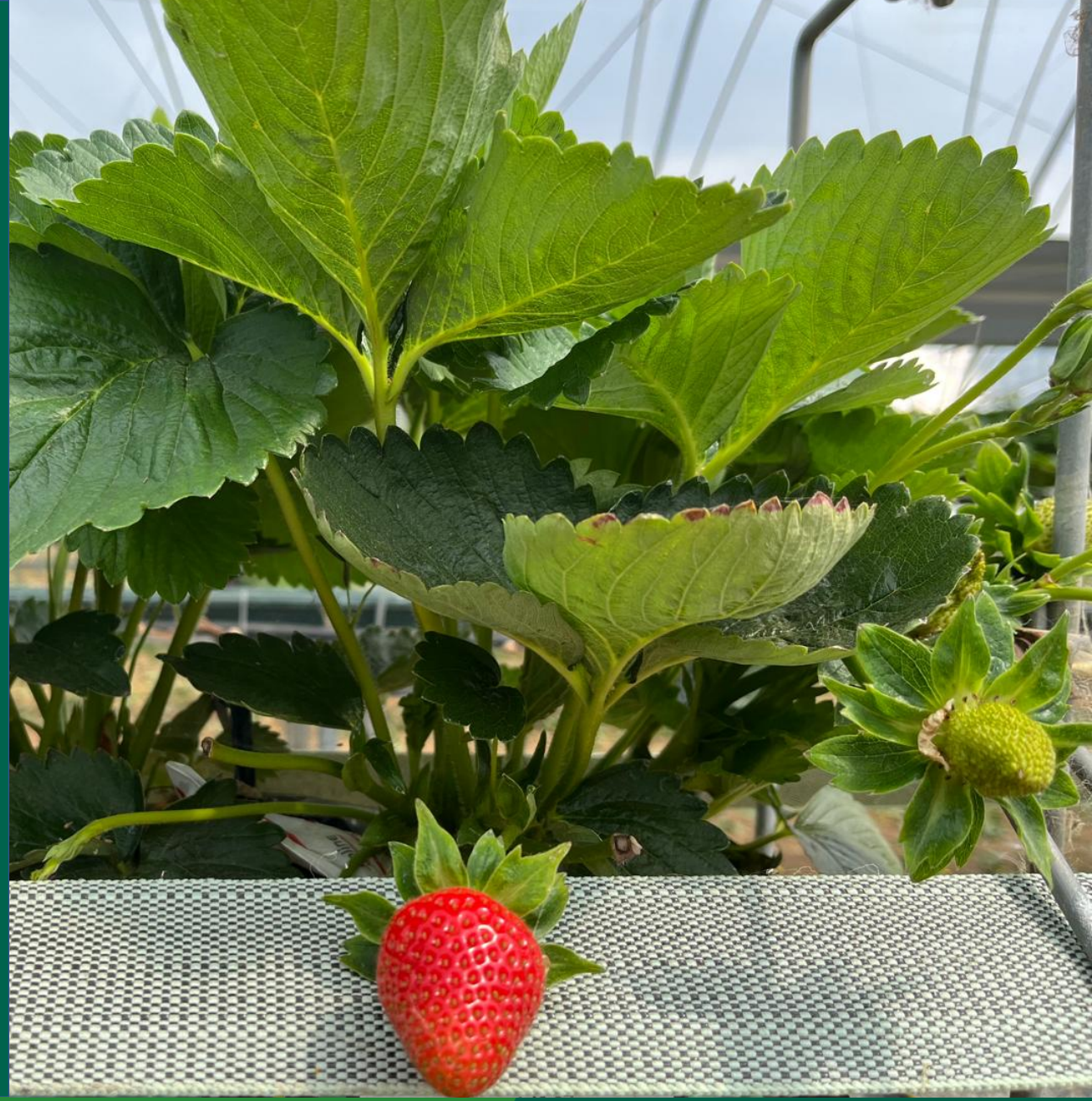
The Holistic Approach to Plant Disease Control



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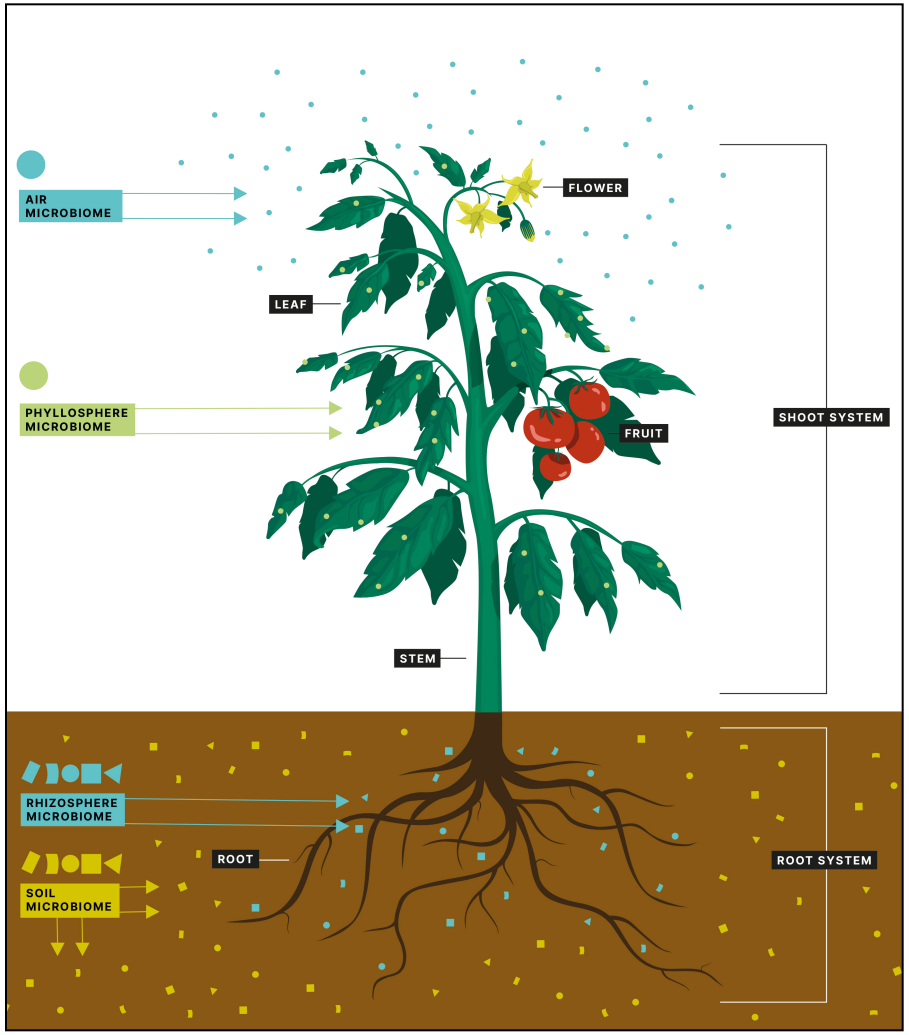
Plant Microbiomes

Plants are colonised by microbes and are in continual interaction with them.

If interactions are **correctly** managed, then pathogens are suppressed.

If interactions are **badly** managed, then pathogens will flourish.

Majority of plant diseases arise from mismanagement of these ecosystems

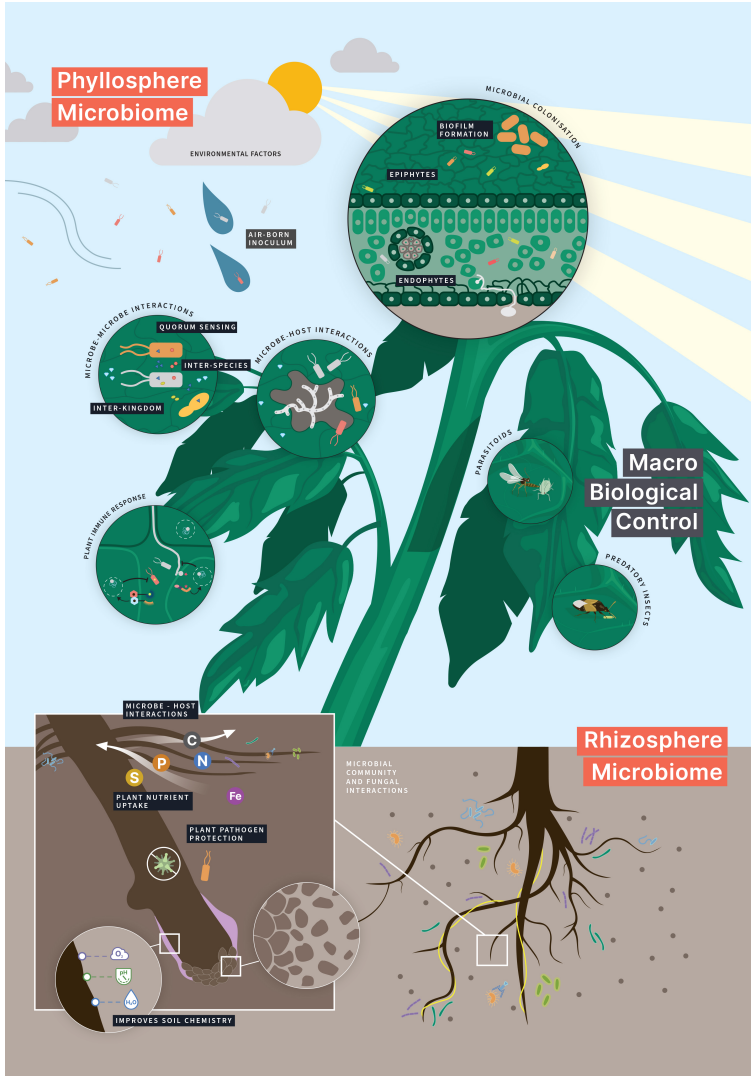


The Key Biomes

The Growing Facility
The wider growing area

The Phyllosphere
Above ground parts of the plant

The Rhizosphere
Below ground parts of the plant



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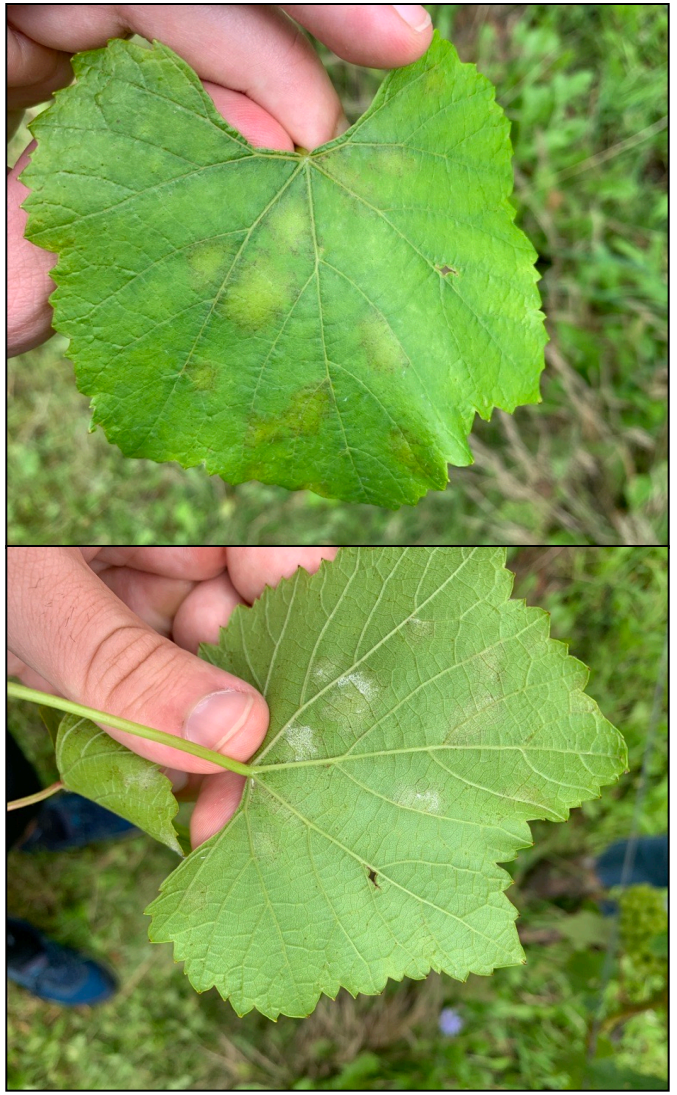
How does disease develop?

Stage 1: Inoculum makes contact with plant

Stage 2: Plant environment is amenable for pathogen to initiate infection

Stage 3: The defences of the plant are overcome by the pathogen

Stage 4: Sufficient nutrition is available for it to establish



Stage 1

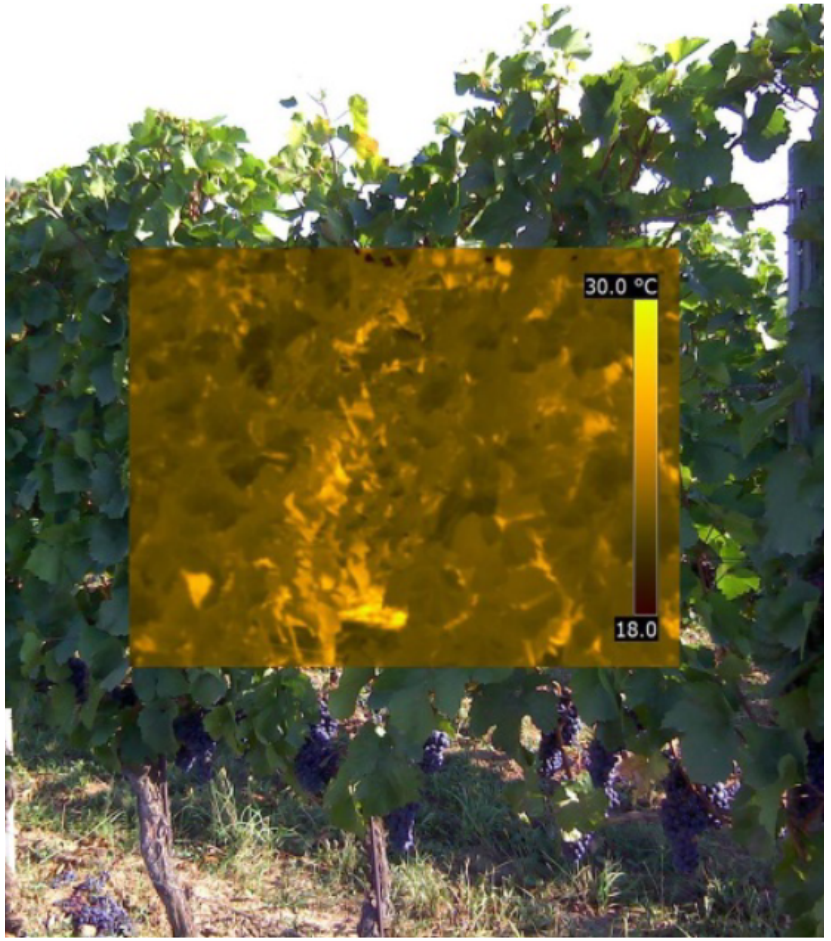
Inoculum makes contact with plant

Generally, we operate under assumption
that inoculum is ever-present and we aim to manage it.

Stage 2

Plant environment is amenable for pathogen to initiate infection.

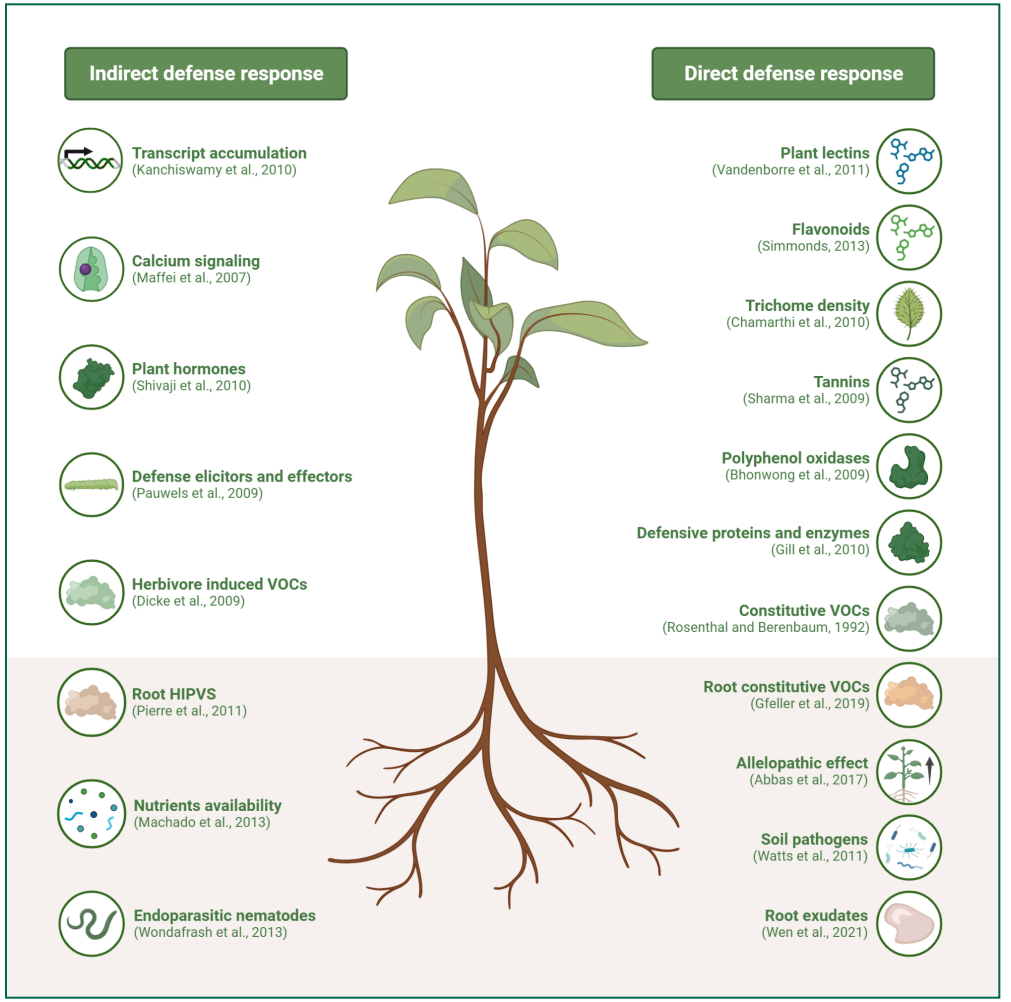
We can use fertilisation and crop training to reduces presence of pathogen friendly microclimates.



Stage 3

The defences of the plant are overcome by the pathogen.

- The <u>first line</u> of defence is the microbiome.
- The <u>second line</u> of defence is plant structural and biochemical defences
- Both are reliant on ***<u>correct plant nutrition</u>*** to function properly



Stage 4

Sufficient nutrition is available for it to establish.

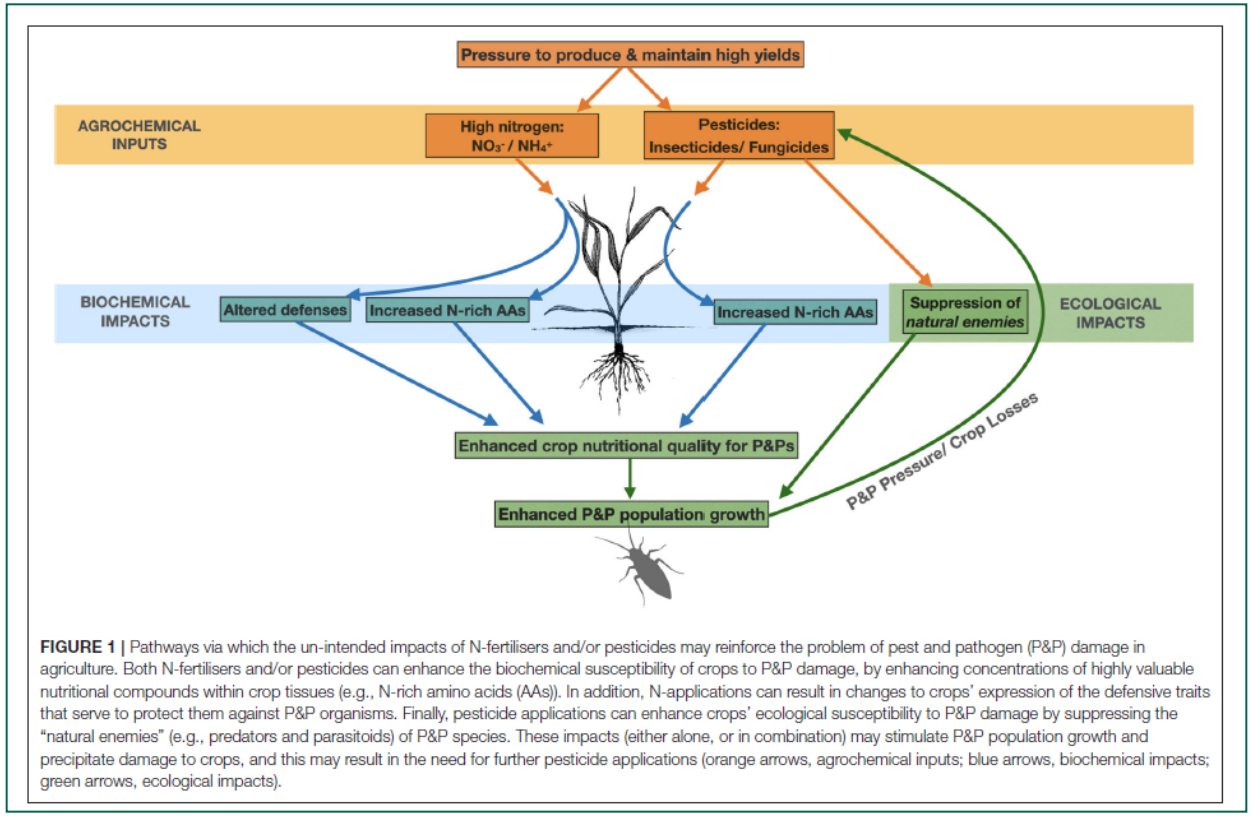


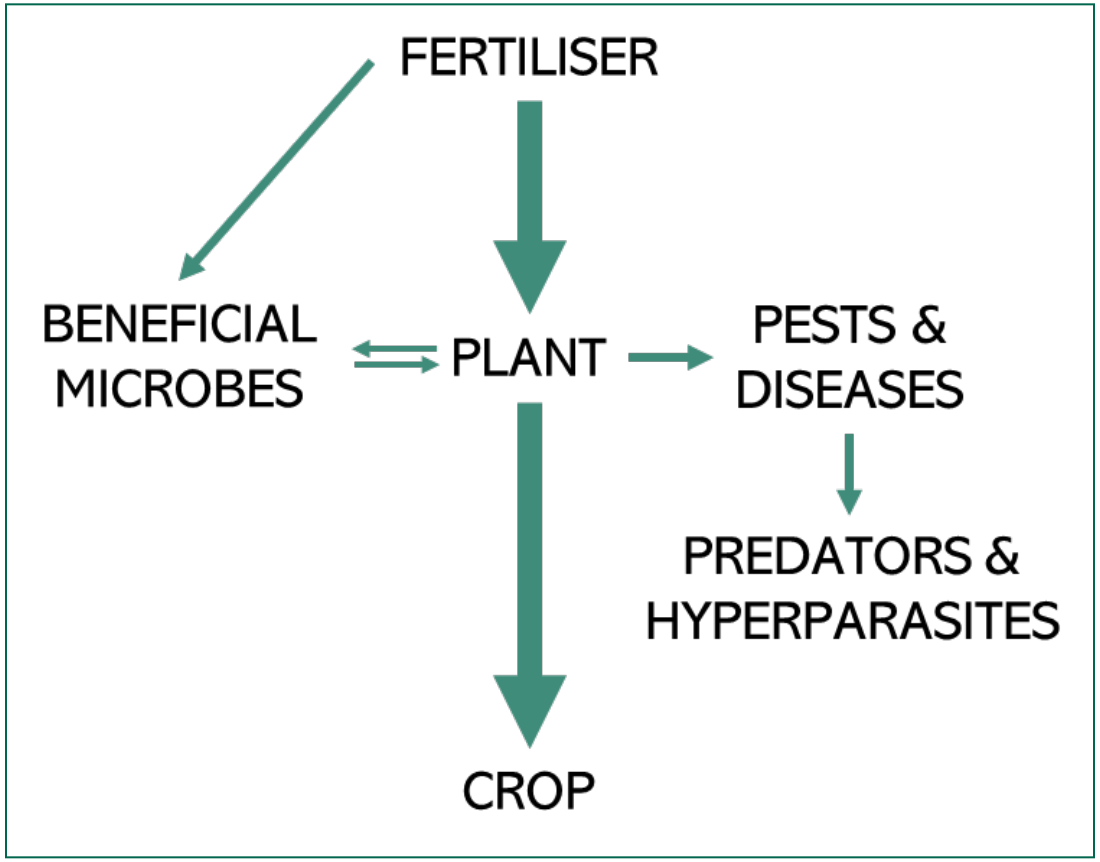
FIGURE 1 | Pathways via which the un-intended impacts of N-fertilisers and/or pesticides may reinforce the problem of pest and pathogen (P&P) damage in agriculture. Both N-fertilisers and/or pesticides can enhance the biochemical susceptibility of crops to P&P damage, by enhancing concentrations of highly valuable nutritional compounds within crop tissues (e.g., N-rich amino acids (AAs)). In addition, N-applications can result in changes to crops' expression of the defensive traits that serve to protect them against P&P organisms. Finally, pesticide applications can enhance crops' ecological susceptibility to P&P damage by suppressing the "natural enemies" (e.g., predators and parasitoids) of P&P species. These impacts (either alone, or in combination) may stimulate P&P population growth and precipitate damage to crops, and this may result in the need for further pesticide applications (orange arrows, agrochemical inputs; blue arrows, biochemical impacts; green arrows, ecological impacts).

Conventional vs Holistic Approach

Independent programmes are created for fertilisation and pest & disease management.

Conventional approach

- Aims to ***replicate*** natural processes with chemistry.
- Can be ***antagonistic*** to one another - requiring ***curative*** actions and an ***increase in costs.***

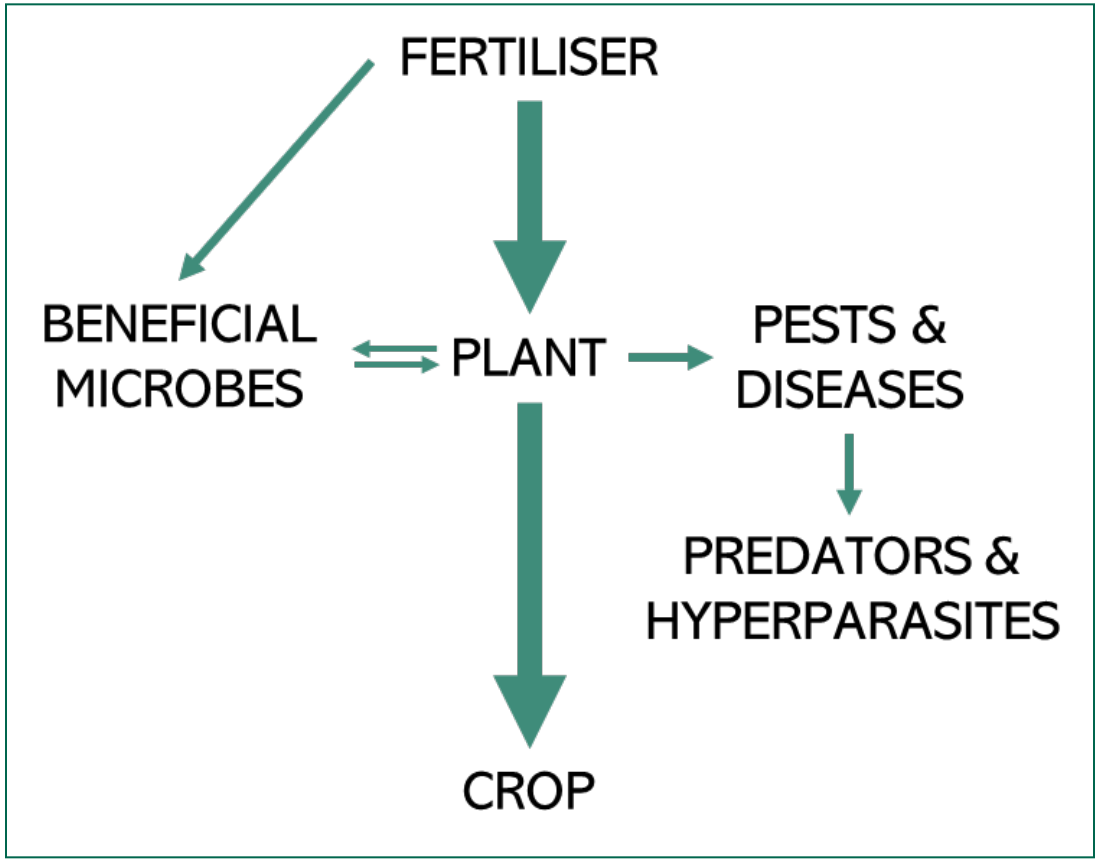


Conventional vs Holistic Approach

Interacting programmes are created for fertilisation and pest & disease management.

Holistic approach

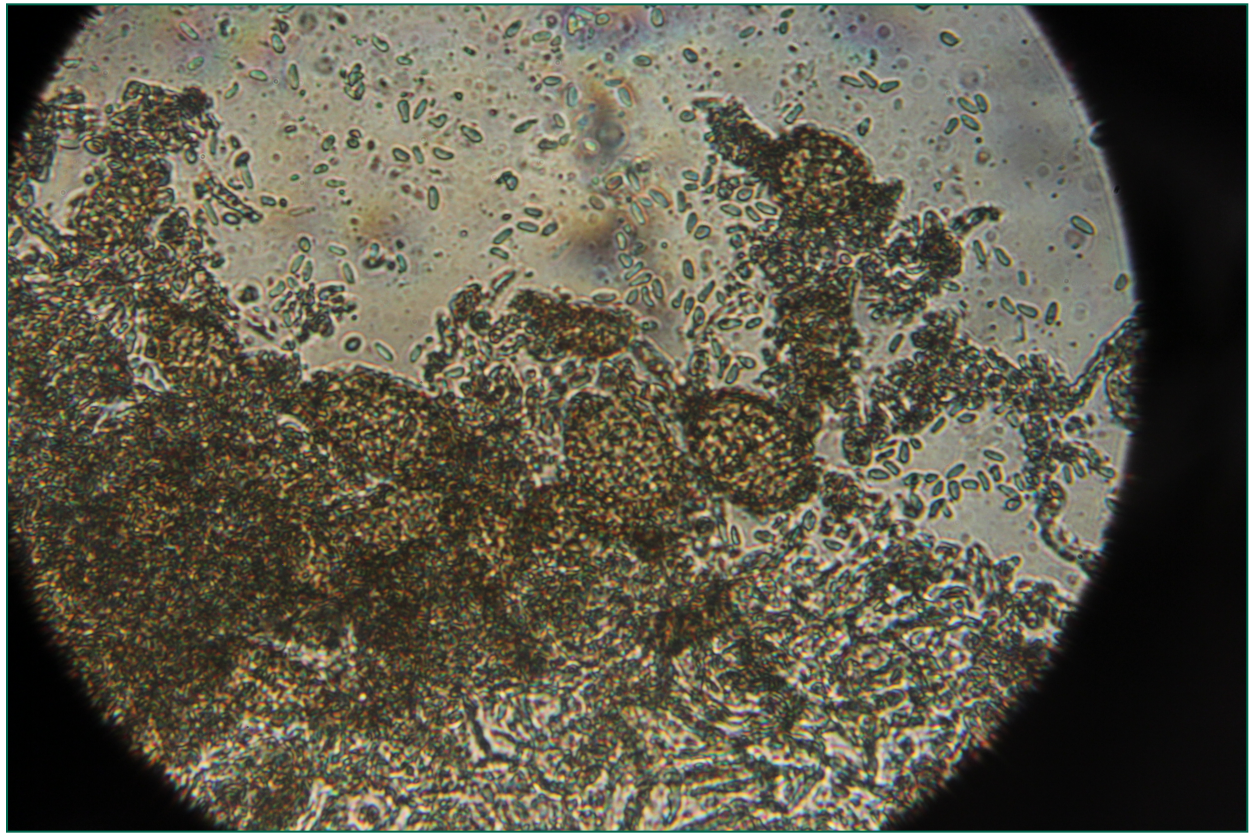
- Programmes designed to be ***complimentary*** of one another.
- Aims to ***harness and enhance*** natural processes.
- Can improve crop health – providing ***preventative*** protection and ***decrease in costs.***



Biofungicides

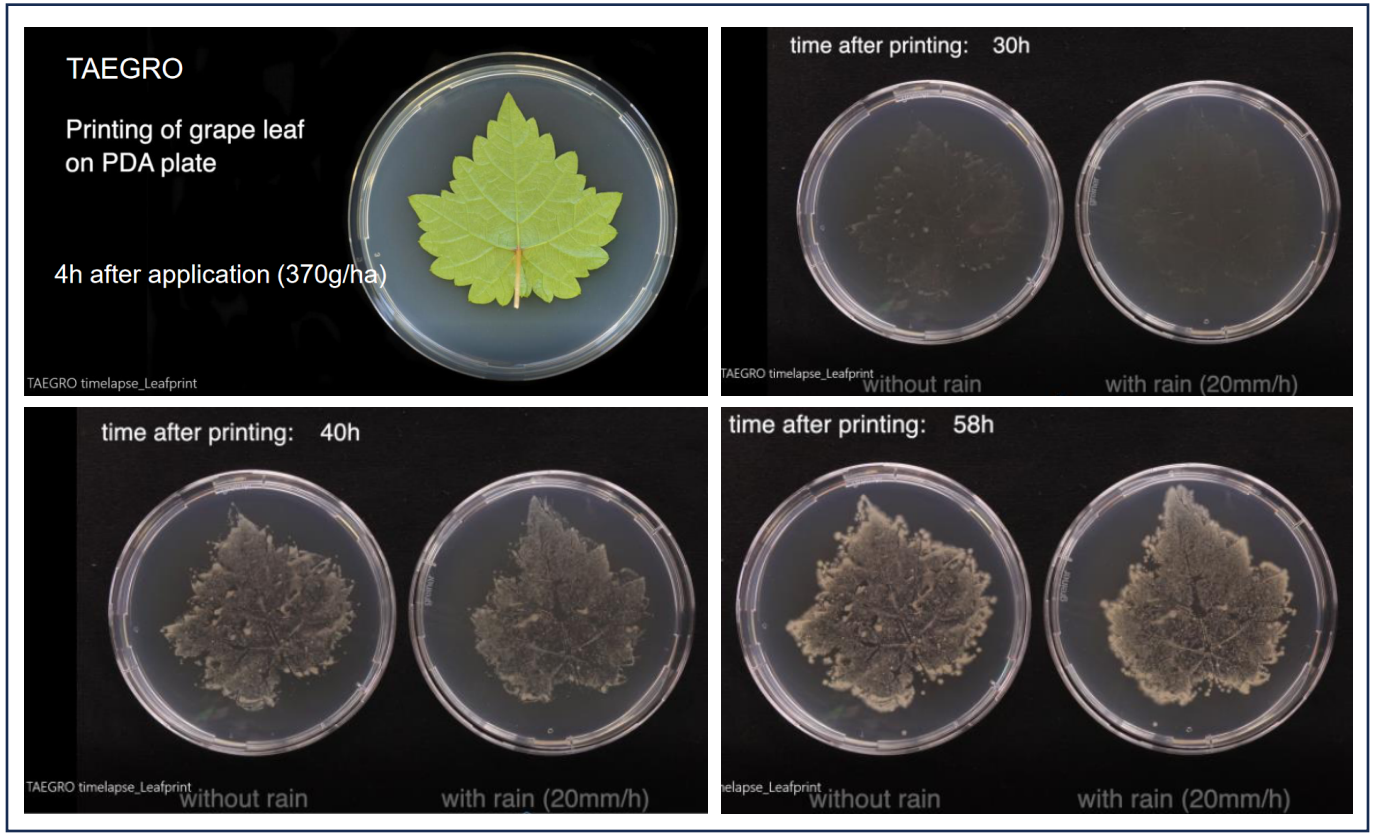
Biofungicides have many capabilities that conventional chemical ones don’t.

Types of biofungicides
Microbial
Contact
Elicitors



Benefits of Biofungicides

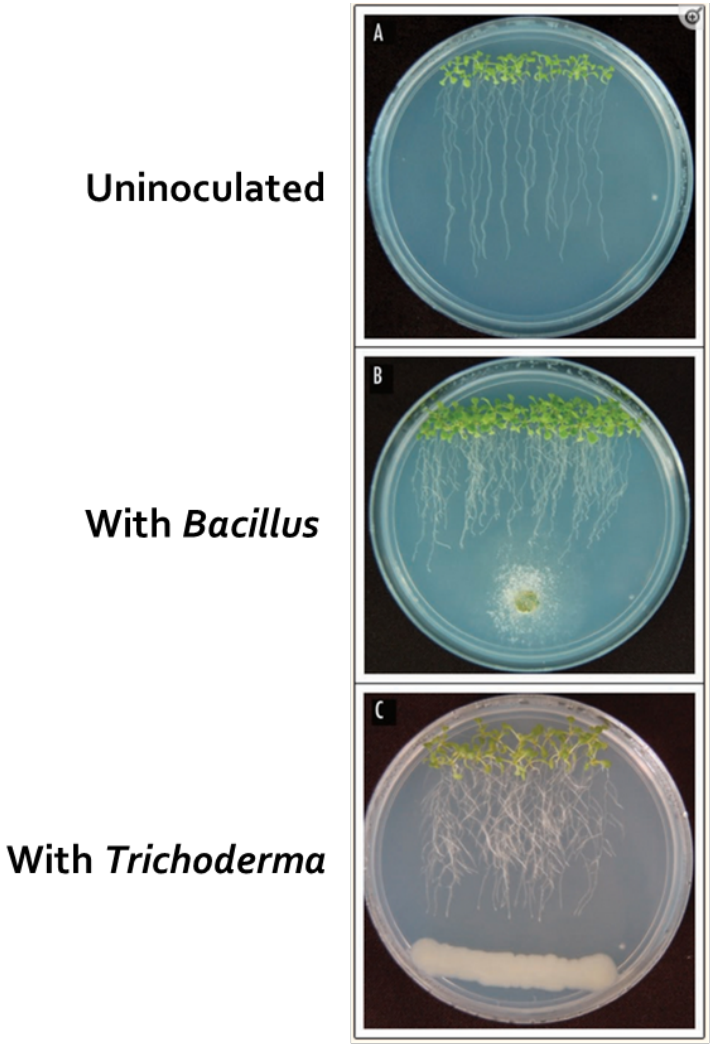
Correctly fertilised plants will respond significantly better to biopesticides and increase their longevity.



Benefits of Biofungicides

Many biofungicides will strengthen a plant rather than weaken it.

Correctly fertilised plants will show stronger positive response to stimulation by biopesticides.



Uninoculated

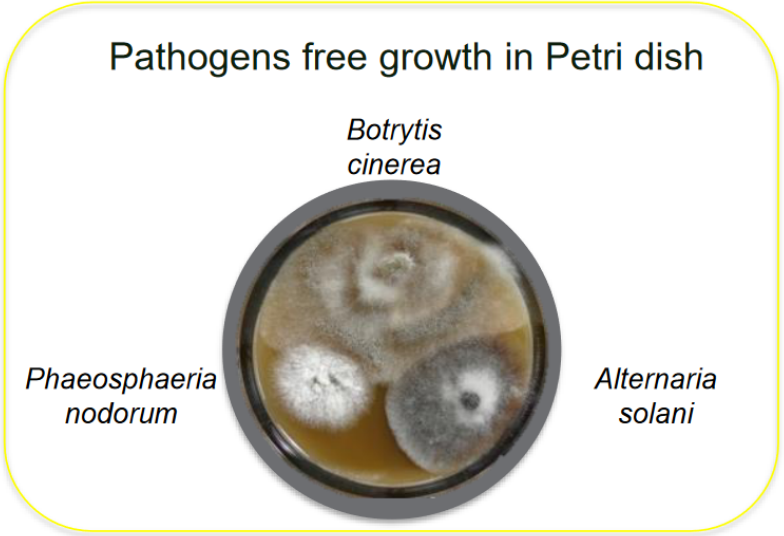
With *Bacillus*

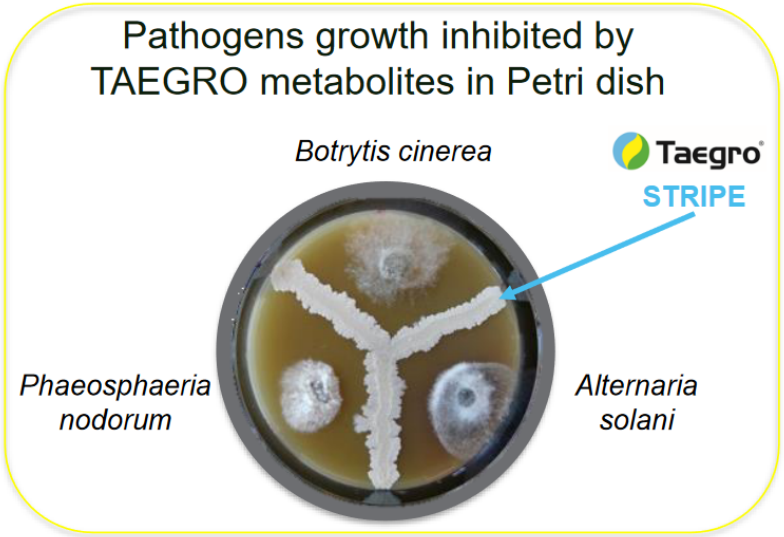
With *Trichoderma*

Source: Ortiz-Castro et al., 2009

Benefits of Biofungicides

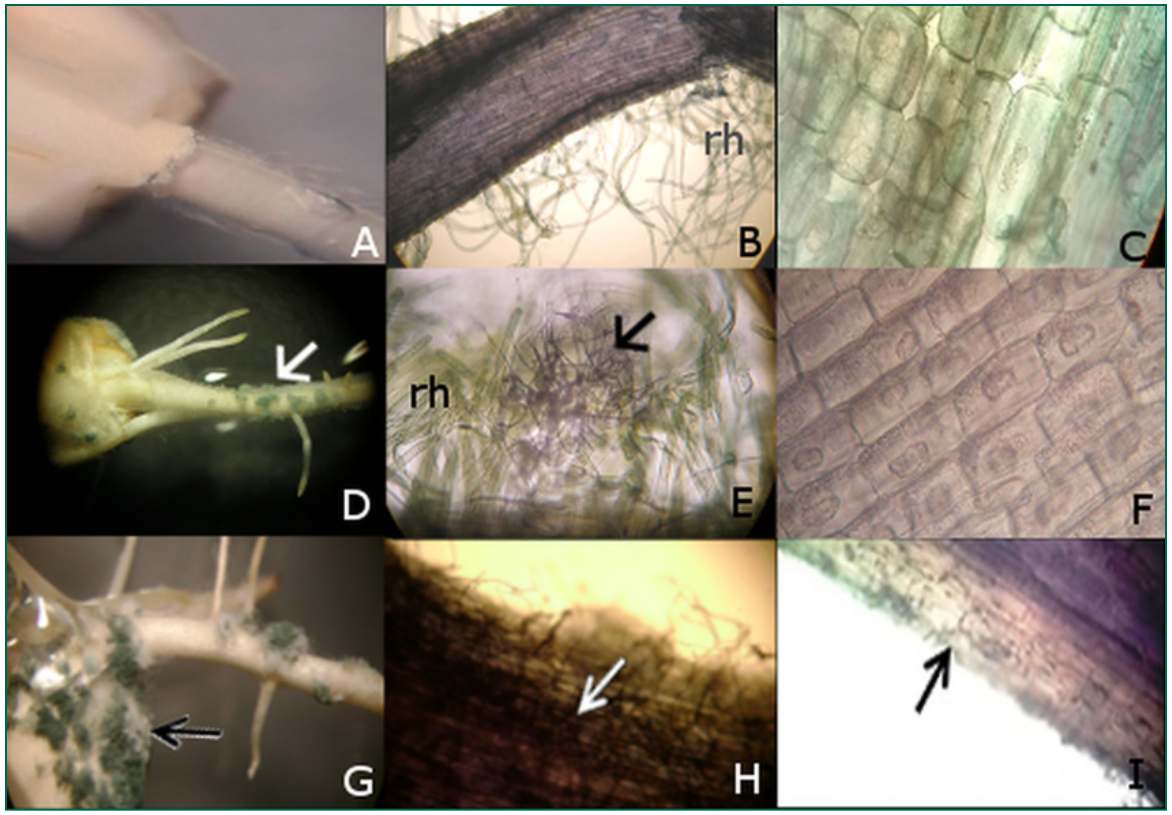
- Broad-spectrum control
- (Almost) no resistance risk





Selecting the correct fungicides

- You must understand the activity and resulting strengths and the weaknesses of each product.
- We can select ones that support one another and avoid using any ineffectively.



Example Programme - Cucumber

Pesticides/ Foliar Nutrition/ Soil Ammendments

Application type:	Drench	Spray					
crop week	T34	SB Plant Invigorator	Romeo	Taegro	Haneia	Maxicrop	AQ10
1							
2			•		•		
3	•					•	•
4		•		•			
5			•		•	•	
6		•		•			
7			•		•		
8						•	•
...		Repeat week 5-7 spray applications until crop end					

Product information	T34	SB Plant Invigorator	Romeo	Taegro	Haneia	Maxicrop	AQ10
MAPP number	17290	N/A	**19170**	**19204**	N/A	N/A	**19968**
Application Rate	**0.01g/L (substrate)**	**1L/ha***	**0.5kg/ha**	**0.37kg/ha**	**1L/ha***	**5L/ha**	**0.035kg - 0.07kg/ha**
Max. number of applications	1	N/A	**8**	**12**	N/A	N/A	**12**
Pre harvest Interval	N/A	N/A	**1 day**	**1 day**	N/A	N/A	**1 day**
Approval	EAMU 20222339	N/A	On-label	On-label	N/A	N/A	On-label

*presumed concentration of 1mL/L at water rate of 1000L/ha

Manipulating the microbiome

Prunus lusitanica bacterial Shot-hole trial.

Holistically managed crop (*left in images*)
vs.
Conventionally managed crop (*right in images*).

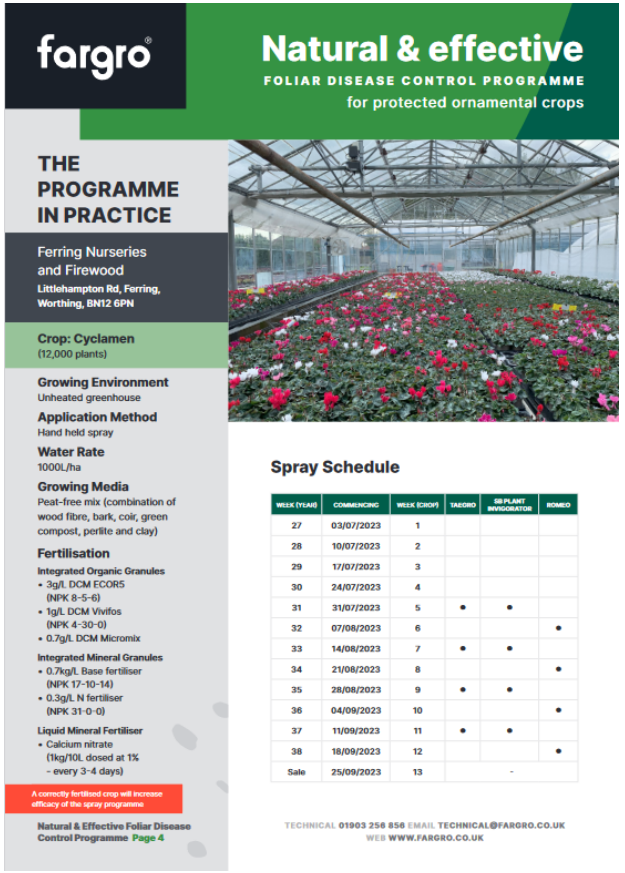
Example Holistically grown crop

Cyclamen (1L pot)

<u>Approximate costings</u>
Media & fertiliser: £0.10 per plant
Pest Management Programme: £0.014 per plant
Disease Management Programme: £0.0006 per plant

TOTAL COST: £0.1146 per plant (£114.60 per 1,000 plants)

<99% of crop sold



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Natural & effective
FOLIAR DISEASE CONTROL PROGRAMME
for protected ornamental crops

THE PROGRAMME IN PRACTICE

Ferring Nurseries and Firewood
Littlehampton Rd, Ferring, Worthing, BN12 6PN

Crop: Cyclamen
(12,000 plants)

Growing Environment
Unheated greenhouse

Application Method
Hand held spray

Water Rate
1000L/ha

Growing Media
Peat-free mix (combination of wood fibre, bark, coir, green compost, perlite and clay)

Fertilisation

Integrated Organic Granules
- 3g/L DCM ECOR5 (NPK 8-5-6)
- 1g/L DCM Vivifos (NPK 4-30-0)
- 0.7g/L DCM Micromix

Integrated Mineral Granules
- 0.7kg/L Base fertiliser (NPK 17-10-14)
- 0.3g/L N fertiliser (NPK 31-0-0)

Liquid Mineral Fertiliser
- Calcium nitrate (1kg/10L dosed at 1% - every 3-4 days)

A correctly fertilised crop will increase efficacy of the spray programme

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Spray Schedule

WEEK (YEAR)	COMMENCING	WEEK (CROP)	TAEGRO	SB PLANT INVIGORATOR	ROMEO
27	03/07/2023	1			
28	10/07/2023	2			
29	17/07/2023	3			
30	24/07/2023	4			
31	31/07/2023	5	•	•	
32	07/08/2023	6			•
33	14/08/2023	7	•	•	
34	21/08/2023	8			•
35	28/08/2023	9	•	•	
36	04/09/2023	10			•
37	11/09/2023	11	•	•	
38	18/09/2023	12			•
Sale	25/09/2023	13		-	

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THE PROGRAMME IN PRACTICE

Ferring Nurseries and Firewood
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'The spray programme was easy to apply and achieved complete control. We lost no plants to disease.'
DAVID COURTENAY LUSCOMBE
GROWER MANAGER, FERRING NURSERIES AND FIREWOOD

Taegro MAPP Number 19204
Romeo MAPP Number 19170

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Results

Botrytis spotting of flowers is the primary disease concern with Cyclamen crops. We achieved 100% control with no flower damage observed in the crop – this is despite an unseasonably cool and humid July and August and no heating of the crop.

CONTROL LEVEL 100%

No Botrytis damage was observed on the foliage or flowers

Costings

PROGRAMME TOTAL COST* £0.0006 per plant (£0.60 per 1,000 plants)

*Product only

Benefits of Programme

- Lower cost than conventional programme
- Limits exposure of staff to hazardous chemicals
- No chemical residues on product
- Application is easy and practical
- Products work on natural plant processes and create stronger and more resilient plants – improving customer success when planting at home

USE PLANT PROTECTION PRODUCTS SAFELY.
ALWAYS READ THE LABEL AND PRODUCT INFORMATION BEFORE USE. FURTHER DETAIL ON WARNING SYMBOLS AND PHRASES IS INCLUDED ON THE LABELS AND LEAFLETS.