Microbial Biocontrol Agents (MBCAs) for IPM

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RA4.3 – Exploitation of natural biological processes

Involved partners:

Endure Partner 1: INRA
Endure Partner 2: RRES
Endure Partner 3: CNR
Endure Partner 4: IBMA
Endure Partner 5: UdL
Endure Partner 6: PRI
Integrated Pest Management (IPM) covers a variety of practices which ensure satisfactory plant protection.
Biocontrol is one brick in IPM implementation

Microbial BioControl Products

Annex VI to Directive 91/414/EEC regarding plant protection products containing micro-organisms

A microbial plant protection product may contain viable and non-viable micro-organisms (including viruses) and formulation substances. It may also contain relevant metabolites/toxins produced during growth, residues from the growth medium, and microbial contaminants.
To analyse the actual situation of biological control in Europe to:

- Identify the key biological and economical constraints in the evaluation and commercial development of biocontrol agents
- Determine how to overcome the gaps: by using/directing/or organizing research, technical improvements, industry initiatives and policy interventions
Use of a MBCA is a reality all over the world

Over 100 products containing *Trichoderma*, a successful fungal BCA on the market
The Honduras project funded by ONU

- Better selection of local strains
- From 40 kg to 5 L per hectare
- Directly into the irrigation system
- Saved energy and reduced cost
- Increased yield by about 20%
- Large reduction in pesticide/fertilizer application

5000 ha melon

700 kg/day *Trichoderma*
40 kg/ha, 120,000 kg
Biocontrol is an available alternative method for crop protection, but in Europe, the growth in the use of biocontrol products is well below the level found in other regions of the world.

- Research
- Industry
- Policy
- Knowledge dissemination
- Economic consideration
There has been an increasing investment in biological control research. Published research on biocontrol against plant diseases: >12,000 publications between 1973 and 2008. BUT:

- steady increase in yearly scientific production since 1973
- soilborne pathogens: 2/3; airborne pathogens: 1/3
Despite decades of research and more than 12,000 scientific papers on biological control of plant diseases, little more than 15 microbe-based commercial products are presently registered.

## Registered biocontrol agents against plants diseases in the EU


<table>
<thead>
<tr>
<th>Agent</th>
<th>Year</th>
<th>Count</th>
<th>Countries</th>
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<tbody>
<tr>
<td>Coniothyrium mimitans</td>
<td>2004</td>
<td>17</td>
<td>AT BE CZ DE DK EL ES FR IT LU NL PL SE SK UK SI FI</td>
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<td>Pseudomonas chlororaphis</td>
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<tr>
<td>Ampelomyces quisqualis</td>
<td>2005</td>
<td>6</td>
<td>BG CY DE EL IT SI</td>
</tr>
<tr>
<td>Gliocladium catenulatum</td>
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<td>BE EE FI SE</td>
</tr>
<tr>
<td>Bacillus subtilis</td>
<td>2007</td>
<td>7</td>
<td>DE FR IE IT PL SI UK</td>
</tr>
<tr>
<td>Phlebiopsis gigantea</td>
<td>2009</td>
<td>7</td>
<td>DK EE FI LV PL SE UK</td>
</tr>
<tr>
<td>Pythium oligandrum</td>
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<td>3</td>
<td>CZ PL SK</td>
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<td>Streptomyces</td>
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<td>9</td>
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<tr>
<td>Trichoderma aspellerum</td>
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<td>3</td>
<td>ES IT SE</td>
</tr>
<tr>
<td>T. atroviride</td>
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<td>3</td>
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<td>T. gamsii</td>
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<td>T. harzianum</td>
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<td>T. polysporum</td>
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<tr>
<td>Verticillium albo-atrum</td>
<td>2009</td>
<td>2</td>
<td>FR NL</td>
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Research needs: key issues identified

- **Devise better strategies for the screening of biocontrol agents:** Current methods need to be improved both in terms of logistics (high throughput to allow rapid mass screening of large numbers of candidates) and in terms of the pertinence of criteria for efficacy, production and commercialization.

- **Improve knowledge on efficacy-related issues:** by exploiting the biological properties of the biocontrol agents and enhancing their effectiveness through formulation of the products.

- **Promote multidisciplinary approaches to integrate better biocontrol with IPM and other production practises:** More emphasis will need to be placed on the compatibility of biocontrol agents with the implementation of IPM, preferably in a systemic approach of integrated production.

- **Develop adapted delivery technologies:** Research is needed to provide growers with low pressure spraying equipment to preserve the viability of the microbials. Technological improvements are also needed for optimal coverage of the target plant surfaces to be protected by the biocontrol agents.

- **Safeguard the durability of biocontrol**
Economic Industrial issues

- **Size of the target market:** Most MBCAs are being developed for small, if not niche, markets. The potential market for MBCAs is fragmented, often involving minor crops of little interest to large agro-chemical companies.

- **Production cost:** Producing MBCAs requires a complicated and much more expensive four-phase production process starting with fermentation and running through extraction, purification, and formulation and packaging.

- **Registration cost:** The estimated cost for registering a MBCA is currently lower than that for a chemical pesticide, though the size of the investment is still very high in comparison with the potential market.

- **Business profitability:** Comparing estimated production and other costs relative to the sales value at the plateau level, highlights large differences between chemical pesticides and microbial biocontrol agents. The gap between the two in terms of estimated profit is nearly 10-fold in favour of chemical pesticides.
Industry needs

- **Quality control:** manufacturers of biological control agents must guarantee the quality of their products. The definition of tests and their routine implementation is crucial to ensure reliable efficacy and maintain confidence of farmers for biocontrol.

- **Improve distribution systems:** by the integration with Decision Support Systems and training courses organized by farmer associations.
Needs for Biocontrol’s Development

- **Training of advisers and farmers:** Compared to chemical control, the implementation of biological control presents an additional level of technical complexity because the "active substance" is a living organism or microorganism. The success of large scale use of biological control in the future will require stepping up the technical training of farmers and advisors.

- **Development and dissemination of Decision Support Systems (DSS):** The complexity of biocontrol and its necessary integration in system approaches of crop protection and production make DSS more and more a key component.

- **Establishment of demonstration schemes and development of farmer networks:** is needed to stimulate the dissemination of information to and among farmers.
Policy issues

- MBCAs must not be considered as a chemical pesticide
- Registration protocols should differentiate between MCBAs and chemical pesticides
- Incentives to growers who convert to IPM agriculture
- Provide assistance for the creation of a strong European-based industry and research.
Thank you for your attention!!!

Grazie
Integrated Pest Management will be the result of INTEGRATION
Thank you for your attention!!!

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