - plant proteins
  - chlorophyll
  - vitamins that increase root growth
- Nitrogen increases plant vigour and yield
- May influence levels of other nitrogen
  - rapid Spring growth and Ca

Nitrogen deficiencies

- Poor vegetative and reproductive growth
- Decreased defense against disease
- Reduces fruit size, yield and returns
- Slower sucker development

PHOSPHOROUS

Phosphorous uptake

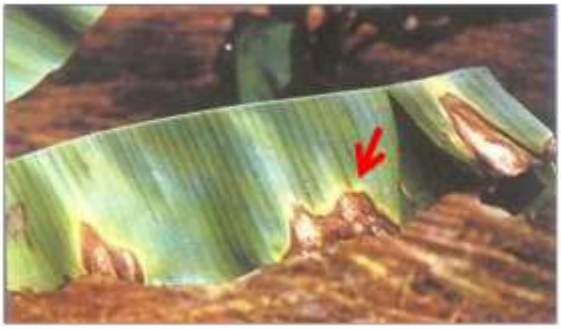
- Involved in;
  - root development and growth
  - energy metabolism in plant growth and maintenance
- Not very mobile in soil
- Redistributed in plant
- Most absorbed at plant crop then slowly during growth
- Soil tests not great indicator of availability

Phosphorous uptake

- Fixed in top few cm so easily lost to erosion
- Uptake increased by mycorrhiza
  - too much soil P and associations don't form
  - roots are then more susceptible to soil disease and nematodes

Phosphorous deficiency

- Purplish brown flecks in leaf margins
- Death of leaf edges
- Sawtooth appearance
- Leaves curl and petioles break
- Young leaves a bluish green colour



CALCIUM

Calcium (Ca)

- Strengthens cell walls (structural component)
  - may provide defense against pathogens
- Important during cell division
- Essential for root hair and leaf development
- Needed during all growth periods

Calcium (Ca)

- Does not readily move the plant
- Uptake is
  - passive
  - best by young roots and root tips
  - difficult to get into fruit from soil or leaf
- Uptake speed depends on particle size
- Outcompeted by other nutrients

Calcium deficiency

- Spike leaves – leaf blade deformed / absent
  - early summer after spring flush and high K applications
- Roots darken and rot in Ca deficient soils
  - can be confused with nematode damage
- Poor fruit quality
- Skin splitting

MAGNESIUM

Magnesium (Mg)

- Central molecule in chlorophyll
  - converts light to energy then sugars
- Regulates the uptake of other nutrients

Magnesium deficiency

- Yellowing of leaf margins
- Yellow areas may turn brown and die
- Bluish-purple petioles
- May increase leaf disease susceptibility

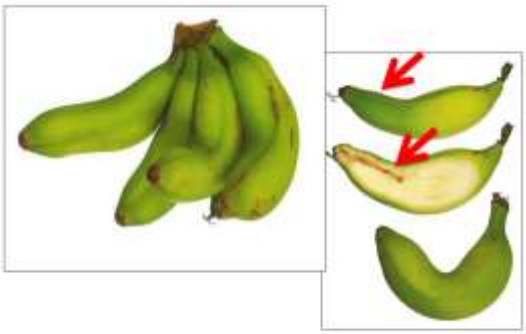
BORON

Boron (B)

- Necessary for all new cell growth
  - flowers and fruit particularly affected
- Important in cell walls
- Helps Ca work
- Affects hormone movement
- Mobile in the soil and but not in the plant
- Easy to go from deficiency to toxicity

Boron deficiency

- Yellow lines at right angles to veins
- Deformed leaves
  - may be confused with Ca deficiency
- Bunch deformities
- Deformed fruit
  - thinner at tip
  - hard brown core at tip



SULPHUR

Sulphur (S)

- Redistributed from old to new leaves
- Uptake between suckering and bunching
- Moves within the plant
  - fruit requirement comes from plant

Sulphur deficiency

- Yellowish white young leaves
- Necrotic patches on leaf edges
- Plants stunted and bunch is small or choked

ZINC

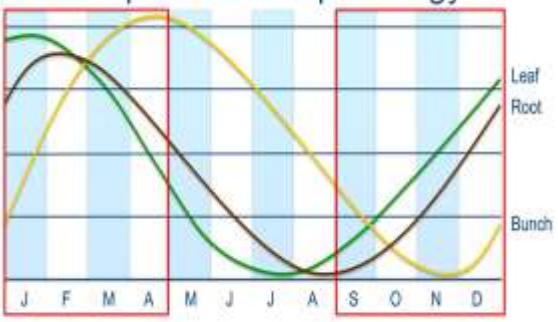
Zinc (Zn)

- Most important trace element
- Some movement within the plant to young leaves
- Important for leaf expansion and growth

Zinc deficiency

- Young leaves smaller, thinner and spear head shaped
- Emerging leaves are redder in colour
- Leaf has alternating white and green bands
  - can be confused with virus symptoms
- Fruit twisted, short and thin
- Reduces yield in follower

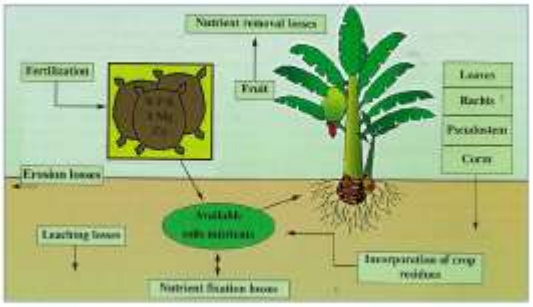
Subtropical banana phenology



DESIGNING A BANANA FERTILISER PROGRAM

'If you are not monitoring you are guessing'

Nutrient cycling



CORBANA manual, 2000

Nutrient recycled in banana

- Parent plant can supply up to 40% of nutrient needed by sucker over 10 weeks

Nutrient	Kg in fruit	Kg in mother	% Recycled
Potassium	15.56	28.76	46
Nitrogen	3.78	7.76	51
Calcium	2.02	3.16	64
Magnesium	0.98	1.52	64
Zinc	0.05	0.08	63

per tonne of fruit removed per hectare

Banana crop management

- Match application to demand
- Reduce stress during key times
  - nutrition, irrigation, pests and diseases
- Supply critical elements at growth stages
- Replace removed nutrients
  - small vs big crops

Determining right nutrient & rate

- Results of leaf and soil tests
- Soil type
- Yield
  - how much nutrition was removed by the crop
- Fertilizer uptake efficiency and/or losses
  - how much was leached, volatilised or tied up?
- Past records

Nutrient loss

- Nutrients are lost through;
  - Fruit removal
  - Leaching
  - Volatilization
  - Fixation

How much is removed/tonne of fruit

Nutrient	Kg removed	Fertilizer equivalent (kg)
Potassium (K)	15.6	36 pot sulphate
Nitrogen (N)	3.8	8.25 urea
Phosphorous (P)	0.6	11.4 superphosphate
Calcium (Ca)	2	9 gypsum
Magnesium (Mg)	1	2 Granomag
Boron (B)	0.14	0.7 Solubor
Zinc	0.01	0.0035g zinc sulphate
Sulphur	0.44	0.77 zinc sulphate

Nutrient loss

- N: 30 to 50+% through leaching & volatilisation
- B: up to 60% through by leaching
- Ca: 5 to 20% through soil erosion or run off
- K: 20 to 30% through leaching

Leaf nutrient standards

Nutrient	Unit	Optimum - Cavendish	Optimum – Lady Finger
Potassium (K)	%	3.0 - 4.0	2.4 - 3.2
Nitrogen (N)	%	3.0 - 4.0	2.4 - 3.2
Phosphorous (P)	%	0.19 - 0.25	0.15 - 0.2
Calcium (Ca)	%	0.74 - 1.25	0.74 - 1.25
Magnesium (Mg)	%	0.3 - 0.46	0.3 - 0.46
Boron (B)	mg/kg or ppm	10 - 20	10 - 20
Zinc	mg/kg or ppm	20 - 35	20 - 35
Sulphur	%	<0.27	deficient

Subtropical banana grower's handbook, 2004

Soil nutrient standards

Nutrient	Optimum
pH (1:5 water tested)	4.6 - 5.5
Potassium (K)	0.4 – 0.5 meq/100g
Phosphorous (P)	Podzol >70 mg/kg Kraznozem > 100mg/kg
Calcium (Ca)	4.0 – 10.0 meq/100g
Magnesium (Mg)	1.0 – 3.0 meq/100g
Conductivity	< 0.15 dS/m
Calcium:magnesium	3 – 5.1:1
Cation balance	Ca 75%; Mg 15%; K 6%; others 4%

Subtropical banana grower's handbook, 2004

Fertilizer by the handful

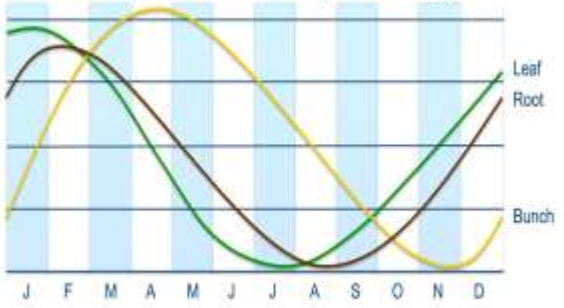
How much is a handful?

Fertilizer	Average of 6 people (g)	Weight range (g)
Urea	**16.6**	**11.3 – 22.5**
15-15-15	**34.1**	**28.8 – 53.34**

Right fertiliser placement

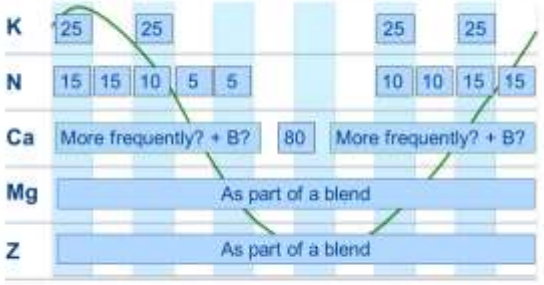
- Nutrients taken up by fine roots/root hairs – root hairs only active for about 3 weeks
- Where are most fine roots?
- Not next to pseudostem!
- Where is irrigation zone?
- Spread fertiliser evenly not in piles

Subtropical banana phenology

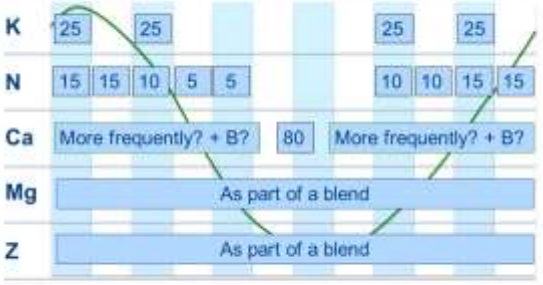


Based on monthly temp averages Coffs Harbour

Monthly nutrition calendar % of total



Monthly nutrition calendar % of total



But wait, there's more!

Due for release June 2016!

If you are not measuring, you are just guessing

Appendix 9: Leaf disease workshop content

NSW NOW The new state of business

Stop the spots and rots - banana leaf spot management

Horticulture Innovation Australia

Aknowledgements

Lynton Vawdrey
Stewart Lindsay
Tegan Kukulies
David Peasley
Chrys Akem

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Presentation outline

- Introduction
- Leaf disease identification and lifecycle
- Disease management options
  - Cultural
  - Chemical
  - Resistance management
- Integrated disease management

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What can we manage?

- Environment
  - over head sprinklers
  - planting density
- Host
  - Susceptibility to the diseases
  - nutrition
  - other stress?
- Disease
  - exclusion
  - inoculum reduction - deleafing
  - treatment – oil and fungicide sprays

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Disease management

- Reduce inoculum levels
- Protect the host
- Inhibit pathogen development

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Why manage leaf spots?

- Leaf spots
  - reduce yield 25-30%
  - complicate the ripening process
  - reduce postharvest quality

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Why manage leaf spots?

Leaves are similar to solar panels, they convert sunlight into energy, in the case of leaves it's sugars and solar panels it's electricity

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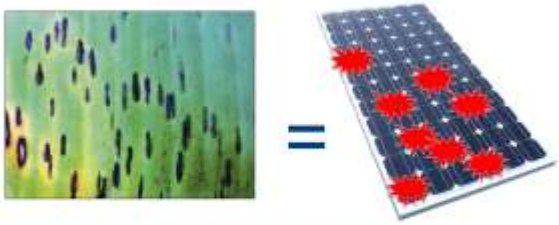
Why manage leaf spots?



Having bad leaf spot is like smashing cells in a solar panel, it reduces the ability to produce energy

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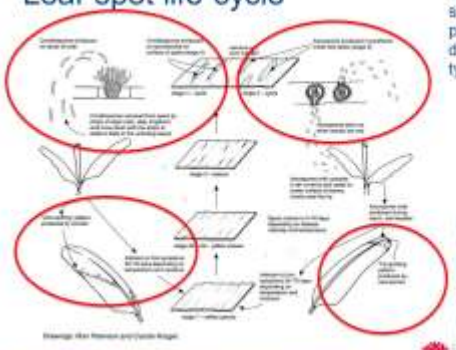
Leaf spot life cycle



Different leaf spot stages produce different spore types

Different spore types produce different disease patterns

Subtropical Banana Grower's Handbook, 2004

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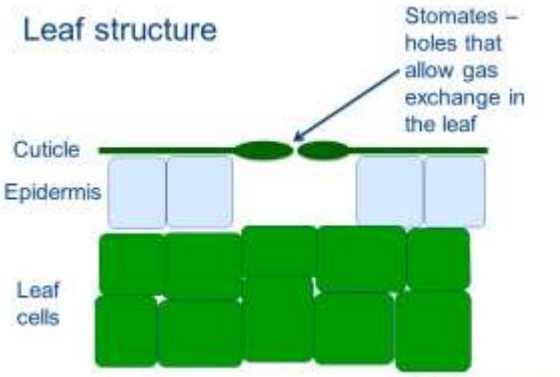
Leaf structure



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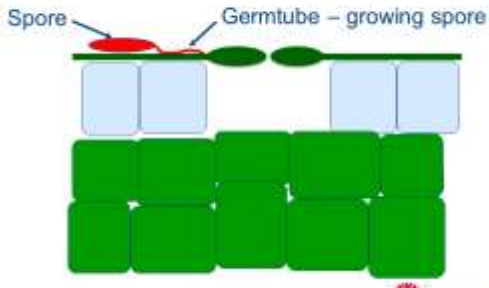
Spore lands on leaf and germinates in 24-48 hours



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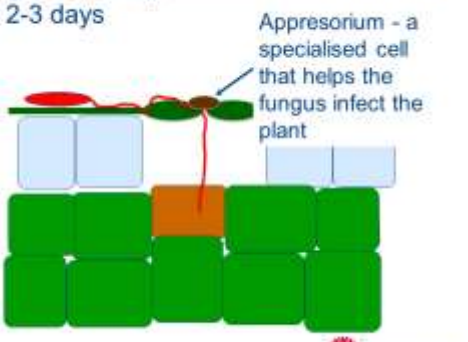
Spore forms and appresorium and infects the leaf in 2-3 days



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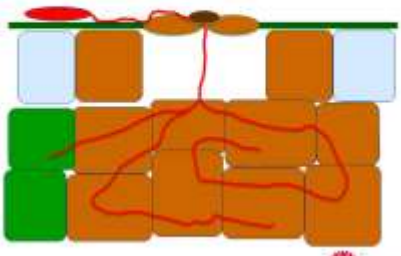
Fungi grows through plant cells killing them as it penetrates them and feeds



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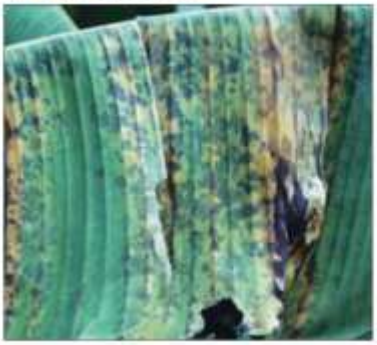
Leaf speckle



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Leaf underside

Spores produced in watery exudate

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Leaf (Mycosphaerella) speckle

- Caused by *Mycosphaerella musae* and other species
- Approximately 66 conidiophores produced per mm^2 of leaf spot
- Many conidia (spores) produced per conidiophore
- Spores produced mainly on leaf underside
- A problem in subtropical areas

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Leaf spot

Yellow Sigatoka

- Caused by *Mycosphaerella musicola*
- Reduces yields
  - up to 30% reduction
- Affects fruit physiology
  - premature ripening
  - complicates ripening process
- Reduces shelf life

Conidial infection

- Conidia form after rain or dew when minimum night temperatures are 18°C
- 30 000 conidia (spores) produced per lesion
- Spread by water to same leaf or nearby leaves
- Conidia germinate in 24-48 hours
- Infect leaves in 2-5 days
- Produce distinct line spotting infection pattern
- Can cause spotting right across leaves

Line spotting caused by conidial infection

Ascospore infection

- Ascospores forcibly ejected during wet weather or after heavy dews
- Greater numbers produced after rain follwoing dry conditions
- Leaves with fruiting bodies can eject spores for at least 16 weeks
- Conditions that favour plant growth favour disease

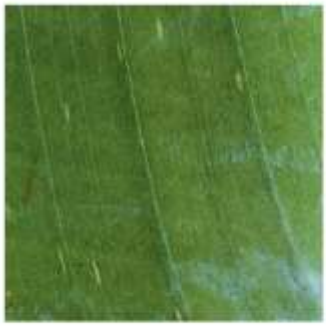
Ascospore infection

- Disease takes 11-105 days to develop
- Greater disease intensity results causes infection in younger leaves
- Tip spotting infection pattern on younger leaves
- Fruiting bodies can eject ascospores for 16 weeks
- Ascospores can spread disease 10-15km

Yellow Sigatoka terminology

Stage 1

Light green dots and dashes 1mm long

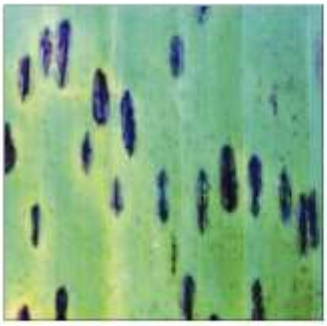


Stage 2

Light green (stage 2a) to rusty brown (stage 2b) streaks

Stage 3

Yellow to rusty brown lesions starting to widen



Stage 4

Brown to black lesions, some with a yellow halo

Conidia start to form

Stage 5

Dry, dead, greyish lesion centre with black margin

Ascopsores being produced

Cordana

- 2 species
  - *Cordana johnstonii and Cordana musae*
- Spores produced on leaf undersides
- Spread during wet windy weather
- More common on stressed plants

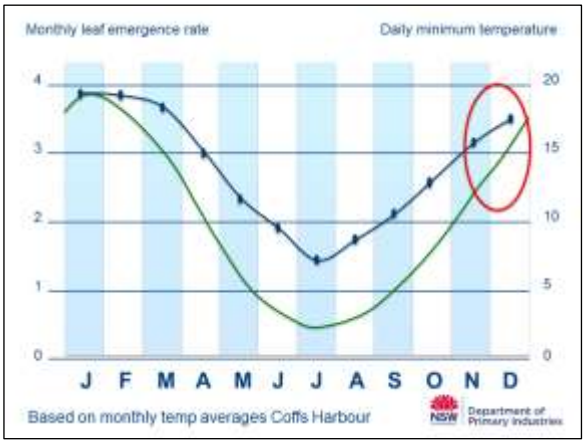
Deleafing

Why deleaf?

- Sprays only work in the early stages of disease
- Once a spot turns dark the chemicals won't work
- Spots develop to form a dead area that produces many spores
- Aim to have plantation clean heading into the warm and wet season

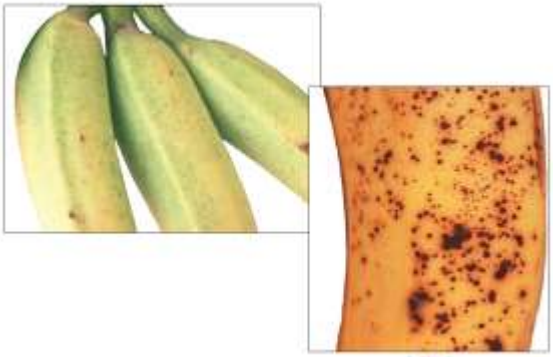
Deleafing

- Regular deleafing reduces spores in the plantation
- Less spores = less disease
- More inoculum = more infection = shorter lifecycle = more inoculum = etc etc
- Only remove the portions of the leaf with lesions
- Suckers can also have disease so deleaf as also
- Deleaf when leaves are being replaced



Fruit speckle

- Caused by several pathogens
  - *Colletotrichum musae, Fusarium oxysporum and Fusarium semitectum*
- Not caused by *Deightoniella*
- Found on dead leaves, bracts, flowers
  - spores discharged into air and infect fruit
  - older fruit less susceptible
- Significantly reduce fruit shelf life
- Thrips may increase speckle caused by *Fusarium*



A break?

Fungicides

FUNGICIDES SHOULD BE AIMED TO PROTECT NEW LEAVES

ALL FUNGICIDE SPRAYS MUST BE APPLIED TO A CLEAN CROP.

MAKE DE-LEAFING A PRIORITY TO ENSURE MAXIMUM EFFICACY OF SPRAYS OVER THE WET SEASON

ALL FRUIT SHOULD BE BAGGED PRIOR TO ANY SPRAY

Oils

- Don't really understand the mode of action
- Check fungicide label if compatible with oil
  - dithane, strobilurins, trizoles are
- Don't use oils when day temperatures are over 30°C
- Oils may manage leaf spot up to 2 weeks after infection
- Several products on the market
- High rates in winter used in organic systems in NQ

Fungicide types

- Mode of action
  - General – protectant
  - Specific - systemic
  - Chemical class
- Effect on the pathogen
  - Inhibit the pathogen
  - Kill the pathogen
- Movement in the plant
  - Systemic

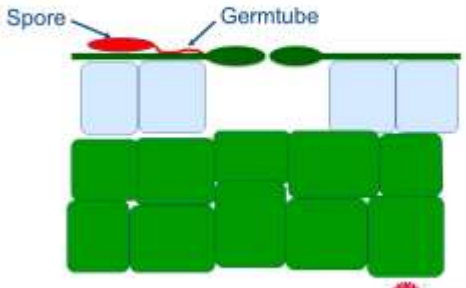
Protectant fungicides

- Protectant / Preventative / Contact
  - protect from infection
  - broad spectrum of activity
  - do not inhibit or eradicate established infections
  - no systemic activity
  - Limited resistance

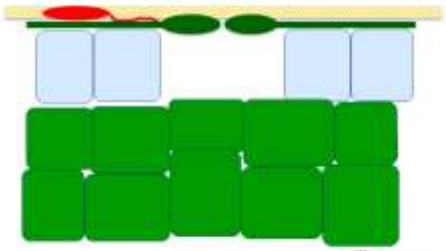
Copper, mancozeb, zineb, chlorothalonil

Protectant fungicides

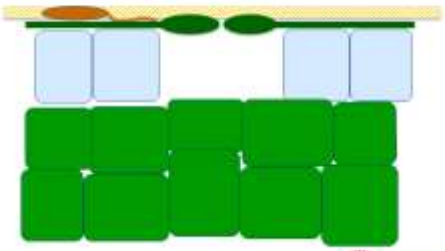
Group	Active	Trade name
M1	Copper	Liquipcop
M3	Mancozeb and Zineb	Dithane, Penncozeb, Zineb
M5	Chlorothalonil	Bravo, Whack, Unite



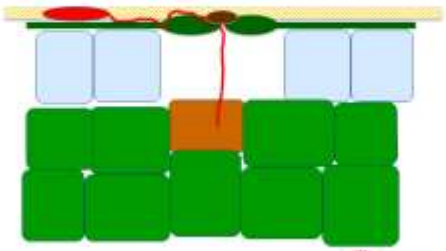
Protectant fungicides



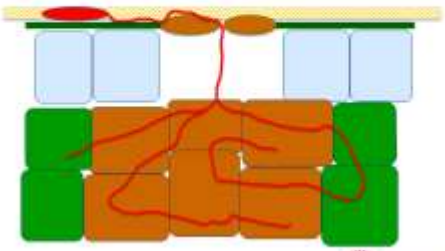
Protectant fungicides



Protectant fungicides



Protectant fungicides



Systemic fungicides

- Systemic
  - specific mode of action
  - inhibit the infection
  - broad range but specific mode of action
  - resistance can be a problem
- Target periods of high disease pressure
- Must be applied to a deleafed crop
- Do not work after stage 3

Trizoles, strobilurins, benzamides,pyrimidines

Systemic fungicides

Group	Active	Trade name
3	Difenconazole	Score, Digger, Ace
	Epoxiconazole	Opus, Soprano
	Fenbuconazole	Indar
	Propiconazole	Tilt, Bumper, Throttle
	Tebuconazole	Folicur, Hornet
9	Pyrimethanil	Siganex, Predict
11	Trifloxystrobin	Flint
	Pyraclostrobin	Cabrio
7	Fluopyram	Luna, Privilege

Fungicide resistance strategy

Group	Max applications/year	Max consecutive applications
3	5	2
9	5	2
11	4	Not allowed

If 2 group 9 sprays are used follow with the same number of other groups before using group 9 again

Apply 2 sprays of any other group between group 11 sprays

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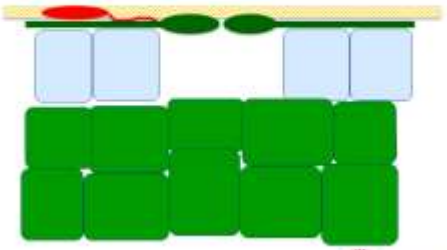
Systemic fungicides



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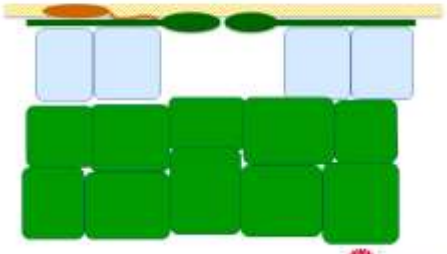
Systemic fungicides



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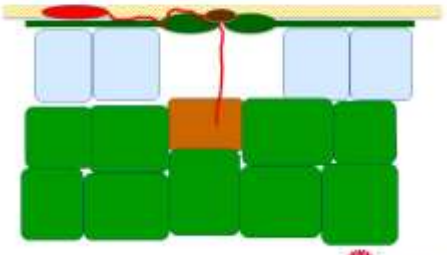
Systemic fungicides



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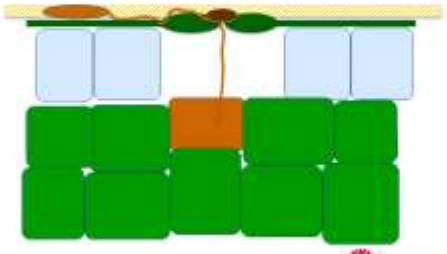
Systemic fungicides



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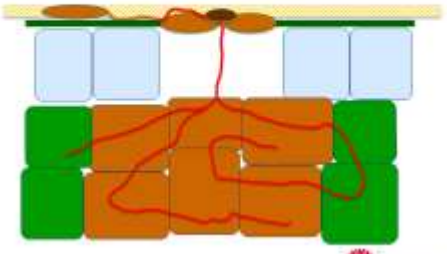
Systemic fungicides



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Recommendations

- Deleaf any obvious leaf spot, particularly stage 3 onwards
- Alternate between the chemical groups
  - oils, protectants and sytemics

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Management

- Check actives to make sure you are alternating chemical groups
- How many of each group are you allowed per year?
- Are back to back applications allowed?
- Is there an application free period?

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A review exercise

Stages 1 & 2

Action

Monitor

Stage 3

Action

Deleaf all leaves of [arts of leaves with lesions
7-10 days until leasions develop into stage 4
Spray a protectant fungicide?

Stage 4

Action

Immediately deleaf all leaves or parts of leaves with lesions
Apply systemic fungicide after deleafing
Systemic applied before deleafing may lead to resistance

Stage 5

Action

Immediately deleaf
Protect new leaves with fungicide spray

Six step leaf spot management

1. Deleaf that spotted leaf, don't spray it
   - twice during the first 4-6 weeks of Summer
   - head into Summer and Autumn with a clean crop
2. Know the fungicide groups
3. Rotate fungicide groups
4. Follow product recommendations
5. Use the recommended label rate
6. Get thorough spray coverage

Links

- http://www.dpi.nsw.gov.au/agriculture/horticulture/tropical
- http://www.croplife.org.au/downloadpdf.php?url=wp-content/uploads/2015/08/2015-Banana-Yellow-sigatoka.pdf

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http://abgc.org.au/projects-resources/industry-projects/national-banana-development-and-extension-program/

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https://www.daf.qld.gov.au/plants/fruit-and-vegetables/fruit-and-nuts/bananas

Deleafing banana plants to control sigatoka

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Appendix 10: Burringbar soil health workshop agenda and images

The workshop was held on 17/02/16 from 9am-12pm at the Burringbar Sports Club

Workshop program

- Graham Lancaster – Environmental Analysis Laboratory Southern Cross University Understanding Soil Test Results
- Tegan Kukulies- QDAF On farm biosecurity
- Jenny Cobon – QDAF Plant parasitic nematodes in the subtropics
- Matt Weinert - NSW DPI Use what when – subtropical banana nutrition
- Peter Regan Biosecurity NSW New banana biosecurity legislation

Tegan Kukulies, QDAF, presenting on On-farm Biosecurity at the Burringbar Soil Health workshop.

Appendix 11: Tullera shed meeting agenda

The workshop was held at Jeff Zanette's farm at Tullera from 6-8 pm on 09/12/15.

Workshop program

- Justine Cox – NSW DPI Fruit salad project, funded by the Australian Department of Agriculture and Water Resources, action on the ground program
- Peter Molenaar – Australian banana industry Central American Study Tour
- Matt Weinert – NSW DPI – The weevil and the damage done, banana weevil borer pheromone lure trials.

Appendix12: Banana weevil borer trial presentation content

NSW NOW The new state of business

The weevil and the damage done

Apologies to Neil Young

The weevil and the damage done
Matt Weinert – DPI

Horticulture Innovation Australia

Thanks to

- Dan Papacek – Bugs for Bugs
- Richard Piper – Scientific Advisory Services
- Sebastian Bonduelle – Scyll'Agro
- André Drenth – University of Queensland
- David Peasley – Peasley Horticulture
- David Tate, Paul Shoker, Stephen Spear, Jeff Zanette, Peter Molenaar, Robin Hundal

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The weevil

Banana weevil borer (BWB)
Cosmopolities sordidus

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The damage done

- Major insect pest of bananas
- 25% infestation reduces yield by up to 30%
- May spread Panama disease

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BWB biology

- Live up 2 - 4 years
- Females lay <2 eggs/week
- Move only short distances
- Haven't been recorded flying
- Don't move far from where they matured
- Hosts Banana and Ensete only

- Manage by mass annihilation trapping?

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Registered chemicals

Active	Schedule	Comments
Imidicloprid	6	Under review in Europe, can flare mites
Chlorpyriphos	6	
Fipronil	6	
Bifenthrin	6	
Oxamyl	7	Nematicide also
Turbufos	7	Nematicide also

S6 – poison, S7- dangerous poison

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Neonicotinoid-Laced Nectar Proves to Be Addictive Additive for Bees

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Other options?

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Traps and pheromones

- Slow release formulations of the aggregation pheromone sordidin +/- other attractants
  - CosmoPlus + amyl acetate (fake banana smell)
  - Cosmolure + green banana + toxicant
- Lures last min 90 days – temp dependant
- Adults drown in soapy water in pitfall trap
- Both used widely overseas

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CosmoPlus
Scyll'Agro - France

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Cosmolure
Chemtica - Costa Rica

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Problems

- Easily dislodged by animals
- Difficult to check
- Beneficial bycatch
  - beetles, lizards, centipedes
  - lure may attract beneficial insects
- Square trap in a round hole
- Fill with soil from erosion
- Cost?

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Benefits

- Manage BWB with soapy water
- Targets BWB although may attract predators
- Reduced a.i. use from 7kg/ha to 2kg/ha in Martinique from 1999 to 2008

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Mass Annihilation Demonstration
Coffs Harbour

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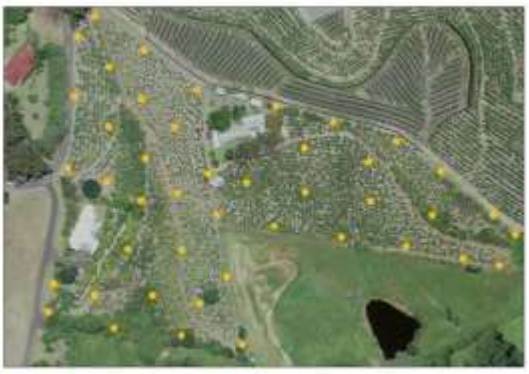
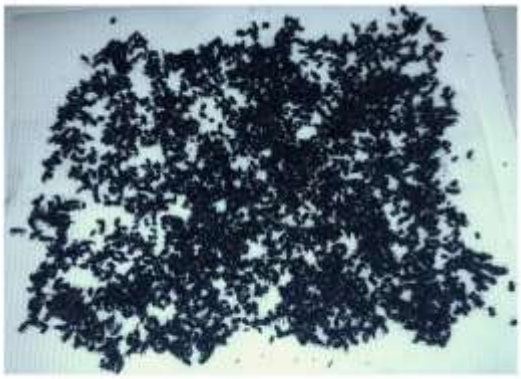


Results to date

- Trial established mid November 2014
- High pressure site
- The lures works well

Total caught 11001!



2009 weevils!

Lure by trap trial - Tullera

- 5 treatments x 5 replicates
- Fully randomised – latin square
- Trial block treated with Confidor Sept 2014
- Established 2nd April 2015

CosmoPlus
Scyll'Agro - France

Smaller holes to reduce by catch

Strainer for easy counts

Lower profile

Prototype trap

Trap by lure trial – Tullera 2015

Trial established 31/03/15

What have we learned so far

- Both lures work – Bugs for Bugs retail Costa Rican lure
- Prototype trap didn't perform as well as the French trap
- Traps can be easily dislodged
- Using soapy water is a PITA!

Department of Primary Industries

So how much does it cost?

- Lure $9.79
- Would need 3 lures/trap/year
- Trap rate/ha work in progress

Department of Primary Industries

Where to from here?

- Design and manufacture trap locally?
- New lure trials
- Can trap system alone can manage BWB?
  - continue mass annihilation trial
  - optimise trap density
- Cost comparison
- Combination of monitoring and chemicals
- Use pesticide with lure instead of water

Department of Primary Industries

Appendix 13: List of and selected press articles from the project

Radio and television articles with story links

13/01 Television interview with Prime 7 Coffs Harbour about BWB lure demonstration, organised by David Tate. https://au.prime7.yahoo.com/v1/video/-/watch/25986161/bio-bid-to-rid-banana-pest/

17/05 Coffs Harbour show with ABC rural report http://www.abc.net.au/news/2015-05-27/ducasse-wins-coffs-banana-cup/6498660

11/08 EPA compost field day Tweed with the ABC rural report http://mobile.abc.net.au/news/2016-08-19/nsw-country-hour-friday-19-august-2016/7767314?pfmredir=sm

Print media

Good Fruit and Vegetables September 2015. This story was also printed in The Land on July 26 2015 and online at http://www.theland.com.au/story/3296870/new-weevil-weapon/

fieldtalk

To have your say email gfv@ruralpress.com

New weevil weapon

By SHAN GOODWIN

NSW banana growers looking to gain marketing advantages via organic farming practices have another significant tool in their arsenal, thanks to some innovative thinking and extensive trials.

The first commercial lures and traps for banana weevil borer (BWB), the biggest insect pest of bananas in NSW, are now making their way onto north coast plantations.

The BWB larvae bore through the base of the banana plant causing yield reductions and "dropouts" – plants snapping at ground level from the weight of the bunch – and treatment to date has been costly and difficult.

NSW banana industry development officer Matt Weinert, who has led the trials and development of the new lure and trap system, said growers sprayed or injected plants with chemicals to manage the pest.

If treatments were mistimed, they could flare other pests, he said.

"The life cycle of the weevil and the fact they don't move very far from where they mature suggest they can be managed by mass annihilation trapping," he said.

The traps had the potential to reduce populations, cutting costs and providing marketing benefits, he said.

Trials of aggregation lures and traps near Coffs Harbour and Lismore had been successful.

A lure manufactured in France and traps made from recycled ice-cream containers were placed across David Tate's Kororo plantation near Coffs Harbour at a rate of 16 per hectare.

More than 9000 weevils have since been removed, and Mr Tate expects to be operating chemical-free in two years.

Already he farms under sustainable principles on his 0ha plantation. Dave's Bananas, which grows Cavendish, Lady Fingers, Sugar and Ducasse fruit.

The traps will save him the $800/hectare it has cost to spray for BWB a year, but he says the marketing advantages are even more significant.

> While the lure here outperformed the French version, the trap reduced the catch of BWB.

"I sell direct to the public and they tell me in no uncertain terms the less chemicals the better," Mr Tate said.

The Tullera trials, near Lismore, compared the set-up used at Dave's Bananas with a second lure manufactured in Costa Rica and a prototype trap designed to reduce the by-catch of beneficial insects.

"While the lure here outperformed the French version, the trap reduced the catch of BWB," Mr Weinert said.

Queensland company Bugs for Bugs at Mundubbera has manufactured the lure and trap system and it's now available to growers.

Industry media

Australian Bananas

Summer 2014-2015 Matt on a mission to help growers – IDO project introduction

Autumn Winter 2015 The race to outpace Panama – Duranbah field day

Spring 2015 The weevil and the damage done - conference poster article

Autumn 2016 Hello, is it me you're looking for – industry survey draft report

Winter 2016 East Coast low batter NSW banana coast – damage report from east coast low

April 2017 Cyclone Debbie NSW update – damage report

April 2017 Duranbah trial site enters new chapter – BA16001 subtropical variety project

April 2017 dreaming Big – brothers in arms building banana empire – young grower profile

Australian banana news

Jan-Feb 2015 High catch rate in borer trial – BWB trial report

Selected industry media articles

INDUSTRY NEWS

CYCLONE DEBBIE NSW UPDATE

Part of the damaged crop in the Duranbah region, which copped a battering by ex-Cyclone Debbie.

At the time of publication, New South Wales growers were still counting the costs of ex-Tropical Cyclone Debbie.

Growers in the Tweed and Brunswick regions faced significant crop losses and infrastructure damage, following the extreme weather in the week following the cyclone. One grower in the Chillingham area, close to the Queensland border, reported over 800mm of rain between 6am and midnight on March 30.

This torrential bucketing came on top of approximately 500mm that fell in the previous two weeks, prior to TC Debbie, and saturated the soil. There was major damage to roadways and landslips in most northern areas. The storm force winds that followed Debbie caused further damage.

The ABGC was told some growers would take days to get to their plantings due to blocked or flooded roads. Early estimates were that crop losses would reach 30–40% on most farms... with one grower at Cudgen losing over 80% of a new planting.

Growers in the Richmond and Coffs areas were spared the full force of Debbie, with much less damage reported there.

DURANBAH TRIAL SITE ENTERS NEW CHAPTER

NSW banana Industry Development Officer Matt Weinert with David Peasley at the Duranbah trial site.

The mission to find the most productive banana varieties with good disease resistance has entered a new stage at the Duranbah trial site in Northern New South Wales. Paula Doran reports.

Originally funded by the Banana Plant Protection Program (BPPP), and now by the new improved plant protection for the Australian banana industry, the Duranbah project is trialling semi-commercial plantings of three 'best bet' varieties that have been selected from the original 18 planted.

Led by David Peasley and Industry Development Officer Matt Weinert, the project is now focused on ripening behaviour and post-harvest handling, including temperature and storage requirements of these three varieties.

"Phase one of the project was about screening for disease, phase two was looking at yield/productivity and now phase three is focused on commercial trials so that we can tell growers how these plants grow best," Mr Peasley said.

"What we're looking at now is ripening behaviour for the three varieties, and then the post-harvest handling requirements, especially ripening temperature and storage," Mr Peasley said.

"We're looking at varieties for three different market segments. The first variety is for the fresh fruit market, and may be an option to replace Williams. It has a flavour similar to Cavendish. It is robust, has better leaf disease resistance and may not need propping (it's got a good structure and doesn't blow over)," he said.

"The second variety is Panama Race 1 resistant, and could be a replacement for Lady Finger. It has a similar taste profile, but is much more productive. It also seems less attractive to birds and bats which feed on the flower nectar and damage the fruit in doing so. That particular variety produces a clean, heavy bunch with good confo rmation," Mr Peasley said.

The third variety being trialled would service the cooking sector and potentially the fresh market as well.

"The cooking market is neglected in Australia. And there's a particularly strong demand for a dual-purpose variety, suitable for fresh consumption and cooking," Mr Peasley said.

Work on the picturesque Duranbah block has long had the attention of subtropical growers, but more recently, it's come under the appreciative gaze of international industry representatives. Those who have visited are now looking forward to seeing the results, and agree the research will have international implications.

Current trials are now reaching commercial stage, where growers will be fully informed on how to grow the new varieties.

DREAMING BIG... BROTHERS IN ARMS BUILDING BANANA EMPIRE

The newest additions to the NSW banana industry, Zack and Ethan McKeever.

In a region that has been hit by its fair share of challenges, Paula Doran meets two inspiring brothers who are determined to break into the New South Wales banana industry and make things work.

Ethan (21) and Zack McKeever (25) are two Murwillumbah locals who have their sights firmly set on building empires from bananas.

The brothers grew up on a poultry farm in the Northern Rivers region of New South Wales (NSW). And, while they both work in various jobs in town, they are quickly chipping away at bananas.

"On both sides of our families our grandparents had banana farms," says Zack. "Unfortunately, though, they sold those farms."

As with any farming/horticulture sector, it's a difficult and expensive job to break into from scratch, but one gets a sense these two have got it covered.

With a quiet determination, they have leased two blocks outside Murwillumbah and begun planting from bits and suckers which have been sourced from a Coffs Harbour block. Their crop of choice is Dwarf Lady Fingers and, thanks to a dedicated 'after-hours' farm focus, which works around their various day jobs, they now have 85 plants in the ground.

Travel by car to their new block with them and you soon get a sense of the chemistry and camaraderie involved in their shared dream. They both enjoy different aspects of the farm management; they agree, so they work well together. And they take great joy in their budding banana business.

"Ethan's got banana sap on all his clothes—we need to get him a new banana rag, one for the block, and one for special occasions that doesn't have sap on it," Zack laughs.

Behind the banter though, is a pair of young men who are willing to put in the hard yards to get things done.

"We certainly have different long-term ambitions, but we want to start this right and do things well," says Ethan.

It's been a game of patience to get from the idea of becoming banana growers, to the first planting. Initially, they began by planting in their backyard at home. Two years ago they attended a field day at the Duranbah trial site into varietal disease resistance, and they got a boost that sent them more firmly towards growth.

"The growers who were there were just so friendly and welcoming," they agree. "And we got to know David Peasely (researcher) and Matt Weinert (industry development officer—NSW Department of Primary Industries) there too.

"We really wouldn't have been able to get far without their support," they say as they stand overlooking their budding banana empire in the cane field country of Murwillumbah.

"David Pike in Coffs Harbour provided us with the suckers for the new planting, free of charge, as long as we went and dug them ourselves. He did need a bit of desuckering done so it helped all of us out. Without Matt putting us onto these suckers, and his help on a huge range of issues, we would not have been able to do banana farming from scratch."

Long term, the McKeever brothers would like to move into transport and a sustainable ripening business.

To the side of their banana block they've built the Taj Mahal of chook pens and have a steady business selling eggs to locals.

"Whatever we do, we will be focussed on good customer service, and looking after people," says Ethan.

The McKeever's have Williams Cavendish at one block (estimate 2100) and Dwarf Lady Fingers at another block (estimate 2100) and some of both at home, for approximately 4500 stools in total.

Appendix 14: Poster for 2015 Australian Banana Congress

NSW GOVERNMENT Department of Primary Industries

The weevil and the damage done

Matt Weinert[1], Richard Piper[2], David Peasley[3] and Andre Drenth[4]
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What is the problem?

The weevil

- The major insect pest of New South Wales bananas
- Adults live up to 4 years
- Females lay 1-2 eggs per week
- Adults don't move very far and haven't been observed flying
- Points above suggest may be managed with mass annihilation trapping

Banana weevil borer adult (top) and larvae (right)

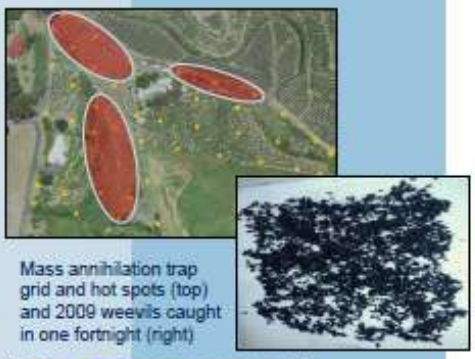
The damage done

- Reduces yield through corm damage and bunch loss due to dropouts
- Current treatments can flare mites
- May spread Panama disease

What have we done?

Mass annihilation demonstration – Coffs Harbour

- 41 traps, counted fortnightly, laid across a plantation
- 8915 weevils caught during the first 6 months of the trial
- Monthly counts have dropped from a high of 2009 in February to 151 in June



Mass annihilation trap grid and hot spots (top) and 2009 weevils caught in one fortnight (right)

Lure by trap trial – Tullera

- Compared two lures in a commercially available and a prototype trap
- Lure one has consistently outperformed lure two
- Prototype trap not as effective as commercially available trap

Trap Lure	Prototype Lure 1	Commercial Lure 1	Prototype Lure 2	Commercial Lure 2
Total*	132#	404	144	259
Average*	11#	26.9	9.6	17.3

* 15 trap counts except # which is 12 trap counts

Commercial trap (top), prototype trap (right)

Where to now?

- Continue mass annihilation trapping to monitor population levels
- Can mass annihilation trapping alone can manage weevil borer?
- Does trapping reduce damage and yield losses?
- Investigate insecticides for trap and if they effect on lure performance

Thanks to Dan Papacek (Bugs for Bugs), Sebastian Bonduelle (Scyll'Agro), David Tate, Paul Shoker, Stephen Spear, Geoff Zanette, Peter Molenaar, Robin Hundal

NSW NOW The new state of business

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www.dpi.nsw.gov.au

Appendix 15: Poster for ProMusa 2016

NSW GOVERNMENT Department of Primary Industries

COMPARING THE EFFICACY OF BANANA WEEVIL BORER TRAPS AND PHEROMONE LURES

Matthew Weinert[1], Richard Piper[2], David Peasley[3], Dan Papacek[4], Stephen Morris[5], Andre Drenth[6]

Background

- Banana weevil borer (BWB) (*Cosmopolites sordidus*) is the major insect pest of bananas in New South Wales, Australia.
- Two slow release lures of the aggregation pheromone sordidin +/- other attractants are available commercially, neither lure is used in banana production in Australia.
- BWB populations monitoring with pseudostem traps is conducted in some plantations, however this is very labour intensive.
- Commercially available traps are not suited to Australian production systems as they are dislodged by animals or catch significant numbers of beneficial insects

Trial design

- Traps placed 20m apart in a double row Cavendish plantation in a latin square experimental design, were filled with soapy water to capture BWB for the fortnightly counts.
- Pseudostem baits were insecticide treated and replaced at the time of each count.
- The trial ran for 140 days. A high intensity rainfall event flooded and dislodged some of the traps at day 40 and the trial was re-established at day 42.

Results

- Fortnightly and cumulative catch rates were similar with both lures paired with the prototype trap.
- The commercially available trap outperformed the prototype trap.
- Both lures outperformed the pseudostem baits.
- Beneficial bycatch was limited at this site so results were not collected.

Trap x lure	total	se
Commercial x Cosmolure	91.6	21.3
Commercial x CosmoPlus	71.6	16.8
Homemade x Cosmolure	34.8	8.4
Homemade x Cosmoplus	37.3	8.9
Stem x nil	7.9	2.2

Mean total catch under each trap class. se = standard error of the means

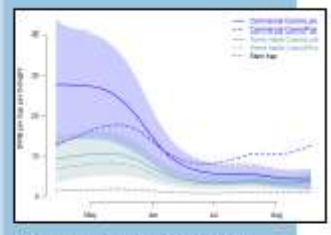
Discussion

- The pheromone lures are significantly more attractive and less labour intensive than pseudostem baiting.
- BWB lures are now available commercially in Australia.
- The flooding and dislodgement of the commercially available trap indicate trap design needs further work for Australian conditions.

Adult BWB (top) and larvae (bottom)

BWB damage

Prototype trap (top) and commercial trap (bottom)



Estimated trends in fortnightly BWB catch. Shaded areas enclose predictions +/- 2 standard errors within the commercial and homemade class.

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Appendix 16: New variety trial plantings in NSW

Trial plantings of three varieties were established on farms as part of BA13025. All varieties were provided by as tissue culture plantlets by the QDAF Maroochy labs as they could not be sourced commercially and then grown out to plants approximately 50cm high with a basal girth of 8-10cm prior to planting. In all cases it was not possible to grow the plants to this size for the spring/early summer planting window in NSW and plants were planted mid to late summer. Despite this late planting and very dry conditions following planting, all the plants survived. Varieties planted include;

DPM25, a desert, Cavendish type cultivar, bred by QDAF and selected for tolerance to cold weather and subtropical race 4 Fusarium wilt.

DPM25 Bunch

PKZ selected is an offtype in South Africa, it is a desert Cavendish type with large bunches of similar sized fruit, some cold tolerance and excellent leaf spot resistance. All fruit on the bunch are of similar size which will make packing easier. The plant is also more robust than currently cultivated Cavendish types and may not require propping, which is an expensive and time consuming procedure in subtropical plantations. Images of the whole plant and bunch are below. Variety rights for PKZ are owned by the Australian Nurserymen's Fruit Improvement Company (ANFIC) and all plantings of this variety have been established under material transfer agreements between the growers and ANFIC.

Plant and bunch of PKZ

Pacific Plantain were also included in the trial plantings after repeated requests from growers, who had been requested to grow fruit by their agents. Pacific plantain is a cooking banana.

Plantings of DPM25 were established in 2016 and 2017 and PKZ and Pacific Plantain in 2017 at nine different sites in NSW

Variety	Location	Number of plantings	Number of plants
DPM25	Taylors Arm	1	25
	Coffs Harbour	4	230
	Uralba	2	50
	Murwillumbah	1	100
PKZ	Coffs Harbour	1	84
Pacific Plantain	Coffs Harbour	1	100

The images below show the two plantings of DPM25 at Uralba. The plants on the left were planted in March 2016 and were close to bunching in August 2017 when the image was taken. Half of the original 50 plants were used as planting material for a new planting in December 2016.

The plants on the right were planted in December 2017 from tissue culture 'bits'. The plants were provided to the grower as 50cm tall plants in 140mm pots. These plants had the stem cut approximately 10cm above the level of the potting mix and were the carefully divided into 4-5 'bits' per plant and planted. No irrigation was applied and the plants have performed as well as traditional 'bits' dug from mother plants. This method provides a potentially new method of using tissue culture plants and reduces the cost to approximately $2 per plant. Plants grown from tissue culture often grow a large amount of poor quality suckers, which require desuckering, this technique has effectively turned these suckers into new plants, reducing the need for desuckering.

DPM25 plantings at Uralba.

A small demonstration block of each of the three varieties was planted in Coffs Harbour in March 2017. This site is quite cold and will be used to monitor the performance of all three varieties, particularly their cold tolerance.

Tissue culture plants established in one of the Coffs Harbour plantings, from left to right, DPM25, PKZ and Pacific Plantain.

All plantings established as part of BA13025 will be monitored in the subtropical variety component of BA16001. Data collected will be time to bunch, bunch weight and fruit number and ratoon time. It is also expected fruit from these plantings will be used for consumer acceptance testing and the site will be used for grower field visits.

Appendix 17: NSW IDO 12 month evaluation summary

Review of NSW Banana Industry Development Officer

Results – Summary Report

17 November 2015

This online survey was undertaken by Horticulture Innovation Australia in November 2015 as part of the stop/go review for BA13025 – NSW Banana Industry Development Officer (Milestone 103). This project is funded by Horticulture Innovation Australia using the banana levy with co-investment from NSW DPI, Banana Industry Committee and Coffs Harbour Banana Growers Association.

- 19 respondents
- 83% of respondents identified as being growers (15 respondents); consultant/agronomist (1 respondent), researcher (2 respondents), industry representative body (1 respondent), ripener/wholesaler (1 respondent), direct marketer (1 respondent), communications support (1 respondent), rural supplier (0 respondents)
- 100% of respondents were aware of the industry development project for the NSW banana industry
- Respondents had participated in or used a range of project initiatives: 68% industry training events/workshops, 74% field days, 84% articles in publications such as e-newsletters, 42% information packages such as factsheets and short videos, 37% accessed relevant banana R&D, 21% baseline survey of NSW banana industry, 53% variety trials, 5 % no participation. Respondents raised 3 other project initiatives they have been involved in: beetle borer project, quarterly grower meeting and variety trial has not yet commenced.
- 42% of respondents rated the value of the project as 'extremely valuable' and 47% rated the project as 'very valuable'
- 10% of respondents rated the project as either 'some value' or as 'little value'
- Feedback on why respondents rated the value of the project as they did included:
    - Every time we had a problem it was fixed very efficiently
    - Regular contact and updates on projects are invaluable; we are most often far too busy to self research
    - The project has been valuable, and I would have found it more valuable if I had attended more of the field days/workshops
    - Allows information to be gathered quickly when needed
    - I can rely on the IDO to answer my call or get back to me within an acceptable time; he is professional, eager and keen in wanting to get results
    - Expanded knowledge about growing bananas (diseases, varieties)
    - Beetle pheromone project alone has saved me thousands of dollar

- IDO offers an opportunity for growers to learn from each other as he interacts with many different growers; brings new information to the growers in this area on new growing practices and ideas that will benefit the industry in the long term; will take time for industry members to take advantage of opportunities this service offers; extremely valuable to the subtropical banana industry; IDO has already helped many growers to communicate between each other in a more valuable way than in the past
- There is no one else to turn to, to discuss any problems or to get information that we require in our day to day growing
- IDO showed me new techniques to improve the efficiency of my banana farming operation
- Good opportunity to talk with others in the industry
- Refocused industry on weevil borer control, leaf disease, and plant nutrition; wealth of contacts; good to have 'outsider' come into the industry
- New approach, filling a gap, refurbishment of information
- IDO role is providing a critical galvanising function for subtropical bananas across many fronts
- The IDO has excellent communication and technical skills, he is keen to learn the practical skills and relates well with growers; he has made a really positive impact on the subtropical banana industry
- The position has improved our ability to coordinate activities between NSW and QLD

- 72% of respondents have made changes to their business as a direct result of participating in, or using information generated by the project, 22% have made no changes to their business and 6% responded that the question was not applicable
- The following changes were described for those that had made changes:
    - Now have a banana fungicide program and fertiliser program
    - Improved biosecurity on farm
    - Beetle trap trials
    - Upgrading packing shed
    - New vehicle purchases to improve efficiency
    - Different chemicals used
    - More aware of spread of disease (e.g. leaf spot, Panama)
    - Pheromone trapping as a part of integrated pest management and phasing out chemical control of BBB
    - Changes to soil amendments
    - Delivering national project objectives in NSW
    - More communication with other growers
    - Considering changes to my pest management
    - Leaf disease management
    - Improved control of weeds

- Large industry when take into account full supply chain – IDO to research who he has contact with
- Include fertiliser topics including nutrients, application rates and when best to apply for our different seasons
- More workshops, more grower field days – fertigation, managing leaf disease, marketing, fruit packing practices, new innovations, best growing practices, new varieties
- More interaction with wholesalers
- Get the growers (especially young growers) in Tweed/Brunswick/Richmond areas to be on board with this project
- Benchmarking, chemical handling and spray application to complement and extend the ChemCert accreditation; general awareness of the environmental and social facets of a "good grower"
- Online communication channels for growers to engage, connect and support one another
- More to promote NSW bananas as different to Qld bananas
- More operating funds to allow the IDO to maximize the positive impact he is having and to expand further training opportunities
- More articles in Australian Bananas magazine
- A clearly defined work plan based on needs survey with clearly defined outputs, i.e. info materials and activities

- Respondents were invited to provide any other comments about the NSW industry development officer project, in summary:
  - Very easy to talk to, down to earth
  - Always available by phone or email
  - Professional and has facilitated a collaborative culture among local growers
  - Valuable asset to our industry
  - Personality a hit with young and old
  - More funds directed to research that can develop a marketing edge for the sweeter sub tropical banana
  - Good that something is being put back into the subtropical industry
  - Growers need a referee to whom they can refer their needs and requirements too
  - I am looking forward to the progress of the project; very positive for the NSW industry so far
  - IDO is doing a great job
  - Role is clearly required for a national approach in banana projects
  - Don't let this one go
  - Fantastic initiative
  - Should be continued, IDO is doing a great job

    - Leaf and soil analysis after not doing for 25 years
    - More importance placed on deleafing
    - Assistance in conducting field trials
- Aspects of the industry development officer project respondents found most valuable included:
    - Abundance of knowledge
    - Provides regular updates on industry news, access to trials, improved pest management techniques
    - Field days
    - Variety trials
    - International visitors
    - Leaf disease workshops
    - Technical advice
    - Weevil control
    - Wide contact list
    - Ability to work with all levels of growers
    - Excited approach and fresh presentation of information
    - Nothing
    - Technical support and the promotion to young growers
    - Generating enthusiasm and encouraging growers to think more broadly about their management and the future for the subtropical industry
    - Having a single point of contact for the NSW banana industry
    - Helping growers who are keen with their productivity
- Aspects of the industry development officer project respondents found least valuable included:
    - Nil/None (7 respondents)
    - "can step on peoples toes"
    - Tendency to get side tracked off the main banana issues, e.g. avocados
    - Seems to lack structure to overall work activities without clearly defined actions; probably a result of a single FTE for many growers and trying to manage their expectations
    - Interference in the project by retired growers
    - Industry politics is part of the game but sometimes the loud noises exert unfair pressure on the IDO
- Suggested inclusions for improvement of future industry development services:
    - More field days and more education
    - Field days – plant health and soil health
    - Develop a network to secure skilled labour in peak times (not sure if this the role of the IDO)

Appendix 18: Final evaluation of the NSW banana IDO

Final review of BA13025 – NSW Banana Industry Development Officer

Results summary

4 September 2017

A short, six question online survey was undertaken to evaluate *BA13025 – NSW Banana Industry Development Officer* for the final report. This project was funded by Horticulture Innovation Australia using the banana industry levy with co-investment from NSW DPI, the Banana Industry Committee trust and the Coffs harbour Banana Growers association.

The survey, sent through email and industry focussed social media had 20 respondents, 13 were growers, one a researcher, one a ripener/wholesaler and four classed themselves as other

The project effect was rated well by respondents with 50% rating the project as extremely valuable, 40% very valuable, 5% said it was of some value and 5% of little value.

Overall good communication and working with and encouraging new growers were seen as aspects of the project that were done well. Recovery efforts for the two east coast lows and ex TC Debbie were also mentioned. A selection of responses to what the project did well included;

- Increasing communication to and between growers and determining aspects/topics for improvement in subtropical banana production systems
- Lots of things - encouraged younger growers; leaf and soil analysis appreciation; work on disaster data was instrumental in getting disaster relief for growing areas; invigoration of Tweed BGA; general "go to" person for the subtropical industry;
- Gave growers information about new variety and help with flood recovery grants
- Communication with younger growers has been outstanding. Matt has engaged younger growers through a range of media especially social media, field days and individual farm visits. His communication skills are exceptional and he is achieving positive responses from all sectors of the industry.
- connected me to growers in NSW and provided great intelligence about what is happening on the ground. kept me up to date on new developments in NSW banana industry
- The project is helping the subtropical industry improve productivity and profitability and links in very well with other research projects to make relevant information and materials available to growers
- Provide information relative to the growing/farming future of subtropical bananas.

Areas the project could have improved were better prioritization of work areas and engagement with more growers particularly in the Tweed. Several responses suggested the project could not have improved. Responses included;

- The project has delivered above expectations. Due to the short time frame it is hard to see what could have been delivered in addition to the current. The only thing would be to bring more unity among the subtropical growers but that is a rather large challenge and not part of the project brief.
- Focus of fewer priority areas
- Needs to prioritise issues rather than attempting to be involved in everything; Survey of the industry; saying less when working with retired growers at BGA meetings;
- Greater acknowledgement of the impact of the project within NSW DPI and the wider banana industry. Matt has worked extremely hard particularly following the devastation caused by Cyclone Debbie in interviewing growers and processing damage claims in addition to his busy work program. He undertook responsibilities outside normal duties and should have received greater recognition.
- Could have provided more meetings and field days
- Liaised with a wider number of growers

- Very little
- The challenge is to get more of the less professional growers on board.

Greater emphasis on better nutrition regimes, a key focus of the project, was the overwhelming response to what growers who had either attended IDO run events or have used information packages developed as part of the project. Responses include;

- I have changed my fertilising regime
- More reliance on plant and soil testing; will give more thought to composting
- We now measure more, base our farming on much of the project outcomes. Very interested in New varieties
- Yes nutrition changes with soil tests. Also would like to trial new varieties
- Yes just got a soil test and looking in to beetle traps
- Pay more attention to nutrition

Survey respondents were asked to identify development areas any future projects should concentrate and indicated further interest in plant nutrition and pest and disease management. Responses included;

- Research into Panama resistant varieties. Nutrition still needs attention...to make growers aware of their influence on the environment and how they can use alternative products that can be both beneficial to both the environment and their production.
- How to interpret plant and soil analysis; more work on sap flow in winter e.g. can sap flow predict the occurrence of our dull winter fruit?
- Nutrition, disease management, pest control.
- Nematodes ... Nutrition
- bunch treatments and what works best at certain times of year (ie; corky scab, rust thrips etc)
- Regular contact with growers
- Getting growers together and cooperating
- fruit quality and plant nutrition research
- Beetle + Nematode control
- Management of diseases including biosecurity

The responses to the survey were overwhelmingly in support of the project and indicate that the information packages and focus areas of the project have led to practice change, particularly in the areas of measuring and targeting plant nutrition inputs.

Nematodes, bunch pests and disease management were all listed as areas of future work and the IDO will work closely with the IPDM components of BA16001 to deliver better pest and disease management outcomes through the new subtropical banana extension project *Subtopics: Delivering extension for the Australian subtropical banana industry*.

Appendix 19: NSW IDO MERI plan

MERI Plan

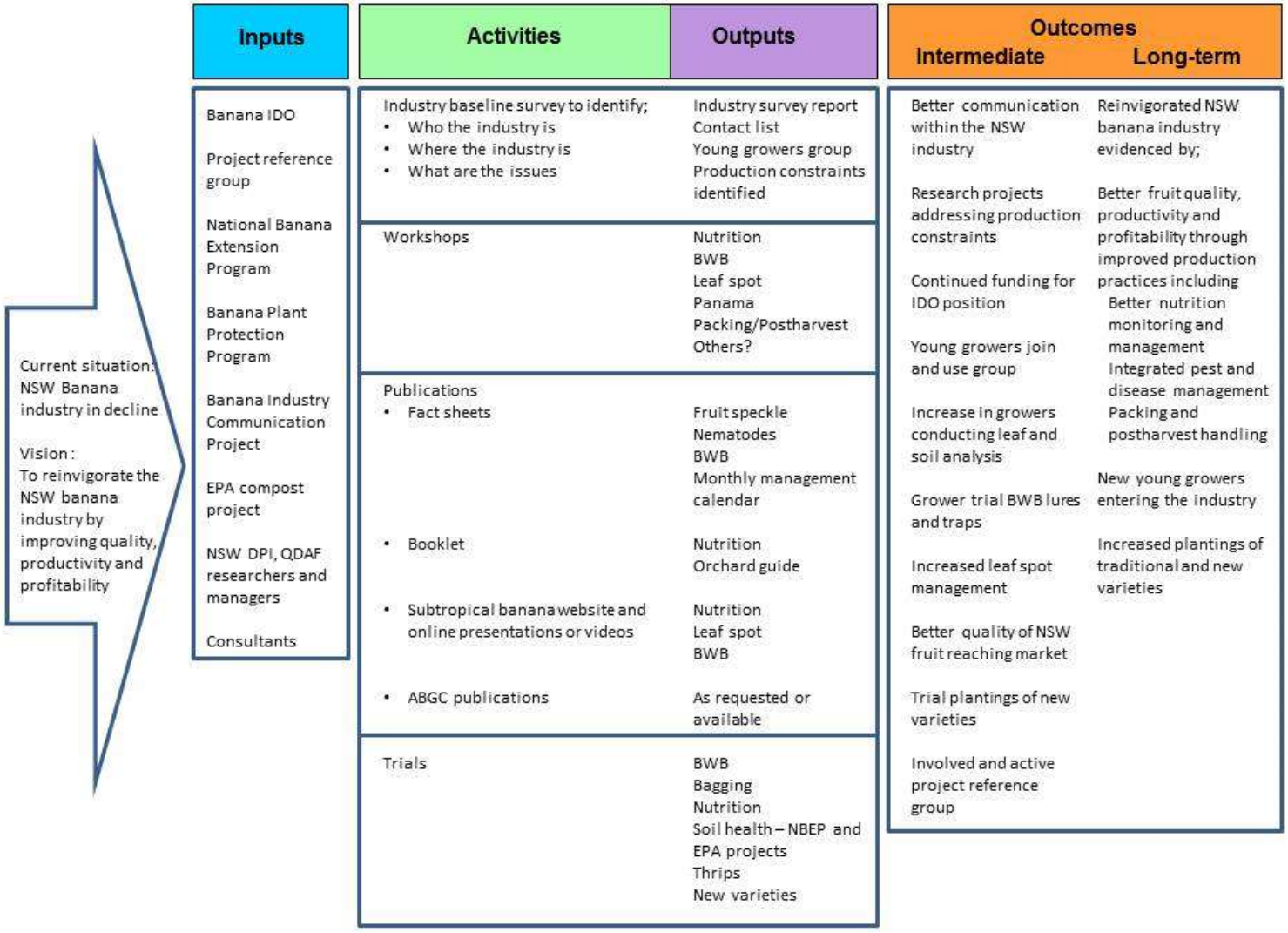
Project Information

PROJECT INFORMATION

Project Details	
Project ID:	BA13025
Project title:	The NSW banana industry development officer
Organisation name:	NSW DPI
Organisation Address:	
Project Manager:	Myles Parker and Matthew Weinert
Project Period:	01/07/2014-30/06/2017

Part 1 - Program Logic

PROGRAM LOGIC DIAGRAM



PART 2 - Project Linkages

2.1 PROJECT LINKAGE TO OUTCOMES

Project Linkage to Program Outcomes	
Relevant Strategic Objective	• Increase production efficiency by 5% by 2018/19 with minimal to no environmental impact

Long Term Project Outcome(s)	Reinvigoration of the NSW banana industry through;
	
	• Improved level of confidence throughout the subtropical banana industry resulting in better industry cohesion
	  – retaining viable production of Ladyfingers and Ladyfinger types as an alternative to Cavendish
	  – introduction and uptake of Panama resistant varieties released through the Banana Plant Protection Program (BPPP)
	  – development of novel varieties and potential improved Cavendish identified in the BPPP for niche markets
	  – higher level of support to younger growers to continue growing bananas and for new entrants into the industry
	• Strengthened linkages with the Banana R&D levy funded program, and regular interactions with researchers and industry advisors
	  – improved pest, disease and nutrition management
	  – reduced costs of production.
	• Measurable practice change on farm resulting in improved packouts through improvement in fruit quality**.**

2.2 PROJECT LINKAGE TO RELEVANT PLANS

Project linkage to relevant plans - List relevant plans that your project aligns with, and intends to deliver against			
Name of Plan	Owner of Plan (organisation that issued the plan)	Relevant actions within plan being addressed, (include reference where possible)	Brief description of how target will be addressed.
The Australian Banana Industry Strategic Investment Plan 2014-2019	Australian Banana Growers Council	Objective 1 Maintain a consistent and quality supply of Australian bananas whilst achieving 5% productivity gain by 2018/19 • Improving production per unit of input: and/or • Reducing production and supply costs per unit of marketed product	Complete survey of the NSW banana industry to identify production constraints Develop and deliver research and training through partnering with banana research and development staff nationally and internationally and private companies

NSW Department of Primary Industries strategic plan 2015-2019	NSW DPI	Economic growth through innovation that improves resilience and boosts productivity • Increase productivity and innovation in agriculture	Develop and deliver research and training through partnering with banana research and development staff nationally and internationally and private companies

PART 3 – Project monitoring

PROJECT PROGRESS MONITORING AND DETAIL

Key monitoring tools	**Describe how the monitoring tools will be used to ensure project outputs are delivered in a timely and appropriate manner.**
Annual work plans	Developed in conjunction with the project reference group (PRG) through face to face meetings and email follow-up Activities will be identified through the industry survey and prioritised by the PRG.
IDO activity diary	Daily diary kept of main tasks related to project
IDO monthly report	Daily diary used to prepare monthly report, emailed to project reference group the first week of each month detailing previous months activities. Activities to be grouped under key project outcomes. Monthly report emailed to project co-investors after comments from project reference group
Project reference group meeting	Face to face or teleconference meeting of project reference group every six months Report against project plan Minutes of PRG meeting emailed to co-investors

Milestone reports	6 monthly report against milestone to funding body

PART 4 Evaluation and Improvement Plan

PROJECT EVALUATION AND IMPROVEMENT DETAIL

Key evaluation tools	**Describe how this project will ensure that evaluation questions will be addressed in a timely and appropriate manner.**
12 month review	A performance review of the position will be held at the end of Year 1, with the inclusion of a 'stop/go' provision in the case of underperformance of the candidate. A copy of the 12 month review questions is in Attachment A.
Event evaluations	Evaluation sheets or TurningPoint software KeePads clickers will be used to evaluate all events conducted by the NSW Banana IDO. An example of the evaluation sheet is in Attachment B. Future events will be modified based on feedback received from the event evaluation.
Information product evaluations	All information products developed as part of the project will be evaluated after a six month period using an electronic survey (link distributed via email). Questions for the survey will be developed in conjunction with the PRG to identify practice changes attributable to each specific information product.
Final project review	A final review of the project will be conducted prior to the conclusion of the project and included in the project final report. Questions for the final review will be similar to the 12 month review questions however greater emphasis will be placed on documenting practice change. Questions will be developed in conjunction with the HIA R&D Manager for the project and the PRG.

ATTACHMENT A: 12 MONTH PROJECT REVIEW QUESTIONS

NSW banana industry development officer project 12 month review

Introduction

Horticulture Innovation Australia Limited (Hort Innovation) is conducting a review of the current NSW banana industry development officer project. The aim is to review the first 12 months of the project and to provide input to the final two years from right across the industry, from producer, researcher, ripeners and wholesalers and all in between. To improve the industry development efforts for NSW bananas, we would appreciate your help by completing this short survey. Your input will be of considerable value to your industry and shaping the future of this project.

Background information on the current NSW banana industry development officer is provided on the next page.

The survey will take about 10 - 15 minutes to complete. Your information will be treated in confidence and the results will not identify individuals or businesses. Thank you for completing this survey.

If you would like to speak with someone directly about the review please contact Alison Anderson (R&D Manager, Hort Innovation) on 0410 395 597 or alison.anderson@horticulture.com.au

Background information

The current NSW banana industry development officer project, is being delivered by NSW DPI. The project, with co-investment from NSW DPI, the banana industry levy, the banana industry committee fund and the Coffs harbour BGA, funds a full time Industry Development Officer, Matthew Weinert.

The current project aims to reinvigorate the NSW banana industry by improving industry cohesion and providing strategic direction, developing information packages and techniques to address production and supply chain issues and work closely with other industry funded R,D&E projects to deliver project outcomes to NSW growers.

Question 1.

What role do you play in the banana industry? (please tick all that apply)

Grower

Rural supplier

Consultant/Agronomist

Researcher

Ripener/Wholesaler

Question 2.

Are you aware of the NSW banana industry development officer project?

Yes

No

Question 3.

Have you participated in or used any of the industry development project initiatives? (please tick all that apply)

Industry training events/workshops

Field days

Articles in publications such as e-newsletters and annual journal

Accessed relevant banana R&D, marketing and/or business information at the advice of the IDO

I have not participated in or used any of the project initiatives

Other (please specify)

Question 4.

Please rate the value you have gained from the industry development project

Extremely valuable

Very valuable

Some value

Little value

No value

Not applicable

Please provide comment on why you rated the value of the industry development project as you did

Question 5.

Have you made any changes in your business as a direct result of participating in, or using information generated by the industry development project?

Yes

No

Not applicable

If 'yes', please describe the change(s) you have made

Question 6.

What aspects of the industry development project have you found to be the most valuable? These may include: Industry training events and workshops; Field days; Improved knowledge of R&D and projects and outcomes; Publications such as e-newsletters; Articles in annual journal.

Question 7.

What aspects of the industry development project have you found to be the least valuable? These may include: Industry training events and workshops; Field days; Improved knowledge of R&D and projects and outcomes; Publications such as e-newsletters; Articles in annual journal.

Question 8.

To improve industry development project/s in the final 2 years of the project what would you like to see included in such a project? This may include specific approaches to technology transfer (e.g. grower study groups, field days, e-newsletters, training) or specific topics you would like more information on

Question 9.

Are there any other comments you would like to make about NSW industry development officer project?

Thank you for your time to complete this survey. Your input is valuable

Question 10.

Please add your contact details if you would like to be contacted about membership of Horticulture Innovation Australia. For more information please visit the Hort Innovation website: www.horticulture.com.au

ATTACHMENT B. EXAMPLE OF EVENT EVALUATION SHEET

To help us evaluate our project and improve future events please answer the following questions.

(workshop) (location) (date)

1. How useful did you find this workshop? Please circle most appropriate description.

Not useful *Fairly useful* *Useful* *Very useful* *Extremely Useful*

2. Given the time available, how did you find the amount of material covered?

Too much		*About right*		*Too little*
1	*2*	*3*	*4*	*5*

3. How did you find the type of information that was presented?

Too basic		*About right*		*Too technical*
1	*2*	*3*	*4*	*5*

4. What was the most useful or interesting thing that you heard during the workshop?

_____

_____

5. From what you heard at the workshop, is there anything you intend to implement on your farm? Please write below:

_____

_____

_____

6. For future workshops, what could we do better? (timing, topics, catering, presenters etc.)

_____

_____

7. Any other comments:

_____

_____

THANKS FOR PARTICIPATING IN THE WORKSHOP

ATTACHMENT B: PROJECT RISK

SWOT analysis: NSW Banana Industry Development Officer

Compiled by Myles Parker and Matt Weinert, NSW DPI, 21 October 2015

Input provided by Alison Anderson, Hort Innovation

Strengths

- Strong linkages with the HIA and levy funded National Banana Extension Project (NBEP) and the National Banana Plant Protection Program (BPPP) and the Communication for the banana industry.
- Engaged, interested and active project reference group
- Monthly report provided to PRG so they are well informed of project progress and issues
- Good working relationship with growers in the Nambucca, Coffs Harbour and Richmond
- Linkages within the Australian and international banana community, including researchers, ripeners growers, private companies and consultants
- Attendance at all BGA meetings since the beginning of the project
- Defined outputs and outcomes for the project: an industry survey to identify production constraints, map supply chains and potential R&D opportunities; linkages and development trials with other HIA and industry funded projects; development of a strategic plan and reinvigoration of the NSW banana industry
- Project personnel have been successful in sourcing additional funds from NSW EPA to further soil health work currently being conducted under the NBEP
- A successful first series of project workshops have been run and will be developed into a subtropical banana nutrition booklet
- Positive environment in bananas in NSW due to this strategic joint investment into the NSW banana industry. New plantings are taking place and young growers are moving into the industry in all four production areas
- The industry baseline survey work has highlighted that banana weevil is the major production constraint in NSW. The focused work on weevil borer has been well received both in the NSW and Queensland industries with a lure and trap system for the banana weevil available commercially for the first time in Australia.

Weaknesses

- Difficulties building relationships with growers in the Tweed production region due to the geographical spread of the industry, the large number of growers and the time required to develop this relationship and many growers being disengaged from the industry and industry bodies
- Have yet to develop relationships with agricultural resellers in all NSW production regions
- Need to develop relationships across the supply chain including ripeners, wholesalers and retailers
- Program logic and Monitoring and Evaluation (M&E) plan not formally developed

Opportunities

- Develop a young growers group around young growers identified in the industry survey and link to the NextGen growers in NQ through the NBEP
- Work with growers to overcome production issues with alternate and new varieties from the BPPP
- Develop links and trial production systems from other subtropical countries in the NSW banana production areas
- Local ripeners/wholesalers willing to work with IDO to further develop existing markets open up new markets

- Development of a stakeholder engagement plan to underpin engagement broader than growers – to increase the reach of the project

Threats

- Dependence upon other projects to deliver project outcomes – some of the new varieties from the BPPP may not be available to plant a trial block in time to meet project milestones
- Supply chain members are less likely to work with the IDO due to the short term nature of the project
- Resistance of industry organisation personnel and some growers to embrace change
- Expectations of a return to a one on one extension model