Best practice IPM strategy:

An oversimplified approach to a very complex topic

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Photo by Borta: https://www.pexels.com/photo/bee-on-white-flower-of-blooming-prunus-cerasifera-tree-4331546/

What IPM is not…

- A method for reducing pesticide use
  - (reduction is more than likely when implemented correctly) – it is not the goal
- An acronym for integrated pesticide management
  - Which is still today probably the primary system used in pome and stone fruit production.
  - Excluding other control strategies (cultural + biological)

- IPM is not one specific practice…
  - Exclusion of various control methods to only focus on one

What is IPM?

Integrated Pest Management is a science-based approach that combines a variety of techniques. By studying their life cycles and how pests interact with the environment, IPM professionals can manage pests with the most current methods to improve management, lower costs, and reduce risks to people and the environment.

IPM tools include:

- Alter surroundings
- Add beneficial insects/ organisms
- Grow plants that resist pests
- Disrupt development of pest
- Prevention of pest problem developing
- Disrupt insect behaviors
- Use pesticides

1 IDENTIFY/ MONITOR

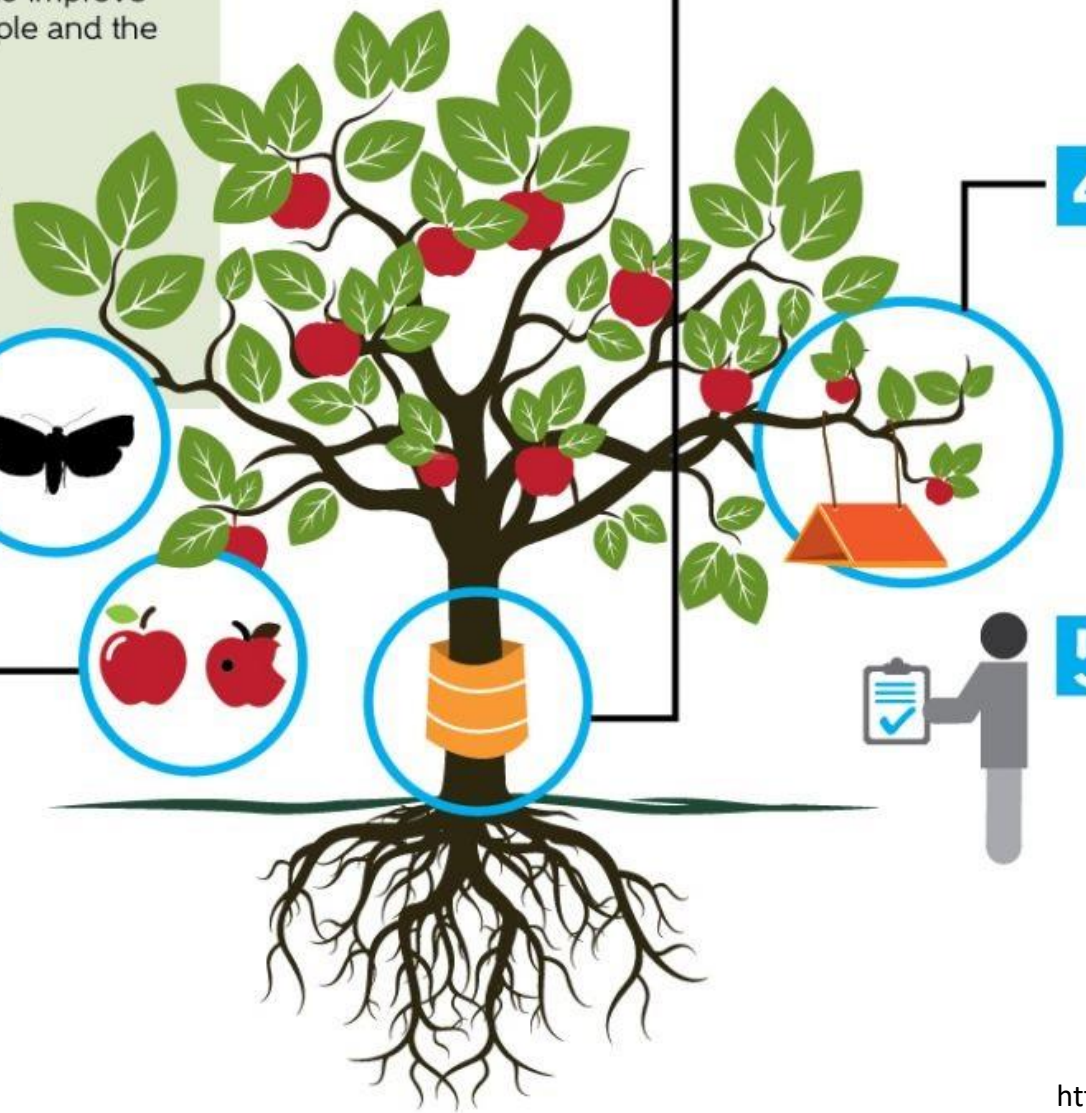
Determine the causal agent and its abundance

2 EVALUATE

The results from monitoring will help to answer the questions: Is the pest causing damage? Do we need to act? As pest numbers increase toward the economic threshold further treatments may be necessary.

3 PREVENT

Some pest problems can be prevented by using resistant plants, planting early, rotating crops, using barriers against climbing pests, sanitation,



4 ACTION

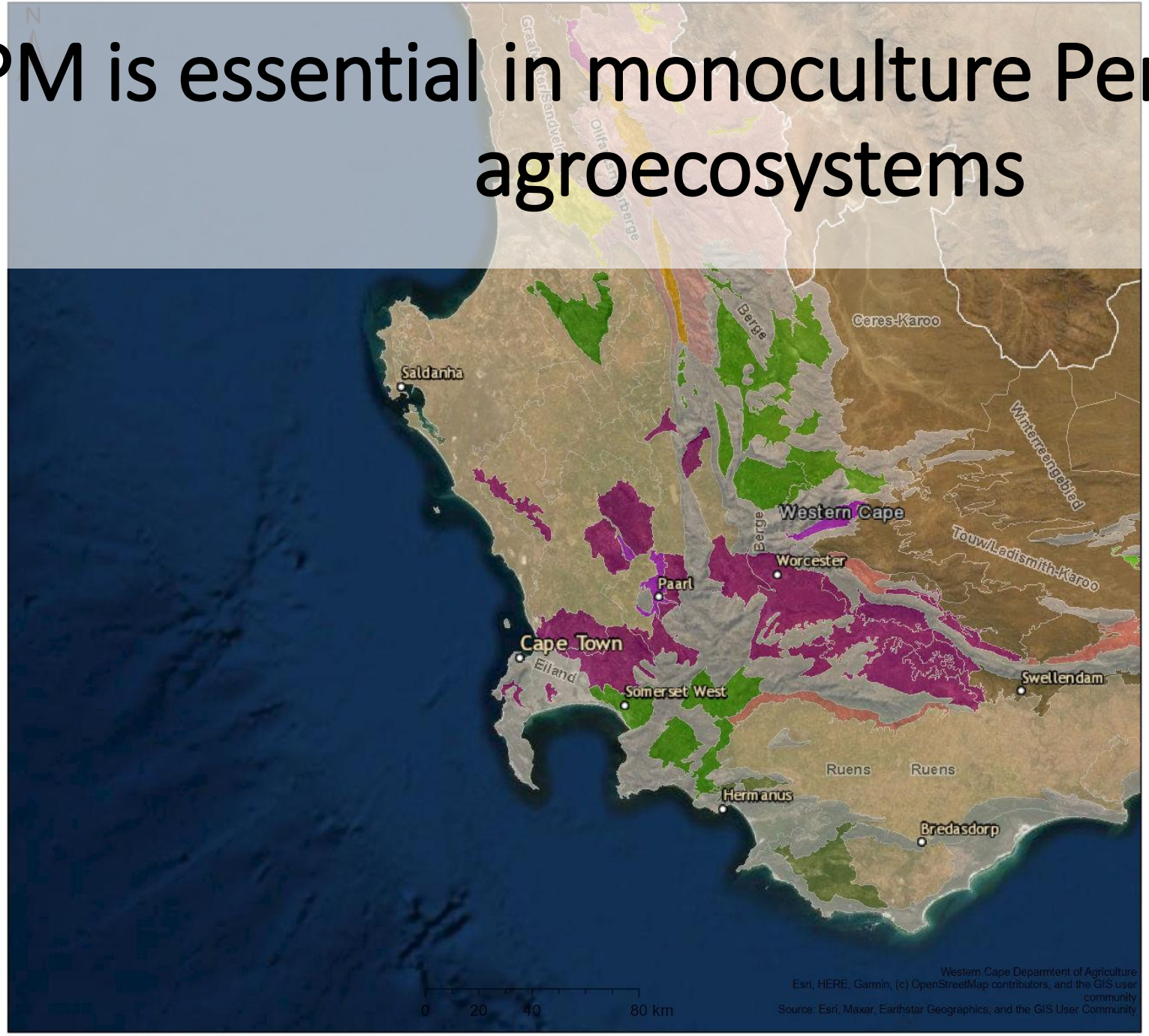
IPM uses multiple tools to reduce pests below an economically damaging level. A careful selection of preventive and curative treatments will reduce reliance on any one tactic and increase likelihood of success.

5 MONITOR

Continue to monitor the pest population. If it remains low or decreases, further treatments may not be necessary, but if it increases and exceeds the action threshold, another IPM tool should be used.

https://www.ipmcenters.org/about/what-is-ipm/

IPM is essential in monoculture Perennial crop agroecosystems



Legend

RHFA

- Beef
- Citrus
- Dairy
- Hops
- Livestock
- Lucerne
- Ostriches
- Pome fruit
- Potatoes
- Rooibos Tea
- Small grain
- Small stock
- Stone fruit
- Table grapes
- Vegetables
- Wine grapes
- Mountains and Built-up

Map Center: Lon: 18°38'31.4"E
Lat: 33°26'54.3"S

Scale: 1:2 311 162

Date created: June 4, 2022

Western Cape Government
Agriculture
FOR YOU

Monoculture agroecosystems

- Area wide large crop monocultures
- Low/poor biodiversity varying at area/farm or orchard level
- Larger the area = lower biodiversity
- Abundant food/shelter source for pest populations over time
- Low diversity lean to unstable open ecosystems that require regular human intervention and inputs
- Leads to homogenous control strategies +
- Leads to a lag or late colonisation/establishment of beneficials

Monoculture agroecosystems

Environment not conducive
Ultimately leads to IPM being one sided OR not abiding to the definition of integrated management

- Pollen, nectar, alternative pray as alternative food source

- Leads to homogenous control strategies +
- Leads to a lag or late colonisation/establishment of beneficials

Annu. Rev. Entomol. 1998. 43:243–70

INTEGRATED PEST MANAGEMENT: Historical Perspectives and Contemporary Developments

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KEY WORDS: IPM, integrated pest control, agroecosystems, history, applied ecology

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INTEGRATED PE
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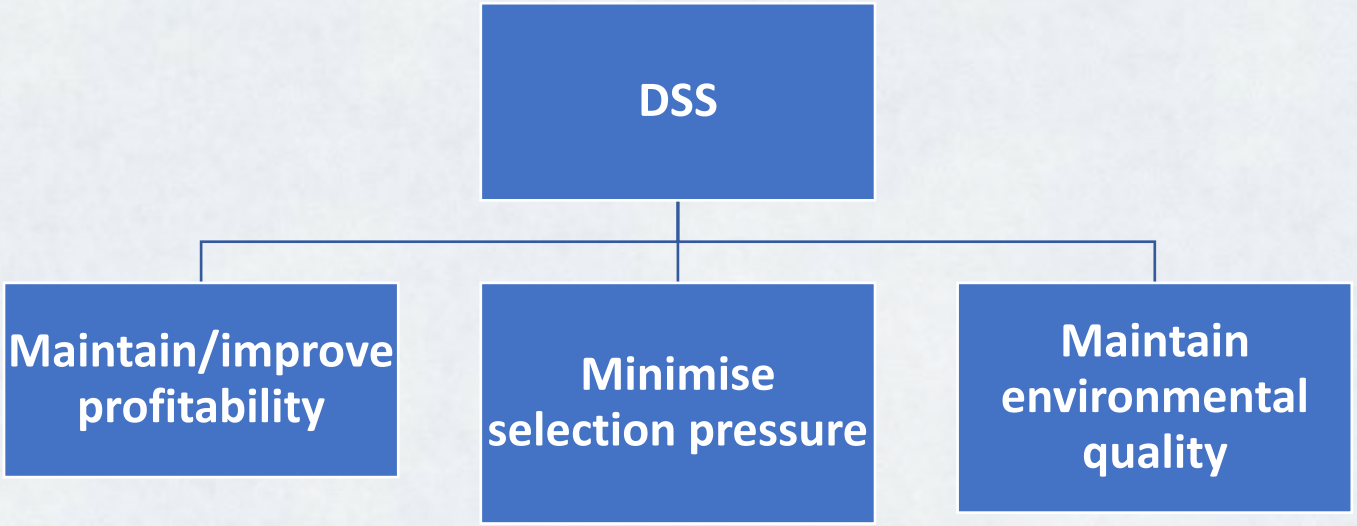
"IPM is a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy, based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment."

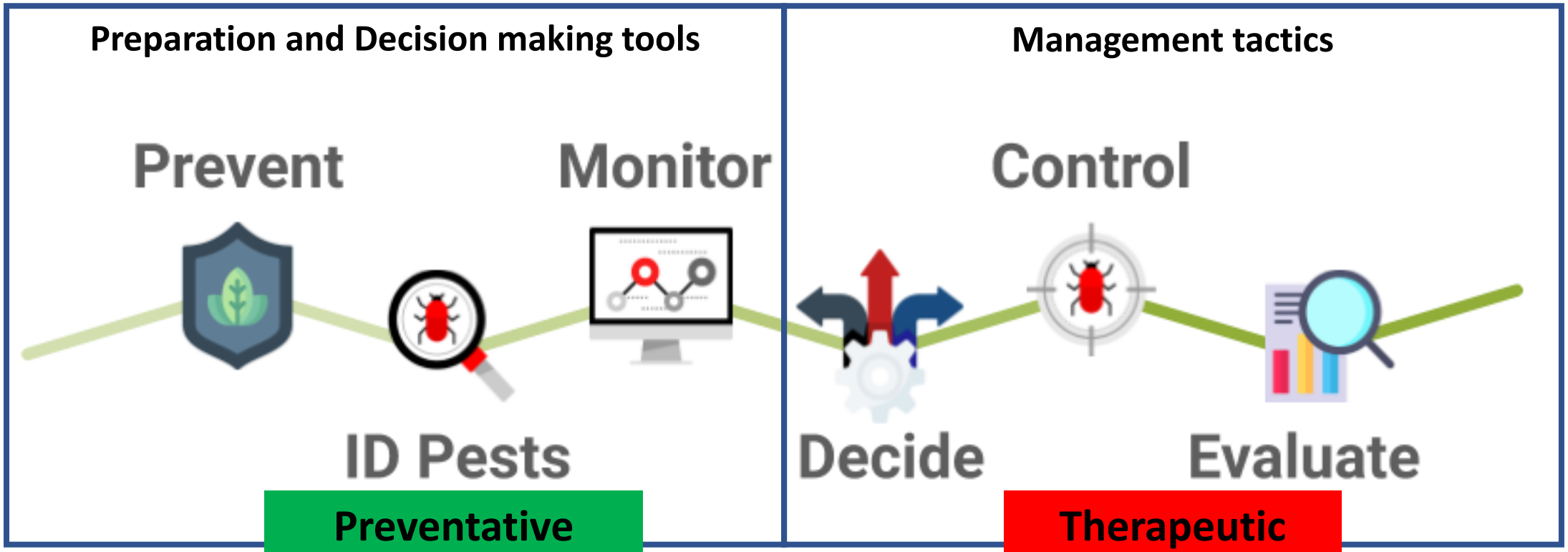
What it should be…



“ Strategy without tactics is the slowest route to victory. Tactics without strategy is the noise before defeat”.

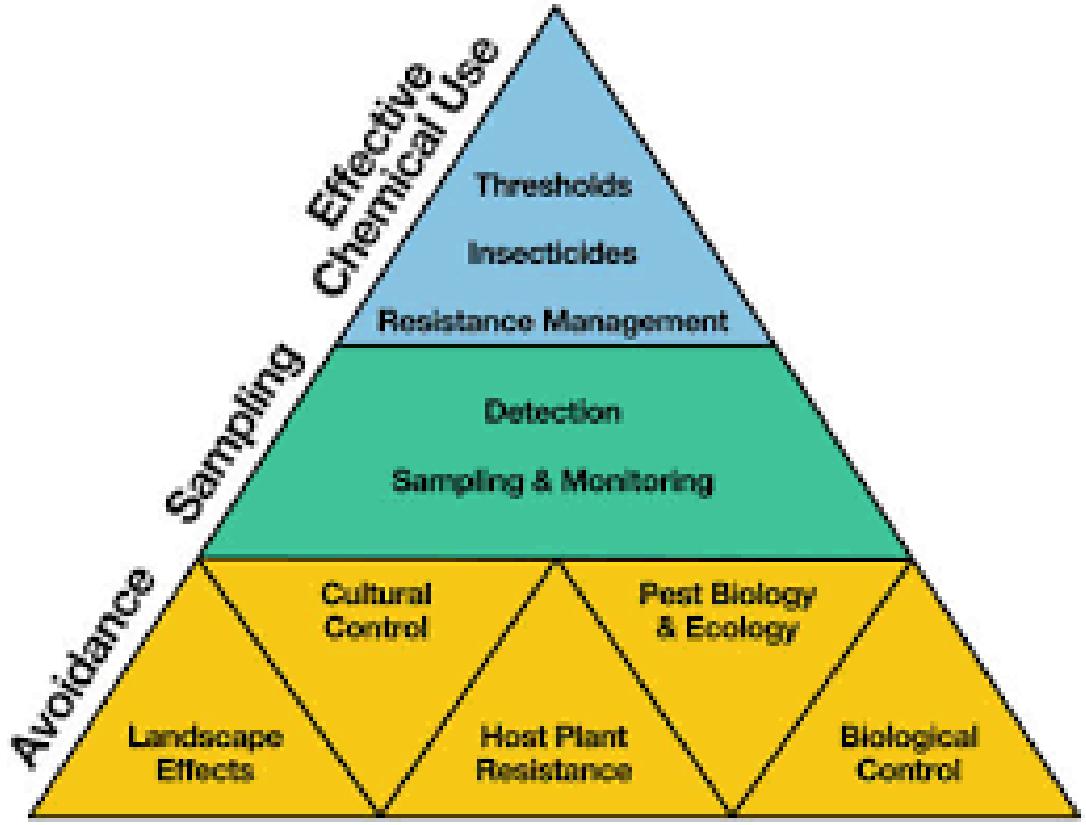
Sun Tzu

Best strategy of IPM is DSS: Integrate multiple complementary, compatible population management tactics



Integrating techniques will sustain management: Why is it necessary

- Pests can adjust quickly to a single management tactic
  - Short term successful
  - Not viable long term
- Difficult for pests to adapt to multiple tactics
  - Mortality/reproductive adverse effects
- IPM Core tactic use of pesticides
  - Selecting more tactics (integration)
  - Help reduce use/reliance needed for adequate control
- Help conserve environmental quality



Naranjo SE (2011) Impacts of B.t. transgenic cotton on Integrated Pest Management. J Agric Food Chem 59:5842–5851

Monoculture agroecosystems is a complex ecological problem or challenge that needs to be corrected/adapted

- Pest dilemma...
  - Favourable physical conditions
  - Abundant food sources
  - Low biotic mortality factors
  - Generates establishes pest population over time

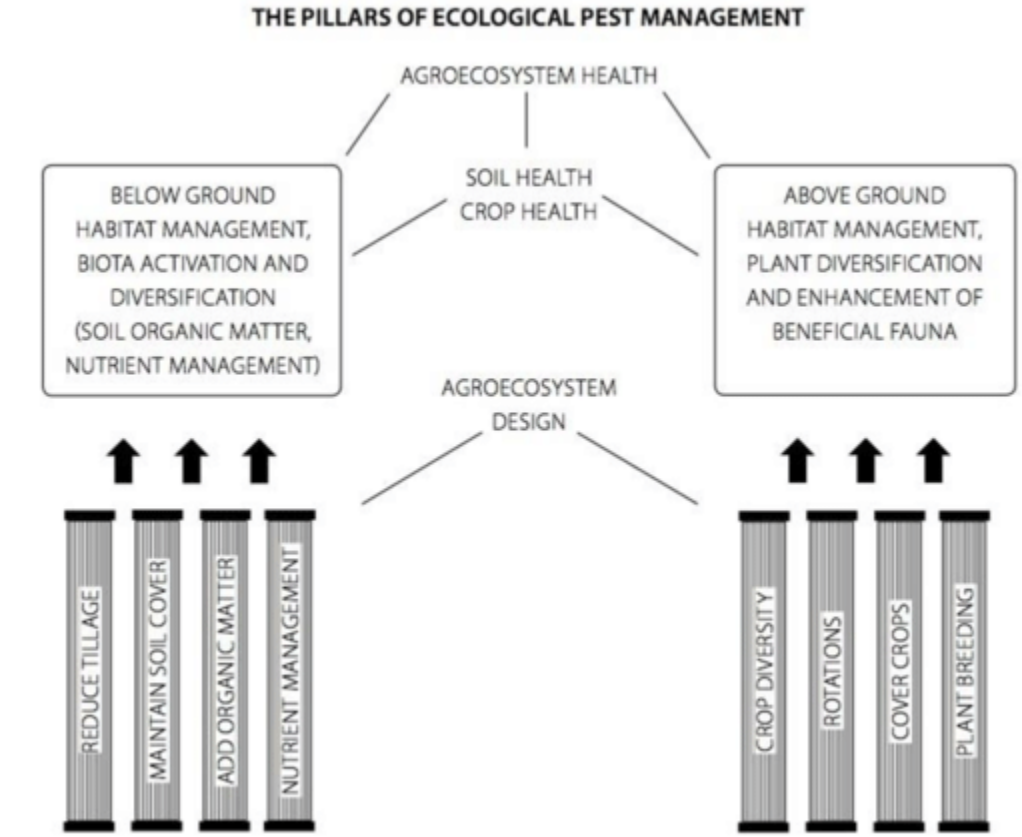
Prevent

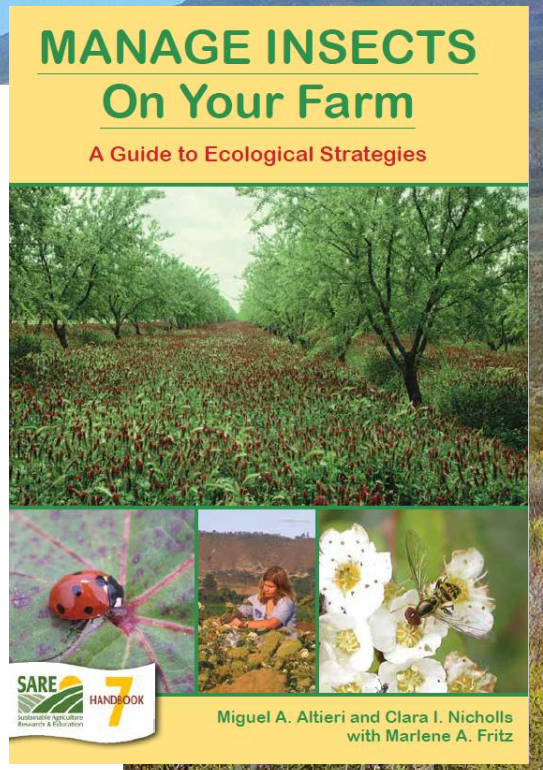
Incorporating and maintaining elements of natural ecosystems

- Where possible create an environment conducive for IPM
- Pollinator habitat promotion
- Increase diversity richness
- Dominated by native species (if and where possible)
- Which can possibly lead to improved natural control
- To sustain a diverse IPM strategy

Prevent

Durable long term sustainable IPM is dependent on EPM





Prevent

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Pest management benefits of compost mulch in apple orchards

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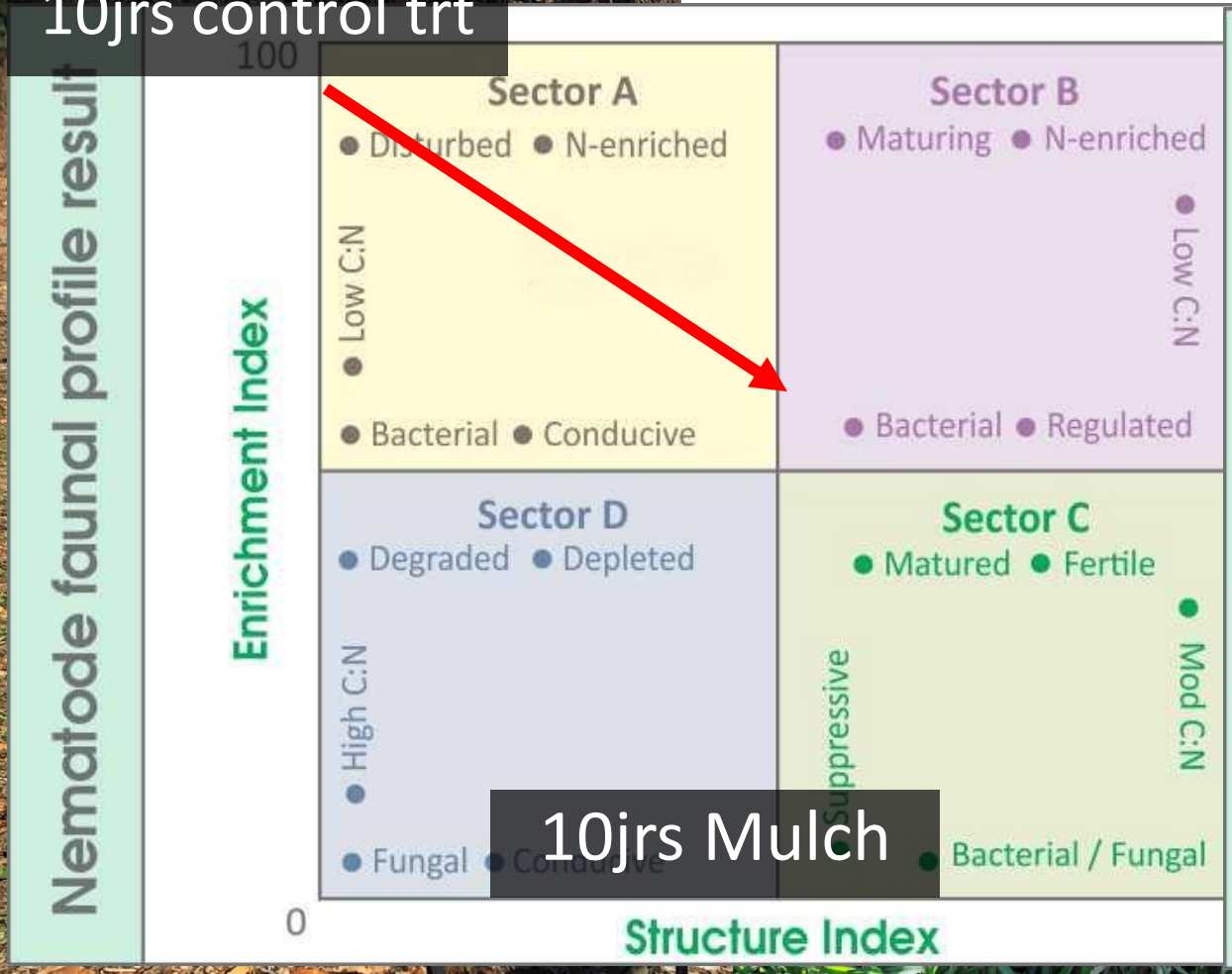
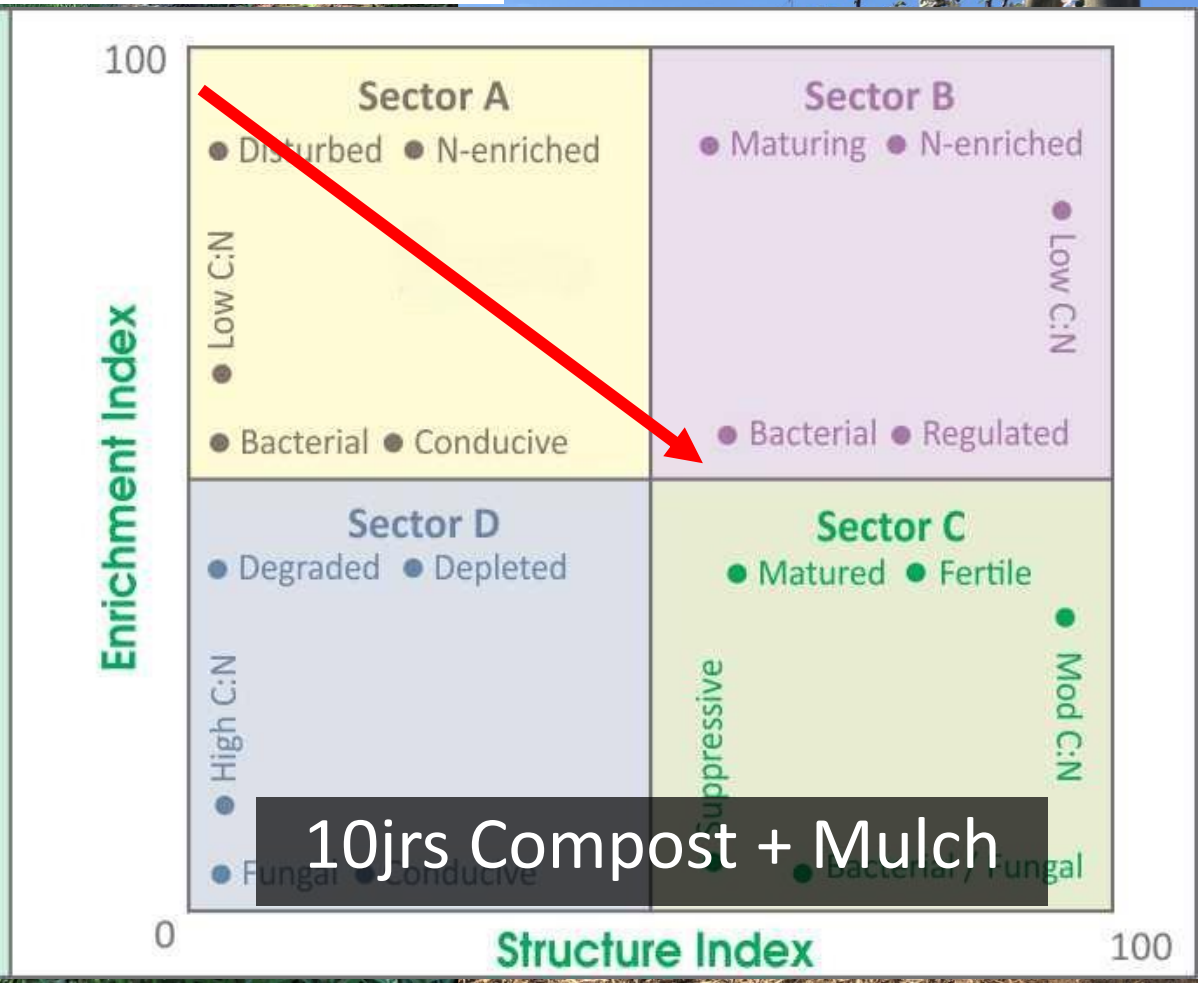
10jrs control trt



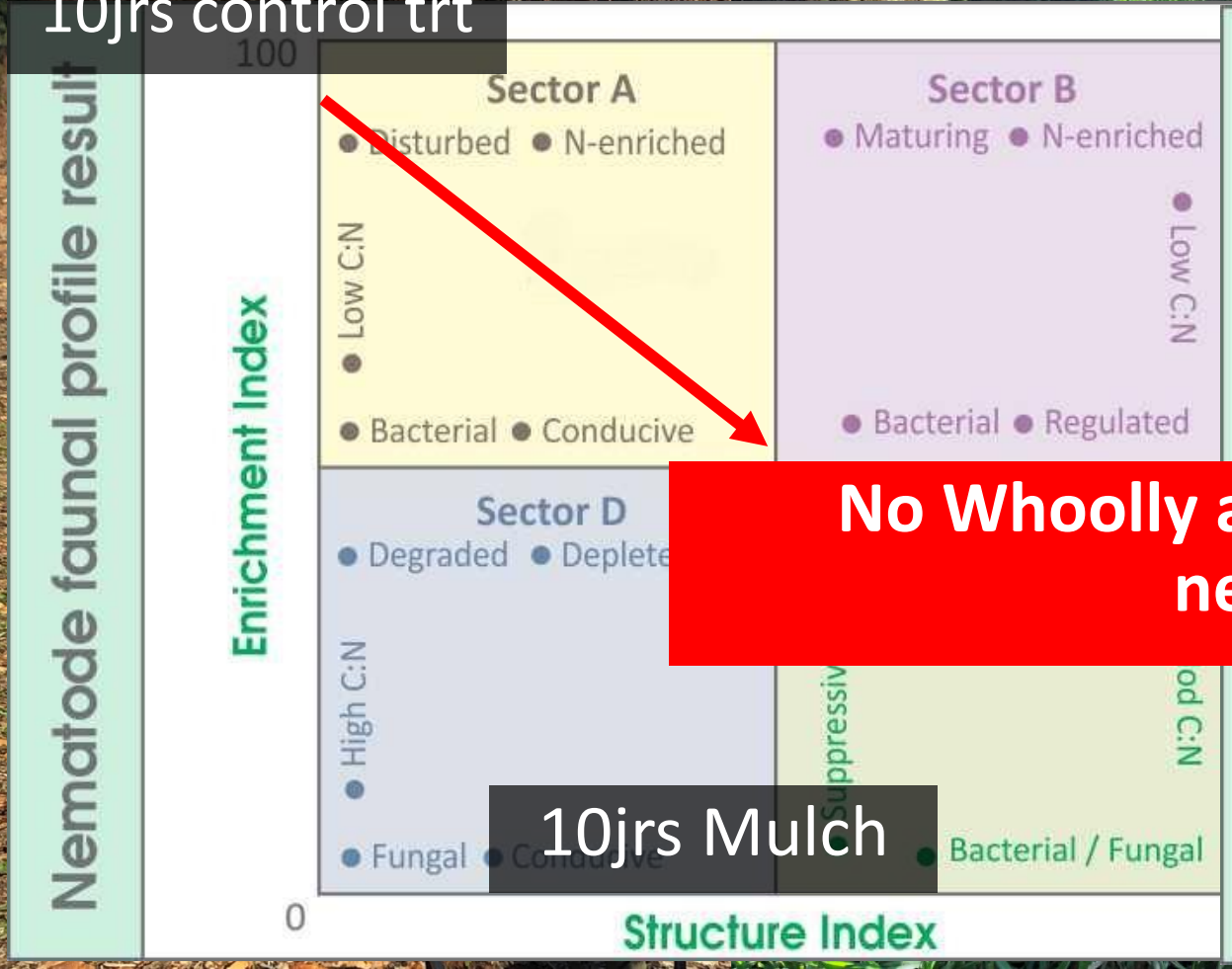
10jrs Mulch



10jrs Compost + Mulch

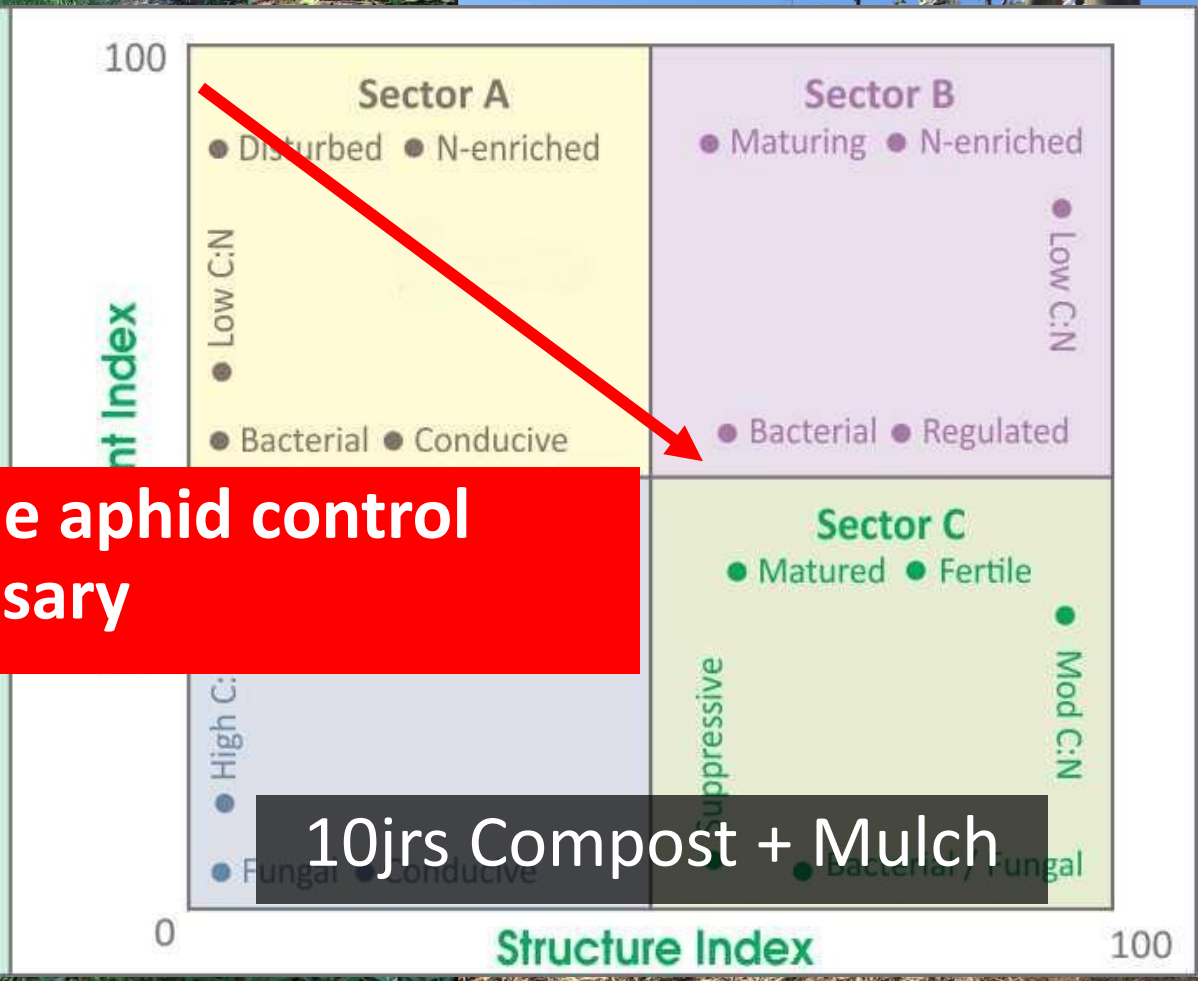
Prevent

10jrs control trt



No Whoolly apple aphid control necessary

10jrs Mulch



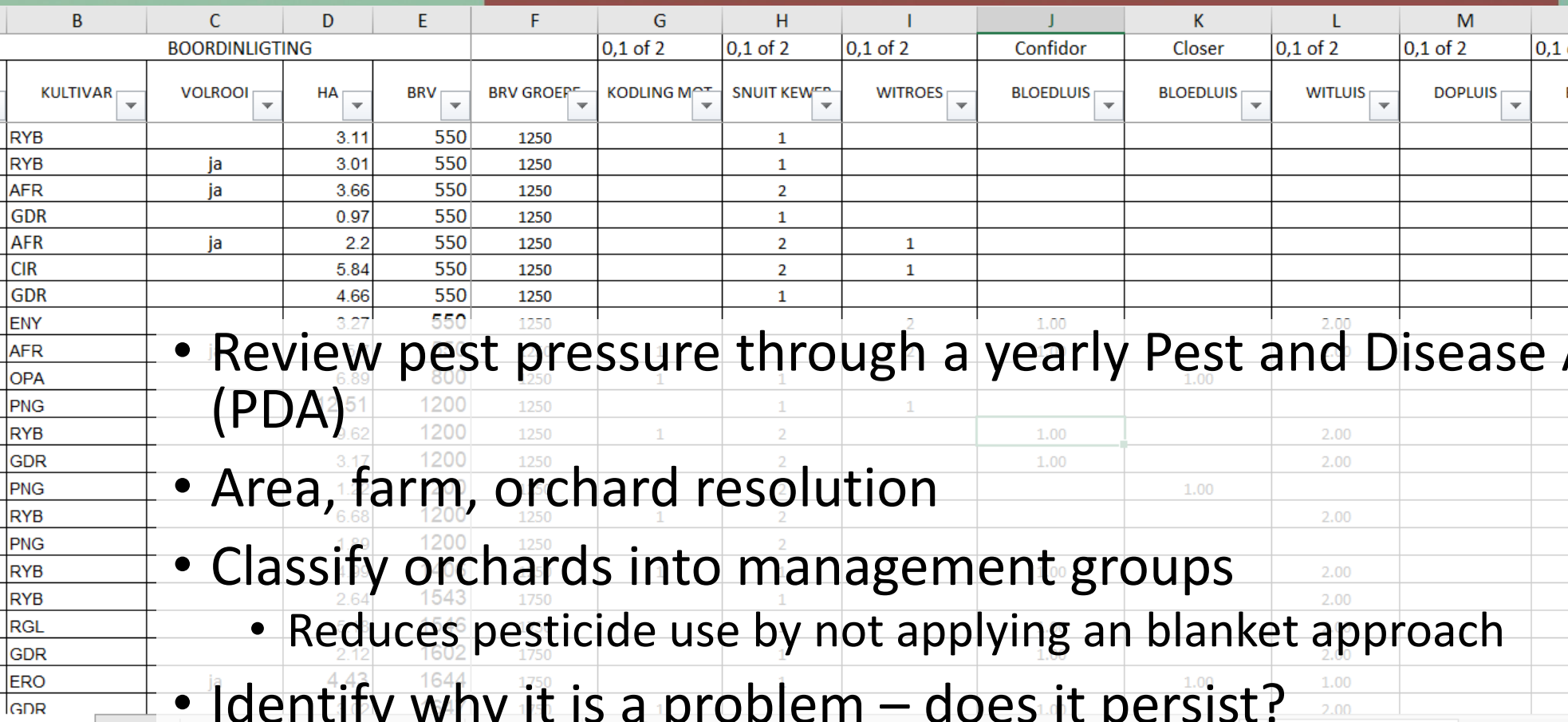
10jrs Compost + Mulch

Prevent

Preventative tactics - Have a plan

Prevent

Have a plan



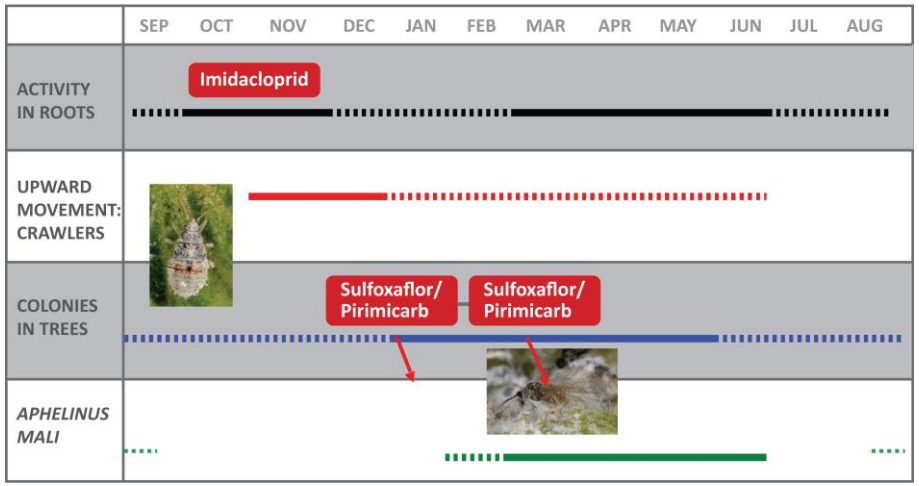
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
BOORDINLIGTING					0,1 of 2	0,1 of 2	0,1 of 2	Confidor	Closer	0,1 of 2	0,1 of 2	0,1 of 2		0,1,2 OF >2
KULTIVAR	VOLROOI	HA	BRV	BRV GROEP	KODLING MOT	SNUIT KEWER	WITROES	BLOEDLUIS	BLOEDLUIS	WITLUIS	DOPLUIS	BRYOBIA	Fusi PAD %	MYTE: AANTAL SPUITE AFGELOPE SEISOEN
RYB		3.11	550	1250		1						1.00		0.00
RYB	ja	3.01	550	1250		1						1.00		0.00
AFR	ja	3.66	550	1250		2						1.00	0.04	0.00
GDR		0.97	550	1250		1						1.00		0.00
AFR	ja	2.2	550	1250		2	1					1.00		0.00
CIR		5.84	550	1250		2	1					1.00	0.16	0.00
GDR		4.66	550	1250		1						1.00		0.00
ENY		3.27	550	1250			2	1.00		2.00		1.00		0.00
AFR														1.00
OPA		6.89	800	1250	1	1			1.00			1.00		0.00
PNG		2.51	1200	1250		1	1					1.00	0.40	0.00
RYB		3.62	1200	1250	1	2		1.00		2.00		2.00	0.40	0.00
GDR		3.17	1200	1250		2		1.00		2.00		2.00		0.00
PNG		1.99	1200	1250					1.00			2.00	0.40	0.00
RYB		6.68	1200	1250	1	2				2.00		2.00		0.00
PNG		1.89	1200	1250		2						1.00		0.00
RYB		2.75	1543	1750						2.00		1.00		0.00
RYB		2.64	1543	1750		1				2.00		1.00		0.00
RGL			1546									1.00		0.00
GDR		2.12	1602	1750		1		1.00		2.00		1.00		0.00
ERO	ja	4.43	1644	1750		1			1.00	1.00		1.00		1.00
GDR										2.00		1.00		0.00

APPELS | PERE | Kersies | NEKTARIENS | PRUIME

- Review pest pressure through a yearly Pest and Disease Assessment (PDA)
- Area, farm, orchard resolution
- Classify orchards into management groups
  - Reduces pesticide use by not applying an blanket approach
- Identify why it is a problem – does it persist?
- Strategy how to (1) prevent and (2) manage pest in agroecosystem

Have a management strategy for each pest

Prevent



Suggested strategy

WK nr.	Active ingredient		
	Low Pressure	Medium Pressure	High Pressure
WK44			
WK45			
WK46	Cyantraniliprole	Cyantraniliprole	Cyantraniliprole
WK47		EPNs?	EPNs?
WK48			Spinetoram
WK49			EPNs?
WK50	Cyantraniliprole	Cyantraniliprole	Cyantraniliprole
WK51			EPNs?
WK52			Spinetoram
WK1			
WK2			
Notes	Weevil trunk barriers should be used in medium and high pressure orchards. Orchard skirting should be done early. Bridge control into trees should be maintained throughout the season		

Bollworm spray window (Week 38 – 44):

Unlikely before full bloom
Unlikely later than 3 weeks after full bloom
Spray window overlaps with first codling moth spray

Suggested strategy:

Phenological growth stage of tree	Active ingredient	
	Low pressure	High pressure
30% bloom	Deltamethrin	Deltamethrin
Full bloom	Deltamethrin	Deltamethrin + Emamectin benzoate
75% Petal drop	Deltamethrin + Emamectin benzoate	Deltamethrin + Emamectin benzoate
7 Days later		Emamectin benzoate
7 Days later (+- WK43/44)	Chlorantraniliprole/Emamectin benzoate	Chlorantraniliprole/Emamectin benzoate

NOTES: It is very difficult to accurately predict a bollworm infestation. Take the development of ˚Days for bollworm into consideration and rather act conservatively if in doubt. Several products that are employed in the program for codling moth control will also control bollworm. In orchards with a high codling moth pressure these products must be preserved for the control of codling moth and not be used for the control of bollworm. In such a case it will be advisable to replace Emamectin benzoate with a registered Nucleopolyhedrovirus product.

Prevent

Have a management strategy for each pest

https://www.yates.com.au/garden-hub/garden-weevils/

PDA Pest pressure

Lower pest density

Reduce host susceptibility

Suggested strategy			
WK nr.	Active ingredient		
	Low Pressure	Medium Pressure	High Pressure
WK44			
WK45			
WK46	Cyantraniliprole	Cyantraniliprole	Cyantraniliprole
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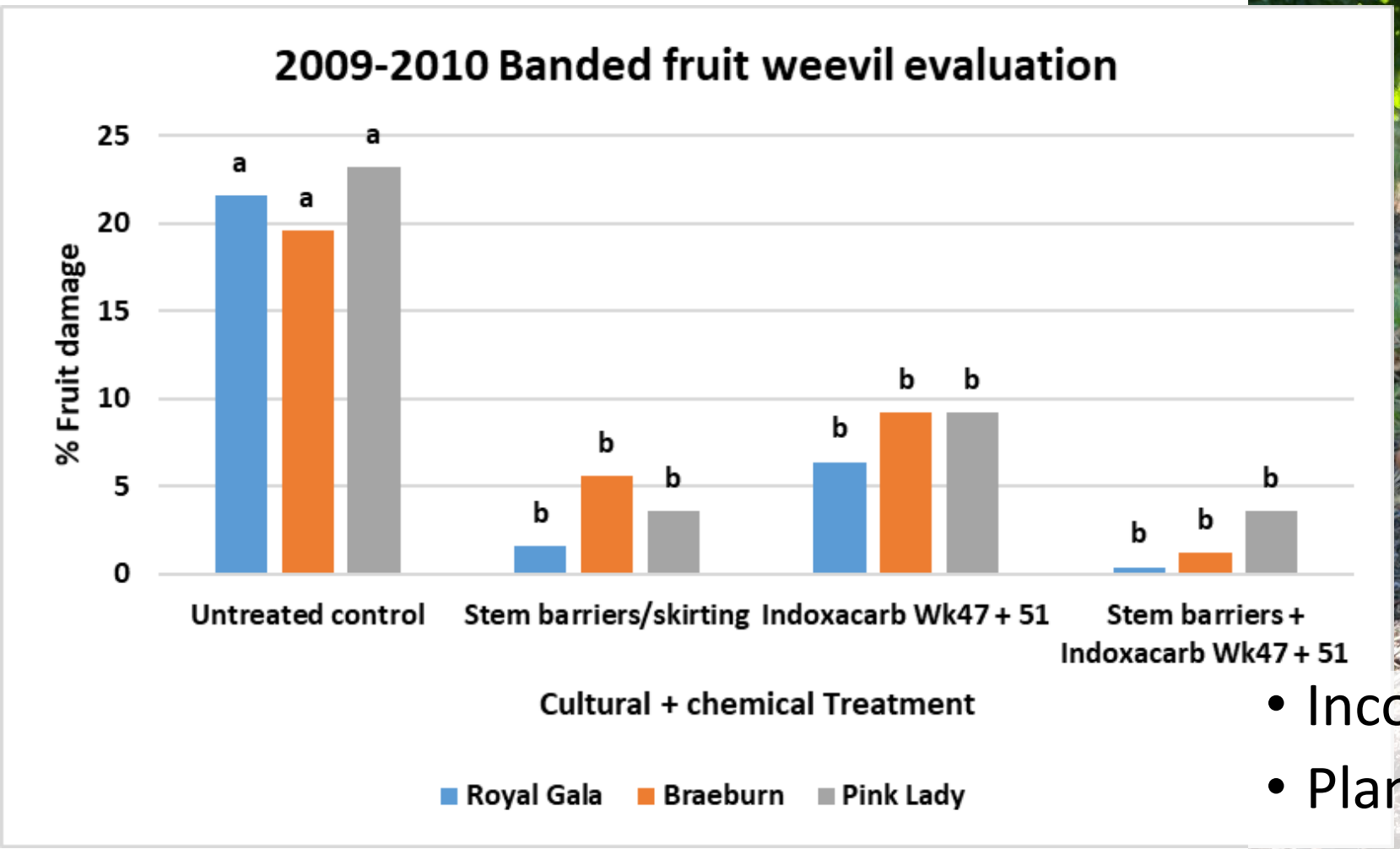


- Incorporate different strategies
- Plan where to implement
- Cost factor

ID Pests

Monitoring: Know your pests

- Correct pest ID
  - Enough well trained personnel
  - Classifying pests as direct or indirect pests
  - Discern between pests and presence of predators

Koue Bokkeveld Opleidingsentrum
Landbou opleiding en menslike ontwikkeling

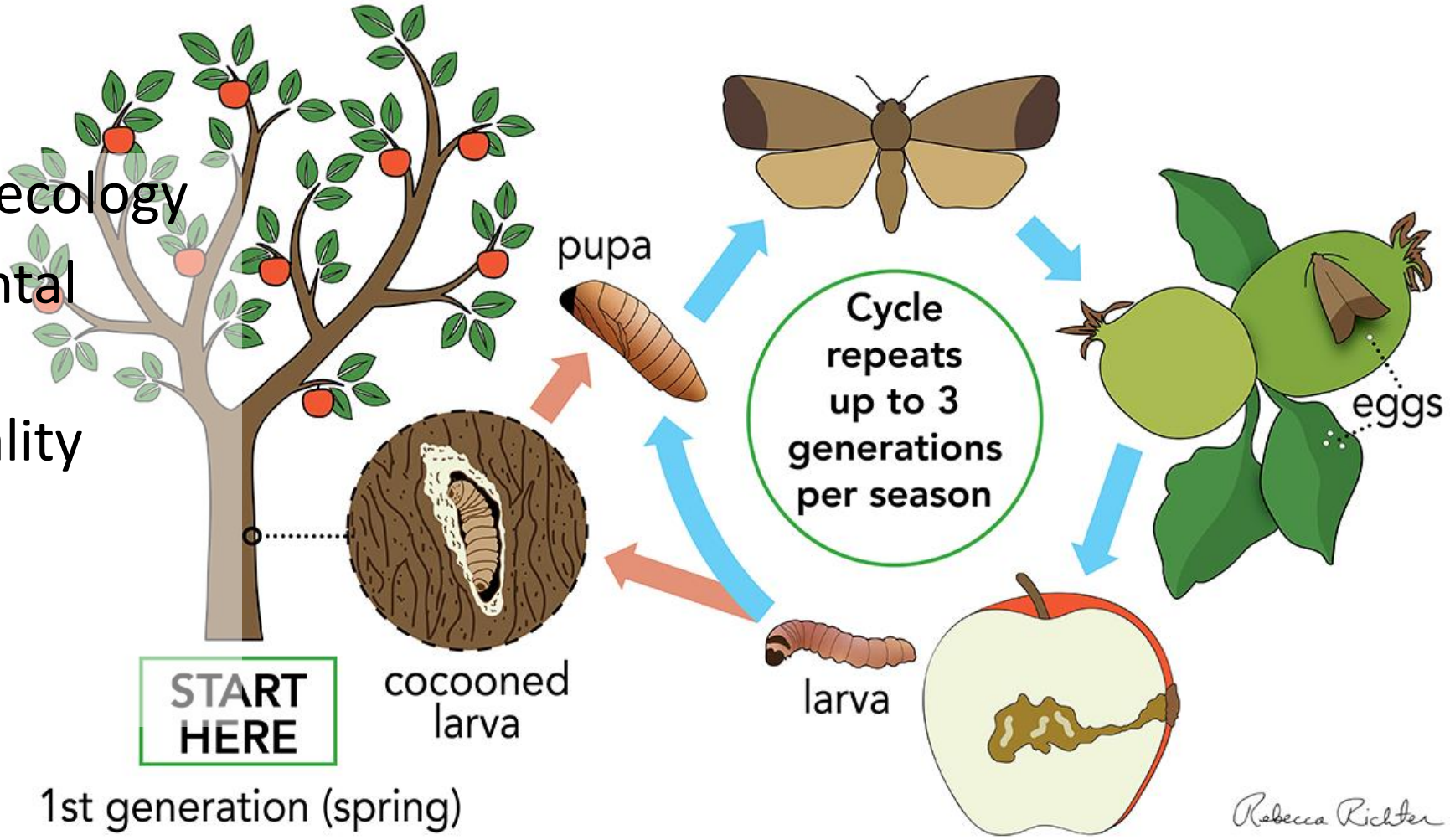
Leer
Presteer

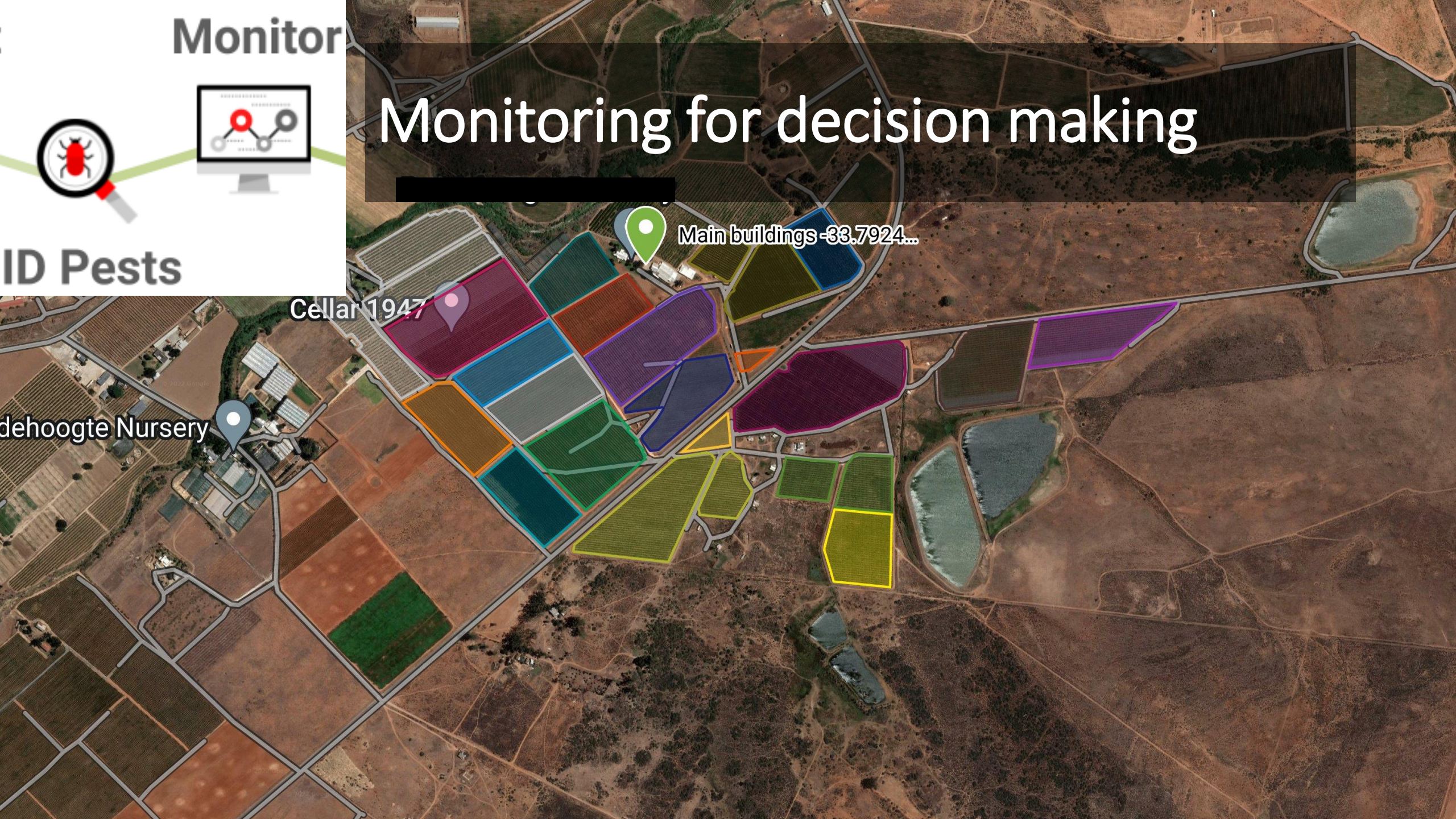
THRESHOLD APPLICATION	
	
RSM on Apples: Possible Spray at average of 2 mites per leaf or 40% leaf infestation in absence of biological control agents.	**RSM on Apples:** Possible pray at average of 4 mites per leaf or 80% leaf infestation in presence of biological control agents.

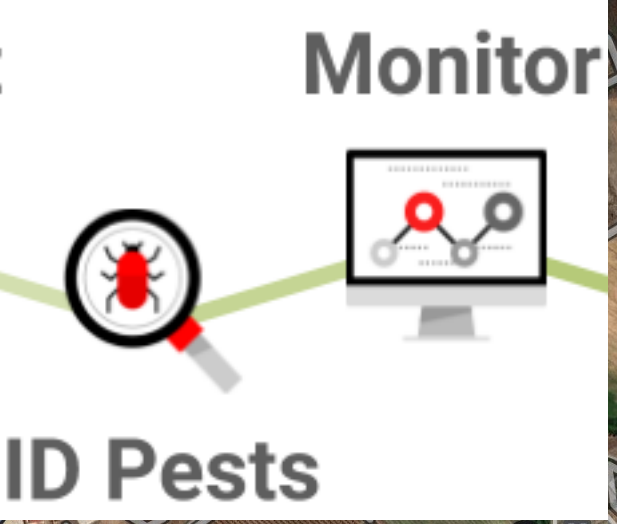
ID Pests

Monitoring: Know your pests

- Biology and population ecology
- Influence of environmental factors
- Abiotic and biotic mortality factors - agroecosystem




Monitor
ID Pests
Monitoring for decision making
[redacted]
Main buildings -33.7924...
Cellar 1947
dehoogte Nursery



Monitoring for decision making

[redacted]

- Monitoring and Pest ID forms the base of IPM DSS
- Detection of species presence
  - Pests and biocontrol agents (natural predators)
- Determining of population density, dispersion
  - Area, farm and orchard level
- Determining and modelling, predicting population dynamics

Monitor

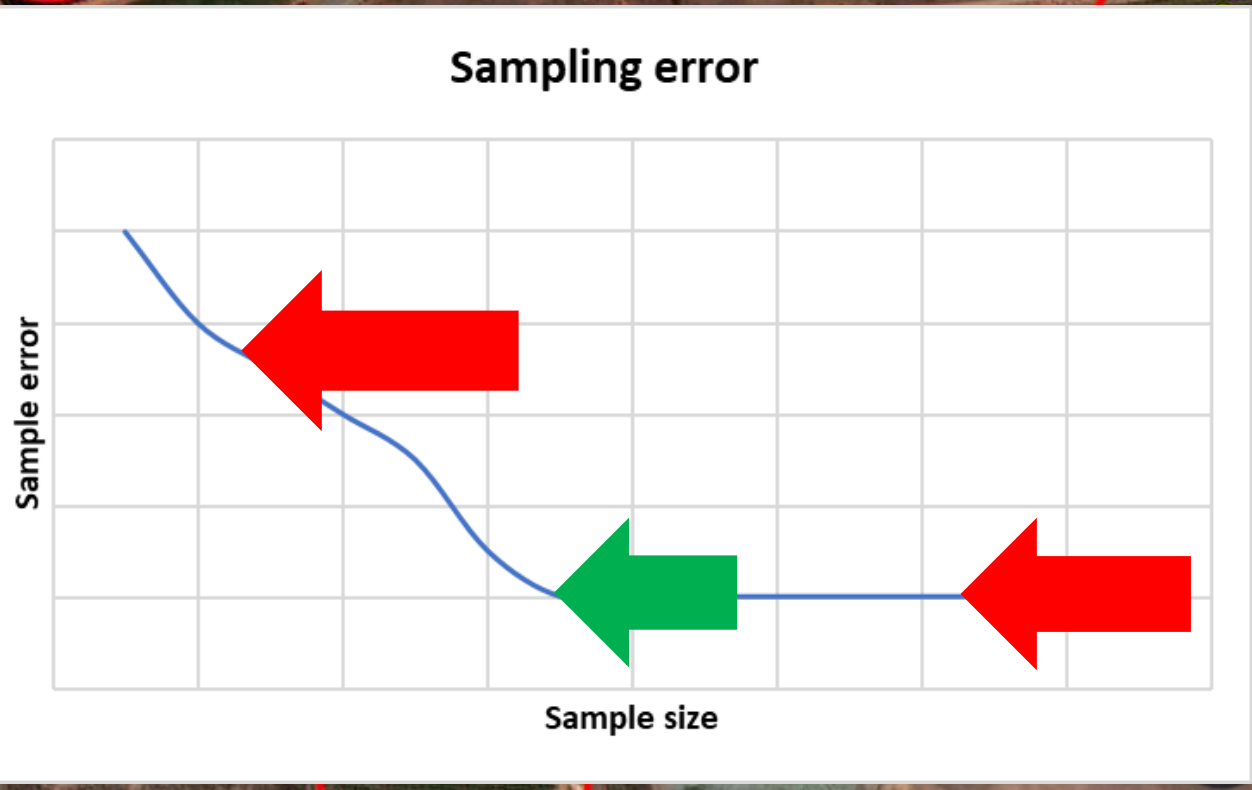
Monitoring for decision making

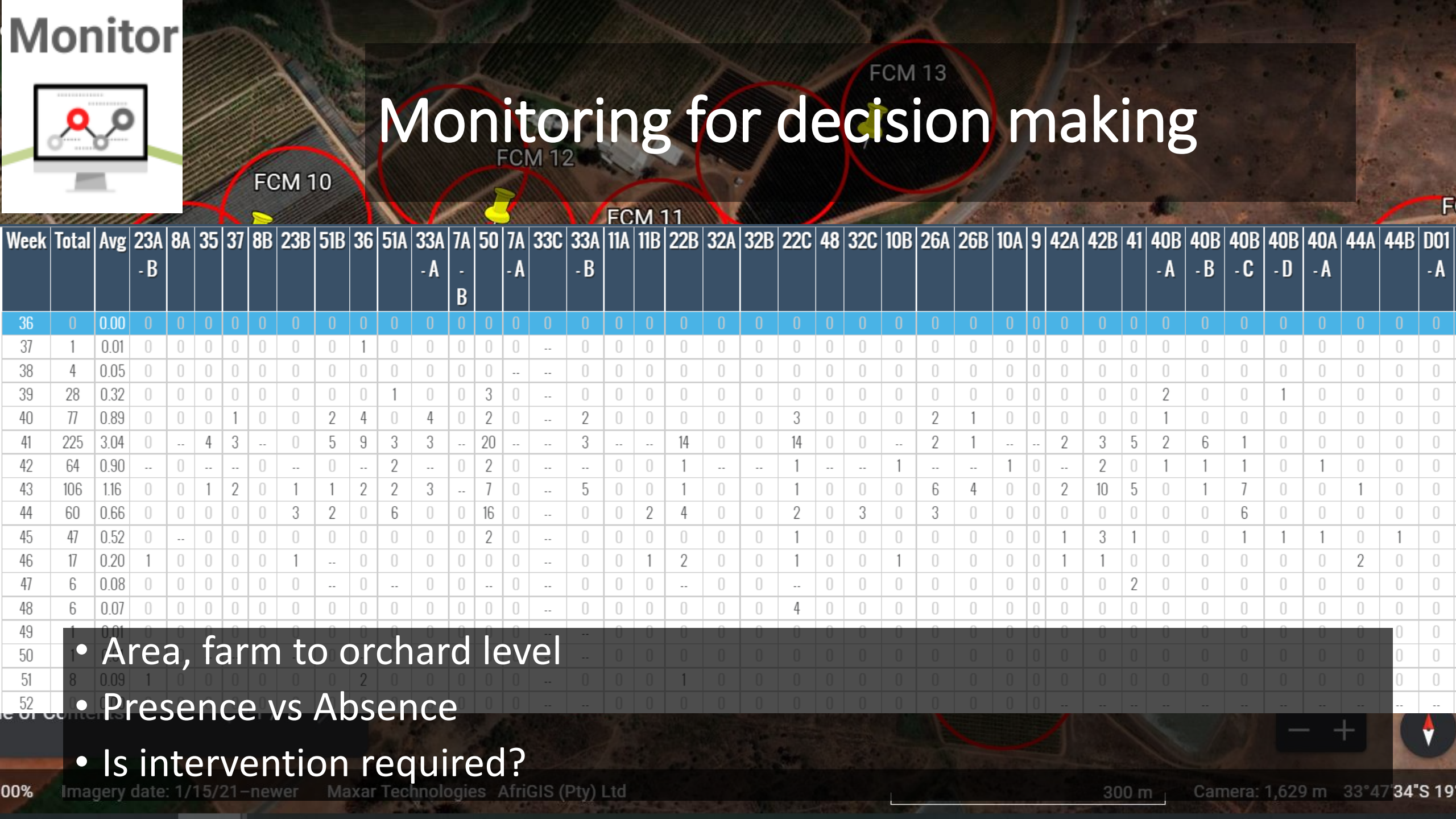
- Use of efficient monitoring strategies

Monitor

Monitoring for decision making

- Reliability of decision made = precision of sample
- Too few samples = high sampling error
- Too many samples = not increasing reliability
- Optimal = logistically sound





Monitoring for decision making

Week	Total	Avg	23A - B	8A	35	37	8B	23B	51B	36	51A	33A - A	7A - B	50	7A - A	33C	33A - B	11A	11B	22B	32A	32B	22C	48	32C	10B	26A	26B	10A	9	42A	42B	41	40B - A	40B - B	40B - C	40B - D	40A - A	44A	44B	D01 - A
36	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	1	0.01	0	0	0	0	0	0	0	1	0	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	4	0.05	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	28	0.32	0	0	0	0	0	0	0	0	1	0	0	3	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0
40	77	0.89	0	0	0	1	0	0	2	4	0	4	0	2	0	--	2	0	0	0	0	0	3	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0
41	225	3.04	0	--	4	3	--	0	5	9	3	3	--	20	--	--	3	--	--	14	0	0	14	0	0	--	2	1	--	--	2	3	5	2	6	1	0	0	0	0	0
42	64	0.90	--	0	--	--	0	--	0	--	2	--	0	2	0	--	--	0	0	1	--	--	1	--	--	1	--	--	1	0	--	2	0	1	1	1	0	1	0	0	0
43	106	1.16	0	0	1	2	0	1	1	2	2	3	--	7	0	--	5	0	0	1	0	0	1	0	0	0	6	4	0	0	2	10	5	0	1	7	0	0	1	0	0
44	60	0.66	0	0	0	0	0	3	2	0	6	0	0	16	0	--	0	0	2	4	0	0	2	0	3	0	3	0	0	0	0	0	0	0	0	6	0	0	0	0	0
45	47	0.52	0	--	0	0	0	0	0	0	0	0	0	2	0	--	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	3	1	0	0	1	1	1	0	1	0
46	17	0.20	1	0	0	0	0	1	--	0	0	0	0	0	0	--	0	0	1	2	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2	0	0
47	6	0.08	0	0	0	0	0	0	--	0	--	0	0	--	0	--	0	0	0	--	0	0	--	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
48	6	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	1	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	8	0.09	1	0	0	0	0	0	0	2	0	0	0	0	0	--	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--

- Area, farm to orchard level
- Presence vs Absence
- Is intervention required?

Monitor

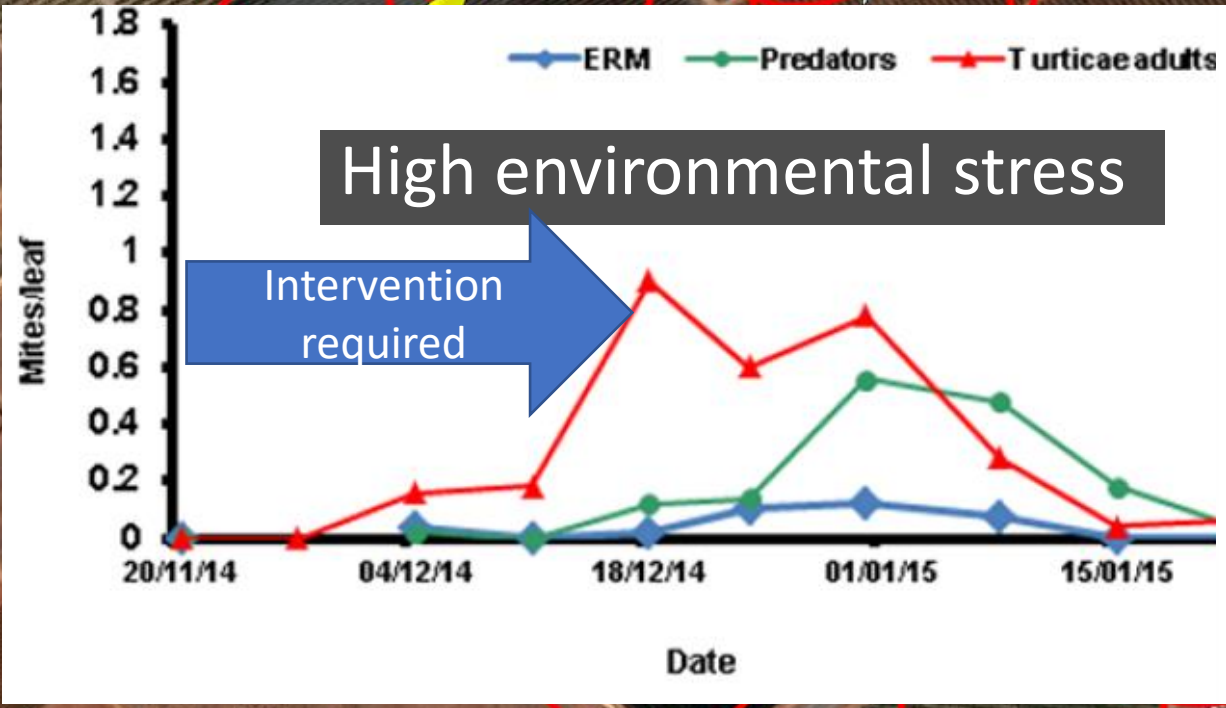
Monitoring for decision making

FCM 10

FCM 12

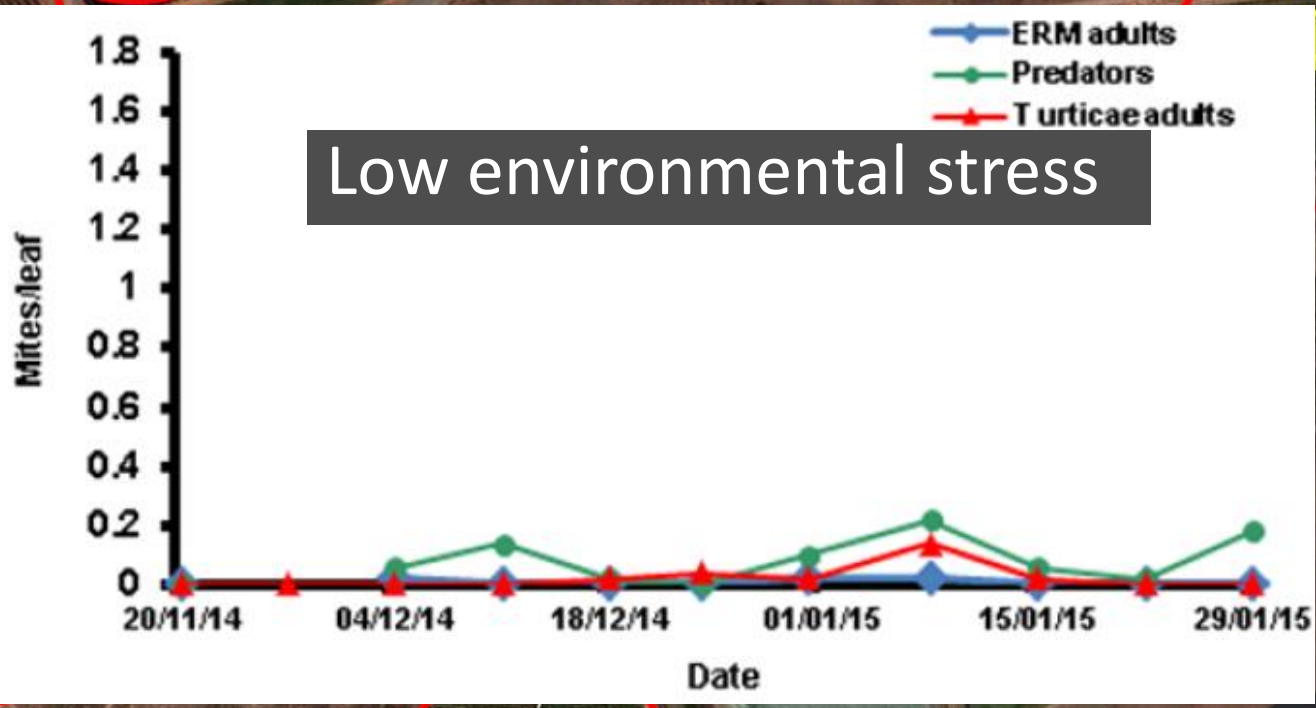
FCM 11

FCM 13



High environmental stress

Intervention required



Low environmental stress

3D

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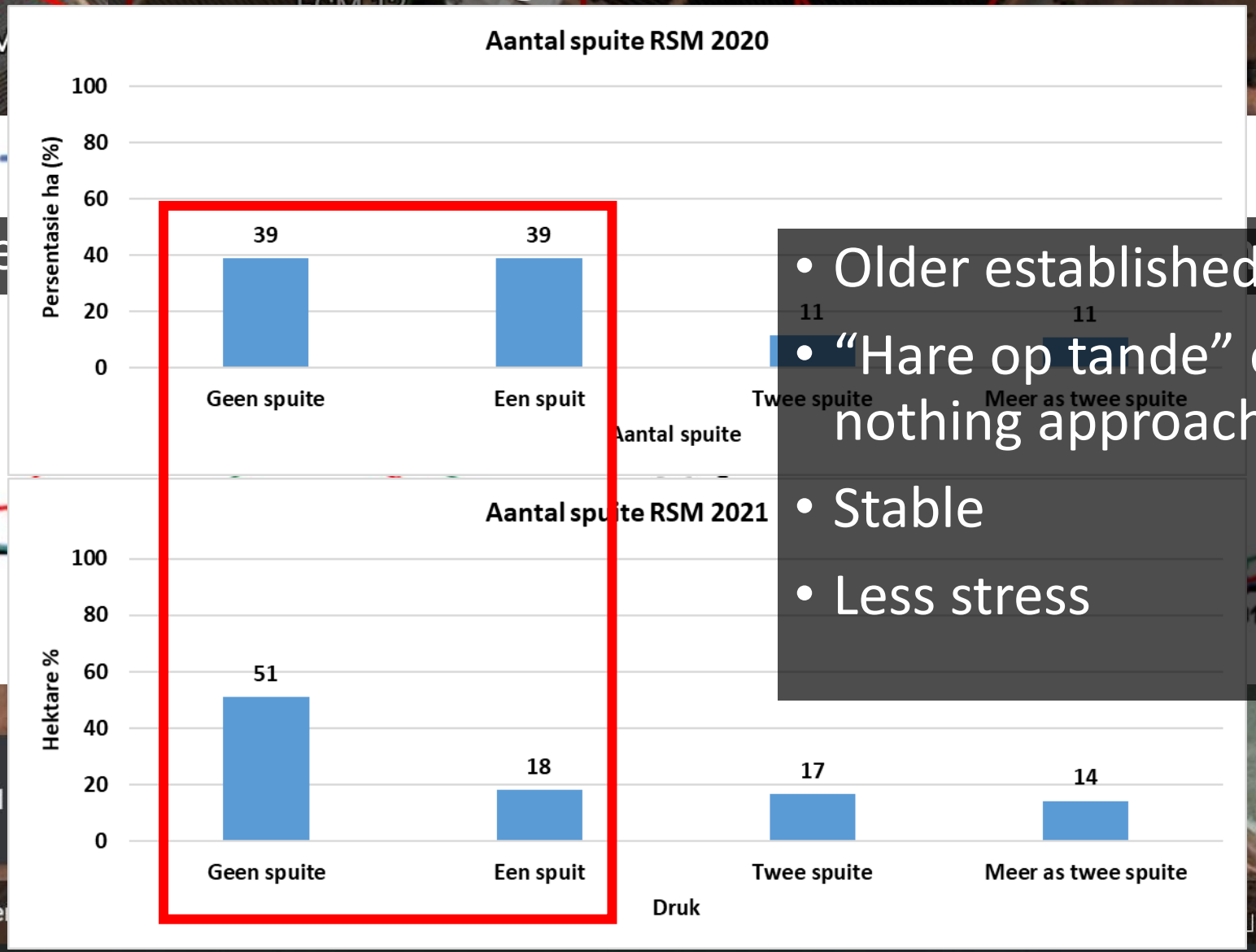
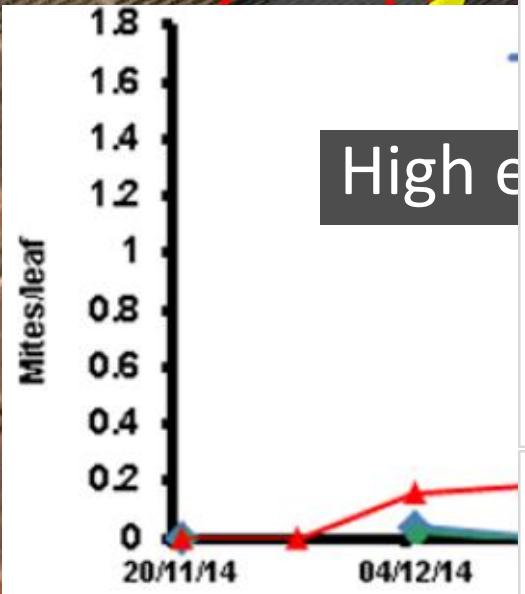
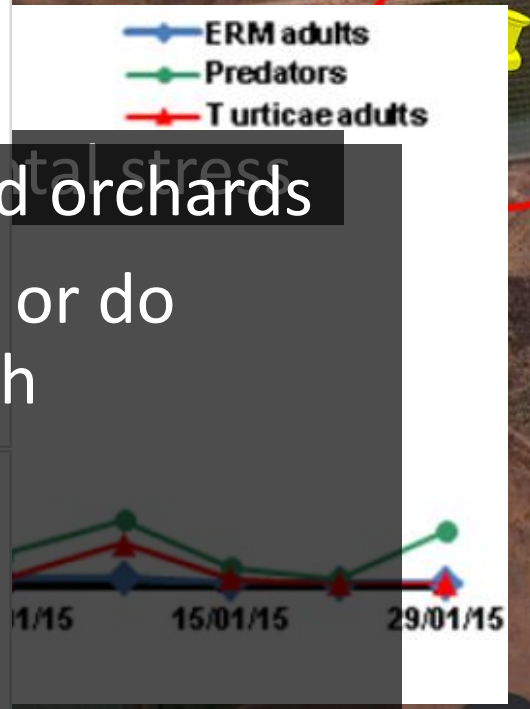
00% Imagery date: 1/15/21–newer Maxar Technologies AfriGIS (Pty) Ltd 300 m Camera: 1,629 m 33°47'34"S 19

Monitor

Monitoring for decision making







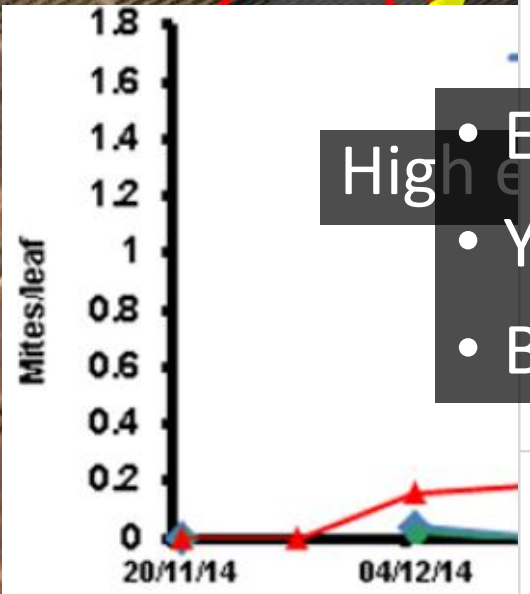
- Older established orchards
- “Hare op tande” or do nothing approach
- Stable
- Less stress

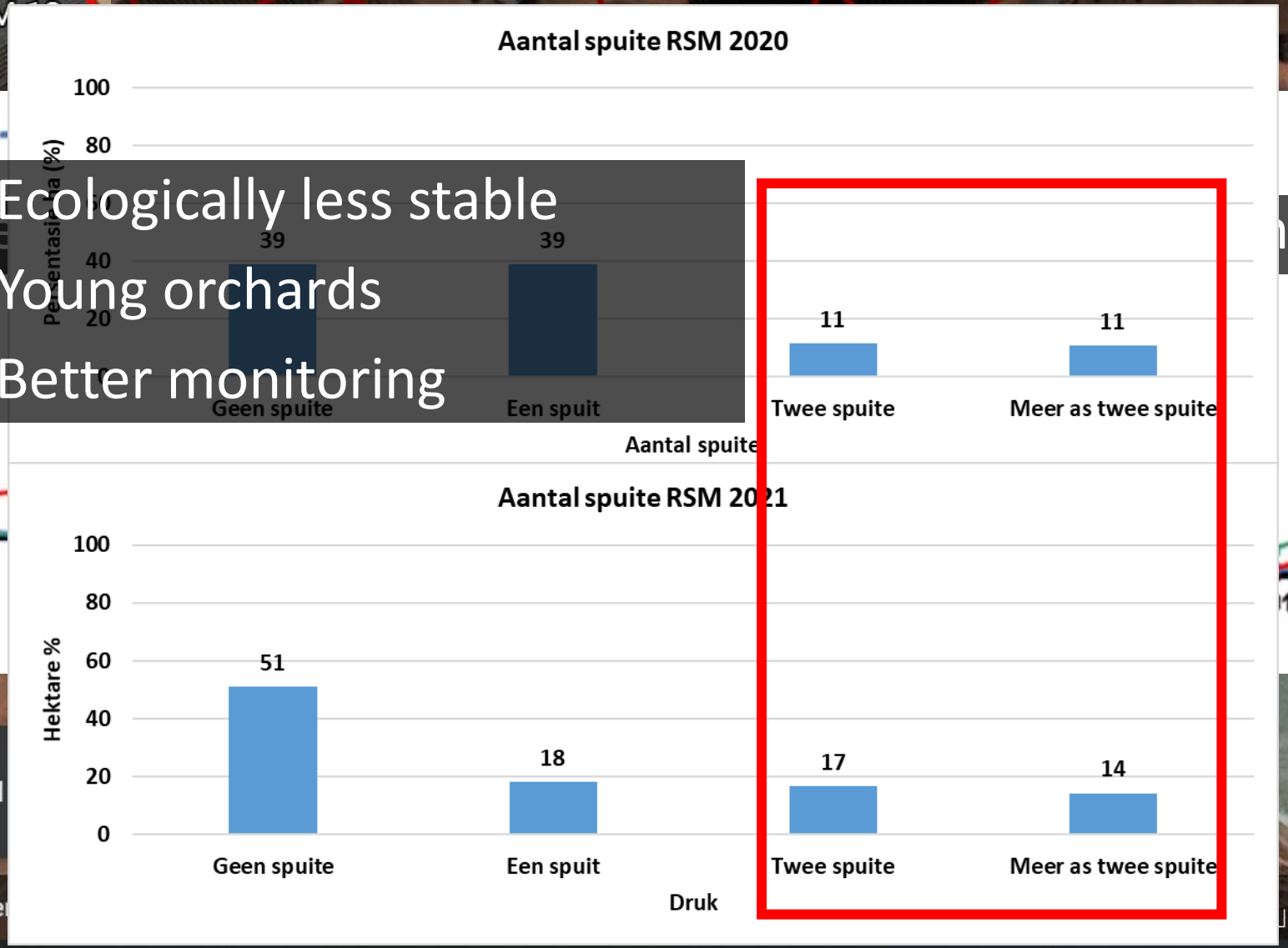
Monitor

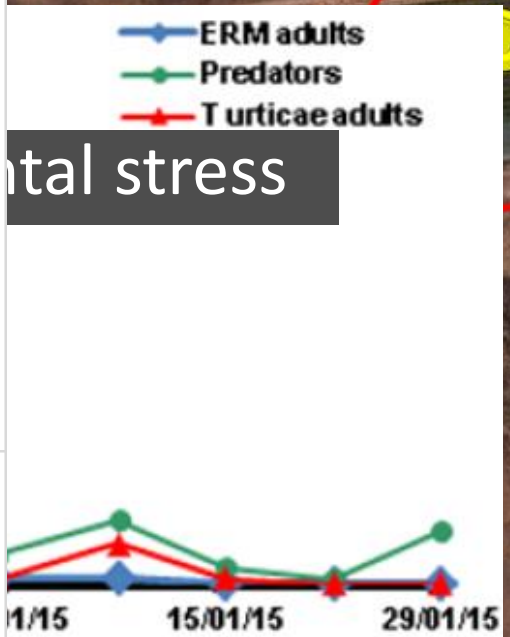
Monitoring for decision making

- Ecologically less stable
- Young orchards
- Better monitoring

High e … ntal stress







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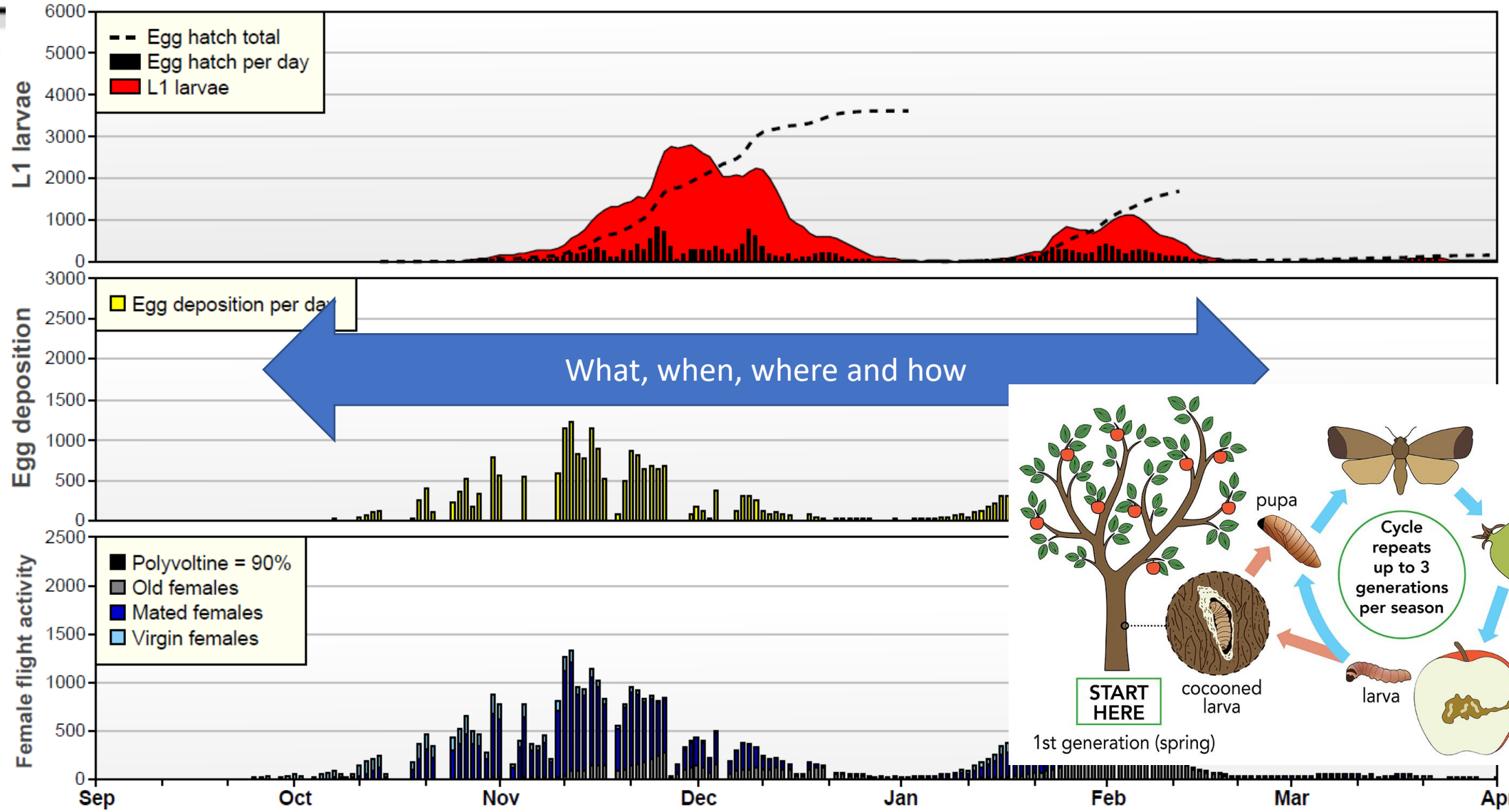
00% Imagery date: 1/15/21–newe

Camera: 1,629 m 33°47'34"S 19

3D

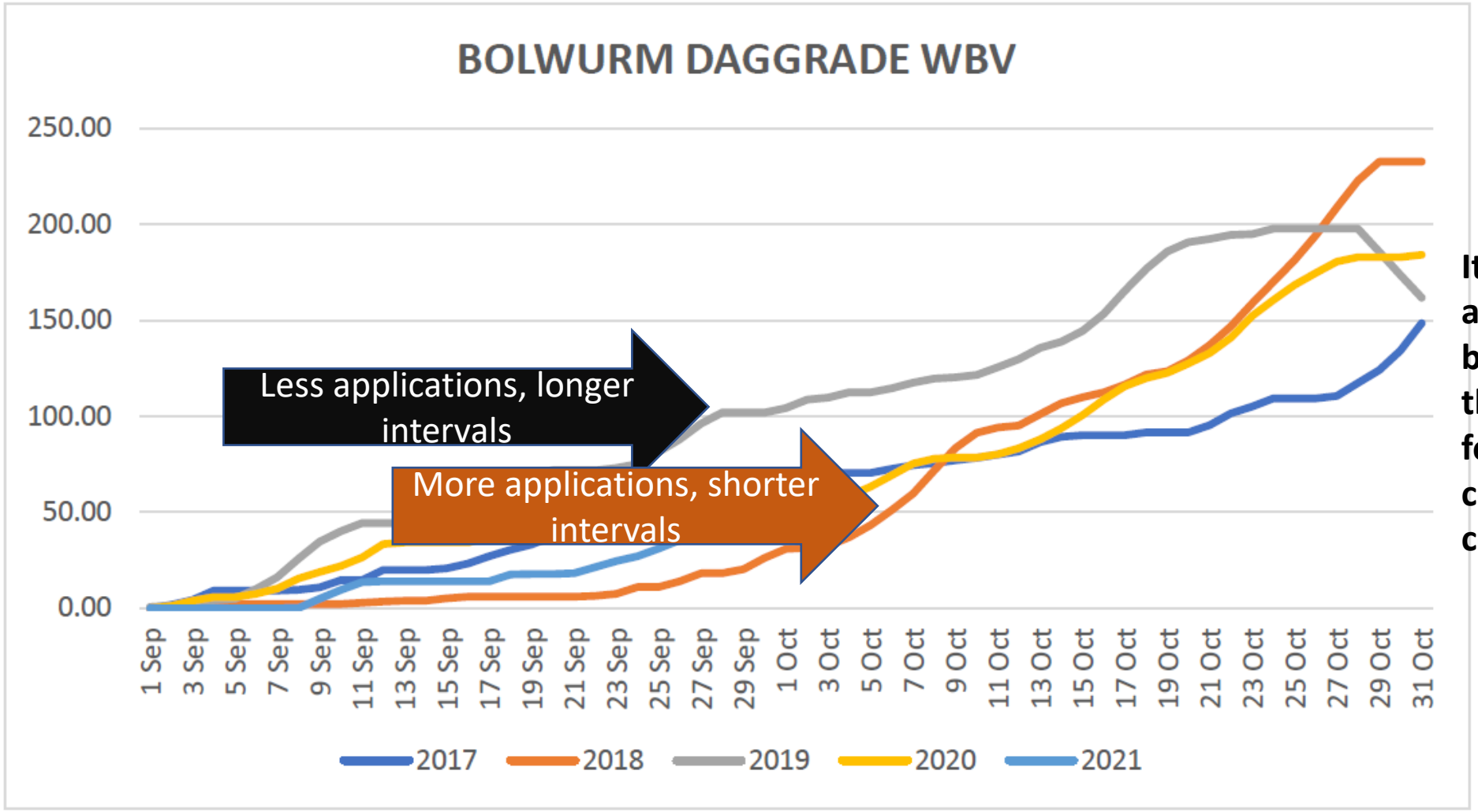
Monitor

Modelling for decision making



Monitor

Modelling for decision making



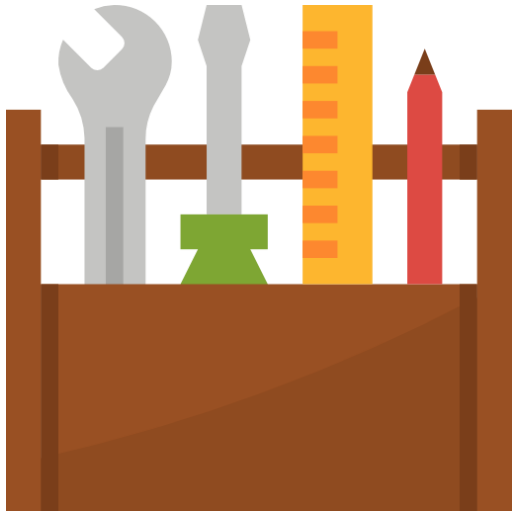
It is very difficult to accurately predict a bollworm infestation. Take the development of ˚Days for bollworm into consideration and rather act conservatively if in doubt.

Information to decision of management tactics

What?
The pathogen/pest that needs to be controlled

When?
Conditions necessary for infection/pest damage (disease/pest life cycle and/or epidemiology)

Where?
What plant organs are susceptible and when (disease/pest life cycle and/or epidemiology)



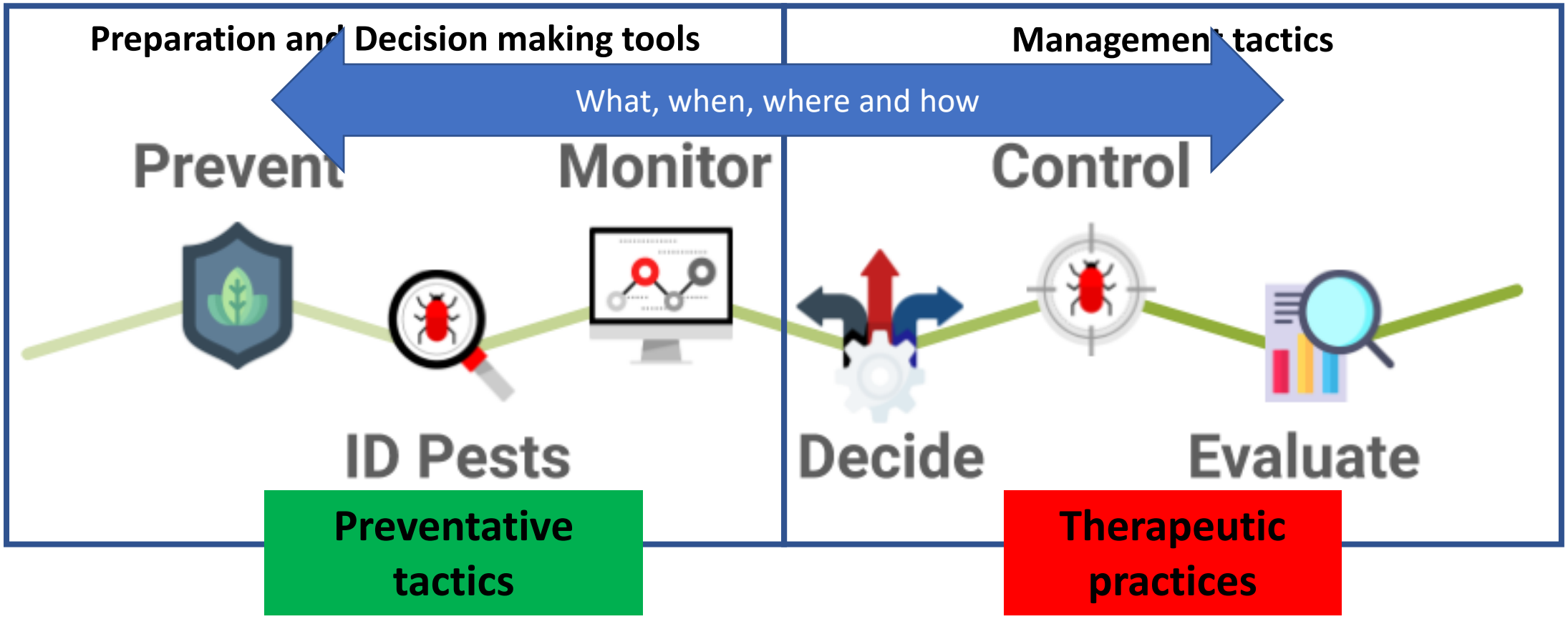
Disease management toolbox

How?
Available control methods

Preventative tactics

Therapeutic practices

Information to decision of management tactics



Information to decision of management tactics

Decide

B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
BOORDINLIGTING						0,1 of 2	0,1 of 2	Confidor	Closer	0,1 of 2	0,1 of 2	0,1 of 2		0,1,2 OF >2
KULTIVAR	VOLROOI	HA	BRV	BRV GROEP	KODLING MOT	SNUIT KEWER	WITROES	BLOEDLUIS	BLOEDLUIS	WITLUIS	DOPLUIS	BRYOBIA	Fusi PAD %	MYTE: AANTAL SPUITE AFGELOPE SEISOEN
RYB		3.11	550	1250		1						1.00		0.00
RYB	ja	3.01	550	1250		1						1.00		0.00
AFR	ja	3.66	550	1250		2						1.00	0.04	0.00
GDR		0.97	550	1250		1						1.00		0.00
AFR	ja	2.2	550	1250		2	1					1.00		0.00
CIR		5.84	550	1250		2	1					1.00	0.16	0.00
GDR		4.66	550	1250		1						1.00		0.00
ENY		3.27	550	[illegible]			2	1.00		2.00		1.00		0.00
AFR	ja	5.7	550	[illegible]	1		2	1.00		2.00		2.00		1.00
OPA		6.89	800	1250	1	1		[illegible]				1.00		0.00
PNG		12.51	1200	1250		1	1					1.00	0.40	0.00
RYB		9.62	1200	1250	1	2		1.00		2.00		2.00	0.40	0.00
GDR		3.17	1200	1250		2		1.00		2.00		2.00		0.00
PNG		1.22	1200	[illegible]		2			1.00			2.00	0.40	0.00
RYB		6.68	[illegible]	1250	1	2				2.00		2.00		0.00
PNG		1.89	1200	[illegible]		2						1.00		0.00
RYB		4.99	1406	1250	1	1		1.00		2.00		1.00		0.00
RYB		2.64	1543	1750		1				2.00		1.00		0.00
RGL		5.18	1546	1750		1		1.00		2.00		1.00		0.00
GDR		2.12	[illegible]	1750		1		1.00		2.00		1.00		0.00
ERO	ja	4.43	1644	[illegible]		1			1.00	1.00		1.00		1.00
GDR		3.02	1647	1750	1	1		1.00		2.00		1.00		0.00

- ID possible risk orchards early
- Classify risk (Low, medium, high)

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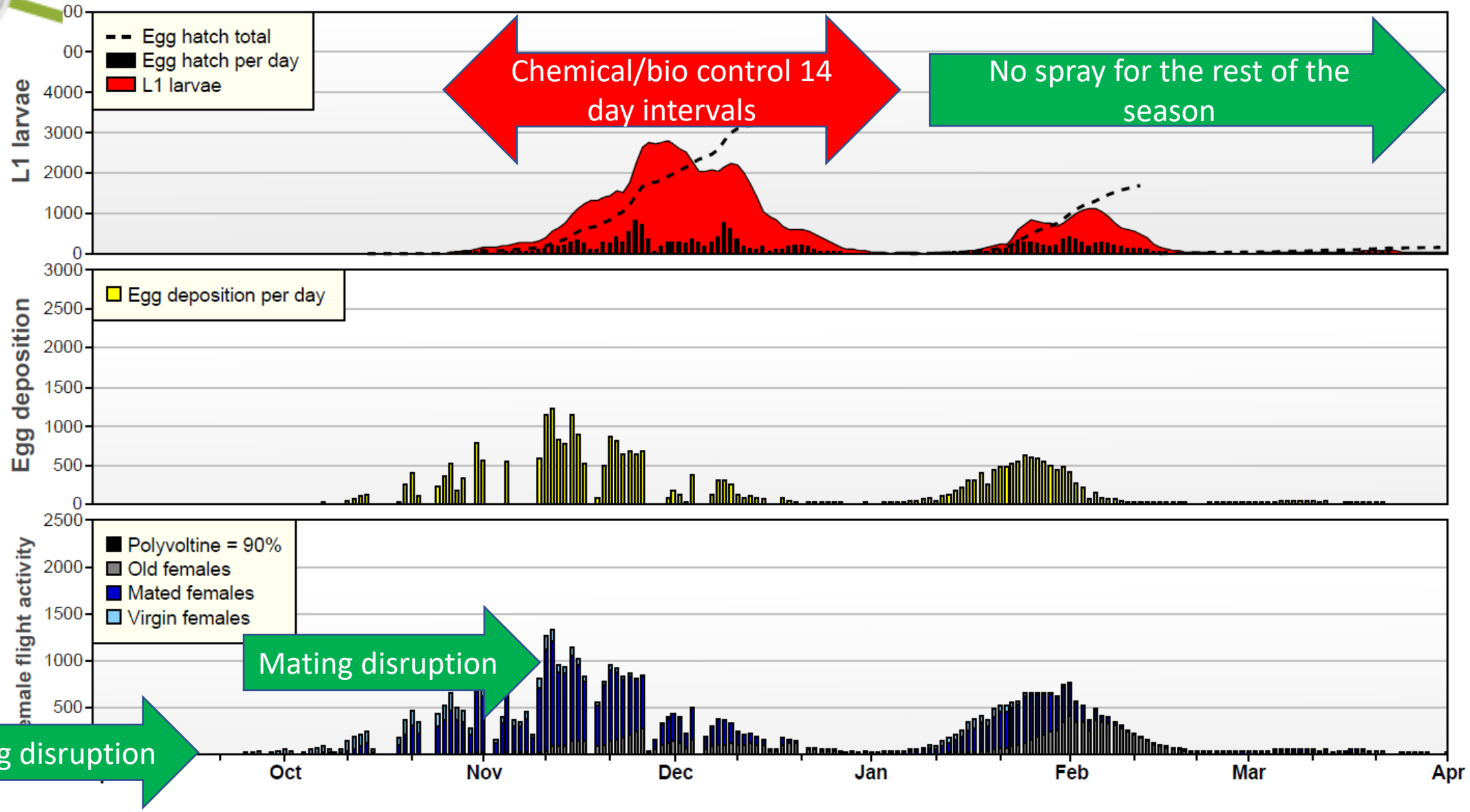
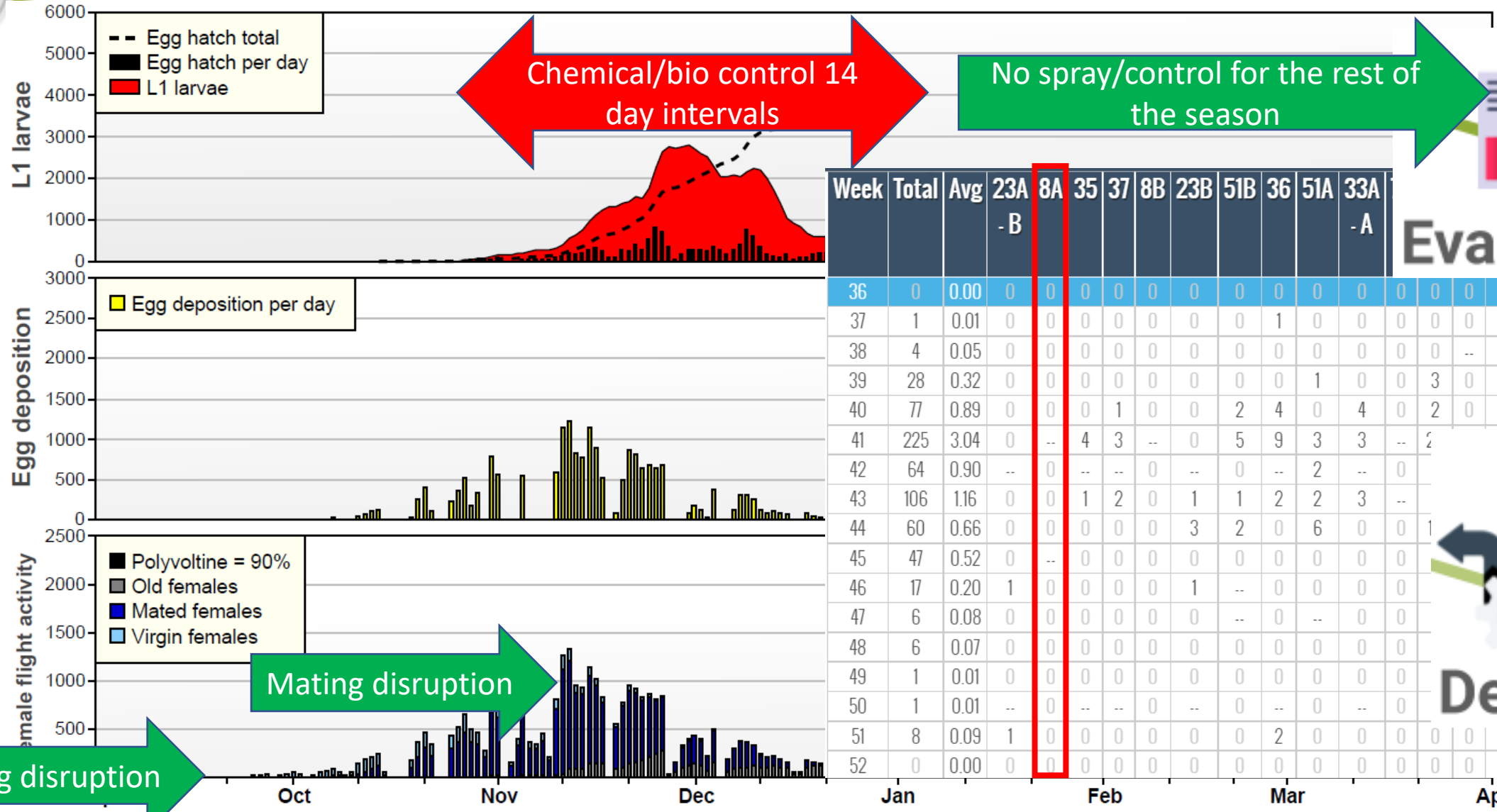
Control

Low risk example – codling moth



Control

Low risk example – codling moth



Chemical/bio control 14 day intervals

No spray/control for the rest of the season

Mating disruption

Mating disruption

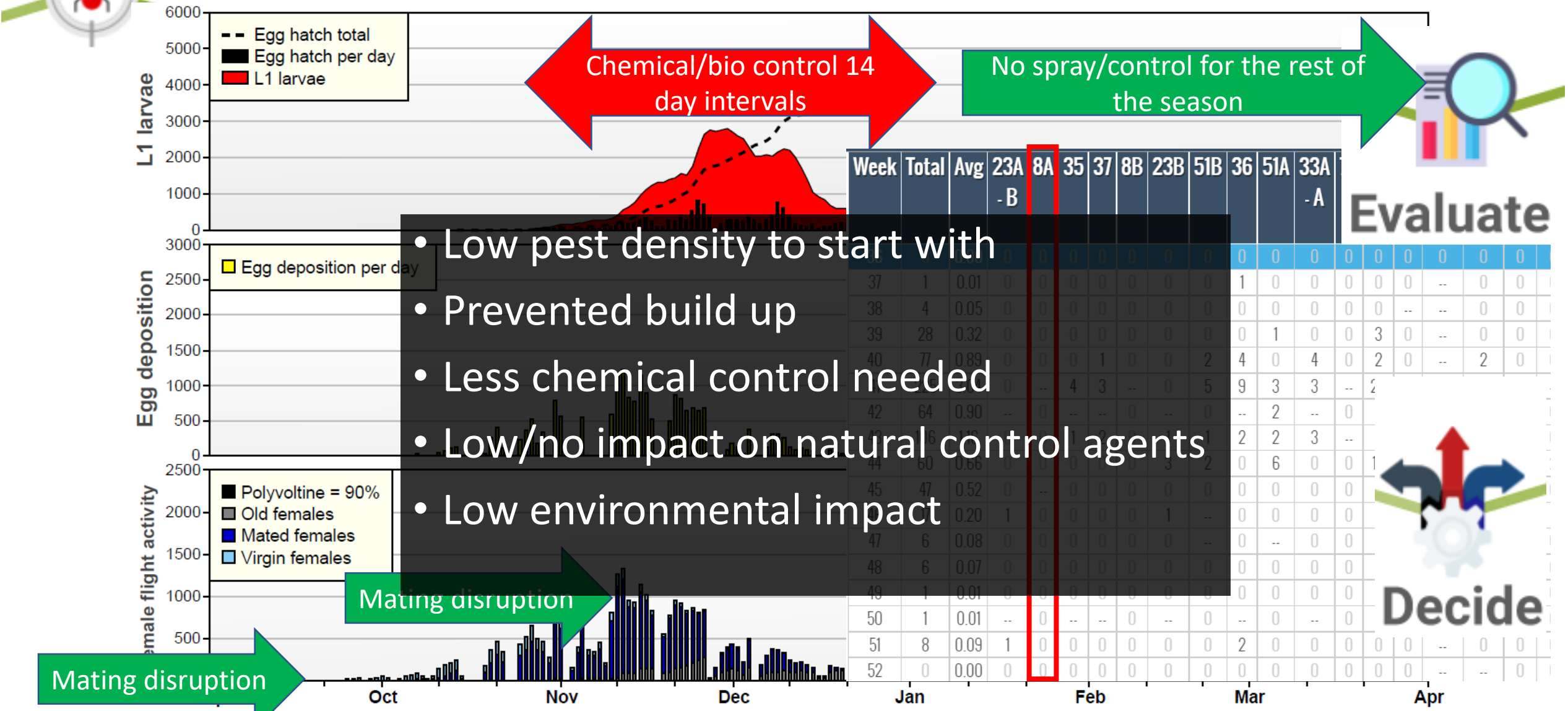
Week	Total	Avg	23A - B	8A	35	37	8B	23B	51B	36	51A	33A - A
36	0	0.00	0	0	0	0	0	0	0	0	0	0
37	1	0.01	0	0	0	0	0	0	0	1	0	0
38	4	0.05	0	0	0	0	0	0	0	0	0	0
39	28	0.32	0	0	0	0	0	0	0	0	1	0
40	77	0.89	0	0	0	1	0	0	2	4	0	4
41	225	3.04	0	--	4	3	--	0	5	9	3	3
42	64	0.90	--	0	--	--	0	--	0	--	2	--
43	106	1.16	0	0	1	2	0	1	1	2	2	3
44	60	0.66	0	0	0	0	0	3	2	0	6	0
45	47	0.52	0	--	0	0	0	0	0	0	0	0
46	17	0.20	1	0	0	0	0	1	--	0	0	0
47	6	0.08	0	0	0	0	0	0	--	0	--	0
48	6	0.07	0	0	0	0	0	0	0	0	0	0
49	1	0.01	0	0	0	0	0	0	0	0	0	0
50	1	0.01	--	0	--	--	0	--	0	--	0	--
51	8	0.09	1	0	0	0	0	0	0	2	0	0
52	0	0.00	0	0	0	0	0	0	0	0	0	0

Evaluate

Decide

Control

Low risk example – codling moth



Chemical/bio control 14 day intervals

No spray/control for the rest of the season

Evaluate

- Low pest density to start with
- Prevented build up
- Less chemical control needed
- Low/no impact on natural control agents
- Low environmental impact

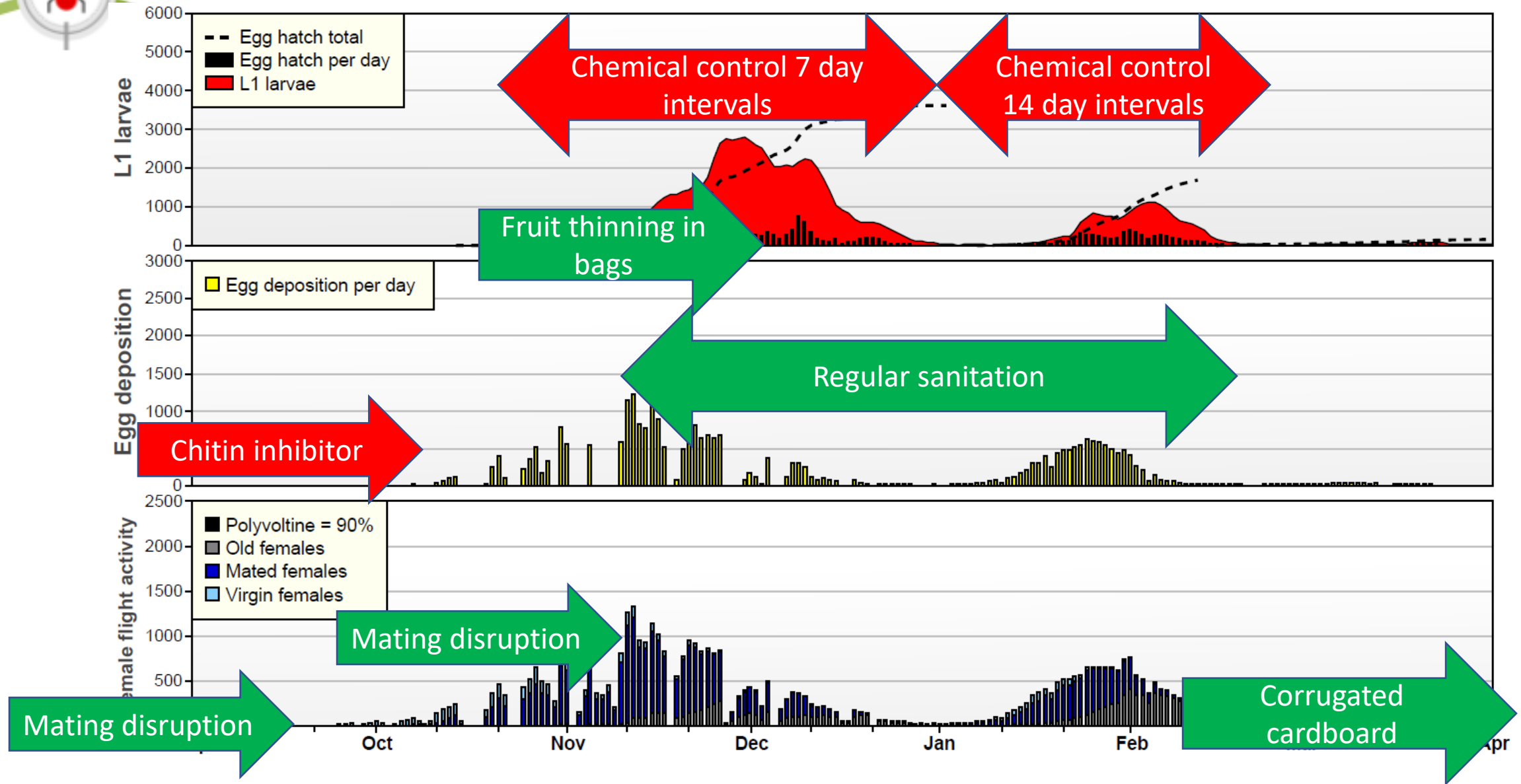
Decide

Mating disruption

Mating disruption

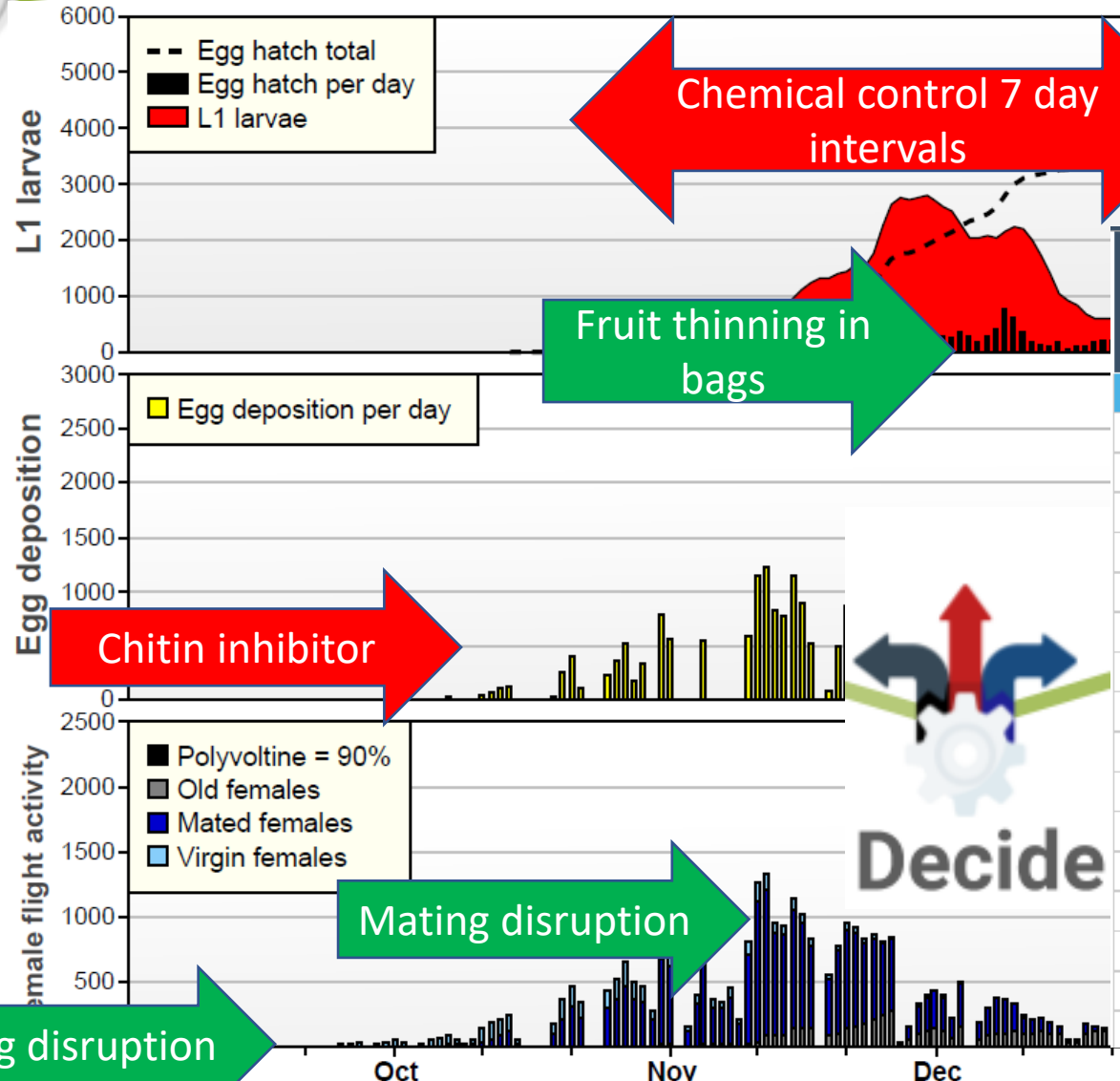
Control

High risk example – codling moth



Control

High risk example – codling moth



Chemical control 7 day intervals

Chemical control 14 day intervals

Fruit thinning in bags

Chitin inhibitor

Mating disruption

Mating disruption

Can we top spraying?

cardboard

Evaluate

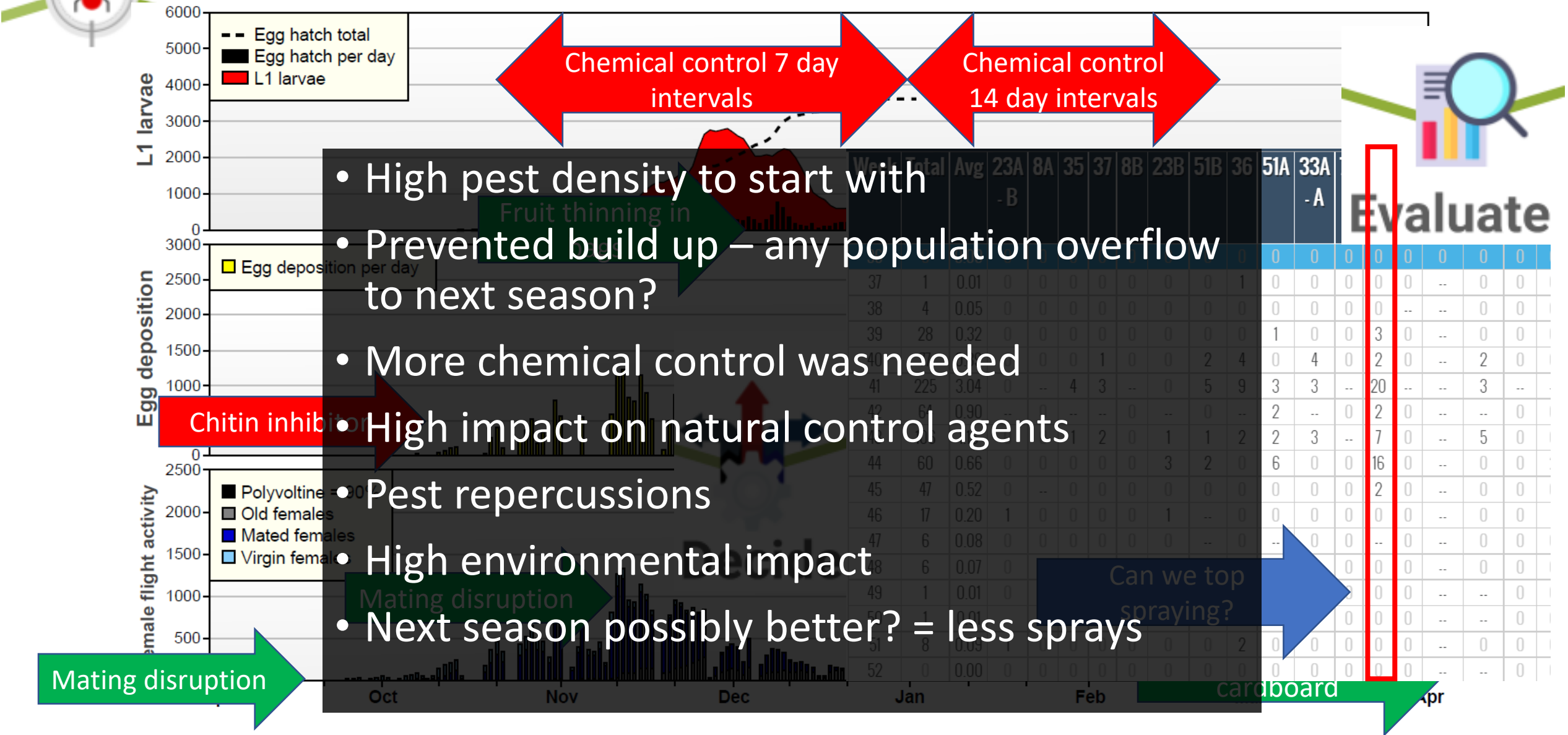
Decide

Decide

Week	Total	Avg	23A - B	8A	35	37	8B	23B	51B	36	51A	33A - A							
36	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
37	1	0.01	0	0	0	0	0	0	0	1	0	0	0	0	0	--	0	0	
38	4	0.05	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	
39	28	0.32	0	0	0	0	0	0	0	0	1	0	0	3	0	--	0	0	
40	77	0.89	0	0	0	1	0	0	2	4	0	4	0	2	0	--	2	0	
41	225	3.04	0	--	4	3	--	0	5	9	3	3	--	20	--	--	3	--	
42	64	0.90	--	0	--	--	0	--	0	--	2	--	0	2					
43	106	1.16	0	0	1	2	0	1	1	2	2	3	--	7					
44	60	0.66	0	0	0	0	0	3	2	0	6	0	0	16					
45	47	0.52	0	--	0	0	0	0	0	0	0	0	0	2					
46	17	0.20	1	0	0	0	0	1	--	0	0	0	0	0					
47	6	0.08	0	0	0	0	0	0	--	0	--	0	0	--					
48	6	0.07	0										0	0					
49	1	0.01	0										0	0					
50	1	0.01	--										0	0					
51	8	0.09	1	0	0	0	0	0	0	2	0	0	0	0					
52	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	

Control

High risk example – codling moth



- High pest density to start with
- Prevented build up – any population overflow to next season?
- More chemical control was needed
- High impact on natural control agents
- Pest repercussions
- High environmental impact
- Next season possibly better? = less sprays

Control

Chemical application

- Integral part of IPM
- Not a silver bullet
- Stop programs! Use strategies!
- We should appoint ourselves stewards of what we have left
- Product positioning NB
  - Protect beneficials
  - Market access

Notes on product choice and positioning		
Full bloom – 100% PD	Post flower – End first generation	Second generation till harvest
Pyrethroids Novaluron Methoxyfenocide Thiacloprid	Acetamiprid Chlorantraniliprole Cyantraniliprole Emamectin benzoate Methoxyfenocide Thiacloprid Virus	Chlorantraniliprole Cyantraniliprole Spinetoram Emamectin benzoate

Notes.

High pressure:

- Spray weekly during first generation and spray ovicide early.

Medium pressure:

- Spray fortnightly during first generation.
- Only spray egg hatch peaks in second and third generations.

Low pressure:

- Spray fortnightly during first generation.
- No sprays in second and third generations.

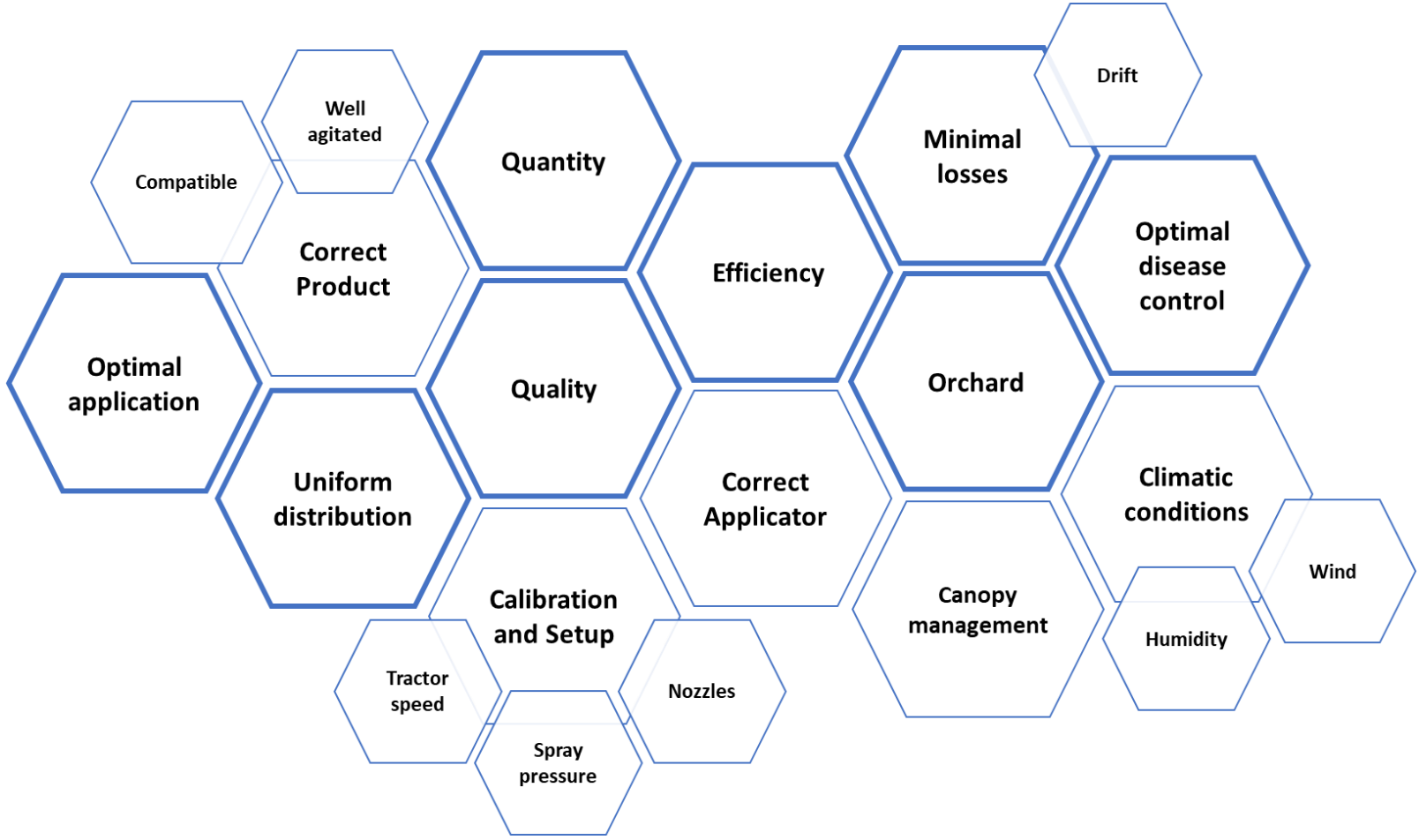
Product choice/positioning:

- Combined control of weevil and mealy bug.
- PHI
- Use restrictions and special market considerations.

Control

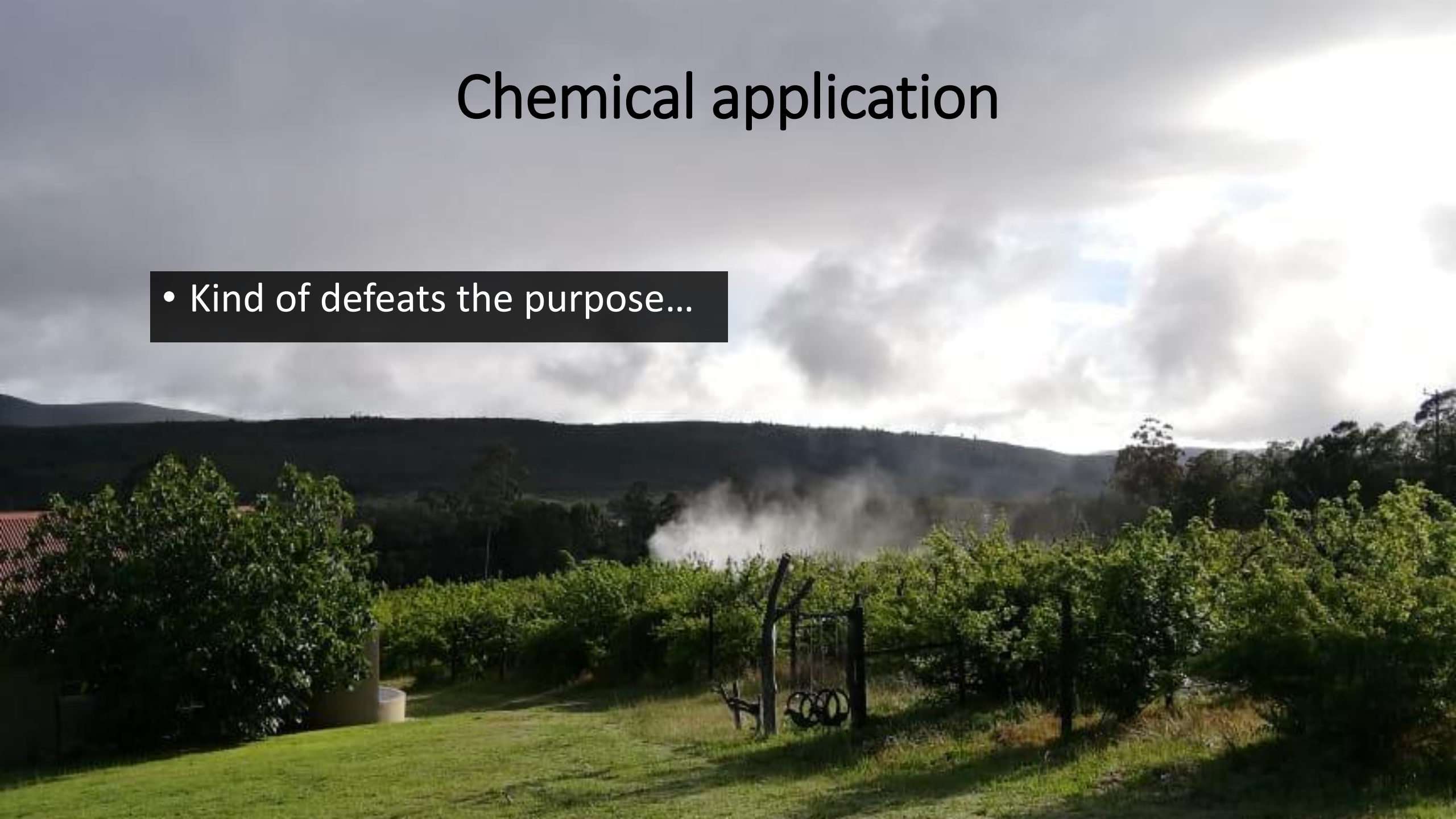
Chemical application

- Only as effective as applied
- Control failures can regularly be attributed to poor application



Chemical application

- Kind of defeats the purpose…



Conclusion

- Best practice IPM should be an DSS system based on your agroecosystem
- Should focus on
  - Maintain/improve profitability
  - Minimise selection pressure
  - Maintain environmental quality
- Improve agroecosystem biodiversity – To improve IPM implementation
- Prevent – have a plan and strategy tailored to orchard level for each pest
- Monitor and model efficiently
- Only spray **where** and **when** necessary
- Control through implementing multiple techniques