



Integrated Pest Management: Theory into practice

Rob Jacobson Science
Consultancy into
Practice

My background as an IPM practitioner...

Over 30 yrs experience in IPM

- Government advisory service
- Biocontrol producer
- Research Leader - HRI
- Independent IPM consultant

IOBC

International Organisation for
Biological Control

british 
TOMATO GROWERS' ASSOCIATION



Rob Jacobson Science
Consultancy into
Practice

Specialised in implementation of whole IPM programmes

- ‘Science into Practice’ Award in 2009
- ‘For work on IPM in glasshouse crops



I will draw mainly on examples from protected edible crops



But include other crops where possible

Structure of the presentation

- **General pest control strategies**
- **Components of IPM**
- **Basic biocontrol strategies**
- **Integration of chemical pesticides**
- **More sophisticated approaches to biocontrol**
- **Added value from your biocontrols**
- **Some biological complications**

Pest control strategies:

Options available

```
graph TD; A[Options available] --> B[Chemical]; B --> C[Routine];
```

Chemical

Routine

Routine chemical control

Application of (largely) broad spectrum chemicals to pre-determined schedules



Advantages

- Follow schedule
- Few decisions during season
- Little day to day management

Pest control strategies:

Options available

```
graph TD; A[Options available] --> B[Chemical]; B --> C[Routine]; B --> D[Supervised];
```

A flowchart illustrating pest control strategies. It starts with a box labeled 'Options available' at the top. A vertical line descends from this box, then turns left to connect to a box labeled 'Chemical'. From the bottom of the 'Chemical' box, a vertical line descends, then turns left to connect to a box labeled 'Routine'. Finally, a horizontal line connects the bottom of the 'Routine' box to the bottom of a box labeled 'Supervised'.

Chemical

Routine

Supervised

Supervised chemical control

- Based on crop monitoring
- Pest forecasting where techniques exist
- Chemical insecticides only applied when thresholds are exceeded
- Much more skilled labour required



P & D control strategies:

Options available

```
graph TD; A[Options available] --> B[Chemical]; A --> C[Integrated Management]; B --> D[Routine]; B --> E[Supervised];
```

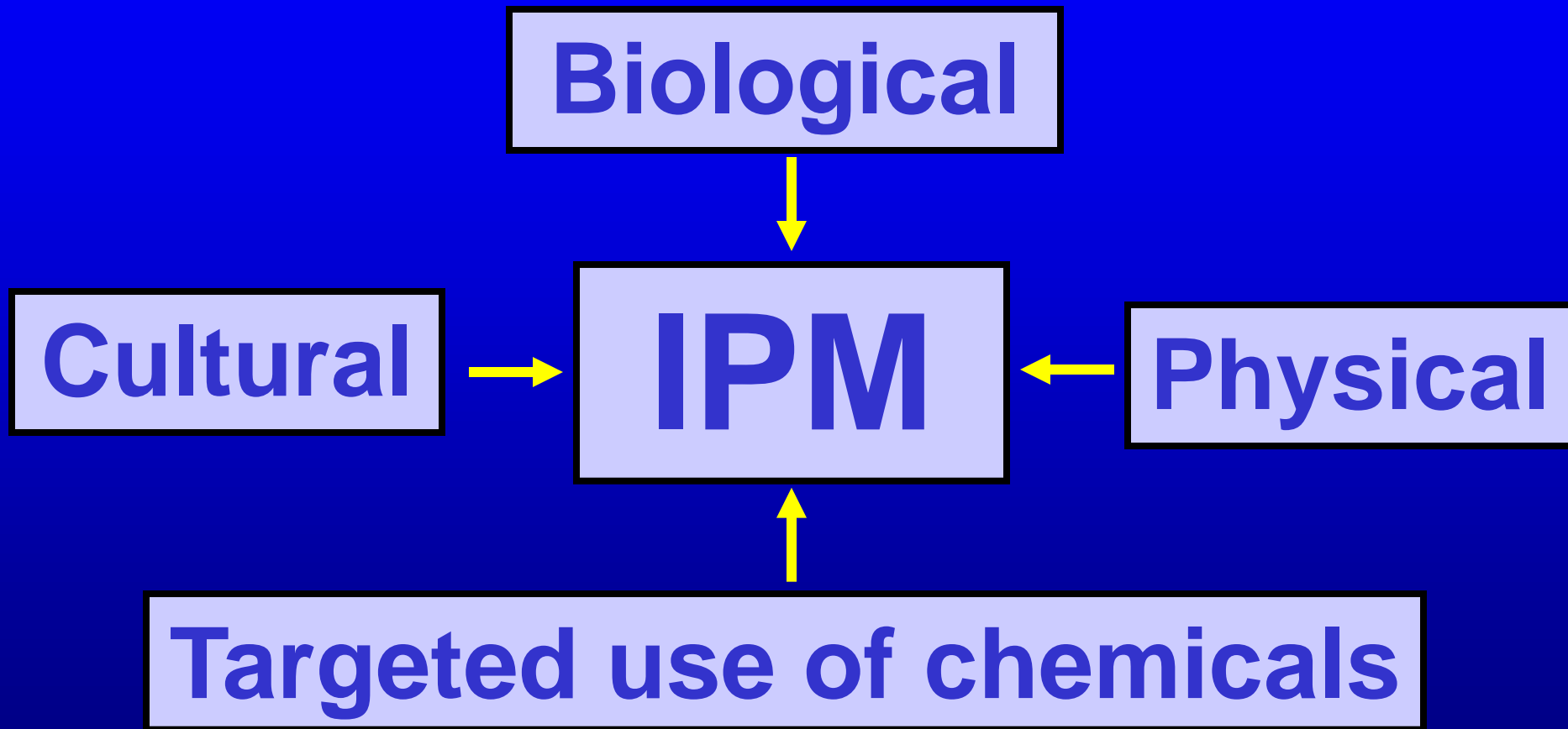
Chemical

Integrated
Management

Routine

Supervised

What do we mean by Integrated Pest Management ?



Some examples of physical controls....



Screens



Barriers



Traps



Physical removal



Irrigation

Some examples of cultural controls.....



Plant resistance / tolerance



Companion crops

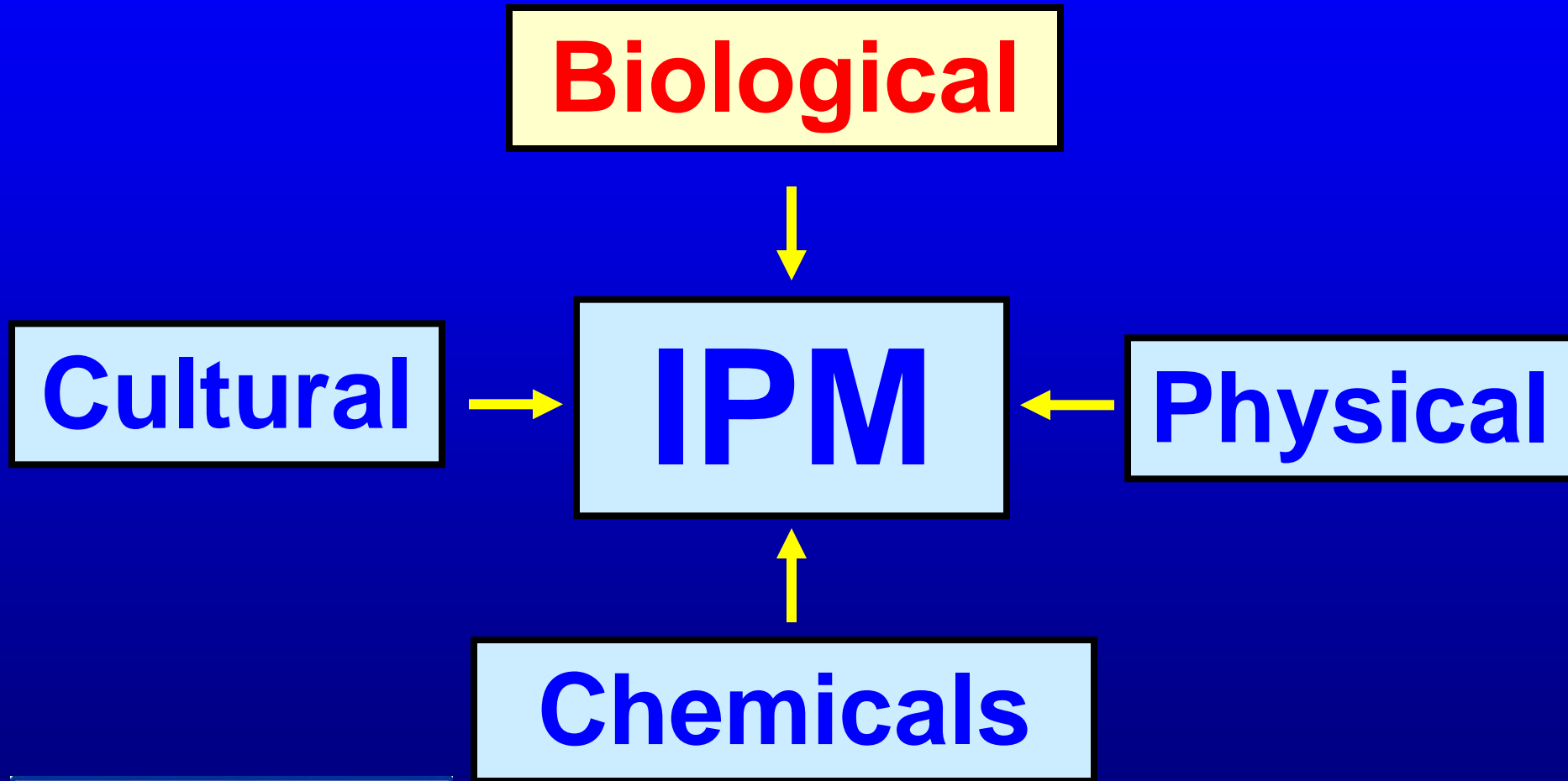


Timing of planting & seed bed preparation



Manipulate growing conditions

Components of IPM:



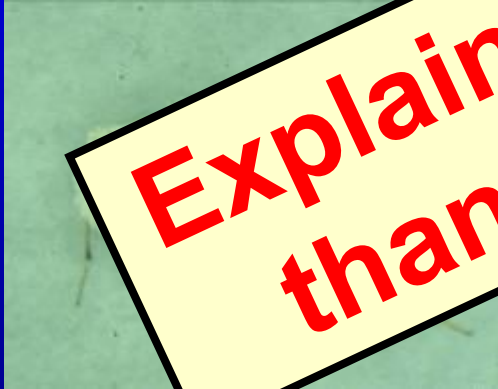
Biological 'products'



Parasitoids

Wasp

Explain my strategies rather than list individual BCAs



Fungi

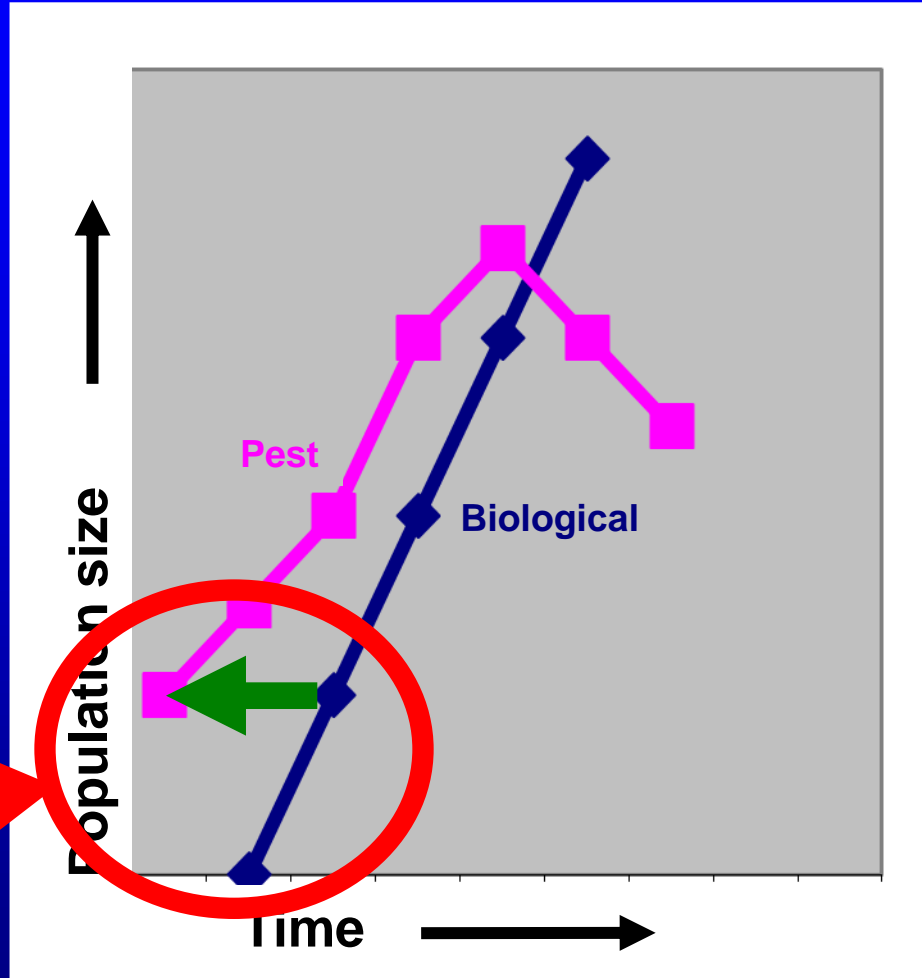


Nematodes



Micros

Simplest biocontrol strategy - Reactive

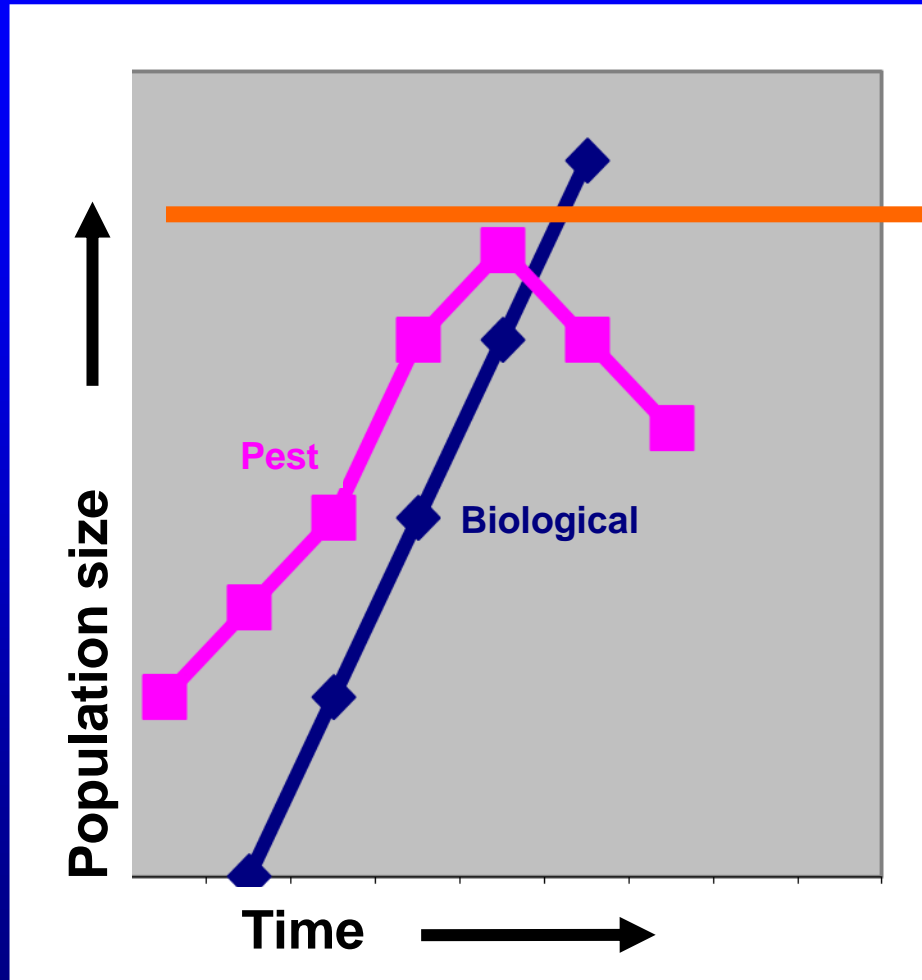


**Key to
success**

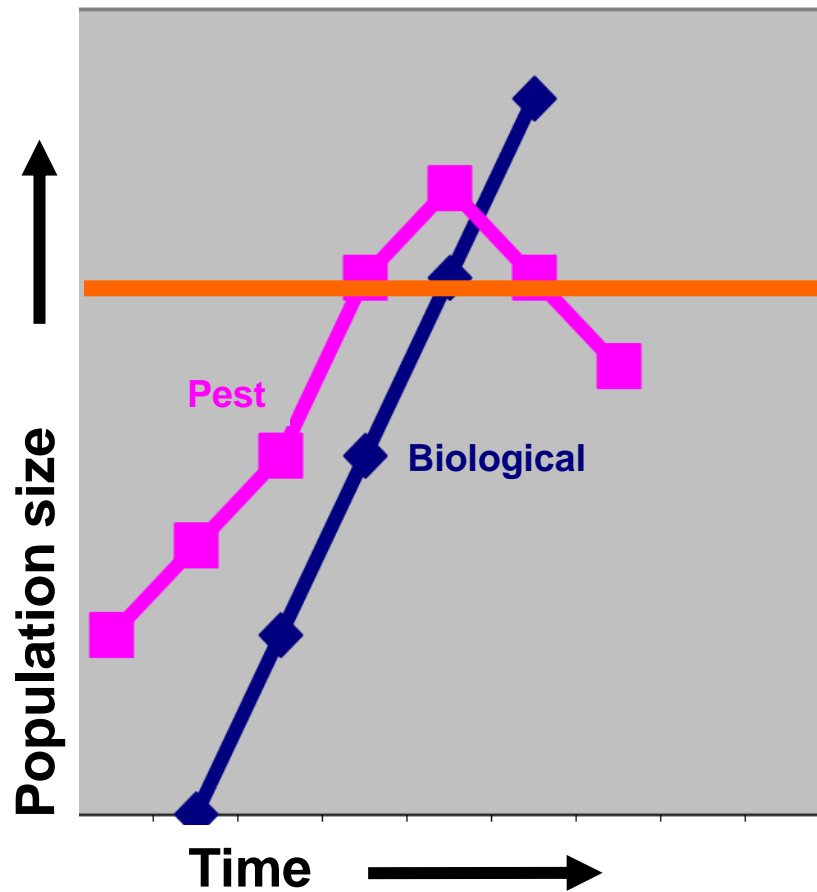
Four rules

1. Detect early
2. Act quickly
3. Release adequate numbers
4. Place them accurately

Ideal situation ...



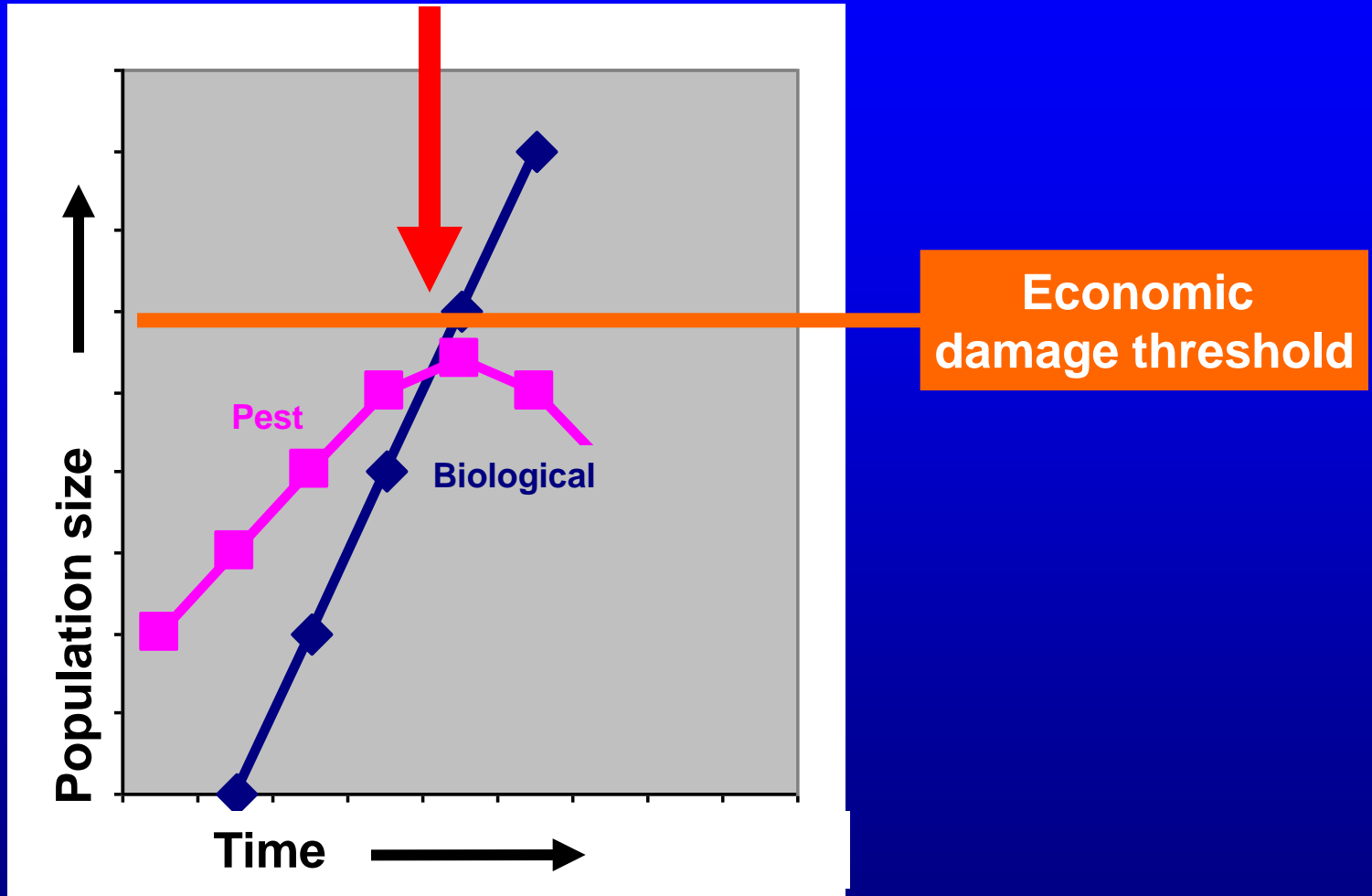
Economic
damage threshold



Economic
damage threshold

But what if it
is here?

Second line of defence



Key features of second line of defence products

- 50% control often adequate
- Quick to apply
- Quick to act
- Compatible with other control agents

Traditionally – Target specific chemicals

Very important because they have provided the 'safety net' !

Example of use of target specific



Phytoseiulus



Fenbutatin oxide

More broad spectrum products

Separated in time



eg: natural pyrethrins



Important

short persistence
so no residues

Or separated 'in space'



via irrigation

Now moving toward biological and plant derived alternatives



Nematodes



Fungi



Micros



Plant derived products

More sophisticated approaches to use of chemicals:

Semiochemicals



Sex pheromones



**Trigger natural plant
defence mechanisms**

Some more sophisticated approaches to biocontrol.....



Methods of establishing biocontrols in the crop before the pest arrives

Four approaches to prophylactic biocontrol.....

- 1. Repeated application / release**
- 2. Plant feeding predators**
- 3 Generalist feeders / scavengers**
- 4. Provision of alternative food**

1. Repeated release

eg: *Encarsia formosa* against whiteflies



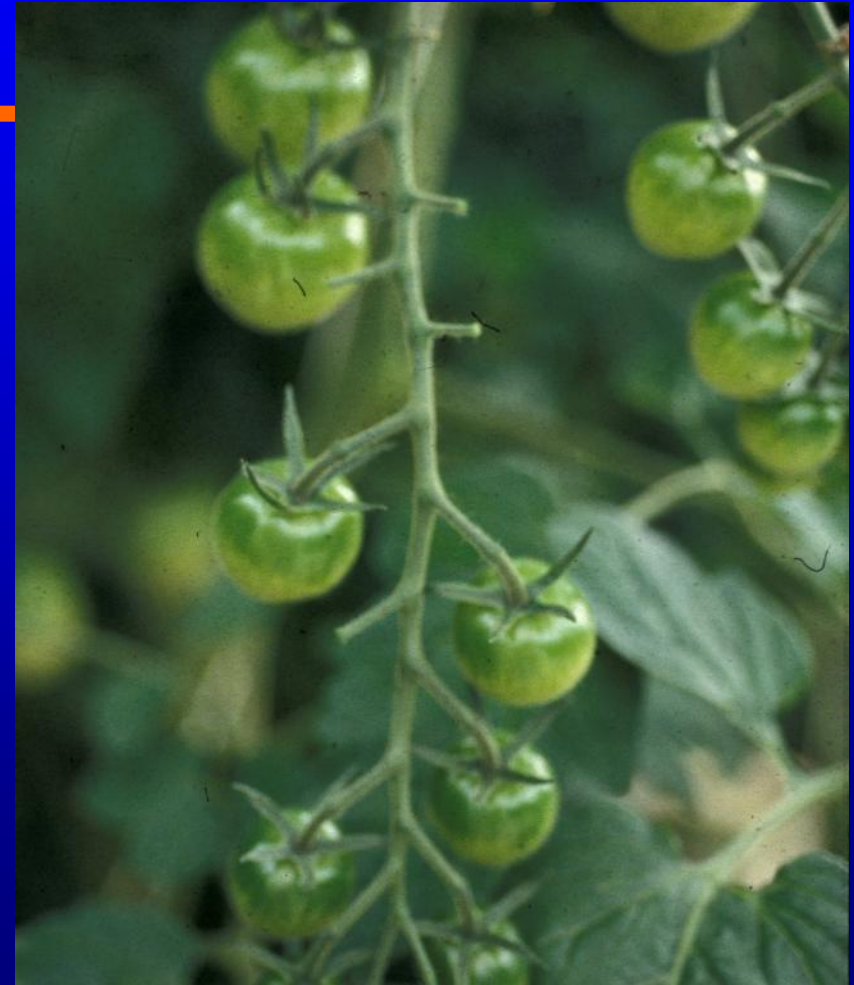
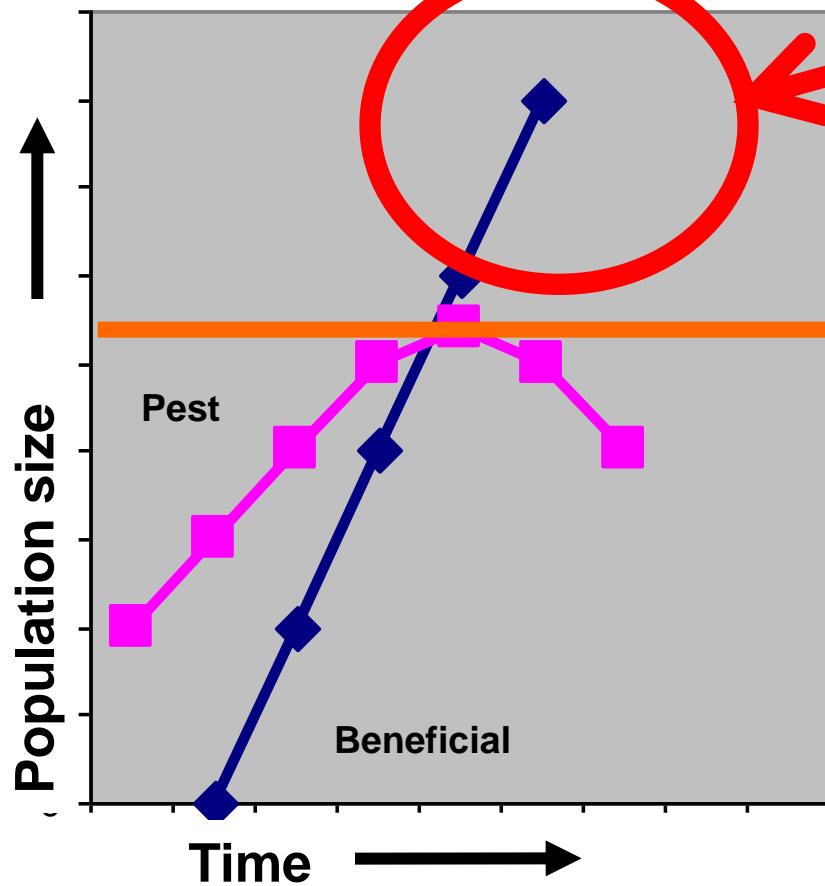
- Weekly release of large numbers from planting
- Possible because inexpensive

2. Plant feeding predators

Eg - Macrolophus



Population
keeps
growing



**In 2006 it was the
most important pest
of organic tomatoes
in the UK**



- **Developed a method of managing the predator**
- **‘Cull’ the population**
- **Based on natural pyrethrins**
- **Applied after pests controlled but before plant damage occurred**
- **Now utilised as an important biocontrol**

3. Generalist feeders / scavengers

eg: *Amblyseius swirski*



- Pollen feeder
- Best above 24°C



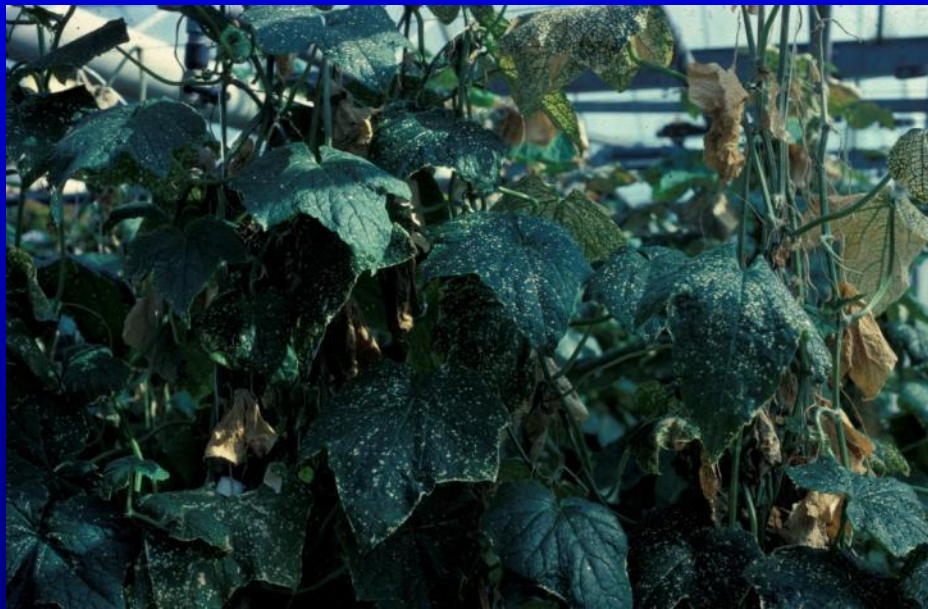
Proving useful against
immature whiteflies

4. Provision of alternative food

Simplest system is use of loose material



Use of culture packs



A potential control measure discovered



Amblyseius cucumeris

But a weak control agent
because only attacks
smallest life cycle stages



Reared in a cereal-based
culture material with
flour mites as prey

Early strategy

- Wasteful
- Messy
- Labour intensive
- Ineffective



Step 2

- To reduce waste
- Kept breeding
- Slightly more effective



Step 3

- Switch to paper pack



Step 4

- Breathable paper
- Colonies produce predators for 6-8 weeks



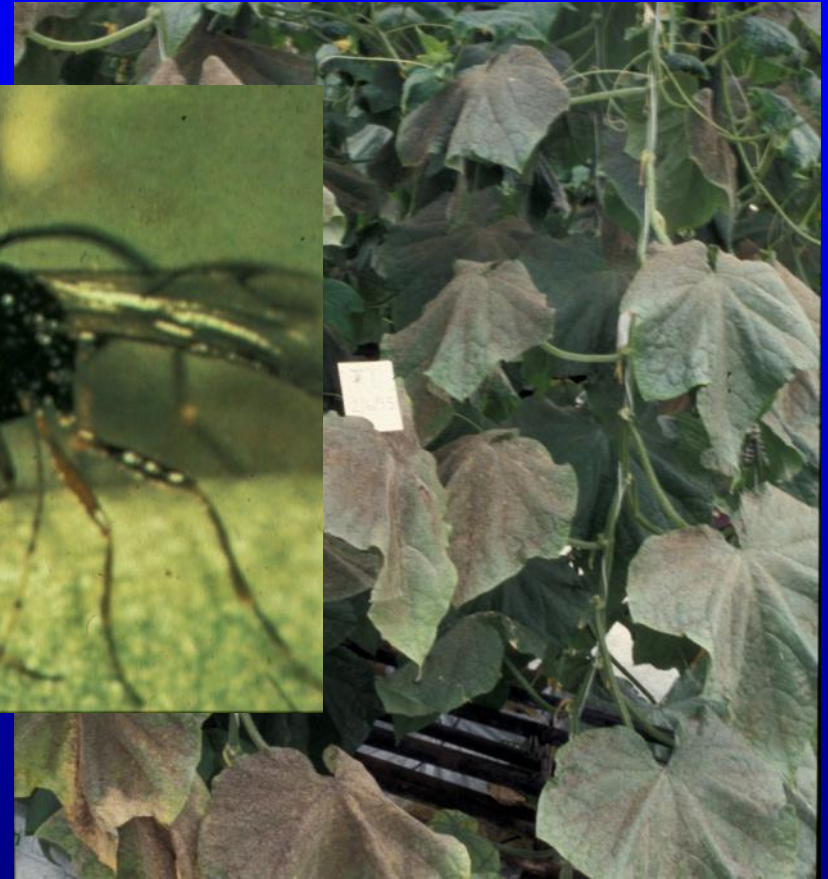
Has it been implemented ?



.... now used by every cucumber grower in the UK

Alternative food via “open rearing unit”

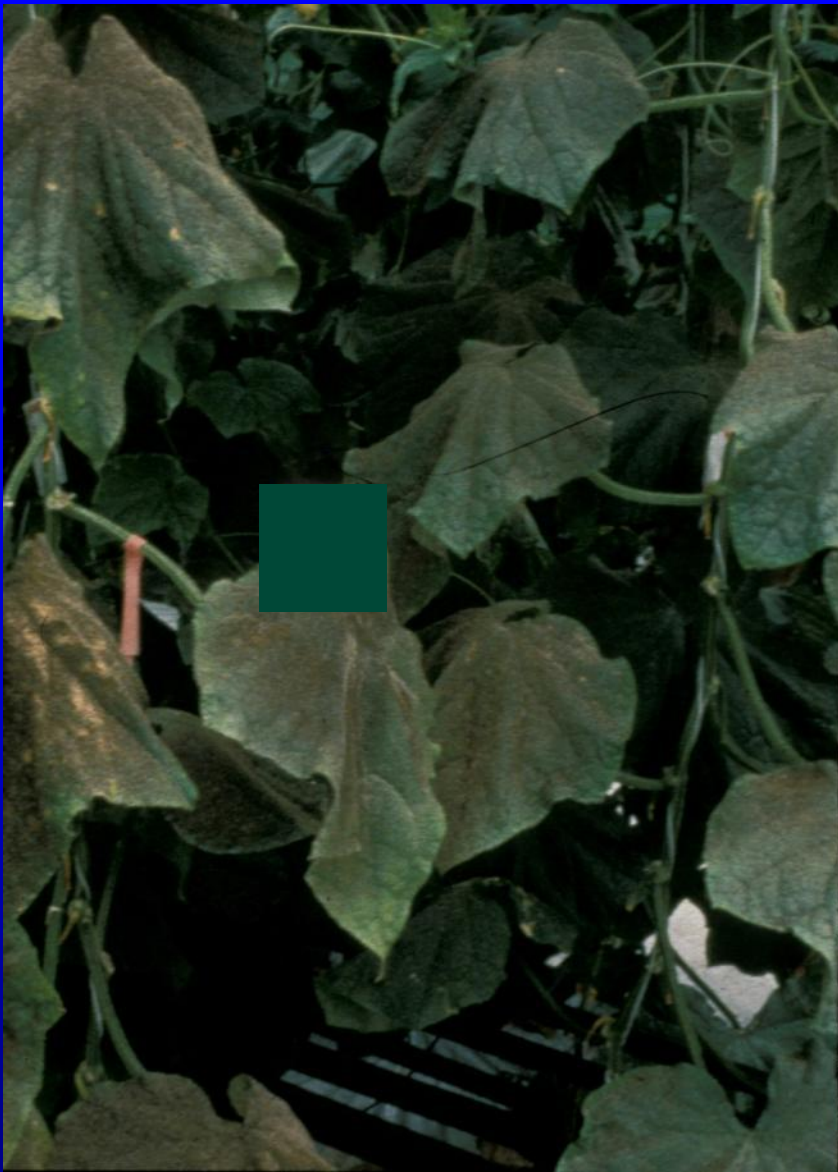
eg: *Aphidius colemani* against *Aphis gossypii*



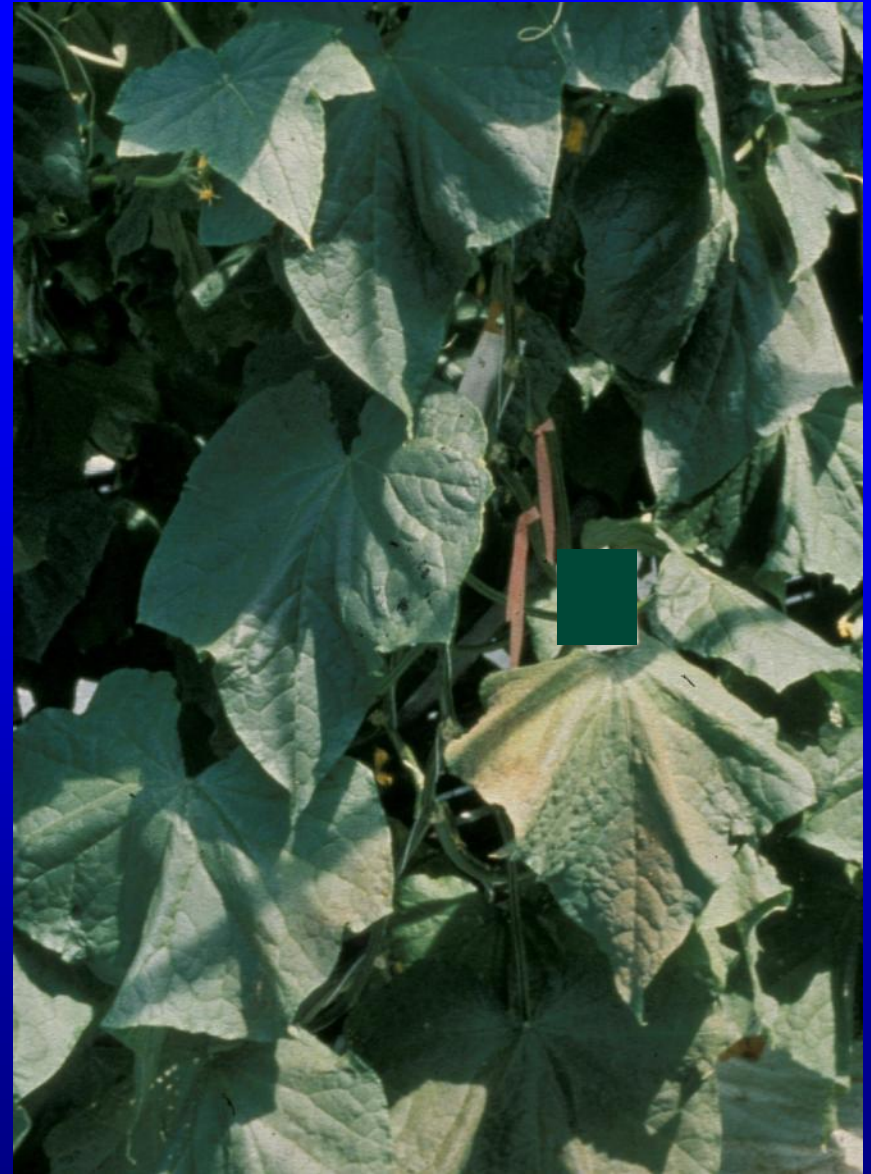
The “open rearing unit”



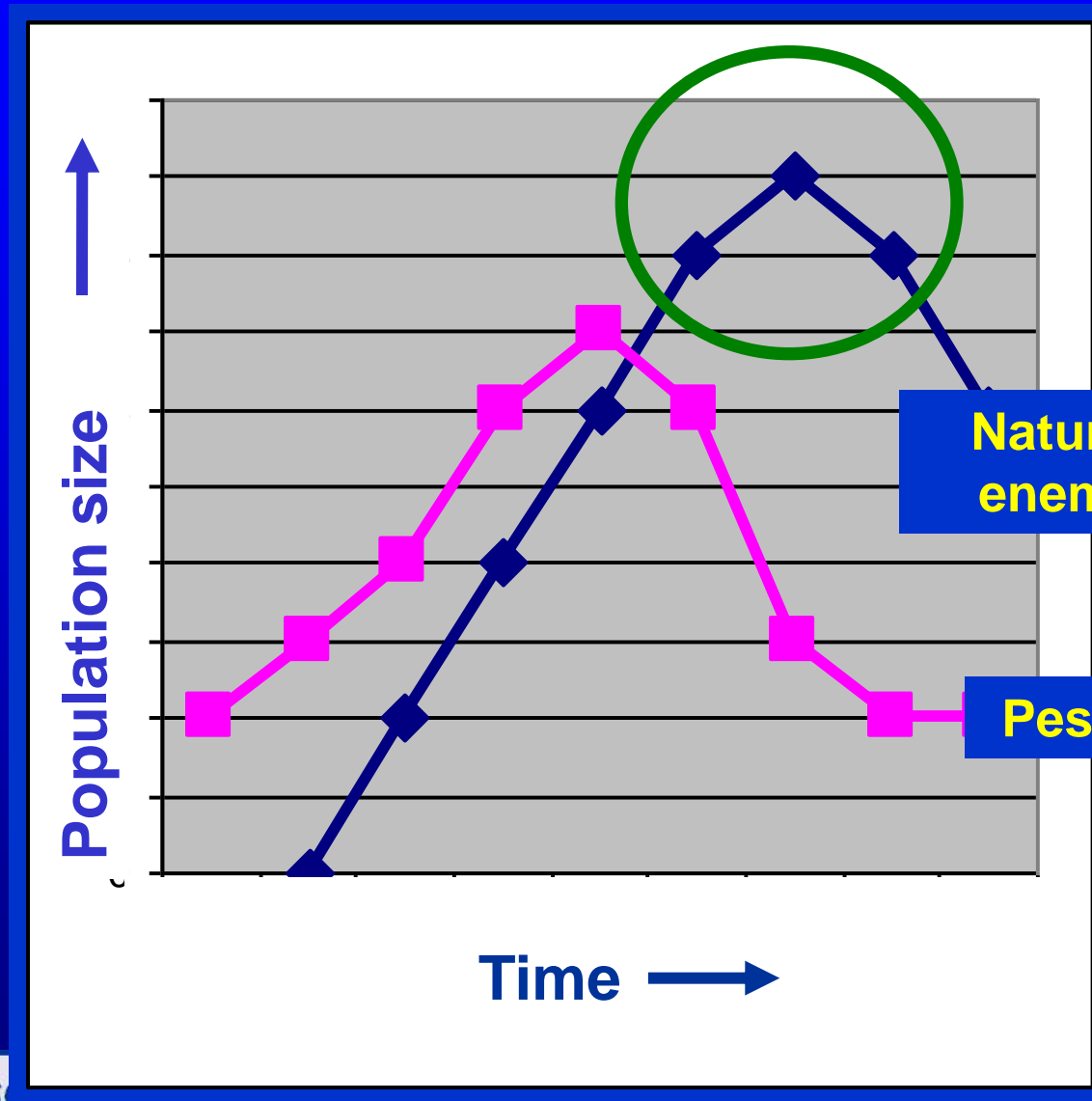
Untreated control



With ORU



Added value from biocontrols:



Use leafminers as an example.....



Diglyphus





Just 1 pupa per leaflet

= 7 per leaf

= 20 per plant

= 800,000 / ha

= £ 60,000 / ha !!!



Our objective:



- To use our own crops to boost biocontrol numbers
- We produce tomato conditioned BCAs without storage or transit
- We can spend more on biocontrol in the early season because we know we will spend less against later infestations

Some potential biological complications



**For example:
with the parasitoids used against aphids**

Hyperparasite



How do hyperparasitoids locate their hosts ?



Hypothesis:

They follow chemical cues released from the mummified aphid



Our goal:

To incorporate this semiochemical into a trap

Interactions between beneficials



Finally

Can we use biocontrols in field crops ?



We can draw on natural resources



Create habitats



Thank you



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