Banana production and marketing information system

Naturelab

Project Number: BA12016

BA12016

This report is published by Horticulture Innovation Australia Ltd to pass on information concerning horticultural research and development undertaken for the banana industry.

The research contained in this report was funded by Horticulture Innovation Australia Ltd with the financial support of the banana industry.

ISBN 0 7341 3498 3

Published and distributed by:
Horticulture Innovation Australia Ltd
Level 8
1 Chifley Square
Sydney NSW 2000
Telephone: (02) 8295 2300
Fax: (02) 8295 2399

Horticulture Innovation Australia

Banana Production and Marketing Information System – Stage 1

Don Chambers and Robert Crossley
Agtrix / Naturelab

Project Number: BA12016

BA12016

ISBN <HAL to add>

Published and distributed by:
Horticulture Australia Ltd
Level 7
179 Elizabeth Street
Sydney NSW 2000
Telephone: (02) 8295 2300
Fax: (02) 8295 2399

Horticulture Australia

Stage 1 Final Report

Banana Production and Marketing Information System

Project No. BA12016

Don Chambers[1] and Robert Crossley[2]

February 2014

[1] NATURELAB

[2] Agtrix P/L

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Project name:	Banana Production and Marketing Information System
Date:	February 2014

Project Purpose: The objective of project BA12016 was to develop a system able to collect, analyse and report on a variety of banana industry data, and to provide the industry with accurate, consistent and up to date information to make improved economic and strategic decisions, with due consideration of grower confidentiality. The collected data was to be housed in a database that can allow querying and generate reports in the form of tables, graphs and maps.

The key outcome from the project was to provide the industry with a database that would enable:

- A record of Industry information on the Australian banana industry over time and space, and;
- Informed decision making, leading to improved economic outcomes for growers and the industry

Key Personnel: Don Chambers (Naturelab)
Rob Crossley (Agtrix)
Charissa Rixon (TRAP Services)

Project Funding: This project has been funded by HAL using the Banana R&D levy and matched funds from the Australian Government.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Contents

Figures

Tables

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Media Summary

New online system for banana production planning

The aim of Stage 1 of the HAL funded project completed by NatureLab, Agtrix and TRAP Services, was to create a database that could hold industry information and be used to monitor and forecast production.

The outcome from the work done has not only provided the industry with a system to forecast long-term trends in production, but will also enable the industry to respond more quickly to biosecurity risks and natural disasters.

Using the advanced AgDat technology has allowed the project to focus on ways that the data may be collated initially and maintained through time, rather than on developing technology.

This initial stage of the study identified data recording opportunities in the supply chain, and methods of data collection as part of normal business operations. The most viable opportunities identified in the study included the industry maintaining the mapping of production areas, and having growers recording bell injections and bagging numbers, or recording pack-out details and transport consignment details.

The study was undertaken over 5 months involving a focus group with 8 growers (21 farms) representing > 15% of the industry, as well as field staff responsible for biosecurity and other industry and market representatives.

Farms managed by the focus group were mapped by the study team using AgDat to demonstrate how the system could provide the base production data needed for long term production trends, as well as providing growers the opportunity to record data about their farming operations through an interactive web mapping interface. The types of data collated included bell injection and bagging numbers, chemical and fertilizer applications, and activities such as desuckering, deleafing, irrigation and nurse suckering.

The industry recognized that up-to-date mapping of production areas could play a key role in identifying longer term trends in production, and would also prove to be a valuable asset in any response that the industry takes in bio-security threats or natural disasters. While the industry could take control of maintaining mapping data to monitor long-term trends in production, the growers were also provided with a system to record activities on their farm through a familiar interface that most people relate to – a map. Growers were able to record data about what is being done on the farm on their computer or mobile device, and this data can then be printed to meet assurance programs like Freshcare.

Growers also found the web site useful for measuring areas or calculating tree numbers for a new block.

The system is secure so that no-one else can see the detailed data entered by a grower, yet other less sensitive information can be used by the industry to make more informed decisions when planning marketing or responding to crisis.

Stage 2 of the project is expected to commence in March 2014, and will map the remainder of the industry.

Keywords: Information systems, market forecast, GIS, Bananas, Supply Chain, AgDat, map.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Executive Summary

The objective of project BA12016 was to create an industry database to hold a range of data that could:

- Provide a record of Industry information on the Australian banana industry over time and space, and;
- Enable informed decision making, leading to improved economic outcomes for growers and the industry

The project was divided into two stages; with the first stage focusing on providing an operational system that could deliver the key requirements for this project (planting data, bio-security and grower data recording), and making sure that the project had industry ownership and supply chain acceptance before purchasing data and populating the database for the transport and market components. The scope and schedule of the second phase, was based on findings from Stage 1.

This report deals with Stage 1 only, however recommendations on Stage 2 tasks based on Stage 1 outcomes were provided to the Industry Advisory Group in February 2014.

Technology developed for the Australian sugar and other industries over the last 18 years was used as a basis for providing the database as it was a mature technology suited to the purposes required. A focus group of eight participating growers (having 21 farms representing >15% of the industry) and the disease response teams were consulted to identify aspects of their operations where data could be collected in a way that would be useful to them as well as contribute to achieving the project objectives. The premise was that any system that was reliant on information provided by growers would need to provide growers with a sufficient incentive to use it before it would be of use for industry analysis or forecasting.

Opportunities identified included capturing and maintaining detailed plantation data (area, variety, date planted) over time, as well as operational data such as bell injection and bagging numbers, consignment details, and plantation activities such as de-suckering, deleafing or nurse suckering. Additional operations such as spray and nutrient inputs and irrigation were also configured to demonstrate how one system could provide growers with data recording capabilities to meet their assurance program reporting needs (eg. Freshcare).

Plantation details were captured by the study team using the customized Geographic Information System (AgDat Mapping) from data provided by the growers (mainly in hard-copy form). Maps and Reports showing details of production areas were then generated to demonstrate how this data could be used by industry. This mapping data was then synchronized to a central database that makes the data accessible from the web through a secure login.

The focus group of growers were then given access to this data through a web mapping interface and were provided with training to use the system, and given the opportunity to record the data for their own farms. Feedback was sought on what data was collected, how it should be collected and types of reports that would be useful.

Access was provided to growers for their farms only. Access to the system was also provided to field staff in the disease inspection teams to evaluate as an adjunct to their existing systems, but these users were not given access to any information that the growers entered.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

At the completion of Stage 1, the system is capable of providing industry reports on areas of production and changes through time through either an analysis of changes in production areas, or potentially predictions based on bell injections or bagging numbers. Growers can also access reports of data they have entered on their own plantations, such as a list of all the activities that have occurred on a block during a specific period

Feedback from the industry in general was that mapping plantations for the whole industry was considered a worthwhile and high priority task, with most participants recognizing the benefits of maintaining this data beyond just production forecasts, such as better response to natural disasters and disease outbreaks. Further options that were proposed by the pilot group for data collection were considered a bit ambitious for the wider industry at this stage, and should be given a lower priority.

This project will be continued in Stage 2, and it is considered that the best path forward is to complete the mapping for the whole industry, and work with the pilot group and enthusiastic growers in progressing some of their other ideas, but not to try to push these to the wider industry at this stage.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Introduction

Project Objectives

The project brief was to develop a system to collect, analyse and report on a range of banana industry data, and to provide the industry with accurate, consistent and up to date information to make improved economic and strategic decisions, with due consideration of grower confidentiality. The collected data was to be housed in a database that can allow querying and generate reports in the form of tables, graphs and maps.

The key outcomes from the project was to provide the industry with a database that could:

- Provide industry information on the Australian banana industry over time and space, and;
- Enable informed decision making leading to improved economic outcomes for growers and the industry

The Banana Production and Market Information System was envisaged to include:

- Map based data of plantations captured from grower feedback, satellite imageries/ aerial or ortho-rectified photography/ other appropriate map based product for determination of location and size of blocks.
- Grower based data: consisting of activities such as bell injections or bagging, crop-dispatch (to be input by growers on a weekly/fortnightly/monthly basis).

The map based data was seen as a means of tracking industry plantings to provide the industry (the IAC and the ABGC) with useful information in the event of extreme climatic events, pest incursions or biosecurity concerns.

The grower based data was seen as being helpful in developing a crop forecasting system in conjunction with map data. Farm data needed to be able to be linked to transport and market data, and integrated with data collected by the field liaison teams for Bunchy Top and yellow Sigatoka. Any access to information needed to be able to be accessed in a secure manner that would honor privacy agreements made between all parties concerned.

When fully integrated, the system will provide the industry with potential supply information in the near term and medium to longer terms, which will be helpful in decision making by growers and industry.

Project Tasks Undertaken

The data flows that generally exist in horticultural industries that operate in a free market is more complex in nature than industries such as sugar or rice where product processing or marketing is centralized, as there is no single point of information collation for the industry. Recognising this disparity of data within the banana industry supply chain, a 2 stage approach was used to fast track the project to a point of industry acceptance and deliver maximum industry adoption for the least cost, reduce the risks and provide a robust system for many of the objectives for this project.

Stage 1 focussed on providing an operational system for the key requirements for this project (planting data, bio-security and grower data recording), and making sure that the project had industry ownership and supply chain acceptance before purchasing data and populating the database for the transport and market components.

Activities in Stage 2 were to be considered at the completion of Stage 1 by the Industry Advisory Group.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Materials and Methodology

Focus Group and Initial Systems Review

Initially, eight growers covering 21 farms and >15% of the industry production were recruited to participate in the project by ABGC as a focus group. These were all located in north Queensland (see Figure 1). Field liaison officers for the Bunchy-Top and Yellow Sigatoka projects were also engaged to ensure any data collected could be integrated with their existing systems.

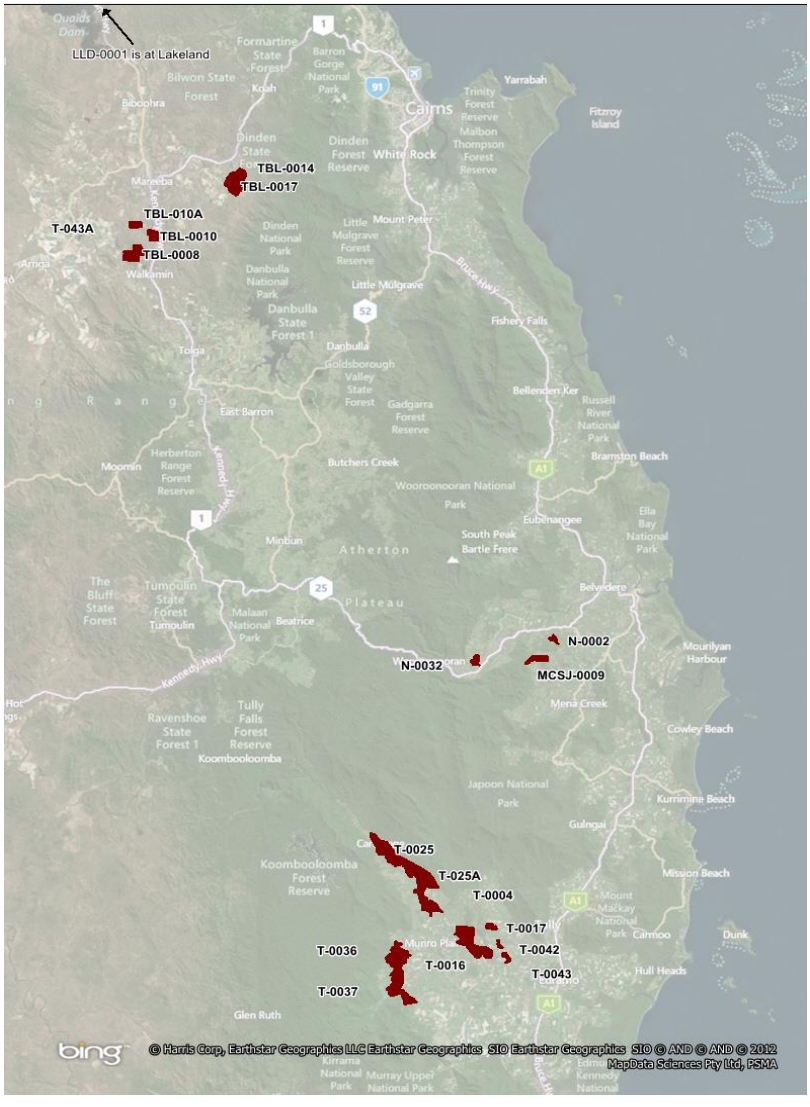


Figure 1 Map showing the locations of the 21 farms participating in Phase 1 of the study.

All members of the focus group were interviewed to identify opportunities where data that could be recorded by the industry to most effectively predict and monitor production, and mechanisms to record relevant data in a way that would also benefit participants business. It was found that there were a number of opportunities in the production and supply chain where data could reasonably be recorded to provide production forecasts.

The key opportunities identified were:

- Mapping production areas (new plantings, areas fallowed/ destroyed) using a Geographic Information System, and providing processes and technology for that data to be maintained through time.
- Bell Injections numbers
- Bagging numbers
- Number of cartons packed and consigned at pack-out
- Transport consignments
- Market sales data

The time frame that these options could forecast production is show in Figure 1, and more detail of how this information can be used in production prediction and the benefits of collating this data to those responsible for supplying the information and the industry is provided in the following Table 1.

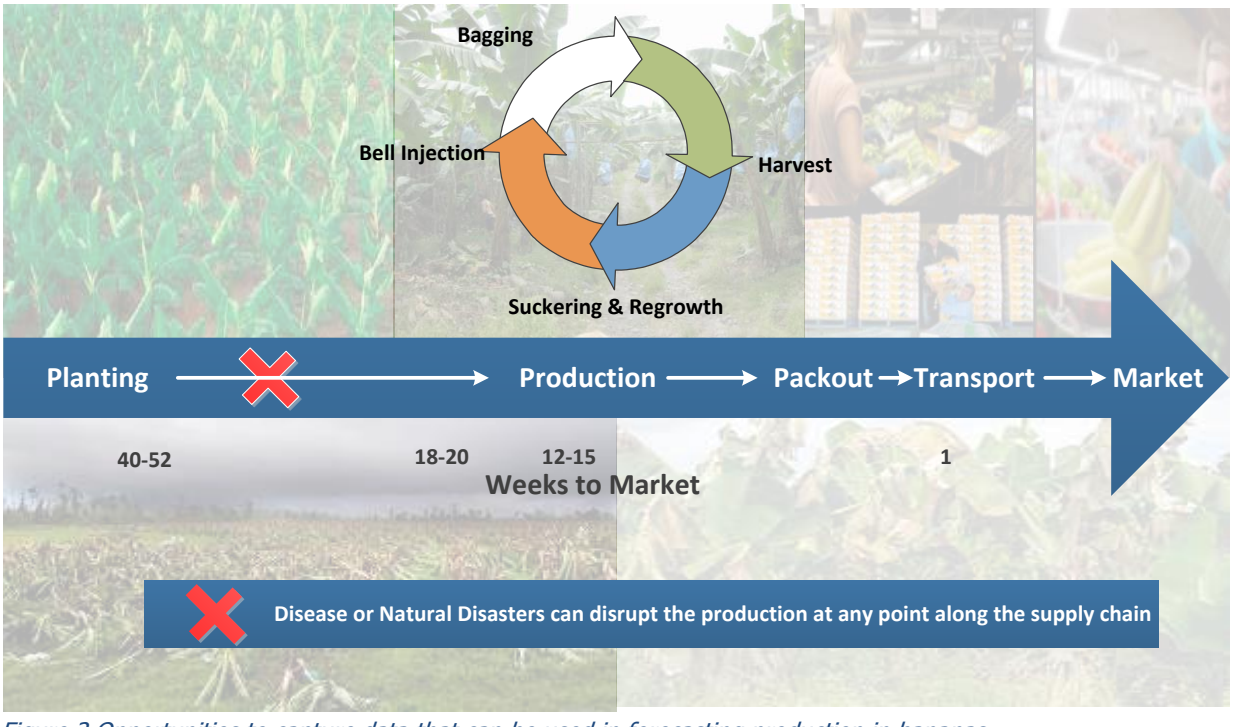


Figure 2 Opportunities to capture data that can be used in forecasting production in bananas

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Table 1 Various opportunities to forecast production/ market supply in the banana industry production cycle and supply chain.

Process/ Event	Market Prediction Timing		Method of data collection
Mapping Production Areas	New Areas	Predict impact on production 12 months after planting.	GIS mapping using aerial imagery and grower notes. Possible that growers could record changes on the web, and would require resources to maintain this data through time.
	Areas taken out of production	Predict immediate influence on production (likely that by time industry notified, all production from that block would have been sold).	
	Natural Disasters	Predict immediate influence on production, loss of area or % loss of production or infrastructure/ access within geographic impact area.	
	Disease Outbreak	Predict influence of quarantine; longer term predictions on crop loss due to disease impact and spread (including influence of vector).	
Bell Injection Numbers and Bagging Numbers		Predict trends ~12-20 weeks in advance.	Growers enter numbers through AgDat Web. Suggestions to use in-field device linked to injection trigger or string dispenser.
Pack-out/ Consignment		Actual cartons sent to various markets less than one week to market.	Staff use Pack-out App to record data and print paperwork or growers enter data through AgDat Web.
Transport		Actual cartons sent to various markets less than one week to market.	Staff use Pack-out App to record data and print paperwork or growers enter data through AgDat Web.
Market		Post analysis of sales, includes price received.	Market reports.

Of these options, the base mapping of production areas was the initial focus as:

- Base maps were recognized as a primary data source for the industry to maintain, providing benefits not only to production prediction, but also to response to natural disasters and disease outbreaks.
- AgDat works most efficiently where base mapping of blocks within farms is used as a base for further data collation, providing the industry options to record other types of data from production through to farm activities such as spraying and nutrient applications.

Technology Used - AgDat

The engagement of Agtrix/ Naturelab was based on previous delivery of Agtrix's AgDat technology, which is a spatial database with various data recording interfaces to store the data and provide desktop, web and mobile access to that data for growers and industry bodies. It also has web service interfaces to communicate with other web based systems or data export facilities for further analysis such as farm costing analysis, contractor usage, and Chemical and Nutrient analysis. This system was already in use in the sugar industry, apples (Lenswood Coop), APAL (HAL Project), and the rice industry (SunRice).

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

The AgDat suite of technology has been developed by Agtrix for the sugar industry since 2006 to share data between organisations and allow growers to record farm activities as part of Reef Regulation requirements (Markley and Crossley 2011).

AgDat currently consists of two integrated components:

- A customised MapInfo Geographic Information System (GIS) designed specifically for managing spatial data and printing maps which manages data stored in a Microsoft SQL Server 2008 spatial database. This is used to capture the base mapping information of growers (including tools for easy data capture and data validation), print maps and provide reports. The data is in a standard format that most GIS can interface with.
- A desktop program, web and mobile compatible web sites and apps to record data into a Microsoft SQL Server 2008 spatial database (Figure 3). It consists of a Microsoft SQL Server spatial database (or databases where data is replicated on local applications), and a number of interfaces to allow users to record data.

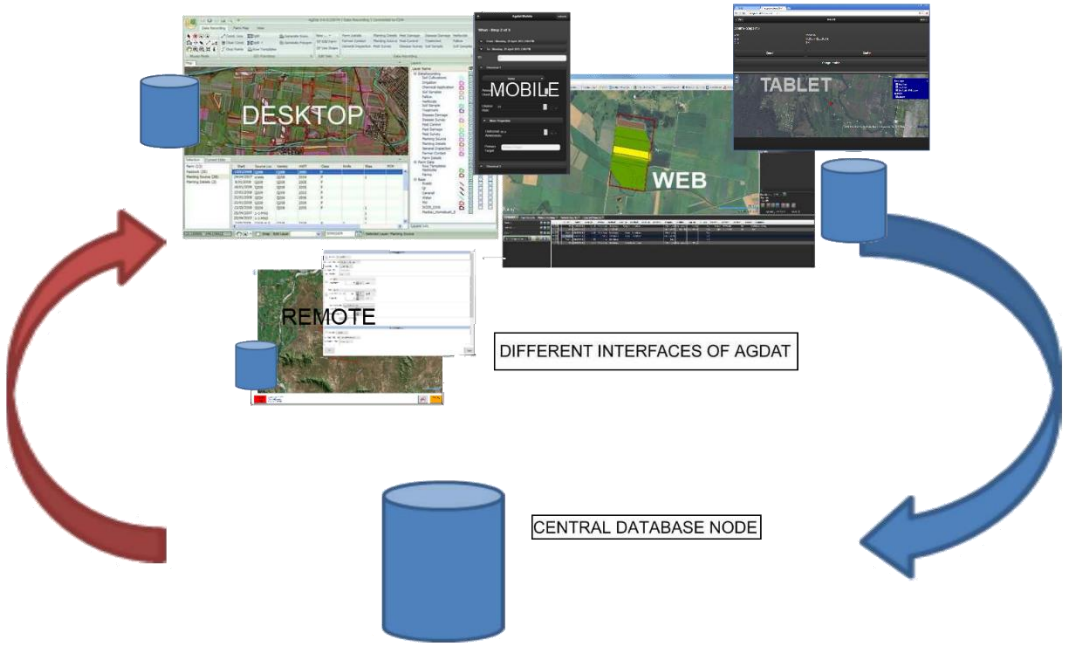


Figure 3 Different Interfaces of AgDat

The data that is recorded and user access is managed through an administration module in the desktop application (AgDat Pro).

Grower Base Mapping Data Capture

While the AgDat database has the capacity to store data concerning planting, cropping operations and production, data needed to be collated in a time frame that was of use in decision making if it was to be useful. This requires both a technology solution and a level of grower participation that can provide adequate proportion of industry information to be valid.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

The initial focus of the system provision was to capture the base mapping data for the 21 farms that were owned by the focus group. This data also provides the basis for further data recording by growers.

Data about the location of each of the participant's farms was received from Barry Sullivan, a field officer in the Bunchy Top project Team who had already implemented a field data recording system for both their project and the Yellow Sigatoka project in North Queensland. To facilitate data exchange between both systems, the farm identifiers that were already in use by these teams were adopted in AgDat.

The farm extent data provided was then overlain on aerial photography and used to print maps for initial meetings and interviews with participating growers.

Block layout information was supplied to the project team in a number of forms such as marked up maps on the printed map that we provided, to printed maps provided from commercial sources, or GPS data.

After this data was supplied, block extents were captured using the GIS component of AgDat (AgDat Mapping), built specifically for capturing farm data and maintaining the integrity of that data (Figure 4). Reports showing areas of varieties for farms at a detailed or summarized level were generated from an Access database linked to the SQL Server database were then generated to demonstrate the flexibilities of the reporting capabilities (Figure 5).

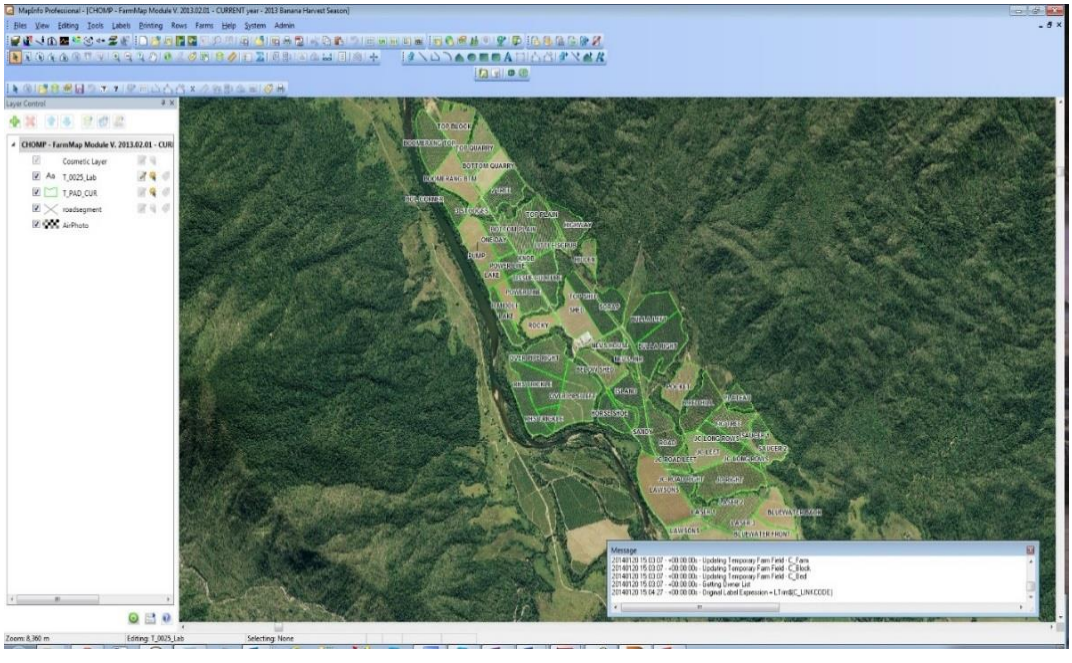
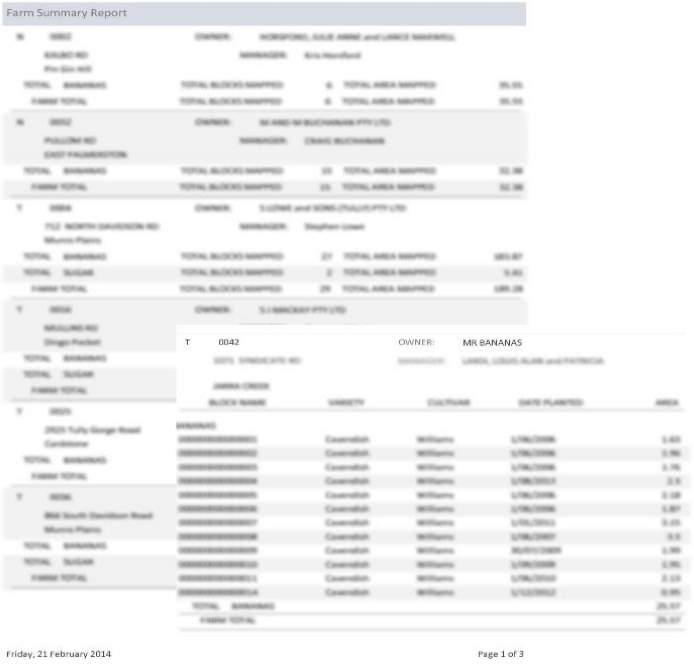


Figure 4 Block data was captured using the customised Geographic Information System in AgDat from data supplied in hard copy and digital form by the growers.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000



Note: report details purposely blurred for confidentiality

Figure 5 Reports showing farm summaries and farm details were produced to demonstrate the potential to provide data for forecasting production

Stakeholder Consultation and Feedback

Access to AgDat was provided to growers in the focus group through a secure log-in process allowing these growers to access the block information captured for their farms only.

This login allowed them to:

- download pdf maps of their farms
- record data for any of the contexts set up for them
- note farm changes required in their mapping

Growers were able to interact with the system to record data through a web mapping interface or the mobile phone/ touch screen interface (Figure 6 and 7)

Each grower was then visited by the project team, and provided with their login details and printed manual, and then shown how to use the system. Each grower was provided with access to their farms only.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

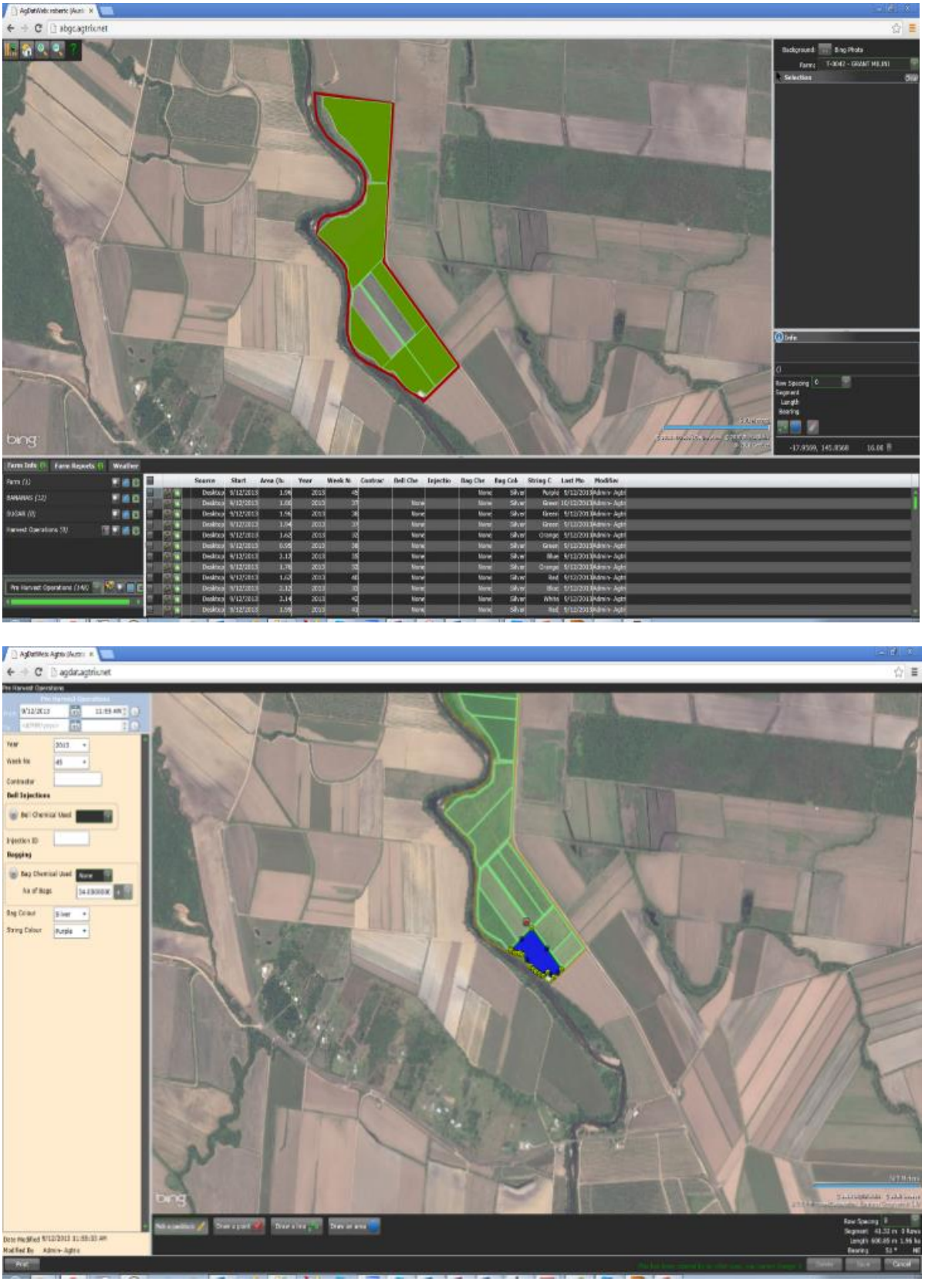


Figure 6 Screen capture of AgDat Web available to growers for their own plantations on a desktop/ laptop (requires Silverlight to be installed on the computer). Growers can access their plantation data or record data for their farm/ farms.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

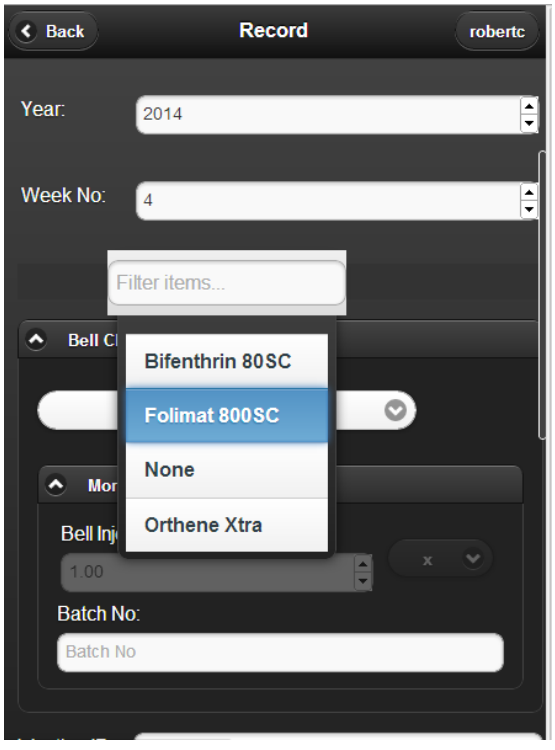


Figure 7 Screen capture of AgDat Web available to growers on a mobile/ touch screen interface

In addition to the growers in the focus group, the study team also met with other stakeholders to discuss findings and options for data capture, and opportunities to engage with the industry. The other stakeholders included:

- ABGC and Project Reference Group
- Yellow Sigatoka and Bunchy Top disease response teams,
- Transport companies
- Market companies
- Grower meetings

As a result of these discussions, it was decided that AgDat would be set up to be able to record the following data for participating growers.

- Preharvest operations (Bell Injections and bagging numbers, chemical used)
- Consignments
- Fertiliser
- Sprays
- Other activities (deleafing, desuckering etc.)
- Farm mapping changes (allows growers to notify of mapping changes required via the web, and allow a semi-automated method of making those edits in the GIS)
- Disease inspections.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Security was then set up so that:

1. All users would have access to the base mapping information, but access may be restricted to particular farms,
2. Industry representatives wold be able to see base information for all farms, but no other data at this stage, but they wold be given a generic login to use
3. growers would only see data for farms that they were entitled to see, but would not have access to the disease inspections information, and
4. disease inspection teams would not have access to data recorded by growers.

Stakeholder Feedback and System Modification

Growers were provided with training on how to record data through the web interface and retrieve reports. Feedback was then sought on the usability of the system and type of data recorded.

A number of changes to the configuration of the system were requested from system users, many of which were implemented by simply changes in the configuration.

It was found that in some cases, data recording on banana plantations required much more frequent data recordings than in other industries (eg. bell injections which may require several records to be recorded each day). Suggestions on how data could be recorded more efficiently in such cases were suggested, and where these required some programming of the system rather than just configuration changes, were either implemented in the next update of the software or scheduled into the development program of AgDat.

A further data recording context was added to the system to allow growers to upload certifications to the web site, and provide their customers on-line access to these.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Results

Outputs

The project has achieved the following outputs:

- Established an industry spatial database capable of storing a wide range of data that can be used by the industry for various purposes.
- Identified opportunities to record data that may be used to forecast production in the long, medium and short term, as well as mechanisms that the industry could use to collect the necessary data.
- Established a web mapping interface to allow growers to see their farms, get maps and reports and record data on a number of subjects.
- Captured the spatial data of the blocks for 17 farms owned by 8 growers estimated to represent > 15% of the industry, but including a mix of farm sizes and technology adoption. All were based in North Queensland (Figure 1 and Table 2). Additionally two test farms were mapped to provide a training area.
- Produced maps of farms, including areas of blocks for participating growers, and developed reports showing areas of production that are linked directly to the mapping data.
- Provided access and training to participating growers to web based system to allow growers to record data that may be used to forecast production such as bell injections and bagging numbers, and other activities such as desuckering, etc.
- Provided growers with opportunity to record spray dairies and nutrient applications to satisfy data recording requirements for assurance programs.
- Provided growers with a system that can be easily customised over time to suit additional needs as they arise.
- Created reports of areas of production for industry reporting and analysis needs.
- Identified a number of additional tools that could integrate with AgDat to provide a more complete data collection system, including a pack-out application and automated bell injection and bagging recording.
- Provided capacity for the industry to use spatial technologies for natural disaster management and disease outbreak management or prevention.
- Provided capacity building for the industry to use computer based plantation data recording systems.

Outcomes

The spatial database and systems established in this project will allow the banana industry to collate mapping data of production areas, including variety, cultivar and planting date. To date, only a small number of farms have been captured (although approximately 15% of the industry), but the technology has been implemented that will allow the industry to develop work procedures to capture the remaining farms and maintain this data over time. For example, growers can record any changes they wish to make through a web mapping interface, and these changes can be incorporated into the GIS data through a semi-automated process.

This database and the web and mobile interfaces to it will also allow growers to enter production data, as well as other operational data such as activities, bell injections, bagging and nutrient and chemical applications. The participating growers received training, but there was only time available to receive and respond to initial feedback during Stage 1. The general consensus was that these options would not achieve widespread adoption quickly without incentive, and the project should concentrate on mapping. Some growers were keen on exploring technology options and this database will provide a common

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

platform that industry can build tools over time to enable, eg. Freshcare/ market certification.

The project team also identified options for further technology development in the future to provide production data to the industry, but would also include incentives for growers to adopt these technologies. These included data recording systems and a pack-out system that would reduce the paperwork, and are summarized in Table 2.

The implementation of spatial technologies and capturing production areas for the banana industry will empower the industry to respond to natural disasters rapidly (eg. Estimate of damage), and predict the likely impact on production over time.

Spatial technologies will also empower disease response teams to respond to disease outbreaks more strategically. For example, if an outbreak is detected at a location, surrounding plantations can be quickly identified and the extent of any infestation mapped or modelled to predict likely spread and appropriate action taken.

Table 2 Property details of growers in pilot group

Code	Location	Owner Name	Blocks mapped Banana	Blocks mapped Sugar
N0002	Pin Gin Hill	Horsford	6	
N0032	East Palmerston	Buchanan	15	
T0004	Munro Plains	Lowe	27	2
T0016	Dingo Pocket	Mackay	62	12
T0025	Cardstone	Mackay	59	
T0036	Munro Plains	Mackay	32	2
T0037	Munro Plains	Mackay	41	
T0042	Jarra Creek	Mr Bananas	12	
T0043	Jarra Creek	Banana Exchange	10	
T025A	Cardstone	Mackay	43	
T043A	Jarra Creek	Banana Exchange	13	
LLD0001	Lakeland	Inderbitzin	17	
TBL0008	Mareeba	Howe	36	
TBL0010	Mareeba	Rigato	17	
TBL0014	Mareeba	Howe	1	
TBL0017	Mareeba	Howe	25	1
TBL010A	Mareeba	Howe	5	
MCSJ	Utchee Creek	Abbott	17	
		TOTAL	438	17

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Table 3 Benefits to various stakeholders if data were collected to predict production/market supply

Process/ Event	***Stakeholder***	***Benefit***
Mapping Production Areas	General	Base mapping data provides base for all data collation with AgDat, including bell injection and bagging, Freshcare certification data recording.
	Grower	Accurate map of farm including areas of blocks. Communication basis for working with contractors/ employees, eg. Provide GIS file of selected blocks to aerial spray operators as work order.
	Packing Sheds	Long term prediction of supply from farms, impacts of natural disasters/ disease outbreaks on supply
	Transport	Long term prediction of supply from farms, impacts of natural disasters/ disease outbreaks on supply
	Disease Response	Rapid identification of farms to inspect in the event of an outbreak. Corporate repository of industry data easily accessible to new staff in event of disease outbreak.
	Industry	Long term production predictions based on area in production in different regions, government response to natural disasters.
	Marketing	Long term strategic planning.
	Markets	Long term strategic planning.
Bell Injection and Bagging Numbers	Grower	Record injection or bagging numbers for resource planning and allocation based on predictions of supply in short term future. Predictions based on algorithms or use own intuition to predict from graphs.
	Packing Sheds	Resource planning and allocation based on predictions of supply in short term future, use own intuition prediction from graphs.
	Marketing	Indication of production in the 12-20 week time frame, issues raised with validity of data if not all growers participate, based on previous experience.
Pack-out/ Consignment	Growers	Faster reports on pack out available to growers where pack out not on farm. Potential to retrieve sales information from markets and integrate to reports. Concern about supply driven market rather than demand.
	Packing Sheds	Systems to allow pack out sheds to complete paperwork easier.
	Marketing	Accurate numbers of cartons of different product being sent to various markets between 2 days to 1 week prior to sale.
Transport	Growers	Systems to allow growers to complete paperwork easier.
	Transport	Potential to integrate systems to transport companies to improve supply chain efficiencies, reduce paper work.
Market	Growers	Most accurate report on sales numbers and values. Data is historical, and of limited use to deciding market and operational decisions for current operations.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Evaluation and Discussion

One of the objectives of this project was to establish a database that could hold data that can improve the decision making and management of the industry. During Stage 1 of the project, the AgDat database was implemented which is capable of holding that data, and opportunities to collate industry data identified.

Feedback on the proposed options for activities in the project were sought from the beginning to guide the form that the system would take, and which systems would interest them enough to participate. This included meetings with the Project Reference Group, as well as discussions a team member (Charissa Rixon) had with focus group growers.

Consistent feedback from these discussions was that the base mapping was a valuable step, particularly as many of the growers also grow sugar cane where AgDat has been used extensively over the last 17 years to map the sugar crop.

The message from these meetings for options other than mapping was that any system had to make an operation easier, or at least allowed to be done conveniently (eg. on a mobile), before its adoption was acceptable. A number of options were discussed, including:

- enabling field operators to enter bell injection or bagging numbers directly (using a data logger in the field, or a touch screen in the pack-out shed), and
- a pack-out application that could manage the data recording for PPS, Plant Health Assurance Certificate and transport consignment documentation.
- Electronic data capture technology for bell injection and bagging number recording

These ideas were presented to the Cassawary Coast growers meeting, and the feedback from the attendees there was that these types of technologies will need to gain wider acceptance of these technologies before attempting more ambitious options, although some growers were interested in exploring these options more. Feedback from this meeting also confirmed that the base mapping data would be of great value to the industry both from a production perspective as well as from disease response.

The most enthusiastic response came from meetings with the Bunchy Top response team (David Peasley, Barry Sullivan and Samantha Stringer). While their current system was spatially enabled to some degree, they recognized the value of the extended capabilities that AgDat offered, in addition to the value of an industry database of where bananas were grown could offer their ability to do their job.

While mapping was the most accepted option for industry participation in data collection, other options were not completely discounted by sectors of the industry.

Bell injections and bagging numbers are typically recorded by the industry, particularly where contractors or employees are paid by the number of operations done each day. While there was little enthusiasm for industry wide forecasting based on bell injection or bagging numbers due to historic failures in this approach, there was general agreement that having a system to record numbers as a guide to production trends would be useful to growers. There was also some interest in the idea of an automated system that would count the number of injections or bags deployed in each block, but this was not considered to be a priority by most of the stakeholders.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

With regard to marketing and transport data, there was a consistent message received from industry stakeholders interviewed and banana growers themselves that there is no clear correlation between wholesale banana prices and retail prices, leaving most producers with unclear market signals. This will continue to create uncertainty for producers and will result in supply fluctuations which are greater and more frequent than would be the case if there was consistent market data available.

Including consignment data into the Information System will allow transport details to be available in real time or as requested, but concerns were consistently expressed over whether this could make the markets "supply-driven" rather than "demand driven". Options to limit this possibility included (a) making those data only available to those participating in the new system, (b) delaying the release of any numbers for a period (c) only publishing generalized indicators of production (eg. average, above average, etc.).

Growers in the focus group were also given the opportunity to use the system to record activities that were not directly aimed at collating data for an industry database, but rather for their own plantation management. Options identified for other data recording using AgDat included (a) spray dairies and nutrient applications to meet data recording requirements for assurance programs like Freshcare, (b) leaf or soils tests and nutrient recommendations, (c) funded plantation improvements, and (d) publicly available certifications for a farm. The main advantage offered by a system like AgDat is the opportunities to share information between the various stakeholders, including growers, advisors, contractors, industry and markets, in a secure and controlled environment.

Security of data will be a key component in any centralized data repository, as growers may be reluctant to participate in using the system if they are concerned who has access to their data (eg. industry access to generalized data for lobbying purposes). Any proposal for such data sharing needs to be carefully considered and clear guidelines developed on how any data in the system may be used before offering participation in this system more widely.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Recommendations

Based on the industry feedback, the project team considers that Stage 2 of the project should concentrate on completing the mapping of plantations, and implement industry processes to either outsource or to maintain data through time.

While the information needed to complete this exercise (new plantings, fallowed areas or damaged) could practically be collected in many areas by disease response field staff as part of their existing duties, the regulatory conditions surrounding their operations exclude this as a possibility. Other options to collect this information exist and have been tried in other industries such as rice and sugar, include mail-out surveys, web data entry, workshops, promotions at grower events and farm visits.

The initial data capture of plantation data is an extensive exercise, and requires a significant initial effort to accomplish this task. After the initial data capture phase, on-going maintenance will require a frequent, but less intensive effort to maintain the data through time. The processes, tools, and incentives required to get growers to communicate changes to their plantations through time need to be developed as part of this initial data capture as well.

Some of the participating growers were, however, quite interested in the data recording capabilities and potential features/ developments that the AgDat system offered. There is an expectation from those growers that this would continue to be available to them, and that the project would explore these possibilities.

The key tasks suggested for Stage 2 of this project will include:

- Expand the mapping program to capture the remaining farms to create an industry spatial database of production areas and the industry reporting available from that data.
- Source and purchase the underlying base mapping information required for this data capture (aerial imagery, cadastral data) for all regions.
- The project team to provide the technical skills for the initial data capture program, but develop processes that will allow the industry more easily maintain data after the project finishes.
- The project team works closely with the field staff from the disease response teams to ensure that farm identifiers and owners are compatible with those used by the disease response.
- Other sources of farm changes information be investigated (eg. Plantings registration, grower input, grower or packout tools) as other potential feeds of farm data changes.
- Make the additional data recording opportunities already implemented in phase 1 available to growers who wish to participate, under the condition that the operation of the data recording is a secondary outcome of the project, and is being made available for discussion on further directions that the technology could offer.

AgDat provides an integrated suite of applications that allow users to record, store, exchange and analyse data about farms, paddocks and crops.

In addition, Stage 2 should include where possible the linking of previous reports that the industry has completed and ensure that all future projects are compatible with the spatial database system.
Projects of note include;

- FRO 1030 – Banana harvest forecasting project
- BA 09037 – Banana Enterprise Performance Comparison
- BA 10021 – Review of current production and marketing information systems

Other Industries – Stage 2 should also include reviewing the Avocado industry marketing aware systems.

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000

Acknowledgements

The project team would like to acknowledge the funding and support from HAL and ABGC, as well as the input from the project reference group, the grower focus group and field liaison officers for Bunchy Top and Yellow Sigatoka. Special mention needs to be made of the cooperation of Barry Sullivan for providing access to farm locations and enthusiastic input into the project.

References

Markley J, Ashburner B, Beech M (2008) The development of a spatial recording and reporting system for productivity service providers. *Proceedings of the Australian Society of Sugar Cane Technologists* 30, 10 - 16.

Markley J. and R. Crossley (2011) "AGDAT: Spatial applications to improve harvest management, data recording and reporting, and data exchange between organisations" *International Sugar Journal 2011 Vol 113 No 1354*

Agtrix Pty Ltd Unit 6, 2 Bonanza Drive, Billinudgel NSW 2483, PO Box 63, New Brighton NSW 2483 Tel +61 (0)2 6680 1309
NATURELAB PO Box 32, Aldgate, SA 5154. Phone 61 8 8370 1000