Research and Development Project Review

VG07079: Reducing *Listeria monocytogenes* contamination from salad vegetable farms

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Introduction

Although now **nearly 10 years old,** this project revealed findings that are still not well known or understood by industry yet have been experienced by numerous businesses in Australia, New Zealand and elsewhere in recent times. The issue is the proximity of livestock to, particularly, vegetable, herb and melon enterprises, and the likelihood of crop contamination by pathogens 'on the wind'.

This study suggests for the first time that in Australia *Listeria monocytogenes* (*L. monocytogenes*) is spread predominantly by the wind on hot dry days. The study supports the circumstantial observation that *Listeria* problems in the leafy vegetable industry are more of an issue in Victoria in summer.

The *L. monocytogenes* bacterium has been widely detected in the environment and on plants, including leafy vegetables, but it is its method of survival and dispersion that makes this project particularly interesting and relevant to growers. Understanding this leads us to recommendations that can help reduce the prevalence of *L. monocytogenes*.

Added to this is testing. Retailers have set very tight specifications that suppliers of value-added fresh vegetables must comply with, based on the Food Standards Australia New Zealand (FSANZ) Microbial Guideline Criteria for Ready-to-eat (RTE) Foods contained within the Compendium of Microbiological Criteria for Food[1]. This, in turn, has led to many grower-suppliers having to pre-test their vegetables for the presence or absence of *L. monocytogenes* as a condition of supply to processors, or processors testing their raw materials. The problem, however, is that there are a number of *L. monocytogenes* tests available and often the grower is confused as to which test should be used.

Furthermore, many growers are unaware of how *L. monocytogenes* enters farming land to contaminate their crops and how to reduce the incidence of this bacterium in the field. The project developed an information package on this issue for growers.

Why undertake this research?

L. monocytogenes is a human pathogen that causes foodborne illness and can cause serious disease outbreaks in humans. Listeriosis, the illness that results from *L.* monocytogenes, can

[1] http://www.foodstandards.gov.au/publications/Pages/Compendium-of-Microbiological-Criteria-for-Food.aspx

have a mortality rate of 30% of illness cases in food outbreak situations. The prevalence of listeriosis has been increasing globally.

Various foods including salads and rockmelons have been responsible for listeriosis outbreaks. Experience shows that an outbreak of listeriosis attributed to a particular grower and/or brand will bring severe reputational harm to that grower and/or brand, other growers and brands of the same product and quite possibly to the entire salad vegetable or melon category. Lost sales are a huge cost to all involved and may persist for months or years.

What was done?

This project:

- Tested cos lettuce, fancy lettuce (oak, coral or butter), curly parsley/coriander and, when available, celery over two years in both summer and winter. Summer testing took place January -March. Winter testing took place between June – October for year one and in June and July in year two. Testing sites were vegetable growing districts in Victoria and Queensland.

- Examined how *L. monocytogenes* is tested for and looked at the value of a rapid testing method.

- Carried out testing for *L. monocytogenes* on environmental samples including water, sheep manure, cow manure, chicken manure, marsupial manure and decomposing plant matter to attempt to identify where *L. monocytogenes* can be found in the environment.

- Produced a guide for vegetable and herb growers to use when managing *L. monocytogenes* on farm and delivered knowledge and information to growers.

What were the results and what do they mean for growers?

1. Listeria monocytogenes on farm:

Firstly, what was *not* found? *L. monocytogenes* was *not* predominantly spread by water and chicken manure, two common farm inputs in Australian vegetable farming.

Significant findings were made:

- *L. monocytogenes* is more prevalent in summer, and in Victoria.

- *L. monocytogenes* was found to be present in high numbers in silage and baled hay, which are fed to and ingested by ruminants (cows, sheep, goats); this passes through the animals usually without causing infection to them.

- *L. monocytogenes* remains trapped within dust when the faeces becomes dry in hot weather. The dust carrying the *L. monocytogenes* can then settle on and contaminate vegetables after being blown large distances by strong winds.

- Leafy vegetables (e.g. curly parsley) that can trap dust more effectively usually show higher levels of detection than smooth leaf vegetables, such as cos lettuce.

- Intensive livestock operations (feedlots) and grazing cattle, sheep and goats should be kept as far from vegetable production as possible and particularly in the direction of prevailing summer winds.

2. Testing for Listeria monocytogenes:

- *L. monocytogenes* can be detected in a number of ways, many growers do not realise which method their laboratory will use.

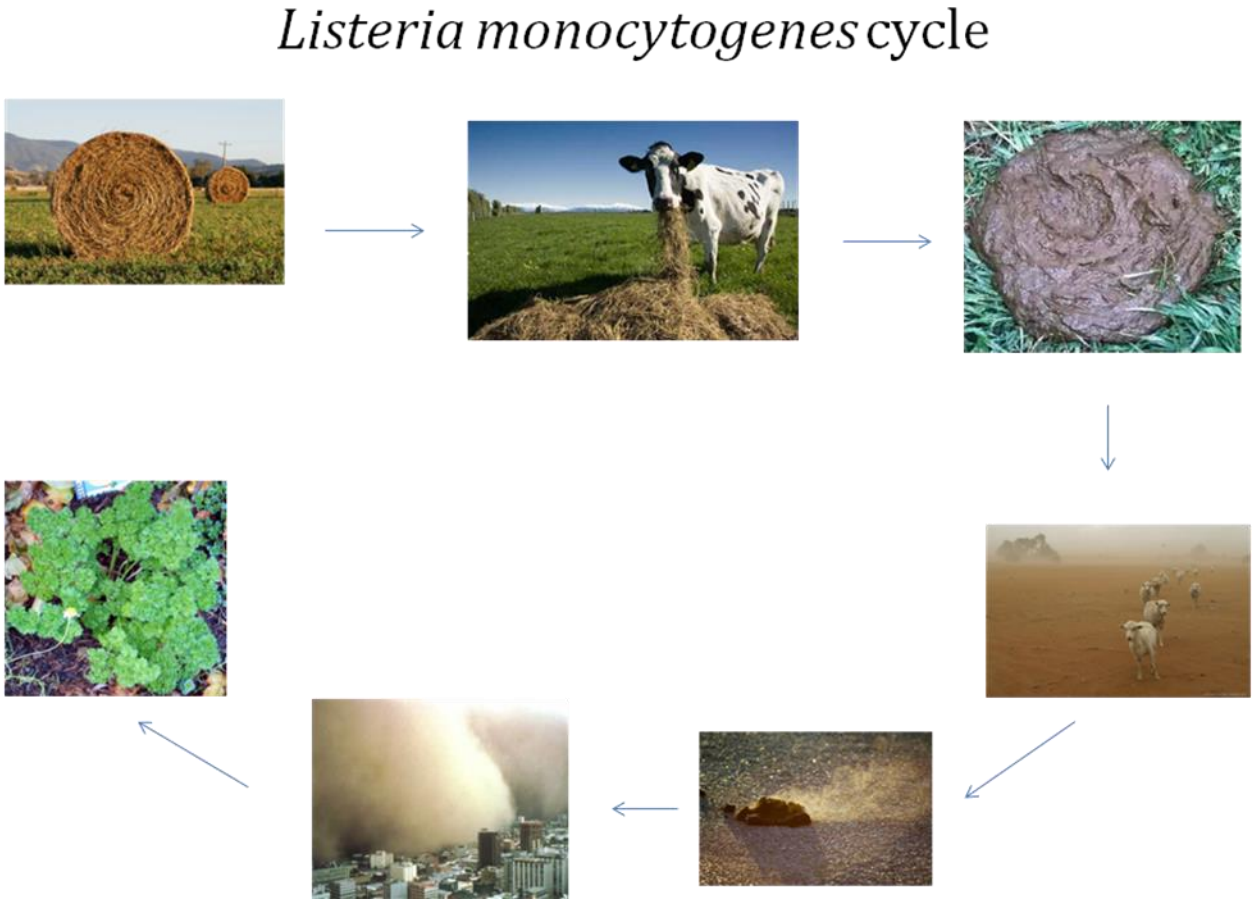
- There are six species of *Listeria* that are found in the environment and only one is pathogenic to humans. Growers should specify a *L. monocytogenes* test as opposed to a generic test as 1) retail specifications are, and FSANZ guidance is, for *L. monocytogenes* and 2) reporting a positive result for non-pathogenic *Listeria* may be unnecessarily detrimental to the grower.

- Rapid testing is not the preferred manner to detect *L. monocytogenes* on produce but can be used as a preliminary screening test followed by culture and enumeration.

- The Australian Standard method based on culture and enumeration is the preferred method to use when testing for *L. monocytogenes.*

The final report for this project contains "Best practices for the management of Listeria monocytogenes on farms"

Photographs of some of the bales of hay that tested positive for *L. monocytogenes*. (Photos taken by author)



Full final report available here:

https://ausveg.com.au/app/data/technical-insights/docs/VG07079.pdf

Best practices for the management of *Listeria monocytogenes* on farms

What farming practices may contribute directly to *L. monocytogenes* contamination of produce?

L. monocytogenes can multiply in a number of environments over a range of temperatures from low to high (as low as 2ºC). It is important to understand that *L. monocytogenes* needs nutrients and sufficient water to multiply at these temperatures. It multiplies readily in decaying vegetable matter and hence it is important to remove as much of this from the field as possible after harvest. Good field hygiene practices should be followed and green waste should be collected and properly composted at high temperature to destroy any *L. monocytogenes* that may be present. In addition it is important not to use hay or silage in the field operations, particularly hay that has been stored for an extended period.

Do I allow farm animals to enter a vegetable field?

Cows and sheep pass *L. monocytogenes* through their digestive system. The *L. monocytogenes* originates from fermented vegetation, usually hay and silage. As we do not fully understand how long the animals continue to pass this bacterium after going from hay to fresh grass, the best practice is to keep ruminants away from vegetable farms.

What can I do to reduce *L. monocytogenes* from contaminating my produce?

Because *L. monocytogenes* is thought to enter vegetable farms as dust particles carrying animal faeces from possibly distant sites and carried by strong winds, it is important to institute good practices on the farm that take strong winds in summer into account. It is important to try not to overhead irrigate vegetables just before strong winds (greater than 45Km/h) are expected on hot dry days as wet plants attract more dust. The direction of the winds is also important. In Victoria winds from the north are more likely to carry dust from distant grazing areas. In Queensland, winds from the south are more likely to carry dust from grazing areas.

Preferably water vegetables immediately after the winds subside to wash away any dust.

The study also found that vegetables with lots of leaf curls and lobes attract more dust (and more *L. monocytogenes*) than vegetables that have smooth leaves. Try and select varieties that have fewer curls and lobes.

L. monocytogenes dies rather fast on healthy plants, so try and harvest at least 48 hours after a strong wind event on hot dry days.

Rotting vegetation is considered as primary source of *L. monocytogenes* so field hygiene is important. Do not dig in waste vegetation unless it is properly composted (composting generates high temperatures that kill *L. monocytogenes*). In addition, the practice of digging in green manure needs to be evaluated as a possible source of *L. monocytogenes* growth. Most importantly, do not use hay as part of your farming practices unless the hay is fresh and has not undergone fermentative breakdown.

How do I remove *L. monocytogenes* from my produce if I suspect that it has been exposed to dust on hot dry days?

Washing of vegetables before delivering to a market is still the best way to reduce the level of *L. monocytogenes* on the produce. It is important to use a turbulent washing system as static washing systems do very little in reducing the level of dust on produce. The best way is to use a turbulent wash bath containing an AVPMA approved sanitiser capable of killing bacteria in solution.

What should I test for *L. monocytogenes* on my farm?

Only test produce. There is little point testing soil or water for the presence of *L. monocytogenes* as levels are low and have little or no impact on produce contamination. If you have packing shed, then you need to abide by the current protocols for contaminants.

Which test do I specify when having my produce tested?

Growers should specify tests for produce that only detect *L. monocytogenes* and that are based on Australian standards or equivalent. Positive tests must be followed by full enumeration. The test must be reported back as negative, or positive with enumeration. Only then can a grower make decisions about their produce status.

How many species of *listeria* are there?

When this project research was conducted, there were four or five species of *listeria* identified. As of 2019, there are about 16 identified species.