GS1 Australia

From Hive to Harvest:
Enhancing Bee-to-Tree Traceability for Sustainable Agriculture

CASE STUDY

First-of-its-kind Pollination Traceability System:

This project demonstrated the real-world implementation of GS1-compliant traceability standards across two industries, horticulture and apiculture, via commercial platforms (GrowData Ops and B-QUAL Australia Pty Limited). This addressed a long-standing data-sharing and compliance challenge, especially for chemical use near hives.

The Australian Bee-to-Tree project aims to improve traceability in the apiarist and orchardist communities, particularly for Almond, Apple, and Pear growers. By creating a unified data standard and implementing advanced traceability solutions, the project drives the tracking of pollination events, including hive movement, hive health inspection and farm chemical applications efficiently. The project, with co-investment from Agriculture Victoria and the Australian Research Data Commons (ARDC), engaged with partners the Almond Board of Australia, the Victorian Apiary Association, and the Australian Honey Bee Industry Council (AHBIC). This initiative enhances transparency, accountability, and operational management across the supply chain while addressing critical challenges in bee health and agricultural sustainability.

" Record keeping and biosecurity controls are now more important than ever for Australian honey production. An effective integrated traceability system using GS1 data standards will enable secure and seamless data sharing regarding orchard chemical applications in relation to beehive movements and health between the apiarist and orchardist communities."

Paul Costa
Director
B-QUAL

The Challenge

Bees pollinate tree crops and are essential for fruit production. Significant bee deaths near the border of New South Wales and Victoria in Australia exposed critical challenges in hive management. A major obstacle was the lack of traceability, which limited the ability to monitor hive health, manage biosecurity threats such as Varroa mites, and meet both regulatory and market requirements. To overcome these issues, the development of a robust, integrated traceability system became essential for enabling accurate data capture and effective information sharing between the orchard and apiary industries.

The Solution

The project leveraged GS1 standards to develop a comprehensive traceability system tailored to the needs of orchards and apiaries. Key activities included:

1. **GS1 Identification Keys:** GS1 Global Location Numbers were allocated to orchards, GS1 Individual Asset Identifiers were used to identify the bee hives and GS1 Global Service Relation Numbers were allocated for the chemical applicators and for the apiarists that move the bee hives. B-QUAL Certifiers were also identified as they conducted the audits on the bee hives.
2. **Data Standardisation:** Existing data standards for orchards were expanded to include GS1-compliant Critical Tracking Events (CTEs) for pollination, as well as their defined Key Data Elements (KDEs). GS1 EPCIS event data structures were adapted and validated against these, and the GS1 ECPIS Data standards for farm events were developed and tested as a framework for event and master data across farm types.
3. **Technology Integration:** Data from research and industry systems, including Agriculture Victoria and AHBIC's B-QUAL, was recorded and integrated using APIs for seamless sharing and storage. Field tests included API-based permission requests and filtering of permissioned data. InformAg's GrowData Ops integrated all GS1 Identification keys into their database as a first commercial implementation. This enables the linking of the key data elements to the critical tracking events.
4. **Digital Tools:** A user-friendly dashboard was developed, enabling stakeholders to control data access and sharing permissions, aligned with the Australian Farm Data Code and Food Agility CRC's Data Sharing Template.
5. **Demonstration and Training:** Practical demonstrations and training sessions validated the system with three farms and three apiaries during almond pollination trials.

By addressing these challenges, the system provided a foundation for enhanced operational efficiency and regulatory compliance.

The Results

The Bee-to-Tree project achieved several critical outcomes:

- **Consensus on Standards:** A unified set of GS1 data and metadata standards was established, covering provenance, compliance, and quality attributes.
- **Integrated System:** APIs enabled seamless data exchange between orchard and apiary systems, facilitating real-time insights and collaboration.
- **Demonstrator Use Cases:** Real-world trials showcased the benefits of the traceability framework, including improved monitoring of chemical applications and hive health and user-defined data sharing between apiarists' and orchardists' existing solutions.
- **Data-sharing Opportunities:** Beekeepers involved in the trial showed interest in data-sharing and saw opportunities for improved hive health decision support services validating the B-QUAL food safety program.
- **Enhanced Tools:** The system supported automated tracking of hive health metrics (e.g., temperature, humidity, weight) and chemical spray data, ensuring informed decision-making.

The Benefits

The traceability system delivered measurable benefits:

1. **Operational Efficiency:** Automated data sharing reduced manual entry and improved accuracy, saving time and resources for both orchardists and apiarists.
2. **Improved Hive Health Monitoring:** Real-time tracking of hive conditions and chemical exposure minimised risks to bee populations.
3. **Compliance and Transparency:** The system is aligned with regulatory standards, enhancing market access opportunities for stakeholders.
4. **Stakeholder Collaboration:** Secure data sharing strengthened trust and cooperation between orchardists, apiarists, and regulatory bodies.

The Future

The Bee-to-Tree project lays the groundwork for broader adoption of traceability solutions across the agricultural sector. Future developments include:

- **Scaling the system** to other crops and industries.
- **Refining tools** to manage larger data volumes and improve usability.
- **Extending market access** through transparent supply chain reporting.
- **Promoting sustainable practices** through informed decision-making and better management of chemical applications.
- **Development of a traceability system** to include new Critical Tracking Events (CTEs) of the hive to help manage Varroa mites, monitor chemical applications to hive boxes and provide a lifetime traceability record for the hive.

- **Scaling data collection** across more sites and longer periods to capture seasonal trends and environmental influences on hive health that could be made available for industry as a generalisable service.

By addressing emerging challenges like pesticide impacts and biosecurity threats, the project aligns with global trends in agricultural traceability and sustainability.

Call to Action

The Bee-to-Tree project demonstrates the potential of traceability to revolutionise agriculture. Stakeholders across the orchard and apiary industries are encouraged to adopt these solutions to enhance transparency, efficiency, and sustainability. This case study highlights the transformative potential of integrated traceability systems in fostering collaboration, improving outcomes and driving innovation in agriculture.

More Information

To learn more about how traceability solutions can be tailored to your operations, contact **GS1 Australia**. This project received co-investment (doi.org/10.47486/DC109) from the ARDC. The ARDC is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS).

" By connecting the GrowData Ops spray diary with apiary platforms like B-QUAL, orchardists and apiarists can efficiently exchange vital information on spray activities and hive movements, and the GS1 standards ensure consistency and cohesion across industries. The insights that can be gained by sharing such information has the potential to give growers better data on how pollination services influence crop performance outcomes, as well as support best practices in chemical applications for hive health and record-keeping for traceability. We look forward to continuing to support this space by giving growers a tool that is practical, easy to use and helps them make data driven decisions."

Steve Lockyer
Inform Ag Director

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