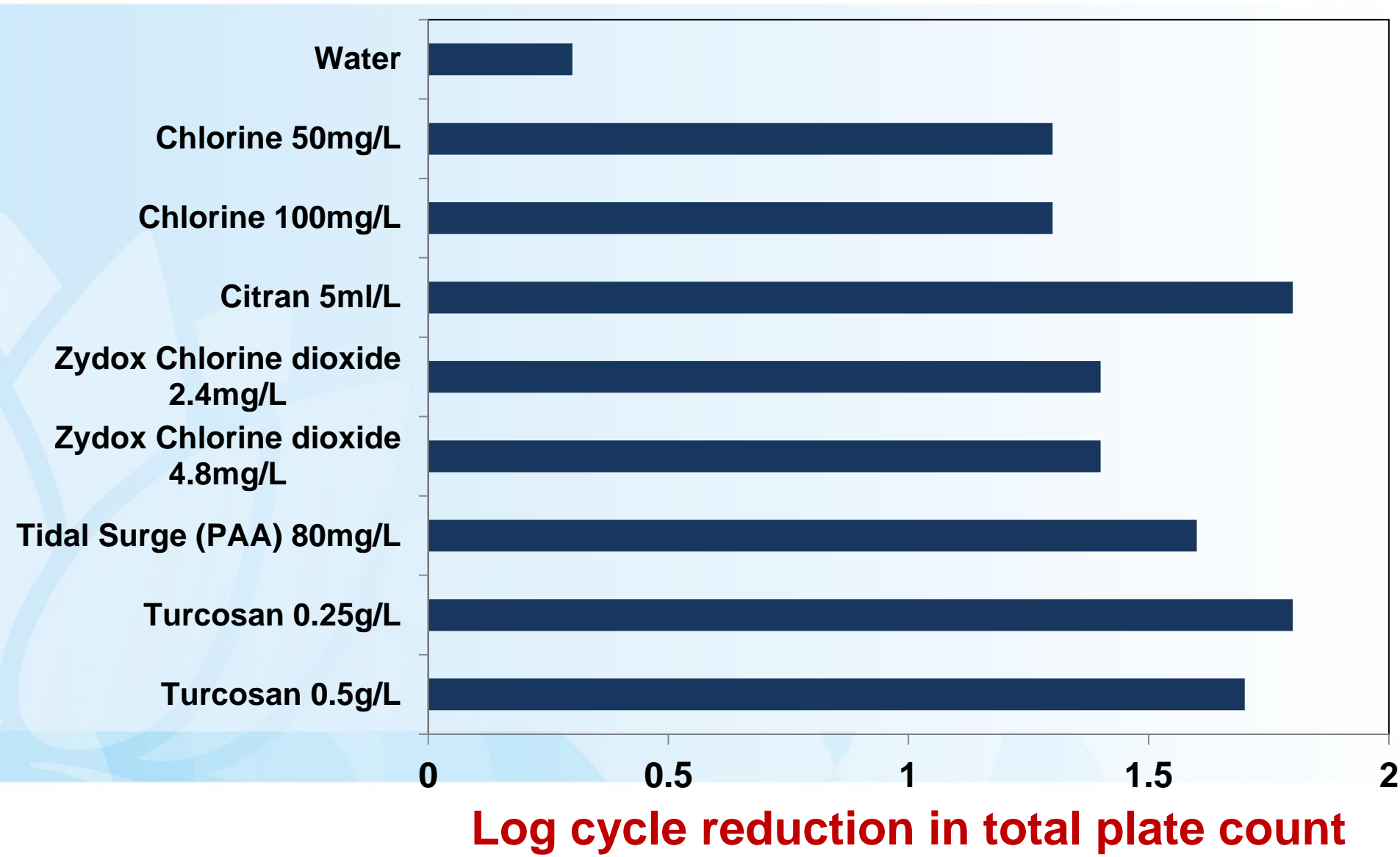


# Reduction in total plate count by sanitisers





Department of  
Primary Industries

# Postharvest Practices to Mitigate Food Safety Risks in Rockmelons

**S.P. Singh<sup>a</sup> and Andrew Watson<sup>b</sup>**

<sup>a</sup> **Central Coast Primary Industries Centre, Gosford**

<sup>b</sup> **Yanco Agricultural Institute, Yanco**

# Presentation Outline

- Background: food safety hazards
- Microbial risks: sources and routes
- Industry practices: a snapshot
- Research on sanitisers
- Conclusions

# Background

- Food safety is a continuing challenge
- Horticultural products linked to foodborne illnesses outbreaks
- Feb 2016, 143 cases due to pre-packed leafy veg salad



# Types of Food Safety Hazards

```
graph TD; A[Types of Food Safety Hazards] --> B[Chemical]; A --> C[Microbial]; A --> D[Physical]
```

**Chemical**

**Microbial**

**Physical**

# Microbial food safety risks

Bacteria, parasites, and viruses

- *Listeria monocytogenes*
- *Salmonella species*
- *E.coli* (pathogenic strains)
- *Campylobacter*
- *Cryptosporidium*
- Noroviruses
- Hepatitis virus

# Microbial food safety risks

## *Listeria monocytogenes*

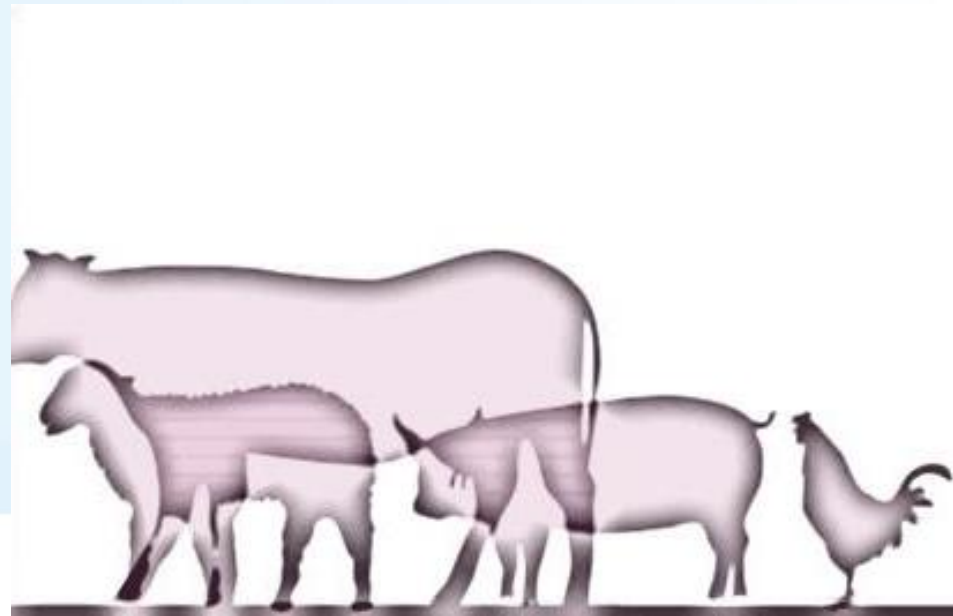
- bacteria found in soil, water, & animals
- causes listeriosis in older people, pregnant women and immuno-compromised people
- can survive and grow even in cold store
- rockmelons under scanner during the Listeria-outbreak in 2010



# Microbial food safety risks

## *Salmonella species*

- live in the intestinal tracts of animals and humans
- causes gastroenteritis
- severe symptoms in children and elderly
- rockmelons linked to a *Salmonella*-outbreak in 2006





# Microbial Food Safety Risks

```
graph TD; A[Microbial Food Safety Risks] --> B[Preharvest]; A --> C[Postharvest];
```

**Preharvest**

**Postharvest**

# Microbial food safety risks

## Pre-harvest contamination

- Proximity to soil, surface netting
- Organic fertilisers (raw manures)
- Contaminated irrigation water (sprinklers)
- Run off from nearby livestock operations
- Livestock and wildlife access to the paddock



# Microbial food safety risks

## Postharvest contamination

- Dump tank-cross contamination
- Wash water without a sanitiser
- Fungicide tank contaminated with bacteria
- Wet surface on packing line
- Workers hygiene and sanitation
- Packing house equipment and cold storage

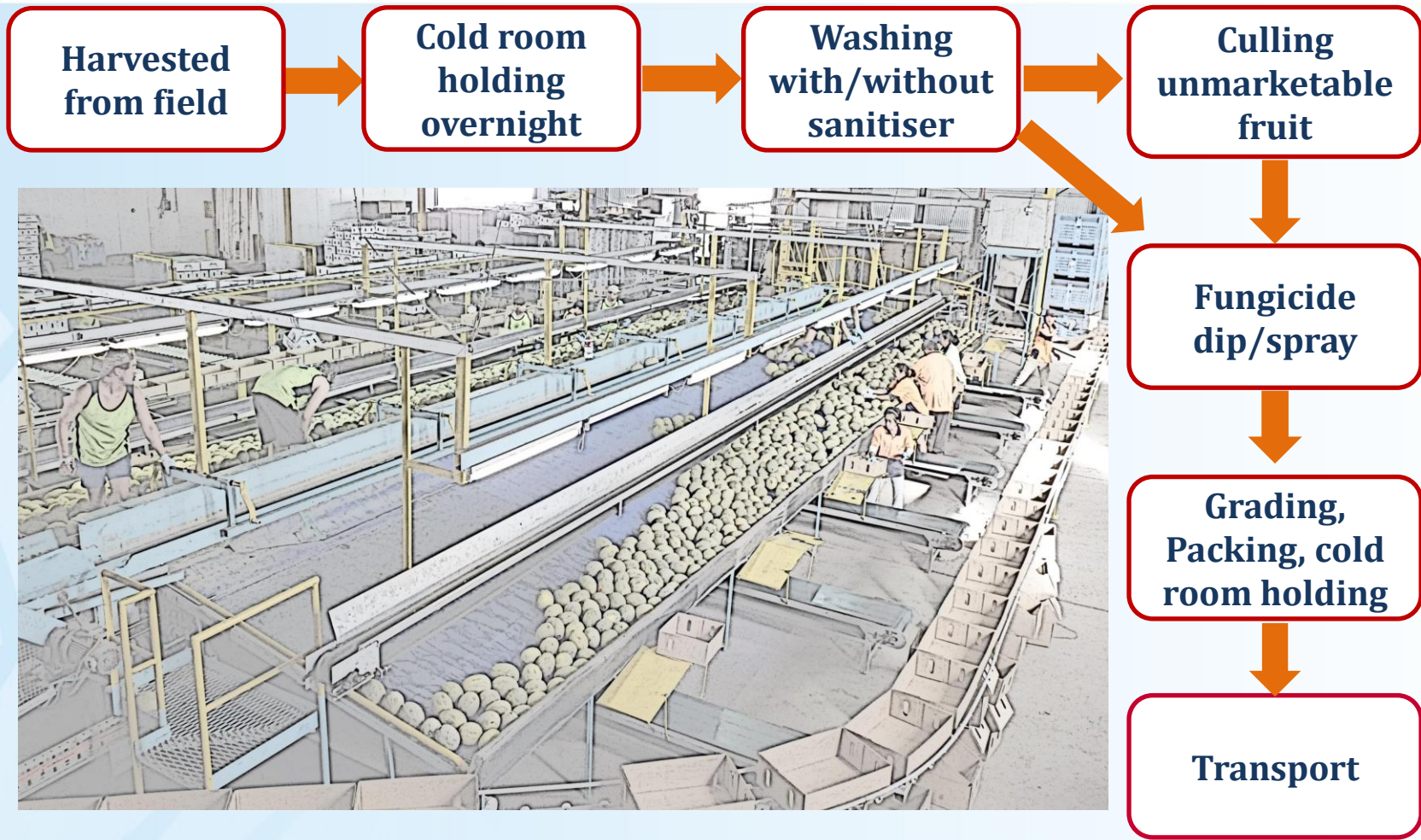


# ACIAR sub-project objectives

- Assessment of the current food safety practices followed by the melon industry
- Evaluation of new sanitisers and sanitation systems to mitigate food safety risks in melons
- Improve the industry practice



# Postharvest practices in a rockmelon packing house



# Variability in industry practices

	<b>A</b>	<b>B</b>	<b>C</b>
<b>Wash water source</b>	Filtered channel water	Town water	Channel water
<b>Wash water run to waste</b>	☑	☑	X
<b>Sanitiser used</b>	☑	X	X
<b>High pressure washing</b>	☑	X	X
<b>Monitoring &amp; recording</b>	☑	X	X
<b>Food safety certification</b>	☑	☑	?

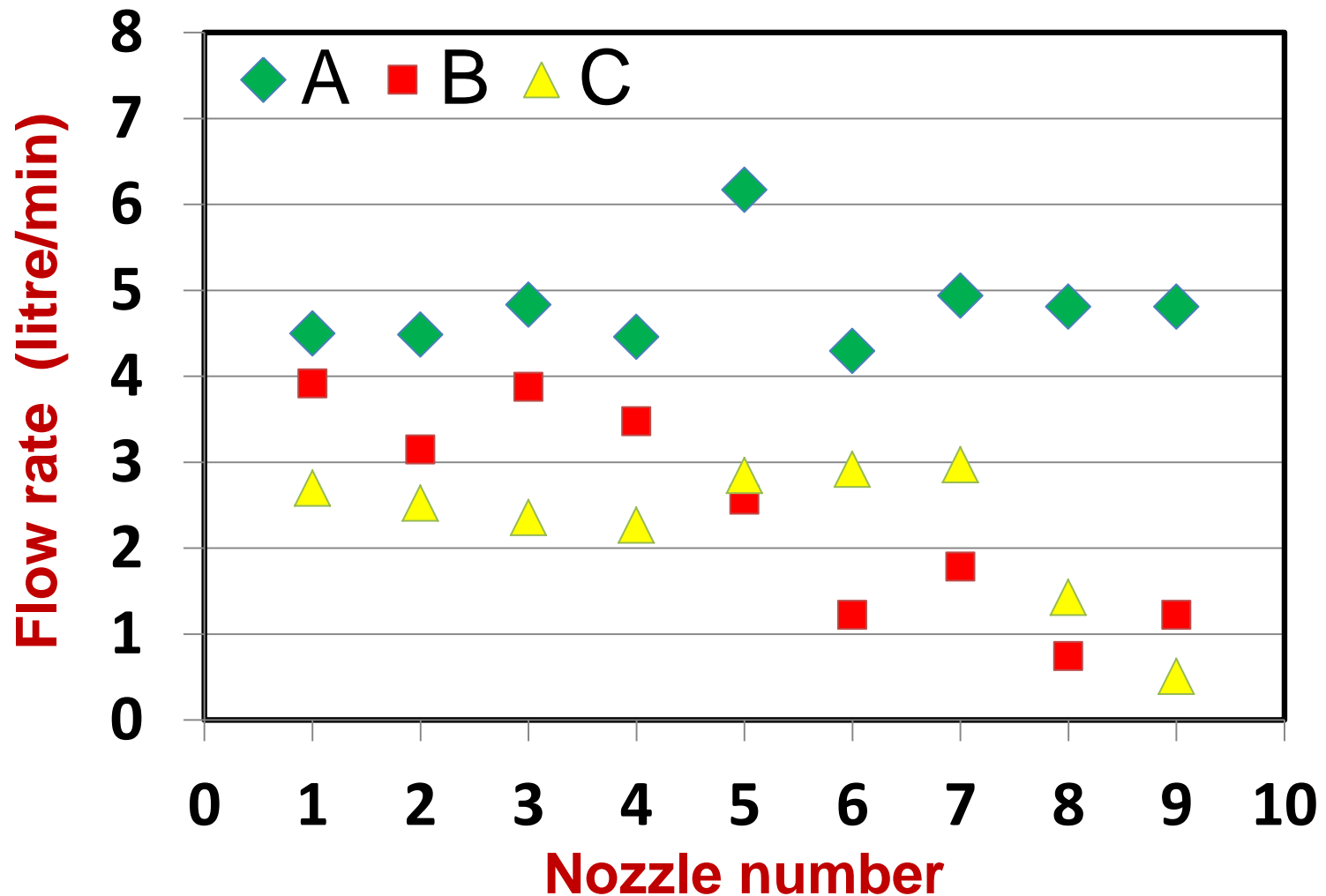
# Variability in industry practices

- **Washing**
  - High pressure (?? psi)
  - Normal pressure (?? psi)



# Variability in industry practices

- **Sprayer** (Number and positioning, and flow rate uniformity)





# Postharvest washing

- **Brushing: Overhead versus flatbed**



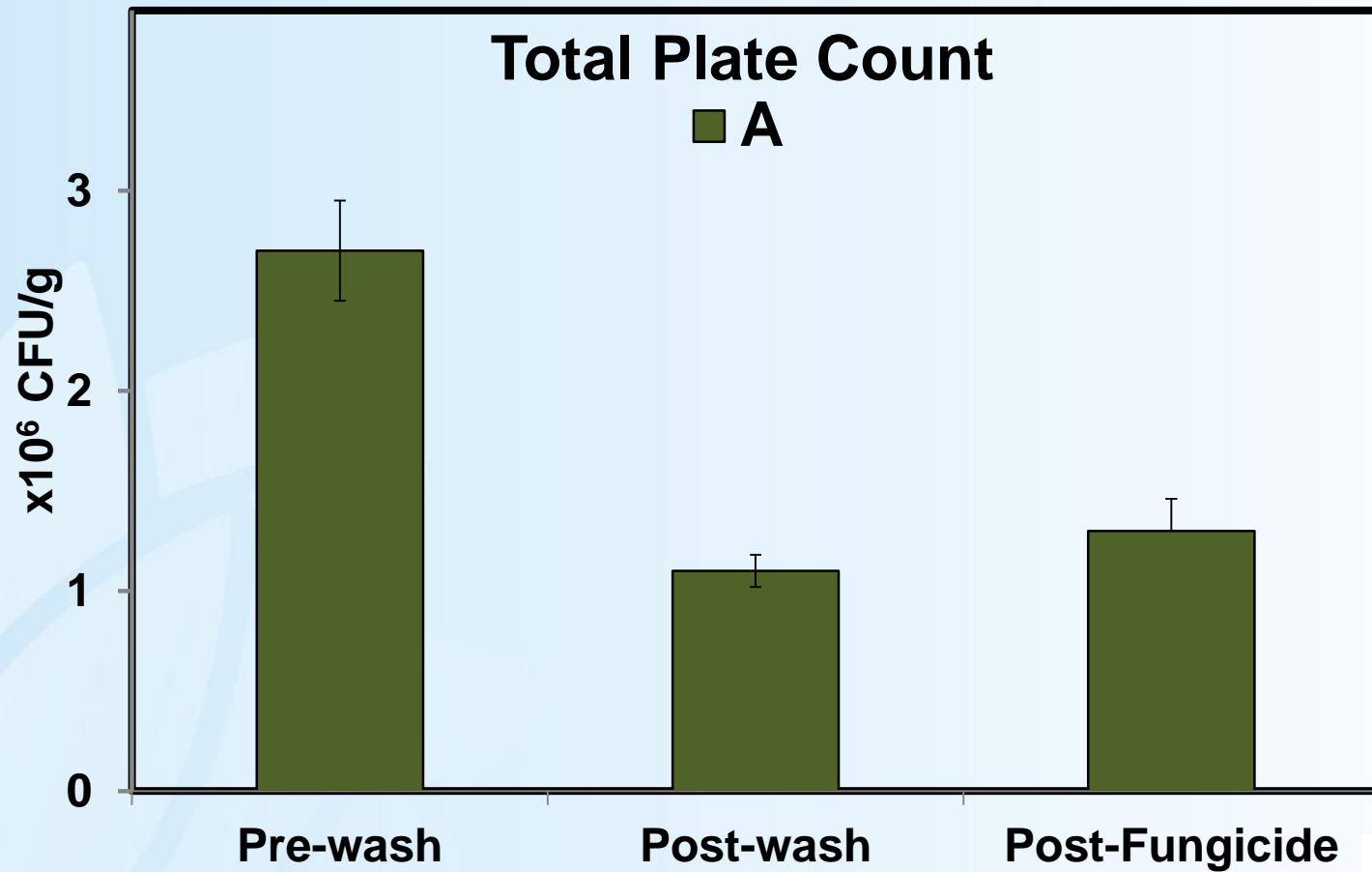
# Variability in industry practices

<b>Wash water</b>	<b>A</b>	<b>B</b>	<b>C</b>
<b>Chlorine (ppm)</b>	<b>17.6</b>	<b>0.15</b>	<b>0.0</b>
<b>ORP (mV)</b>	<b>763</b>	<b>432</b>	<b>349</b>
<b>pH</b>	<b>7.7</b>	<b>8.7</b>	<b>8.0</b>
<b>Exposure time (sec)</b>	<b>90</b>	<b>45</b>	<b>45</b>

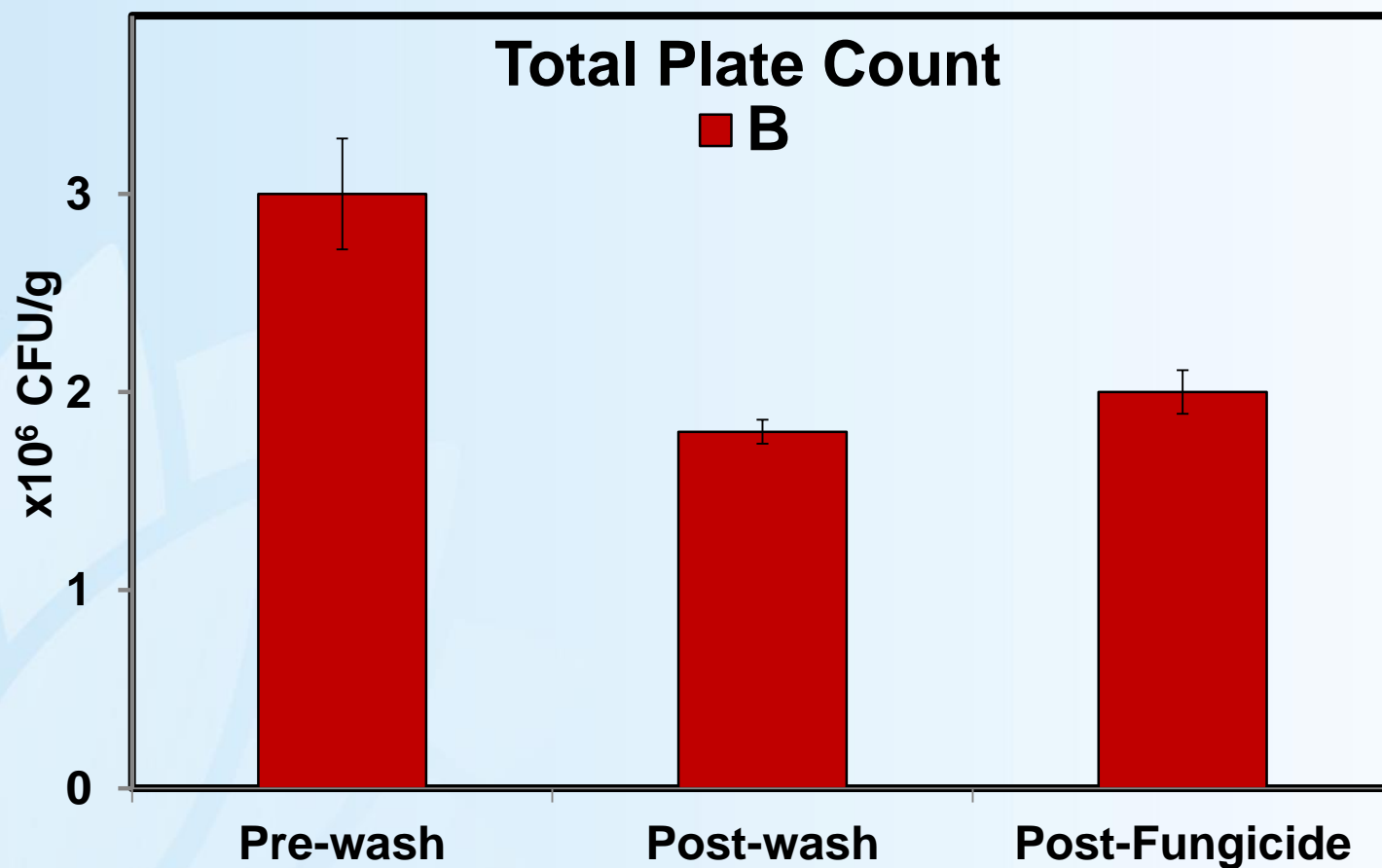
**ORP-Oxidation reduction potential- an indirect measure of the sanitation potential**



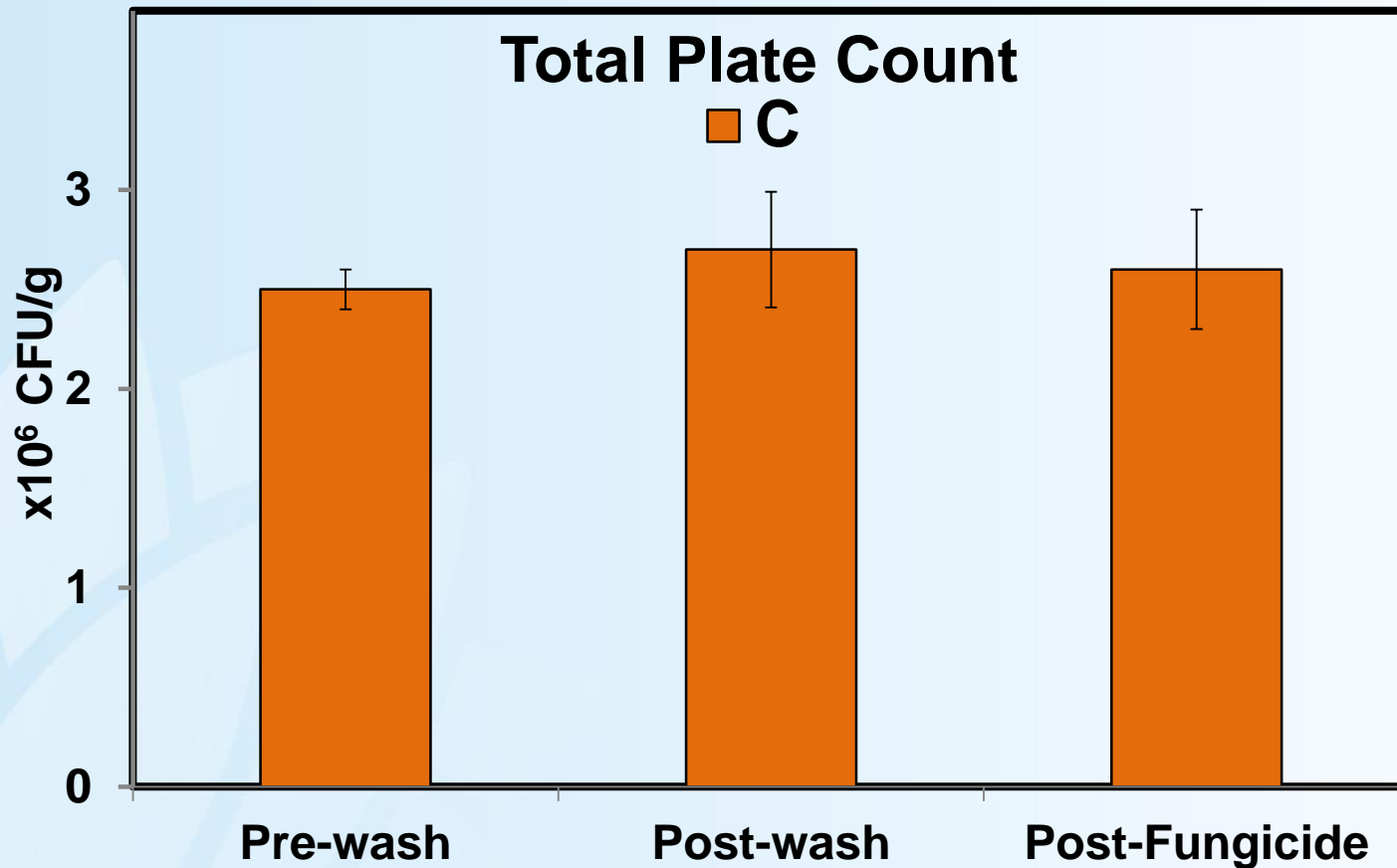
# Variability in industry practices



# Variability in industry practices

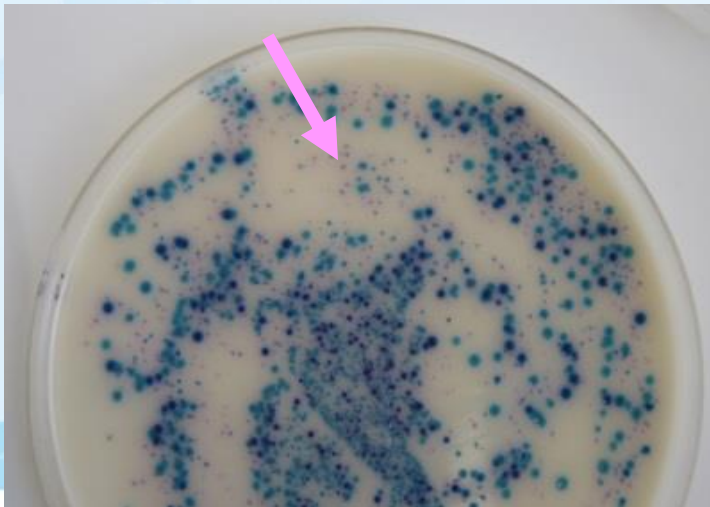


# Variability in industry practices





# Detection of human pathogens on rockmelon fruit



*Salmonella* spp



*Listeria monocytogenes*

# Do we need to change?

**Change is possible if  $D \times V \times F > R$**

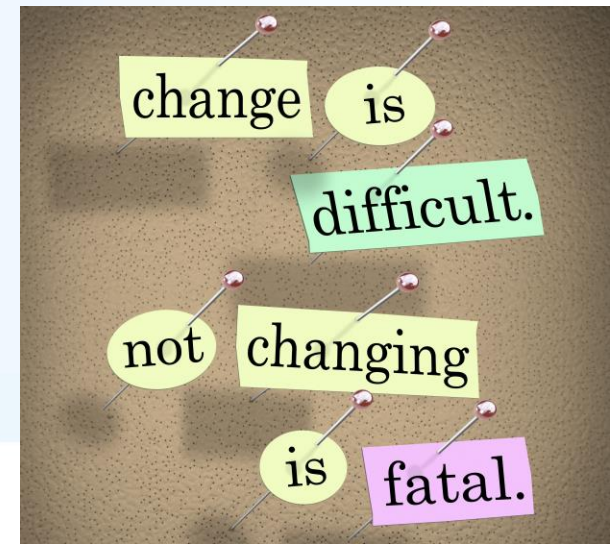
**D** = Dissatisfaction with current practice

**V** = Vision (what is possible)

**F** = First concrete steps towards the vision

**R** = Resistance to change

- If  $D/V/F = 0$ , then  $D \times V \times F = 0$
- Resistance to change



# Postharvest sanitation

## Selection of a sanitiser

- Chlorine (sodium hypochlorite liquid)
- Chlorine (calcium hypochlorite powder)
- Peroxyacetic acid (PAA)
- Bromo-chloro-dimethyl hydantoin (Nylate)
- Chlorine dioxide
- Organic sanitisers
- Ozone





# Postharvest sanitation

## Selection of a sanitiser

- **Water source** (Town water, Channel water, Dam water etc)
- **Water quality**
  - pH of water
  - organic load
- **Sanitiser application** (manual or automatic dosing)
- **Sanitiser monitoring** (digital meter or paper strips)
- **Packing-line machinery** (corrosiveness)
- **Requirement of the buyer**
- **Economics**



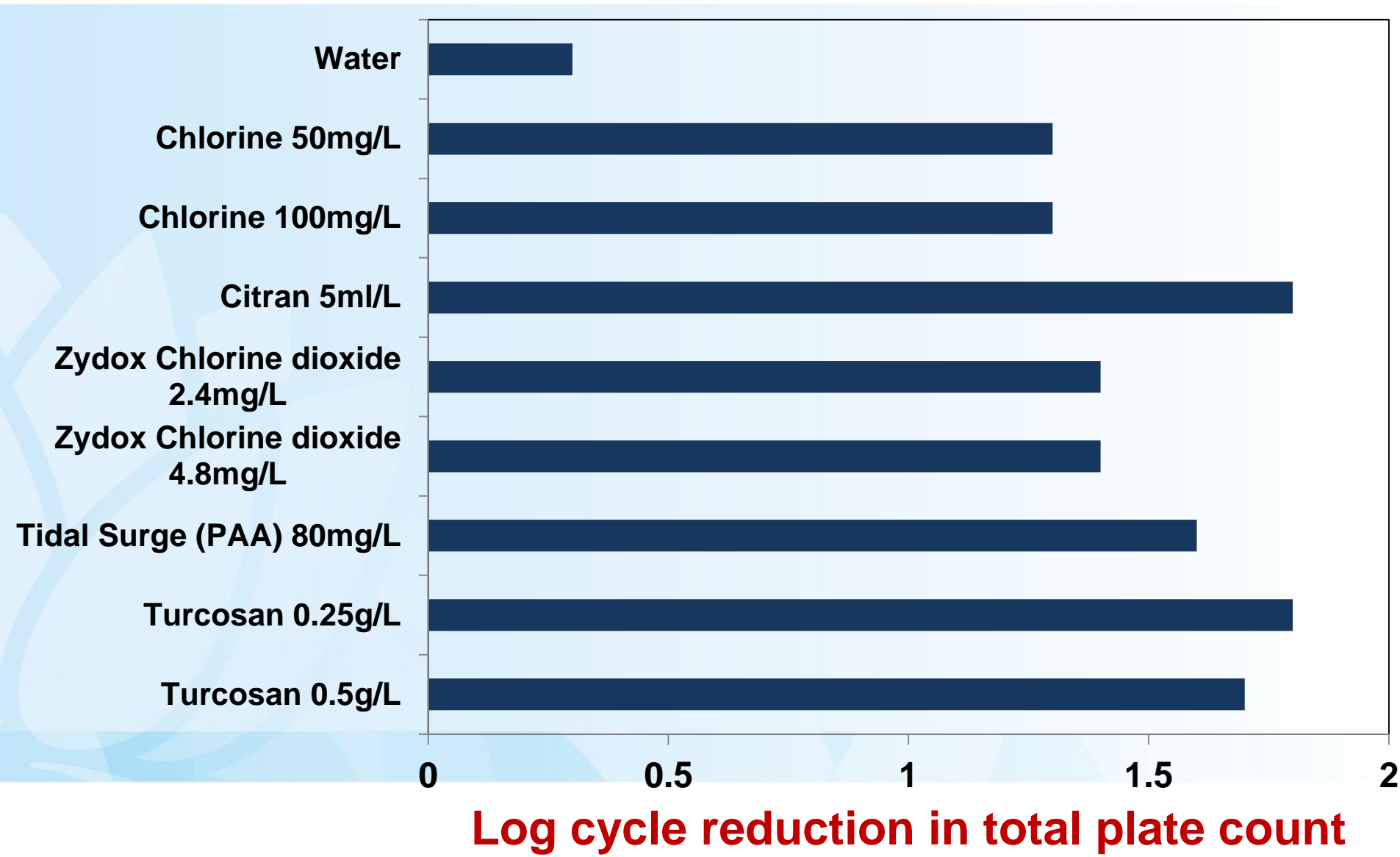
# Laboratory trials on postharvest sanitisers

2015 season (2016 ongoing experiments)

- Sodium hypochlorite liquid
- \*Calcium hypochlorite powder (Frexus)
- Peroxyacetic acid (Tidal Surge)
- \*Bromo-chloro-dimethyl hydantoin (Nylate)
- Chlorine dioxide (Zydox)
- \*Chlorine dioxide (Vibrex)
- Organic sanitiser (Citran 1)
- Dichloro isocyanuric acid (Turcosan)

\* Included in 2016 trials

# Reduction in total plate count by sanitisers



# Mixing of sanitiser and fungicide?

- Not recommended
- Incompatible tank mix: chlorine and imazalil

	pH	ORP (mV)	Measured chlorine (ppm)
Chlorine (100 ppm)	7.2	707	92
Chlorine (100 ppm) + Imazalil (500 ppm)	8.7	487	43

After 1 hour			
Chlorine (100 ppm)	7.3	690	60
Chlorine (100 ppm) + Imazalil (500 ppm)	8.5	480	10



# Monitoring, validation and record-keeping of good practices

- Monitoring of processes
  - Wash water quality (pH, ORP, organic load etc.)
  - Sanitiser concentration
  - Sprayers flow rate, positioning
  - Brushes
  - Fungicide concentration
  - Sanitation of packing machinery
  - Cool room hygiene

## Validation

Microbiological testing of water, produce and equipment



# Manual Digital Monitoring Tools



pH and ORP meter



Chlorine meter



Test strips

pH



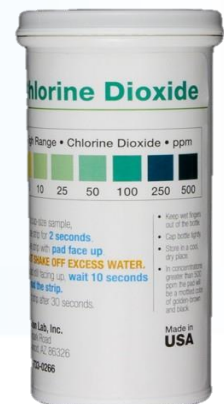
Chlorine



Peracetic acid



Chlorine dioxide



**Disclaimer: No endorsement of products and brands, for information only**

# Automated Monitoring Tools



**Chlorine**



**Peracetic acid**



**Ozone**



# Conclusions

- Industry practices are variables.
- The lack of a sanitiser (chlorination) and recirculation of contaminated wash water linked to higher microbial load
- Maintaining and monitoring critical parameters to prevent pathogen survival and cross-contamination
- Research to explore new sanitation technologies to mitigate food safety risks in rockmelons



# Some food safety facts

- Microbial food safety risks can not be **ELIMINATED**, but can be **MINIMISED**.
- Microbial contamination can occur at **ANY POINT** along the farm-to-fork food chain.
- Contamination is **IRREVERSIBLE**.
- **PREVENTION** is better than reliance on corrective actions once contamination has occurred.

# Resource: Australian Melon Food Safety Guide

**Australian Melon Food Safety Guide**

This Guide is designed to assist growers to identify key areas of food safety concern and to suggest improvement in practice and procedure that can easily be implemented on farm. Most growers won't have to do much beyond current practices; however this Guide might act as a timely reminder of things to be done.

The series of factsheets focuses on minimizing food safety hazards by providing information that is shown to be effective in reducing, controlling or eliminating microbial contamination in the field and packing shed. Because there are many different types of melons, some practices may be more suitable than others. You should consult your quality assurance service provider for business-specific information.

Compiled by D Fullelove B App Sc (Horticultural Technology) Grad Dip Teach & Helena Whitman Dip Management

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# No more bad news.....

## BREAKING NEWS



what's new in **Food** technology & manufacturing  
www.foodprocessing.com.au



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### Rockmelons kill 30 in the US

By Janette Woodhouse  
Monday, 19 December, 2011

With a final death toll of 30 people, including one miscarriage, the US's most deadly outbreak ever of food poisoning has been declared over. In total, 146 people across 28 states became ill after eating *Listeria monocytogenes* contaminated whole rockmelon. While the number of deaths was not the largest ever recorded for a food poisoning outbreak, the greater than one in five death rate makes the outbreak of listeriosis the deadliest food poisoning incident in the US. The outbreak was also the first

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# Acknowledgements



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- Sean Parsons, Easy Clean Chemicals (Tidal Surge)
- Kevin Lew, Henkel Australia Pty Ltd (Turcosan)
- Organic Farming Systems (Citran 1)
- Lionel Freedman (Zydox Chlorine dioxide)
- Sarah Bliss, Wobelea Pty Ltd. (Nylate)

# Thanks!

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