CASE STUDIES: ACTIVE RESEARCH ON FOOD SAFETY

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PROGRAM PARTNER pma AUSTRALIA+NEW ZEALAND

Remediation and recovery measures following chicken manure-based soil contamination by *Salmonella enterica subsp. enterica*

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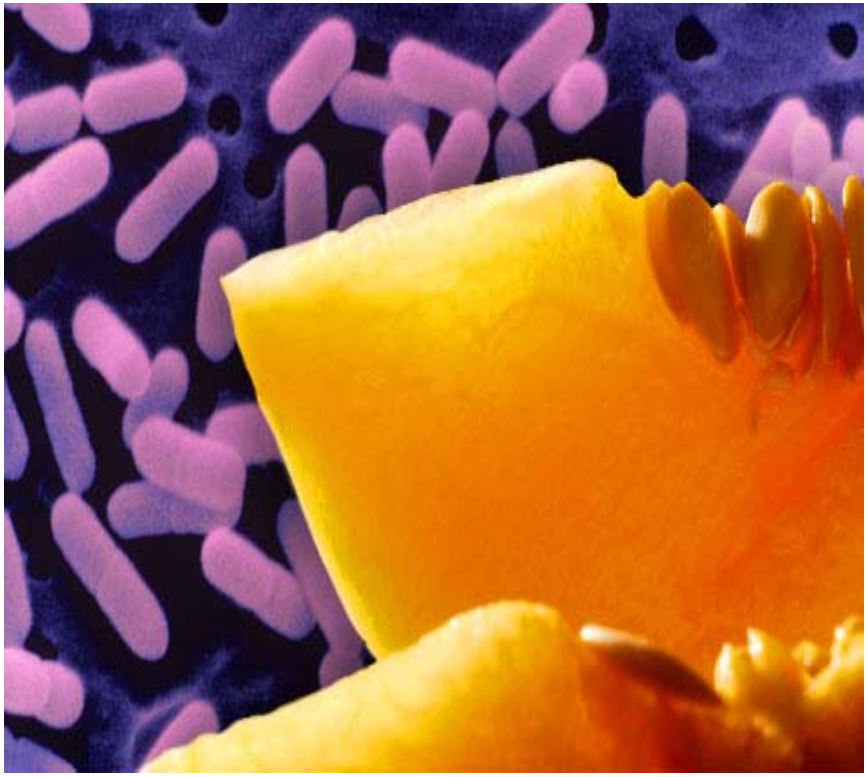
RESEARCH COLLABORATION WITH CPC

- First call for research in 2013 by CPC
- Collaborative project with the US Center for Produce Safety and Australian fruit and vegetable industries
- Topics based on priorities for both countries
- Collaboration with US partner UC Davis
- Jointly funded by CPC and HAL
- Same experiments in two continents
- Reporting end 2015

INTRODUCTION

- Fresh produce is important part of healthy diet
- Produce eaten raw e.g. leafy greens are vehicles for transmission of human pathogens
- Bacterial pathogens continue to be a major contributor
- Salmonella is the most commonly reported pathogen in Australia
- Salmonella is a widespread bacteria with more than a hundred serovars
- In Australia (2008) *Salmonella* was the second highest cause of notified cases of food-borne illness (Chinivasagam *et al*., 2012)

INTRODUCTION

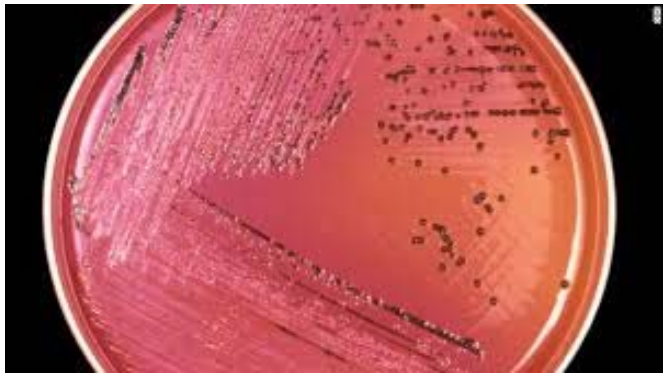


- Fresh produce can be contaminated at any point in the production chain:
  - irrigation water
  - inadequately composted manure
  - wild or domestic animals
  - human handling
  - harvesting equipment
  - transport containers
  - wash water
  - transport vehicles and processing equipment

INTRODUCTION

- Soil amendments with chicken manure (rich in N-P-K content), but associated with *Salmonella* (Runge *et al*., 2007)
- Pre-harvest contamination of vegetables is mainly from the use of fresh/not properly composted manure (Wilkinson, 2011)
- If not composted, stored, applied and managed in an appropriate manner, has potential to create human health risks:
  - Dust
  - Water pollution
  - Smell

SALMONELLA



- Optimal growth temperature of *Salmonella*: 35 to 43ºC
- Most serovars can grow as low as 7ºC
- In general, between 10^5-10^6 cells are needed to be consumed to cause illness (Lawley *et al.* 2008)
- Over 99% of human Salmonella spp. infections are caused by *S. enterica* subsp. *enterica* (Crum-Cianflone 2008).

CHICKEN MANURE USE IN AUSTRALIA

- In Australia most salad producers do not use manure amendments because of the risk
- Most growers use composted organic amendments that are certified
- Some growers continue to use aged or stockpiled manure and or litter, not necessarily composted
- Poses a risk of soil contamination
- Little research under Australian conditions on survival of *Salmonella* and *Listeria* in vegetable farms using chicken manure

RESEARCH AIMS

Pot and Field Trials

- Clarify risk posed by chicken manure amendments to soil used for vegetable production
- Survival and growth of Salmonella
  Serovars - S.Enteridis, Montevideo, Sophia
  Cocktail - S. Enteridis, Infantis, Montevideo, Zanzibar, Typhimurium
  - Different soil types - sandy & clay loam
  - Temperature - 5, 22, 37ºC
  - Moisture - constant & fluctuating
  - OM - plus & minus chicken manure
  - Laboratory & Field conditions

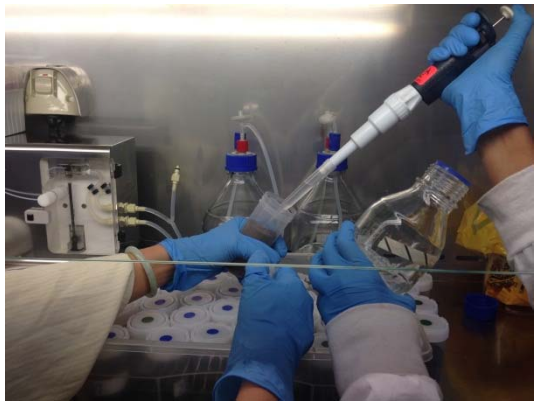
COVER CROPS - ANTIMICROBIAL COMPOUNDS

- Some cover crops/green manures produce biofumigants
- Glucosinolates and phenolics have antimicrobial activity in the soil
- Glucosinolate (GSL) hydrolysis products exhibit antimicrobial activity (Brader *et al*., 2006)
- Phenolics 2,4-dihydroxybenzoic and protocatechuic acids have antibacterial activity against human pathogens (Alves *et.al*, 2013)
- Analysis of antimicrobial activity of:
  - Caliente 199
  - Fumig8tor
  - Buckwheat

Also…SOLARISATION, ODOUR, OUTREACH

- Survival of *Salmonella* spp. under solarised field conditions
- *Listeria monocytogenes* survival in field treated with cover crops.
- Literature review on odour
- Outreach to growers

LABORATORY TRIAL

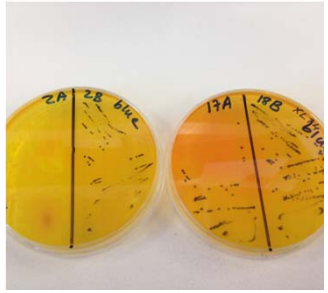


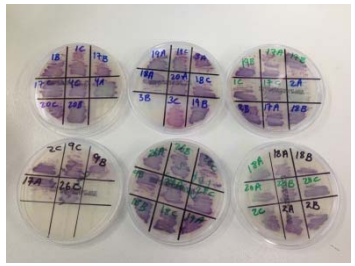
Inoculation

Incubation

Extraction

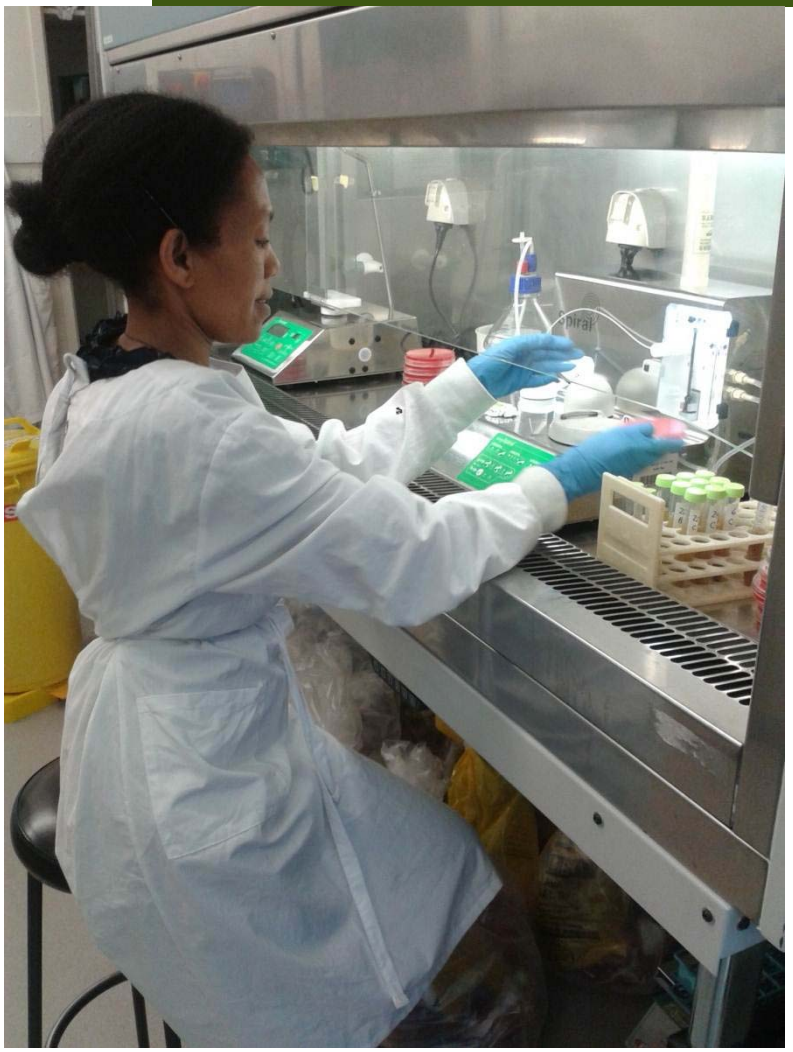
Enumeration





Enrichment

OUTCOMES



- The persistence of Australian serovars of *Salmonella* in different soil types under different environmental conditions
- Evaluation of cover crops that contain active antimicrobial components and the conditions under which they kill *Salmonella*
- Determination of field conditions under which cover crops might be used to remediate *Salmonella*-infected soil
- Assess the potential increase of *Listeria spp*. in cover crop amended soils

FACT SHEETS FOR GROWERS

- Persistence of Australian *Salmonella* serovars in amended and non amended soils
- Potential for risk *Listeria* sp and *L. monocytogenes* in amended and non amended soils
- Efficacy of cover crops and solarisation to expedite die-off of Salmonella in contaminated soils
- Best practice re-plant of vegetables in previously contaminated soils
- Best practice guidelines for safe use of chicken manure amendments.

Thank You

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