



Food and Agriculture  
Organization of the  
United Nations



International  
Plant Protection  
Convention



Department  
for Environment  
Food & Rural Affairs

# Understand the ecology of biocontrol microbes for effective deployment

London, 21 – 23 September 2022

## International Plant Health Conference



# Outline

- Disease management is context-dependent
- Biocontrol agents (BCAs) differ from synthetic pesticides
- Using strawberry disease management as an example



# Managing strawberry diseases

A biopesticide-based management is effective against mildew and grey mould in strawberry under protection

Summary of fungicides, biopesticides, biostimulants applied to strawberry at NIAB in 2019 and the programme material costs (£/ha)

Products used	Management programmes	
	Routine	Managed
Total fungicides	29	2
Biopesticides	0	10
Biostimulants	0	4
Total programme cost	<b>2,006</b>	<b>1,082</b>
<i>Mildew only cost</i>	889	1,082
<i>Botrytis only cost</i>	1,361	184



# Disease management – context dependent

- Epidemiology primarily dictates interventions
  - Timing depends on risks (past/present/future weather)
  - The actual intervention is context dependent
- For example, for *Botrytis cinerea*
  - Infection of flowers leads to latent infection
  - Regular removal of unmarketable fruit minimises inoculum
  - Rotting fruit are rarely seen before harvest under protection, in contrast to under the open-field conditions
- Post-harvest cool-chain management is sufficient to delay the onset of latent grey mould development
  - Pre-harvest use of fungicide/BCA not needed



# Biocontrol organisms

- Biocontrol mechanisms differ from pesticides
  - Competition
  - Antibiosis
  - Induced resistance
  - Mycoparasitism
- BCA are living organisms
  - Spread to other sites/areas
  - Survival/reproducing
- BCA ecology has not received sufficient attention



# BCA dispersal/spread

- Applying *B. subtilis* increased its population density on leaves
  - Can vary greatly with specific strains
- *B. subtilis* may remain on treated strawberry leaves for many days
- Limited spread of *B. subtilis* among leaves, particularly under protected conditions
  - True for several other biocontrol strains

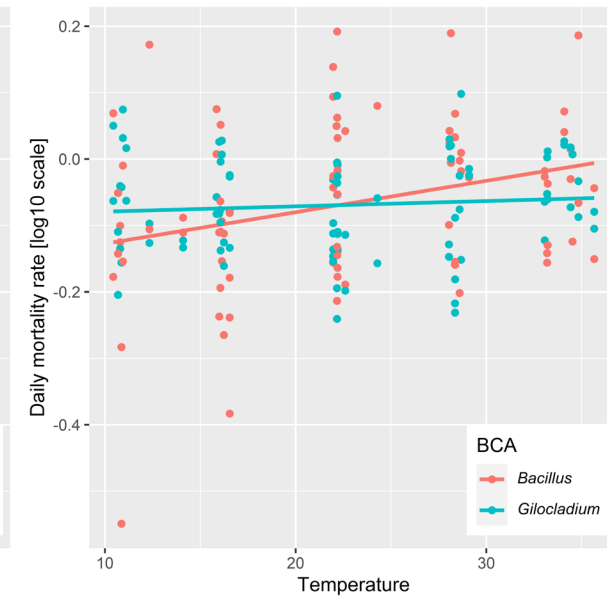
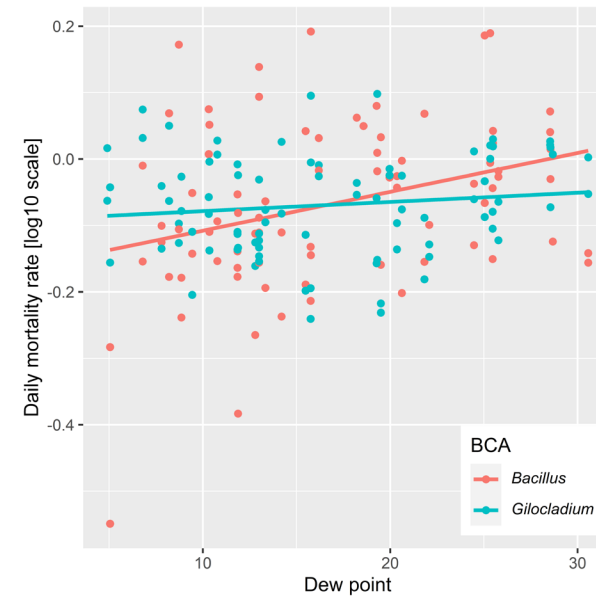
<i>B. subtilis</i> sequence counts on strawberry leaves			
Treatment	4 hours after treatment	8 Days after treatment	
		Old treated leaves	New leaves not directly treated
<b>Open field:</b>			
Untreated	2	1	5
Treated	3011	1559	459
<b>Protected</b>			
Untreated	2	2	1
Treated	1017	1151	70





# BCA survival

- Both *B. subtilis* and *G. catenulatum* can survive on strawberry and lettuce leaves for many days
- Factors limiting biocontrol efficacies are, thus, likely to be
  - Host growth dilution
  - Lack of dispersal among host tissues
- Biocontrol efficacy is expected to be reduced during the period of host rapid growth



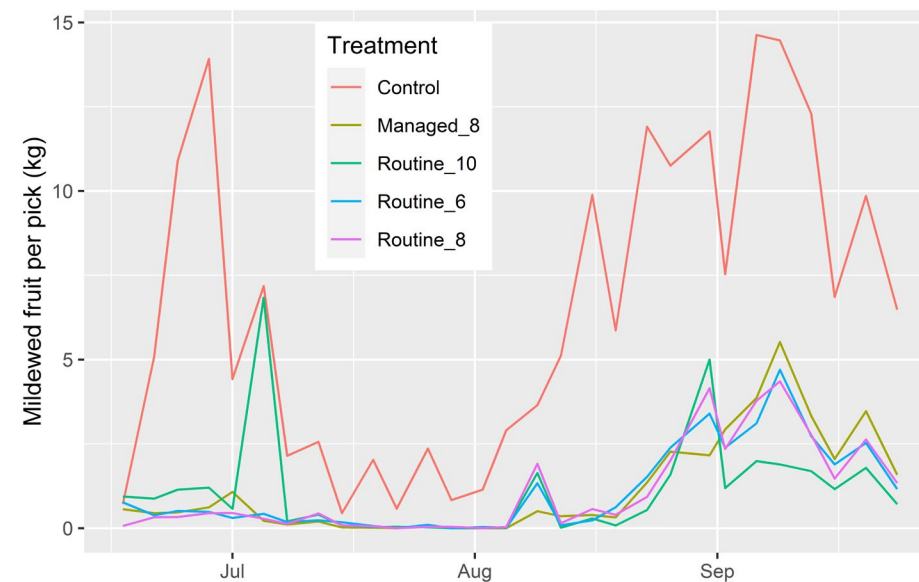
# Disease pressure

## ➤ Under high disease pressure

- High inoculum level
- Highly susceptible genotypes
- Rapid host growth
- Favorable weather conditions

achieving effective disease control is nearly impossible unless the intervention interval is significantly shortened

## ➤ Hence the importance of integrated management







Food and Agriculture  
Organization of the  
United Nations



International  
Plant Protection  
Convention



Department  
for Environment  
Food & Rural Affairs

Thanks you for  
your attention

Xiangming Xu  
*Head of Science, NIAB*

London, 21 – 23  
September 2022

**International  
Plant Health  
Conference**

