



**FPSC 2025  
Innovation Agenda  
Rapid Diagnostic Methods  
for Foodborne Pathogens:  
Outlook for the Fresh  
Produce Industry**

July 2021

## How can we quickly identify pathogens on fresh produce?

The Fresh Produce Safety Centre (FPSC), an industry-led, not-for-profit company established to enhance fresh produce safety across Australia and New Zealand, has identified that the quick and reliable identification of pathogens on fresh produce is an area ripe for innovation, and that this area could be a game changer for advancing food safety in the fresh produce industry.

## What did we set out to do?

The FPSC set out to review the area of 'rapid diagnostics' – or the way that pathogens can be quickly, reliably and cost-effectively identified on fruit and vegetables. We wanted to know what research was being undertaken, what stage of development these rapid technologies are at and what needs to happen so that growers and others in the supply chain can use these technologies for quick and reliable testing for pathogens on fresh produce.

## Why did we undertake this study?

One of the key issues facing the fresh produce industry is the time, expertise and cost of testing for pathogenic microorganisms (e.g. bacteria or viruses) in order to make sure that produce is safe for the consumer.

- **Time:** It is important that results can be produced fast enough to enable potential risks to be detected before produce departs the warehouse. Most conventional tests for microbes take between 1-3 days to complete, meaning produce may be already on shelves before results are returned.
- **Expertise:** Another factor is the ease of use, expertise and equipment required for testing. Most samples need to be sent to a specialist lab, requiring high levels of expertise and sophisticated equipment. This prevents or restricts the ability for this testing to occur on farm.
- **Cost:** Tests can potentially run into the hundreds of thousands of dollars annually.

Conventional methods of pathogen detection are typically slow, laborious, and not precise to species

or subspecies level, involving culturing of bacteria or relatively difficult and expensive procedures that require expertise and a well-equipped laboratory.

## Why do we need rapid diagnostic methods?

We identified the following reasons for interest in advancing rapid diagnostics:

- Current methods are time-consuming, expensive and not sufficient for rapid detection in fresh produce samples.
- Rapid, sensitive, inexpensive and reliable detection is needed to give real-time results.
- Faster results will mitigate and prevent outbreaks of foodborne illness, improving delivery times, safety and profitability.

Ideally, it will be possible for testing to be performed on-site by staff using inexpensive, simple and robust devices, requiring only a minimal level of training to ensure reliable results.

## What challenges are there to the use of rapid diagnostic methods in the fresh produce industry?

Detection of pathogens in a fresh product is dependent on a number of variables including:

- Type and structure of the produce
- How produce is grown, processed and handled
- If there is a potential for internalisation of pathogens (as opposed to the pathogens just being on the surface of the product), which requires internal sampling. Internal sampling introduces other complications and will generally require additional and special preparation steps before detection, and / or may preclude certain types of rapid methods.

## What did we find?

**No one-size-fits-all solution.** Due to the differences across fresh products, there may be a need to develop a specific rapid diagnostic method for each fresh produce product.

Risk factors for contamination are also different for each type of produce. Integration of rapid diagnostic methods into the industry will likely involve risk assessment on a case-by-case basis, and there may be implications in terms of the best methods to apply, frequency of testing, at what point(s) in the process and supply chain it is most effectively applied, and the stringency of tests required.

## What are the most promising types of RDMs for the fresh produce industry?

**Microfluidic chip (e.g. "lab-on-a-chip" devices) and paper-based devices (e.g. lateral flow test strips)** appear most promising in "real world" testing scenarios and offer the advantage of being affordable, sensitive, specific, easy to use and quick to provide results. The detection methods in such devices are generally based on different types of biosensors, sometimes with a pre-sensing step also incorporated. Further data interpretation can be sometimes provided by inputting signals or data into smart phone apps or the like.

## What will drive uptake of rapid diagnostic methods in the fresh produce industry?

It is important that the realistic expectation of a suite or "toolbox" of useful methods that could be selected for their suitability by each producer is expected and understood by the industry as an outcome of further research. Industry bodies have an important role to play in compiling information about the requirements and preferences of industry members and using this information to lead to the development of useful, robust prototype rapid methods. Prototypes will need to be extensively tested in the field to ensure that existing challenges to translating promising laboratory techniques to "real world" settings can be overcome.

## Conclusions and recommendations

The fresh produce industry has high variability – between produce types, growing techniques, handling and processing methods and the end use of the product by the consumer. These increase



the challenges to finding appropriate rapid methods that can provide fast, reliable and inexpensive results in a "real world" setting. Various lab-on-a-chip devices incorporating biosensors are promising methods that may be able to meet all these requirements. However, it is unrealistic to expect one single chip-like device to be suitable for the entire fresh produce industry. Instead, we suggest a suite of methods should be investigated, developed and validated, allowing each producer to choose the method(s) most suitable for their needs from this "toolbox".

FPSC recommends focusing on:

- Further investigating, developing and validating a small suite of promising methods.
- Two to three high priority produce sectors which have the greatest need.
- External pathogen contamination over internalised pathogens.
- Engaging several industry "big players" first, and including other industry members later in the development pathway.

## How can you get involved?

- Read the full report [here](#).
- Join the FPSC mailing list [here](#) to be kept up to date on further events and updates.
- Email FPSC on [info@fp-sc-anz.com](mailto:info@fp-sc-anz.com) with your views on how the industry can further advance rapid diagnostic methods.



## About the FPSC

The Fresh Produce Safety Centre Australia & New Zealand brokers connections and collaborations with global leaders in fresh produce to build industry capacity and capability that delivers safer fresh produce to consumers. We do this through innovation, knowledge and leadership. More [here](#).

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### Fresh Produce Safety Centre Limited

Room 517, Level 5  
Life Earth & Environmental Sciences Building, F22  
City Road  
The University of Sydney NSW 2006  
Email: [info@fpssc-anz.com](mailto:info@fpssc-anz.com)

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