



IPM: What to measure? Crop physiology perspective Kate Storer

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Components of IPM





The science of doing nothing

ADAS

- Most difficult decision you can make
- Do you need to treat?
- Requires 100% confidence in available information



Why is tolerance important?



- Damage does not necessarily mean yield loss
- Help to rationalise insecticide use
- Uses crop as first step in risk assessment
- That's where the team work comes in...

Entomology

• Pest biology



- Assessment methods
- Control options



Physiology

- Plant number
- Yield parameters
- Crop tolerance

How does the pest interact with the crop?



Insect feeding group	Example pests
Tissue consumers	Pollen beetle, Slugs, flea beetles, pea and bean weevil, seed weevil, dipterous stem borers
Leaf senescence accelerators	Aphids
Plant number reducers	Slugs, wireworms, leatherjackets
Photosynthetic rate reducers	Aphids (honeydew & sooty moulds), leaf miners, leaf beetles
Assimilate sappers	Aphids, saddle gall midge, orange wheat blossom midge
Turgor reducers	Nematodes, leatherjackets, wireworms through root damage

(Litsinger, 2009)







What should a threshold scheme consider?



1. How much damage does an individual pest cause?

E.g. how many buds can a beetle destroy?

2. How much damage can a crop tolerate before losing yield?

E.g. how many excess flowers does an oilseed rape plant produce?

3. Methods for easily monitoring/predicting the state of the crop and pest prevalence *E.g. Is it possible to predict the number of excess flowers per plant using an easier in-field measure?*

We can use this information to produce a threshold (for chemical application) or management scheme based on plant growth and pest presence – reducing the risk of applying insecticides unnecessarily

1. How many buds can a beetle destroy?



 Used polytunnel inoculation experiments to determine the number of buds a beetle can destroy

> Buds lost/beetle $R^2 = 0.9823$ Inoculated beetles/plant

> > On average a single pollen beetle can destroy 9 buds

2. How many excess flowers does an oilseed rape plant produce?



- OSR needs 6000-8000 pods/m² to achieve potential yield
- OSR produces up to 12,000 flowers/m²
 - Therefore up to 4000 excess flowers (buds)/m²
- 3. Is it possible to predict the number of excess flowers per plant?
- Negative relationship between plants/m² and excess flowers per plant
- Typical crop produces 200 excess flowers/plant

Mouiste.	Excess flowers/m ²		
variety	2008/09	2009/10	
Castille (OP)	3747	8816	
Excalibur (Hybrid)	7019	10760	
PR54D03 (Semi dwarf hybrid)	7107	9505	
Mean	5958	9694	



Pollen beetle results



1. How many buds can a beetle destroy?

Nine buds per beetle

2. How many excess flowers does an oilseed rape plant produce?

~200 buds/flowers per plant

3. Is it possible to predict the number of excess flowers per plant?

There is a negative relationship between plants/m² and excess flower number

Information Sheet 18/Spring 2013

Monitoring and control of pollen beetle in oilseed rape

Biology

HGCA

In recent years, pollen beetles have rarely been abundant enough to warrant treatment: careful monitoring can prevent unnecessary 'insurance' sprays and preserve the efficacy of pyrethroid products.

Pollan beatles migrate to winter ofseed rape crops from mid-March and throughout April. If flowers are not open, beatles bite into and kill buds. Damage to buds declines as the flowers begin to open and pollen becomes more easily obtainable.

Beatles lay their eggs in closed buds. On hatching, larvas fead within the buds and in flowers throughout May before dropping to the soil to pupate. A new generation of adults: manage in Juna-July and fead beline from a wide range of flowers, including spring oilseed rape. Adults then hibernate over winter in leaf litter, mainly in dociduous woodland.

Risk assessment

The damage-susceptible stage of the crop is green-yellow bud. Once the crop starts flowering, the beetles move to the open flowers, becoming polinators rather than pests.

Crops are usually most at risk when the weather is dry and warm (above 15°C). Using beited monitoring traps (Gocos), as well as online polion beatler ingration forecasts, to detact local movement can allow effort to be focused to when and where they are most needed. A pollen beetle migration forecast besed on local weather data is fixedy available online (www.hgea.com/pestal). This pradiction tool provides a series of three maps, informing on a local scale. (1) whether or not migration is islay to have started, 2(1) the risk of migration in the next three days and (2) the predicted completion of migration. Use of maps 2 and 3 in particular can help to reduce unnecessary "insurance sprays.

Control thresholds

The revised threshold for winter and spring oilseed rape is based on the maximum number of buds each beatle can destroy and the number of excess flowers produced by different crops. The plant population makes a large difference to the pollan beatle threshold, as plants in low plant population crops produce more branches and, therafore, more flowers. Revised control thresholds for winter and spring oilseed rape





Monitoring pollen beetle numbers

ways consider your local conditions and

Monitor the number of pollan baselies per plant pariodically throughout the damage-auscophible stage of the orop (green-yellow bud). Sample at last ten plants along a transact of a 30m minimum from the middle of the hasdand towards the contre of the orop and calculate the mean number of beatles per plant, spraying only when that runneer auscodes the control threshold. When counting the number of baselies per plant it is important to recognise the plants in higher population orops are likely to have one budding shoot, whereas plants in lower population orops are likely to have branched out and produced several more.

Pollen beetle threshold varies with plant number

- Dividing excess bud number by 9 gives threshold – varies by plant number
- Increases with decreasing plant number: more sparse plant populations = more branches & excess buds





Validation & further testing



Insecticide experiments



- Validating the new threshold
- 5 sites, range of plant populations
- Insecticides had no significant effect on yield
- Never exceeded threshold

Pruning & defoliation



- Is damage to the main
 raceme likely to result in
 greater yield loss?
- What about pigeon damage?
- OSR crops surprisingly
 resilient to flower bud loss &
 simulated pigeon grazing,
 with no significant impact on
 yield.



Pest	How many pods/shoots required for potential yield?	How many excess buds/shoots can the crop produce?	How hungry is the pest?	How to manage the pest?	What should we measure?
Pollen beetle	6000-8000 pods/m²	Up to 4000 pods/m²	Eats nine buds	Threshold based insecticide application	Number of beetles & plant population
Wheat bulb fly	500 shoots/m ²	Up to 600 shoots/m²	Destroys four tillers	Modify sowing date & seed rate	Adult fly numbers (or historic egg counts)
Slugs	500 shoots/m ²	Up to 600 shoots/m ²	Unknown	Slug pellets or seed rates?	Number of slugs

Common themes – what to measure?

- 1. How much damage does an individual pest cause?
 - How many pests are there on the plant what damage can they do?
- 2. How much damage can a crop tolerate before losing yield?
 - Does the plant produce excess growth that may tolerate this type of damage?
 - » Flower number (pollen beetle)
 - » Shoot number (wheat bulb fly)
 - » Plant number (slugs)
- 3. Methods for easily monitoring/predicting the state of the crop and pest prevalence
 - Potentially:
 - Predict excess flower number based on plant population
 - Model shoot number based on thermal time











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