Biocontrol agents for plant disease prevention

The Technology

The synthetic fungicide market is estimated to reach over $15 billion by 2019 in the US alone (BCC 2014). Fungicide product sales continue to expand at a CAGR of 7.8% whilst the EU commission’s new policies on highly toxic pesticides could remove up to 35% of fungicides from the market (BCC 2014). With this increase in demand and anticipated shortfall in supply, biological fungicides have enormous commercial potential with the convergence of: consumer demand for cleaner food; grower needs for effective and flexible pesticide alternatives; and pressure on government agencies to restrict older chemistries in the interest of community safety.

Researchers at the University of Queensland have isolated novel bacteria from suppressive soils which strongly antagonise the growth of fungal plant pathogens. These bacterial strains have demonstrated efficacy as biocontrol inoculants.

The team has successfully developed and licensed a commercial product HayRite™ containing a proprietary Bacillus strain for the protection of hay from mould. The advantage of this inoculant is the spore forming properties which make the active organism resistant to UV (better survival in the environment e.g. leaf surface) and hatch in synchrony with the target pathogens to give better activity. Subsequent strain development has identified a number of new strains which have shown promising results for the biocontrol of a variety of common soil borne and leaf borne fungal pathogens with the potential for seed coating or foliar spray applications respectively.

Competitive Advantages

• can be used as seed coat or spray depending on target pathogen
• selected strains have optimum spore forming properties
• selected strains have specific antibiotic and antifungal compounds
• selected strains have simple, proven fermentation properties
• low cost of production

Table 1: Effect of selected Bacillus strains from the UQ library on Fusarium oxysporum f.sp. lycopersici infection of tomato basal and upper stem

IP Position

As the library of strains show efficacy for particular applications with commercial partners, they will be protected at the appropriate time.

Commercialisation opportunities

UniQuest Pty Limited, the main commercialisation company of The University of Queensland, seeks industry partners to license and co-develop this technology.
Example Publications


<table>
<thead>
<tr>
<th>Species</th>
<th>Pathogen targets</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Crown rot. <em>Fusarium pseudograminearum.</em></td>
<td>$79m pa (Aus)</td>
</tr>
<tr>
<td>Maize</td>
<td>Stalk Rot lodging. <em>F. moniliforme ; F.graminearum</em></td>
<td>25% (US)</td>
</tr>
<tr>
<td>Soybean</td>
<td>5 soil borne pathogens in US cause losses</td>
<td>&gt;$600m pa (US)</td>
</tr>
<tr>
<td>Cotton</td>
<td>Wilts. <em>Fusarium ; Pythium ; Rhizoctonia ; Thielaviopsis ; Verticillium</em></td>
<td></td>
</tr>
<tr>
<td>Oil seed rape</td>
<td>Black leg. <em>Leptosphaera maculans.</em></td>
<td>&gt;1mha (Aus)</td>
</tr>
<tr>
<td>Turf grass</td>
<td>Soil borne fungal diseases major problem.</td>
<td></td>
</tr>
<tr>
<td>Peanut</td>
<td>Leaf spots. <em>Cercospora spp</em></td>
<td>70% (Aus)</td>
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Table 2: Potential target pathogens for the novel *Bacillus* strains and their estimated impact on production.

A/Prof. Peter Dart
Honorary Associate Professor

A/Prof. Dart has worked with Government Agencies, private industry and Universities (Sydney, Harvard, London, ANU, Queensland) in 8 countries. Since 1972 he has appraised and developed projects for International Agencies including World Bank; AIDAB and AusAID; UKODA; USAID; UNDP; UNEP; FAO; ACIAR; Rockefeller Foundation; IITA: IRRI; ICARDA; CIAT, ICRISAT, IAEA, All India Coordinated Programs for sorghum, millet, groundnut, chickpea and nitrogen fixation; Indian Standards Institute., Indonesian Dept of Agriculture: Consultative Group on International Agricultural Research involving Quinquennial External Program and Management Review of the International Centre for Research on Agroforestry (ICRAF), and of the International Centre for Research on Tropical Agriculture (CIAT) both with an annual budget of c. $30million.