Crop protection in 2030: towards a natural, efficient, safe and sustainable approach

Dr Willem Ravensberg President of IBMA

Biopesticides

innovative technologies and strategies for pest control

International Symposium Swansea University, 7-9 September 2015



Outline of presentation

- Introduction
- Overview of biopesticides
- Limiting factors and threats for biocontrol
- Promotional factors and trends for biocontrol
- Role of IBMA
- Future developments: crop protection in 2030
- Concluding remarks



Introduction

- Crop protection is constantly changing
- Due to societal and political influences
- As a result of scientific and technological innovations
- Demand for safe plant protection methods and products
- Promotional factors and trends
- Limiting factors and threats
- Changing landscape of plant protection industry
- Changing landscape of regulations
- Future developments of plant protection and biocontrol



Current tool categories available from the Biocontrol Industry

		Photo: E. Floistad, Bioforsk	
Microbials	Macrobials	Semiochemicals	Natural and Biochemical Products
Viruses Bacteria Fungi	Predatory mites Insects Nematodes	Pheromones Plant volatiles	Plant extracts Seaweed products Basic chemical substances



Biopesticides – market, manufacturers and products

- Biopesticide market
 - Worldwide in 2014: \$1.9 billion at user level; Europe: \$542 m; annual growth 15-20%
- <u>Biopesticide manufacturers</u>
 - Worldwide : approx. 230 (ex China, India)

91

- Europe:
- America's 98
- IBCAs 52
- Microbials
- Semio-chemicals
 171
- Natural products
- <u>Total of biopesticide products:</u>
 - Macro's:
 - Micro's, semio's, naturals:



> 230 organisms

> 450 actives, > 2300 products

Sources: DunhamTrimmer, Biopesticide Industry Overview 2015 CPL, Biopesticides Worldwide Market 2013

Use of biopesticides in a broader context

- Driving forces in pest management are many and varied, they continue to develop and change
- Macro-environmental factors: intergovernmental and governmental policy influences crop protection through legislation, funding of research and extension, environmental programmes, trading policies, biodiversity topics, etc.
- Major influences: legislation, environmental and food safety concerns, science and technology, and economics (the market)
- Several external factors limit or promote biocontrol, IPM and the use of biopesticides



Limiting factors and threats (1)

Political

- Research needs: governmental funding reduced
- Result: less fundamental research, 'ad hoc' research focused on short term deliverables
- Extension services: often no longer supported
- Access Benefit Sharing of genetic resources (Convention of Biological Diversity 1992) (Cock *et al.*, 2009) (see publication)



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BioControl DOI 10.1007/s10526-009-9234-9

FORUM PAPER

Do new Access and Benefit Sharing procedures under the Convention on Biological Diversity threaten the future of biological control?

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Received: 25 August 2009/Accepted: 28 September 2009 © International Organization for Biological Control (IOBC) 2009

Abstract Under the Convention on Biological Diversity (CBD) countries have sovereign rights over their genetic resources. Agreements governing the access to these resources and the sharing of the

Handling Editor: Eric Wajnberg.

Electronic supplementary material The online version of this article (doi:10.1007/s10526-009-9234-9) contains supplementary material, which is available to authorized users.

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Published online: 01 December 2009

benefits arising from their use need to be established between involved parties [i.e. Access and Benefit Sharing (ABS)]. This also applies to species collected for potential use in biological control. Recent applications of CBD principles have already made it difficult or impossible to collect and export natural enemies for biological control research in several countries. If such an approach is widely applied it

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ical Diversity 1992)



Limiting factors and threats (2)

<u>Societal</u>

- Lack of understanding of terminology and concepts examples: biocontrol and IPM
- •"Food-scare", risk of negative association with microbes (e.g. EHEC bacterium, EBOLA virus), and "man playing with nature" (DNA, RNAi)
- Biopesticides/IPM/sustainable agriculture are more expensive for farmers, while agricultural returns are declining: → consumers should pay more for their food



Limiting factors and threats (3)

Registration

- Regulatory issue: little change to system designed for synthetic pesticides: time too long and costs too high
 - some examples
- 1: EU: Annex I Inclusion of mbca's > 75 months (EFSA reviews) under 91/414; approx. 40 months under 1107/2009
- 2: EC 1107/2009 enforced in September 2009: provision of approval of low-risk substances and basic substances – 4 years later still no criteria accepted and no procedure established
- 3: New active and/or product applications or mutual recognition refused by MSs due to workload



Limiting factors and threats (4)

New legislation

- Nagoya Protocol and Access and Benefit Sharing of the CBD
- Registration for natural enemies, even up to strain level
- New requirements for non-native beneficials
- More national requirements
- Lack of harmonization and flexibility
- Import and export, and transport restrictions



Promotional factors and trends (1)

Societal and market-related factors

- Reduced to zero levels of residue on food
- Worker and by-stander protection
- Resistance to chemicals, chance for biopesticides
- Organic production of food
- Sustainable agriculture



Promotional factors and trends (2)

Scientific and technological trends

- Flow of new ideas and results
 - e.g. insect pathogens may be used as antagonists of plant diseases
 - endophytes against insects (Vega et al., 2009)
- Micro-organism: strain improvement (hybridization)
- New production, formulation, and application technologies
- Genetically improved microorganisms, GM insects



Promotional factors and trends (3)

Changes in the regulatory climate - at EU level

- Regulation EC/1107/2009
 - Zonal authorizations
 - Mutual recognition
 - Low risk substances
- Directive 2009/128/EC: sustainable use of pesticides
 - "Encourage the use of alternative approaches....."
 - National Action Plan



Promotional factors and trends (4)

Changes in the regulatory climate

- National initiatives
 - France: 'Ecophyto" 50% reduction of chemicals in 2023
 - Green Deal Project in the Netherlands
 - Biopesticide track in Belgium
 - Pesticide levy system in Denmark
- OECD BioPesticides Steering Group
 - Development of appropriate guidance documents
 - Involvement of regulators, scientists and industry
 - OECD/EU/KEMI workshop Stockholm, June 2013



Promotional factors and trends (5)

Changes in the regulatory climate

- Increasing pressure on chemical pesticides
 - Neonicotinoids and honey bees, and birds (see ABC report)
 - Honey bee's immunity affected by fungicides
 - Endocrine disruptors
 - Candidate substances for substitution, comparative assessment
 - Risk assessments on cumulative effects of pesticides

 \rightarrow Opportunity for biopesticides to fill the gap





Promoting factors and trends (6)

Biodiversity

- The Convention of Biological Diversity requires governments to improve biodiversity and to mitigate negative impacts
- Scientists showed that chemical pesticides have a negative influence on biodiversity

(Geiger et al., 2010) (see publication)

• EU Directive 2009/128/EC states that the use of pesticides should be minimized due to environmental and biodiversity concerns







Basic and Applied Ecology

Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland

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Received 14 November 2009; accepted 4 December 2009

Abstract

During the last 50 years, agricultural intensification has caused many wild plant and animal species to go extinct regionally or nationally and has profoundly changed the functioning of agro-ecosystems. Agricultural intensification has many components, such as loss of landscape elements, enlarged farm and field sizes and larger inputs of fertilizer and pesticides. However, very little is known about the relative contribution of these variables to the large-scale negative effects on biodiversity. In this study, we disentangled the impacts of various components of agricultural intensification on species diversity of wild plants, carabids and ground-nesting farmland birds and on the biological control of aphids.

In a Europe-wide study in eight West and East European countries, we found important negative effects of agricultural intensification on wild plant, carabid and bird species diversity and on the potential for biological pest control, as estimated from the number of aphids taken by predators. Of the 13 components of intensification we measured, use of insecticides and fungicides had consistent negative effects on biodiversity. Insecticides also reduced the biological control potential. Organic farming and other agri-environment schemes aiming to mitigate the negative

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ments to improve

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ides should be

Promotional factors and trends (7)

Biopesticide industry

- Considerable progress has been made in production, formulation, efficacy, quality, and application strategy
- Biopesticides have become reliable and efficacious. Products deliver function and value to growers
- Markets are expanding, also in ag-crops
- Large ag-chem companies become involved in biopesticides
- A substantial biopesticide industry has been created; this is a solid foundation for further progress



Acquisitions

BUSINESS CONSULTANTS



Biopesticides Microbial biostimulants **Biostimulants & biopesticides** Microbial biopesticides Microbial 'biosolutions' **Biostimulants & biopecticides Microbial biostimulants** Microbial biopesticides **Biopesticides & biostimulants**

Microbial biopesticides

Microbial biopesticides

Collaborations and Partnerships

BUSINESS CONSULTANTS



Co-development of bioactives

Discovery and development of bioactives and biopesticides

Formation of Preceres LLC to develop new bioactives

BioAg Alliance to research and commercialise microbials

Licensing agreement for Delbon's Pseudomonas biostimulant

Marketing agreement for Novozyme's Teagro biofungicide

Collaboration on development of biopesticides

Distribution agreement for Marrone's biofungicide

Development of biopesticides and plant health promoters



The role of IBMA





What is IBMA?

- International Biocontrol Manufacturers Association
- Established in 1995, this year 20th anniversary
- Over 230 members
- Global (European focused) Association
- Strong growth from 10 original founding members
- Diverse membership
 - SME's to multinationals
 - Organic and biocontrol only to IPM and conventional
 - Principally involved in agriculture and horticulture



What is the focus of IBMA?

- Ensuring proportionate regulation of members' products
- Promoting the interests and activities of the sector and its' members
- Promote members main interest biologically-based crop protection
- Accelerate strong growth in the use of biocontrol products
- Maintain a strong European focus
- Assist in establishing a global network to deal with global issues
- Promote diversification into other areas



IBMA Outreach Activities

- EU Commission
- OECD
- FAO Minor Uses Summits / Forums
- EU Parliament
- Events: ABIM, Biocontrols 2015, Biocontrol Asia, Biocontrol Latam
- NGO's
- Industry Bodies
- Entire Food Chain
- Media



Global Federation of Biocontrol/Biopesticide Associations

- First meeting at ABIM 2015: IBMA, BPIA, ANBP, ABCBIO, SABO
- First Conference, Fresno, USA, March 2015
- Annual meeting at ABIM, Switzerland
- Objective: be a spokesman for global issues affecting biocontrol
 - IGO's (FAO, WHO, OECD, UN-CBD)
 - NGO's (Greenpeace, WWF, PAN, Sustainability Platform, IFOAM)
 - Harmonization
- Members from other areas





About IBMA's Regulatory Affairs





IBMA - Regulatory Activities

- OECD Activities (technical guidance documents, workshops, data requirements)
- FAO Activities (awareness, IPM programmes)
- EU Parliament
- EU Commission
 - Guidance Documents
 - Low Risk Substances
 - Sustainable Use of Pesticides Directive (SUD)
 - National Action Plans (NAP)
 - New Regulations
- EFSA
- NGO's
- Industry Bodies
- Entire Food Chain



IBMA - Regulatory Activities

- Low Risk substances and products: fast track procedure
- ABS Access and Benefit Sharing, Nagoya Protocol
 - \rightarrow a threat to the biocontrol industry??
- Natural enemies: positive list of EPPO, national approvals, species versus strain level issue
- Biostimulants and biopesticides ensuring seemless legislation, not conflicting
- Harmonization





IBMA in the Marketplace





IBMA in the Marketplace

- Promotion of Biocontrol and IPM
- Company responsibility in the first place, IBMA as supporting organization
- ABIM, the global Annual Biocontrol Industry meeting
- Fruit Logistica
- Conferences and Trade shows
 - BioControls 2015 (USA)
 - Biocontrol Asia 2015
 - Biocontrol LATAM 2016



IBMA in the Marketplace

Member market survey

- Sales of Biocontrol Products, per group, country, region,
- Economic benefit, job creation, expectation
- Pipeline estimation for notifying registration authorities
- Information for politicians, decision makers, and other stakeholders





Crop protection in 2030





Crop protection 2030: emphasis on prevention

- Resistant cultivars, developed via DNA and RNAi techniques
- Seed provided with endophytes: microorganisms for crop protection and growth stimulation
- Seed coated with biostimulants and biopesticides
- Use of natural/organic fertilizers
- Addition of 'microbial community' to soil or growing media
- Use of these methods in plant propagation phase
- Optimized growing conditions: fertilization, irrigation,
 - in protected crops: light, CO2, temperature, RH,
- \rightarrow Resilient plant from the start;
- \rightarrow Optimal use of the plant's 'defense' system
- \rightarrow Resilient growing medium
- ightarrow Optimised control of growing conditions



Crop protection 2030: emphasis on monitoring

Occurrence of pests and diseases: intensive monitoring

- By new methods:
 - Efficient automated traps for attracting insects with light, odours, pheromones, etc
 - Scouting for diseases and pests through use of odours released by disease-pest/plant combination
 - Continuous scouting via odour detection'- robots, early detection and diagnostics → automatic reporting to farmer
 - Remote sensing on weather, soil moisture, insects, nutrition, crop
 - Knowledge database (ICT tool) \rightarrow decision supporting tools \rightarrow proposed intervention to farmer





Crop protection 2030: intervention

- Based on early detection \rightarrow limited and minimal intervention
- Application via precision technologies and localized applications
- Application by agricultural robots: dispersion of beneficial insects, spraying, drenching, fertigation, dispersion of pheromones
- New techniques and means:
 - Extensive range of beneficial insects and mites available
 - Efficient beneficials with endo-symbionts
 - "Standing army" of natural enemies
 - Introduction of pests and diseases on a low level to trigger plant resilience or defense system
 - "Self-limiting" insect pests
 - Plant protection products based on natural substances, microorganisms, pheromones, RNAi, etc.
 - Mass-trapping systems (attractants, lures, colour-odour combinations)
 - Increasing plant resilience by using elicitors, kairomones,
 - Protected crops: climate and light settings to prevent and suppress pest and disease development



Crop protection 2030: intelligent agriculture

- New tools based on computer technologies and devices
 - Use of sensors, remote sensing
 - Plant phenotyping, early warning
 - In field diagnostics
 - Data processing, big data
 - Decision making
 - Application by intelligent equipment (robots, aerial, spot wise)
 - Precision application of plant protection products
 - Tracking and tracing in the chain
 - Etc. etc.







Crop protection 2030

- Emphasis on prevention and monitoring
- Intervention only when needed
- New tools all nature-based solutions
- Biopesticides, biostimulants, biofertilizers
- Resilient soils and resilient plants (microorganisms, seed treatments)
- Automation, ICT tools and intelligent equipment minimise use of products and exposure
- Holistic approach, IPM programme
- Chemicals only upon a licensed PCA written recommendation



Concluding remarks





Concluding remarks

Macro-environmental factors and influences

- Political and societal needs favour the use of biopesticides (environment, biodiversity, food safety)
- Increased legislation for chemicals will stimulate alternative solutions
- Demand for sustainable agriculture is a chance for biopesticides
- The main driving force is the requirement of supermarkets and consumers for residue-free food !!!!
- The biocontrol industry reached a sufficient level of maturity enabling solid growth in the near future



What are the challenges to IBMA and the biocontrol industry?

- Ensure appropriate regulation
- Produce usable tools for farmers and advisors
- Move the industry from fresh produce to major agricultural crops
- Ensure global availability and adoption
 - Global federation of regional biocontrol associations
 - Harmonization in regulation
 - Market access and use in all markets
- Communication of needs, solutions and knowledge with farmers and advisors
- Work effectively with all partners from farmers to consumers ensuring tools and research are fit for purpose



What does the future look like for the biocontrol industry?

- Biocontrol is becoming an essential part of IPM
- The Biocontrol industry will continue to grow
- The manufacturers landscape continues to change and grow
- The opportunities will increase, sales will grow
- Harmonization in regulations is a need
- ABS is threatening new innovations
- Knowledge transfer to users is crucial to success
- Sustainable agriculture, IPM and biocontrol is the only way forward



Bright future expectations for biopesticides

- Expected growth of biopesticides: 15-20% until 2020 to reach \$ 6-7 bn
- source: many business consultants and market analysts

(Agrow; CPL Business Consultants; Markets & Markets; MicroMarketMonitor; BCCResearch; Research and Markets; DunhamTrimmer)

- Similar growth rates as for biopesticides are expected for biostimulants, biofertilizers, agricultural inoculants, seed treatments
- Expected growth of pesticides 6-7%, to reach > \$80 bn in 2019 (Research and Markets)



Concluding remarks

Market for biopesticides

- Growth expected in:
 - Bacteria, for disease control, for nematode control
 - Antagonistic fungi, for disease control
 - Entomopathogenic fungi: slow growth
 - Baculoviruses: increased use in orchards and vegetables
 - EPNs: orchard, vegetables, amenity areas
- Biopesticides use extent to other sectors too
- Annual growth will continue with 15-20%
- Biopesticides will become a major part of crop protection means: > 50% in 2030



Thank you for your attention

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