



# New market opportunities and gaps for biological control agents



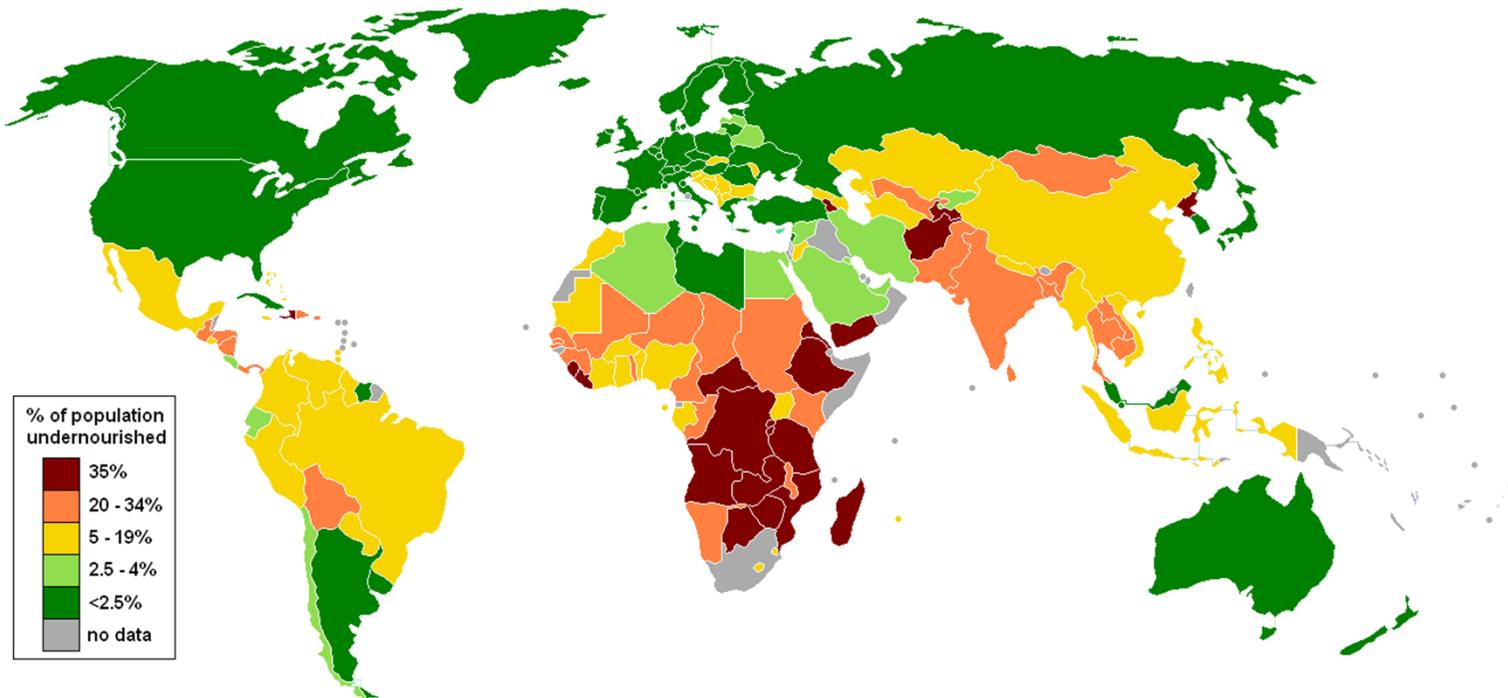
**RATIONALE**  
BIOPESTICIDE STRATEGISTS

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# Role of crop protection in food security

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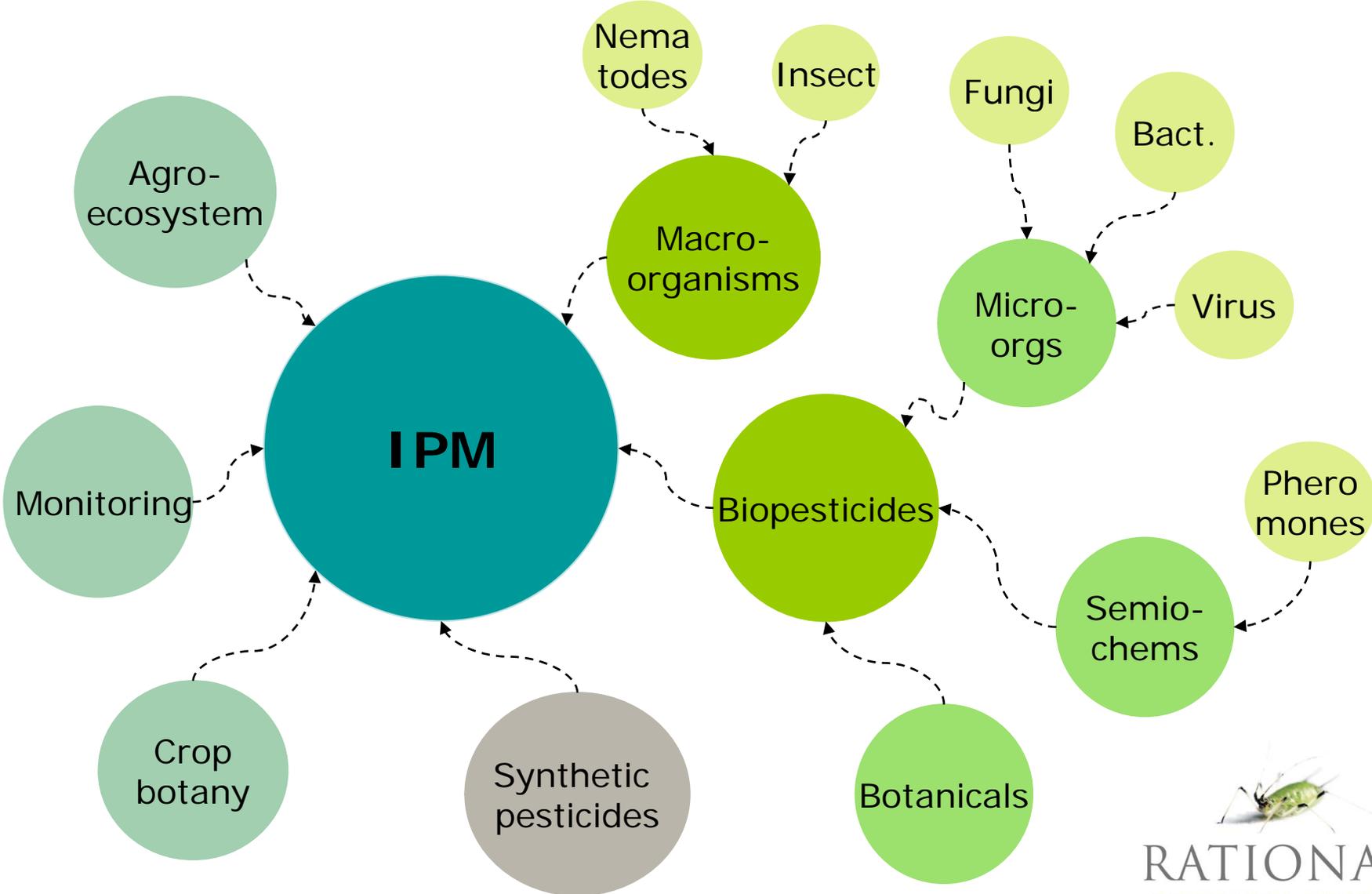
In last 40 years farmable land per person has halved



30 - 40% of crops are lost before harvest and > 10% after harvest

Source: UN World Food Programme and the FAO  
"The State of Food Insecurity in the World 2006" report.

# IPM – sustainable crop protection



## Biopesticides – USA active substances

	<b>Insecticide</b>	<b>Fungicide</b>	<b>Herbicide</b>	<b>Nematicide</b>
Microorganism Bt	44	-	-	-
Microorganism non-Bt	18	41	5	3
Botanical	8	6	1	2
Semio-chemical + pheromones	56	-	-	-
Other	25	8	3	0
<b>Total</b>	<b>151</b>	<b>55</b>	<b>9</b>	<b>5</b>

## Biopesticides – EU active substances

	<b>Insecticide</b>	<b>Fungicide</b>	<b>Herbicide</b>	<b>Nematicide</b>
Microorganism Bt	5	-	-	-
Microorganism non-Bt	7	20	0	0
Botanical	0	0	0	1
Semio-chemical + pheromones	28	-	-	-
Other	2	1	1	0
<b>Total</b>	<b>42</b>	<b>21</b>	<b>1</b>	<b>1</b>

## Biopesticides – EU active substances

Country	Crop*							Total
	Pome Fruit	Vine	Tomato	Cereal	Rape	Maize	Potato	
France	6	7	4	1	1	1	1	21
Germany	10	6	7	2	1	2	3	31
Spain	6	7	6	0	1	0	1	18
UK	4	0	7	1	0	0	0	12
<b>Total</b>	<b>26</b>	<b>20</b>	<b>24</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>5</b>	

\* Data derived from IBMA

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# Biological control agent - market gaps

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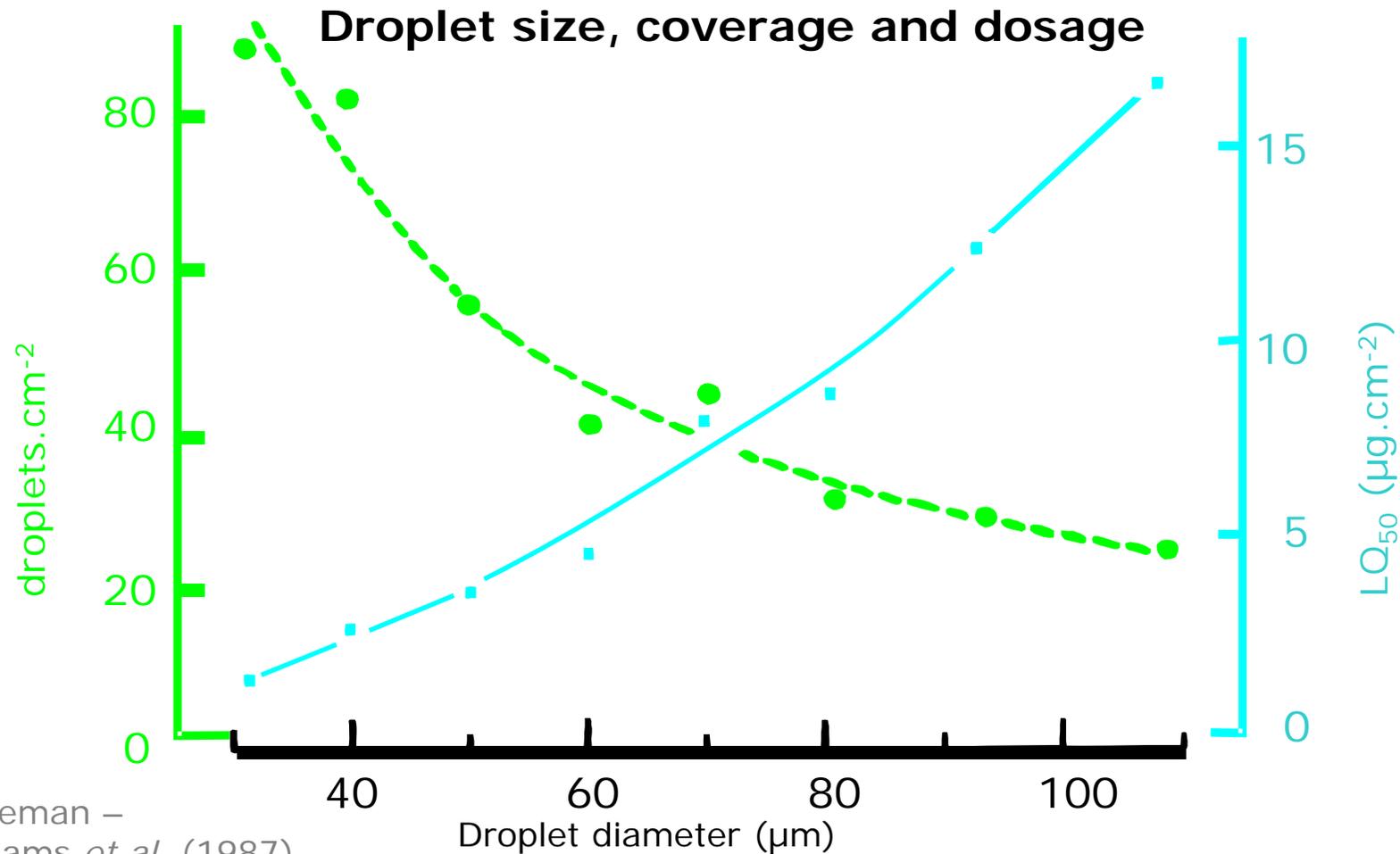
## Market increase by:

- Developing products for new groups – herbicides, nematicides,
- Developing active for new target pests – aphids, rust, septoria, blight, resurgent pests
- Developing products for new areas – broad acre field crops, bio-fuel crops, storage, post harvest



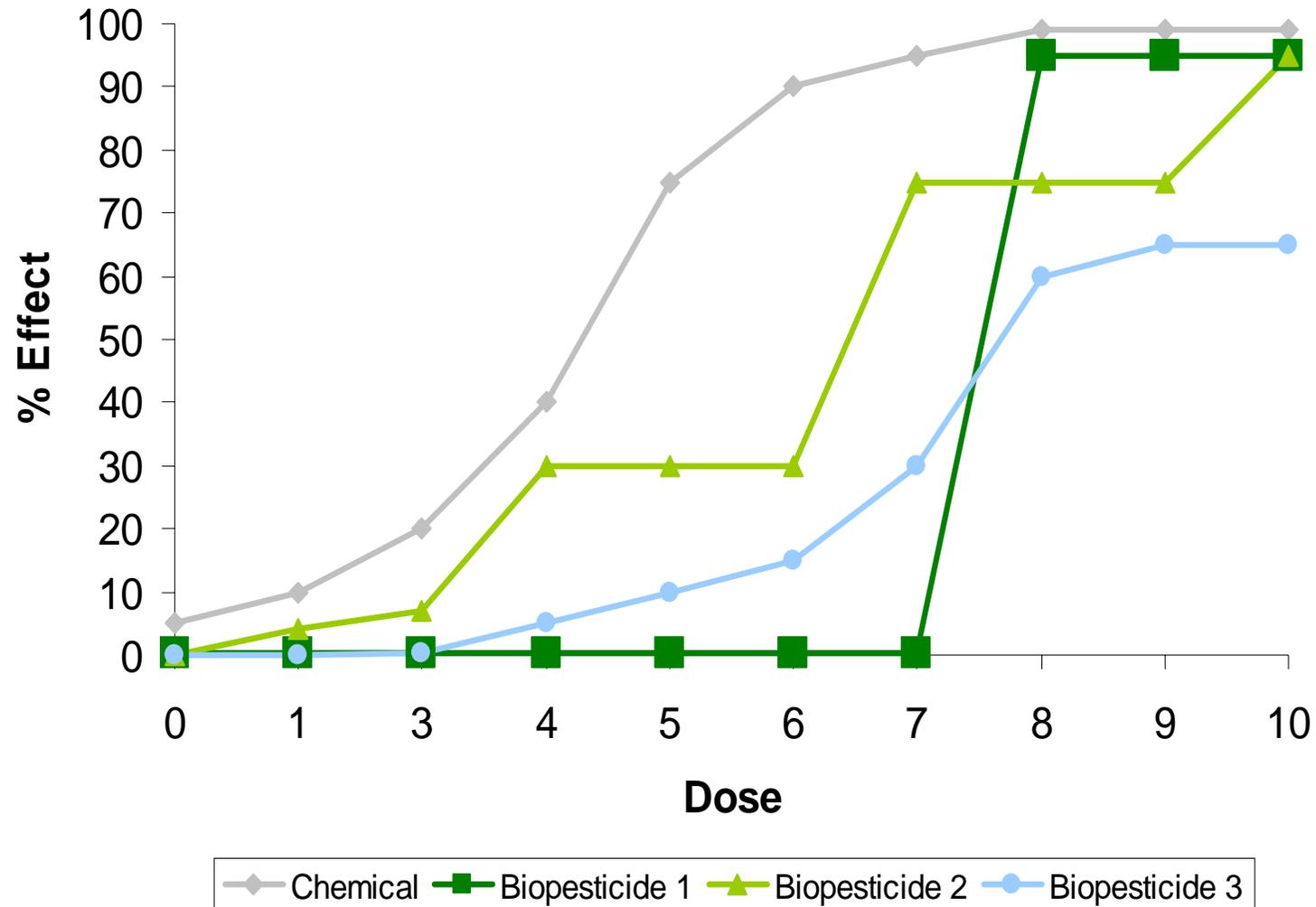
## Biopesticides – field optimisation

- Formulation – to improve bioavailability in the field
- Application technology – nozzles, pressure, water volume, etc.



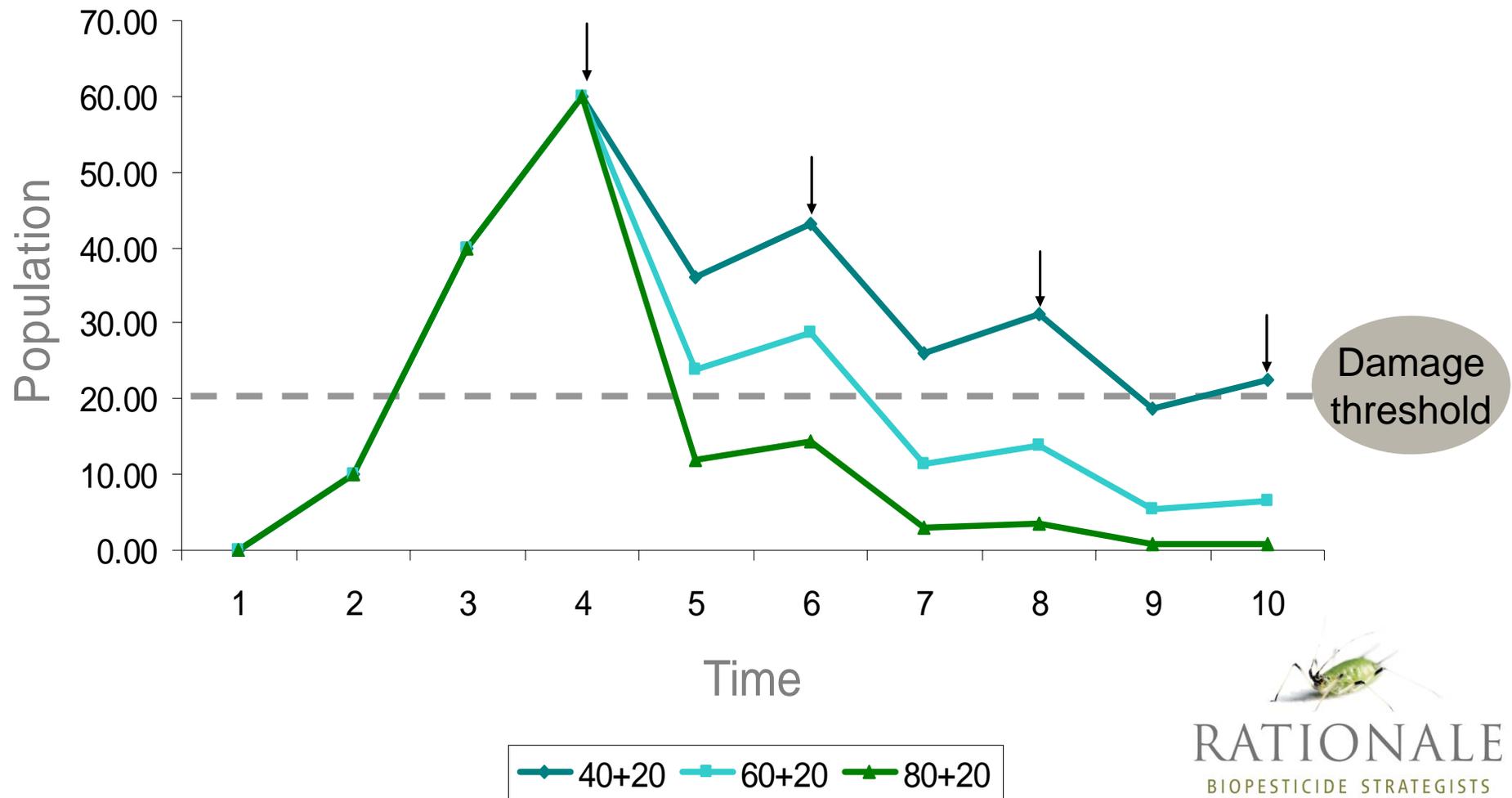
LO<sub>50</sub> - dosage required to achieve biological effect

## Biopesticides – dose response curves



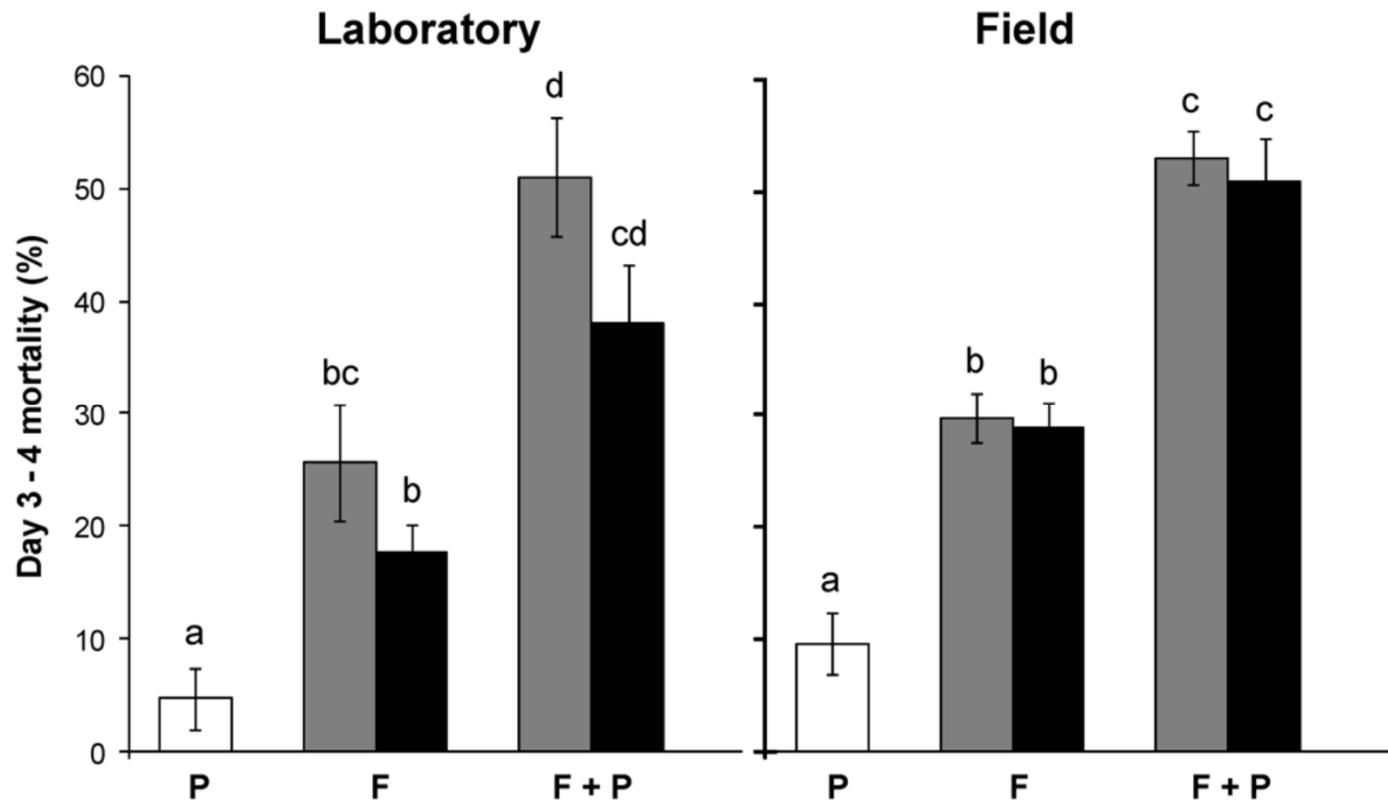
# Biopesticides – programme use

Biopesticides: Variable effect, 20% recovery



## Biopesticide – synergy with chemical pesticides

Effect of permethrin on fungal virulence to *Anopheles gambiae* - mean % mortality when exposed to permethrin (P), fungus (F) or both (F+P) on day 0. (Farenhorst *et al*, 2010).



□ = uninfected    ■ = *Beauveria bassiana* infected    ■ = *Metarhizium anisopliae* infected

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# Biopesticides – product optimisation

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- What are we trying to achieve on the crop
  - what is the dose response curve
  - field observations vs lab,
  - how to assess use in IPM
  - use with chemical pesticides
- Alter evaluation to consider – when product 'not' working
- Mode of action
- In crop survival – how often to treat and why ?



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## Biocontrol market – new territories

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### Africa

- Zambia's flower and vegetable industry was losing about \$150K a day.
- Ethiopian rose exporters losing about \$200k a day.
- Kenya's horticulture exports was losing \$3 million to \$4 million a day.
- 65% of Kenyan flower - European Union.
- Agriculture represents 20% to 30% of GDP in Sub-Saharan Africa and 50% of exports.



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# New Markets – Biocontrol Technology

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- Build towards a new crop protection system – based on an agro-ecosystem IPM



- Develop the next generation of biocontrol technology

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## Biopesticides – ‘systemic’ activity

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- *Beauveria bassiana* – insect pathogenic fungus
- Many reports of endophytic activity in range of crops – coffee, cotton, tomato
- Activity against plant pathogens and potentially against insects

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# Biopesticides – plant interactions

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- stimulating defense pathways
- *Trichoderma* spp. offer plant protection but also stimulate plant health
- Potentially improve ability of plant to withstand environmental stresses.

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## Biocontrol – Plant secondary compounds

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- Production of alarm compounds to attract predators and parasites of pest herbivores – phytohormone stimulation
- Stimulation of new biosynthesis of phytochemicals – terpenoids, phenylpropanoids and fatty-acid derived green leaf volatiles
- Stimulation of plant defense mechanisms – jasmonic acid and salicylic acid.

**Induction in roots, shoots and leaves  
– treatment of seeds, soil and foliar**



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# Biocontrol – market opportunities

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- New crop uses and new pest targets
- Expansion into new territories
- Optimising on-crop efficacy
- Development of IPM
- Exploit potential of
  - endophytic activity – systemic action
  - secondary plant compounds
  - plant defense mechanism pathways

Thank you for your attention



Associate member of IBMA



RATIONALE  
BIOPESTICIDE STRATEGISTS