CRC PLANT biosecurity

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Improved Sampling Strategies

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Sampling

- Improved detection along supply chain
- Support insect free status of Australian product

Theory vs action

- Science **supports decision making** in all aspects of biosecurity

- Without sensible and appropriate science difficult to make good decisions

Industry benefits

- Decisions
- Finding critical sampling points (time/space) = where and when to sample
- More efficient allocation of sampling effort
- Decide where and when to fumigate - reduction in use of Phosphine

Research stages to date

Research steps	reason
Develop statistical sampling model	Provide more accurate sampling regime
Sample farm silos	'real world' data for confirmation of sampling model –Australian data
Comparison with US data	Test against different models; data from different environment
High resolution examination of insect spatial distribution	Confirm ecological basis for model
Sampling silos across Australia (Graincorp, Viterra, CBH)	Parameters from different geographical regions for input to tailor sampling regimes

Sampling stored grains

- The spatial and temporal distribution of insects in stored grain influences capacity to detect

- Variation may be driven by a number of factors
  - Species behaviour
  - Climatic conditions
  - Human factors

- Develop flexible sampling model

Development of model

- Need to consider ecology as well as statistics
- $P(A \geq 1) = 1 - (1 - p \times e \times w)^n$
- Elmouttie, David and Kiemeier, Andreas and Hamilton, Grant S. (2010) *Improving detection probabilities for pests in stored grains. Pest Management Science.*

Field sampling

Australian and US data

0 0 0 0
1 0 0 0
1 0 0 0
0 0 0 2
1 0 1 1
0 0 0 0
0 1 1 0
1 0 1 1
0 0 0 0
0 0 0 0
1 0

Low density
Low infestation

1 1 0 4 4
1 2 3 0 1
0 0 5 0 1
1 2 1 7 0
1 1 **14** 2
5 2 1 4 1
1 2 0 1
16 3 0 1
1 0 0 0 0

Med density
Med infestation

0 0 1 0 0
0 0 0 0 0
0 0 **11**
18 1 0 0
0 0 0 0 0
3 1 1 0 0
0 0 0 0 0
0 **179**
151 15
0 0 0 0 0
0

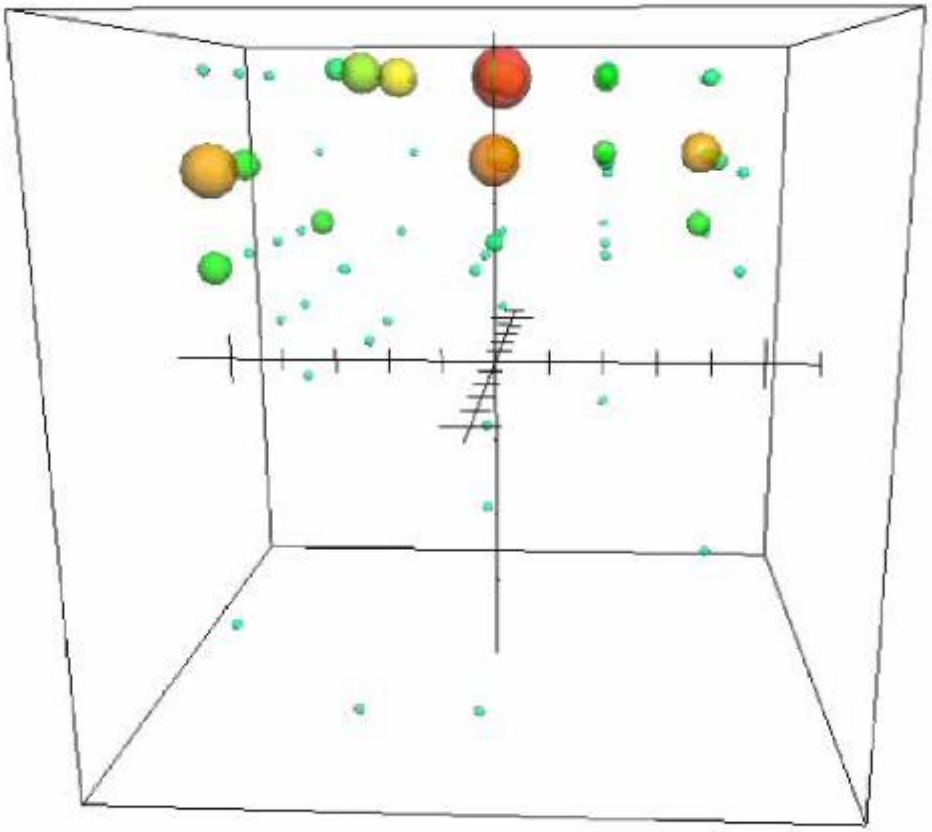
High density
Low infestation

Comparison of models

Data description	Our model	Negative Binomial	Poisson
$L_{density}$ $L_{infestation}$	97-98	92-97	84-97
$M_{density}$ $M_{infestation}$	93-97	92-99	64-78
$M_{density}$ $H_{infestation}$	93-95	92-94	71-80
$H_{density}$ $H_{infestation}$	93-97	97-99	90-97
$H_{density}$ $L_{infestation}$	94-95	72-91	12-24
$M_{density}$ $L_{infestation}$	95-97	82-99	69-79

**80+ Sampling events

High resolution 3d spatial



Industry outcomes

- Short term
  - ↑ detections
  - ↓ sampling costs (sample when they are there)
  - ↓ Phosphine applications with scientific support
- Long term
  - Reduction in resistance
  - maintenance of Phosphine as treatment

Future questions

- Determine and sample to a treatment threshold
- Sampling regimes for better detection of strong resistance
- Cost benefit analysis of new sampling regimes

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