NSW Department of Primary Industries
Department of Regional NSW

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Using a standards-based traceability system to improve horticulture supply chains

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[6] Cantrill Organics

Australian Government
Department of Industry, Science and Resources

AusIndustry
Cooperative Research Centres Program

Executive summary

Traceability is being able to identify a product anywhere along the supply chain and follow its journey from origin to destination (Olsen & Borit, 2013). It is becoming a critical part of modern agriculture because it provides information about provenance, authenticity, chain of custody and enhances food safety measures. Although traceability in some form is common in horticulture, increasing challenges with the interoperability of systems and data standard agreements make it difficult for growers, retailers and government to work together. This is especially important if a food recall, emergency management situation or biosecurity incursion occurs. Having a data standard for traceability systems would make it easier for all stakeholders along the supply chain to work together and receive data quickly and efficiently. It would also reduce the time spent identifying products in the supply chain, reduce food waste and provide better protection for our fresh food industries.

The International Organisation for Standardisation/International Electrotechnical Commission (ISO/IEC) endorses common data structures that allow for easy integration. GS1 is an international standards-writing organisation that has been recognised by ISO/IEC as a standard system provider for a wide variety of supply chain processes, including globally unique product identification. Using these standards allows for the integration of many supply chain processes, increasing traceability.

This report describes the results from a pilot trial of adopting digital traceability in two horticulture production systems. Woolworths-branded brushed potatoes and organic cherries had unique serialised QR codes with a GS1 Digital Link label applied to the bags and punnets. The GS1 Digital Link was encrypted with location data and a scannable QR code, which led to an interactive consumer application that could be viewed on a smartphone. The GS1 Digital Link enabled the product to be traced in real-time, from property to store. It also provided information about how the product moved along the supply chain, the time spent at each location and allowed for real-time feedback from consumers. Specifically, the following outcomes were achieved:

- successful proof-of-concept of ISO/IEC-compliant data standards
- understanding the value of the GS1 Global Location Number and National Location Registry for integrated traceability
- understanding the importance of a digital traceability system for managing an emergency, biosecurity incursion or food safety recall
- exploring the importance of data sharing agreements and permissions-based data
- realising the potential for data standards to provide a framework for electronic certification for market access and protocol requirements
- increased awareness of the value of connecting the grower and consumer via the GS1 Digital Link.

This type of integrated traceability system offers many potential benefits for growers, exporters, governments and consumers including providing assurances of food safety, provenance and authenticity of products. It also provides the framework for data standards and integration of traceability systems in the horticulture supply chain.

Photo: Mitolo Family Farms.

Glossary

API: Application Programming Interface

COVID-19: Coronavirus pandemic that started in 2019

CGA: Cherry Growers Australia

CTE: Critical Tracking Event

DC: Distribution Centre

E2E: End to End

Food Agility CRC: Food Agility Cooperative Research Centre

GTI: GS1 Document Type Identifier

GLN: Global Location Number

GTIN: Global Trade Item Number

ISO/IEC: International Organisation for Standardisation/International Electrotechnical Commission

KDE: Key Data Element

NLR: National Location Registry

NSW DPI: New South Wales Department of Primary Industries

POS: Point of Sale

QFF: Queensland Fruit Fly

QR: Quick Response

SSCC: Serialised Shipping Container Code

WW: Woolworths Supermarkets

Contents

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Department of Regional NSW

Introduction

Consumers are now demanding more transparency and information about a product's journey along the supply chain (Zhang, Mankad, & Ariyawardana, 2020). The fresh food industry should use this as an opportunity to provide information to consumers and promote good food standards. In theory, end-to-end or property-to-store traceability should be a simple process to meet growers', retailers', government and consumer needs. However, tracking a product and maintaining its traceability with all supply chain stakeholders is challenging (Shahid et al., 2020). This is due to the lack of interoperability of the systems and the absence of data standards, making it difficult for these parties to work together. Without an efficient traceability system, if a food recall or emergency management situation such as fire or biosecurity incursion should occur, the responses will likely be inefficient and paper-based, resulting in product waste and loss of consumer trust. These responses can cause a large economic burden.

Australia has a reputation for producing safe, high-quality agricultural products in both domestic and international markets (Bollen, Riden, & Cox, 2007). The National Livestock Identification System (NLIS) is a successful process for the identification and traceability of cattle, sheep and goats. The NLIS enables an animal's property of origin and movements to be tracked and traced efficiently and quickly. Unlike the livestock industry, there is no nationally consistent way to identify properties and products in the horticulture supply chain. This has caused significant challenges during emergencies, such as floods or bushfires, and biosecurity and food safety incidents.

With the current system, once a product leaves the farm or packing facility, very little is known about how it is transported, how it arrives at the market or the condition it is in when received by consumers. While numerous traceability systems are available, they all rely on different requirements and standards used for data identification, collection and sharing.

The International Organisation for Standardisation/International Electrotechnical Commission (ISO/IEC) has endorsed certain data standards that can provide the ability to integrate and share data easily. There is an opportunity to implement ISO/IEC-compliant data standards for property identification, traceability and supply chain management. Using this system, growers and retailers could find out more about the challenges and inefficiencies in their product's supply chain by using environmental and location sensors to show temperatures and time spent at locations.

Full trace-forward and trace-back of a product requires serialised data using global standards to be linked on the punnet, crate and pallet for unique identification, data capture and exchange. All partners in the supply chain, such as growers, carriers, retailers and the government, need to capture and share their data to enable full trace-back and trace-forward visibility in real-time.

This project was developed to assess ISO/IEC recognised GS1 global data standards in the fresh food industry to track products from the property to the consumer. The pilot trial used the globally unique Global Trade Item Number (ISO/IEC 15459-6) and the Global Location Number (ISO/IEC 6523) for digital identification. It was also designed to trace that product should a biosecurity threat, food safety incident or emergency response occur.

The contributing partners in the project include:

NSW Department of Primary Industries

NSW DPI is encouraging fresh food producers to adopt technology to track and trace a product's journey along the supply chain to improve responses to emergency, biosecurity, and food safety incidents. This is part of an agreement to implement a nationally harmonised animal and plant industry property identification system. Encouraging the digital flow of biosecurity and food safety information through the supply chain and modernising certification systems have been identified as priorities for NSW DPI. An integrated traceability system can improve our industries' competitiveness, buyer confidence and market access for horticultural products produced in NSW.

Woolworths Supermarkets

End-to-end (E2E) product traceability is a key focus area for Woolworths, along with the importance of data standards and partnerships to gain interoperability. This project was a great opportunity to collaborate with the government and industry and to learn more about traceability. As a leading Australian retailer, we want to learn about our customers' expectations regarding the provenance and other relevant traceability data for our fresh produce. Serialised Quick Response (QR) codes with a GS1 Digital Link are a mechanism to not only engage with our customers, but also to collect traceability data throughout the supply chain. It builds on the work we have done with 2D barcodes on products for managing expiry dates.

This trial will improve our understanding of using standards e.g., GLNs and the National Location Registry (NLR) for tracking products through the supply chain.

By working with our growers, we want to improve our understanding of what is required on-farm to enable traceability and what the benefits would be to our partners along the supply chain. This trial is an opportunity to learn more about the current processes and data and any areas we need to improve.

"*We see traceability as a key enabler to provide access to all the required data to ensure that we can offer our customers the freshest, best quality and safest products. We also want to be able to share the product's journey with our customers. The CherryPlus industry trial enabled us to see how this could come to life*," Warwick Hope, Head of Strategic Sourcing for Fruit and Vegetables, Woolworths.

Food Agility CRC

The Food Agility Cooperative Research Centre (Food Agility CRC) invests in world-leading research that is changing the way growers produce and supply food. With partners, the Food Agility CRC creates new data-driven technology for the agri-food industry using artificial intelligence (AI), robotics, blockchain, sensors and advanced data analytics. The Food Agility CRC is funded by the Australian Government under its Cooperative Research Centre program and by strategic partners, which include agri-food businesses, technology companies, research institutions, agribusinesses, and service providers.

FreshChain Systems

FreshChain Systems is an Australian digital end-to-end traceability and provenance platform that helps growers understand their product's journey and performance. By using global data standards, FreshChain can deliver seamless data flow to identify, capture and share critical information. FreshChain connects producers with consumers through on-pack labelling, encouraging information exchange.

FreshChain were delighted to contribute to the traceability project to enhance faster resource deployment from the government in a biosecurity or food safety incident. The rapid and accurate identification of affected products, and understanding the product's journey through the supply chain, were also of interest to FreshChain. FreshChain also wanted to provide the growers in this project with a first-hand account of consumer feedback about the produce to see if those insights could be actioned for better outcomes.

GS1 Australia

GS1 Australia is the leading provider of standards to over 20 industry sectors. GS1 Australia introduced barcoding in 1979 and today enables more than 21,000 member companies of all sizes to become more efficient by implementing the GS1 system.

GS1 standards are the most widely used for supply chain identification globally. Using trusted data, the information about a product, including its origin, what it contains and where it has been along the supply chain can be shared. This removes friction between business partners by enhancing integration and improves performance along the entire supply chain.

This trial allowed GS1 Australia to test a property and product identification system based on GS1 standards, in particular the Global Location Number (GLN) and Global Trade Item Number (GTIN). GS1 Australia was excited to test and demonstrate the new GS1 Digital Link used in QR codes on the products. Another key objective for GS1 Australia was implementing and testing the GLN for property and asset identification with the National Location Registry. This should ensure effective supply chain logistics and an efficient emergency response when required. Having a central registry for the data allowed key information about properties and locations to be validated and syndicated to industry and government throughout the project.

Mitolo Family Farms

Founded in 1972, Mitolo Family Farms is Australia's leading potato and onion growing and packing company, with sites located in South Australia and Hillston, NSW. Mitolo Family Farms grows and harvests more than 40,000 tonnes of brushed potatoes each year from their Hillston farms in western NSW.

As part of Mitolo Family Farms' continuous focus on delivering fresh, Australian grown produce ethically and sustainably, our involvement in this project was closely aligned with our values. As a business, we are constantly reviewing ways to improve our production to support our consumers.

Cantrill Organics

Cantrill Organics is Australia's largest organic cherry orchard and is family owned and operated in Nashdale, near Orange in the central west region of NSW, Australia. The altitude and colder nights of the Orange climate slow the cherry ripening process, increasing sugar production, and creating a better cherry flavour. Cantrill Organics supplies both domestic and international markets and has a strong focus on building future export markets. Cantrill Organics leads the organic industry in Australia by using science-based authenticity to open new markets. Understanding authenticity and provenance are clearly advantageous in retail, however, the costs of establishing and maintaining technology and digital sensor devices represent a new cost to the producer. This can reduce the competitiveness of the product and the producer. To date, there has been no justification for the introduction of these costs, and no clear requirement from retailers for such systems. In this pilot trial, Cantrill Organics sought to collaborate with government, retailers, and industry service providers to demonstrate commercially viable applications of authenticity and provenance information.

"*Traceability provides transparency of production location and production systems, allowing us to oversee our product further in the supply chain once it has been shipped from the shed. It provides the consumer confidence in a high-quality Australian product and allows them to become aware of the direct source of the product. In a new era of food security challenges, we welcome further technological advances in traceability to show the quality systems applied and to secure the provenance of our cherries. It also helps the consumer engage directly with our business and subsequently strengthens our brand*."
Luke Cantrill, Cantrill Organics.

Cherry Growers Australia

Cherry Growers Australia (CGA) was established more than 40 years ago as a member-based, not-for-profit organisation for orchardists nationally. CGA strives to assist Australian cherry growers by providing access to the best available resources, networks, and market information. CGA sees the opportunities traceability systems present when accessing protocol markets and wishes to continue to support research in this area.

Objectives

1. To use ISO/IEC-compliant data standards to immediately identify a product's origin or properties in the horticulture supply chain
2. Show that data standards enable efficient emergency responses and supply chain logistics, including all required data for interstate market access
3. Identify areas in the supply chain where the product sits for too long or is exposed to unsuitable conditions to reduce waste.

Methods

To test the suitability of an ISO/IEC-compliant data standard for an integrated traceability system, GS1 data standards and the GS1 National Location Registry were used. Pilot trials using potato and cherry were conducted to test the efficacy of a data standard traceability system. Potato and cherry were used as pilot commodities as potato is a well-established industry and a staple market commodity and the Australian cherry industry has an interest in using traceability to gain access into markets. Both commodities were supplied to Woolworths as the retailer brands of 'Macro Organics' and 'Woolworths' own label.

Serialised unique QR codes with a GS1 Digital Link label were applied to all consignments in the potato and cherry trials. For potatoes, 4,500 labels were printed before the pilot trial and applied to 3 batches over 3 days. For cherries, unique serialised labels embedded with data were applied to 1,152 punnets that were linked to 144 crates and 4 shipping container codes (Figure 1). These labels were printed as the product was coming down the packing line and applied by hand (Figure 2).

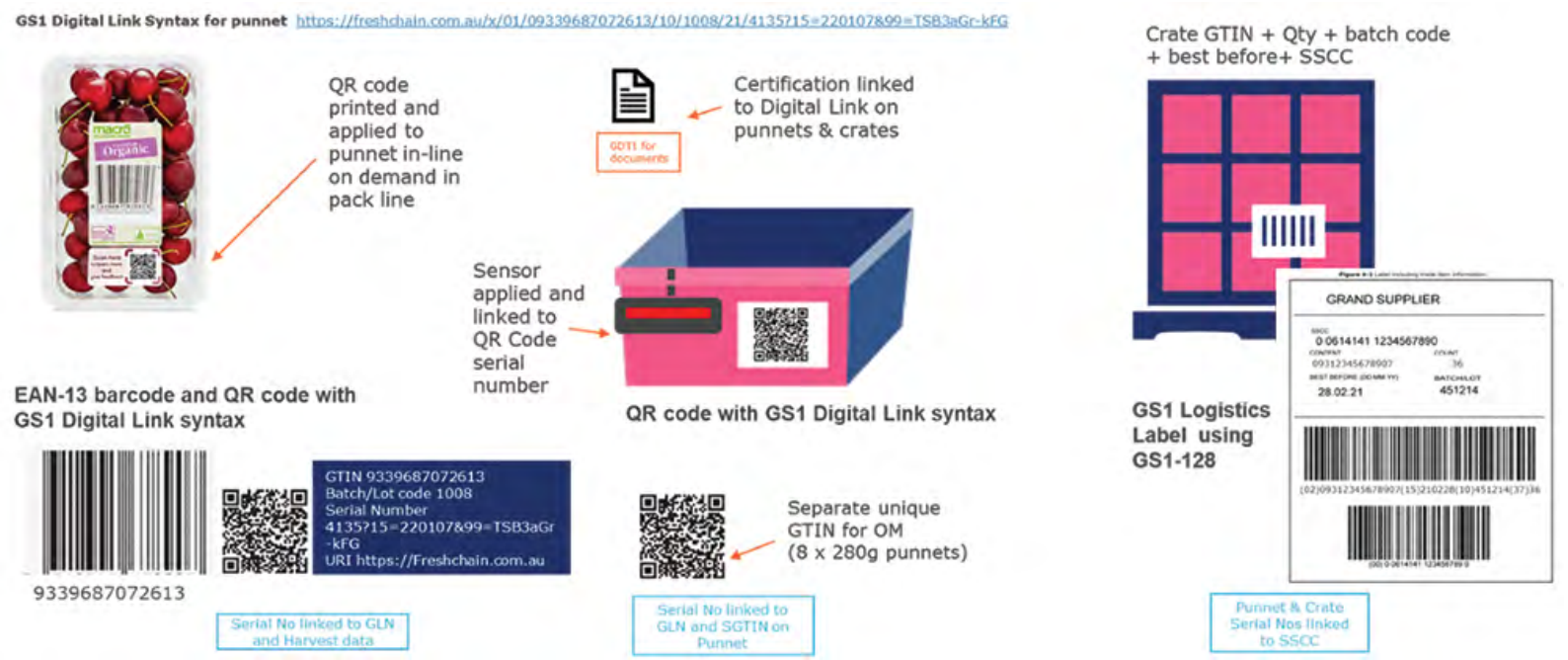

Figure 1. In the cherry trial, every level of packaging was uniquely identified. Source: Wishart (2022).

Figure 2. Printing on-demand labels deployed by FreshChain systems in the cherry packhouse.

The project team mapped each critical tracking event (CTE) and key data element (KDE) then shared the relevant data with the FreshChain platform. A CTE is when the product is moved between premises or is transformed, or is determined to be a point where data capture is necessary to maintain traceability. A KDE is the information required to successfully trace a product and its ingredients through all relevant CTEs. A Woolworths Global Tracking Identification Number (GTIN) was allocated to Mitolo's 2 kg bags of washed potatoes and Cantrill Organic's 280 g organic cherries and uploaded to the FreshChain system. A GS1 GLN was then allocated to each location where a CTE would occur and was uploaded to the National Location Registry (NLR) using Excel™. FreshChain then exported all GLNs associated with every CTE to the FreshChain system.

As the cherry punnets were packed into a crate (8 punnets per crate, 72 crates per pallet), a crate label linked to the punnets was printed and applied to the pallet. This process was repeated for each punnet and crate until a pallet was complete (Figure 1). A GS1 Logistics Label containing a serial number was printed and applied to all crate labels. These were then activated on the FreshChain dashboard. Each pallet then had a serialised FreshChain data logger linked to the pallet serialised shipping container code (SSCC) to measure temperature, location and light interception. The pallets were then shrink-wrapped and put into cold storage awaiting shipment. Data on the labels were then captured by the FreshChain platform.

Track and trace trials

Samples of both cherry and potato products were randomly selected through the FreshChain platform to identify their current location, previous and future locations, and time. Five scenarios were created to simulate a real-life food safety recall or biosecurity outbreak:

1. Property location cherry
2. Property location potato
3. Product location in supply chain (cherry)
4. Food recall cherry
5. Food recall potato

For each scenario, a QR code was randomly selected from the activated labels and entered into the FreshChain system to find the origin and current location of the product in the supply chain. A batch number was randomly selected and used to send out recall messages through the platform, which would inform the consumer that the product was subject to a recall. A representative from the NSW Food Authority was present for the exercises to determine if the system was an effective solution for their use.

Electronic certificates

All certificates that growers elected to share with the project were converted to PDF documents and uploaded to the FreshChain cloud-based file storing system and given a unique serialised GS1 Global Document Type Identifier (GTI). This was then attached to a growing or packing location, shipment or product.

Data sharing agreements and privacy

A Data Sharing Agreement was signed with the participating project partners. This was to protect Mitolo and Cantrill Organics with the additional data being shared for the trial. The Data Sharing Agreement highlighted the purpose for sharing the data:

"*The main objective of the trial is to trace the product from the farm to the customer using agreed data standards and storing the relevant data centrally to easily identify where the product is in the case of a food safety incident (e.g., mock recall) and to communicate relevant data with customers by using QR codes with GS1 Digital Link*," Woolworths, 2022.

The agreement also referenced data sharing principles including who will have access to the data, how it will be used, how long it will be kept and how it will be disposed of. This was a key step to ensuring that all participants were willing to share the required data.

When customers scanned the QR code on the product, they were asked if they were willing to share their current location i.e., they could opt in or out. There were no further privacy concerns as the project was unable to link the product that was bought to the customer. If a customer chose to rate the product, they could leave an email address if they wished to be contacted about their comment.

Results

Identifying supply chain points

Global Location Numbers (GLN) were successfully allocated to CTEs and uploaded to the FreshChain system and National Location Registry (Figure 3).

For the potato trial, a GLN was allocated to the following points in the supply chain:

- The Mitolo Family Farm's head office, Virginia SA
- Three paddocks on the Mitolo Hillston farm, Hillston NSW
- The Mitolo NSW farm, Hillston NSW
- The Mitolo packhouse, Hillston NSW
- The Mitolo storage location, Hillston NSW
- The Woolworths Minchinbury NSW Distribution Centre (DC)
- All NSW Woolworths stores supplied by the Minchinbury DC

For the cherry trial, a GLN was allocated to the following points in the supply chain:

- The Cantrill Organic farm, Nashdale NSW
- Three Cantrill Organic cherry orchards, Nashdale NSW
- The Cantrill Organic packhouse inbound cooler, Nashdale NSW
- The Cantrill Organic packhouse, Nashdale NSW
- The Cantrill Organic packhouse outbound cooler, Nashdale NSW
- The Woolworths South Australia DC, Gepps Cross SA
- All South Australia Woolworths stores
- The Woolworths Minchinbury NSW Distribution Centre (DC)
- All NSW Woolworths stores supplied by the Minchinbury DC

Figure 3. Potato supply chain with GLN addition points outlined. Source: Wishart (2022).

Labels

Labels applied to the punnets and bags stayed in place for the duration of the pilot trial (Figure 4). Consumers were able to scan the QR code on the label and access the interactive web-based application. The labels allowed for product identification, traceability and access to the FreshChain dashboard.

The FreshChain sensors identified how long the product was at each GLN and in the supply chain. Consumers were also able to find out when the product was packed and given a freshness index based on how much time had elapsed since packing.

Figure 4. Woolworths Macro Organic 280 g cherry punnet and Woolworths 2 kg brushed potatoes with a GS1 Digital Link Barcode. Source: Calvert (2022).

Track and trace

For each of the scenarios, track and trace demonstrations could instantly identify the product's location in the supply chain. Product origin was accurately identified and the FreshChain system was able to send instant recall alerts to display on the QR code when scanned. All batches could be managed from the FreshChain dashboard. Figure 5 shows the interface that a Food Authority officer or retailer will see when initiating a track and trace or food recall. Product can be traced by entering the batch number or packed date and all data associated with that number will be identified and displayed as shown in batches. There is a 'lock down all' button that, when activated, will send a recall message to the identified affected batches.

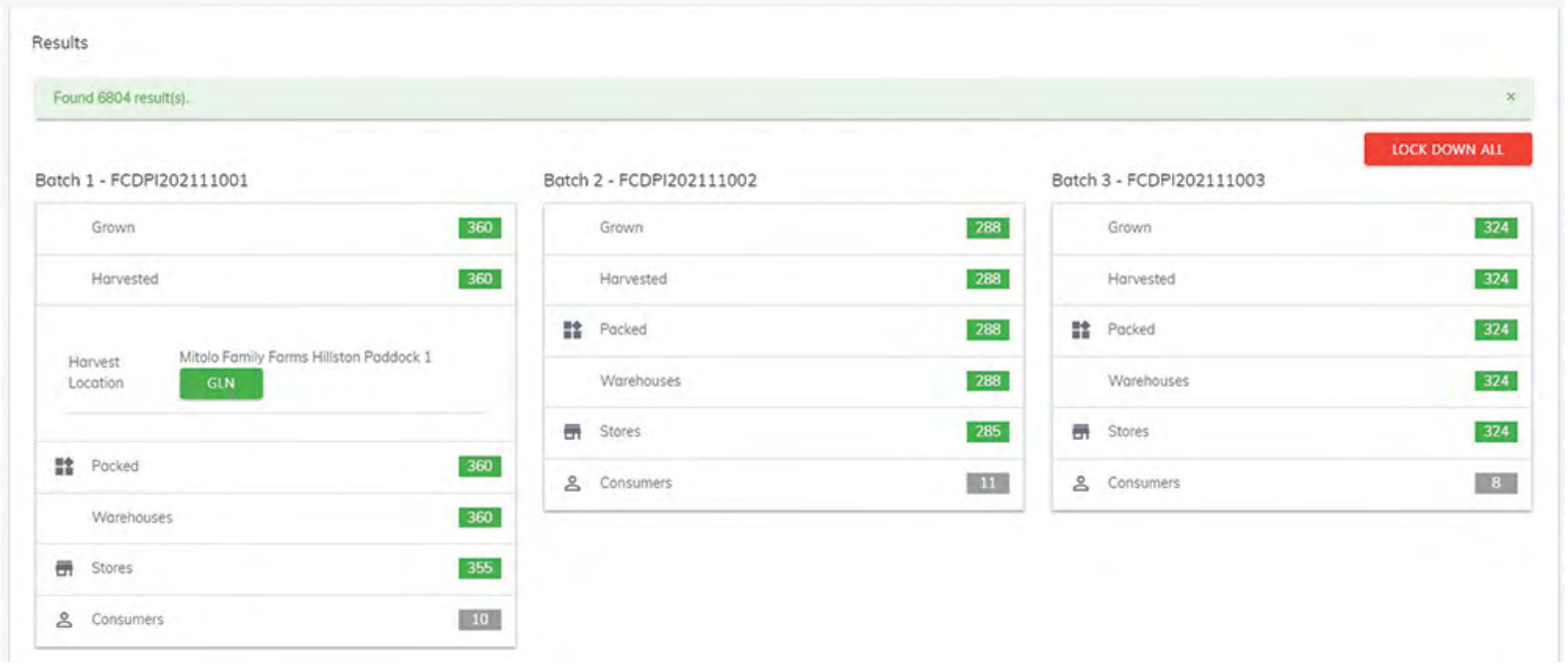

Figure 5. The FreshChain Systems track and trace dashboard identified the potato batches.

Consumer experience

When the consumer scanned the QR code with the GS1 Digital Link, they were directed to the 'consumer experience' webpage. Here, the consumer could access videos, recipes, information about packing, storage, and agreements such as the Fairtrade Agreement or Organic Accreditation (Figure 6 and Figure 7).

Consumers could also rate the product and these ratings were reported to the grower and retailer in a closed feedback circuit (Figure 8).

The potato labels recorded 386 scans and the cherries recorded 97 scans. For potatoes, storage was the most viewed item on the consumer experience webpage, while in cherry, the farm introduction video was the most viewed.

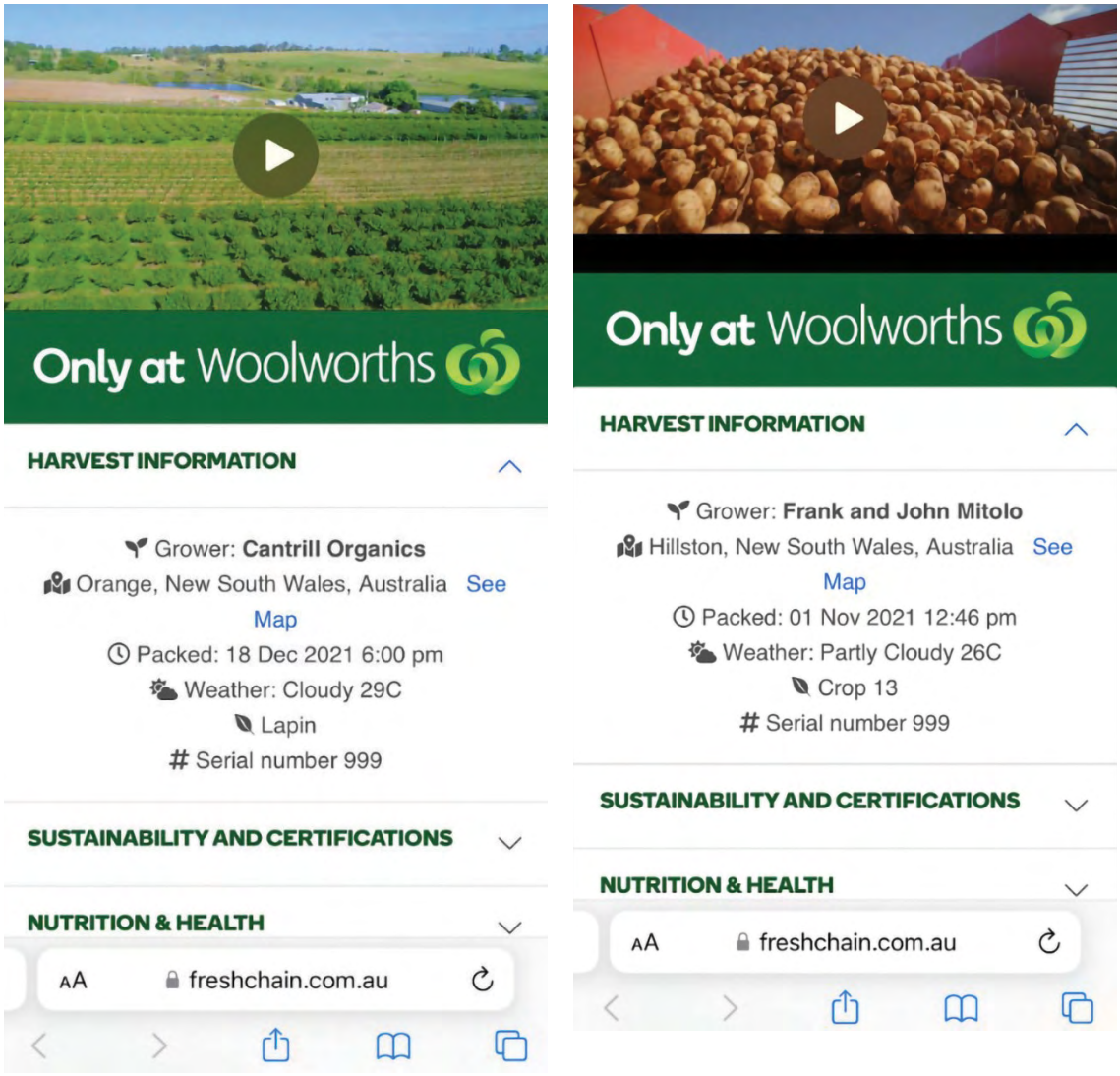

Figure 6. The landing page for the 'user experience' for the cherry and potato pilot trials.

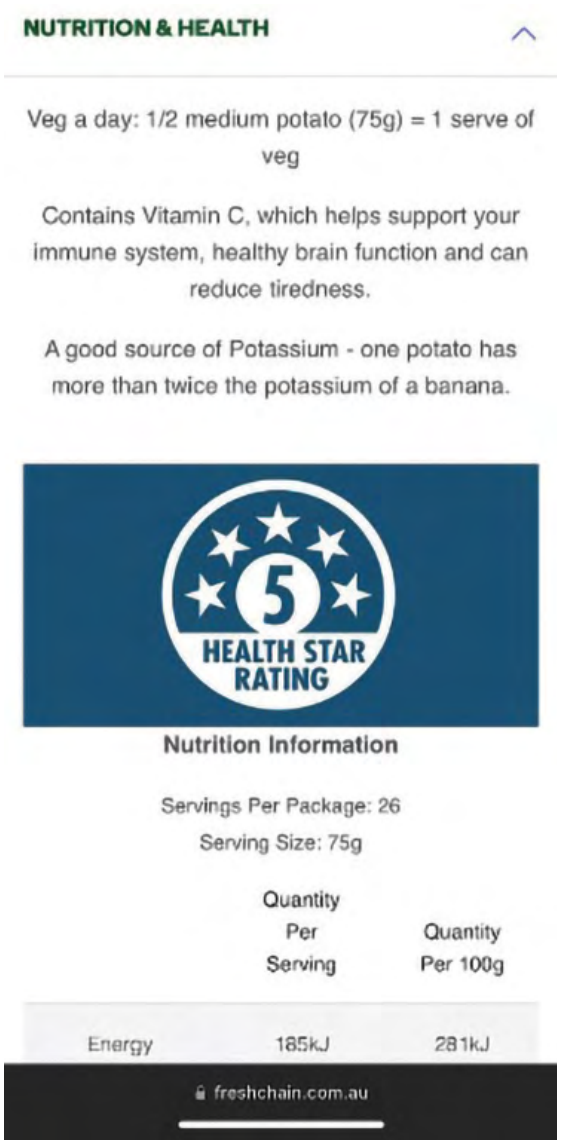

Figure 7. Example of information provided to the consumer on the user experience webpage.

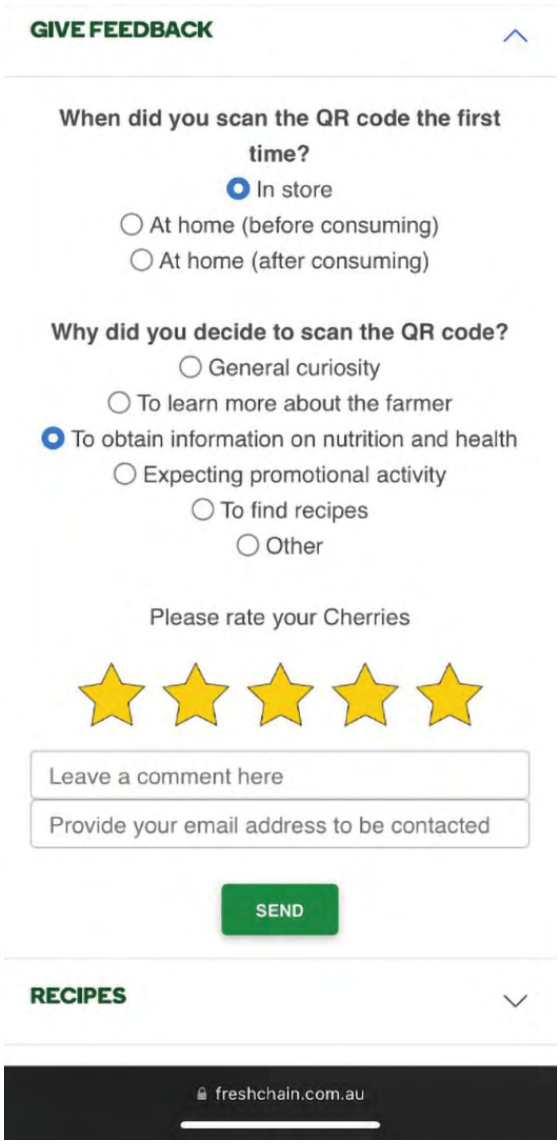

Figure 8. Feedback form for consumers.

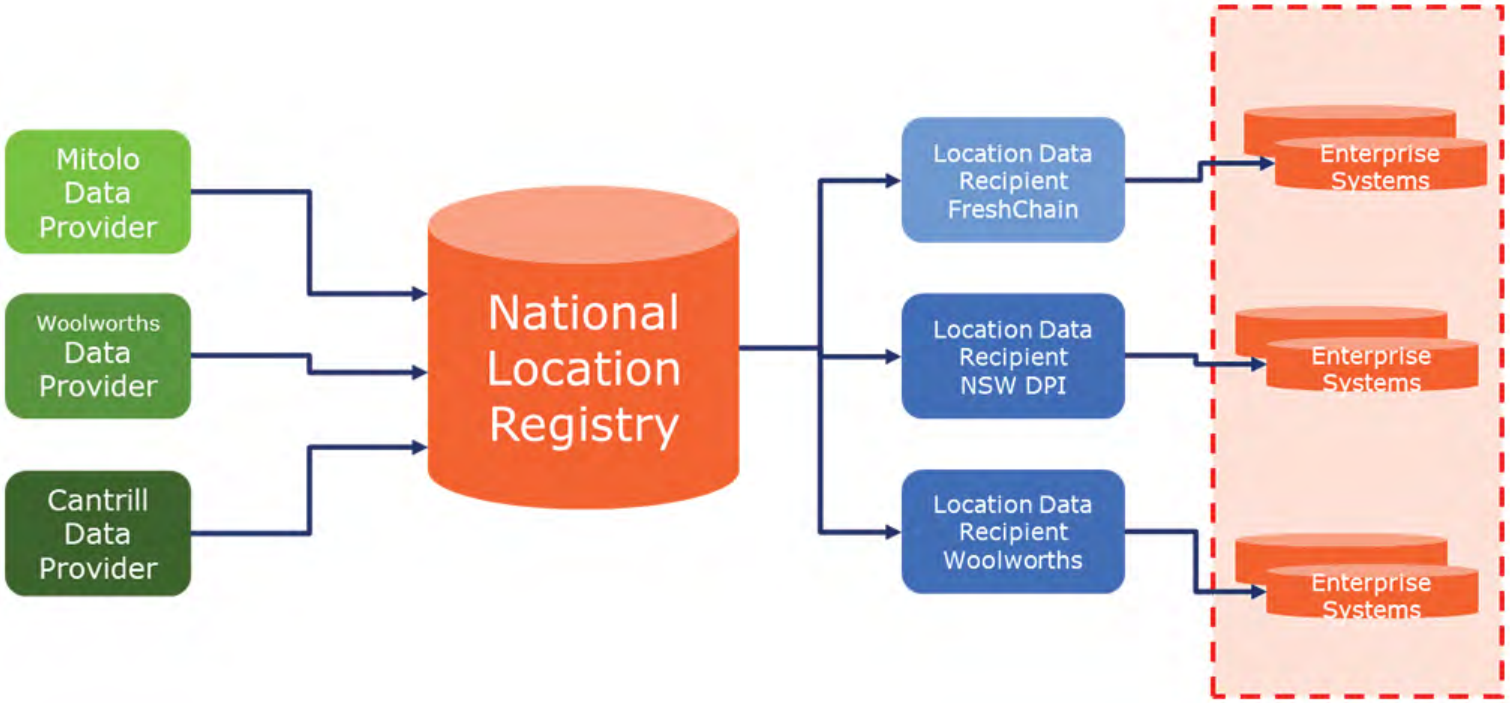

Figure 9. The process of data flow through the National Location Registry. Source: Wishart (2022).

Discussion

Property location

Traceability systems allow for transparency, information flow and help with domestic and international market access. There are many traceability systems available, but these often cannot be integrated between grower, supply chain, retailer and consumer due to the different data types. This project trialled an ISO/IEC-compliant data standard to trace a product using the GLN and NLR, showing that a standardised location identification system could be established nationally. This would enable growers, supply chain partners, retailers, and the government to use a 'common language' when identifying property and products location.

In both the potato and cherry pilot trials, CTEs were used to help allocate GLNs to test the effectiveness of a standardised identification system. Establishing these GLNs provided the foundation for the traceability system, which allowed data to flow through the supply chain and be accessed efficiently when needed. The GS1 National Location Registry was used to capture and share the location data. Currently, collecting and exchanging information about physical locations are manual processes. This can be a significant problem if managing an emergency. For example, during the 2020 bushfire season in NSW, government officials were trying to allocate resources for packhouses and orchards but did not have an efficient property and asset identification system to use. Additionally, having different traceability systems throughout the state can result in duplication of efforts and multiple data sources, creating inefficiencies and confusion. Using a common place to house the data, such as the NLR, will allow for better integration. Figure 9 shows how the data for both pilot trials were used to demonstrate the flow of location data on an integrated system.

Track and trace

Storing data in one location that is accessible quickly by approved agencies nationally would enhance the response in a food recall or biosecurity incident. As part of this project, a NSW Food Authority representative authorised under the *Food Act 2003* tested the viability of an integrated traceability platform and data standards in different tracing scenarios. The main responsibility of the NSW Food Authority is to protect consumers against food-borne illness and disease (WHO and FAO, 2012). Food safety recalls can cause significant economic loss resulting from damage to brand reputation, loss of product and costs of recalling products (Bosona & Gebresenbet, 2013). When using GS1 Digital Link enabled technology, the time taken for the recall was significantly reduced from approximately 24 hours to under 60 seconds and the product was able to be isolated at a batch or item level. The World Health Organisation and Food and Agriculture Organisation state that unsafe products must be rapidly removed from the market to minimise the risk to human health. This traceability system used in this pilot trial met this requirement and gave consumers real-time updates to ensure recalls and incidences were actioned immediately (Figure 10). Using an integrated traceability system will significantly reduce time spent recalling product, reducing the risk to consumers.

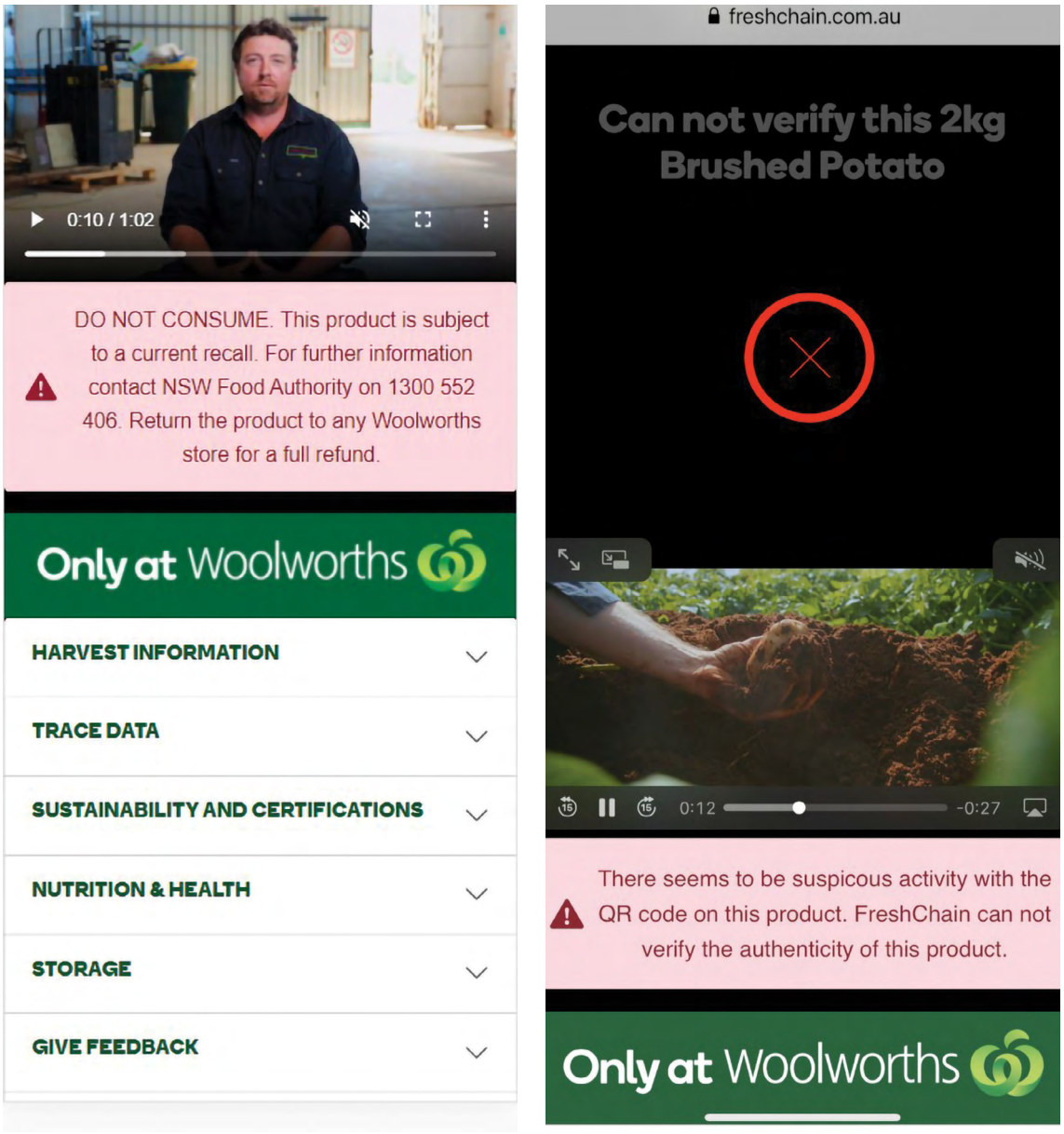

Figure 10. Through the traceability system, the consumer experience can be updated immediately to reflect any food safety incidents.

As this system has identification data attributed to every level of packaging, individual punnets and bags could be identified and isolated. Outside of the project, these products would be able to be removed, without affecting the trade of other unaffected products. This would significantly reduce the amount of waste that occurs due to food recalls.

Consumer experience

As well as trialling the NLR, the new GS1 Digital Link and integrated QR technology were tested to gain feedback about how consumers rated the product, as well as capture serialised traceability data along the supply chain. The GS1 Digital Link lets consumers access information that can strengthen a brand name, as well as provide education and feedback opportunities. Where a typical barcode can only be scanned at the point of sale, the GS1 Digital Link enables connections to all types of business-to-business, business-to-consumer, and business-to-government information. The consumer experience in this trial enabled Mitolo Family Farms and Cantrill Organics to engage with consumers in real-time, with feedback they were previously unable to access. Consumers could also view a video of the farm and grower, storage information and recipe ideas. These recipes linked back to the Woolworths online store where customers could put together an order quickly and efficiently. The growers participating in the project identified this direct connection to the consumer as an excellent value-add, as it gave them information about their product after it left the packhouse. The ability to build a brand and relationship with the consumers was an extremely positive outcome for the growers participating in this pilot trial.

Electronic certificates

Industries requiring their product to comply with specific protocols to enter certain markets could also benefit greatly from an integrated traceability system. Enhanced visibility and knowledge about the chain of custody can prevent pest infestations off-farm, which can compromise market access. This is particularly important for Queensland Fruit Fly (QFF), an endemic pest of mainland Australian cherries. QFF is found in most of Australia's eastern states. Detection of QFF in sensitive domestic markets usually results in a temporary import ban, or in more serious cases, suspension of trade. This ban is put in place as the receiving country does not want to have these pests present in their food systems. To prevent the chance of infestation, many importing states require a chemical or cold storage single-point treatment for all consignments of QFF host fruit. Both treatments reduce fruit quality and shelf-life. Also, if a chemical treatment is applied, it negates the organic status of the product.

An effective closed traceability system could render these endpoint treatments unnecessary. This project piloted the concept of a closed supply chain to gain access into the South Australian market. By keeping track of who interacted with the product and its location, coupled with the FreshChain light sensors, product tampering could be detected. This system could be further enhanced by being able to electronically confirm the plant health status of the produce. Electronically accessible certification would mean the plant health status is permanently ‘attached’ to the product if the product and the QR code remain connected. This would enable consignments to be split and recognised without the need for re-issuing or copying certificates. Thousands of plant health assurance certificates are issued by government officers and accredited businesses in Australia annually. Currently the system is almost entirely dependent on


macro
wholefoods market
Certified
Organic
Organic Cherries 280g
9 339687 072613
BEST BEFORE: 07/01 BATCH No. 1008
Keep refrigerated. Wash before use
NASAA
CERTIFIED
ORGANIC
Cert. No.
2036
Tub
Grown in
Australia
Packed for Woolworths, 1 Woolworths Way, Bella Vista NSW 2153, Australia 04127
Scan here
to learn more
and
give feedback

hard copy certification, although electronic formats accessible by email are currently available and used in some jurisdictions by some producers. A traceability system could store the certification status of the product and have the information accessible at any time via a QR code. The use of GS1 GDTI when using digital certification will allow each document to be uniquely identified and integrated across systems. This could significantly improve access to information critical for market access worldwide. Furthermore, it would also potentially reduce the costs associated with certification and verification of produce plant health status.

Sensors

The FreshChain sensors used in this pilot trial detected temperature changes in the supply chain, highlighting a potential area for improvement, especially where the cherries were exposed to higher than optimal temperatures during transport (Figure 11). More research into the transport component of the supply chain could identify areas where waste due to inefficiencies can be reduced.

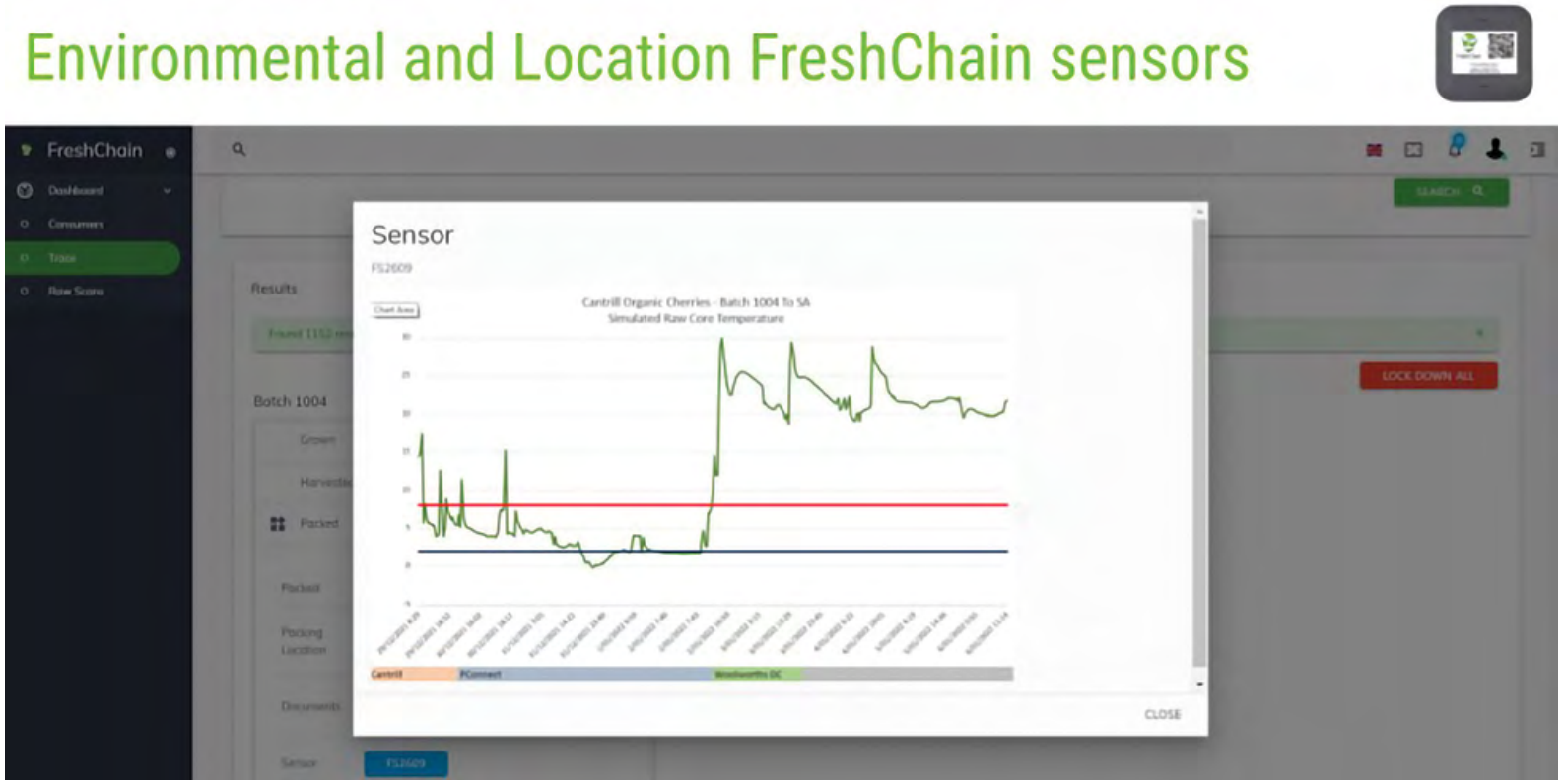

Figure 11. FreshChain sensor data for a cherry consignment into South Australia.

Throughout the pilot trial, significant challenges were encountered and resolved (Table 1). In some cases, these challenges created an opportunity for the project team to rethink the methods and processes used.

Table 1. Challenges encountered by the project team.

Challenge	How it was resolved	Opportunity presented
Timing of the cherry pilot (weather effects)	The cherry packhouse staff were extremely flexible in packing dates when the consignments were being distributed and when the team were allowed in the packhouse.	Involving multiple sites meant we could compare varietals, quality (based on location, time of year) and growing methods.
Inability to get into the packhouse	Remote consultation for FreshChain and team.	The ability to trial a new method of consultation that allows more flexibility when helping the grower prepare to use the system.
Scan fatigue due to COVID-19	Applied call-outs next to the labels to encourage scanning.	Scanning of QR codes is now part of society and these types of systems can be integrated into normal day-to-day activities. Using a comprehensive and coordinated marketing plan to include 'gamification' and rewards programs for a more targeted approach might result in more scans. There is also the opportunity to link the product scanned to the Everyday Rewards program, which could allow testing an alert on a consumer's mobile in the event of a critical food incident or biosecurity risk.
Participation levels of consumers at Christmas	Cherries were a good product to use during Christmas as people associate cherries with the festive season.	Look for out-of-season opportunities to assess and compare key metrics.
Were people shopping more online and not in-store to see our products?	Organic cherries were very limited in volume in the organic section. Price at the time was very high with competing products and focus on Christmas.	Dedicated fresh space to highlight and encourage engagement through promotions.

Challenge	How it was resolved	Opportunity presented
Absence of critical people along the supply chain due to COVID-19	Flexibility in how data were collected.	Earlier engagement with supply chain members and a more targeted approach to partner digital capability.
Inability to get into the Distribution Centre (DC)	Flexibility in how data were collected.	Integrate with DC's existing scanners for 2D barcodes or use modified FreshChain devices to send store orders back to the platform for real-time capture/ processing and sharing.
Limited sharing of KDEs	Data were provided as CSV files in real-time.	Integrate using an application programming interface (API) with the grower, carrier, and retailer. This would allow more KDEs and CTE to be captured and shared with the team in real-time.
Lack of inline print and labelling solutions	A combination of pre-printed tags (potatoes) and printing on demand (cherries).	Use on-demand printing inline to remove additional handling of products or manually applying labels.
Unable to activate GS1 Digital Link at the store Point of Sale (POS)	Kept the current industry barcodes for sale and added the QR code on the pack for consumer interaction.	By enabling this technology, products could be blocked from sale at the checkout and analyse sales and quality data from different suppliers of the same line.
Unable to have a sensor in each crate	Only added a couple of sensors with some of the consignments.	This is a financial decision based on the price of each sensor and the assurance that they are returned.
Sensitivity around location and traceability data sharing from the growers	Signing Data Sharing Agreements with each of the suppliers.	Advising growers about data privacy, permission access, who sees the data, what it is used for and processes for data disposal. Ensuring T&Cs are discussed and agreed on.

Although the framework suggested in this pilot trial has the potential to deliver great benefits to industry, there are still a few challenges that require further research to ensure its success. More industry consultation and education about what is required for these systems to be successful and practical on-farm are needed. A better understanding of the common traceability systems currently being used and how these could be integrated using standards will be critical.

Understanding who owns and maintains the data throughout the supply chain will need regulation and a framework to develop policy before these systems become enforced. This will require all supply chain parties such as the retailers, freight services and growers to integrate their systems and data.

Conclusions

Using a global data standard as a foundation for a traceability system means information can be integrated to make managing products in the supply chain much more efficient. Global data standards will also reduce the time spent identifying products in the supply chain, making food safety incidences and product recalls easier to manage. Although there are many traceability systems available, there are increasing challenges with their interoperability. Data standards agreements can pose challenges for growers, retailers, and government's ability to work together during food recalls, emergency management situations and biosecurity incursions.

For this pilot trial, GS1 global data standards and the National Location Registry were tested in a traceability system, enabling accurate identification of property and products at pre-determined points in the supply chain. This type of traceability system will reduce downtime, allow quicker, more accurate deployment of government resources, and increase consumer confidence. The system also encouraged consumers and growers to communicate with each other, enabling feedback and product information to be shared. all supply chain participants including the retailers, freight services, growers and government.

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Benefits to industry

This pilot trial identified the following key benefits for industry in adopting an ISO-compliant data standard traceability system:

1. Successfully demonstrated an integrated digital traceability system for horticulture.
2. Successfully traced products forward and backwards in the supply chain.
3. Identified the benefits of traceability for growers, exporters, retailers, governments and consumers.
4. Quick identification of property and assets, minimising loss to the grower.
5. Assuring consumers of the food safety, provenance and authenticity of Australian products to improve consumer confidence.
6. Reducing economic damage to the growers and industries through efficient recalls.
7. Creating new export opportunities by:
   - enhancing clearer supply chain visibility
   - quickly and accurately identifying the origin of the product
   - providing the framework for electronic certification for increased market access
8. Connecting growers with consumers and encouraging communications that could influence buying decisions.

Key outcomes

- Successful proof-of-concept of ISO/IEC-compliant data standards
- Understanding the value of the GS1 Global Location Number and National Location Registry for integrated traceability
- Understanding the importance of a digital traceability system for managing an emergency, biosecurity incursion or food safety recall
- Exploring the importance of data sharing agreements and permissions-based data
- Realising the potential for data standards to provide a framework for electronic certification for market access and protocol requirements
- An increased awareness of the value of connecting the grower and consumer via the GS1 Digital Link.

Appendices

Appendix 1. The GS1 Digital Link

The GS1 Digital Link can send information directly to the consumer, strengthening brand loyalty and improving supply chain traceability. Where a URL typically points to a single, specific website, the GS1 Digital Link enables connections to all types of business-to-business, business-to-consumer, and business-to-government. If a QR code is added to a product, using the GS1 standards provides a URL for people to scan and follows a web-based application that allows growers to promote anything they would like associated with their brand. As this system is protected by permissions-based data, the brand owner remains in complete control of the product but can still link to any number of information sources. The QR code contains a number for unique identification, the batch lot code linking to the pack details and an encrypted serial number allowing for full traceability of a product. The GS1 Digital Link is fast becoming the 'missing link' connecting product information from multiple locations to consumers, retailers and regulators.

Appendix 2. The National Location Registry

The National Location Registry (NLR) is a digital platform where information about locations is digitally stored and accessible to authorised users. Using a standardised location identification system, the NLR enables supply chain partners to speak a 'common language' when identifying a specific party or location. This also allows products or places to be uniquely identified and information about the location, such as the type of building, to be added.

Location identification and master data are critical components to achieving traceability. This includes identifying where a product is, where it should be or where it has been. Currently, property identification for horticulture is reliant on industry information and can be time-consuming to obtain. This makes tracing products for a recall, biosecurity incident or emergency, difficult. Many track and trace providers are using a variety of data in different traceability systems, resulting in a lack of interoperability with other systems and trading partners. Creating and keeping traceability information is a costly process and can be subject to errors. The NLR enables businesses to upload and manage their location data and share it with trading partners (with permission) for traceability along the supply chain, transport and logistics.

The NLR works using the following processes:

- **Location data owners** who provide data to the registry and make it available to be used for traceability purposes. These data attributes include the GLN for the location, location name, location type, company details, address, contact details and contact type. Location data owners control access to their data based on data recipient requests or can elect to make it public to the registry.
- **Location data recipients**, such as NSW DPI, NSW Food Authority or Woolworths, request access to location data or can search data that are publicly available. The registry enables the electronic publication, storage, retrieval and exchange of location identification and location master data between location, owner and relevant business partners. Location data recipients such as traceability solution providers can put this data into their applications, providing one source of current data.

Each GLN links to a master location data record, and each record will have the contact details and contact detail types, such as quality and safety, supply chain, operations or farm manager, that may be required for urgent contact in an incident or emergency.

Benefits for industry:

- having a central database with accurate location information to help effectively manage:
  - trading or operating hours for peak periods
  - safety constraints at a site
  - driver amenities available
  - weight/height restrictions
  - dedicated truck entry points
  - other site requirements such as drivers must wear hard hats
- it can be accessed via web or API
- there is a subscription model to link to internal systems and maintain currency via updates
- data are provided directly from the source.

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