How research works for biocontrol technologies?

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Who are EUVRIN?

- European Vegetable Research Institutes Network

- Informal, voluntary organization of research institutes or departments that specialize in research, development, and extension on vegetable production

- Outdoor and protected vegetable production

- No outside funding. Admin support:
Aims of EUVRIN

- Establish and improve cooperation between vegetable R&D institutes and teams within Europe
- Promote the exchange of information on vegetable research and development
- Enhance and facilitate coordinated research, development and technology transfer, focused on aiding sustainable vegetable production
- Enhance joint bids for funding of R&D in European, International, programmes
- Conduct surveys on the changing priorities in Vegetable R&D within the participant countries
- Establish and update a research agenda and communicate it to national, European and international authorities

Several working groups...
EUVRIN IPM Working Group

- Annual meetings in different locations
  - Exchange ideas and information
  - Visit facilities
  - Break-out groups

Some of us are also IOBC WPRS members!

St Pol de Léon - 2019
Diversity of cropping systems - vegetables

Quality is paramount!
Contaminants are unacceptable - even if beneficial insects!
Research addresses the IPM pyramid

Informed by grower needs conveyed to researchers and sometimes by workshops or focus groups e.g. *EIP-AGRI Focus Groups*
Biocontrol in greenhouses

- Protected, high value
- System developed to accommodate pollinators and avoid insecticide resistance
- **Inundative/inoculative biocontrol**
- Well-developed system, especially in tomato, but need to adapt when new problem arrives e.g. *Tuta absoluta* in late 2000s; *Nezara viridula* in early 2010s
- Biocontrol agents can need management e.g. *Macrolophus*
- Current ‘new’ threats include – Tomato Brown Rugose Fruit Virus (*ToBRFV*), Brown marmorated stink bug (*Halyomorpha halys*), potato & tomato psyllid
- **But** biopesticides are not always used optimally
AMBER project - Application & Management of Biopesticides for Efficacy and Reliability (led by Dave Chandler, Warwick UK)

Protected edible & ornamental crops
Identify where biopesticides being used sub-optimally
Develop management practices to improve biopesticide performance, grower confidence & uptake

1. Making spray application more effective: Improve grower current practices (e.g. tank washing); encourage use of reduced water volumes for more efficient spraying.

2. Biofungicide performance: use knowledge on biofungicide persistence to improve timing of application.

3. Bioinsecticide performance: use pest population models to identify optimum biopesticide application strategy.

4. Knowledge exchange: workshops on biopesticides in IPM, biopesticide application.
Biocontrol in outdoor crops – considerable challenge!

*Lower value crops, no physical barriers, no environmental control*

Research focuses on:

- **Conservation biocontrol**
- **Biopesticides** – including microbials and nematodes

Minimising impact of insecticides and other treatments on natural enemies

New tools and approaches
New ‘tools’ and approaches

H2020 – SMARTPROTECT

**Thematic network** focusing on cross regional knowledge sharing of SMART IPM solutions for farmers and advisors.

**Aim:**

- Stimulate knowledge flow in the regional AKISs (Agriculture Knowledge and Innovation Systems) across the EU
- Spread the innovative potential of advanced methodologies for IPM to the EU regions in vegetable production
- 16 partners from 12 EU countries; Inagro (B) is Lead Partner’; Duration: Jan 2020 – Dec 2022
New approaches

**Exploration of soil microflora for plant protection**

3 projects: AGROFILM, CORAL, BOUSSOLE

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**AGROFILM (2015-2019)**: For an efficient and sustainable control of the *Agrobacterium rhizogenes* hairy roots in tomato greenhouses

- Understand biofilm development → importance of the Quorum Sensing (QS, molecular way of communication & perception by bacteria)
- Find molecules preventing the development of the biofilm → screen for antagonists showing anti-QS properties
- From 1,600 isolates, found 3 anti-QS and anti-biofilm strains as good candidates for new biocontrol products

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**CORAL (2017-2018)**: Benefit from the microbial communities to protect Allium species against white rot

- Soil sampling of contaminated and non-contaminated fields
- Soil physicochemical analysis and microflora characterization through metabarcoding (high through-put sequencing of micro-organisms)
- Determine the suppressive properties of non-contaminated soils
- Establish strain library of bacteria and fungi and setup of a screening process

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**BOUSSOLE (2019-2021)**: Soil biodiversity characterization of vegetable crops through bioindicators → links between biodiversity and cultural practices

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Integration...

How do/can different levels interact?

- Chemical control
- Biological controls
- Physical / mechanical controls
- Decision support tools: monitor, forecast
- Agronomic practices: crop breeding, rotation, intercropping, conserve & enhance beneficials
Evaluation of biocontrol products

MilPomBio (2015-2018) : to find strategies against potato late blight

Context:
❖ Today, potato growers do not have any biocontrol solution against late blight

Objectives of the project:
❖ To find biocontrol products to decrease the application of usual fungicides (quantity and frequency)
❖ To optimize the efficacy of the most interesting biocontrol products by determining the right associations with varieties and with other chemicals

Method:
❖ Evaluation of the efficiency of products under controlled conditions, and under production conditions with decision support systems (DSS)
❖ Understand the mode of action of products

Main result:
❖ Diminution of 50% of the application of chemicals against potato late blight by using, in combination: phosphite product + variety natural resistances + DSS
An IPM system for aphids on Brassica: combining durable, partial crop resistance with biocontrol

BBSRC SARIC: Warwick, Keele, Harper Adams, Durham, ADAS
Integrated control of root-feeding fly larvae infesting vegetable crops

- Chemical control
- Biological controls
- Physical / mechanical controls
- Decision support tools: monitor, forecast
- Agronomic practices: crop breeding, rotation, intercropping, conserve & enhance beneficials

Chemical applied to 'repel' Trap crop
Eggs
Cash crop

Eggs
Cash crop

Agronomic practices: crop breeding, rotation, intercropping, conserve & enhance beneficials

Decision support tools: monitor, forecast

C-IPM Coordinated Integrated Pest Management in Europe
Where are the priorities?

- Control strategies with **less side effects on beneficials**. Existing knowledge about side effects could be exploited further.
- **New and emerging pests and diseases** and climate change.
- Exploiting **soil microbiome diversity** to prevent/control soil-borne diseases.
- Reliable, cost effective and simple **monitoring and decision support systems**.
- Very little effort is being made to **breed for pest resistance**.
- More applied research is needed on **plant defence elicitors**.
- Need to understand which crops and wild hosts are **reservoirs for pests and diseases**.
- **Functional biodiversity** is not easy to implement and manage.
Thank you:

- Colleagues – including Sarah Danan (Vegenov); Rob Jacobson, Hannah McGrath (Reading, Rothamsted Research), Dave Chandler (Warwick)
- The EUVRIN ‘team’
- Admin support: 
- Funders
- Growers
- For the invitation to speak
- For listening!