Enhancing grape traceability from grower to consumer through GS1 Standards: A case study of the Australian table grape industry

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Abstract. The traceability of agricultural products, including grapes, is essential for ensuring food safety, quality control, and supply chain transparency. This article investigates the use of GS1 standards to enhance grape traceability from grower to consumer. Through a case study approach, we examine how Global Trade Item Numbers (GTINs), Global Location Numbers (GLNs), and Serial Shipping Container Codes (SSCCs) were integrated into grape production and distribution processes to harmonize domestic and export supply chains and prepare for global regulatory requirements.

1. Introduction

In the modern agricultural landscape, traceability is essential for ensuring food safety, quality control, and supply chain transparency. Grapes, as a key agricultural product, must be traceable from grower to consumer to meet increasing demands for food safety and sustainability. This article explores how GS1 standards — including Global Trade Item Numbers (GTINs), Global Location Numbers (GLNs), and Serial Shipping Container Codes (SSCCs) — enhance traceability in the Australian table grape industry, improving transparency and regulatory compliance across both domestic and export supply chains.

1.1. Importance of traceability in agriculture

Traceability in agriculture has become a vital component in maintaining food safety, quality, and transparency throughout the supply chain. As consumers increasingly demand to know the origins of their food, traceability systems allow for tracking produce from "farm to fork." According to the Food and Agriculture Organization (FAO), *"effective traceability systems reduce the risk of foodborne illnesses by identifying and*

addressing contamination sources quickly" (FAO, 2023)[1].

These systems not only help mitigate risks but also improve consumer confidence, ensure regulatory compliance, and facilitate efficient product recalls. Moreover, traceability promotes sustainability practices by encouraging responsible sourcing and enhancing the overall integrity of the food supply chain.

2. GS1 Standards overview and their role in agricultural traceability[2]

GS1 is an international, neutral, and non-profit organization that plays a pivotal role in creating and maintaining global standards for business communication, particularly within supply chains. Established in 1974, GS1's mission is to develop a common language for businesses, enabling seamless interaction across different sectors, geographical locations, and technological systems.

With local member organizations in over 150 countries, GS1 adapts its global standards to regional markets and needs, facilitating effective traceability in agriculture. For instance, the implementation of Global Trade Item Numbers (GTINs) allows for the unique identification of agricultural products, enabling tracking from the farm to

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[1]   https://www.fao.org/food-safety/food-control-systems/supply-chains-and-consumers/traceability-and-recalls/en/.

[2] www.gs1.org/

the consumer. This is crucial in addressing challenges like food safety and quality assurance, particularly in a global market where consumers are increasingly concerned about product origins.

In a world where supply chains are becoming more complex and consumer demands for transparency and safety are growing, GS1's role in standardizing processes and ensuring smooth business operations across borders and industries remains essential.

Figure 1. GS1 Standards overview and their role.

2.1. QR Code powered by GS1: enhancing traceability and consumer engagement

QR codes powered by GS1's Digital Link standards provide a robust solution for enhancing traceability, inventory management, and waste reduction. These codes connect consumers, retailers, and supply chain partners to a wide array of product data, including origin, batch/lot numbers, expiration dates, and real-time updates, enabling greater visibility and transparency across the product lifecycle. By seamlessly integrating product details into one scan, QR codes powered by GS1 unlock benefits for inventory efficiency, supply chain traceability, and freshness management, which in turn support sustainability goals and regulatory compliance.

2.1.1. Key Benefits of QR Codes powered by GS1

– **Inventory management**: QR codes powered by GS1 help businesses manage stock more effectively by encoding batch numbers, expiration dates, and serial numbers, enabling first-in-first-out inventory systems and improving the speed of returns processing.
– **Traceability**: With enhanced product traceability, businesses can easily authenticate products, perform targeted recalls, and track items through their entire lifecycle, building consumer and regulator confidence.
– **Sustainability & waste prevention:** By providing real-time information on product freshness and expiration dates, QR codes powered by GS1 help reduce food waste and ensure better management of

recycling and end-of-life processes, supporting the transition to a circular economy.
– **Compliance with regulations**: QR codes powered by GS1 simplify regulatory compliance by storing and retrieving critical data like product certifications, safety standards, and country of origin, ensuring businesses meet local and global requirements. he title is set in bold 14-point Arial, flush left, unjustified. The first letter of the title should be capitalised with the rest in lower case. You should leave 30 mm of space above the title and 5 mm after the title.

Figure 2. Utilize unique GS1 Digital Links to trace the origin of grapes, enhancing transparency for consumers.

Scanning provides supply chain partners & consumers
– product verification
– access to information on B2B or B2C Microsite

Scanning provides producers
– location scan data & feedback survey data

3. Case Study Approach: Australian table grape industry[3]

The Australian Table Grape Association (ATGA), in partnership with Agriculture Victoria, Perfection Fresh, and other stakeholders, conducted a traceability pilot to enhance traceability within the table grape industry. The pilot, conducted during the 2021/22 harvest season, aimed to develop a system that could provide end-to-end traceability from farm to consumer. The project integrated GS1 standards with existing farm systems, ensuring minimal disruption while enhancing data capture and transparency throughout the supply chain.

Figure 3. Supply chain diagram: GS1 standards enable supply chain partners to identify, capture and share information in à globally harmonised way.

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[3] https://australiangrapes.com.au/wp-content/uploads/2022/11/ATGA_traceabilityreport_FINdigital.pdf

3.1. The driver

Enhancing grape traceability from grower to consumer using GS1 standards is a crucial focus for the Australian table grape industry. Over the past decade, the industry has seen remarkable growth, with exports increasing by 300%, from $80 million to $623 million in 2019/2020, primarily driven by demand from Asia.

Several **key drivers** underscore the importance of traceability for export success:

1. **Regulation compliance**: Growers must prioritize traceability due to increasing regulations from importing countries, ensuring they meet international safety and quality standards.
2. **Global competition**: Australian table grapes are competing against other Southern hemisphere producers like South Africa, Peru, and Chile, making it essential to demonstrate superior traceability systems to maintain market position.
3. **Product safety and quality**: Consumers value high-quality, safe produce. Implementing traceability ensures that the end consumer enjoys a product that can be traced back through every stage of the supply chain.
4. **Limitations of existing systems**: Currently, product and cold chain traceability often end once the fruit enters export countries. This gap prevents Australian producers from monitoring fruit quality post-shipment and fully leveraging their brand value abroad.
5. **Building trust**: A robust traceability system from grower to consumer enhances safety and trustworthiness, helping Australian table grapes stand out in competitive international markets.
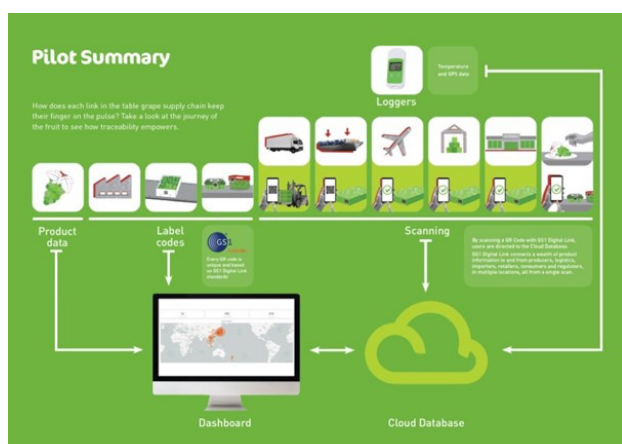

Figure 4. Table Grapes Traceability Pilot: Australia case study.

3.2. Benefits of GS1 Standards for grape traceability

Implementing GS1 standards in the table grape industry has brought several benefits:

- **Enhanced supply chain transparency:** The use of GTINs, GLNs, and SSCCs has enabled detailed tracking of grapes through every stage of the supply chain.
- **Improved consumer engagement:** QR Codes powered by GS1 allow consumers to access information about the product's origin, handling, and quality, thus fostering trust.
- **Support for regulatory compliance:** With increasing global regulations on food traceability, GS1 standards help producers meet requirements, such as those from the US FDA, ensuring that their products can be traced back to the farm within 24 hours.
- **Reduction of food fraud:** The unique product identifiers help detect and prevent fraudulent activities by ensuring that only genuine products reach the market.

This pilot serves as a model for other horticultural industries, showcasing the potential for GS1 standards to transform traceability and drive industry-wide improvements in product integrity and consumer confidence.

4. Conclusions and findings

The integration of GS1 standards into the grape supply chain offers transformative benefits for the industry, from enhanced transparency and regulatory compliance to improved consumer trust and engagement. The case study of the Australian table grape industry demonstrates that adopting GTINs, GLNs, and SSCCs provides robust tracking from the farm to the consumer, ensuring product integrity and supporting the industry's competitive position in global markets.

Looking ahead, the continued adoption of GS1 standards presents an opportunity for broader applications across various agricultural sectors. Future challenges, such as the need for scalability and the integration of emerging technologies (like blockchain), will be critical to enhancing traceability further. By addressing these challenges and leveraging the full potential of standardized systems, the agricultural industry can ensure a more secure, transparent, and sustainable food supply chain.

5. References

1. Food and Agriculture Organization (FAO) (2023). Traceability and recalls https://www.fao.org/food-safety/food-control-systems/supply-chains-and-consumers/traceability-and-recalls/en/

2. GS1 (2023). The Role of GS1 Standards in Global Traceability www.gs1.org/

3. Australian Table Grape Association (ATGA) (2022). Enhancing Traceability within the Table Grape Industry https://australiangrapes.com.au/wp-content/uploads/2022/11/ATGA_traceabilityreport_FINdigital.pdf