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

Fresh saleable yield (t/ha)

<table>
<thead>
<tr>
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<tr>
<td>New Innovator</td>
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No fertiliser response
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**

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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

- None
- Root galls
- Compaction
- Stem canker
- Root galls
- Compaction
- Stem canker

Fresh gross yield (t/ha)
Potential and field yield

![Graph showing fresh saleable yield in t/ha for different varieties with and without fertiliser application.](image)

- **New Innovator**
  - Potential yield: 80 t/ha
  - Field yield: 60 t/ha
- **Old Innovator**
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- **New Russet Burbank**
  - Potential yield: 80 t/ha
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*No fertiliser response*
Fumigation — First time for potatoes in Canterbury
Rhizoctonia stem canker severity
Final yields

Average yield — 57 t/ha

- Control
- Azoxyarin
- Flusulamide
- Chloropicrin — Low
- Chloropicrin — Med
- Chloropicrin — High

Fresh tuber yield (t/ha)
Pesticide and generation trials – final yield

Tuber fresh weight (t/ha)
Days after planting

- Potato model
- Pesticide trial RB G4
- Rest of crop RB G4
- Inn G1
- Inn G2
- Inn G3
- Inn G4
- Inn G5
- Inn G5 Cut
- RB G1
- RB G2
- RB G3
- RB G4
- RB G5
- RB G5 Cut

hail storm
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 °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°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 °C•d 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
» Soil compaction — restriction of root growth
» Poor seed quality
» Foliar disease
» Weed competition
» Irrigation mismanagement
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?