

Final Report

Banana Strategic Industry Development Manager

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Delivery partner:

Australian Banana Growers' Council

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BA16008

Project:

Banana Strategic Industry Development Manager BA16008

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Summary

The Banana Strategic Industry Development Manager project (BA 16008) was delivered by the Australian Banana Growers' Council (ABGC) over three years from 2017 – 2020. The ABGC employed Ms Michelle McKinlay to the position of Industry Strategy Manager (ISM) for the duration of the project. Ms McKinlay had also successfully delivered the preceding banana industry strategic industry development project (BA 13023) from 2014 – 2017.

An independent review of the BA16008 project found that the ISM had helped the banana industry to engage in critical issues and deliver on the project outcomes and priorities of the Banana Industry Strategic Investment Plan (2017 – 2021). The end of project objectives of the project were:

- A sustainable banana industry that is better able to respond to issues arising in biosecurity and the environment
- Growers are informed about the impacts of biosecurity and the environment and know where to go for assistance
- Stakeholders understand the impacts that key issues have on banana growers and how to engage with growers to ensure adoption of best practice for a sustainable industry.

These outcomes were achieved by ensuring that all activities delivered by the ISM aligned to the project's outputs:

- Implementation of the Banana Industry Biosecurity Framework.
- Implementation of the Banana Industry Water Quality Strategy 2017 – 2020.
- Provision of technical advice to growers and non-grower stakeholders; and
- Creating productive relationships with stakeholder groups who are important to the banana industry.

This project has left the banana industry with a legacy that includes:

- Environmental regulations that align closely to best practice with flexibility to allow growers to apply the required nutrient rates – that is, the regulations should not reduce yield and profitability of growers in north Queensland. Without the ISM's ability to influence policy, these regulated rates would have been inflexible and significantly lower which would have reduced growers' yield and profitability and made compliance very difficult.
- Higher degree of preparedness to deal with future and current incursions of exotic diseases as a result of work done with Plant Health Australia.
- In control of the future management of the TR4 Program as it transitions from government to industry's ongoing management of the disease.
- Permanent practice change across at least 2,500 hectares of banana production that will improve farming profitability and water quality outcomes.
- A reputation of being a willing participant in the quest to improve the water quality of the Great Barrier Reef and a worthy recipient of government funding.
- A trusted and reliable 'library' of information and relationships that will assist growers to be more profitable and resilient in the future.
- A well-established and expanding network that links many biosecurity and environmental projects to provide more efficient and effective outcomes.

Considering the successful delivery of this project, the independent review recommended that a further project with a focus on strategic biosecurity and environmental issues be prioritized by the banana industry and the funding body Hort Innovation.

Keywords

Banana

Industry Development

Strategic

Water quality

Biosecurity

Environment

Great Barrier Reef

Industry Strategy Manager

Extension

Best Management Practice

Introduction

Biosecurity, environmental stewardship and sustainability issues have been identified as major challenges in the *Banana Industry Strategic Investment Plan* since 2014. To be prepared for and manage the threats, the banana industry prioritized funding for two strategic industry development projects – Banana Strategic Industry Development (BA 13023) from 2014 – 2017 followed by Banana Strategic Industry Development Manager (BA16008) from 2017 - 2020. This investment over six years has allowed the industry to consolidate its learnings and strengthen its long-term profitability by managing risks, developing networks and brokering solutions in very complex content areas. Ms Michelle McKinlay was employed by the Australian Banana Growers' Council (ABGC) to deliver both BA13023 and BA16008. The continuity of Ms McKinlay in this role has resulted in a highly efficient and effective investment for the industry.

BA16008 consolidated and expanded the achievements of the previous strategic industry development project (BA13023) to deliver benefits to banana growers and provide a reliable, informed point of contact for grower and non-grower stakeholders. For banana growers, this project has informed them of current emerging issues that will impact their industry over the next decade. This proactive approach to managing risks helps to educate growers so they can anticipate, plan and adopt new practices where necessary. It gives them greater control over their farming future. This project was designed to provide non-grower stakeholders with confidence that their decision making is more robust as it incorporates accurate information about banana farming and the industry more generally.

During the three years of this project, there have been several major issues that have demanded a response from the banana industry. These included the spread of Panama tropical race 4 (TR4) within the Tully Valley and the introduction of environmental regulations for north Queensland growers. The ISM has successfully worked with growers and non-grower stakeholders to provide options and solutions to the many questions these issues raised. The ISM has also attracted \$3.6million of non-levy project funding to the industry during this project.

This report demonstrates how the ISM has delivered on the end-of-project outcomes by working collaboratively with many stakeholders across multiple fields to provide technical industry advice and implement important strategies that will strongly position the industry into the future. The report also highlights the lasting benefit of this project to the banana industry.

Methodology

Implementation of BA 16008 built on the project outcomes from BA13023 that concluded in September 2017. The aim of BA16008 was to provide strategic direction, coordination and project linkages in two critically important areas of grower and government interest and investment – biosecurity and the water quality of the Great Barrier Reef. This project provided timely and accurate information to banana growers as well as information about the industry to non-grower stakeholders to improve their understanding and decision making. The elements of the project are described below.

Appointment of Industry Strategy Manager

Mr Jim Pekin, CEO of the ABGC, was the Project Leader. To deliver this three-year project, the ABGC reappointed Ms Michelle McKinlay as the Project Manager. Her job title was Industry Strategy Manager. As Ms McKinlay had successfully delivered BA13023 and had built a large network of growers and non-growers, she was immediately effective in the role.

ABGC BMP extension team

Throughout this project, the ISM had strategic oversight of the ABGC's Best Management Practice extension team and provided the important alignment and coordination between strategy and extension. The team consisted of three extension staff, all based at South Johnstone, and funded by the Queensland and Australian Governments (not matched levy funds).

Formation of Project Reference Committee

To support the priority setting for the project, a Project Reference Committee (PRC) was formed. Its membership included an Innisfail banana grower (who is also a Director on the Board of Plant Health Australia), the leader of the National Extension Project, an expert in biosecurity, the project leader, project manager and the R&D Manager from Hort Innovation. The PRC met formally every six months to provide feedback and expert guidance to the ISM. The ISM also maintained regular informal contact with individual PRC members (during trips to north Queensland as well as by phone and email). The ISM had scheduled monthly phone calls with the leader of the National Extension Project to look for opportunities to collaborate and to avoid overlap.

Work Plans

In line with the Milestone Achievement Criteria and Deliverables, all governance documents were prepared and submitted to Hort Innovation as part of Milestone 102. This included the Project Logic, M&E Plan, Risk Register, Stakeholder Engagement Plan (Appendix 1). The PRC referred to these documents, particularly the Risk Register, throughout the life of the project.

All work completed as part of BA16008 aligned to the agreed outputs and outcomes of the project. The project outputs were:

- Implement the Banana Industry Biosecurity Framework (Appendix 2)
- Implement the Banana Industry Water Quality Strategy (2017 – 2020) (Appendix 3)
- Provision of technical advice to grower and non-grower stakeholders
- Develop and maintain productive relationships.

An annual work plan (a list of activities divided into the outputs listed above) outlined the ISM's proposed priority activities and outputs for the next 12 month period. This draft document was presented to the PRC each year for their input and when finalized, submitted to Hort Innovation as part of a Milestone Report.

During these discussions, the PRC members provided advice about the feasibility of undertaking some projects – facilitating a cost-benefit discussion to make sure that the ISM was attending to the highest industry priorities. Input from growers and other non-grower stakeholders also influenced the priorities in the annual work plan.

Progress on the Milestone Achievement Criteria was provided to the PRC and submitted to Hort Innovation every six months.

Independent project review

In March 2020, a monitoring and evaluation consultant, Jill Knell, was engaged to undertake an independent review of the project and make recommendations about the effectiveness of the project based on stakeholder feedback. Three groups of stakeholders were identified for interview - six growers, six non-growers and two ABGC staff. Non-growers included representatives of the Department of Agriculture and Fisheries (DAF), Office of the Great Barrier Reef (OGBR) and the Wet Tropics Major Integrated Project (MIP).

The review recorded overwhelming support for the role of ISM. It provided four recommendations including that the role should be continued beyond the conclusion of the BA16008 project. A copy of the review included at Appendix 4.

The ISM has achieved the planned deliverables and outputs for BA16008.

Outputs

The BA16008 project has delivered an extensive set of outputs and these are reflected in the Milestone Reports that were provided to Hort Innovation every six months for the duration of this project. The strategic nature of this project meant that the ISM often contributed to the outputs that are ultimately owned by other organizations – such as providing banana technical information to strategy documents being prepared by the Australian Government or Plant Health Australia. The examples below provide an insight into the range of contributions the ISM has made to various documents as well as examples that are the sole output of BA16008. The deliverables are presented according to the three Outputs featured in the Program Logic.

Implement the Banana Industry Biosecurity Framework and provide technical advice to grower and non-grower stakeholders

- Prepared the Collaborative Agreement and reviewed the Memorandum of Understanding to guide the transition of the TR4 Program from government to industry responsibility (international best practice).
- Initiated the ‘Under the Microscope’ series of articles/fact sheets to profile the High Priority Pests in the banana industry. Eight articles, written by a range of content experts, have been produced since April 2018. The ISM has contributed two articles. These are listed in Appendix 5.
- Presented material (including photos) about the high priority pests for the banana industry and the phone number to report suspect plants to north Queensland agronomists. There was also a reminder in the Australian Bananas magazine.
- Contributed technical banana industry advice to:
 - Plant Health Australia to assist the drafting of the new Banana Industry Biosecurity Plan.
 - Biosecurity Queensland for the drafting of the Queensland Biosecurity Strategy and the review of the *Biosecurity Act 2014*.
 - ACIL Allen/Biosecurity Queensland review of the TR4 Response Strategy.
 - a review of the Torres Strait Fruit Fly eradication response.
 - PHA video targeting backpacker/seasonal farm workers and biosecurity.
 - Department of Agriculture’s Property Identification Code discussion paper; Northern Australia Biosecurity Strategy; National Plant Biosecurity Surveillance Strategy; Tropical Plant Industries Biosecurity Surveillance Strategy.
 - PHA’s National Plant Biosecurity Status report
- Participated in two grower forums to discuss the future of the TR4 Program (some were scheduled for 2020 but were cancelled due to Covid 19).
- Presented at the Biosecurity Partners Forum (speaker and panel member); Industry Liaison Training workshop; National communication and Engagement Network.

Implement the Banana Industry Water Quality Strategy 2017 – 2020 and provide technical advice to grower and non-grower stakeholders

The outputs that align to the Water Quality Strategy were produced as a collaborative effort between BA16008 and the BMP project funded by the Queensland Government. The ISM has strategic oversight of the BMP project including extension delivery and the development of extension materials. For the outputs listed, the role of the ISM varies from being the primary action officer to providing oversight and direction.

- Initiated discussions with the OGBR that resulted in a research trial examining the optimum nutrient application rates for banana plants.
- Contributed to the design of sediment and nutrient workshops prepared for banana growers.

- Wrote nine water quality articles. Provided oversight and facilitated the drafting of 20 other water quality related articles.
- Designed a three-year BMP project funded by the Office of the Great Barrier Reef (OGBR).
- Contributed technical banana industry advice to:
 - OGBR to support the development of the regulations including the Agricultural Environmentally Relevant Activity Standard for Banana Cultivation and guidance material to explain the regulations in grower-friendly language.
 - OGBR on the implementation of the Reef Plan 2050 – Water Quality Improvement Plan and the Research, Development and Innovation Strategy
 - the Department of Agriculture and Fisheries water quality modelling team about the risk assessment framework.
 - MIP regarding the selection of banana farms to trial new technology and farming practices (constructed wetland in the Tully catchment; high efficiency basin in the Johnstone catchment; in drain wetlands and water quality monitoring sites and equipment across both catchments).
 - WTHWP and OGBR for water quality report cards, website material and a video.
 - Hort Innovation as part of a project group trialing remote sensing technology in four horticultural commodities (including bananas).
- Presented information about water quality at Banana Roadshows in Queensland. Participated in the R&D Roadshows held in NSW and WA.
- Formed a reference group of growers with an interest and expertise in water quality to provide advice on draft water quality regulations and other water quality projects. Held two meetings with these growers.
- Organised a soil health workshop for banana growers to help them potentially reduce their nutrient application rates.
- Recorded a podcast interview about the banana industry and its involvement in water quality.

Develop and maintain productive relationships

- Met with industry leaders many times to discuss biosecurity and water quality priorities in every year of the project.
- Delivered three strategic planning sessions to map out an annual plan of ABGC extension and grower engagement. This included consultation with other extension providers in the Wet Tropics.
- Appointed to the MIP governance panel to increase collaboration between the cane and banana industries and the Queensland Government as well as the involvement of the banana industry in water quality projects in the Wet Tropics. The MIP panel meet on average five times per year and has membership from the cane industry, local government, James Cook University, local indigenous leaders and Terrain NRM.
- Attended five Cassowary Coast Banana Grower meetings in person. ABGC extension staff attended all meetings and informed the ISM of any controversial issues as well as kept the growers up to date on the development of issues such as the environmental regulations.
- Attended four meetings with NSW growers – in Murwillumbah and Coffs Harbour as well as a meeting with growers in Carnarvon.
- Attended the meetings of the Banana Industry Technical Advisory Group (a group of growers who help to guide the allocation of water quality grants)
- Attended meetings convened by the Wet Tropics Healthy Waterways Partnership.

Through the ABGC, the banana industry is a member of this partnership and it is a useful mechanism to find out about developments in water quality in the Wet Tropics region. This information was then fed back to banana growers through meetings and magazine articles.

- Initiated regular meetings to exchange information and collaborate with several government departments but most particularly DAF and the Department of Environment and Science (including the OGBR).
- Participated in PHA regional forums and Plant Industry Forums for networking and updates on plant industry biosecurity issues and the Emergency Pest Plant Response Deed.
- Attended events hosted by the National Extension Program including R&D Roadshows and 'speed dating' workshop
- Attended workshops such as the banana bunchy top virus R&D Planning Workshop; Pathways and Surveillance for Tropical Industries Workshop.

Outcomes

The Project Logic for BA16008 describes three ‘end of project’ outcomes for the project. These are addressed below:

1. A sustainable banana industry that is better able to respond to issues arising in biosecurity and the environment.

- The *North Queensland Banana Industry Water Quality Strategy 2017 – 2020* was successfully implemented. All targets (extension delivery and extension material) were achieved and the banana industry can confidently state it has contributed to the improved water quality and health of the Great Barrier Reef (the Strategy’s goal). A copy of the Strategy can be found at Appendix 3. A copy of the Implementation Plan is located at Appendix 6.
- The project was able to successfully influence the Queensland Government’s water quality regulatory framework so that it reflected the environmental best management practice guidelines. This means there is a much greater chance of grower compliance with the regulations. The framework also includes a flexibility provision to allow growers to apply more fertilizer than the regulated rate if they have evidence to show that the plants require higher amounts. This process of consultation took three years to finalise but has left banana growers in a much better position to maintain a profitable business and improve water quality on the Great Barrier Reef. The ISM was also able to influence the Queensland Government to produce grower-focused information so that they can more easily understand how to interpret and comply with the new regulations. The Queensland Government has committed to implementing additional environmental regulations and the process of influencing outcomes will need to continue over the next few years.
- The ISM has influenced the OGBR to provide \$2.5million in new project funding which allowed the ABGC to employ three extension officers and provided \$750,000 in grants to enable practice change. At the time of writing this report, just over half of the available funding had been committed to fund 16 practice change projects.
- The ISM successfully influenced the OGBR to fund a project (\$1.4m) to determine the optimum amount of nutrients to be applied to a crop. The industry currently has no information on this critical topic. The project ends in December 2022 and will provide a wealth of information to assist profitability and knowledge about the relationship between nutrient loss, nutrient application rates and water quality improvement.
- During the BA16008 project, the ISM completed the Reef Trust III project that was funded (\$900,000) by the Australian Government. This project, delivered from 2016 to 2019, achieved 45 permanent practice changes implemented across 2000 hectares.
- The ISM’s representation of the banana industry on the MIP has opened the banana industry to new opportunities and experiences in the water quality arena. As a result, the banana industry now has access to water quality monitoring programs, extension specialists and involvement in projects that have the potential to establish current best practice.
- The ISM has facilitated the initial introduction of the new Reef Credits scheme to banana growers. If trials of this scheme are successful, it will see banana growers paid by investors to reduce their nitrogen application rates. This scheme has the potential to financially reward those growers who are successfully reducing their nitrogen levels over a long period of time (10 – 20 years). The scheme is voluntary and based on similar principles to the Carbon Credit scheme. It could be a ‘game changer’ for banana growers – providing them with another income stream.
- The project was instrumental in establishing a Memorandum of Understanding that will guide the transition of the Panama TR4 Program from government to industry control. This is a world-first undertaking. It will mean that growers will eventually have full responsibility for funding and delivering a containment program to slow the rate of spread of TR4 across the production regions.

- The ISM has commenced the categorization of banana bunchy top virus (BBTV) under the Emergency Plant Pest Response Deed (EPPRD). This means that the industry will be able to mobilize an emergency response quickly if BBTV is found outside of the current BBTV zone in northern NSW. BBTV is a significant risk to the north Queensland banana industry and it is important that there is a preparedness strategy to deal with a possible incursion. This is a long and bureaucratic process that was initiated but not yet completed under BA16008. This was a priority identified in the Banana Industry Biosecurity Framework
- The project has actively participated in preparedness activities such as maintaining current information in the EPPRD, the implementation of the Banana Industry Biosecurity Plan and Industry Liaison Officer training. This proactive activity not only positions the banana industry well but it also helps other industries (particularly horticulture) be prepared for a response to an exotic incursion. The ISM role has helped to cement the banana industry as a well-respected member of the biosecurity community. This was recognized by the appointment of the ISM to the Biosecurity Queensland Ministerial Advisory Council.

2. Growers are informed about the biosecurity and environmental developments impacting on them and the industry and know where to go for assistance.

- The ISM developed a Communication and Engagement Plan to help growers understand the range of water quality issues impacting on the industry. It was a strategic approach, using different mediums to guide the ISM and the ABGC's extension team's interaction with growers. It includes key messages as well as content-rich information. This comprehensive Plan will last beyond the life of BA16008 and can be found at Appendix 7.
- The ISM has facilitated the creation of a library of water quality related resources that are "grower-friendly". This has been done in collaboration with the ABGC extension team as well as other organizations such as the MIP and the WTHWP. It includes fact sheets, videos, podcasts and Australian Banana magazine articles.
- Based on the ISM's relationships and banana industry knowledge, the ISM highlighted to the WTHWP team that some of their publications including the Wet Tropics Reef Report Card were too technical for growers yet the content was essential for them to understand the water quality issues associated with local catchments. As a result, the WTHWP team created new material (including a video) aimed at non-scientists so that the information had a broader reach. The ISM was used as a sounding board during this process.
- The ISM worked with the ABGC Communication Manager to revamp the water quality/BMP section of the ABGC website so that resources were able to be found more easily. This will ensure that resources can be used and reused by growers and assist them to be more profitable and resilient in the future.
- The project worked with the ABGC Communications Manager to implement a feature article series that profiled High Priority Pests in the banana industry. The series is called *Under the Microscope*. The articles were simple and easy to understand with photos to show growers what diseases to look for in their plantations. This feature has appeared in every Australian Bananas magazine since April 2018 (eight pests have been profiled). Contributions were made by several authors including the ISM.
- The ISM engaged with pest scouts and other agronomy professionals who regularly visit farms to remind them to look for unusual plants and how to report them. Photos of the high priority pests were also provided to the group. A reminder for growers was also included in the Australian Banana magazine. This was identified as a priority action in the Banana Industry Biosecurity Framework.

3. Stakeholders understand the key issues impacting on banana growers and how to engage with growers to ensure adoption of best practice for a sustainable industry.

- As the banana industry has not had a history of environmental regulations, officers from the Office of the Great Barrier Reef were not familiar with the banana industry. They

initially had assumptions that policy applied to the cane industry (already regulated) could be transferred to the banana industry. Given the very different production systems, such a transfer was not possible. Consequently, the ISM invested a significant amount of time to educating these officers about the industry, the complexity of its production system and getting policy makers onto farms so that they could see things first-hand and ask growers questions. This exposure to information and experience helped to achieve regulations that were specifically for the banana industry. This gives the regulations the greatest chance of being adopted and strategic water quality targets achieved.

- A similar education process to that described above has occurred with government officers who undertake the water quality modelling of practice change that inform the Great Barrier Reef Report Cards. The ISM has identified inaccuracies in the assumptions about banana farming and work is underway to change the assumptions and improve the accuracy of the modelling and reporting.
- The ISM has worked with Queensland Government representatives to set up a water quality monitoring program on 'banana dominant' sub-catchments. Prior to contact with the ISM, the officers were not aware of the best sample locations or the growers who farmed in the area. The ISM organized for the growers to be briefed about the monitoring program (to diffuse a potentially sensitive situation) and gained a commitment from the government officers to continue to inform the growers and the ABGC about the findings. The government officers were grateful for a collaborative effort with industry.
- As identified previously, the ISM has provided feedback to water quality organizations that their publications have been too technical for non-scientists and were not being used. This was a waste of funding and resources. These organizations have taken swift action to use the science to create new material that can be understood by a larger audience.

Evidence of these outcomes is provided in several sections of this report including the extensive list of Outputs (pages 9-11) and the independent review (Appendix 4).

Monitoring and evaluation

The M&E Plan considered the Impact, Effectiveness and Efficiency of the project. Each of these themes are addressed below.

IMPACT

The M&E Plan identified four questions to assist in the evaluation of the project's impact. These are listed below.

Key Evaluation Questions

- What contribution has this project made to growers being better informed about the biosecurity and environmental developments impacting on them?
- To what extent has this project helped non-grower stakeholders understand the key issues impacting on banana growers?
- To what extent has this project helped non-grower stakeholders to maximise the benefits derived from their interaction with banana growers (and the industry more broadly)?

However, to simplify the analysis of the project's impact (and reduce repetition in the analysis), the three questions above will be rolled together and addressed by responding to the question below.

1. What changed or is different for grower and non-grower stakeholders as a result of the project?

BA16008 will have a lasting impact on the banana industry. It has placed the banana industry in a stronger state of preparedness for both biosecurity and environmental issues. The following is a sample of what is different for growers and non-grower stakeholders as a result of this project.

- Banana growers have benefited from a coordinated approach to extension – driven by the goals and objectives in the Banana Industry Water Quality Strategy. The Strategy provided the industry with a starting point for its extension effort. This strategic approach maximized opportunity for knowledge transfer and practice adoption and minimized their time away from their farm and their business. The WQS also signaled to non-government stakeholders that the industry was engaged in the water quality conversation at a strategic level.
- Government representatives had a consistent, informed, single point of contact that made discussions about the industry's production system and the provision of technical advice more effective. Government representatives had a very poor knowledge about the banana industry and the ISM has spent a large amount of time educating them to ensure that their policy and regulatory decisions could be adopted into a banana farming system.
- The ISM influenced the design of the regulatory framework so that growers can more easily comply with the regulations – reducing the potential for fines and multiple, time consuming interactions with compliance officers. The ISM's influence and ability to present compelling evidence meant that higher nutrient rates were incorporated in the government's regulations than originally planned. The lower nutrient rates may have had a serious negative impact on yield and profitability across the entire industry.
- If the Reef Credits scheme can be developed to suit banana production, a new, reliable and long term income stream will be available to banana growers. Discussions and research on Reef Credits will continue beyond BA16008.
- During development of the TR4 Program's MOU that outlines the commitment to transition governance and funding responsibility from government to industry, the ISM ensured that grower's views and concerns influenced outcomes. Banana growers will have control over the structure and delivery of the TR4 Program. This will empower and give certainty to the industry as the longevity of the program will be less impacted by the Queensland Government's changing priorities.
- The work advancing the categorization of BBTV will help the industry respond quickly

should there be a detection of the virus outside of the current Bunchy Top Virus Zone in NSW. Preparedness is key to an effective and fast initiation of an emergency response.

- Growers have access to a collection of water quality and biosecurity resources that are current, content- relevant and prepared for a grower audience. The ABGC website has been rearranged to make finding information easier for growers.

2. Have there been any unexpected impacts of the project?

- The ISM has spent a large amount of time in the last three years working with officers from the OGBR to educate them about the banana industry, the production system and the variety of production methods used by growers. This was necessary so that the government's policy reflected the reality of banana farming. Prior to the ISM's involvement, officers had very little knowledge of the industry and thought that the policy work underpinning the cane industry could translate to bananas. While this has been a very time consuming activity, it was worthwhile as the regulations now in place for the industry closely align to the BMP Guidelines making it easier for growers to understand and comply.
- It was not originally envisaged that the ISM role would attract funding to the industry for the delivery of extension and R&D projects. This has been a significant benefit to the industry. Project funding that the ISM has successfully obtained for the industry includes:
 - \$900,000 in 2016 from the Australian Government as part of the Reef Trust III program. This funding employed two extension officers, delivered an innovation trial and coinvested with growers to adopt practice change. This Program commenced under BA13023 (the predecessor project) but was completed under BA16008.
 - \$2.5million from the Office of the Great Barrier Reef (OGBR) to fund three extension officers as well as a significant investment supporting growers to adopt best practice. Investment ends in June 2022.
 - \$1.4million to fund a research trial about the optimum nutrition rates required by banana plants. Investment ends in December 2022.

EFFECTIVENESS

1. To what extent were the planned outputs successfully delivered?

a) Implementing at least one priority from the Banana Industry Biosecurity Framework;

- Implementation of priorities from the Biosecurity Framework have progressed well.
- Priorities addressed include:
 - encouraged growers to look for unusual symptoms on their plants and reminding them where to report (magazine articles, general industry engagement, collaboration with Biosecurity Queensland).
 - provided training for pest scouts on what to do if they find a suspect plant (addressed a meeting of pest scouts, fielded questions and provided material detailing steps).
 - developed extension materials including images on symptoms of high priority pests (a feature in every Australian Bananas magazine since 2018).
- Priorities underway include the categorization of BBTV. This is a much more complex process than originally understood and will take time and the cooperation of several government jurisdictions to bring it to completion. NSW has informally signaled its support to undertake this process but further advice is required from the Queensland Government and potentially the Western Australian Government.
- Priorities identified in BA16008 Project Plan and Payment Schedule but not advanced include:
 - Develop a strategy to deal with feral bananas in north Queensland.

- Finalise at least one draft National Diagnostic protocol.

Both activities were to be completed on the condition that the Project Reference Committee thought they were a significant priority. All agreed that the ISM's efforts on the transition of the TR4 Program from government to industry responsibility was a greater priority. More detail is featured in the "Efficiency" section below.

- The Biosecurity Framework recommended as a priority to update the Banana Industry Biosecurity Plan and fact sheets. Hort Innovation provided funding to Plant Health Australia (PHA) to prepare the Biosecurity Plan and the associated Implementation Strategy (BA 15001). The Biosecurity Plan supersedes some aspects of the Biosecurity Framework. The 15001 project did use the Framework as a resource and basis for its research. The ABGC is a significant contributor to this Plan and has implementation responsibilities. PHA has responsibility for keeping the Plan updated and calls meetings on an annual basis to monitor implementation progress. To summarise, the landscape relating to the Biosecurity Framework changed during the life of BA16008 however the ISM was able to adapt and work with PHA to achieve important biosecurity priorities without running parallel processes.

b) Implementing the Banana Industry Water Quality Strategy (WQS) 2017-2020;

The WQS was successfully implemented with all targets achieved. Refer to the Implementation Plan in Appendix 6 for more details.

c) Provision of technical advice to grower and non-grower stakeholders;

- The provision of technical advice is a fundamental element of the BA16008 project.
- The ISM has been highly effective in providing technical biosecurity and environmental information to growers and non-grower stakeholders. Evidence of this can be found in the Outputs and Outcomes sections of this report.
- Very positive stakeholder feedback has been captured in the independent review (Appendix 8). Comments include:
 - "Grower issues around water quality have influenced changes with non-government stakeholders".
 - "Has been good at helping growers recognise issues and understand about nitrogen levels".
 - "ISM has definitely been able to improve grower understanding".
 - "ISM is pivotal. A voice for industry, represents growers and their perspectives very well. Has really helped our project progress".

d) Improved relationships (between the banana industry and non-grower stakeholder groups).

The banana industry will continue to reap the benefits from the productive relationships formed by the ISM beyond the BA160008 project. Evidence of the strength of these relationships can be found in the independent review conducted for this project (Appendix 4). Amongst other things, the strong relationships have:

- resulted in the ISM influencing government policy so that government decisions are relevant to the industry and more likely to be adopted;
- created opportunities for the banana industry to be introduced to experts from new fields and increase their knowledge and understanding.
- Attracted significant funding for extension and R&D trials.

2. In what ways could the effectiveness of this project be improved?

- In hindsight the ISM could have been more selective when accepting invitations to participate in activities from non-grower stakeholders. The ISM is frequently asked to contribute advice (written and verbal) and attend meetings that are not high priorities for the banana industry. Participation is time consuming and reduces the time available

to progress important issues for the banana industry and the BA 16008 project. This was raised by a stakeholder in the independent review and is a learning for any future project.

- As time and issues progress, relationships are consolidated and take less time to form and maintain. The increase of virtual meetings has increased the reach of the ISM.
- More relationships and a growing network of the stakeholders makes it faster to find the appropriate person or organization to contact to resolve or advance issues.
- Increased flexibility in the contracted deliverables means that the ISM could quickly respond to emerging issues with the agreement of Hort Innovation and the Project Reference Committee but without formal variations. This was raised by a stakeholder in the independent review – “the project model needs scope for contingencies”.
- Continued and increased collaboration with other banana development and extension projects.

EFFICIENCY

To what extent has this project achieved agreed outputs according to the contract?

If there have been variations what were the reasons?

Despite the unpredictable nature of agriculture, the implementation of this project went largely to plan. All contracted deliverables were completed with the following comments regarding three Achievement Criteria:

- Exploration of developing a feral banana program as described in the Biosecurity Framework (to be confirmed with the PRC as a priority in the annual work plan)

This Achievement Criterion was discussed with the PRC who advised that they did not think it would be possible or feasible for BA19023 to undertake this project. One of the PRC members with a Biosecurity Queensland background described a project about feral banana control that BQ had considered. BQ did not proceed with the project due to the complexity of locating feral bananas, and the ongoing need for resources (people and funding) to remove feral bananas. Based on this information, the PRC advised that they thought the ISM’s time could be more productively spent working on other biosecurity issues. The ISM instead is a member of a working group that is designing the transition of the TR4 Program from government to industry responsibility. More time was also allocated to the banana bunchy top virus categorization process.
- Implementation of the Biosecurity Framework with particular emphasis on updating/finalizing at least one draft National Diagnostic Protocol (to be confirmed with the PRC as a priority in the annual work plan).

The ISM conducted preliminary research on this Achievement Criterion. This research revealed that the national sub-committee on Plant Health Diagnostics manage the protocols and the prioritization process to move them from draft to final. The sub-committee has not deemed the protocols for banana pests to be of sufficient priority. There are approximately 350 high priority pests requiring protocol development and two or three are developed each year if funding is available. Advice provided to the ISM was that the current draft protocols are adequate and the PRC agreed that this Achievement Criterion would not be pursued.

- **Water quality workshop held**

Initially the water quality workshop was to be reported in the Milestone 104 (November 2018). Due to the delayed start of several research projects to be featured at the workshop, a crowded extension calendar at the end of 2019 and Covid 19, the workshop was rescheduled three times – twice requiring a formal variation. While these variations created an inefficiency, the workshop was highly effective in engaging with growers and potentially bringing about a change of practice that will improve their profitability and local catchment water quality. The workshop was held in September 2020 and 23 growers attended. It focused on the benefits of having good soil health. Evaluation results indicated that most growers in attendance learnt new information and were

planning to take steps after the workshop to investigate and implement a change to their farm. The ABGC extension team will follow up with these growers to offer further assistance. See Appendix 8 for some evaluation results.

Recommendations

- This project has delivered excellent biosecurity and environmental outcomes for the banana industry. The ISM role has been deemed to be critical for the banana industry by both grower and non-grower stakeholders. Evidence of this is captured in the independent review. It is therefore recommended that the function of Strategic Industry Development be continued to be funded as a priority activity for the banana industry.
- The content areas of biosecurity and the environment will remain very important for the banana industry as environmental regulations commence implementation and as the transition of responsibility for the TR4 Program moves from government to industry. Unexpected priorities within these content areas can emerge quickly and the banana industry must remain agile and able to move with the change. A strategically focused project must be flexible and able to change priorities - sometimes at short notice. A constructive relationship with Hort Innovation will be critical in allowing such changes to occur. It is recommended that a representative from Hort Innovation continue to be a part of the Project Reference Committee (PRC) for any future project so that they are aware of the strategic priorities. PRC meetings should also be supplemented with phone or video contact for additional information.
- Outcomes of a strategic nature (such as practice change) often take a long time to deliver measurable outcomes and rely on many different stakeholders to achieve change. Sometimes these stakeholders have different priorities that delay progress. It is important that this restriction is acknowledged by delivery and funding partners and that in some circumstances the effort and inputs need to be recognized when outputs and outcomes have not yet eventuated.
- It is recommended that the industry continue to seek non-levy funding for projects (particularly environmental projects) as it opens opportunities for the banana industry that could not otherwise be funded (due to the exhausted levy funding allocation). It is further recommended that the strategic industry development function has leadership responsibility to link and align these projects to produce cohesive outcomes for the banana industry.
- Traditional methods of monitoring and evaluation can be difficult to apply with projects of a more strategic nature (such as BA16008). It is recommended that Hort Innovation work with project managers across multiple projects (and industries) to share ideas and test ways to improve M&E so that it can be used more constructively during the life of a project.

Refereed scientific publications

N/A

References

N/A

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report.

Acknowledgements

A project of this kind cannot be successful without the contribution and collaborations of many people. The ISM would like to thank the following people for their role in helping to guide and influence this project over the last three years:

- Rebecca Sapuppo, Tegan Kukulies and Doug Phillips, who as Project Reference Committee members, helped to separate out the 'urgent' from the 'less-urgent' priorities.
- The team from the National Extension Project who are always great collaborative partners.
- The team from the Wet Tropics Major Integrated Project who worked hard to bring stakeholders together to improve relationships and water quality outcomes.
- The staff from the Office of Great Barrier Reef who were always willing to listen and learn about the banana industry - its practices and people.
- The staff at ABGC who regularly shared their wisdom and experience to ensure that sanity (generally) prevailed.
- And last, but not least, to the banana growers who always gave up their precious time to answer my never-ending questions. The banana industry is a great industry to work in and I hope as many people as possible get that chance.

Appendices

Appendix 1: Monitoring and Evaluation Plan for BA16008

Appendix 2: Banana Industry Biosecurity Framework

Appendix 3: North Queensland Banana Industry Water Quality Strategy 2017 - 2020

Appendix 4: Independent review of BA16008 by Jill Knell

Appendix 5: List of Australian Bananas magazine articles written as part of BA16008

Appendix 6: Water Quality Strategy Implementation Plan

Appendix 7: Communication and Engagement Plan for BA16008

Appendix 8: Soil Health Workshop evaluation material

Project Information

PROJECT INFORMATION

Project Details	
Project code:	BA 16008
Project title:	Banana Strategic Industry Development
Project type	Industry Development
Service Provider:	Australian Banana Growers’ Council
Industry	Banana 100%
Hort Innovation investment priority	Grow the horticulture value chain capacity
Project Leader:	Mr Jim Pekin
Project Period:	28 August 2017 - 21 September 2020
Project Manager	Michelle McKinlay

1. MONITORING AND EVALUATION (M&E) PLAN PURPOSE

The purpose of this M&E plan is to

- Demonstrate the process for monitoring and evaluating progress, performance and achievements of BA 16008.
- Enable communication and reporting on progress, performance, and achievements and the resulting impacts.
- Enable lessons learned from M&E to be identified and fed back into the project for improvement.
- This M&E plan will be prepared by the project manager and identifies:
 - Evaluation questions necessary for assessing achievements
 - Requirements for monitoring progress and performance
 - Project risks and how they will be managed
 - Stakeholder engagement plan

1.1 STAGES

The M&E Plan for BA16008 (Banana Strategic Industry Development) covers the three phase cycle of preparation, implementation and review:

- i. Preparation – developing the Project Logic and using it to develop the M&E plan. This occurred at the beginning of the project.
- ii. Implementation –providing for continual monitoring or progress, evaluation of impact and achievements and reporting to Hort Innovation. The frequency of reporting is provided in the project plan and payment schedule. The evaluation process suits the length of the project and provides for milestone and final reports.
- iii. Review –to occur annually and at the end of the project. This will allow an assessment of progress in delivering the targets identified in the project outline; a review of management and delivery processes, recommendations for improvements and assessment of the effectiveness of the project in delivering against outcomes specified in the project proposal.

2. SCOPE

Timeframe: 28 August 2017 – September 2020

Background and Rationale

This project, BA16008, follows on from the original Strategic Industry Development project approved for the banana industry (BA 13023). Consequently, this project will consolidate and expand on the achievements of BA 13023 – Banana Strategic Industry Development. This continued strategic approach will again deliver significant benefits to banana growers as it provides a mechanism for banana growers to provide technical advice to inform government policy development and project design. This will ensure that public funding is directed into programs that are practical, relevant and that will deliver long-term benefits for growers, the industry, the environment and the community. There will also be direct benefit to banana growers. This project will ensure that growers are better informed about impacts and consequences of the changing policy context and will be involved in designing and implementing a more holistic, strategic response to policy change that includes practice change.

BA 16008 funds the employment of the Industry Strategy Manager (ISM) who has responsibility for delivering strategic industry development for the banana industry. The end-of-project outcomes are:

- A sustainable banana industry that is better able to respond to issues arising in biosecurity and the environment.
- Growers are informed about the impacts of biosecurity and environmental developments and know where to go for assistance.
- Stakeholders understand the impacts that key issues have on banana growers and how to engage with growers to ensure adoption of best practice for a sustainable industry.

As identified in the Project Logic Framework, the primary outputs of the Industry Strategy Manager are:

- i. Implement the Banana Industry Biosecurity Framework and provide technical advice to grower and non-grower stakeholders;
- ii. Implement the Banana Industry Water Quality Strategy 2017 – 2020 and provide technical advice to grower and non-grower stakeholders;
- iii. Creating productive relationships with stakeholders groups who are important to the banana industry.

Activities:

The ISM will deliver these outcomes and outputs through three foundational activities:

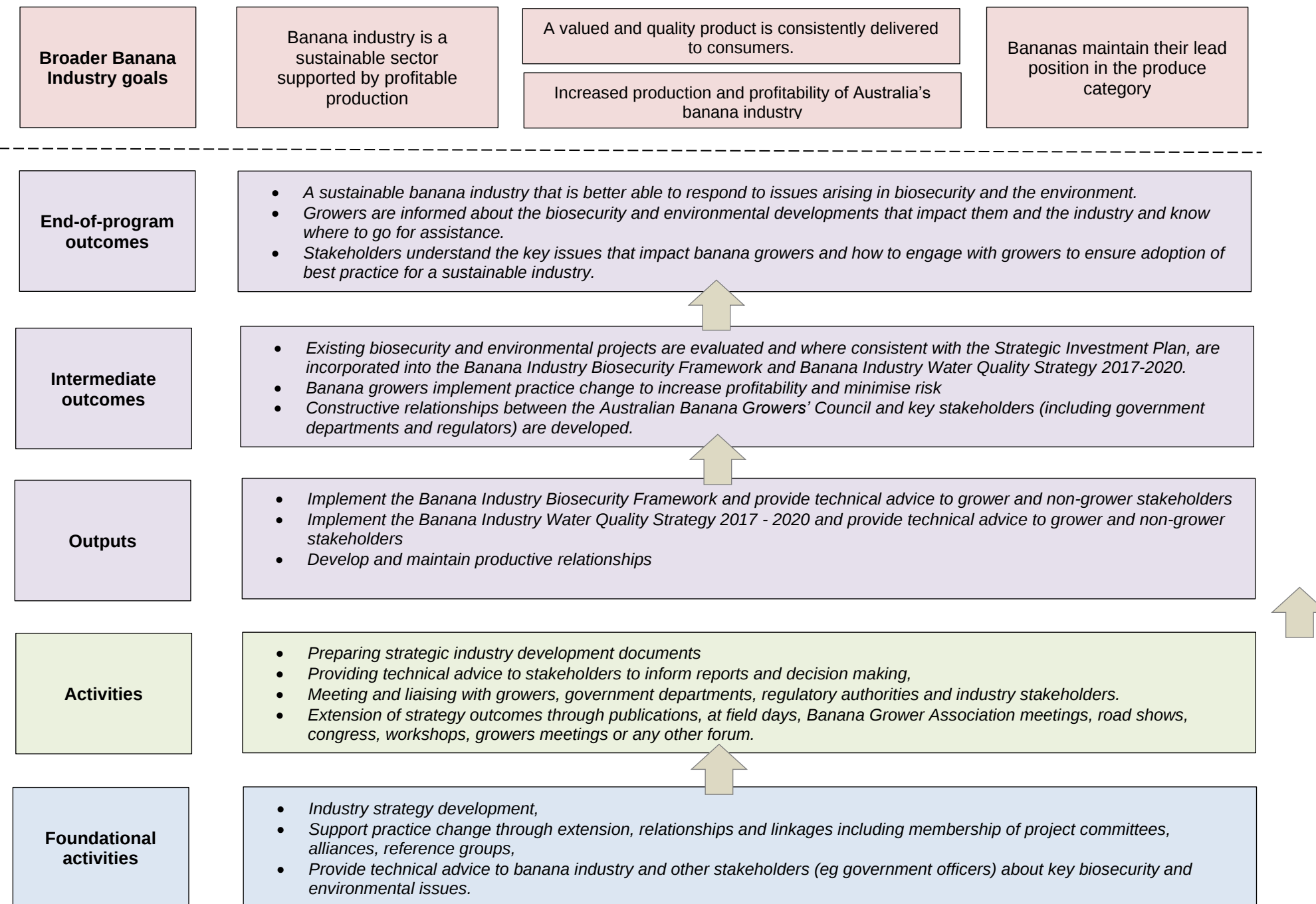
- Industry strategy development,
- Support practice change through extension, relationships and linkages including membership of project committees, alliances, reference groups,
- Provide technical advice to banana industry and other stakeholders (eg government officers) about key biosecurity and environmental issues.

Budget: The budget for the M&E plan (except the independent review) will be part of the overall project budget. Hort Innovation has responsibility for funding and organising the review unless otherwise negotiated.

Part 1 - Program Logic

PROJECT LOGIC DIAGRAM - BA 16008 BANANA STRATEGIC INDUSTRY DEVELOPMENT

The project logic for BA 16008 is based on the information provided in the project scope and was developed by the Industry Strategy Manager. The purpose of the project logic is to link the foundational activities to the broad industry goals. The project logic underpins the M&E plan has been developed for this project.



PART 2 Monitoring and Evaluation Plan

The Key Evaluation Questions relating to the impact, effectiveness, appropriateness and efficiency of the project are detailed in the table below along with the evaluation methods and frequency, method of monitoring and methodology employed. This forms the basis of the Monitoring and Evaluation (M&E) plan. The M&E Plan will help to elicit:

- What contribution this project has made to:
- Output 1 – Implement the Banana Industry Biosecurity Framework and provide technical advice to grower and non-grower stakeholders
- Output 2 - Implement Banana Industry Water Quality Strategy 2017 – 2020 and provide technical advice to grower and non-grower stakeholders
- Output 3 – Develop and maintain productive relationships
- Did the project deliver what was intended? To what extent has the industry funds achieved their objectives in delivering intended outcomes and benefits to growers?
- How relevant was this project to the needs of the growers and non-grower stakeholders (eg departmental representatives)
- To what extent were the activities and engagement processes appropriate for the identified target audience?

Evaluation Purpose	Key evaluation questions	Evaluation methods and frequency	What will be monitored and when	Monitoring measures and methods
Impact	What contribution has this project made to growers being better informed about the biosecurity and environmental developments impacting on them?	Milestone and end of project reports There will be an independent review of this project in the final year. The feedback and recommendations from the review will inform and strengthen the project.	Extent of grower access to information about biosecurity and environmental initiatives Number of growers participating in biosecurity and environmental extension activities.	Number of news stories in local media Information published in banana industry related publications. Surveying growers at activities such as field days, grower meetings, small group extension activities, extension roadshows etc. Increased grower awareness of key biosecurity and environmental issues relevant to the banana industry identified through the independent review. Feedback provided by non-grower stakeholders through the independent review.

	To what extent has this project helped non-grower stakeholders understand the key issues impacting on banana growers?	There will be an independent review of this project in the final year. The feedback and recommendations from the review will inform and strengthen the project.	Invitations for the ISM (or a banana industry representative) to provide advice to inform policy development and participate in forums, membership on committees and advisory groups.	Records of ISM participation in major activities relevant to this project. ISM has provided information to inform the development of legislation, policy outcomes and funding decisions for the benefit of banana growers.
	To what extent has this project helped non-grower stakeholders to maximise the benefits derived from their interaction with banana growers (and the industry more broadly)?	There will be an independent review of this project in the final year. The feedback and recommendations from the review will inform and strengthen the project.	Invitations for the ISM (or a banana industry representative) to provide advice to inform policy development and participate in forums, membership on committees and advisory groups.	Records of ISM participation in major activities relevant to this project. ISM has provided information to inform the development of legislation, policy outcomes and funding decisions for the benefit of banana growers.
	Have there been any unexpected impacts of the project?	Stakeholder feedback and observations throughout the project recorded in milestone reports, project reviews.	The types of unexpected impacts will be recorded throughout the life of the project and summarised for the final report	Methods such as observation and stakeholder feedback will be used to capture unanticipated impacts of this project and the way in which they were addressed.
Effectiveness	To what extent were the planned outputs successfully delivered? 1. Implementing at least 1 priority from the Banana Industry Biosecurity Framework; 2. Implementing the Banana Industry Water Quality Strategy 2017-2020; 3. Provision of technical advice to grower and non-grower stakeholders;	There will be an independent review of this project in the final year. The feedback and recommendations from the review will inform and strengthen the project. Milestone and end of project reports	Stakeholder awareness of the outcomes delivered as a result of the Banana Industry Biosecurity Framework and Banana Industry Water Quality Strategy 2017-2020.	Progress in the three outputs will be discussed and evaluated by the project reference committee and stakeholders. This will be reported in milestone and end of project reports.

	4. Improved relationships (between the banana industry and non-grower stakeholder groups).			
	In what ways could the effectiveness of this project be improved?		Milestone reports (every 6 months) and Project Reference Committee meetings. Implementation of lessons learned (resulting from the project's mid project review and ongoing monitoring and evaluation)	Expected outputs will be measured against actual outputs. Methods such as observation and stakeholder feedback will be used to measure the effectiveness of this project and the way in which improvements could be implemented. Lessons learned discussed at management meetings and recorded in final report as recommendations.
Efficiency	To what extent has this project achieved agreed outputs according to the contract? If there have been variations what were the reasons?	Milestone reports	Comparing actual activity progress and outputs to planned progress and outputs. Information gathered for project meetings and reported twice yearly in milestone reports and the final report.	Project accounts and audited records of expenditure. Project Reference Committee records/minutes. Evidence of amended/varied contract.

PART 3: PROJECT RISK REGISTER

Risk/Threat Description <i>Describe the threat/risk, its sources and impacts</i>	Likelihood* <i>Rare, Unlikely, possible, likely, almost certain</i>	Consequence* <i>insignificant, minor, moderate, major, critical</i>	Rating <i>Low, Medium, high, severe</i>	Current Controls/Contingency <i>Describe what you will do to mitigate the threat/risk, source or impact to an acceptable level</i>	Residual Risk <i>Describe any remaining risk after application of the control / contingency. Consider whether further management strategies are needed</i>
The Biosecurity Framework and Water Quality Strategy fail to link relevant projects and opportunity for synergy is lost.	Unlikely	Moderate	LOW	Develop and maintain wide-reaching networks to ensure the ISM's knowledge of existing and proposed projects is accurate and up-to-date. Broadly promote the existence of the strategies and the role of the ISM to encourage proponents of new projects to make contact to discuss linkage opportunities.	There is a significant amount of biosecurity and environmental work being undertaken by multiple stakeholders across Australia. This means it can be difficult to keep track of (and respond to) all developments. This could lead to gaps in the biosecurity framework and environmental strategies and potentially date each strategy.
The Biosecurity Framework and Water Quality Strategy do not deliver to the banana industry a strategic direction that will guide investment or evaluate future project relevance.	Unlikely	Moderate	LOW	Align the strategies with the Strategic Investment Plan for the banana industry. Ensure the strategies recognise current and future policy direction of key stakeholders such as Australian and State Governments. Project Reference Committee members will guide the implementation of each strategy. Ensure the banana industry's strategic documents recognise the priorities identified by the Strategic Industry Advisory Panel.	Government policy direction can change very quickly and this can impact on the banana industry's priorities and responsibilities. Awareness of anticipated changes and an ability to determine the banana industry's response will help to minimise this risk and keep the strategic documents relevant.
Industry Strategy Manager (ISM) does not develop effective relationships with stakeholders and implementation is negatively impacted.	Unlikely	Moderate	LOW	Attendance and participation in industry events such as Congress, field days, workshops, conferences , grower meetings etc ISM visits to a growing region are structured to deliver maximum contact with banana growers, industry extension officers and other stakeholders. Scheduling of regular meetings and telephone calls with stakeholders. The ISM has a focused effort on Australia's largest banana growing region.	The large workload of the ISM position may reduce the opportunity to spend an appropriate amount of time in the growing regions, talking directly to growers and building relationships. Given the industry-wide focus of strategy development (and the type of day-to-day work that underpins it) many strategic stakeholders are based in Brisbane or Canberra and the ISM spends the vast majority of time working with these stakeholders in these locations. This can result in less frequent interactions with growers than desired.

				The ISM has excellent “people skills” and easily mixes and communicates with people from a wide range of backgrounds.	Regular face-to-face engagement with banana growers in Coffs Harbour and Carnarvon districts is difficult due to the expense and time it takes to travel to these regions.
The banana industry has proactively developed a water quality strategy with delivery targets. Strategy implementation has commenced. Governments may enforce compliance of aspirational targets instead of current minimum standards.	Possible	Moderate	MEDIUM	Regularly engage with government and other stakeholders to moderate their expectations and reinforce that the strategy targets are aspirational. Regularly review the targets set in the strategy to monitor industry’s progress towards achieving targets, and assess any requirements to change targets, strategies etc.	Negotiations have occurred with Government regarding the new regulatory requirements for water quality and new targets. The Banana Industry Water Quality Strategy aligns with the direction of government.
The spread of TR4 leaves growers uninterested in implementing new farming practices to improve water quality leaving farms (risk added post PRC meeting in May 2018)	possible	moderate	MEDIUM	Focus on those practices that can save growers money or can be easily implemented. Water quality is only a component of the BA16008 project. The biosecurity component of this project will remain very useful to growers.	Sediment mitigation measures may not be widely adopted by the banana industry. This may impact on the industry’s ability to achieve/contribute to Reef Plan 2050 targets and the Banana Industry’s own water quality goals and objectives as outlined in the Banana Industry’s Water Quality Strategy Government is aware of the pressure resulting from the detection and likely spread of TR4. The banana industry’s access to strategic thinking and industry development (provided through BA16008) is critical in this period of uncertainty.
Consistent low prices for bananas may result in growers not being able to afford to change their farming practices to improve water quality (risk added post PRC meeting in May 2018).	possible	moderate	MEDIUM	Focus on those practices that can save growers money or require little financial investment. Water quality is only a component of the BA16008 project. The biosecurity component of this project will remain very useful to growers.	Sediment mitigation measures may not be widely adopted by the banana industry. This may impact on the industry’s ability to achieve/contribute to Reef Plan 2050 targets and the Banana Industry’s own water quality goals and objectives as outlined in the Banana Industry’s Water Quality Strategy. Government is aware of the financial pressure experienced by growers and is prepared to discuss future adoption strategies if the financial situation (combined with TR4 spread) worsens. The banana industry’s access to strategic thinking and industry development (provided through BA16008) is critical in this period of poor prices.

	Consequence
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Likelihood		Insignificant	Minor	Moderate	Major	Critical
	Almost Certain	Low	Medium	High	Severe	Severe
	Likely	Low	Medium	Medium	High	Severe
	Possible	Low	Low	Medium	High	Severe
	Unlikely	Low	Low	Low	Medium	High
	Rare	Low	Low	Low	Medium	High

PART 4 Stakeholder Engagement Plan

AIM

The aim of the stakeholder engagement plan is to identify the stakeholders who will have a key role to play in the success of the BA16008 project (Banana Strategic Industry Development). This includes those non-grower stakeholders who are contributors to the water quality strategy and biosecurity framework as well as banana growers who are beneficiaries of the project's outputs (eg the Biosecurity Framework and Water Quality Strategy).

Engagement Objectives		
- To develop strategic documents in the fast changing and crowded fields of biosecurity and the environment – particularly water quality on the Great Barrier Reef. - To work with growers to ensure strategy documents can be implemented; and - To support practice change through a clearly articulated and “joined up” approach to the industry’s strategic direction, extension effort and relationships.		
Who	1. Stakeholders	- Australian and State Government departments eg Queensland and NSW agriculture departments and the Australian Government departments of agriculture and the environment); - Banana growers; - Local Banana Growers’ Associations; - Plant Health Australia; - Peak industry bodies (eg Growcom; Queensland Farmers Federation, CANEGROWERS, AgForce) - Wet Tropics Healthy Waterway Partnership; - Wet Tropics Major Integrated Project Panel; - Reef Alliance; - Horticulture Innovation; - Banana supply chain businesses; - ABGC colleagues; - NRM bodies especially Terrain NRM and Cape York NRM; - Consultants,
How	2. Level of Engagement	- Australian and State Government departments: High interest / High Influence - Banana growers: medium interest /High Influence - Local Banana Growers’ Associations: medium interest / High Influence - Plant Health Australia: High interest / High Influence - Peak industry bodies: high interest / high Influence - Wet Tropics Healthy Waterway Partnership: High interest / low Influence - Wet Tropics Major Integrated project: high interest/ high influence - Reef Alliance: High interest / medium Influence - NRM bodies: High interest / High Influence - Banana supply chain businesses: Low Interest / low influence - Consultants: low interest / Low Influence - Hort Innovation: high interest /high influence - ABGC colleagues: High interest / High influence
	3. Proposed method of engagement	Australian and State Government departments Face-to-face meetings, membership of project reference groups, steering committees, teleconferences; public comment, forums, Australian Bananas magazine; ABGC website; newsletters; E bulletins, newspaper articles.

		Banana growers Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Local Banana Growers' Associations Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Plant Health Australia Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Consultants and supply chain business Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Peak industry bodies Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		NRM bodies Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Wet Tropics Major Integrated Project Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Wet Tropics Healthy Waterway Partnership Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
		Horticulture Innovation Meetings, project reporting, workshops, project steering committees Australian Bananas magazine; ABGC website; newsletters; E bulletins
		ABGC colleagues Collaborations; meetings and reporting requirements.
		Reef Alliance Face-to-face meetings; fact sheets; newsletters; bulletins; workshops; Australian Bananas magazine; ABGC website; newsletters; E bulletins; newspaper articles
	4. Timing	Australian and State Government departments There are numerous interactions with representatives from government departments – the timing and frequency depends on the issue or project.
		Plant Health Australia There are at least 3 meetings of PHA members annually as well as ongoing contact by email, teleconference meetings and phone calls.
		Banana growers Meet individually with banana growers at every opportunity Have input into fact sheets, websites, newsletters, bulletins, surveys, public meetings, workshops – ongoing Participation in Extension Roadshows held every 2 years (2018 and 2020). Participation at the Banana Industry Congress 2019.

		Local Banana Growers' Associations Attend meetings of growers' associations at least three times per year, provide written or verbal advice/updates at meetings as requested
		Wet Tropics Healthy Waterways Partnership Meetings, networking events, meetings, forum and workshops – as required -on going Attendance at two meetings per year (face-to-face or teleconference)
		Reef Alliance Reef Alliance members to meet at least quarterly. Meetings, networking events, meetings, forum and workshops – as required -on going
		Horticultural peak bodies; NRM Groups; consultants; supply chain businesses Liaise with other stakeholders through meetings, networking events, meetings, forum and workshops – as required -on going
		ABGC colleagues Meetings and collaboration on different projects and towards goals relevant for industry. This will be ongoing occurring frequently each week. Joint input into publications and representation for industry – ongoing.
		Hort Innovation Liaise with HI officers through meetings, networking events, forum and workshops – as required -on going. Project Reference Committees meetings held and milestone reports submitted as required.
	5. Resources	The project is appropriately resourced to meet the stakeholder engagement plan.
	6. Responsibilities	- Responsibility for the implementation of the Stakeholder Engagement Plan rests with the Industry Strategy Manager, ABGC. - Extension project teams (non-HI funded) will mainly be responsible for the roll out of extension strategies. - The ISM will work closely with the ABGC Communications manager for the dissemination of information to industry and other stakeholders. - The ISM will work collaboratively with the R&D Manager to ensure no duplication of effort and that a collaborative approach will deliver excellent biosecurity outcomes for banana growers. - The ISM will work collaboratively with other banana-focused projects and the ABGC management team in stakeholder engagement activities. - It will be the responsibility of the ISM, together with the Project Leader, Jim Pekin to submit milestone and final reports to HI.
	7. Key messages to communicate	- Strategies are an important tool to focus, coordinate and leverage the effort and available funding that is currently directed at the industry from multiple funding sources. - Strategy implementation will set a foundation for the industry's future and map a way forward. - Strategies will identify current gaps in knowledge or tools, and help determine who can fill and fund the gaps. - Strategies will help attract future investment for the industry.
Other considerations	8. Managing Risk	Refer to the Risk Register included in this document.

Biosecurity Framework for the Australian banana industry

March 2017



This Biosecurity Framework has been produced by the Australian Banana Growers' Council as a part of the Banana Strategic Industry Development Project that is funded by HIA Ltd using the banana industry R&D levy and matched funds from the Australian Government.

Background

Bananas are a highly genetically homogenous crop which are propagated from vegetative material and around 94% of the industry is grown in close proximity in North Queensland. Therefore, exotic and endemic pests and diseases as well as those under active containment pose a threat to banana production.

Purpose of framework

The aim of this framework is to examine the current extent of biosecurity preparedness within the banana industry – from growers' awareness levels to research gaps and the ability to contain (and continue to farm with) exotic pests given Australian production systems. The framework considers those pests and diseases that have been determined to be High Priority Pests (HPPs) in the Banana Industry Biosecurity Plan (2010) as well as other pests and diseases that impact on the banana industry.

In preparing this report and to give structure to the information currently available, this report uses the different elements of the biosecurity continuum to make an assessment about how well positioned the Australian banana industry is if it had to respond to an exotic pest (both exotic to Australia or currently found outside of a current production area). The elements include:

- Prevention of pest and disease movement into and within Australia;
- Preparedness - including:
 - Grower and general industry awareness;
 - Research including diagnostic tests;
 - Contingency planning.
- Surveillance;
- Response Actions including pest classification under the Emergency Pest Plant Response Deed; and
- Ongoing Management of the pest or disease.

This framework is the result of an assessment of existing, published information. Importantly the framework has a list of recommendations to guide possible further work in the banana biosecurity area. There is also a “traffic light” summary that reflects the current level of preparedness in response to each pest identified. The colour system used does not rate the importance/impact of the actual pest on the banana industry.

The assessment of the available information and subsequent preparation of the Banana Industry Biosecurity Framework would not have been possible without the research contribution of Dr Jay Anderson, Plant Pathologist, Research and Development for Primary Industries Pty Ltd.

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List of acronyms

ABGC – Australian Banana Growers Council

BBTV – Banana bunchy top virus

BPPP – Banana Plant Protection Program, HIA funded project 2011 – 2016.

BQ – Biosecurity Queensland

BWAP – Banana wilt associated phytoplasma

CCEPP – Consultative Committee on Emergency Plant Pests

DAF – Department of Agriculture and Fisheries (Queensland)

EFSA – European Food Safety Authority

EPPRD – Emergency Plant Pest Response Deed

HFS – Horticulture and Forestry Science (a group within DAF)

HIA – Horticulture Innovation Australia

HPP – high priority pest

NAQS – Northern Australia Quarantine Strategy

NDP – National Diagnostic Protocol. Links to NDPs:

<http://plantbiosecuritydiagnostics.net.au/resource-hub/priority-pest-diagnostic-resources/>

PaDIL – Pest and Disease Image Library – online resource from the Australian Government's Department of Agriculture, in collaboration with Museum Victoria, Plant Health Australia, the Department of Agriculture and Food Western Australia and the Plant Biosecurity Cooperative Research Centre. <http://www.padil.gov.au/>

PEQ – post-entry quarantine

PHA – Plant Health Australia

QAAFI – Queensland Alliance for Agriculture and Food Innovation

QBAN – Quality Banana Approved Nursery

SEQ – South East Queensland

SPHDS – Subcommittee on Plant Health Diagnostic Standards

Biosecurity Framework Summary Table

	Organism	Pathways ^a	Awareness	Research	Prevention of movement	Surveillance	Diagnostics	Contingency plans	Management	EPPRD
	Exotic									
Abaca bunchy top virus		  								NC
Banana bract mosaic disease		  								✓
Banana bunchy top virus (exotic strains)		  								✓
Blood Disease		     								✓
Moko		     								✓
Bugtok		   								✓
Bacterial wilt – <i>X. c. pv. musacearum</i>		     								NC

	Organism	Pathways ^a	Awareness	Research	Prevention of movement	Surveillance	Diagnostics	Contingency plans	Management	EPPRD
Freckle disease		  								✓
Eumusae leaf spot		  								✓
Black Sigatoka		  								✓
Banana skipper butterfly		 								✓
Spider mite		 								✓
Banana Wilt Associated Phytoplasma		 								?
Exotic nematodes		  								?

	Organism	Pathways ^a	Awareness	Research	Prevention of movement	Surveillance	Diagnostics	Contingency plans	Management	EPPRD
Restricted range										
Panama disease Tropical race 4		   	Green	Red	Orange	Green	Orange	Orange	Red	X
Panama Race 1		   	Green	Red	Orange	Orange	Orange	Orange	Red	X
BBTV (Australian strain)		  	Red	Green	Red	Orange	Green	Green	Orange	X
Endemic										
Yellow Sigatoka and leaf spot diseases		  	Green	Green	Green	Green	Green	Orange	Orange	X
Coffee bean weevil		 	Green	Red	Orange	Orange	Orange	Red	Red	X

Organism:  - virus,  - bacteria,  - fungus,  - butterfly,  - mite,  - phytoplasma,  - nematode,  - weevil. ^a Adapted from R. Sapuppo, J. Anderson “Risky Business” Roadshow presentation 2014  – planting material,  – fruit,  - soil,  – moved by insects or insects able to move themselves,  - tools, footwear and equipment,  – water,  – wind.

Colour indicates level of preparedness (rather than impact of pest) : **Red** - very little preparation, needs attention, **Orange** – moderate preparation, needs attention but not most urgent, **Green** - relatively well prepared, **Light orange** – unknown, needs further investigation

NC = not classified. √ = covered by the EPPRD. X = not covered by EPPRD. ?=not clear if covered by EPPRD.

List of priorities and gaps

The following recommendations are listed in order of priority.

- Continue to encourage growers to regularly look for anything unusual on their plants and get someone qualified to look at a symptom ASAP. There is potential to contain/eradicate pests and diseases if found early enough.
- Maintain existing systems and research capacity that are preventing the movement and establishment of exotic pests and diseases into Australia for example:
 - NAQS surveillance,
 - post entry quarantine facilities and conditions,
 - germplasm banks and
 - diagnostic, networking and high calibre technical knowledge capacity.
- Address potential for Banana Bunchy Top Virus (BBTV) spread from South East Queensland and Northern NSW to other growing regions by ensuring support for the BBTV containment program. There needs to be more information about this virus targeted at north Queensland growers. Clarification is required about the current EPPRD classification (pg 10).
- Maintain education program on Panama disease Tropical Race 4 and development, importation and testing of varieties with resistance to the disease. Update of PHA factsheet on the disease (pg16).
- Continue to develop management strategies for Panama disease (pg 16).
- Investigate a program for supply of black Sigatoka resistant varieties to replace susceptible varieties on Cape York in conjunction with a structured sentinel program to support for black Sigatoka detection. Support regular surveillance in the Cape (pg 22).
- Develop extension materials with information and high quality images on symptoms for growers to look for. Provide training for pest scouts on what to do if they find a suspect plant.
- Develop National Diagnostic Protocol (NDP) and Contingency plans for bacterial wilt diseases to enable a swift response if there was an incursion.
- Develop a north Queensland strategy to deal with feral bananas that could harbour potential incursions e.g. banana bunchy top virus
- Update of the industry biosecurity plan (IBP) and facts sheets.
- Categorise *Mycosphaerella eumusae* (cause of Eumusae leaf spot) under the EPPRD (pg 24)
- Understand more about the distribution of Eumusae leaf spot as well as other research on the disease. (pg 24)

- Address the lack of information on banana wilt associated phytoplasma (pg 19)
- Develop a diagnostic protocol and contingency plan for Banana Skipper Butterfly (pg 38)
- Review all draft NDPs and assess the resources required to finalise them.
- Develop management strategies for coffee bean weevil (pg 41)
- Any future surveillance projects, regardless of the pest or disease ,must include that inspectors also note and act on ANY unusual symptoms.

It is recommended that all of the priorities listed above are reviewed annually.

Specific Pest and Disease Information

Banana Bunchy Top Disease

Caused by *Banana Bunchy Top Virus*

Banana bunchy top virus (BBTV) is the most devastating banana virus disease world-wide. The virus is present in Southeast Asia and the South Pacific and is present in parts of India and Africa (refer to attached maps).

The disease causes a stunting and a choking of the banana plants and badly affected plants do not produce bunches. The disease is spread in infected planting material and by aphids (*Pentalonia nigronervosa*). There is no known resistance to the virus.

The virus has alternate hosts (*Canna*, *Heliconia*, *Strelitzia*) that are commonly found in backyards across Queensland.

The disease is under active containment in northern NSW and SEQ. There are however, concerns about the introduction of exotic strains into Australia as well as the introduction of the current strain(s) into north Queensland (NQ), NT and WA. The high density of plantings in north Queensland and the ubiquitous nature of the vector could make eradication difficult in north Queensland.

If the current virus was found outside of the existing regions, then it would be covered under the EPPRD.

Awareness and research

Grower awareness of the virus is high in northern NSW, moderate in SEQ and generally low amongst growers in NQ, NT and WA. Awareness in the gardening communities in SEQ and NNSW is currently relatively high due to work of BBTV project Phase I and II. There is a concern that without ongoing education, general public awareness will decrease. It is critical to maintain awareness of this pest to reduce the likelihood of the general public spreading the pest into the main Australian production area via the movement of contaminated planting material.

Due to the ongoing containment program in SEQ and northern NSW there are many resources on recognising and dealing with the disease. Material includes photos, popular articles, scientific literature and videos. There needs to be work done to determine whether these resources are up to date.

Research is currently being undertaken to understand latency of the virus in corms of banana plants as the disease has appeared in locations a long distance from other infected plants but in close proximity to where infected plants were removed over 12 months prior.

GAPS:

- NQ and WA growers lack knowledge about the disease and its symptoms.
- There needs to be continued effort to educate the general public about the risks of moving planting material outside of the B BTV zones (particularly in NSW and SEQ).

Prevention of movement

Into Australia

Prevention of movement into the country on planting material is covered under importation conditions. Banana is considered a high risk crop and therefore tissue culture plantlets are imported into post entry quarantine (PEQ) glasshouse under strict protocols.

Clean, well packed fruit is not a potential vector of the disease.

Within Australia

There are restrictions on the movement of planting material between States and also for some areas between biosecurity zones.

Encouragement of growers to use QBAN tissue culture plants to start new plantations.

GAPS:

- Biggest threat is the potential build-up of the disease in SEQ (and NSW if resources are lessened there) and then disease then spreading to other growing regions, potentially very easy for a member of the public to take infected suckers to NQ.
- Prior to Panama TR4 in NQ, lack of care by growers in sourcing planting material from neighbours in NQ, with the TR4 incursion growers now take much more care in sourcing plants.

Surveillance

Early infections have subtle symptoms and so can be difficult to identify.

Regular surveillance and eradication of BBTv infected plants is being undertaken as part of the HIA funded projects “National banana bunchy top virus program – Phase 3 – QLD (BA15006) and National banana bunchy top virus program – Phase 3 – NSW (BA15007).

Due to the longevity of funded BBTv projects, there are trained inspectors who can identify early symptoms and have an awareness to look for symptoms of other diseases.

ABGC's yellow Sigatoka inspector has had training on recognising the disease, however he has not had regular exposure to seeing infected material and so may have difficulty in identifying early infections.

GAPS:

- Growers need to be encouraged to closely monitor their plants and to know what actions to take if they notice something unusual.
- There is currently no succession planning for inspectors.

Diagnostics

Testing for BBTv is routinely performed by DAF/QAAFI however there is no National Diagnostic Protocol (NDP) (draft or ratified).

Expertise:

- Diagnostics: Dr John Thomas with Dr Kathy Crew.
- Visual identification: Barry Sullivan, Joshua Chapman David Peasley, Samantha Stringer (no longer working on BBTv but have extensive field experience).

GAPS:

- Fast assays, ratified NDP

Contingency/Covered under EPPRD

Incursion into NQ, NT and WA could be covered under EPPRD as the disease is under active control in northern NSW and SEQ. Work may be required on the classification of this disease.

A well-established plan for containment exists for this disease (Thomas, 2009). Research is currently being undertaken to understand the potential for the virus to remain latent in the eyes of corms and appear a number of years after the last detection of BBTv in a plantation. This has implications for declaring an area free of BBTv.

Management

Current management practice is to contain the disease and eradicate it from commercial plantations. Management relies on regular inspections and destroying infected plants. There is good information available on destruction methods of infected plants (standard operating procedures were updated in 2016) with more research being done to examine the efficacy of insecticides and herbicides at different times of year.

No resistant varieties.

GAPS:

- Major scientific gaps in knowledge about the disease have been or are being addressed.
- Increasing public awareness of how to report this disease is very important.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Banana-bunchy-top-disease-FS.pdf>

<http://abgc.org.au/projects-resources/industry-projects/banana-bunchy-top-virus/>

<http://www.promusa.org/Bunchy+top>

Thomas JE (2009) Strategies for the control of banana bunchy top virus – a review

Cook DC, Liu S, Edwards J, Villalta ON, Aurambout J-P, et al. (2012) Predicting the Benefits of Banana Bunchy Top Virus Exclusion from Commercial Plantations in Australia. PLoS ONE 7(8): e42391. doi:10.1371/journal.pone.0042391

Stringer S, Sullivan B and Peasley D. SOP for destruction of BBTv infected plants. ABGC.

Abaca Bunchy Top Disease**Caused by *Abaca bunchy top virus***

Abaca bunchy top virus (ABTV) affects abacas plants and has some similarities to *banana bunchy top virus* as they are both Babuviruses. Abacá, (*Musa textilis*) is a species of banana native to the Philippines and is grown as a commercial crop in the Philippines, Ecuador, and Costa Rica. It has a great economic importance as it is harvested for its fibre that is pulped and

used in a variety of specialized paper products including tea bags, filter paper and banknotes. The fruit is inedible and is rarely seen as harvesting occurs before the plant produces fruit.

ABTV symptoms in abaca plants are similar to those caused by BBTV in banana plants.

For some time it was thought ABTV was caused by *banana bunchy top virus* but abaca bunchy top virus was described for the first time in 2008 (Sharman et al, 2008).

Strains of the virus in Malaysia have been recorded from banana while banana plants in the Philippines have grown alongside infected abacá plants and remained free of the virus.

Awareness and research

Active research is being undertaken in the Philippines to understand more about the disease as well as other viruses of banana (Cruz et al, 2016).

GAPS:

- There is very little awareness of the disease in all banana growing states of Australia however awareness by growers of the related *Banana Bunchy Top Virus* is high in SEQ and northern NSW.
- There are large gaps in understanding the different strains of the virus, where it is present and potential resistance in abacá.
- There is no PHA factsheet for the virus.

Prevention of movement

Like BBTV, ABTV is spread by banana aphids (*Pentalonia nigronervosa*) and in infected planting material.

Into Australia

Prevention of movement into the country is covered under PEQ glasshouse. Similar potential for entry as for exotic strains of *BBTV*.

Within Australia

There are restrictions on the movement of planting material between states. Encouragement of growers to use QBAN tissue culture plants to start new plantations will decrease the possibility of moving infected planting material. ABTV is not currently listed in the *Biosecurity Act 2014* as being either prohibited or restricted matter.

GAPS:

- Grower awareness of this virus is not high however since Panama TR4 being detected in NQ, there is an increased awareness of the importance of using clean planting material.

Surveillance

There is no specific surveillance activities targeting this disease.

Diagnostics

There are specific PCR primers for ABTV. They have been tested against the small number of known isolates in existence (currently six).

Expertise: Dr John Thomas (QAAFI), Dr Murray Sharman (DAF) did the studies on ABTV in mid 2000s, Dr Kathy Crew (DAF).

GAPS:

No NDP for ABTV.

Contingency/Covered under EPPRD

An incursion into Australia would be covered under EPPRD but the disease has not been categorised.

GAPS:

There is no contingency plan but there is a well-established plan for containment and eradication of BBTV (Thomas, 2009) that could be used. There would be overlap in contingency plans between BBTV, ABTV and BBrMV, but they differ in:

- Mode of transmission (non-persistent vs persistent) and vector species (*Pentalonia* only vs a wide range of species)
- Host range differences – BBrMV has some known hosts (*Alpinia*, *Elletaria*) outside *Musa*. Alternative hosts for ABTV and BBTV are likely, but still a work in progress.

Management

Potentially similar as for BBTV. No resistant varieties.

GAPS:

- Very little is known for ABTV but in the absence of specific knowledge, the industry response would be similar to BBTV.

Resources

Sharman M, Thomas, J, Skabo S and Holton T (2008) Abaca' bunchy top virus, a new member of the genus *Babuvirus* (family *Nanoviridae*). *Archives of Virology* 153: 135-147.

Cruz FCS, Belen GB and Alviar AN (2016) Serological and molecular detection of mixed bunchy top and mosaic virus infections in abaca (*Musa textilis* Nee) *Philippine Agricultural Scientist* 99(1): 88-98

Banana Bract Mosaic Disease

Caused by *Banana bract mosaic virus* (*Potyvirus*)

Banana Bract Mosaic Virus causes Banana Bract Mosaic Disease (also called Kokkan). It was first found in the Philippines in 1979. The disease can cause significant losses (up to 40%) and can infect banana and abacá. The most striking symptom are purple mosaic symptoms on male flower bracts and can cause distortion of bunches and underdeveloped fingers.

The disease is exotic to Australia. It is present in the Philippines, India and Sri Lanka.

Although belonging to a different group of viruses to BBTV, BBrMV is also spread by the banana aphid (*Pentalonia nigronervosa*). Three other aphids widespread within Australia also vector the disease; corn aphid (*Rhopalosiphum maidis*), cotton or melon aphid (*Aphis gossypii*) and cowpea aphid (*Aphis craccivora*). Unlike for BBTV, BBrMV is non-persistently transmitted meaning that aphids are no longer infective after moulting and the aphid is only able to spread the virus for a short period of time.

Awareness and research

There is a PHA Factsheet for the disease.

GAPS:

- There is very little specific awareness of the disease in Australia however the impact of virus diseases in general is high in SEQ and northern NSW (because of BBTv) but significantly less in NQ, WA and NT.

Prevention of movement

Into Australia

Prevention of movement into the country is covered under PEQ glasshouse. Similar potential for entry as for exotic strains of BBTv.

Within Australia

There are restrictions on the movement of planting material between states and between biosecurity zones within some states.

GAPS:

Grower awareness of this virus is not high however since Panama TR4 being detected in NQ, there is an increased awareness of the importance of using clean planting material. Encouragement of growers to use QBAN tissue culture plants to start new plantations.

Surveillance

The NAQS and BQ surveys are conducted regularly around Cape York and urban NQ. Staff looks for any unusual symptoms and teams are aware of the range of exotic pests and diseases.

The staff employed in the HIA funded projects for BBTv and yellow Sigatoka inspections take note of unusual symptoms and seek help if need be.

There is a large range of pest scouting services used by growers and inspection of plantations by growers. Some growers inspect plants very closely and others do many operations by calendar and may miss seeing the development of issues in the field.

GAPS:

Growers need to be encouraged to closely monitor plants but also know what actions to take if they notice something unusual.

Diagnostics

Expertise:

- Dr John Thomas (QAAFI),
- Dr Kathy Crew (DAF),
- Dr Andrew Geering (QAAFI).

GAPS:

- There is a draft NDP which has not yet been ratified.

Contingency/Covered under EPPRD

Incursion into Australia would be covered under EPPRD and the disease has been categorised as Category 3.

GAPS:

There is no contingency plan but there is a well-established plan for containment and eradication of BBTV. There would be overlap in contingency plans between BBTV, ABTV and BBrMV, but they differ in:

- Mode of transmission (non-persistent vs persistent) and vector species (Pentalonia only vs a wide range of species)
- The (unknown) potential for seed transmission of BBrMV only – only relevant to wild seeded bananas).
- Host range differences – BBrMV has some known hosts (Alpinia, Elletaria) outside Musa. Alternative hosts for ABTV and BBTV are likely, but still a work in progress.

Management

Management practices would be similar as for BBTV. The virus is aphid vectored but the virus only survives in the aphids for a short period of time.

GAPS:

- No resistant varieties

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Banana-bract-mosaic-virus-FS.pdf>

<http://www.padil.gov.au/pests-and-diseases/pest/main/136660>

Panama disease/ Fusarium wilt

Caused by the fungus *Fusarium oxysporum* f.sp. *cubense*

The disease is characterised by a yellowing of the older leaves and an eventual collapse to form a 'skirt'. When cut open there are brown streaks through the water conducting vessels of the pseudostem. Yields are severely impacted and eventually affected plants die. The symptoms are similar to those caused by Moko.

The disease is soil-borne and can remain infective in the soil for up to 40 years. In addition to transmission via soil the disease can be spread in infected bits and suckers, on farming equipment and via fungal spores in flood and irrigation water. It can take some time between the infection of the roots of a plant and symptoms to develop, meaning that the disease can be spread without people realising it is present.

There are a number of races of *F. o.* f.sp. *cubense* each with a different host range.

Race 1 affects Lady Finger, Sugar and Ducasse, but not Cavendish.

Race 2 affects 'Bluggoe' and other cooking bananas

Race 3 is not a pathogen of banana and affect *Heliconia*

Race 4 has the widest host range and is the most destructive. It affects all varieties that Race 1 and 2 affect as well as 'Cavendish' and others which are resistant to Race 1 and 2.

Race 4 is divided into Subtropical Race 4 which affects Cavendish in subtropical conditions and when the plant is subject to stress and Tropical Race 4 which does not require predisposing factors for infection to occur.

Race 1 is present in nearly all banana growing countries in the world. Tropical Race 4 has been present in South East Asia for some years, where it has had a significant impact, but more recently has been found in Mozambique, Jordan, Lebanon and Pakistan (<http://panamadisease.org/en/map>).

Tropical Race 4 was first found in Australia near Darwin in 1997 where it significantly impacted on local banana production. In March 2015 the disease was found for the first time in Queensland on a commercial farm near Tully.

Awareness and research

Since the incursion of Tropical Race 4 awareness of Panama disease has increased significantly both in growers and the general community particularly in NQ.

A large amount of extension and communications materials have been developed since the detection in NQ. Workshops to help growers develop and implement on-farm biosecurity plans were delivered.

NSW Biosecurity has produced a Panama Tropical Race 4 alert and also undertook well promoted surveillance in April 2015 in northern NSW.

There is a PHA factsheet that requires updating.

Panama research has been ongoing for many years in Australia (the world's first record of Panama disease was Race 1 – found at Eagle Farm, Brisbane in 1876). Research efforts increased in the late 1990s early 2000s due to the incursion of Tropical Race 4 in the NT. Research was also part of the CRC for Tropical Plant Pathology and the follow-up CRC for Tropical Plant Protection. In recent years ongoing efforts have been made as part of the Banana Plant Protection Program (2011 – 2016). With the detection in NQ there has been an increase of funding from the Federal Government for research into the disease.

GAPS:

- Adherence to good biosecurity practices will need to be promoted as the initial activity surrounding the detection in Tully reduces.
- There is a gap in the epidemiology knowledge of the disease. Many studies were started prior to 1960 when Race 1 was affecting 'Gros Michel' production but were stopped when the Race 1 resistant 'Cavendish' was found. In order to prolong the life of any tolerant/resistant varieties found basic questions on epidemiology (study of the disease in plant populations) need to be addressed.

Prevention

Into Australia

Planting material being bought into the country must go through PEQ as part of the import conditions.

F. o. f. sp. cubense is not moved in banana fruit.

Within Australia

There are state and territory restrictions on movement of planting material, soil and farm implements, there are also restrictions on movement between biosecurity zones.

In NQ growers have been assisted with the development of on-farm biosecurity plans to prevent movement onto their farms. The workshops focused on making sure potentially infected material is not moved from one farm to another.

Prior to the Tropical Race 4 incursion in NQ, Banana Bunchy Top teams undertook measures to ensure they did not spread Race 1 or Subtropical Race 4 in SEQ and northern NSW. The Yellow Sigatoka Liaison Officer undertakes measures to lessen the potential spread of soil borne diseases as part of his routine inspection work.

Surveillance

BQ has an extensive surveillance program in place in the NQ production region that has targeted commercial plantings. BQ teams also respond to public enquiries about residential plants or feral bananas.

Panama disease is a high priority for NAQS surveillance.

The Yellow Sigatoka Officer and BBTV inspectors have been trained to look for TR4 symptoms.

NSW DPI undertook surveillance for banana freckle and Tropical Race 4 in April 2015.

GAPS:

- There will be a change to the BQ surveillance strategy which will mean they employ a more targeted, risk based approach to inspections. This may create gaps.

Diagnostics

There is a diagnostic method using 'Vegetative Compatibility Groups' (VCG) of growing various races of *F. oxysproum* f.sp. *cubense* with 'tester' isolates. This test takes a number of weeks but produces reliable results for all known races of Panama disease.

There is a reliable molecular diagnostic protocol available.

Expertise:

- Wayne O'Neill (DAF - VCG testing, culturing of the fungus, routine use of molecular diagnostics)
- Dr Juliane Henderson (QAAFI – development of molecular tests).
- Dr Julie Pattemore. (DAF)
- Lynton Vawdry (DAF).

GAPS:

- A SHPDS ratified diagnostic assay

Contingency/Covered under EPPRD

Tropical Race 4 was categorised as a Category 2 pest, but as the pathogen itself cannot be demonstrated to be practically eradicated it was not deemed to be covered under the EPPRD.

There was no contingency plan for the Tropical Race 4 at the time of detection. Planning for containment of the Tully incursion soon after the incursion was led by BQ with input from other parts of DAF, ABGC, QAAFI and banana growers.

GAPS:

- Contingency plan if there is an incursion of Tropical Race 4 in an area outside NQ or NT.

Management

Race 1

- Many 'Lady Finger' (and other Race 1 susceptible varieties) growers have had strict quarantine procedures in place on their properties to prevent the introduction of the disease.
- Management of Race 1 on infected properties has been left up to individual growers.
- Growers would try to prevent the movement of the fungus by undertaking operations to reduce spread of the disease to unaffected areas on the farm.
- In affected plantations in SEQ and northern NSW, plants are grown on steep slopes and operations are undertaken manually so there has slow spread of the disease. When the spread of Race 1 makes it uneconomical to farm, growers switch to 'Cavendish' or change crops all together.

Tropical Race 4

The current focus is containment of the disease and assisting growers in developing their on-farm biosecurity plans including prevention of movement of soil and planting material off their own farms.

GAPS:

- Agronomically suitable and consumer acceptable Tropical Race 4 varieties.
- There is potential to learn from 'Lady Finger' growers who have been living with Race 1 for many years, although it should be noted that Tropical Race 4 is thought to be more aggressive on susceptible cultivars.

Resources

PHA fact sheet: <http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Panama-disease-FS.pdf>

Biosecurity Queensland Tropical Race 4 Grower Kit: <https://publications.qld.gov.au/dataset/panama-disease-tropical-race-4-grower-kit>

ABGC Panama disease information: <http://abgc.org.au/panama-tr4/>

NSW Department of Primary Industries alert: http://www.dpi.nsw.gov.au/data/assets/pdf_file/0011/516764/Exotic-Pest-Alert-Panama-disease-Tropical-Race-4.pdf

Wilt disease of bananas

Symptoms of wilted banana plants with vascular tissues with discontinuous streaks of brown were first being noted in cooking bananas growing near dead or dying coconut trees in Papua New Guinea. The coconut trees were infected with a phytoplasma that is associated

with 'Bogia Coconut Syndrome' (Davis, 2009). A phytoplasma was later found in the bananas using a PCR assay and subsequent targeted surveys undertaken in PNG in 2009 and 2010 (Davis et al, 2012) consistently found a particular phytoplasma associated with wilted bananas. Further studies (Davis et al, 2015) have found a group of closely related phytoplasmas from bananas which have similarities with phytoplasmas from wilted coconut plants.

It should be noted that Koch's Postulates (whereby a potential causal organism is conclusively proven to be the cause of a disease) has not been undertaken for this disease yet but phytoplasmas are consistently associated with the symptoms.

Phytoplasmas are like a small bacteria except they have a single membrane instead of cell wall and are unable to survive outside of a suitable host, either a plant or an insect vector. Thus they are unable to be grown up in pure culture which makes demonstrating Koch's postulates more difficult. Due to not being able to survive outside a host, phytoplasmas can only be spread via vegetative planting material or insect vectors such as leafhoppers and not via tools such as cane knives.

Phytoplasmas affecting banana have been recorded in PNG and the Solomon Islands, they are not known to occur in Australia.

The impact of the disease has not been described. The disease is thought to be spread via infected planting material and by vectors. Suggested vectors are leafhoppers.

Awareness and research

It is unlikely many growers or consultants would be aware of the disease as it has only just been recently described, and is not recorded in Australia.

NAQS staff were among the first to identify the disease in surveys and link it with a potential phytoplasma.

GAPS:

It is not known nor an estimate made on what kind of impact this disease could have in Australia.

Very little research has been conducted thus far; Koch's postulates has not been undertaken, it is not known what vectors the disease nor an extensive survey been undertaken to establish geographic spread.

The phytoplasmas from coconut wilt affected plants and wilt affected plants are very similar and more work needs to be done to examine the link between the two and potential vectors.

Prevention

Into Australia

The disease is currently exotic to Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

GAPS:

- Knowledge on the presence of the disease in the Pacific and on vectors of the disease and their potential movement.

Surveillance

NAQS undertake regular surveillance in northern Australia and also in neighbouring countries when invited. BWAP is not specifically listed in the NAQS target list however coconut wilt is listed. NAQS staff do look for any unusual symptoms on bananas as part of their regular surveillance.

GAPS:

NAQS are well aware of this disease but there is a gap in grower and consultant knowledge about the disease and symptoms in Australian production areas.

Diagnostics

There is a 'general' assay for phytoplasmas which is undertaken on plants in PEQ glasshouse testing.

The development of a specific assay was commenced as part of the Banana Plant Protection Program and will be continued in the new HIA project (BA16005).

Expertise:

- Dr Richard Davis (NAQS – visual symptoms)
- Dr Julianne Henderson (molecular assay).
- Professor Geoff Gurr (insect vectors)

GAPS:

- A SHPDS ratified diagnostic assay
- Once potential vectors are identified, some experts would need training in identification of the vectors.

Contingency/Covered under EPPRD

The disease is not currently listed in the Banana Industry Biosecurity Plan (BIBP) as the disease was not known at the time of writing of the plan. The BIBP is currently being reviewed. Although the disease is not known to occur in Australia, surveillance is undertaken for unusual symptoms on bananas and it has not been found in Australia.

There is no contingency plan for the disease.

GAPS:

- The disease has not been categorised.
- The disease is not listed in BIBP
- There is no contingency plan and it will be difficult to develop one without more basic research on the disease being undertaken.

Management

As very little is known about this disease at present it is hard to devise management plans.

It is not known if there are varieties which are resistant to the disease or to the potential vectors.

GAPS:

- So little is known about the disease that a management strategy would need to be based on strategies used for similar diseases such as BBTv.

Resources

Davis, 2009 <http://www.musarama.org/en/image/phytoplasma-associated-wilt-symptoms-157.html>

Davis RI, Kokoa P, Jones LM, Mackie J, Constable FE, Rodoni BC, Gunua TG, Rossel JB (2012) A new wilt disease of banana plants associated with phytoplasma in Papua New Guinea (PNG). *Australasian Plant Disease Notes* 7: 91-97.

Davis RI, Henderson J, Jones LM, McTaggart AM, O'Dwyer C, Tsatsia F, Fanai C and Rossel JB (2014) First record of a wilt disease of banana plants associated with phytoplasmas in Solomon Islands. *Australasian Plant Disease Notes* 10: 14

Black Sigatoka

Caused by *Mycosphaerella fijiensis*

Black Sigatoka (also called black leaf streak, BLS) is one of the most devastating banana diseases in the world. It is present in the Pacific, Asia, Africa, Latin America and the Caribbean. The disease is present on Norfolk Island and in the Torres Strait. There have been incursions onto the Australian mainland multiple times, each time with the pathogen being eradicated with the most recent incursion being into NQ growing region in 2001.

The casual organism may also be called *Pseudocercospora fijiensis* or *Paracercospora fijiensis* but most of the literature refers to *Mycosphaerella fijiensis*. While the fungus is related to the one which causes yellow Sigatoka (*Mycosphaerella musicola*) which is already present in Australia, the lifecycle of the *M. fijiensis* is much shorter than *M. musicola* (meaning the fungus can cause greater damage in a shorter period) and *M. fijiensis* is able to infect a wider range of hosts.

The disease appears as small brown/ reds flecks on the undersides of leaves expanding to black lesions and finally grey necrotic sunken patches. In severe infections leaves die and yields are reduced and uneven ripening of bunches occurs. Yield losses of up to 50% can occur. Control is through regular de-leafing and an intensive fungicide program (over 36 sprays a year). The fungus develops fungicide resistance very quickly under these conditions.

Awareness and research

Awareness of black Sigatoka is high in the industry due to the successful effort to eradicate the disease from North Queensland after the 2001 incursion of the disease.

There are many images available of the disease however symptoms are not diagnostic.

There is a lot of international research is being done on the disease and Australian researchers have links into these programs.

Prevention

Into Australia and within Australia

The disease is currently exotic to mainland Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse.

The disease is present in the Torres Strait (providing a potential pathway to mainland Australia) and NAQS and BQ regularly survey the area. In previous years black Sigatoka resistant varieties were provided to the communities on Cape York Peninsula and surrounds to prevent the planting of susceptible varieties which could provide a pathway for the disease from the Torres Strait.

Fruit is a potential pathway. The Philippines have requested to export fresh fruit to Australia. Conditions imposed by the Australian Government mean that fruit must be from an area of low pest prevalence. As yet no Filipino (or other nations) company has attempted to demonstrate they would meet the import conditions of Australia.

There is a potential for spores to blow into northern mainland Australia from PNG or the Torres Strait, hence the need for ongoing surveillance.

GAPS:

- Evidence based quarantine measures to prevent the potential movement of the disease into Australia must be continued.

Surveillance

The disease is present in the Torres Strait and NAQS and BQ regularly survey the area. BQ also conduct regular urban surveillance in NQ for banana diseases including black Sigatoka.

In 2014 BQ did a review of their surveillance program.

Samples are provided by the Yellow Sigatoka Liaison Officer to the DAF plant pathologists at Mareeba who test isolates collected from leaf spots in the production areas.

GAPS:

- There will need to be continued support for surveillance in NQ and the NT.

Diagnostics

Expertise:

- Kathy Grice (DAF),
- Dr Julianne Henderson (QAAFI) and
- Lynton Vawdry (DAF).

Both Kathy Grice and Julianne Henderson have seen the disease in the field overseas and worked with the molecular diagnostic. Dr Richard Davis has field experience with the disease.

There is a draft NDP.

GAPS:

- A SHPDS ratified diagnostic assay

Contingency/Covered under EPPRD

There is an eradication plan from the successful 2001 incursion which could be used as a basis for any further incursions. In addition there are many similarities between *M. fijiensis* and *Phyllosticta cavendishii* which is currently subject to an eradication program in the NT.

As black Sigatoka is under active containment in Australia (Norfolk Island and Torres Strait) it is covered under the EPPRD if an incursion was to occur on the mainland,

It is a Category 2 pest.

GAPS:

- No obvious gaps.

Management

There are management strategies for yellow Sigatoka and these could be used for black Sigatoka but with much shorter intervals for spraying and more severe de-leafing programs

GAPS:

- Breeding of commercially acceptable resistant cultivars. If the disease was to establish in Australia there may not currently be consumer acceptance of resistant/tolerant cultivars.
- Access to effective fungicides which *M. fijiensis* does not have the potential to develop resistance.

Resources

<http://pbt.padil.gov.au/index.php?q=node/6&pbtID=166>

<http://www.apsnet.org/publications/apsnetfeatures/Pages/blacksigatoka.aspx>

<http://www.apsnet.org/edcenter/intropp/lessons/fungi/ascomycetes/Pages/BlackSigatoka.aspx>

<http://www.agriculture.gov.au/biosecurity/australia/naqs/naqs-target-lists/black-sigatoka>

Eumusae leaf spot

Caused by *Mycosphaerella eumusae*

Eumusae leaf spot was first described in 2000 and hence there is still relatively little information on it.

The fungus is able to infect leaves and fruit (Thangavelu et al. 2007).

The fungus is closely related to the fungi which cause black and yellow Sigatoka and is thought to behave in a similar manner. *M. eumusae* is able to cause disease on the dessert bananas that are resistant to black and yellow Sigatoka.

The fungus is present in southern India, Sri Lanka, Thailand, Malaysia, Vietnam, Mauritius, and Nigeria. It is expected to be found in other areas when surveys are completed in locations where previous surveys could not attribute similar leaf symptoms to *M. fijiensis* or *M. musicola*. The fungus is exotic to Australia.

Awareness and research

There is very little grower awareness of this disease.

There is a PHA fact sheet for the disease as well as a PaDIL page (see resources below).

Prevention

Into Australia

The disease is currently exotic to Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a potential pathway but fresh fruit imports from affected countries into Australia are not occurring.

There is a potential for spores to blow into northern mainland Australia from PNG or Indonesia if the disease were to establish in these countries. The need for ongoing surveillance by NAQS is critical.

GAPS:

- Evidence based quarantine measures to prevent the potential movement of the disease will be critical.

Surveillance

NAQS and BQ regularly survey northern Australia.

As part of the Banana Plant Protection Program, DAF tested isolates collected from leaf spots in the production areas. The Yellow Sigatoka Liaison Officer is able to supply samples.

GAPS:

- Continued support for surveillance in NQ and the NT will be critical.

Diagnostics

Expertise:

- Kathy Grice (DAF),
- Dr Julianne Henderson (QAAFI).

There is a draft NDP.

GAPS:

- A SHPDS ratified diagnostic assay

Contingency/Covered under EPPRD

The disease would be covered under the EPPRD however it has not been categorised.

There is no specific contingency or eradication plan, however much could be used from the black Sigatoka and Banana Freckle plans.

GAPS:

- Very little is known about this disease so all planning would be done based on assumptions from knowledge for black and yellow Sigatoka.

Management

GAPS:

- Very little is known about this disease (e.g. potential sources of resistance, how fast the fungus may develop resistance to fungicides). Potential management practices would be based on knowledge for black and yellow Sigatoka.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Eumusae-leaf-spot-FS.pdf>

Thangavelu R, Carlier J, Henderson J & McTaggart AR (2007) Eumusae leaf spot (*Mycosphaerella eumusae*) Updated on 10/16/2007 Available online: PaDIL - <http://www.padil.gov.au/pests-and-diseases/pest/main/136640/7749>

Carlier J, Zapater M-F, Lapeyre F, Jones DR & Mourichon X. (2000) Septoria leaf spot of banana: A newly discovered disease caused by *Mycosphaerella eumusae* (anamorph *Septoria eumusae*). *Phytopathology* **90**: 884-890.

Crous PW & Mourichon X (2002) *Mycosphaerella eumusae* and its anamorph *Pseudocercopsora eumusae* spp. nov.: casual agent of eumusae leaf spot disease of banana. *Sydowia* **54**:35-43.

Banana Freckle

Caused by *Phyllosticta cavendishii*

Infections by *Phyllosticta cavendishii* cause raised 'freckles' on the leaves and fruit of banana plants. The disease can reduce the photosynthetic area of the leaves reducing yields and caused mixed ripening. Unsightly blemishes cause downgrading of fruit.

There are different strains of the fungus and they have been divided into 'Cavendish-infecting (Cavendish competent) and non-Cavendish infecting. Until 2013 banana freckle was present in Australia but only on non-Cavendish plants. Part of the difficulties with the fungus is being able to distinguish the two (or potentially more) different strains. This led to the removal of all banana plants (Cavendish and others) in the NT eradication zones of the 2013 eradication program.

Awareness and research

High level of awareness amongst growers and community, especially in NT due to the incursion into the NT in July 2013.

There is a PHA fact sheet for the disease as well as a PaDIL page (see resources below).

Dr Mee-Hua Wong completed her PhD on the disease and published a number of papers (see below).

Prevention

Into Australia

The 2013 incursion into the NT is currently being eradicated.

Prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a potential pathway but fresh fruit imports into Australia are not occurring.

Within Australia

Restrictions on the movement of planting material between states and between biosecurity zones within some states

GAPS:

- Continued support for evidence based quarantine measures to prevent the potential movement of the disease will be critical.
- It is not known how the inoculum that caused the 2013 incursion arrived into Australia. Understanding this would help to prevent future incursions.

Surveillance

NAQS and BQ regularly survey northern Australia.

GAPS:

- The 2013 incursion was not picked up as part of a survey but rather from an NT DPI staff member seeing the disease on a farm near Darwin.

Diagnostics

Expertise:

- Dr Lucy Ran-Nguyen (NT DPI),
- Dr Jose Liberato (NT DPI),
- Kathy Grice (DAF),
- Dr Julianne Henderson (QAAFI).

There is no NDP but there are molecular tests which have been used extensively throughout the NT incursion/eradication campaign.

GAPS:

- A SHPDS ratified diagnostic assay

Contingency/Covered under EPPRD

The disease is covered under the EPPRD and is a category 3 pest. The current eradication program is being undertaken under the Deed.

Prior to the incursion there was no contingency plan for the disease. There is now a plan that is specific to the NT which could be modified for other locations.

One of the advantages of eradicating the disease from the NT, is the distance between hosts. This is a very different situation to NQ. If there was an incursion in NQ, a response plan would need to be more like the 2001 black Sigatoka plan.

GAPS:

- Contingency plan more suitable to NQ production area.

Management

Management techniques similar to those used for black Sigatoka would be required as well as additional measures to protect the fruit from blemishes.

GAPS:

- Varieties resistant to banana freckle along with other leaf spot diseases.

Resources

<https://nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/banana-freckle-eradication-program>

<http://abgc.org.au/biosecurity/banana-freckle-response/>

<http://www.planthealthaustralia.com.au/wp-content/uploads/2015/03/Banana-freckle-FS.pdf>

<http://www.padil.gov.au/pests-and-diseases/pest/main/136600>

Wong, MH, Henderson, J and Drenth, A (2013) Identification and differentiation of *Phyllosticta* species causing freckle disease of banana using high resolution melting (HRM) analysis. *Plant Pathology* **62**: 1285 - 1293

Wong, MH, Crous, PW, Henderson, J, Groenewald, JZ and Drenth, A (2012) *Phyllosticta* species associated with freckle disease of banana. *Fungal Diversity* **56**: 173-187.

Yellow Sigatoka**Caused by *Mycosphaerella musicola***

Yellow Sigatoka is endemic in all banana growing areas of Australia except for the growing area around Carnarvon in WA. When left unchecked the disease affects the photosynthetic ability of leaves and yields are decreased and mixed ripening can occur. Disease pressure is much higher in tropical NQ than in SEQ and NSW.

Until 2015 yellow Sigatoka control was mandatory for growers in Queensland who were not allowed to have any more than 5% leaf spot on one leaf (Plant Protection Regulation 2002). This limit was set to help control the build up of inoculum in plantations because it can spread very easily to neighbouring farms. The regulations changed in 2016 and this leaf spot provision is no longer contained in the regulations. Instead, there is the Banana Industry Biosecurity Guideline that describes to growers how they are to manage this disease to meet their General Biosecurity Obligation (GBO). To help growers meet their obligations ABGC has employed a HIA-funded 'Yellow Sigatoka Liaison Officer' since 2010. This officer visits every commercial banana farm in North Queensland twice a year.

Yellow Sigatoka is controlled with regular de-leafing to remove inoculum sources and a range of fungicide sprays rotated to avoid the development of resistance to the sprays by *M. musicola*. There are varieties which are resistant to yellow Sigatoka but they do not have consumer acceptance nor the agronomic characters currently desired.

Awareness and research

Growers in NQ are very aware of the disease due to the work of the Yellow Sigatoka Liaison Officer.

The Banana Industry Biosecurity Guideline also describes to growers what they need to do to manage leaf spot.

Current research in Australia has mostly been on efficacy of different fungicides as well as screening new varieties for yellow Sigatoka resistance.

Prevention

Within Australia

The Carnarvon growing region is the only area without yellow Sigatoka. Movement controls into Carnarvon targeting other pathogens also prevent the movement of yellow Sigatoka.

GAPS:

- If any new areas are developed for banana growing then there is the opportunity to put in place protocols to prevent the introduction of yellow Sigatoka to the area.

Surveillance

As part of the Banana Plant Protection Program, DAF tests isolates collected from leaf spots in the production areas by the Yellow Sigatoka Liaison Officer.

The yellow Sigatoka isolates are also checked to examine if the isolates are developing resistance to the systemic fungicides.

Diagnostics

- Expertise: Kathy Grice (DAF),
- Dr Julianne Henderson (QAAFI).
- Louis Lardi (ABGC) – visual inspection.

Diagnostics are usually not required unless regulatory action is being taken by BQ.

There are protocols for *M. musicola* that distinguish it from *M. fijiensis*.

Contingency/Covered under EPPRD

Not applicable.

Management

Regular de-leafing and fungicide applications applied as part of an anti-resistance strategy.

GAPS:

The General Biosecurity Obligation contained in the new Biosecurity Act and Regulation are yet to be tested. This may impact on ongoing management of the disease.

The continued role of the Yellow Sigatoka Liaison Office is critical to the management of the disease.

Resources

National Banana Extension and Development Program Factsheet: “Top ways to manage banana fungicide resistance fact sheet”.

Banana Industry Biosecurity Guideline (Department of Agriculture and Fisheries, 2016).

Moko

Caused by *Ralstonia solanacearum* biovar 1 and race2

Moko affects a range of banana varieties and plantains. Similar to Panama disease, on infected plants the oldest leaves turn yellow and die first, the rest of the leaves are then affected and eventually the pseudostem collapses. Fruit can also be affected with the flesh of infected fruit turning brown and then grey.

The bacteria causing Moko can be spread in infected soil, via water, cane knives and farm machinery. Moko can also be spread by root to root contact. Insects play a large role in moving the disease; Trigona bees, wasp and other flying insects vector the disease and can move long distances (reports of over 90km for some strains of Moko).

The disease is present in Central and South America, the Caribbean and the Philippines.

Moko, Bugtok and blood disease are often grouped together. It is accepted that blood disease is caused by a distinct bacterium, the causal organisms of all three diseases grouped into the '*Ralstonia solanacearum* complex'.

GAPS:

Further taxonomic work has clarified the naming of the pathogens but further work is still required, especially as the two bacteria which cause Moko and Bugtok are distinct from one another but are hard to distinguish using current lab tests. Correct identification could delay an EPPRD response should there ever be an incursion.

Awareness and research

There is some awareness of this disease by growers because of its relevance to the Import Risk Analysis that was conducted for the importation of fresh bananas from the Philippines. However, while growers are aware of the disease is it unlikely they would be able to describe the symptoms nor know what to look for in their plantations.

There is a PHA fact sheet for the disease as well as a PaDIL page (see resources below).

Prevention

Into Australia

The disease is currently exotic to Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a pathway but fresh fruit imports in Australia are not occurring.

GAPS:

- There will need to be continued support for evidence based quarantine measures to prevent the potential movement of the disease e.g. on-going for import of fruit conditions.

Surveillance

NAQS and BQ regularly survey northern Australia.

GAPS:

- There will need to be continued support for surveillance in NQ and the NT into the future.

Diagnostics

A major emphasis will be placed on researching Moko, Bugtok and Blood Disease for the development of accurate diagnostics in the HIA funded project BA16005. There is an assay for Moko.

Expertise:

- Dr Nandita Pathania (DAF),
- Dr Anthony Young (formerly DAF, now USQ),
- Dr Mark Fagan (formerly CRC for Tropical Plant Protection),

There is a draft NDP. It is unclear if the draft clearly distinguishes between Moko, Bugtok and Blood Disease.

The current standard protocol is more than 10 years old so confirmation is required as to whether it still works against the existing isolates.

As there is potential for a hold up in diagnostics due to the diversity of *Ralstonia* species, a finalised NDP (incorporating the latest taxonomic information is a priority.

GAPS:

- A SHPDS ratified diagnostic assay.

Contingency/Covered under EPPRD

The disease is covered under the EPPRD and is a Category 2 pest.

GAPS:

- There is no contingency plan for moko disease or any of the other bacterial diseases. If detected in Australia, a swift response would be required as insects could spread the disease quickly and over a great distance.

Management

There are no resistant varieties and *Heliconia* is also a host.

Filipino companies have a system of destroying infected plants that involves burning the plant and the site of the infection with rice hulls to heat treat the soil below. Provided that infected plant material, sap and soil from below the infected plant is not spread around or disturbed, the bacteria will break down in the soil relatively quickly (6-12 months).

As the bacterium can spread in sap, farming tools (cane knives, hook knives etc.) need to be regularly and thoroughly disinfected.

A complication to the Australian production system compared to overseas is our high reliance on mechanised operations. If the bacterium did get into a plantation in NQ (where there is a high use of machinery) the bacterium could spread very quickly via wet soils, cane knives and other farming tools.

GAPS:

- Management systems for highly mechanised Australian production systems.
- Management systems for dealing with vectors.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Moko-FS.pdf>

<http://www.padil.gov.au/pests-and-diseases/pest/main/136650>

Fegan, M and Prior P (2006) Diverse members of the *Ralstonia solanacearum* species complex cause bacterial wilts of banana. *Australasian Plant Pathology* **35**: 93-101

Bugtok

Caused by *Ralstonia solanacearum* biovar 1 and race2

The disease occurs in the Philippines, it affects ABB cooking bananas but does not have an impact on export 'Cavendish'. Unlike Moko and blood disease, Bugtok infections affect fruit and bracts but symptoms are rarely seen in the pseudostem. Infection is thought to be via thrips transmitting the disease to the flowers. The pulp of affected fruit turn grey to yellow and only a few fingers or all of the fingers in a bunch may be affected. Bracts may turn black and have bacteria oozing from them. The disease is not thought to be transmitted in planting material.

One of the difficulties with the bacteria which causes Bugtok is that it is extremely difficult to distinguish it from the bacteria which causes Moko.

Awareness and research

There is probably less awareness of this disease than Moko (although there may be some knowledge because of its relevance to the import risk analysis for importing fresh bananas from the Philippines). It is unlikely that growers would know what the symptoms are.

There is a PHA fact sheet as well as a PaDIL page for Moko and Bugtok.

Prevention

Into Australia

The Bugtok bacterium is thought to not be carried in planting material but any planting material being brought into the country is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a pathway but fresh fruit imports into Australia are not occurring.

GAPS:

- There will need to be continued support for evidence based quarantine measures to prevent the potential movement of the disease.

Surveillance

NAQS and BQ regularly survey northern Australia.

GAPS:

- There will need to be continued support for surveillance in NQ and the NT.

Diagnostics

A major emphasis will be placed on researching Moko, Bugtok and Blood Disease for the development of accurate diagnostics in the HIA funded project BA16005. There is an assay for Moko.

Expertise:

- Dr Nandita Pathania (DAF),
- Dr Anthony Young (formerly DAF, now USQ),
- Dr Mark Fagan (formerly CRC for Tropical Plant Protection).

There is a draft NDP for *Ralstonia solanacearum* race2 but it is unclear if the draft clearly distinguishes between Moko, Bugtok and Blood Disease.

The current standard protocol is more than 10 years old so confirmation is required as to whether it still works against the existing isolates.

There is potential for a hold up in diagnostics due to the diversity of *Ralstonia* species. Therefore a finalised NDP (incorporating the latest taxonomic information Safni et al 2014) is a priority.

GAPS:

- A SHPDS ratified diagnostic assay

Contingency/Covered under EPPRD

Moko and Bugtok are covered under the EPPRD and is a Category 2 pest.

GAPS:

- There is no contingency plan for Bugtok disease or any of the other bacterial diseases. This is a priority.

Management

GAPS:

- Management systems for highly mechanised Australian production systems.
- Management systems for dealing with vectors.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Moko-FS.pdf>

<http://www.padil.gov.au/pests-and-diseases/pest/main/136650>

Safni I, Cleenwerck I, De Vos P, Fegan M, Sly L, Kappler U. (2014) Polyphasic taxonomic revision of the *Ralstonia solanacearum* species complex: proposal to emend the descriptions of *Ralstonia solanacearum* and *Ralstonia syzygii* and reclassify current *R. syzygii* strains as *Ralstonia syzygii* subsp. *syzygii* subsp. nov., *R. solanacearum* phylotype IV strains as *Ralstonia syzygii* subsp. *indonesiensis* subsp. nov., banana blood disease bacterium strains as *Ralstonia syzygii* subsp. *celebesensis* subsp. nov. and *R. solanacearum* phylotype I and III strains as *Ralstonia pseudosolanacearum* sp. nov. International Journal of Systematic and Evolutionary Microbiology. **64**:3087–103.

Fegan, M and Prior P (2006) Diverse members of the *Ralstonia solanacearum* species complex cause bacterial wilts of banana. Australasian Plant Pathology **35**: 93-101

Blood disease

Caused by: *Ralstonia syzygii* subsp. *celebesensis*

Symptoms are similar to Panama disease and Moko. Leaves turn yellow, wilt and form a 'skirt'. When cut open affected plant will have reddish-brown discoloration of the vascular tissue. Freshly cut stem surfaces may exude bacteria white to red-brown in colour. Fruit may turn black. Transmission of the disease is thought to be in a similar manner to that of Moko i.e. via insects transmitting the disease to flowers, via infected fruit, soil and on farming implements. Spread has been rapid in Java (to a distance of over 25km per annum in some areas) which supports the insect dispersal hypothesis (Eden-Green, 1994).

The disease is present in Indonesia including West Papua, but until recently it had not been found elsewhere in the world until a recent incursion in Malaysia (limited distribution).

Awareness and research

There is likely to be some awareness of this disease by growers because of its relevance to the import risk analysis for fresh bananas from the Philippines.

There is a PHA fact sheet for the disease as well as a PaDIL page.

The taxonomy of this disease has only just recently updated (Safni et al 2014) and is yet to be widely adopted. More research needs to be done to better understand the bacterium as many assumptions about blood disease are based on Moko.

Prevention

Into Australia

The disease is currently exotic to Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a potential pathway but fresh fruit imports into Australia are not occurring.

GAPS:

- There will need to be continued support for evidence based quarantine measures to prevent the potential movement of the disease.

Surveillance

NAQS and BQ regularly survey northern Australia.

GAPS:

There will need to be continued support for surveillance in NQ and the NT.

Diagnostics

A major emphasis will be placed on researching Moko, Bugtok and Blood Disease for the development of accurate diagnostics in the HIA funded project BA16005. There is an assay for Moko.

Expertise:

- Dr Nandita Pathania (DAF),
- Dr Anthony Young (formerly DAF, now USQ),
- Dr Mark Fagan (formerly CRC for Tropical Plant Protection),

There is a draft NDP. This may need to be reviewed based on the latest taxonomic information (Safni et al, 2014). It is unclear if the draft clearly distinguishes between Moko, Bugtok and Blood Disease.

GAPS:

- Lacking a SHPDS ratified diagnostic assay.
- Lacking widespread recognition of the current taxonomic assignment.

Contingency/Covered under EPPRD

The disease is covered under the EPPRD and is a Category 2 pest.

GAPS:

- There is no contingency plan for blood disease or any of the other bacterial diseases.

Management

Management is expected to be similar as for Moko disease.

A lack of understanding about transmission of the disease and confirmation of which vectors are involved could hamper control measures targeting transmission.

GAPS:

- Management systems for highly mechanised Australian production systems.

Resources

<http://www.padil.gov.au/pests-and-diseases/pest/main/136649>

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Blood-disease-FS.pdf>

Eden-Green, SJ (1994) Banana Blood Disease. Musa Disease Fact Sheet No.3:

http://www.bioversityinternational.org/uploads/tx_news/Banana_blood_disease_127.pdf

Safni I, Cleenwerck I, De Vos P, Fegan M, Sly L, Kappler U. (2014) Polyphasic taxonomic revision of the *Ralstonia solanacearum* species complex: proposal to emend the descriptions of *Ralstonia solanacearum* and *Ralstonia syzygii* and reclassify current *R. syzygii* strains as *Ralstonia syzygii* subsp. *syzygii* subsp. nov., *R. solanacearum* phylotype IV strains as *Ralstonia syzygii* subsp. *indonesiensis* subsp. nov., banana blood disease bacterium strains as *Ralstonia syzygii* subsp. *celebesensis* subsp. nov. and *R. solanacearum* phylotype

I and III strains as *Ralstonia pseudosolanacearum* sp. nov. International Journal of Systematic and Evolutionary Microbiology. **64**:3087–103.

Xanthomonas bacterial wilt

Caused by *Xanthomonas vasicola* pathovar *musacearum*

Xanthomonas bacterial wilt (XBW) has been present on Ensete plants in Ethiopia since 1968 but in the last 15 years it has spread and is now present in Ethiopia, Kenya, Uganda, Democratic Republic of Congo, Burundi, Rwanda and Tanzania on dessert and cooking bananas.

The symptoms of the disease are very similar to Panama and Moko and whole plants can be killed within a month of first symptoms appearing. One characteristic symptom is the oozing of yellow bacterial exudate out of cut pseudostems of badly affected plants.

Awareness and research

Very little awareness of this disease in Australia.

Research is being undertaken in Africa where management plans have been developed.

GAPS:

- Awareness of the disease is low in Australia.

Prevention

Into Australia

The disease is currently exotic to Australia and prevention of movement into the country with planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

Fruit is a potential pathway but fresh fruit imports into Australia are not occurring.

GAPS:

- There will need to be continued support for evidence based quarantine measures to prevent the potential movement of the disease e.g. on-going for import of fruit conditions.

Surveillance

None specifically conducted for XBW.

GAPS:

- There will need to be continued support for surveillance in NQ and the NT.

Diagnostics

Expertise:

- Dr Julianne Henderson (QAAFI),
- Dr Nandita Pathania (DAF)

There is no diagnostic test available.

GAPS:

- No assay exists.

Contingency/Covered under EPPRD

Not yet categorised but would come under the Deed.

GAPS:

- There is no contingency plan.

Management

Management systems have been developed in Africa and are reportedly working well when supported with extension programs. These management systems may not work in a highly mechanised production system like in Australia.

The bacterium is spread via planting material, insect vectors, in soil and water, on farming implements and via animal vectors such as rats, birds, bats and livestock.

GAPS:

- Management systems for highly mechanised Australian production systems.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Banana-Xanthomonas-wilt-FS.pdf>

EFSA assessment of risk of introduction <http://www.efsa.europa.eu/en/efsajournal/pub/669>

<http://www.promusa.org/Xanthomonas+campestris+pv.+musacearum#footnote7>

<http://www.promusa.org/Xanthomonas+wilt>

Exotic nematodes

Under the current import conditions, there is an extremely low chance of nematodes entering Australia on banana plants provided they are imported through the correct channels. However, there is a chance that they could enter Australia on other products such as the burrowing nematode *Radopholus similis* on fresh ginger from Fiji.

In January 2013 conditions to import fresh ginger from Fiji to Australia were published. This included treatment of consignments with methyl bromide. In mid-2014 live root knot nematodes were found in a consignment of ginger in Sydney indicating that the methyl bromide did not kill the root knot nematodes (which are closer to the surface of the ginger rhizome than the burrowing nematodes).

There was a Australian Government review of the conditions which came to the conclusion that no live quarantine pests were found (root knot nematode was not considered a quarantine pest) and that experiments were needed to understand the relatedness and host preference of burrowing nematodes from Fiji. This information would then be compared to Australian isolates.

Awareness and research

There is likely to be very little grower awareness of the exotic nematodes. Very little research has been done.

Research has commenced to look at the different populations of *Radopholus similis* in Australia and Fiji. This work will compare if they are genetically different and if there are differences in pathogenicity. The results should be available in 2017.

GAPS:

- There is a gap in the level of knowledge about the pathogenic differences between Australian and Fijian isolates of burrowing nematode.

Prevention

Into Australia

Movement into the country with banana planting material is covered under import conditions requiring holding of plants in PEQ glasshouse with testing.

GAPS:

- Potential to come into Australia on fresh ginger imports from Fiji if methyl bromide treatments do not work.

Surveillance

GAPS:

- No formal surveillance.

Diagnostics

Expertise: Jenny Cobon (DAF)

GAPS:

- An understanding of the diversity of lesion nematodes in Australia and Fiji.

Contingency/Covered under EPPRD

GAPS:

- Not enough information to know if it is required.

Management

GAPS:

- There is not enough information to know if different management practices would be required in addition to the current practices for endemic burrowing nematode.

Resources

<http://www.agriculture.gov.au/biosecurity/risk-analysis/plant/import-conditions-fresh-ginger-from-fiji>

Banana Skipper Butterfly

Erionata thrax

Banana skipper butterfly is native to South East Asia. It is now present in South East Asia, Papua New Guinea, Mauritius, Guam and Hawaii.

The symptoms of infestation are large cut sections on banana leaves rolled into tight cocoon shapes. Damage to bananas is from reduced photosynthetic area due to feeding and rolling. Banana skipper butterfly affects all cultivated bananas.

Awareness and research

There is probably not a high level of awareness of this pest despite characteristic symptoms of infestation. There is a PHA fact sheet.

Previous research was done by CSIRO into control of the pest using biological control agents. There would be benefit in revisiting this research to look for any knowledge gaps or material/information that could be shared with growers.

Prevention

Into Australia

Eggs could be potentially moved on planting material but movement into the country with banana planting material is covered under import conditions requiring holding of plants in PEQ glasshouse.

There is a risk associated with the illegal movement of planting material between PNG, Torres Strait Islands to mainland Australia (eg via Cape York).

Within Australia

The butterfly can move short distances by flying. Longer distance dispersal is via eggs on planting material.

Surveillance

NAQ target banana skipper butterfly in their surveillance.

GAPS:

Pest scouts could potentially undertake surveillance but it is likely that growers do not have a lot of knowledge about this pest.

Diagnostics

Expertise:

- Donna Chambers (DAF),
- Bruno Pinese (DAF – may no longer work in the field).

GAPS:

- A diagnostic protocol. There is a closely related butterfly which may cause confusion if there is an incursion.

Contingency/Covered under EPPRD

Banana skipper butterfly is covered under the Deed and is a category 4 pest.

GAPS:

- There is no contingency plan.
- While there is confidence that the parasites that CSIRO released into PNG keep these pests in check, it is not known what the impacts of the insecticides used to control other banana insect pests would have on the banana skipper butterfly.

Management

GAPS:

Knowledge on the effect of the Australian insecticide program on parasites of the banana skipper butterfly.

Resources

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Banana-skipper-butterfly-FS.pdf>

<http://www.ento.csiro.au/biocontrol/skipper.html>

<http://www.cabi.org/isc/datasheet/21833>

Banana spider mite

Tetranychus piercei

T. piercei causes damage on a range of crops resulting in a high economic impact. The mite has been recorded in Asia, Indonesia, Malaysia and Papua New Guinea. Mites feed on the leaves thereby reducing the photosynthetic area. This leads to reduced yields and potentially mixed ripening. Spider mites also produce a fine web.

Tetranychus gloveri (cotton red mite) was present in the NT and in 2014 the mite was found in banana plantations in NQ. By the time it was detected it had established and was deemed too difficult to eradicate by CCEPP due to the wide range of weed host plants.

Awareness and research

There would be low awareness of banana spider mite amongst growers and early infestations could look like other mite damage.

Prevention

Into Australia

T. piercei is exotic to Australia.

Mites can only travel short distances unaided. Any long distance dispersal will be via planting material.

Banana planting material introduced to Australia must go through PEQ.

Within Australia

Banana spider mites could be moved on planting material. Movement controls for pathogens should limit the spread of banana spider mites if an incursion into Australia occurred.

Surveillance

GAPS: Difficulty for growers to distinguish banana spider mite from other mites.

Diagnostics

Expertise: Owen Seeman (Queensland Museum).

There is a draft NDP.

GAPS: A ratified diagnostic protocol.

Contingency/Covered under EPPRD

T. piercei is covered under the Deed and is a category 4 pest.

GAPS: There is no contingency plan.

Management

Banana spider mites feed on a wide range of host plants meaning if they were to establish in Australia, control measures would need to also target alternate hosts.

For the mite populations currently in Australia, issues arise on bananas growing in dry, dusty conditions or where a chemical application has knocked out predators which normally keep mite populations in check. It is not known if there are predators present in Australia which would suppress *T. piercei* if it were to establish here

GAPS:

- Effects of natural predators
- Alternative control measures.

Resources

<http://pbt.padil.gov.au/index.php?q=node/6&pbtID=116>

<http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Banana-spider-mite-FS.pdf>

Coffee bean weevil***Araecerus fasciculatus***

The coffee bean weevil is a pest of stored products. It is present on the east coast of Australia but absent from WA. It does not damage bananas but rather survives in the dried flower parts that remain attached to the fruit.

The main problem for growers is the rejection of consignments into WA when coffee bean weevil is found.

Awareness and research

Awareness of the pest is high amongst NQ banana growers who export to WA.

Prevention

Into Australia

Consignments of dried goods coming into Australia are subject to inspections for pests.

Within Australia

Consignments of fruit are inspected on arrival into WA fruit are removed from 6 cartons and placed on a white inspection tray where flower ends are flicked off fruit and insects collected and examined. If a grower gets a detection the fruit must be treated at the growers cost (fumigation may cause damage to fruit particularly if there is condensation on the fruit), re-exported at the growers cost or disposed of by deep burial at the cost to the grower. The next consignment that the grower sends will then be subject to a higher rate of inspection.

Surveillance

Nil formal.

Diagnostics

Expertise: Dr Rolf Oberprieler (CSIRO) has provided literature in the past and may be able to assist with identification.

GAPS:

- A diagnostic protocol.

Contingency/Covered under EPPRD

If there was an incursion into WA eradication could potentially be covered under EPPRD. Further clarification on this point is required.

GAPS:

- Contingency plan for incursion into WA.

Management

It is thought that coffee bean weevils invade the flower parts when the fruit is in the field. The current control measure is to use water or manually remove flower parts off the bunches of fruit just before they enter the packing shed. This adds a considerable cost to packing. Some growers are more thorough than others at removing the flower parts.

GAPS:

- In field control measures for coffee bean weevil.

Resources

<http://www.padil.gov.au/pests-and-diseases/pest/main/135950/7030>

Conclusion

This desk top analysis highlights that the banana industry has a strong foundation in biosecurity preparedness. Research, to varying extents, has been done on most of the High Priority Pests. However, there are gaps that need to be filled and this can be done over time according to priority. Given the economic importance of the banana industry and the public's love for Australian bananas, it is important that the industry continues to build on its existing knowledge, reduce the research gaps and prepare the industry against future potential incursions. It is also vitally important that the scientific capacity that currently supports the industry is maintained.

The detection of Panama tropical race 4 in north Queensland has shown growers across Australia that they must not be complacent when it comes to on-farm biosecurity. It is hoped that this developing biosecurity culture amongst growers continues. It can then be supplemented and strengthened with new knowledge as it emerges.

The list of recommendations, informed by the analysis in this report will guide future research projects as the industry implements a more strategic and proactive approach to filling the gaps in its biosecurity knowledge and practices.

Appendix 1

General surveillance and prevention of movement of pests and diseases

Domestic Quarantine

Domestic Quarantine (DQ) have a website with information for travellers (<http://www.quarantinedomestic.gov.au/>) divided by State/Territory. Information on movement of bananas is listed. It is suspected that very few travellers check the website prior to moving. DQ also produce brochures to provide to travellers and also work with organisations (like the Defence Force) to provide information on interstate quarantine issues when staff are relocated.

Northern Australia Quarantine Strategy (NAQS)

NAQS undertake activities to minimise the risk of pest and disease incursions into the north of Australia, they are a group within the Department of Agriculture and Water Resources. They assess the risks, undertake regular surveillance activities, liaise with local communities, manage the biosecurity risk in the Torres Strait and contribute to Australian and international initiatives.

NAQS surveillance areas:



Appendix 2

Terms use in the Queensland Biosecurity Act

From: <https://www.daf.qld.gov.au/biosecurity/about-biosecurity/biosecurity-act-2014/information-and-resources-about-the-act/overview-and-foundation-principles/terms-used-under-the-biosecurity-act>

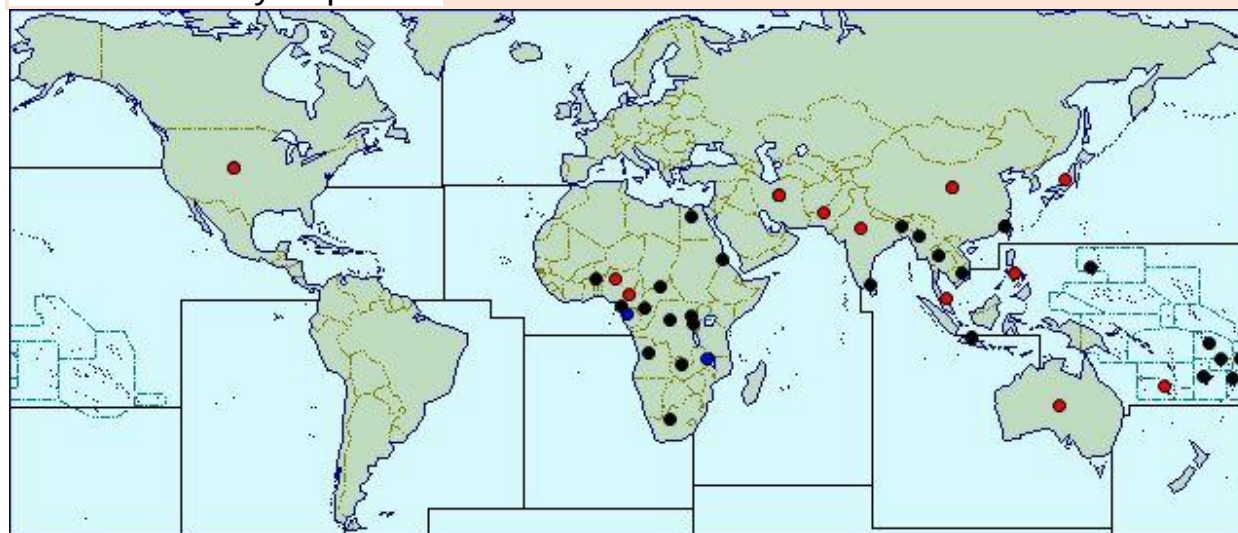
Prohibited matter: Prohibited Matter is biosecurity matter not currently present or known to be present in Queensland. It is prohibited because it may have a significant adverse effect on a biosecurity consideration if it did enter Queensland.

Restricted matter: Restricted Matter is biosecurity matter found in Queensland that may have adverse effects on a biosecurity consideration if conditions or restrictions under the Act were not imposed.

Appendix 3 – maps of locations of pests

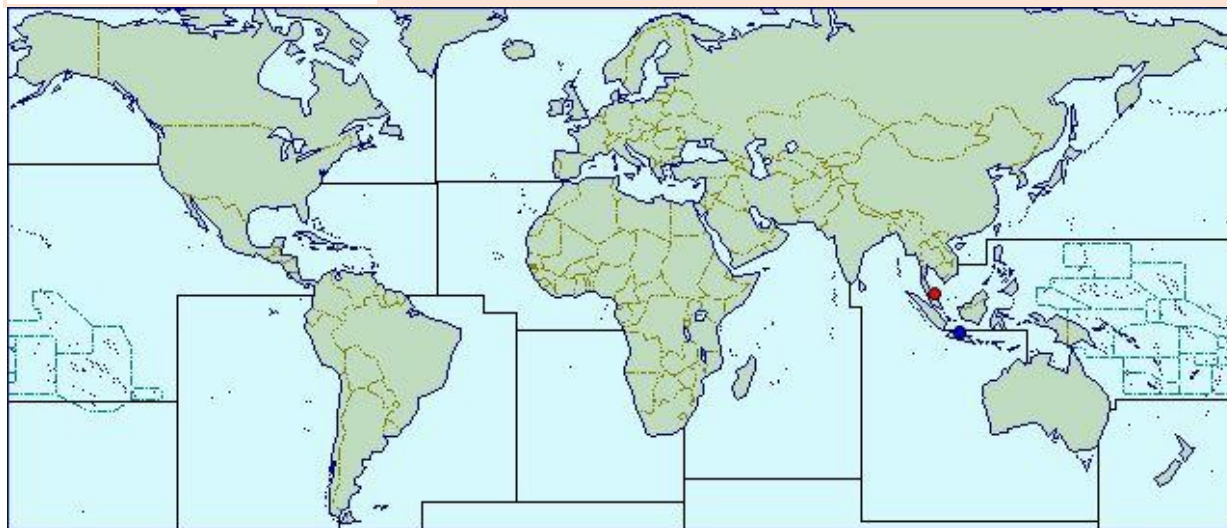
Sourced from: <http://www.cabi.org/isc/> . More detailed maps for each country are available.

Banana Bunchy Top Virus

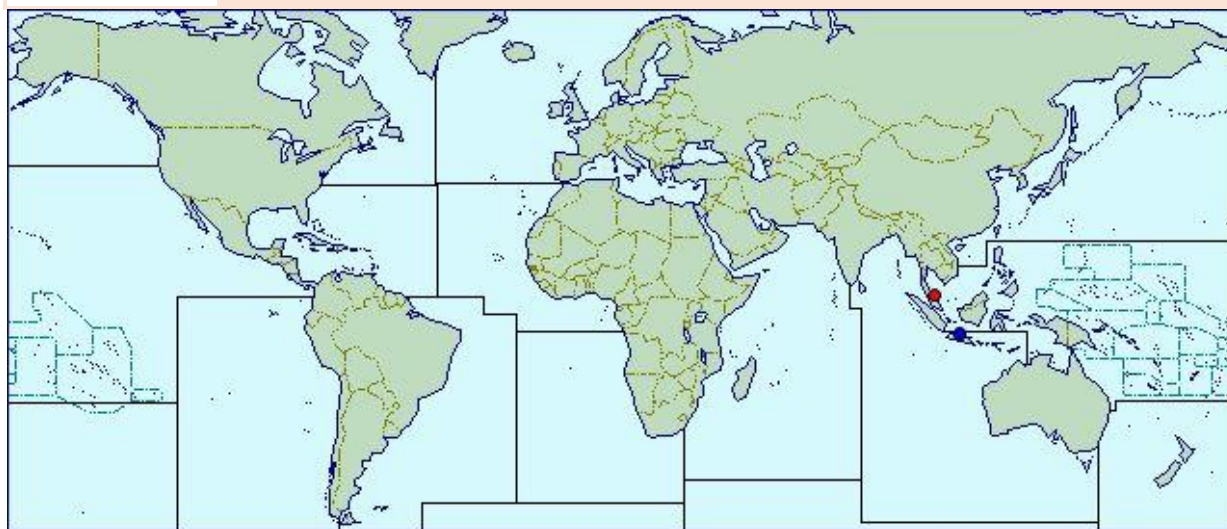


■ Present, no further details	■ Evidence of pathogen
■ Widespread	■ Last reported
■ Localised	■ Presence unconfirmed
■ Confined and subject to quarantine	■ See regional map for distribution within the country
■ Occasional or few reports	

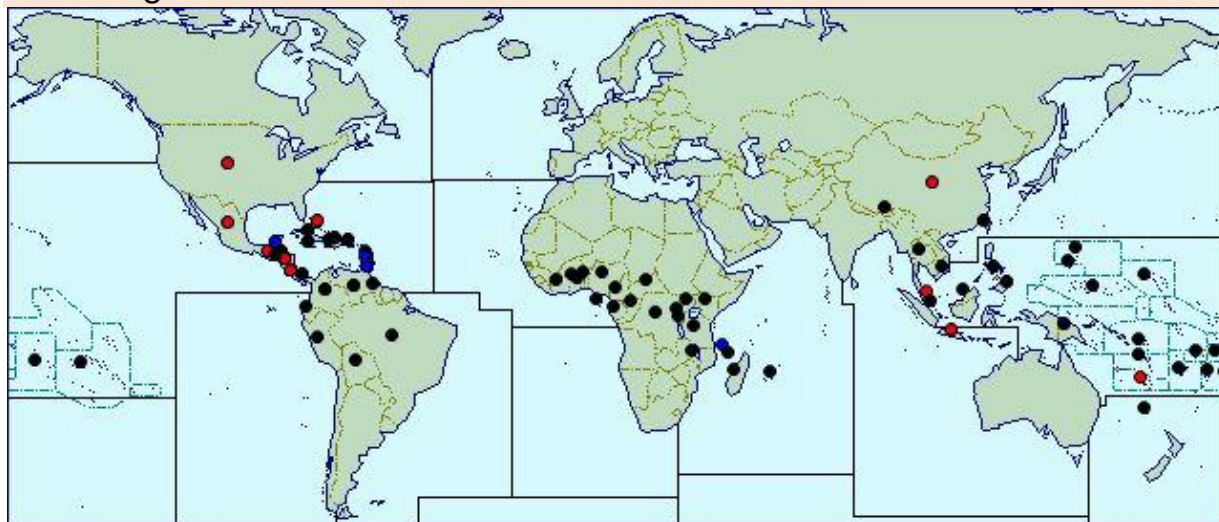
Banana blood disease



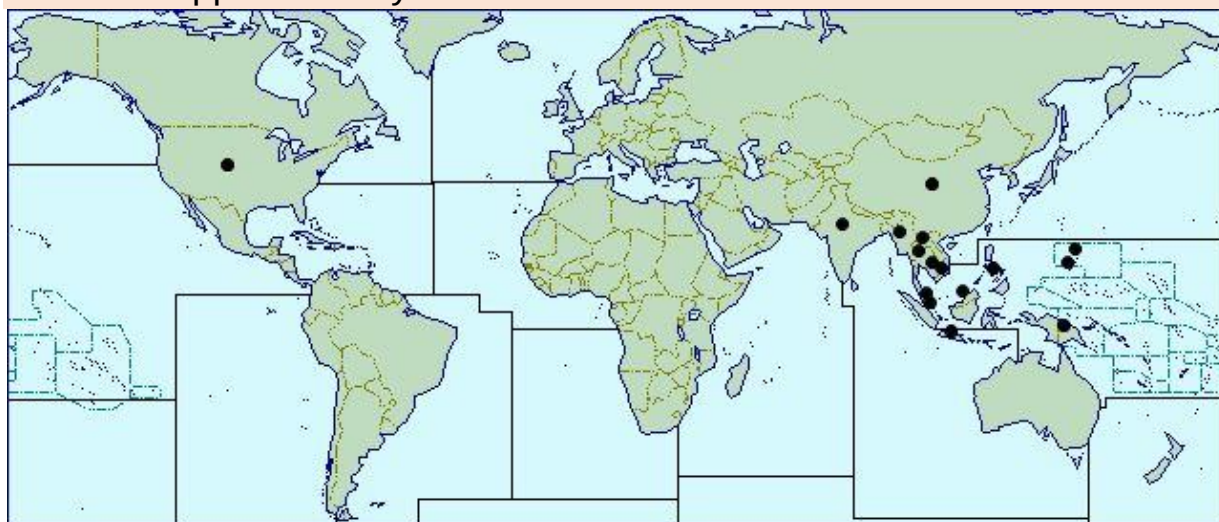
Bacterial wilt



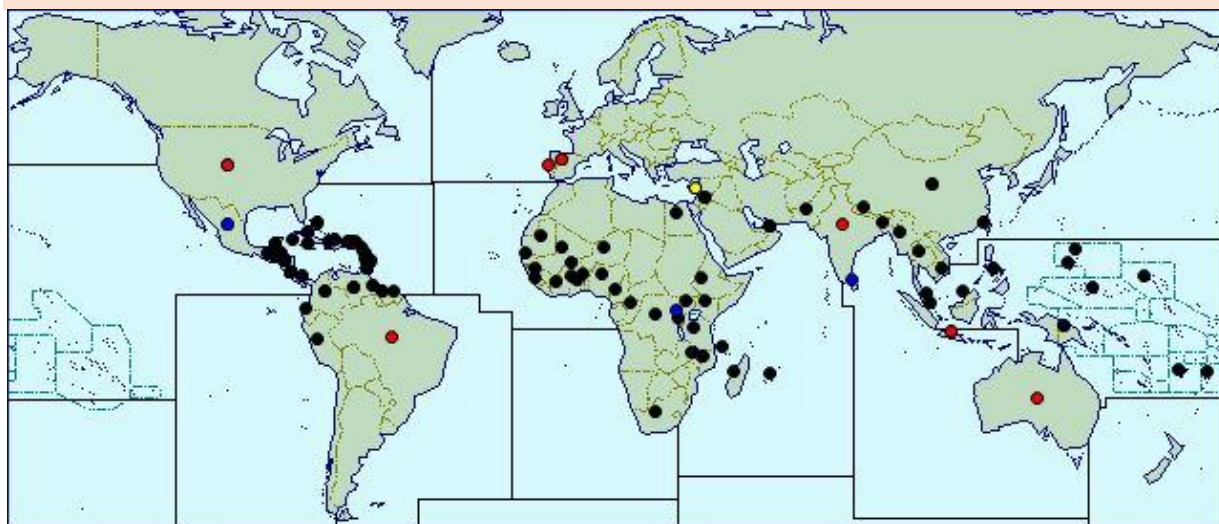
Black Sigatoka



Banana skipper butterfly



Panama disease



NORTH QUEENSLAND BANANA INDUSTRY

WATER QUALITY STRATEGY

2017 – 2020



FOREWORD

The banana industry has a great reputation for adopting environmental best management practices. The majority of growers respect the natural environment and the Great Barrier Reef and understand the impact their farming can have on the quality of water in local catchments. There are increasing numbers of growers implementing best management practices on their farms with the industry having reduced the rate of nitrogen application by 40% over the last 10 years. While this is an outstanding achievement, there is room for improvement.

This Water Quality Strategy has been written with a focus on extension and working with growers to help them improve their adoption of nutrient and sediment management practices. It is the goal of the Australian Banana Growers' Council (ABGC) to help more growers farm at best practice without compromising their productivity and profitability. Consequently, this Strategy contains targets and actions that demonstrate that the ABGC is committed to helping growers improve the water quality of the Great Barrier Reef. This approach to sustainable farming is increasingly important to many Australians.

The Strategy lays out the priorities for the ABGC for the next three years with a clear focus on reducing the amount of nutrients and soil leaving farms. The ABGC will work closely with funding and delivery partners to develop new extension tools that will support growers adopt practice change so that these changes can be quantified, measured and achieved.

The ABGC encourages growers to get on board and adopt best management practices so that the industry can proudly showcase its responsible approach to farming.



Chair - Australian Banana Growers' Council

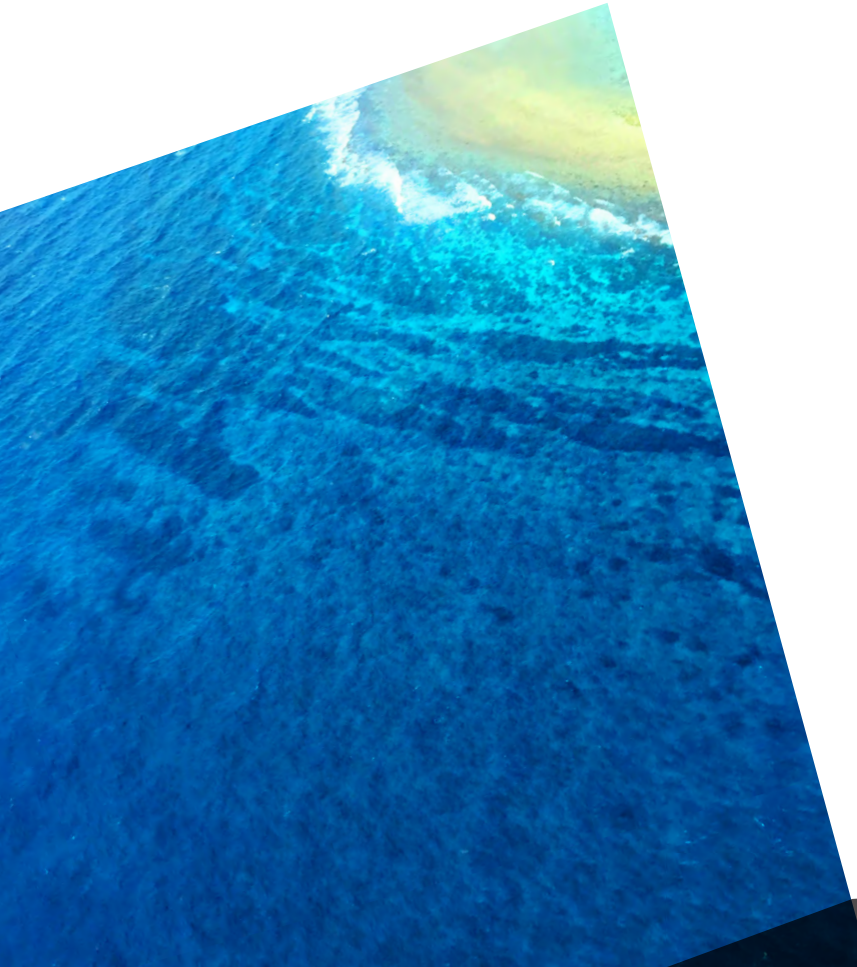


GOAL

The banana industry will continue to contribute to improved water quality and health of the Great Barrier Reef.

OBJECTIVE

The banana industry will contribute to a 10% decrease in dissolved inorganic nitrogen and a 5% decrease in sediment run off to improve the water quality of the Great Barrier Reef (GBR) Lagoon by 2020.



STRATEGY

North Queensland banana growers will be supported to improve their production standards and adopt recognised best management practices. Specifically, this strategy will focus on assisting growers to:

- apply the optimum amount of nutrients to their banana crops; and
- retain soil on their farms.

Targets

- Over the next four years, the banana industry will participate in modelling and monitoring work to identify the production areas and practices that are at the highest risk of contributing to poor water quality and implement changes to management practices to mitigate the risks. Specifically,

-



2. Extension material

- Banana growers' adoption of BMP will be supported through the design of extension material and tools. Examples include:
 - Nutrient budgeting tools and plans;
 - Electronic extension and decision making tools such as smart device applications, the BMP Guidelines and videos;
 - Case studies to demonstrate best practice and innovation;
 - BMP Guidelines that reflect evolving best practice;
 - Farm and topographical maps to improve farm layout; and
 - Fact Sheets and other technical information products.

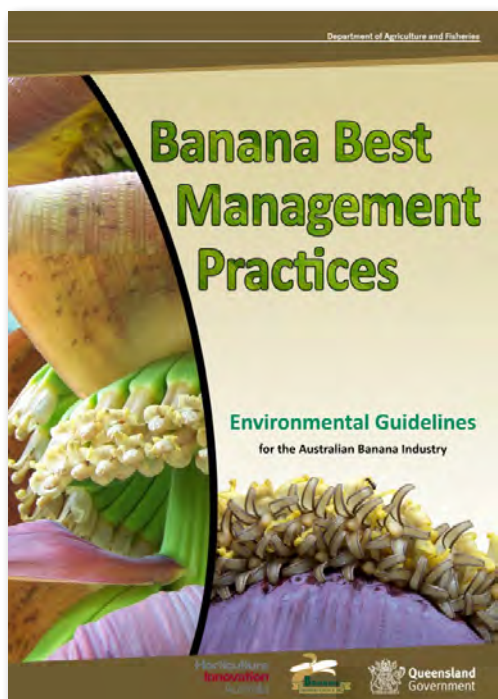
Targets

- **Commencing in 2017**, extension material targeting nutrient and sediment retention (such as the tools listed above) will be developed to inform banana growers of the benefits of adopting best management practices;
- **Commencing in 2017**, there will be a biennial review of extension material and techniques used in other industries – to identify possible new extension opportunities for the banana industry;
- **Commencing in 2018**, there will be a biennial review of banana-industry BMP extension material to ensure it promotes current best practice;
- Production of two videos per year to promote innovation and best management practice.



It is important to keep banana growers and other stakeholders informed about the steps the industry has taken, and is continuing to take, to reduce the loss of nutrients and sediments from farms. Consequently, regular communication and engagement with growers will raise their awareness of the water quality issues impacting on the banana industry as well as the Great Barrier Reef. This will include regularly profiling the efforts and initiative of growers who are delivering on-farm best practice and innovation. The ABGC will use a number of avenues to keep growers informed including:

- Workshops;
- Water quality events and seminars
- Australian Banana Magazine;
- E bulletins;
- ABGC website;
- Banana Congress;
- Social media – including Facebook;
- Media releases;
- Local grower group meetings.



WWW.ABGC.ORG.AU

AUSTRALIAN BANANA GROWERS' COUNCIL
Stakeholder Evaluation of
Industry Strategy Manager (ISM) Role
May 2020

"Pretty good experience working with ISM - very fruitful"
*"I wonder if anyone else could have pulled off what she has -
she should clone herself"*
*"Highly collaborative in co-design, co-production and co-
delivery"*
"An incredible asset for ABGC"

Jill Knell
Independent Evaluator
Soul in the Workplace.com.au
Cairns, Queensland

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Summary of outcomes

The Banana Strategic Investment Plan (2017 - 2021) identifies the priorities for the banana industry to ensure the industry has a high likelihood of success in the short, medium and long term. Investment Plan outcomes relevant to the role of the ISM include;

- Continue to drive adoption of best management practices for on-farm biosecurity to ensure biosecurity risks are minimised.
- Strategically communicate the industry's biosecurity and environmental best management practices to the community.
- Strategically communicate the industry's economic and social benefits to the community; and
- Identify and develop innovative leaders to promote best management practice adoption and drive the development and adoption of innovative practices.

ISM outcomes align very closely with the outcomes from the Investment Plan mentioned above. In addition to those outcomes, the project was also to deliver:

- Increased grower adoption of environmental best management practices.
- Improved grower profitability and productivity through grower's expanded knowledge base and adoption of best management practice standards.
- Growers are prepared for potential pests and disease incursion, legislative changes and the public's increasing expectation of growers using responsible farming practices; and
- Stakeholders understand the key issues impacting on banana growers and know how to engage with them to ensure informed decision making.

The stakeholders of the ISM fall within two broad categories - those who are growers (and the banana industry more broadly) and those who are non-growers. The non-grower stakeholders are largely drawn from the Queensland Government and Australian Government as well as other organisations such as Natural Resource Management groups, Plant Health Australia and other industry peak bodies. The wide range of non-grower stakeholders make the range of issues to be tackled by the ISM extensive.

In preparing this report, 12 stakeholders were asked to reflect on their involvement with the role of the ISM and how the ISM has helped the banana industry engage in critical issues and deliver on the outcomes listed above. A summary of responses is included in the report.

In the feedback provided, there is consistent agreement from both grower and non-grower stakeholders that the ISM has contributed constructively to the profitability and sustainability of the banana industry. During the last three years, the ISM has resolved multiple, complex issues across the disciplines of biosecurity and water quality. As part of the problem solving and communication, the ISM has engaged with, and linked, diverse stakeholders that range from growers to Ministers.

The ISM has also proactively identified opportunities for the banana industry and initiated action to benefit growers. The ISM has successfully engaged with the stakeholders so that each has collaboratively played a role in advancing the profitability of the banana industry. The ability to work with multiple stakeholders, listen, think strategically and solve problems is a key requirement and success factor for this role and the banana industry's long-term sustainability.

Recommendations

1. **ISM Role to continue**

The ISM project has consistently delivered the project outcomes at a very high level in all areas. There have been excellent unexpected consequences such as securing additional funding for priority environmental projects. The ISM is highly regarded by all stakeholders and is seen as an invaluable asset. Without this role, the industry would not have an entry point for non-grower stakeholders to discuss issues or raise collaborative opportunities. This role has provided a dedicated resource to assist growers become more aware of the strategic water quality and biosecurity issues confronting the industry and themselves. The role needs to be continued.

2. **Maintain strategic and collaborative focus**

The ongoing focus should be at a strategic as well as a collaborative level on biosecurity and the environmental issues. A resource focused on the understanding and implementation of these issues provides a valuable, practical link to the priorities identified in the Strategic Investment Plan. Consideration should be given as to how capacity can be created to respond to emergent issues as project should have some, albeit limited, scope for contingencies.

3. **Increase capacity of growers**

It is important that growers are supported to be better influencers and mentors as industry owned and led solutions are preferable to reliance on regulations. Growers are likely to be more effective in engaging the disengaged. Also, it is important that growers have a greater understanding of the direct operational impacts of the ISM's strategic initiatives.

4. **Benchmark best practice agri-collaboration**

The ISM project has been instrumental in developing sophisticated models of stakeholder collaboration, co-design, co-production and co-delivery. Stakeholders consider these models are at an international level of practice. There is opportunity to transfer these learnings to other industries. There is also potential for the role to seed action research initiatives around partnership journeys in biosecurity response situations. Very helpful to share learnings with and from other industries.

Introduction and background

The Banana Strategic Investment Plan (2017 - 2021) identifies the priorities for the banana industry to ensure the industry has a high likelihood of success in the short, medium and long term. An outcome included in the Investment Plan seeks the increased adoption of the industry's Best Management Practice (BMP) guidelines to improve industry sustainability, biosecurity and environmental stewardship.

The banana industry has responded to this identified outcome in a number of ways but particularly through its decision to fund the Industry Strategy Manager (ISM) project. Over the last three years, the ISM has successfully delivered on project outcomes as well as key strategies from the Investment Plan and this is demonstrated in this evaluation of the ISM role. The Investment Plan's outcomes relevant to the ISM role include:

- Continue to drive adoption of best management practice for on-farm biosecurity to ensure biosecurity risks are minimised.
- Strategically communicate the industry's biosecurity and environmental best management practices to the community.
- Strategically communicate the industry's economic and social benefits to the community; and
- Identify and develop innovative leaders to promote best management practice adoption and drive the development and adoption of innovative practices.

In March 2020 independent consultant Jill Knell was engaged to assist with an external evaluation of the effectiveness of the role of the ABGC Industry Strategy Manager from the perspective of a range of stakeholders and the development of recommendations for the future of the project. The evaluation was a requirement from the funding body prior to the conclusion of the current three-year ISM funding agreement in September 2020.

Three core groups of stakeholders were identified; growers, non-growers and ABGC staff. Non-grower stakeholders were largely drawn from the Queensland Government and Australian Government as well as other organisations such as Natural Resource Management groups, Plant Health Australia and other industry peak bodies.

A total of twelve stakeholders were asked to participate in the evaluation. Due to a range of logistical issues these interviews were conducted by phone.

Stakeholder interviewees were comprised of;

- Growers - four interviewees
- Non-growers (government & non-government agencies) - six interviewees with collaborative interests across biosecurity, water quality, the environment.
- ABGC staff - two interviewees

Three sets of questions were developed with each set reflecting four specific measurables in relation to interests of each of the three stakeholder groups.

Attachment 1 outlines the stakeholders interviewed and the different questions used.

Grower stakeholders

ISM deliverables for growers

The ISM project has delivered benefits at both a strategic, whole-of-industry level and for individual growers.

At a strategic level, this project links the banana industry into government policy and funding opportunities. This improves farming, grower profitability and the water quality in the Great Barrier Reef lagoon. The outcomes are 'win-win' for all parties. Examples include:

- The ISM initiated a project, funded by the Office of the Great Barrier Reef that is delivering information to the industry about optimum nutrient requirements of banana plants. This will save growers money, provide them with peace of mind and reduce the amount of nutrients leaving the farm;
- The ISM is a member of the governance panel for the Wet Tropics Major integrated Project which means that the banana industry is involved in and learning from the outcomes of a \$16m multi-faceted water quality project. The banana industry is unlikely to have been involved in this project if it did not have an ISM function;
- The ISM prepared the original draft of the Memorandum of Understanding between the Queensland Government and the banana industry that sets out roles and responsibilities for the sharing of responsibility for funding, governing and delivering the Panama TR4 Program. This type of joint arrangement is ground-breaking in Australia and establishes international best practice. The ISM's participation gave banana growers a voice and leadership role in designing a way forward that will see the spread of TR4 slowed and improve on-farm biosecurity.

The project also delivers outcomes that impact individual growers. As a result of the project, banana growers are informed of major environmental and biosecurity changes and policies that will impact on their farming practices. Importantly the role will help growers understand how best to position their business so that their profitability is not negatively impacted by these changes. It helps them adapt and adopt new practice. It also helps them to farm within the law.

Examples of this include:

- The implementation of new water quality regulations that are practical and easily implemented by the majority of banana growers;
- The assessment and prioritisation of grants designed to improve water quality outcomes;
- Participation in best practice projects on farms - benefitting both the individual grower and through extension, the industry more broadly.

Grower feedback on effectiveness of ISM Project

Different types of information provided to the Banana industry about the priority issues of biosecurity, water quality and the environment

- Provides lots of useful information. Focus groups work especially well and are critically important as a learning tool as are one-to-one meetings. Increasingly growers are connecting virtually especially younger growers. Most growers prefer to be out farming and need to be hounded to focus on anything other than hands on growing. However ISM is so well respected that growers are very responsive to her.
- Very well handled. Industry works together. Michelle really gets out there, responds quickly, jumps on things. Pretty damn good.
- Very positive in relation to reef regulations. Lots of work and effort undertaken that has really landed for growers. Has needed to use a range of different methodologies due to grower challenges e.g. roadshows etc. Sometimes it's preaching to the converted. Excellent understanding of grower limitations, there's always a percentage who are dis-engaged. Provides information when people are ready to hear it. Industry is under greater scrutiny than ever. Industry as a whole is engaged and informed.

Changes in the Banana industry around biosecurity, water quality and the environment

- Growers want to do the right thing. ISM is very straight forward, answers questions with clear language. Ground truths sometimes raw decisions. There might need to be additional change with Covid 19 around workplace relations, workplace health and safety. ISM streamlines changes.
- Overall ISM has influenced positive change. Water quality practice changes are excellent, changes in biosecurity good, though there are a range of responses and it's patchy in some areas. Covid 19 may require industry changes. There will always be areas of policy change that need responses.
- ISM has been very good at influencing change especially in the area of water quality. I wonder if anyone else could have pulled off what she has. She should clone herself! In the future interactive consultation with growers will become even more important. Setting farmers up as mentors and influencers is very important. ISM and her team have been critical for implementation of changes.

Non-growers (e.g. government & non-government agencies) understanding of key issues impacting on the Banana industry

- Yes, absolutely effective. Grower issues around water quality have influenced changes with stakeholders. ISM well regarded by growers and non-growers. ISM has led to growers being willing and being seen to be willing to collaborate and be part of the solution.

- ISM is very experienced with government and influencing up. Growers get a great deal as a result of this. They feel they're in the loop and the benefit shows when the shit hits the fan.
- Non-growers always need better awareness of and respect for industry. Need to reduce paperwork, regulations, record keeping, duplication, audits compliance etc. These are very costly for growers. Need assistance with record keeping.

Strategic relationships with other stakeholders including government & non-government agencies

- ISM talks to both sides. Some growers still in denial about TR4 and need to start planning now.
- There is no doubt that the ISM has buffered us from a number of issues and that has helped us immensely especially around reef regulations and water quality. Growers would have got a far worse deal without ISM.
- ISM has been good at maintaining relationships with a range of stakeholders. Industry is well placed to refocus and respond to any emerging issues. She tailors information to ensure everyone understands. ISM is a sophisticated collaborator, takes the time to build relationships and is solution focussed.

Other comments

- ISM is excellent in her role, capable, engaging. Great all-rounder.
- Great job especially with reef stuff. Fantastic really. Need to consider strategic responses to natural disasters, global warming, and unexpected catastrophic events.
- ISM is very well respected by the industry. Growers need to know more about her role. There should be a greater acknowledgment of her achievements and the quality and amount of work she does. The magazine has no mention of her role and this might be a good vehicle. ISM has been very successful in bringing funding into the organisation and the industry.

ISM is very impressive. She presents well, really listens, asks good questions and is excellent at strategic analysis. She's not high 'falutin' and uses plain English. She has great interpersonal skills and can talk to all stakeholders. She has the second-best strategic brain I've encountered. She achieves great results, is reserved, positive and considered. Her role is very important. Her skill set and approach would be highly transferable to other regions e.g. NSW in five to ten years' time.

Non-grower stakeholders

ISM deliverables for non-growers

Strong relationships with non-grower stakeholders are a critical element of success for the delivery of the ISM project. The ISM has been able to introduce non-grower stakeholders, particularly government representatives, to the industry and issues it is confronting. The ISM is able to constructively influence the policy settings and implementation strategies to achieve the best possible outcomes for grower and non-grower stakeholders. This project provides a function that translates policy impacts to growers and importantly feeds grower issues and constraints to policy makers. The project ensures policy settings are appropriate, achieve the desired outcomes and avoid perverse, unintended consequences. This has been particularly important in the water quality field as the Queensland and Australian Governments have historically had very little, ad hoc interactions with the banana industry - therefore no sense of its culture, practices or achievements.

Examples include:

- Regularly liaised with growers over two years to provide feedback to the Office of the Great Barrier Reef on the proposed water quality regulations;
- Provided significant input to the government officers responsible for the Panama TR4 Program and the Best Management Practice project so that each project delivered positive outcomes for all parties but particularly banana growers;
- Represented the banana industry in the design of the Wet Tropics Major Integrated Project to make sure the interests of banana growers were included in the project design features as well as implementation strategies. The design and scale of this project was the first of its kind in Queensland.

Through relationships, knowledge and negotiation skills, the ISM has been able to attract \$4.9m for specific banana projects from non-grower stakeholders. This has translated into the employment of three extension staff who work with growers to improve their farming practices and profitability and two very large grants programs to support growers to make practice change. This relieves the pressure on levy investment to address priorities identified in the Banana Industry's Strategic Investment Plan.

Non-grower feedback on effectiveness of ISM

Non-grower understanding of the key issues impacting on the Banana industry

- ISM has facilitated an excellent understanding of issues. With Basin Integration this means we're good to go and this have really strengthened integration and led to positive collaboration.
- ISM has been absolutely pivotal. A voice for the industry, represents growers and their perspectives very well. Has really helped our project progress. Never at loggerheads or at a stalemate.
- ISM is the go-to person. She understands industry issues and attitudes. She's a good advocate. The industry is well organised. ISM is informative, knows biosecurity, very active, a natural. In the future increased pressures on the industry will increase impacts on growers. Always a big ask to stretch between national high-level strategy and the farm gate. ISM knows the importance of increasing non-grower understanding of growers' views - growers pay ABGC to do that as well as paying the consequences if it's not done well.
- Pretty good. Interacts and links with many different stakeholders. Sometimes the impacts are not always clear due to the strategic nature of the role. ISM is well connected and it is important to continue to strengthen communications.
- Very effective especially over last 2 years. Very good at facilitating. Very experienced and has been helpful finding possible solutions to governance issues around nutrient trials. Would be good to have more action learning around working together better.

Improved Banana industry understanding of issues around biosecurity, water quality and the environment

- Newsletters and regular updates work really well. They are popular with growers. Language is accessible, easy to interpret, plain language. Being able to piggy back our interests into grower meetings, AGM etc. is very helpful. ISM is an incredible asset for ABGC. No suggestions for changes or improvements. There is a huge amount of work that needs to be done so have to be realistic about the amount of work one person can reasonably be expected to do.
- Has been very good at helping growers recognise issues and understand about nitrogen levels given variable data. Minimum standards about sediment understood better. Improvements in understanding agronomy better would be good.
- ISM has definitely been able to improve grower understanding, it's a collective effort. She helps keep it all together. She does a very good job coordinating and utilising the team on the ground for face-to-face work.

- Supportive of DAF's perspective. Conveys our intentions well so trials can be robust and effective. Bridges the gap between intensive experimentation and commercial reality. Allows for practical implementation. There are some areas of repetition, some necessary while maybe others could be streamlined or avoided. ISM cross checks to deliver true and clear messages to avoid things being lost in communication. Gets right to the point in clarifying areas of concern. Aware of and responsive to the critical nature of issues and timeframes.
- ISM very influential. Data is shared and this has led to concrete shared understanding. Pivotal in maximising diverse outcomes. Industry understanding has skyrocketed, duplication has been minimised. Might be possible to look at the Cane Industry shared data benchmarking and its applicability for the Banana industry. Very helpful to share learnings from other industries.

Influencing changes in the Banana industry around biosecurity, water quality and the environment

- Very influential. Extension capacity has not peaked yet but very good in translating information into practice.
- Does this really well. Always looks for different ways to influence change. Very solution focussed. Growers very comfortable with ISM. She's honest with them and distils issues for them.
- Hopefully farmers can proactively adopt new practices rather than just reacting to accreditation, codes, regulations etc. Industry owned solutions with on-ground implementation by them is the way to go. Growers need to be aware of the risks and losses of not doing anything. Behavioural change important for farmers.
- ISM supports Extension Officers so not so directly influential with growers - she pulls the threads together. Manages team well. Translating Cane Industry cases to Banana industry could be helpful.
- ISM mostly influences indirectly via the South Johnstone team. Does a great job bringing together growers and non-growers to achieve agreement about what needs to be done - getting everyone on the same page. Be good to have further research. Has clearly influenced change for growers.
- Good in passing on strategic information and facilitating outcomes with the team. Able to negotiate agreements beyond any pre-conceived ideas on reef regulations. Enabled growers to know that no one was trying to screw anyone.

Establishing and maintaining strategic relationships with the Banana industry and non-growers

- Intelligent and articulate especially with senior bureaucrats and decision makers. Ensures that she consults and substantiates her position. Willing to listen, adapts, amends. Works hard to engage the disengaged.
- Really good job, very important work with support from team - very accessible. Very productive discussions. Even if people don't always agree on everything there are negotiations and collaborations. ISM is the honest broker.
- Relationship are working pretty well. ISM makes a conscious effort to build relationships. She has a strong commitment to both formal as well as informal relationships. Very good networks, good team. Increased collaboration across tricky groups and competing interests. Very important to continue to strengthen and leverage the strengths of the network.
- Trusted and respected, able to have the hard conversations. True partnerships. Highly collaborative in co-design, co-production and co-delivery. Supports move from government led strategy to industry led, builds capacity for future priorities.
- ISM really important role beyond the local office as often strategic approval is needed from ABGC. Builds trust, is the voice of reason, has a broad overview - big picture oversight. Helps streamline and coordinate local meetings so that collaboration can occur as much as possible beyond competitiveness.
- Exceptionally good particularly with key government stakeholders but also with growers. Excellent interactions with government funding bodies. Has got things on track. Exceptional communication skills, proven outcomes. Important to avoid repetitions, to-ing and fro-ing. Bridge builder. Would be hard to manage without her, she's always the conduit.

Other comments

- Plays a key role. Top marks! ISM working in a sensitive area for growers who may have negative views in response to some issues. She has performed exceptionally well with support from ABGC.
- Very influential as well as very busy. A real role model.
- Project has delivered an absolutely enormous amount. Such a fully committed work program limits wriggle and capacity to respond to emerging issues beyond current priorities. Need to avoid burn-out. The project model needs scope for contingencies.
- Great operator. TR4 agreement demonstrates how well government and industry can work together with funding for on-ground implementation. Very proactive and strategic initiative, the first of its kind. A unique partnership. ISM's work managing disease sets a benchmark. ISM sits on Ministerial Advisory committee which has developed a new trajectory and a high level of effectiveness. World class model that has national and international potential for

other agricultural products. ISM operates at an international level across industries. Important for Banana industry to recognise broader learnings in grant funding. There is a potential for action research initiatives around partnership journeys in a crisis response situation.

- ISM has potential future role in other projects around governance mirroring previous projects Having grower representatives in a decision-making capacity on steering committees is important. Need to have 'open minded sceptics' working with 'policy entrepreneurs'.

ABGC staff stakeholders

ISM deliverables for ABGC staff

The ISM's involvement in strategic water quality and biosecurity issues means that the actions of ABGC staff align to, or are informed by, the 'bigger picture'. This consistent approach strongly positions banana growers to adopt change and influence policy development. The ISM analyses and sets the strategic direction and the extension officers implement it – supporting change on the ground. Conversely the local intelligence gathered by the extension officers, who work closely with growers, helps the ISM to inform and influence policy so that practical outcomes are delivered. They are an effective sounding board for each other.

The ISM supervises three extension staff but also provides input into the work undertaken by other ABGC project officers and the Chief Executive Officer. The extension staff are not funded through banana grower levies.

ABGC staff feedback on effectiveness of ISM Project

Non-growers understanding of key issues impacting on the Banana industry

- Important to have a role that has a strategic overview of current and emerging issues and can communicate these effectively to non-grower stakeholders as well as support other staff to do this. ISM does this well despite a range of competing priorities.
- Fantastic job in increasing understanding of non-growers especially regarding Reef Regulations. Singlehandedly ensured that non-growers understood that Cane Industry issues were not directly transferable to the Banana industry regarding water quality.

Growers understanding of biosecurity, water quality and the environment

- ISM has developed very positive relationships with growers and has been able to provide trusted and valued information across the different topics of biosecurity, water quality and the environment. Different strategies have been developed for each topic area. Changing learning approaches need to be monitored and incorporated e.g. moving from workshops to one-on-one mentoring and to the increasing use of technology. Potential changes in political and environmental priorities may broaden the areas needed for grower education.
- Has done this really well especially in regard to reef issues. Maybe improved grower capacity for peer coaching so that future initiatives can be more grower led. Moving forward perhaps a sharper and narrower focus on reef issues. The role can potentially become too broad – maybe more depth, less width.

Changes in the Banana industry in relation to biosecurity, water quality and the environment

- ISM has been very influential within the industry. There has been increased capacity within the industry to understand and respond to change. ISM is very good at identifying gaps and emerging issues that impact the industry and has supported growers to adapt to changing external pressures and priorities. ISM has also negotiated changes in funding and accessed new funding. While ISM has been good at balancing competing priorities across the role the question remains - can one person stretch across so many domains?
- Excellent delivery of outcomes in best management practice. Grower resistance is decreasing. Very impressive. ISM is a perfectionist. Sometimes needs to balance relationships with deadlines.

Strategic relationships with the Banana industry and non-grower stakeholders

- ISM does a great job at building and maintaining relationships. She is personable, pleasant, a good listener and gets out there! There is concern that more strategic relationships may falter without her input especially with Brisbane based relationships. FNQ relationships are somewhat less reliant on her and often project based. There is considerable pressure on the role due to the breadth of the role and competing priorities. However, the depth of focus can be compromised in some areas. This leads to some issues being addressed at an operational level (workshops etc.) and others at only a strategic level. Going forward there will be increased complexity in the system and the need for skilled navigation and relationship skills. Local level collaboration will present ongoing challenges especially responding and managing changes versus delivering on project outputs and the differing focus between outputs versus outcomes in a dynamic environment. Overall ISM has a high level of knowledge, a finger on the pulse - knows what's going on, has the capacity to respond, supports other people's roles and goals, sees the bigger picture, limits duplication in the industry and makes influential recommendations.
- Excellent at building and maintaining relationships. Has been a great influencer especially in relation to reef issues and biosecurity. The successes in building relationships to deliver reef outcomes are so good that they are a pilot that could be a potential model for use in other industries. Great outcomes in influencing policy development. Has been able to attract significant grant money/seed funding. A real value-add.

Other comments

- Things wouldn't have changed so much and so well in water quality and biosecurity without ISM. Highly competent, very effective, very capable in every area.

Attachment 1: List of stakeholders and questions – April 2020

Non-grower interviewees and questions

Non-grower interviewees (with collaborative interests in water quality, biosecurity and the environment)

- Tegan Kukulies, Development Horticulturalist, Department of Agriculture and Fisheries
- Sandra Henrich, Basin Coordinator (Johnstone) , Wet Tropics Major Integrated Project
- Dominic Henderson, Principal Project Officer, Reef Programs, Environmental Policy and Programs, Office of the Great Barrier Reef (OGBR)
- Dr Stuart Irvine-Brown, Senior Research Agronomist, Horticulture and Forestry Science, Department of Agriculture and Fisheries
- Rebecca Sapuppo, A/Principal Policy Officer, Biosecurity Queensland, Department of Agriculture and Fisheries
- Salvo Vitelli, General Manager, Plant Biosecurity and Product Integrity, Biosecurity Queensland

Non-grower questions

Please consider the effectiveness of the role of the Industry Strategy Manager (what's working, what needs improving changing or doing differently, what are your insights, learnings, emerging issues, future priorities and/or any unintended consequences) in relation to;

1. Non-grower understanding of the key issues impacting on the Banana industry
2. Improved Banana industry understanding of issues around biosecurity, water quality and the environment
3. Influencing changes in the Banana industry around biosecurity, water quality and the environment
4. Establishing and maintaining strategic relationships with the Banana industry

Grower interviewees and questions

Grower interviewees

- Doug Phillips, South Johnstone
- Stephen Lowe, Tully
- Stephen Spear Macksville, NSW
- Leon Collins Tully

Grower questions

Please consider the effectiveness of the role of the Industry Strategy Manager (what's working, what needs improving changing or doing differently, what are your insights, learnings, emerging issues, future priorities and/or any unintended consequences) in relation to;

1. Different types of information provided to the Banana industry about the priority issues of biosecurity, water quality and the environment

2. Changes in the Banana industry around biosecurity, water quality and the environment
3. Non-growers (e.g. government & non-government agencies) understanding of key issues impacting on the Banana industry
4. Strategic relationships with other stakeholders including government & non-government agencies

AGC staff interviewees and questions

ABGC staff interviewees

Jim Pekin, CEO ABGC, Brisbane

Amelia Foster, BMP Coordinator, South Johnstone

ABGC staff questions

Please consider the effectiveness of the role of the Industry Strategy Manager (what's working, what needs improving changing or doing differently, what are your insights, learnings, emerging issues, future priorities and/or any unintended consequences) in relation to;

1. Non-growers understanding of key issues impacting on the banana industry
2. Growers understanding of biosecurity, water quality and the environment
3. Changes in the Banana industry in relation to biosecurity, water quality and the environment;
4. Strategic relationships with the Banana industry and non-grower stakeholders

Australian Bananas magazine articles authored by the Industry Strategy Manager.

Biosecurity

Spotted Anything Unusual Lately? (December 2019)

Under the Microscope series

- Banana bunchy top virus (December 2018)
- Fall Army Worm (April 2020)

Water Quality

- Sediment Management Workshops (April 2018)
- BMP Back for Round Two (December 2018)
- Water Quality Regulations – Staying Afloat (April 2019)
- Get Reg Ready (April 2019)
- Score funding for sediment run off (April 2019)
- Water Quality Regulations Reman in the Spotlight (August 2019)
- Reef Protection Regulations in the Great Barrier Reef Region (December 2019)
- Is Record Keeping Adding to you Bottom Line? (April 2020)
- Independent Report Forecast Bright Outlook for Australian Banana Industry (April 2020).

Water Quality Strategy for the North Queensland Banana Industry (2017 – 2020) - Implementation Progress report

GOAL: The banana industry will continue to contribute to improved water quality and health of the Great Barrier Reef.

OBJECTIVE: The banana industry will contribute to a 10% decrease in dissolved inorganic nitrogen and a 5% decrease in sediment run off to improve the water quality of the Great Barrier Reef (GBR) Lagoon by 2020.

STRATEGY

North Queensland banana growers will be supported to improve their production standards and adopt recognised best management practices. Specifically, this strategy will focus on assisting growers to:

- apply the optimum amount of nutrients to their banana crops; and
- retain soil on their farms.

ACTIONS

1. Extension Delivery

The ISM has responsibility for designing and delivering a coordinated, multifaceted approach to extension, that will focus on working closely with growers, officers from the Australian and Queensland government departments, natural resource agencies, universities and industry service providers. Below outlines the highlights of achievements from the last 2 years that support the implementation of the Banana Industry Water Quality Strategy.

Actions from the Strategy	Implementation progress
Identify the optimum rates of nutrient application on a farm and/or block basis;	The ISM is a member of a Project Reference Committee (PRC) for a research project that is identifying the optimum rates of nutrient application and yield on a farm and/or block basis. The ISM has helped in the design of the project and has also advocated for growers to be included in the PRC to ensure that the project design and implementation remains practical. Growers' involvement also gives the trial credibility and hopefully broader industry acceptance of the results. The trial (and extension work) will continue for a further 2 years at least. This R&D project was funded by the Queensland Government (budget \$1.4m over three years) in response to requests and representations made by the ISM.

Identify and assist growers to implement the most cost effective land management practices;	The ISM has designed incentive programs based on the most cost effective land management practices. Since the commencement of the Banana Industry Water Quality Strategy the ISM has attracted \$2.5m in non-levy funding specifically to improve land management practices. 45 individual projects covering approx 2,300 hectares were completed by growers (from Australian Government funding). There is a second funding round available for north Queensland growers that will expire in June 2022. At the time of finalising this report, \$363,000 and 16 permanent practice change projects had been initiated. The ISM has also reviewed the extension delivery model and will be working on implementing these changes over the final year of the Strategy. These changes will focus on delivering enhanced services to growers.
Support trialling and validating innovation to establish improved sustainable practices;	The ISM has had strategic oversight for an innovation trial aimed at reducing the sediment loss from farms – replacing the wheels of bagging machines with tracked tyres. This trial revealed that there was no statistically significant difference in the amount of water and sediment leaving banana farms as a result of the tracked wheels. The results of this innovation have been shared with growers at grower forums. The ISM is working with other delivery partners to guide innovations for the banana industry that include constructed wetlands and High Efficiency Sediment (HES) basins (never trialled before on banana farms). This research is still underway.
Create opportunities for peer to peer learning from industry champions and innovators;	The ISM has facilitated: • the promotion of several growers' water quality innovations at the 2019 Banana Congress (by video and question and answer session); • sub-catchment water quality monitoring for nutrients, sediment and more recently pesticides (shared and discussed in shed meetings). • Growers exchanging information about nitrogen application rates and yield during meetings about the Queensland Government's environmental regulations (this was a major step forward as such information is often held tightly by growers as their competitive advantage); • The ISM has guided the creation of the Banana Women's network that meets 2-3 times each year. Members of this network include women

	who are associated with banana farming – owners, office managers, shed supervisors etc. There are currently 60 members. Facilitated a soil health workshop that focused on growers who are leading best practice in this field. They shared their knowledge and experience with growers who have less knowledge but are keen to improve their profitability by improving their soil.
Use new technology to improve farming profitability and environmental outcomes;	As part of the incentive funding available to growers, several new pieces of machinery have been adopted to work on banana farms including a slasher used traditionally in vineyards (reduce labour costs and increase the grass between rows to improve water quality leaving farms) and the HES basin. The ISM has enabled the Wet Tropics Major Integrated Project (MIP) to link with banana growers to trial innovative projects that may lead to improving the existing best management practice The ISM is a member of a project team that is exploring remote sensing opportunities as a method to improve farm management, particularly nutrient and sediment run off. If successful, this project has the potential to strongly influence best practice on farms.
Provide access to experts in water quality management;	The ISM has contracted a soil conservationist on a part time basis so that growers have access to skilled advice. This has been a great opportunity for banana growers as there is a skills shortage in this field. The ABGC offers an extension service for growers to help them improve their farming practice. This service is available to growers as a result of the ISM negotiating with the Queensland Government to fund BMP delivery. The ISM's involvement in the MIP has increased the number of extension officers able to work with banana growers. These MIP officers bring with them extensive information about water quality in the local catchments and is working with growers to explain water quality results and the link to production practices.

Explain to banana growers, using clear language, the findings and implications of new research about the condition of water quality on the Great Barrier Reef.	The ISM successfully influenced the Wet Tropics Healthy Waterways Partnership to provide grower friendly information on their website. This information explains the annual report card in a way that non-scientists can understand. As a result of the ISM's intervention, the Partnership has also produced a video that explains how the Queensland Government's water quality model works. The video is targeted to a grower audience. The ISM recently facilitated the delivery of a soil health workshop aimed at banana growers. Significant effort went into making sure the pitch of the information provided was appropriate for the grower-audience. Feedback from the growers who attended will help the ISM improve future similar events. The ISM has provided leadership to the ABGC to ensure that extension material produced (videos, fact sheets, incentive guidelines and application forms etc) is able to be easily understood by banana growers.
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EXTENSION DELIVERY TARGETS

Over the next four years, the banana industry will participate in modelling and monitoring work to identify the production areas and practices that are at the highest risk of contributing to poor water quality and implement changes to management practices to mitigate the risks.

Targets in the Strategy	Progress
By June 2019, at least 43 banana growers (or approximately 4,200 hectares) will have changed their farming practices and adopted 'B' level practices ¹ for nutrient and sediment management.	Target achieved. At least 45 growers had improved their practices to at least B level as a result of accessing incentives funded by the Australian Government. This equated to approx 2,000 hectares. It is highly likely that many other growers also improved their practices without such incentives (but the ABGC is unable to account for these). Extension efforts will continue to engage with growers to provide incentives and advice until at least June 2022 (current Queensland Government funding). To date 15 growers have been contracted to delivered 16 permanent practice changes that will lead to water quality improvements.

¹ Level according to the Water Quality Risk Management Framework for the banana industry.

By 2020 at least 70% of all north Queensland banana production land will be farmed using the Banana BMP Guidelines for nutrient and sediment management	Target exceeded. By September 2020 90% or 9631 hectares the north Queensland production land (107 growers) had been benchmarked at least once against the Environmental BMP Guidelines (including nutrient and sediment management).
By 2020, all north Queensland growers who have completed the BMP or who are assessed to be farming at industry best practice standards will have access to industry developed extension tools (such as the <i>Better Bunch App</i>) to improve their productivity and profitability.	Target achieved. All growers who completed their BMP benchmarking were offered training in the BetterBunch app. Sixty-four growers have received BetterBunch training.
By 2020, the ABGC will facilitate an effective informal network of industry champions who influence other grower's farm management practices by actively promoting the economic and environmental benefits of adopting BMP and innovative practices.	Activity ongoing. An informal network of growers was established to assist the ABGC to understand nutrient application rates and methods occurring across the industry. This group was assembled twice in 2019. Particular effort was devoted to build the knowledge of this group with the expectation they will share their knowledge and experiences with other growers. They are becoming the 'go to' growers for water quality advice. A subset of this group volunteered to be members of a reference group for a project that is examining nutrition rates on commercial farms.
Commencing 2018, there will be a biennial workshop to keep growers, industry service providers and consultants up-to-date on new developments relating to best management practice, water quality improvements, nutrient management, new products etc	A soil health workshop was held for banana growers in September 2020. This was delayed several times due to a delay in the availability of research data, crowded extension calendars and COVID 19. The workshop was attended by 23 growers who rated the applicability of the content very highly. Follow up extension contact is being made with these growers to provide further technical support with the hope to bring about practice change (application of less nutrients).

2. Extension material

Banana growers' adoption of BMP will be supported through the design of extension material and tools.

Actions from the Strategy	Implementation progress
Nutrient budgeting tools and plans	Completed. A consultant was engaged by ABGC to produce a Nutrient Management Plan "template" to assist growers to develop their own plans. This is available to growers and used as an extension tool for the ABGC reef team.

	As a result of feedback, this plan is being reviewed to make it easier for growers to use to comply with the new environmental regulations.
Electronic extension and decision making tools such as smart device applications, the BMP Guidelines and videos;	Ongoing implementation. • Smart phone record keeping app developed. • 3 videos produced (how to use the record keeping app; innovation and water quality improvements; grassed interrows). A fourth video (farm mapping and contouring) is under production and will be completed by the end of 2020). • 1 podcast recorded (progress of banana growers implementing best management practices on farm) • Workshop material on sediment mitigation • Workshop material on nutrient mitigation • The ISM instigated a revamp of water quality/BMP related section of the ABGC website to make it more intuitive for growers to navigate and locate extension materials.
Case studies to demonstrate best practice and innovation;	Ongoing implementation • Three case studies have been included in the ground cover video; • Information gathering has commenced on the development of 2 new best practice farms. As these farms reach milestones, information will be recorded and a case study built to promote best practice; • Profile on Shane and Rachel Zonta's farming practices in the April 2019 Australian Bananas magazine; A case study on the benefits of sediment traps using the owner of Boolabah Farm (Darveniza family)
BMP Guidelines that reflect evolving best practice;	Completed. The BMP Guidelines were reviewed in 2019 to ensure the practices endorsed remain at industry best standard. They were further reviewed in 2020 to incorporate the changes introduced by the environmental regulations.
Farm and topographical maps to improve farm layout (eg drainage and all weather access); and	Completed. Farm maps were offered to those growers who attended a sediment workshop offered in 2018. Approx 60 growers accessed this information (workshops were not offered in 2019 due to resourcing constraints. A new format of workshop has been devised and roll out commenced in July 2020).

	The ISM has facilitated an ABGC extension officer to undertake basic training in surveying so that they can assist growers to design and implement practice change. There has been done to address a severe skills shortage in the Wet Tropics.
Fact Sheets and other technical information products.	Ongoing implementation The ABGC promotes the work done by researchers by sharing factsheets, magazine articles etc as well as develops its own material where it sees gaps. It as produced ground cover fact sheets and video, sediment workshop material and regulation awareness material.

EXTENSION MATERIAL TARGETS

Targets from the Strategy	Progress
Commencing in 2017, extension material targeting nutrient and sediment retention (such as the tools listed above) will be developed to inform banana growers of the benefits of adopting best management practices;	Ongoing Implementation. A variety of extension material including a videos, factsheets, magazine articles etc have been produced. This body of work will continue until at least June 2022 (when the current funding expires).
Commencing in 2017, there will be a biennial review of extension material and techniques used in other industries – as a way of identifying new extension opportunities for the banana industry;	Ongoing Implementation. In 2017 there was a concerted effort to identify opportunities to share research methodologies and results from R&D projects completed for other industries – specifically cane. Since then, a review occurs as new non- banana specific extension material is discovered/released. To date there has been little opportunity to learn from the results from R&D projects for other industries due to the vastly different production systems. Through the ISM, the ABGC worked with Growcom to share ideas on how to create a mini accreditation scheme for each industry's BMP Guidelines. This was a very efficient and effective way to create a new product for growers. Opportunities will continue to be explored.
Commencing in 2018, there will be a biennial review of banana-related water quality extension material to ensure it demonstrates and promotes current best practice;	Ongoing implementation. There were annual reviews of banana-related water quality extension material to ensure the continued currency and accuracy of the material available to growers. . This process helped to identify gaps which are

	progressively being filled eg the ground cover extension package produced in 2019 and the contour mapping vide under production in 2020.
Production of two videos per year to promote innovation and best management practice.	Ongoing implementation. One video was made in 2018 – how to use the BetterBunch electronic record keeping app. There were two videos made in 2019 – one on growing ground cover (profiling three growers and their approaches to great ground cover) and the other on innovative water quality practices (screened at the Banana Congress in 2019). A video on contouring and farm mapping is in production at the time of writing this report and will be released in late 2020.

3. Communication

It is important to keep banana growers and other stakeholders informed about the steps the industry has taken, and is continuing to take, to reduce the loss of nutrients and sediments from farms. Consequently, regular communication and engagement with growers will raise their awareness of the water quality issues confronting of the industry as well as the Great Barrier Reef. Equally important will be to educate stakeholders who are external to the industry about the significant gains being made by the industry in respect to controlling soil and nutrient movement. This will include regularly profiling growers who are delivering on-farm best practice and innovation using:

- Workshops;
- Australian Banana Magazine;
- E bulletins;
- ABGC website;
- Banana Congress;
- Social media – including Facebook;
- Preparing media releases targeting local publications;
- Encourage industry champions to participate in water quality forums to provide current and accurate information about the improvements made by the industry;
- Regular attendance at local grower group meetings

Implementation Progress: There is significant effort directed at communicating about best practice with banana growers and non-grower stakeholders. For example, the ABGC was a delivery partner of two soil health workshops and a field day with the Wet Tropics Major Integrated Project. ABGC staff had a BMP information booth, promoted examples (case studies) of best practice at the booth and promoted the event through the ebuletin, Facebook and SMS service. Also, ABGC staff members attend

industry events eg- Banana Congress 2019, extension events held as part of the National Extension Project, Cassowary Coast Banana Grower meetings and at every opportunity they encourage growers to get involved in improving on-farm practices. The ISM developed a communication and Engagement Plan to provide structure to the work of the ABGC extension team.

Inspiring Queensland banana growers to improve profitability through sustainable farming

Communication and engagement plan

Objective

This is an ambitious plan to help banana growers understand the bigger system in which they farm so that they can have an informed opinion on water quality issues. As a result of the plan, growers will feel more empowered to be a part of the debate rather than be the people whose practices are debated. It is important that they know what is going on. This may also encourage them to continue to make practice improvements on their farms. The water quality regulations recently developed by the Queensland Government are a good catalyst to start the engagement process but this Plan will look at water quality issues more broadly than regulations.

Specifically, the purpose of the plan is to develop a style and method of communicating with Queensland banana growers that does not alarm them about the incoming regulations or make them feel like their farming is 'killing' the GBR. It is to reassure them that they are doing good work, there is room for improvement and there are people and funding to help them work through tricky problems. To see changes in water quality results, growers need to be active participants in farm and water quality improvements – not because they have to, but because they want to as they can see the benefits for them, their children, their grandchildren and their industry.

As part of this engagement plan, there will be a workshop held in the first quarter of 2020 that will profile, amongst other things, some of the developments in water quality – policy and/or research and development.

Communication and extension objectives	• To inspire growers to be better farmers by implementing BMP on their farm – produce material that emotionally engages with growers (and encourages them to adopt improved practices). Using images of the natural beauty of banana farms, the rainforest etc to affect change. • To change growers' potential negative mindset around water quality by focusing the messages on the benefits of improved practice for them, their farm and future generations. • To raise awareness of water quality issues including water quality regulations and relevant codes amongst north Queensland banana growers. • To improve banana growers' understanding of good farming practices and the impact that poor farming practice can have on local water ways and the economic performance of the farm. • To deliver BMP and BetterBunch extension and training to north Queensland banana growers. • To educate growers about how they can have their on-farm best management practices recognised. • To create opportunities for growers to speak to growers about new/changing practices and the benefits of change.
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Target audience	Primary: - Banana growers in the Wet Tropics Secondary: - Queensland-based banana growers outside of the Wet Tropics (who will be regulated in three years) - Banana growers in Cape York and non-reef catchments - Agricultural resellers - Extension professionals who work with banana growers - Department of Environment and Science staff - Minister for Environment and Science - Department of Agriculture and Fisheries - Minister for Agriculture and Fisheries - Freshcare Environmental (and other quality/accreditation schemes) - Wet Tropics Major Integrated Project Tertiary - Conservation sector - Wet Tropics communities - Government representatives (Australian, Queensland and local)
Implementation coordination responsibility	Industry Strategy Manager
Delivery responsibility	There are many people who will have elements of responsibility for delivering on the communication and extension products outlined in this plan. Who does what and when they do it will depend on the timing of opportunities and sometimes cannot be planned too far in advance. This is why it is important that the ABGC staff are anchored in the extension networks in north Queensland. The main people with delivery responsibility will be: - Industry Strategy Manager - ABGC Extension team - ABGC communications team (to provide advice, experience, contacts and support)
Key messages (specialised messages for industry segments can be found in this Plan)	NOTE: The social research recently commissioned by the ABGC has identified that water quality on the GBR is a very emotive topic and growers feel victimised and defensive when it is raised. As a result, the communication products produced by the ABGC will be very mindful of this and it will not feature in the key messages. Wherever possible, references to the regulations will also be avoided – ie they will not be presented as a motivation to implement change. The focus will instead be on practice improvement for sustainability and profitability.

	• Banana growers can feel good about themselves and their farming practices. Growers care about their land, the environment and farming sustainably – it is essential to their livelihood and their communities. It is important to maintain the value of the farm for generations. • BMP is the pursuit of excellence. BMP is good for increasing farm profitability – minimise costs and maximise profit. It is more than a ‘tick and flick’. It helps growers focus on the details to prevent costly mistakes. • Improving practices is not just about complying with the regulations. It is about sustainability and good business performance. The regulations are just a small part of the story. Growers can try to be the best grower they can be and reap the rewards. • To maximise profitability, growers need to retain their assets (especially soil) which is the foundation of their farm and their livelihoods • Implementing some practice change can be time consuming. Incremental change and continuous improvement is good. • There is funding available to help implement best practice on farms in priority areas. ABGC has experienced extension staff who can help growers work out the next step.
Potential issues and barriers to successful implementation	• Field days are no longer a common way to engage with a large group of growers due to the existence of TR4 in north Queensland. Communicating to large groups of banana growers at once is difficult. • Banana growers are exceptionally busy farmers who supply fruit 52 weeks a year. It can be hard to get their attention. • It is understood that the best way to increase awareness is through one-on-one extension delivery. This is time consuming and expensive. • Growers may not seek out extension advice as a high priority. They need to be convinced to make time to learn about new developments. • Extension delivery is a skill that takes time to develop. • Successful extension relies on trust between a grower and the extension officer and this takes time and persistence. Government is impatient for large results. • The data that is relied upon by government to “score” the performance of the banana industry and its contribution to water quality outcomes is not robust. It is therefore difficult to give growers the evidence they seek (and deserve) that it is their practice that is contributing to the poor water quality in the GBR catchment. • There are many extension officers (and organisations) working in the reef space who provide information to growers. Ideally linkages are created to maximum opportunity to share information (and reduce duplication). This coordination takes time and resources.

	• Growers are likely to react badly to (or not hear) messages that focus entirely on regulation and the links between agriculture to the health of the Reef. • Communication messages about regulations need to be balanced with good news stories about how practice change can lead to better profitability and that is good for now and future generations. • Getting the right pitch for messages may prove tricky. In addition, conveying that message in the space of a few seconds or sentences (depending on the medium and with the aim of encouraging growers to read or watch further) is a challenge. • Wet Tropics banana growers are impacted more significantly by the reef regulations and therefore will require additional support, messaging etc in order to comply. • Growers may receive mixed messaging, or even misinformation, from other groups/communities/advocacy bodies they are part of – sometimes contrary to the banana industry's approach. • Growers think that by doing the checklist they are at best practice and do not need to revisit. It becomes irrelevant. They do not see it as part of continuous improvement. • Growers think they need to be 'tech savvy' to use BetterBunch and so do not seek out training. • Growers don't see BMP as providing immediate and notable benefit to their profitability.
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Implementation plan

Who is the audience	What are the key messages?	What will you produce?	What channels will you utilise?	When will this activity take place?	Lead on actions
Banana growers in the Wet Tropics (Indian and Hmong growers)	- Don't panic! 12 months before any compliance occurs. Get "regs ready". - ABGC extension staff can help. - Do (or refresh) the BMP training - There are minimum regulated standards for nutrient application and sediment/erosion control (Prescribed Minimum Standards- PMS) and these link closely to the Banana BMP Guidelines. These are foundation practices for sustainable, profitable farming. - Explain Farm Design standards for new cropping land – what it means for growers. - Growers with Fresh Care Environmental accreditation will be the lowest priority for DES compliance audits. Encourage growers to get FCE accreditation. - Growers can voluntarily choose to do the BMP module to help them be "audit ready". It will also be a bridge to FCE accreditation. - Grants available to improve farming practices. - Low interest rate loans are also available to support implementation of BMP (QRIDA). - Growers will be entitled to \$1,000 rebate on nutrient and sediment advice if their agricultural advisor is registered under the Farming in Reef Catchments Scheme. - All bagged fertiliser blends will need to have the amount of N and P included on a label so you know how much you are applying and you can keep records. - Accurate record keeping will be really important. - Use BetterBunch for your record keeping (it will help with the regulations as well). - Explain the Report Card results - We know growers care about their land and farming sustainably – let's support and celebrate that. (or something similar)	- Guidance material that explains the PMS - Simplified summary of regs - Magazine articles (especially good news stories) - FB posts - Videos - Emails - Web updates - Accreditation module (voluntary for growers) - Factsheets in Hmong (TBC) - Case studies on exceptional practice - Prepare a simple to understand story of water quality and why the government believes regulation is required including water quality results in the Wet Tropics catchments and GBR overall - Information about water quality monitoring sites for banana catchments - Peer-to-peer groups	Options include: - ABGC Website - Meetings with growers on specific issues - Grower association meetings - DAF organised Roadshow–2020 - ABGC e-bulletins - ABGC Facebook page – explore cost effective targeted options or ways to utilise features favoured by the algorithm (eg live videos) in addition to regular posts. - ABGC Twitter account - ABGC YouTube account - Australian Banana Magazine - Agricultural/regional field days - Grower workshops - Grants scheme - BMP extension - BetterBunch extension (and video) - NextGen group channels (as appropriate) - Reef Alliance publications & networks - Reef Champion Awards	Commence effort 2019 and will be ongoing. Regs commence mid 2020. CCBGA meetings every 2 months; Grower workshop November 2019;	Industry Strategy Manager ABGC Extension team ABGC Board Directors <u>Partners:</u> DES staff WTMIP staff (monitoring)
Banana growers (In reef catchments but not Cape York)	- Don't panic! - ABGC extension staff can help. - Do (or refresh) the BMP training - Three years before any compliance occurs – use this time wisely. Get your BMP training completed. - There are minimum regulated standards for nutrient application and sediment/erosion	- Guidance material that explains the PMS - Simplified summary of regs - Magazine articles (especially good news stories) - FB posts - Videos - Emails - Web updates - Accreditation module (voluntary for growers)	Options include: - ABGC Website - Meetings with growers on specific issues - ABGC e-bulletins - ABGC Facebook page, Twitter and YouTube - Australian Banana Magazine - Grower workshops	Basic knowledge sharing starts immediately in 2019 but regional focus to begin in 2021. Regs commence 2023.	Industry Strategy Manager <u>Partner:</u> DES staff

Who is the audience	What are the key messages?	What will you produce?	What channels will you utilise?	When will this activity take place?	Lead on actions
	control (Prescribed Minimum Standards- PMS) and these link closely to the Banana BMP Guidelines. These are foundation practices for sustainable, profitable farming. • Explain Farm Design standards for new cropping land – what it means for growers. • Growers with Fresh Care Environmental accreditation will be the lowest priority for DES compliance audits. Encourage growers to get FCE accreditation. • Growers can voluntarily choose do BMP module to help them be audit ready. It will also be a bridge to FCE accreditation. • Grants available to improve farming practices. • Low interest rate loans are also available to support implementation of BMP. (QRIDA) • Growers will be entitled to \$1,000 rebate on nutrient and sediment advice if their agronomic advisor is registered • Accurate record keeping will be really important. • Use BetterBunch for your record keeping (it will help with the regulations as well). • We know growers care about their land and farming sustainably – lets support and celebrate that. (or something similar)	• Case studies on exceptional practice • Prepare a simple to understand story of water quality and why the government believes regulation is required including water quality results in the Wet Tropics catchments and GBR overall (perhaps a video) (	• Grants scheme (priority catchments only) • BMP extension • BetterBunch extension (and video)		
Banana growers (Cape York and non- reef catchments)	• No regulations for Cape York growers but BMP farming is still better for profitability; • Identify those farms on Tablelands that do not drain to the GBR (any farms split across boundaries?). • Maintain farming standards or the region risks regulation in the future; • Do (or refresh) the BMP training – it makes good business sense. • Explain Farm Design standards for new cropping land – what it means for growers. • Accurate record keeping will be really important. • Use BetterBunch for your record keeping (it will help with the regulations as well).	• Guidance material that explains the PMS • Simplified summary of regs • Magazine articles (especially good news stories) • FB posts • Videos • Emails • Web updates • Case studies on exceptional practice • Prepare a simple to understand story of water quality and why the government believes regulation is required including water quality results in the Wet Tropics catchments and GBR overall (perhaps a video)	Options include • ABGC Website • Meetings with growers • Grower association meetings • DAF organised Roadshow–2020 • ABGC e-bulletins • ABGC Facebook page • Australian Banana Magazine • Agricultural/regional field days • Grower workshops • Grants scheme (priority catchments only) • BMP extension • BetterBunch extension (video)	Commenced effort January 2019. This will continue for beyond the life of the BA 16008 project.	Industry Strategy Manager ABGC Extension team <u>Partner:</u> DAF staff
Grower reference group of Wet Tropics banana growers.	• Their participation makes a difference. • They can continue to influence government policy development – stay involved. Make the changes practical. • Continue to provide feedback on more detailed aspects of the regulations, extension material etc	• A well informed group of banana growers who can form the basis of a peer-to-peer/grower champion network. • Material on other water quality projects so that they start to understand the bigger picture and their role in the bigger picture. • Feedback on BetterBunch app and its useability.	Options include • Emails • Face-to-face contact • Meetings • Leadership/business improvement training	Commenced in 2019 and will continue into the long term. Ideally would like to touch base with them monthly on various issues.	Industry Strategy Manager ABGC Reef extension team <u>Partners:</u> DAF staff MIP (leadership/business improvement training)

Who is the audience	What are the key messages?	What will you produce?	What channels will you utilise?	When will this activity take place?	Lead on actions
	- Share their best water quality practices with other growers - Welcome their input into other projects such as RP191.		Communications material, as appropriate, to showcase their efforts and own on-farm successes		
Extension professionals (including agronomists, soil conservationists etc)	- Work with ABGC to promote the content of the regulations so that growers will “pass” compliance audits; - Refer growers to do (or update) their BMP training - Grants are available to help implement sediment and nutrient improvements. - Register as an accredited agricultural advisor for the Farming in Reef Catchments Scheme so that growers can receive up to a \$1,000 rebate on the cost of obtaining nutrient and sediment advice. Scheme is administered through QRIDA.	- Guidance material - Simplified summary of regs - Magazine articles (including good news stories) - FB posts - Videos - Emails - Web updates - Case studies on exceptional practice - Prepare a simple to understand story of water quality and why the government believes regulation is required (perhaps a video)	- Options include: - ABGC Website - DAF organised Roadshow–2020 - ABGC e-bulletins - ABGC Facebook, Twitter and Youtube pages - Australian Banana Magazine - Agricultural/regional field days - Existing communications networks to share content and messages	Commenced in 2019 and will continue into the long term (frequency of engagement is likely to reduce after first 12 months of regulations being in place)	DES staff <u>Partners:</u> ABGC Reef extension team ABGC Communication team INDUSTRY STRATEGY MANAGER
Resellers	All bagged fertiliser blends will need to have the amount of N and P included on a label so growers know how much they are applying.	Summary of nitrogen provisions from the PMS (maybe factsheet)	Options include: - Letter - Email - BAGMAN meetings - ABGC website	Once regulations and PMS are finalised. BAGMAN meetings twice a year.	Industry Strategy Manager Reef extension team <u>Partners:</u> DES staff DAF staff
Food safety programs and auditors	- The Queensland Government is keen for growers to have third party accreditation to demonstrate that they are farming to the best standards possible (assuming the alignment between third party schemes and BMP and regulations). - New PMS will need to be incorporated into the existing quality assurance schemes so that the Scheme align with legal requirements. - Environmental quality assurance schemes (such as FCE) will need to be registered with DES to allow growers to be recognised as meeting the regulated minimum practice standards. This will place accredited growers into the lowest priority category for compliance audits. This may be an incentive for more growers to be accredited with third party schemes.	Banana BMP module accreditation scheme (for the core water quality related sections) of the Banana BMP Amended BMP Guidelines to reflect the regs requirements (can be shared with the owners of the quality assurance schemes)	Options include: - Phone calls - Emails - Meetings - ABGC website - DES staff	Once regulations and PMS are finalised. This will be a process that will take some time to complete.	Quality Assurance Schemes staff DES staff <u>Partners:</u> Industry Strategy Manager (provide information and linkages)
Queensland Minister for Environment and the Great Barrier Reef Queensland Minister for Agriculture and Fisheries	- Banana growers are farming in sustainable ways. - The industry is lifting its standards - The Cape York region can remain regs-free because the growers have excellent farming systems. - Growers are focusing on sustainability and profitability	Identify opportunities for the Environment Minister and DES senior managers and project managers to attend banana industry events, functions and farms.	Options include: - Letters - Emails - Events - Functions - Farms visits - Meetings	Farm visit for the Environment Minister and advisors within first 12 months of the grants program commencement (perhaps at the completion of an early grant project).	Industry Strategy Manager DES staff <u>Partners:</u> Environment Minister Agriculture and Fisheries Minister

Who is the audience	What are the key messages?	What will you produce?	What channels will you utilise?	When will this activity take place?	Lead on actions
DES senior managers and project managers	Government needs to use more reliable methods of data gathering eg monitoring so that modelling data can be more accurate.		- Networks of other industry organisations eg QFF - Australian Bananas magazine	Invitation for the Minister and DES staff to attend Congress 2021 Meetings with DES staff will occur frequently (weekly) over the next year at least.	
Government representatives (Australian, State, local)	- The banana industry is adopting sustainable farming practices but there is always room for improvement. - Economic contribution to the region - Regulation should not impede regional economic development - The banana industry invests strongly in R&D to find ways to improve productivity and sustainability. - You are informed advocates for the industry.	Background information on industry progress towards BMP adoption.	Options include: MIP meetings (Local Government) - Annual briefings of local members? - Annual briefings of relevant Australian Government members including Ministers and Queensland Senators. (face-to-face or email)	- MIP meetings occur 5 times a year; - During visits to Canberra and Brisbane Brisbane ABGC Board meetings(if timing matches issues)	Industry Strategy Manager ABGC CEO ABGC Board Directors

Evaluation results from the soil health workshop held on 3 September 2020.

Evaluation survey completed by 23 growers

