SUPPRESSION OF FUSARIUM CROWN ROT IN WHEAT BY ENDOPHYTIC ACTINOBACTERIA

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14 September 2015
Fusarium Crown Rot

- Caused primarily by *F. pseudograminearum*
- Stubble-borne disease
- Reduces yield and quality of cereals
- Costs growers $80M (wheat) & $18M (barley) – Murray & Brennan (2009)
- Necrotrophic pathogen – active both in pathogenic & saprophytic phases
Fusarium Crown Rot: Infection & Consequences

Infection of crown and lower stem

White heads
Crown Rot Incidence

- Changes in farming practices
  - Stubble burning & cultivation
    - Up to early 1980s
  - Mixed farming
  - Stubble retention & no-tillage
    - (~90% of farmers by 2006)
  - Continuous cropping

- A drying climate

Estimated cost to growers
>$100M per annum

Ref: BOM 2010
Management Strategies to Control Crown Rot

- **Fungicides (seed dressings)**
  - Provides little protection beyond seedling stage

- **Biotechnological approaches difficult – disease is complex due to:**
  - Range of disease-causing organisms within a complex
  - Number of genes in the plant required for resistance to disease

- Plant breeding has produced some tolerant/resistant varieties
  - Limited in effectiveness
  - Resistant varieties only effective in reducing colonisation during crop growth
  - After maturity, *Fusarium spp* grow as saprophyte in stubble of all varieties

- **Agronomic managements reduce disease inoculum**
  - Cultivation to bury stubble
  - Stubble burning
    - Risk of erosion and loss of soil organic matter
  - Crop rotations
    - But *Fusarium* can survive several years in stubble
Biocontrol – an alternative approach

**Aim**: To develop inoculants for the control of Fusarium Crown Rot in wheat
In vitro suppression of *Fusarium pseudograminearum* by antibiotic production in Actinobacteria MH243
**In vitro** antifungal activity of actinobacteria against three *F. pseudograminearum* strains

<table>
<thead>
<tr>
<th>Actinobacteria Isolate</th>
<th>Suppression zone (mm)</th>
<th>Species</th>
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<tbody>
<tr>
<td></td>
<td>CS5642</td>
<td>CS5834</td>
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<tr>
<td>MH71</td>
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<td>MH243</td>
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Small Plant Assays

Wheat (cv Wyalkatchem), *F. pseudograminearum* CS5642
Consistent response across 2 cultivars with actinobacteria MH71 & MH243
Pot Trials
Pot trials - Actinobacteria inoculants protected wheat plants from symptoms of Fusarium Crown Rot

- MH71 & MH243 reduced disease symptoms by 50% in glasshouse pot trial
- But, infection rate of disease was poor

Under improved infection rate in controlled environment cabinet,
- MH71 & MH243 again reduced disease symptoms by ~50%

Wheat (cv Wyalkatchem), *F. pseudograminearum* CS5642
Two species of Streptomyces (MH71 & MH243) strongly suppress *Fusarium pseudograminearum* in

- *In vitro* agar plate assays (suppression of *Fusarium* by 30-44 mm)
- *In planta* small plant assays where crown rot disease was reduced by 75-100% in repeated assays
- Pot trials (glasshouse/controlled environment) that support the above findings with both isolates reducing crown rot symptoms by 50% or more.

Further glasshouse pot trials to

- Validate the above isolates and test a small number of other promising isolates
- Evaluate the performance of ‘best performers’ in plants grown to maturity
- Select 2 ‘best performers’ for testing in field trials
Thank you