The Holistic Approach to Plant Pest Management

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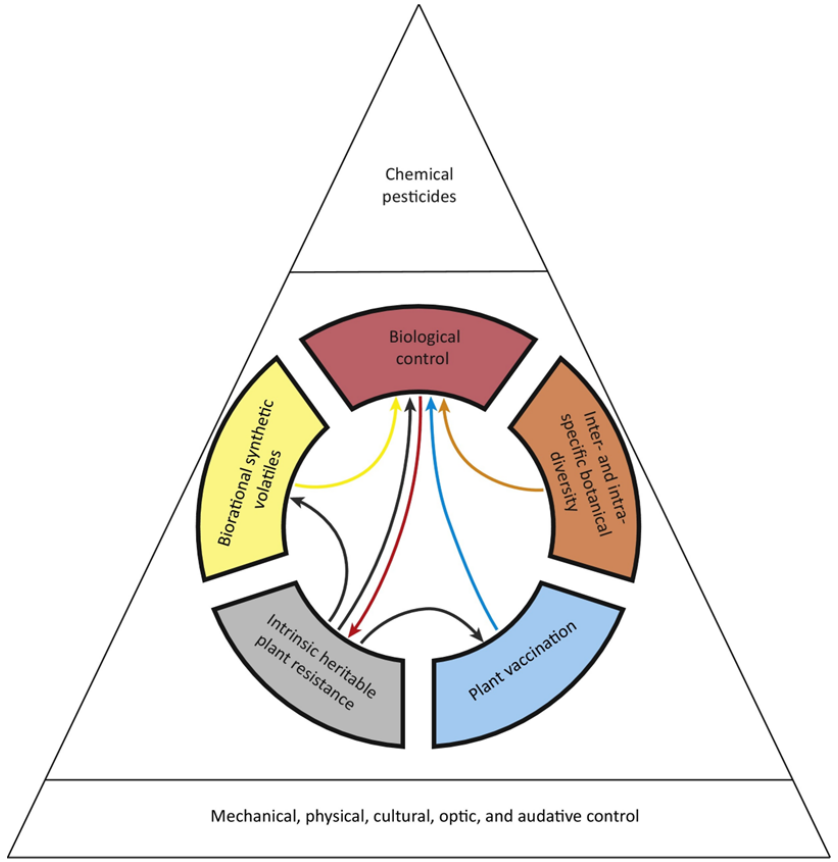
Direct and Indirect Plant Protection

We often focus on direct plant protection methods.

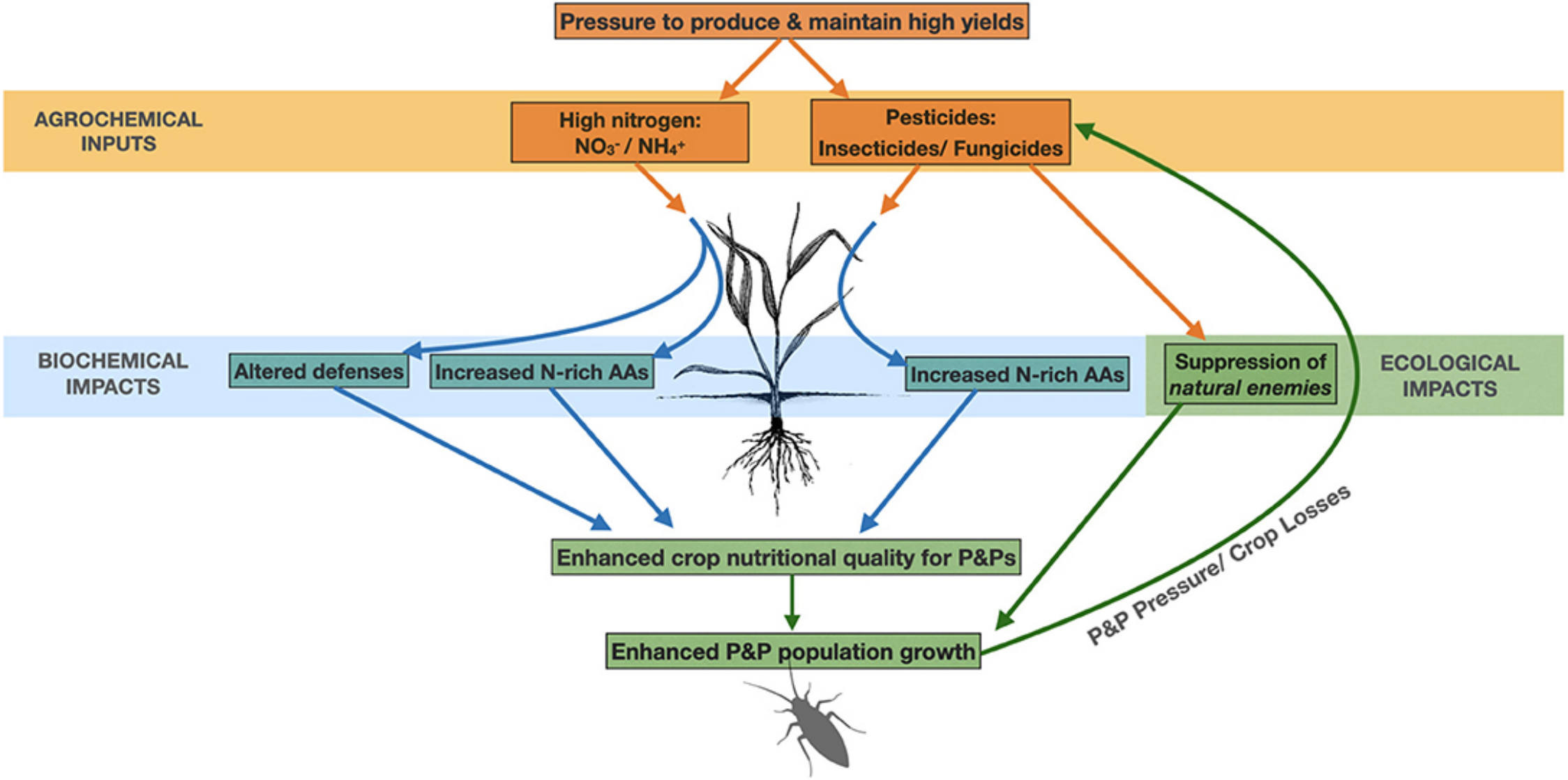
To form a holistic IPM system both indirect and direct methods must be considered.



Indirect Plant Protection

Indirect plant protection measures include environmental management and nutrition.

Nitrates → **Amino Acids** →


Pressure to produce & maintain high yields
AGROCHEMICAL INPUTS
High nitrogen: NO_3^- / NH_4^+
Pesticides: Insecticides/ Fungicides
BIOCHEMICAL IMPACTS
Altered defenses
Increased N-rich AAs
Increased N-rich AAs
Suppression of *natural enemies*
ECOLOGICAL IMPACTS
Enhanced crop nutritional quality for P&Ps
Enhanced P&P population growth
P&P Pressure/ Crop Losses

Holistic Fertilisation

- Organic nutrition is mineralised by microbes, feeding them to foster a healthy rhizosphere.
- Microbe metabolic speed aligns with plant metabolic speed, providing a steady supply of nutrition.

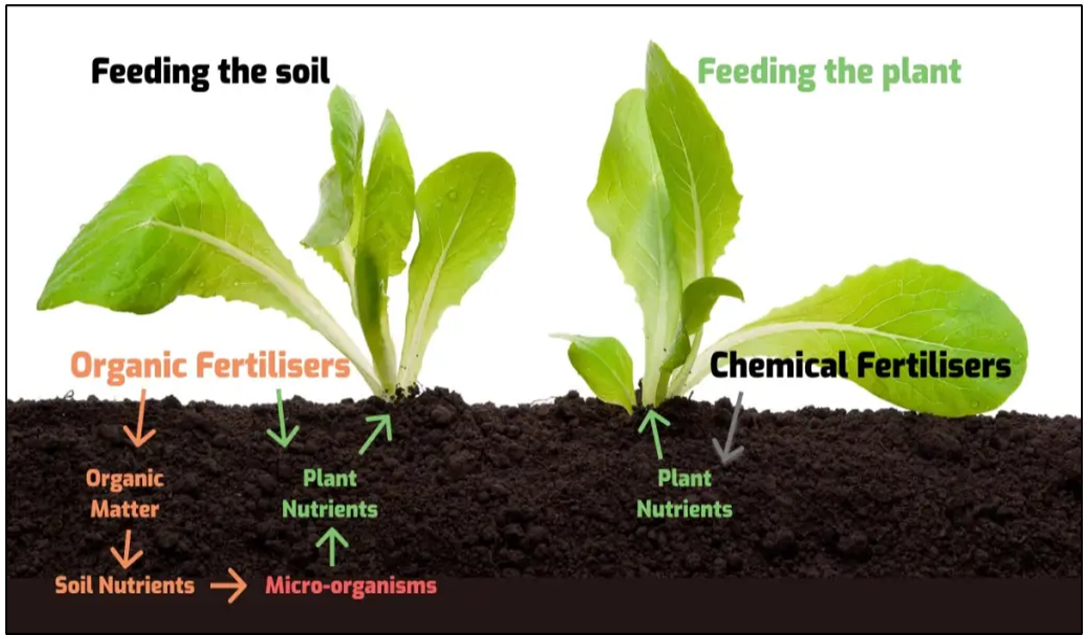


Table 3. Life-table parameters mean (±SEM) for the cotton aphid, *Aphis gossypii*, on cucumber as a function of nitrogen fertilization levels (ppm) ($n = 30$).

Parameters	Nitrogen treatment (ppm)			
	90	110	150	190
Developmental time (days)	6.77 ± 0.11 a	6.88 ± 0.13 a	6.68 ± 0.14 ab	6.38 ± 0.11 b
Adult longevity (days)	12.27 ± 1.2 b	14.36 ± 1.22 a	14.95 ± 1.6 a	15.00 ± 1.43 a
Total nymphs produced per adult aphid	58.7 ± 5.15 b	67.1 ± 5.63 b	73.63 ± 7.1 b	93.14 ± 7.48 a
R_o (♀♀/♀/generation)	57.31 ± 5.24 b	66.81 ± 5.88 b	72.16 ± 7.32 b	91.05 ± 7.7 a
r_m (♀♀/♀/day)	0.391 ± 0.005 b	0.398 ± 0.007 b	0.402 ± 0.007 b	0.458 ± 0.005 a
λ (♀♀/♀/day)	1.449 ± 0.0084 c	1.47 ± 0.011 b	1.478 ± 0.011 b	1.54 ± 0.008 a
T_c (day)	10.929 ± 0.213 a	10.82 ± 0.135 a	10.96 ± 0.159 a	10.47 ± 0.168 a
d_t (day)	1.869 ± 0.023 a	1.784 ± 0.035 ab	1.773 ± 0.034 b	1.61 ± 0.021 c

Note: r_m, intrinsic rate of increase; R_o, net reproductive rate; λ, finite rate of increase; T_c, mean generation time (days); d_t, doubling time (days). Within the same row, means followed by different letters indicate that they were significantly different ($P = 0.05$, LSD after one-way ANOVA).

Table 2. Effect of Different Rates of Nitrogen on Abundance of Thrips on Onions at Quetta, Pakistan, for 2002 and 2003 Combined

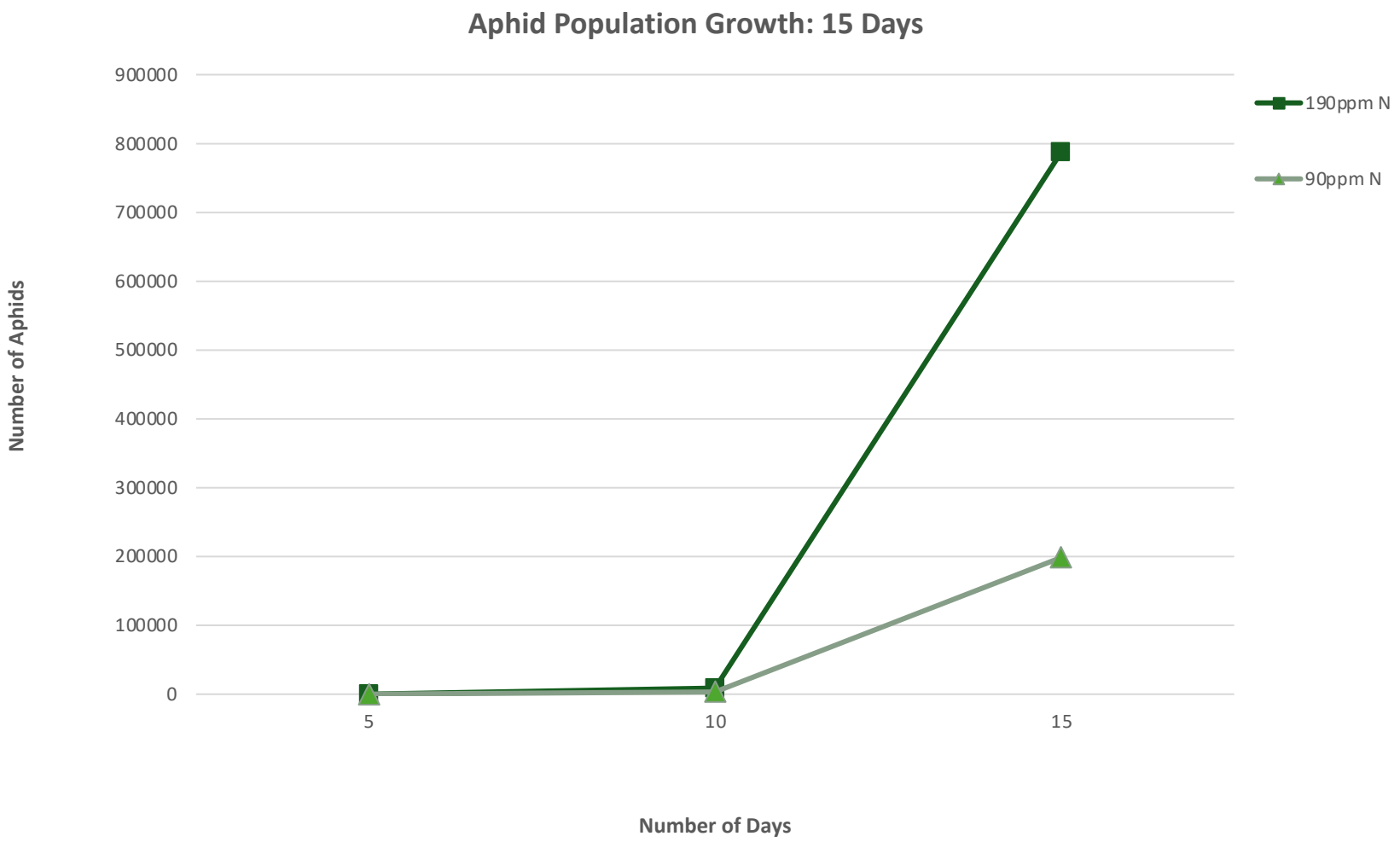
Nitrogen-phosphorous-potassium (kg/ha)	Thrips per plant	% increase
00-00-00	7.50 b	0.00
50-100-100	7.51 b	0.13
100-100-100	7.53 b	0.41
150-100-100	7.59 b	1.13
200-100-100	13.04 a	73.86
250-100-100	13.08 a	74.40

Means followed by the same letter in a column are not significantly different at $P <$ 0.05 (LSD).

Table 4
Longevity and oviposition frequency of *T. vaporariorum* females grown on from plants fertilized with three nitrogen levels and allowed to oviposit on to plants fertilized with 140 ppm of nitrogen

Nitrogen level (ppm)	Mean female longevity[a] (d)	Mean oviposition frequency[b] (no.eggs/female/d)
308	45.7 a	3.9 a
140	45.1 a	3.7 a
84	40.2 a	3.2 b

N and Pest Development



Nitrogen: 90ppm (x59)

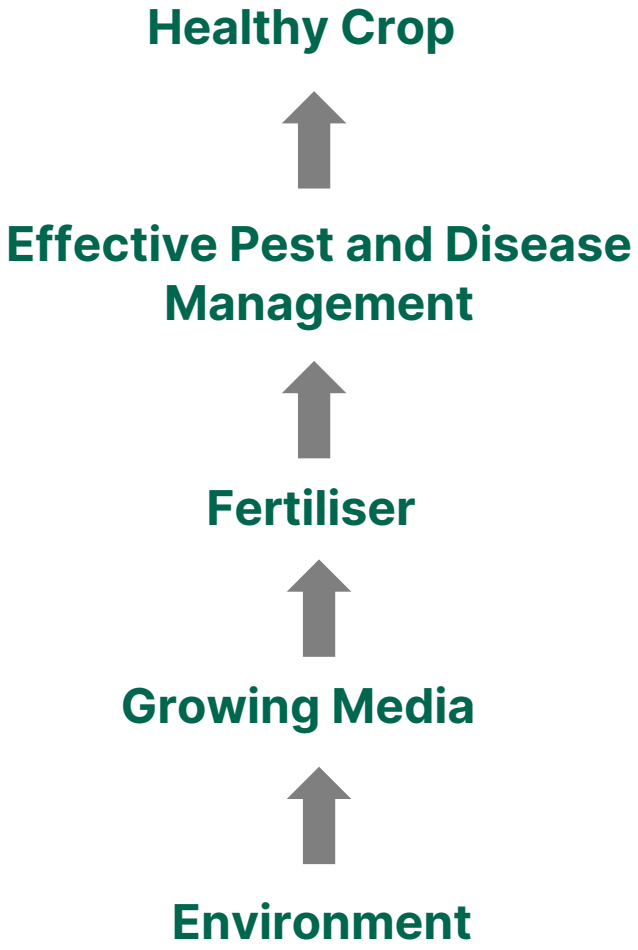
Number of Days	Number of Young
5	59
10	3,422
15	198,476
20	11,511,608
25	667,673,264
30	3.87×10^{10}

Nitrogen: 190ppm (x93)

Number of Days	Number of Young
5	93
10	8,556
15	787,152
20	72,417,984
25	6,662,454,528
30	6.19×10^{11}

Holistic Growing

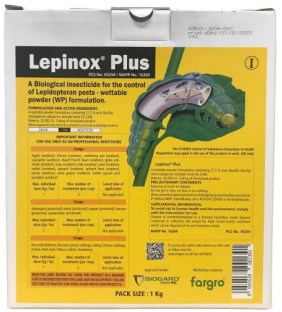
- By working with the plant and delivering a steady nutrient supply, the crop is stronger and less attractive to pests.
- With a reduced pest population, preventative pest management measures can be adopted - BCAs and Biopesticides.
- Direct pest management can be designed with complimentary products - Promotion of natural predators and parasitoids.
- Reduced chemical use means less impact on crop metabolism - Trophobiosis



Beneficials and Biopesticides

Programme Development:

- Crop
- Site surroundings
- Temperatures, weather conditions
- Pest emergence timings
- Crop development - Canopy coverage, plant spacings, crawling vs. flying beneficials
- Application method - Hand vs applicator, even distribution, nozzles, moisture
- **Cost and practicality for the grower**



Macrobiological Control

Cucumber Production

Macrobiological Controls Programme

Apply Thu/Fri

Species:	*Phytoseiulus*	*A. cucumeris*	*A. californicus & A. swirskii*	*Encarsia formosa*
Formulation:	Loose	Loose	Bugline Duo	Card
Target/Notes:	Spidermite	Thrips	Spidermite & Thrips / Exc. gaps between slabs	Whitefly

Crop Week	*Phytoseiulus*	*A. cucumeris*	*A. californicus/A. swirskii*	*Encarsia formosa*
1				
2	30 mites/slab	1,500 mites/slab		
3				1 card/5m^2
4			1 box (600m)/600 slabs	
5				1 card/10m^2
6				
7				1 card/10m^2
8				
...	Repeat week 4-8 applications until crop end ↺			

Macrobiological Control

Cucumber Production

Apply Mon/Tue

	Product type:		Insecticide
	Application type:	Spray	Spray

Crop Stage	Crop Week	SB Plant Invigorator	Naturalis-L
Up To First Fruit	1		•
	2	•	
	3		•
	4	•	
During Fruiting	5	•	
	6		
	7		•
	8		
	9	•	
	10		
...		Repeat week 7-10 spray applications until crop end ↺	

Product information	SB Plant Invigorator	Naturalis-L
MAPP number	N/A	**17526**
Application Rate	**1L/ha***	**3L/ha**
Max. number of applications	N/A	**5**
Pre harvest Interval	N/A	N/A
Approval	N/A	On-label

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

Trials Work

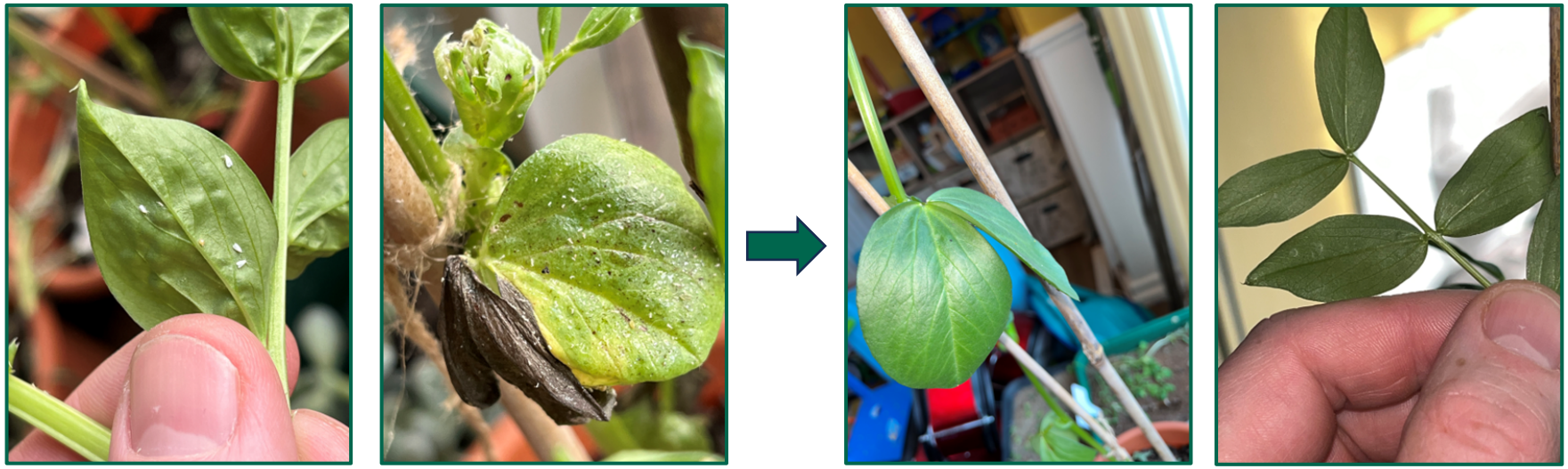
Naturalis-L

Adult Sciarid flyer

Ants

Trials Work

SB Plant Invigorator



Beans – Whitefly and Aphid

Wildflowers

Research: Species compositions, structure, longevity, area size, edge effects.

Cost and practicality for the grower.

Holistic IPM

- Much focus is given to direct crop protection methods - BCAs and biopesticides.
- We need to take a holistic view of the system, starting with the environment, growing media and fertilisation.
- Crop fertilisation - Trophobiosis.
- Balanced nutrition leads to more preventative pest control - Reduced need for chemicals.
- Biological programme considerations.
- Working **with** the plant - Harness and enhance natural processes.