The New Zealand Institute for Plant & Food Research Limited

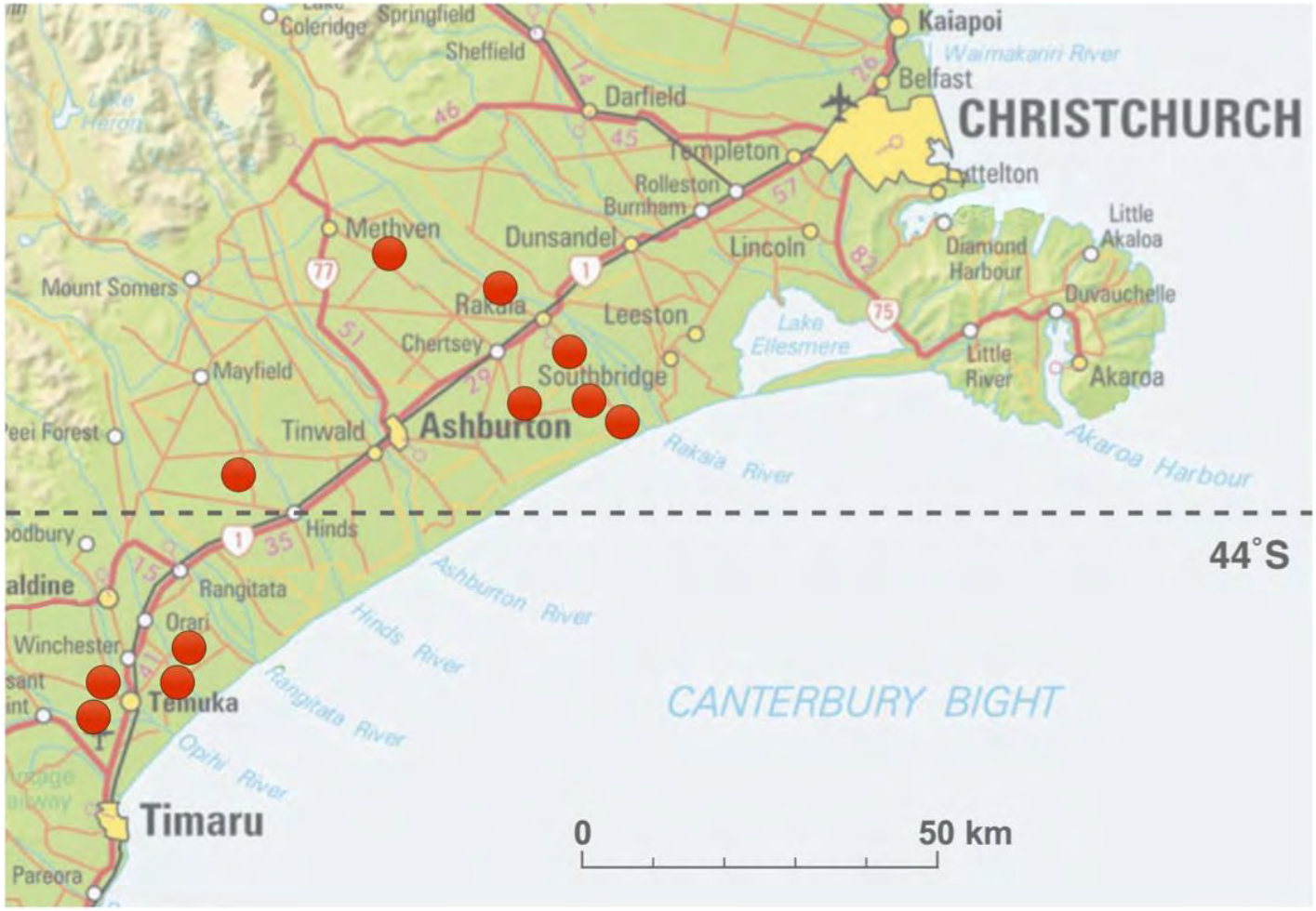
Plant & Food potato physiology and agronomy 26 August 2014

Presented at grower workshop in Ashburton

Latest work

- 2012-13 — Field survey of 11 commercial potato crops to determine yield loss factors
- 2013-14 — Field trial to isolate and quantify disease effects
- 2013-14 — Field trial to compare yield potential from G1-G5 RB and Innovator
- Juliano Oliviera – physiological seed age, PhD complete.

2012-13 — Field survey sites

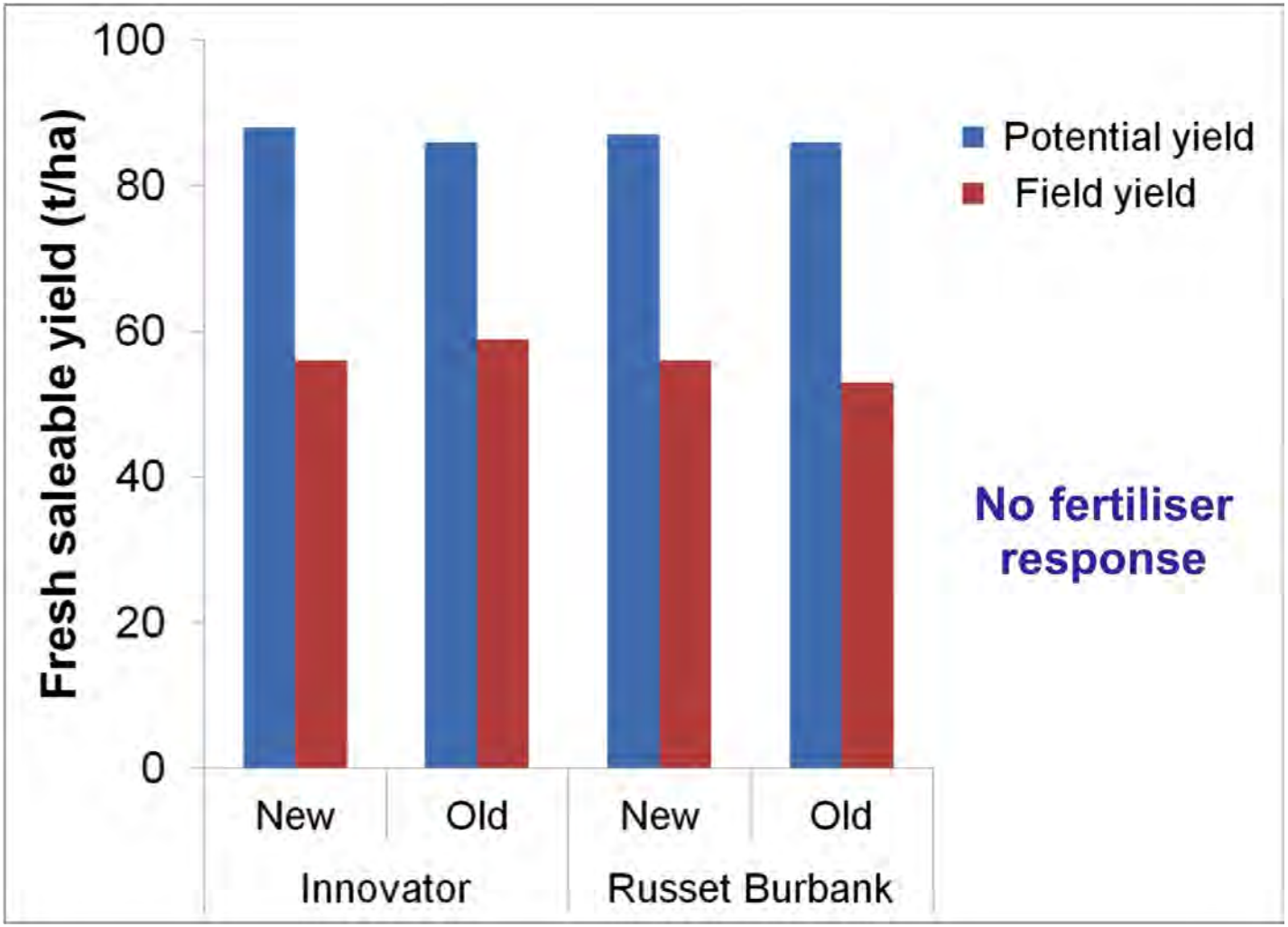


2012-13 — Field survey approach

- 11 Crops — 5 “new ground”, 6 “old ground”
- ‘Russet Burbank’ (7), ‘Innovator’ (4)
- Crops assessed fortnightly
- Recorded pesticide use and irrigation schedules

Four fertiliser trials — double application rate

Potential and field yield

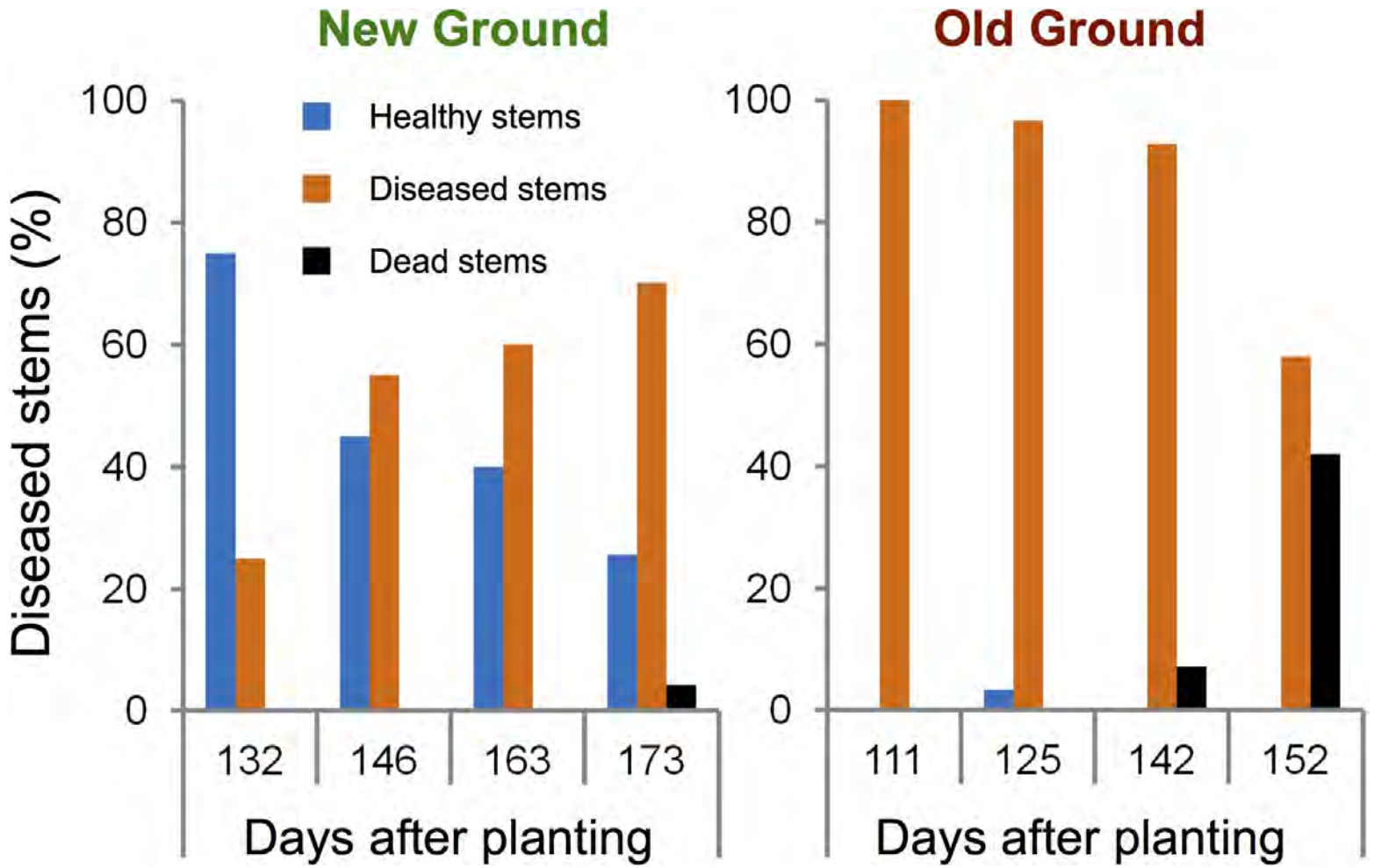


Main factors reducing yield

- Soil-borne disease
- Soil compaction — restriction of root growth
- Poor seed quality
- Foliar disease
- Weed competition
- Irrigation mismanagement

Rhizoctonia stem canker – Found in all crops

Rhizoctonia stem canker incidence



Rhizoctonia stem canker onset

New/old land	Years since potatoes last grown	Dominant land use last 10 yrs	Last crop	Crop emergence to disease onset (wks)
Old	8	Grass	Grass	8
New	>10	Crop	Grass	8
Old	7	Crop	Grass	6
New	>10	Crop	Grass	5
New	>10	Grass	Onions	5
New	>10	Crop	Wheat	5
Old	8	Grass	Wheat	4
Old	5	Crop	Wheat	4
New	>10	Crop	Wheat	3
Old	4	Crop	Onions	2
Old	5	Crop	Wheat	0

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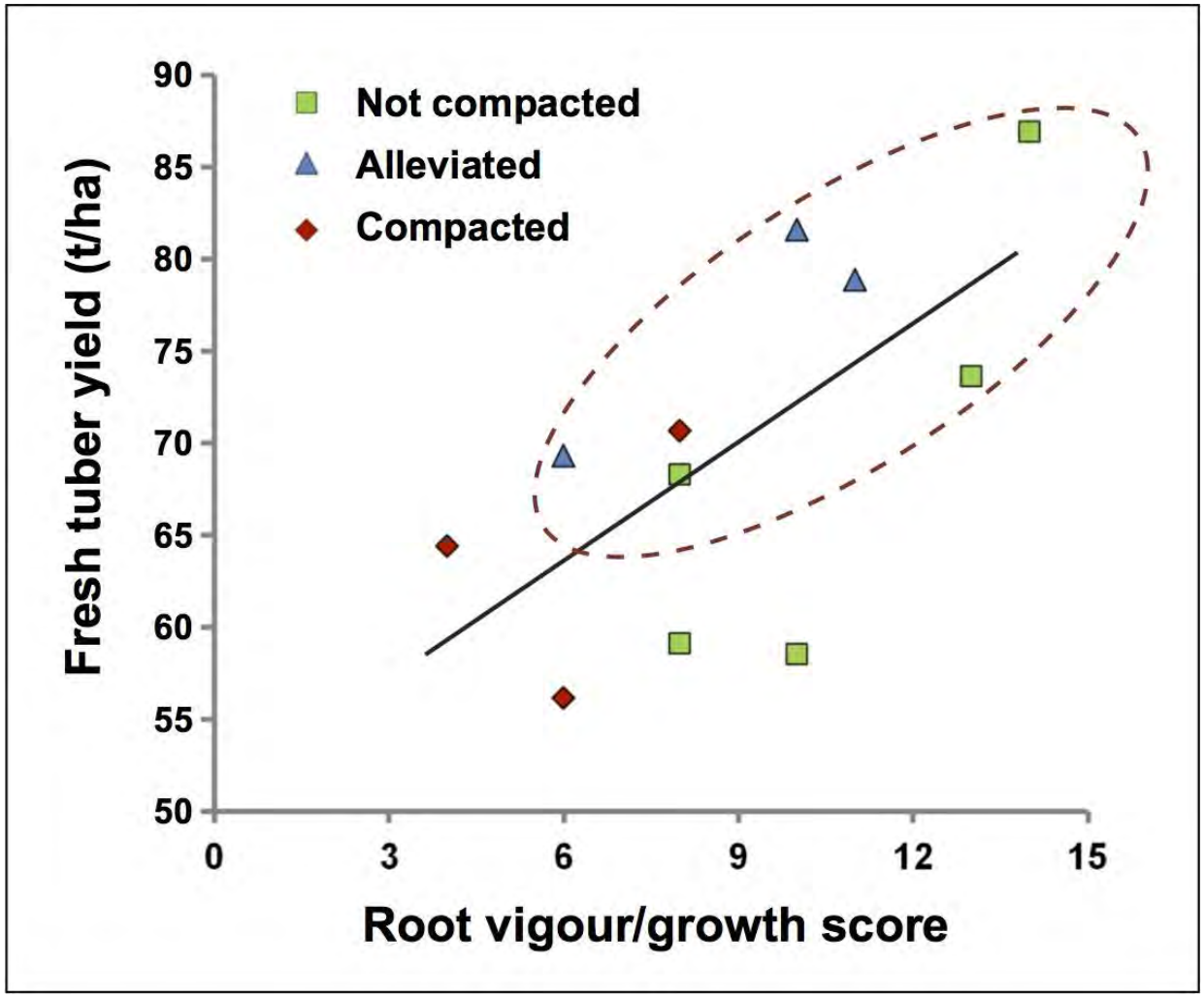
Spongospora root galls

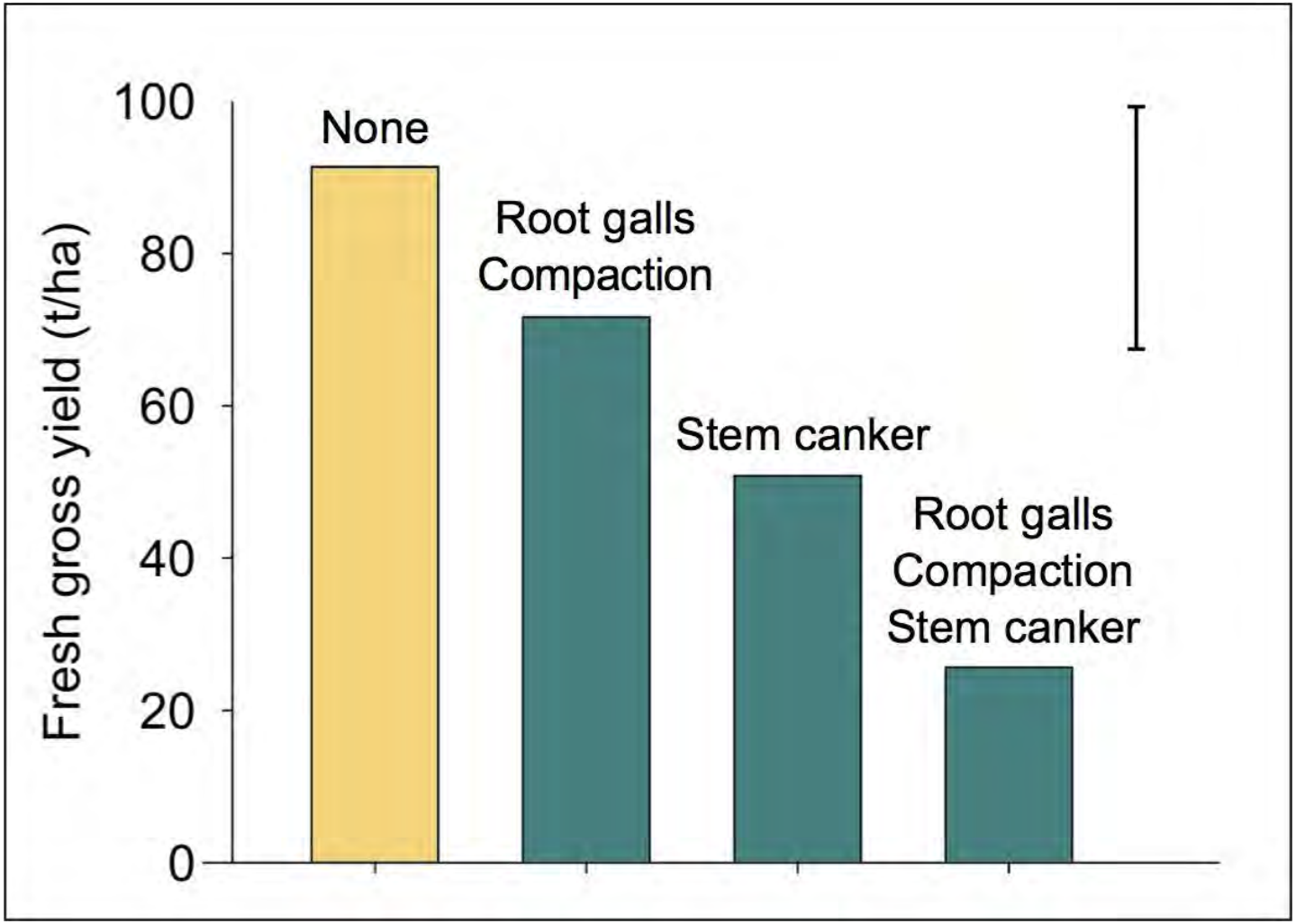
Spongospora root galls

- Root galls in 6 of the 11 crops
- 5 of the 6 in old ground
- This disease associated with old ground

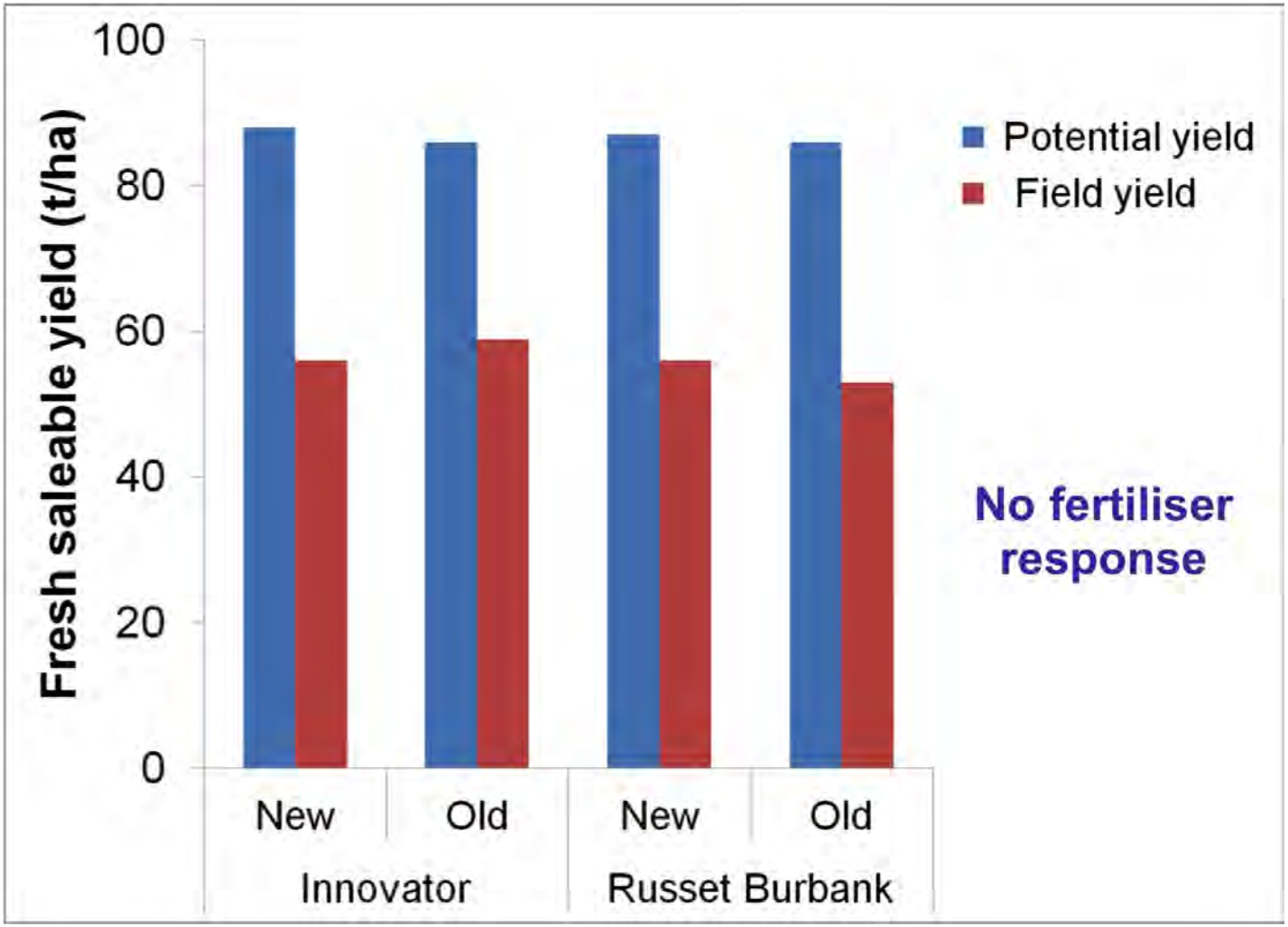
Yield *vs* root growth / vigour



Factors limiting yield in selected plants

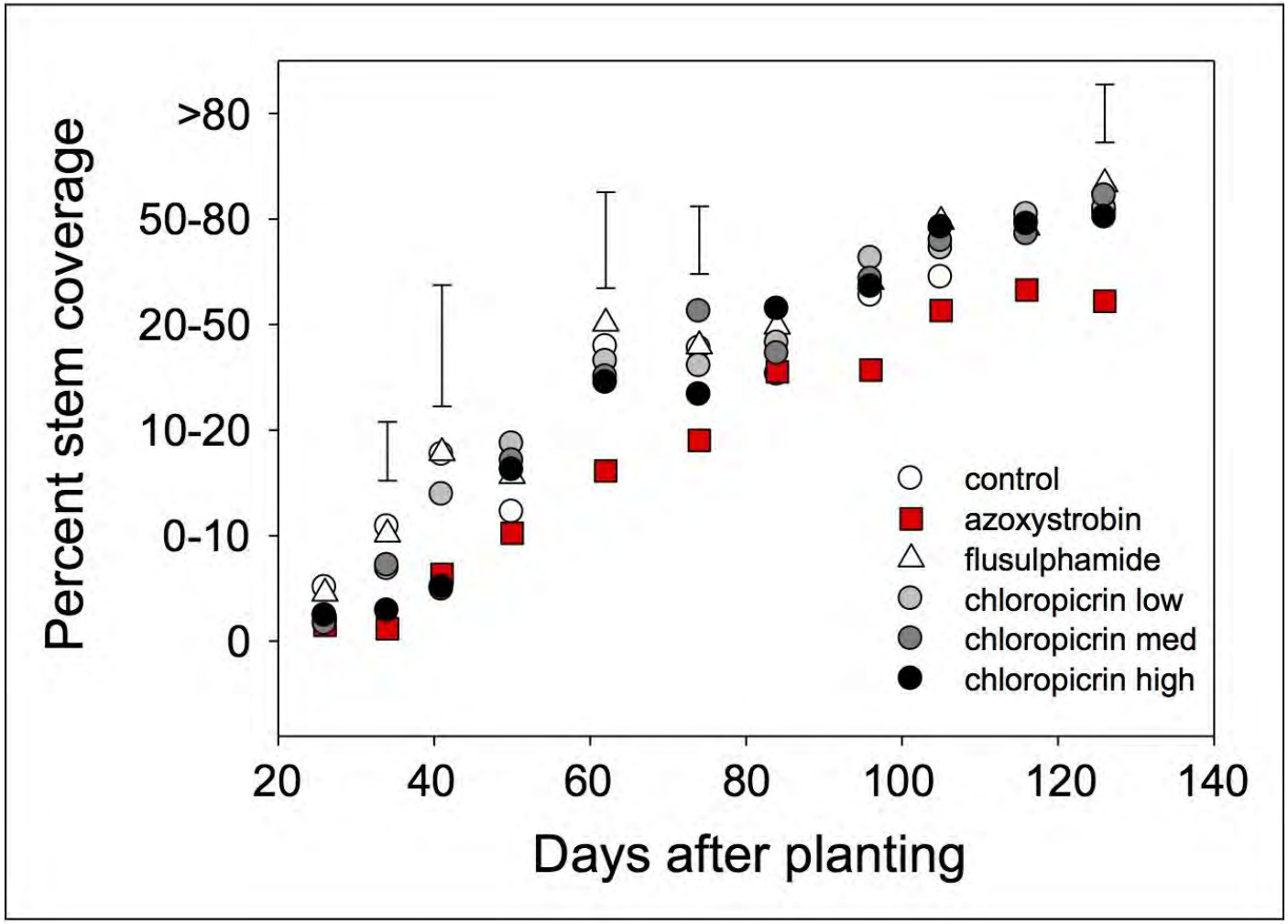


Potential and field yield

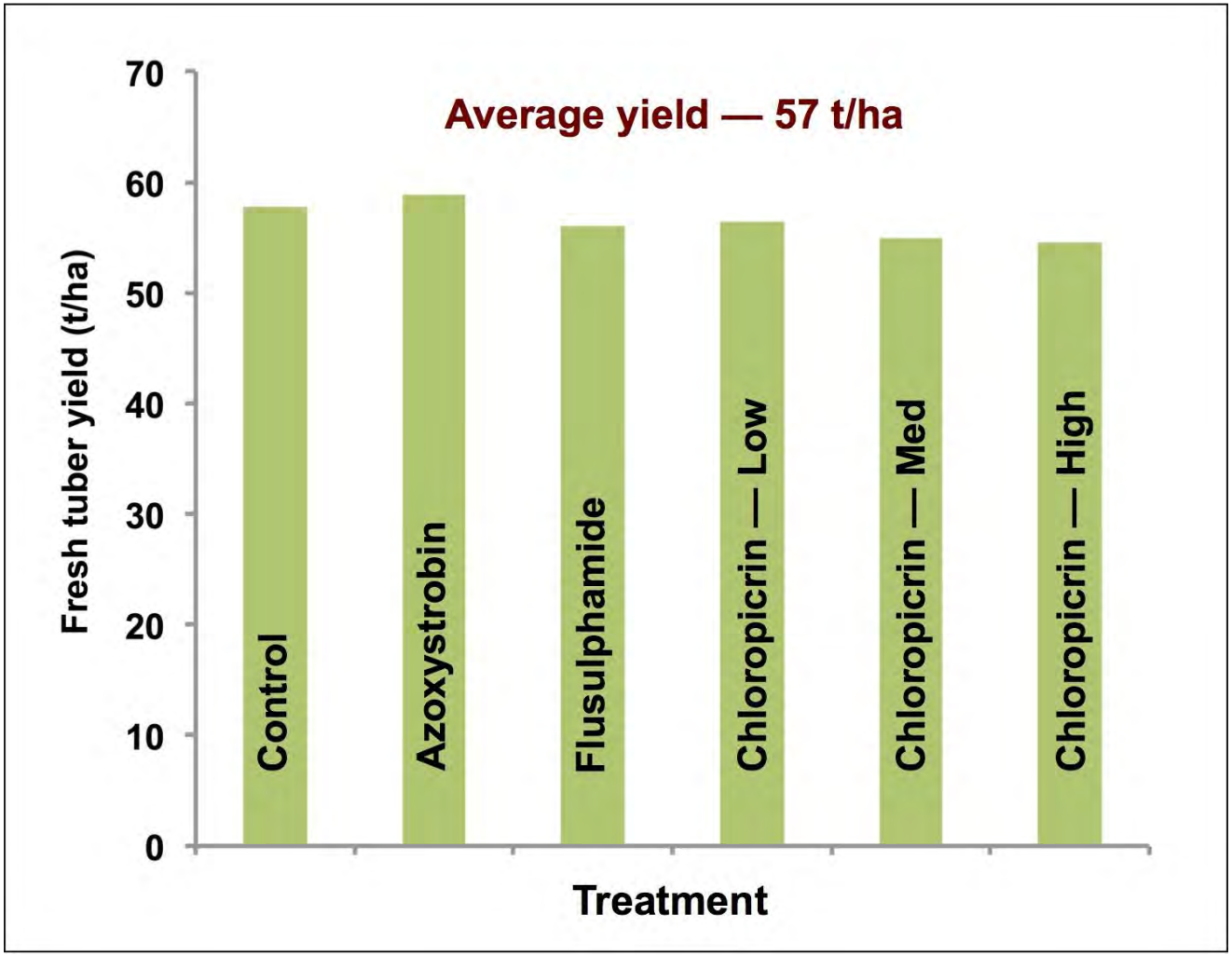


Fumigation — First time for potatoes in Canterbury

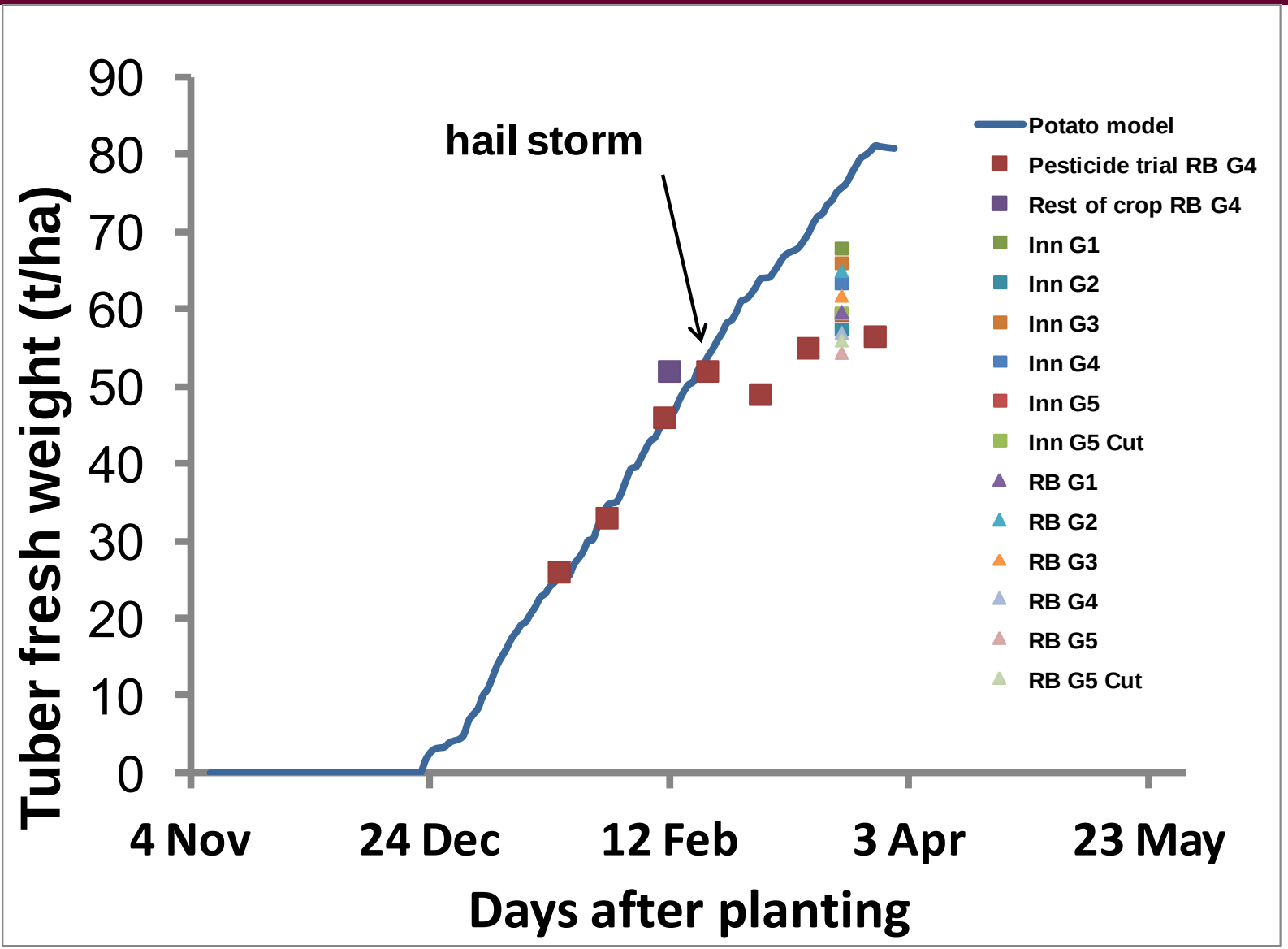
Rhizoctonia stem canker severity



Final yields



Pesticide and generation trials – final yield



Juliano's PhD – Understanding the effect seed physiological age on yield and yield distribution.

- Locally bred and grown cultivars used - issues
- Bondi – high yields but tubers too large.
- Fraser – high quality crisp, resistant to cold induced sweetening but low yields.
- Winter seed storage usually 2-4 ^{o}C March to September.
- Storage requirements vary with cultivar.

Juliano's PhD - Manipulating seed physiological age

- Non-limiting conditions for Bondi, Fraser and RB to benchmark growth and development under usual storage conditions.
- Range of storage regimes: ground, shed, chiller
- Warm up: 1 month and 3 month
- Sprouts on sprouts off.
- To test outer limits, lab expt with a wide range of storage temperatures (4-20^{o}C) and time periods (3 Aug planting-8 months Jan planting)

Juliano's PhD – Main findings

- Benchmark expt: Bondi 66 t/ha, Fraser and RB 52 t/ha, same canopy development and growth but different radiation use efficiency.
- Bondi also had high sink strength, but Fraser low, and with long stolons which delayed tuber initiation.
- Sprout removal increased stem number (Bondi +1stem)
- Apical dominance patterns different
- Storage expts: temperature accumulation 200-2000 ^{o}Cd but no difference in plant establishment or tuber size distribution (potential savings in storage costs).

Juliano's PhD – Main findings

- Bondi final tuber size could be manipulated by increasing stem number:
  - Store at ambient temp over winter (cost reduction!)
  - grow early seed crops (eg Pukekohe)
  - or use ethylene, giberellic acid
- Fraser – yields will always be limited by low sink strength, long stolons. Remediation probably not possible.
- Try and breed for high radiation use efficiency and short stolons.

Main factors reducing yield

- Soil-borne disease
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Future

- Monitoring high producing crops
- SFF disease, soil compaction, biofumigation?
- Continuation of seed phys age work.
- N leaching under veg crops (incl potatoes) SFF already underway.
- Fungicide resistance worry
- Look at different cultivars?