

Crop tolerance as a component of IPM

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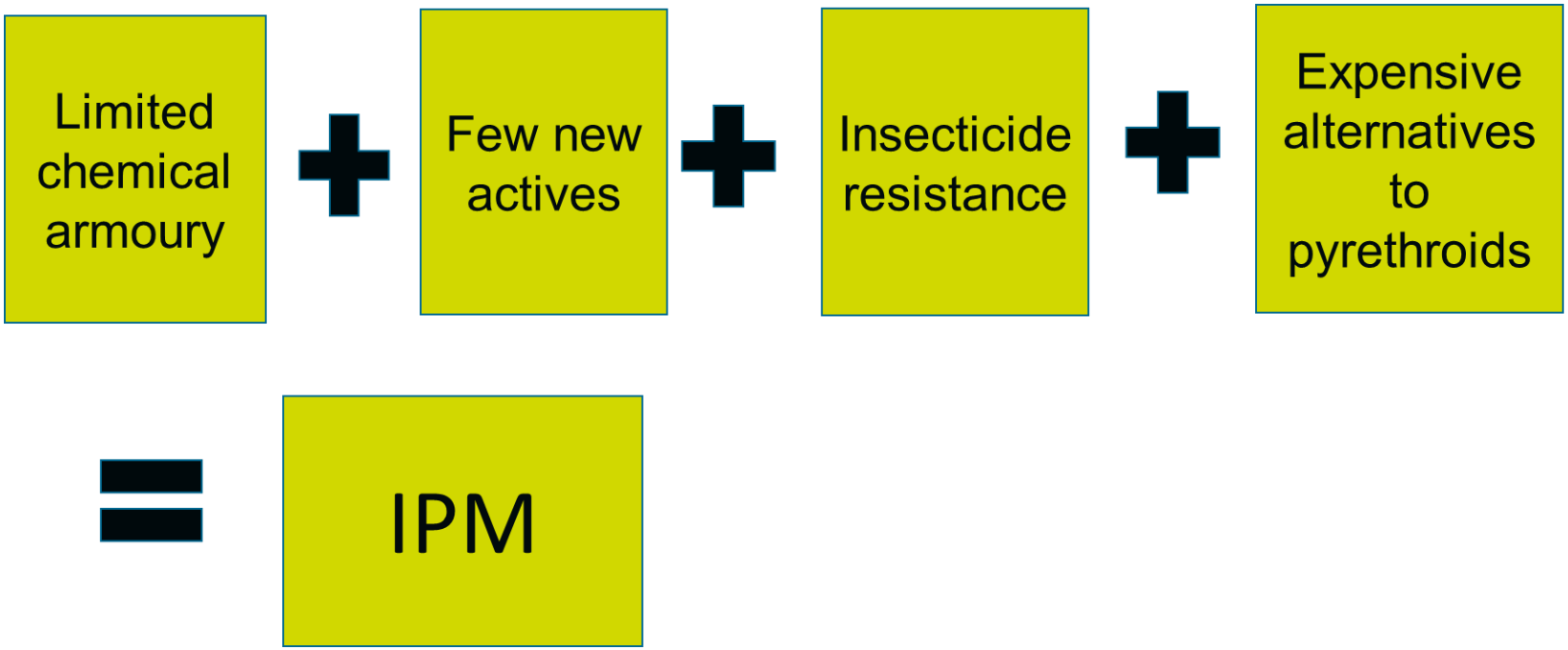
The case for change



Pyrethroids & their alternatives: Pollen beetle control in UK

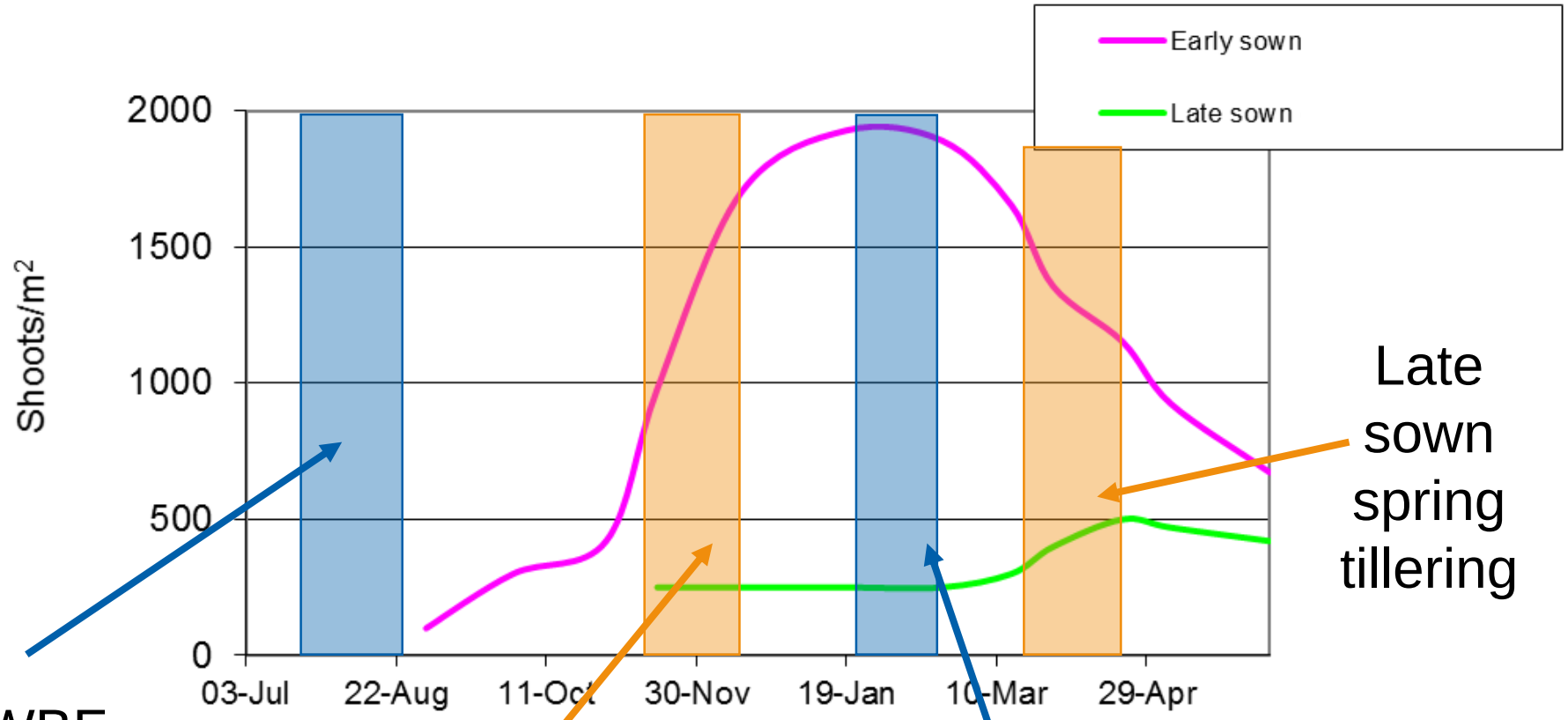
Standard treatment	Alternative products		
	Pymetrozine	Indoxacarb	Thiacloprid
Lamda-cyhalothrin @ £7.48/ha	£40.86/ha	£31.34/ha	£19.32/ha

What is crop tolerance?

The capacity for a plant to withstand or recover from injury without any discernible impact on yield

‘With resistance things are kind of stop right there,
But with tolerance things are more laissez-faire’

Key timings



WBF eggs laid

Early sown autumn tillering

WBF damage

Late sown spring tillering

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Why is tolerance important?

- Damage does not mean yield loss
- Use tolerance to rationalise insecticide use
- Uses crop as first step in risk assessment

Asking the right questions

Pest	How many pods/shoots required for potential yield?	How many excess buds/shoots can the crop produce?	How hungry is the pest?
Pollen beetle	6000-8000 pods/m^2	Up to 4000 pods/m^2	Eats nine buds
Wheat bulb fly	500 shoots/m^2	Up to 600 shoots/m^2	Destroys four tillers
Slugs	500 shoots/m^2	Up to 600 shoots/m^2	Unknown

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Are we measuring the right things?

Problems with current thresholds:

- Not user friendly
- Time consuming
- Temperature dependent
- Elusive quarry

What have the Americans ever done for us? (Litsinger, 2009)

Insect feeding group	Example pests
Reduce green leaf area	Slugs, flea beetles, pea and bean weevil, pollen beetle, seed weevil, slugs
Reduce plant number	Slugs, wireworms, leatherjackets, dipterous stem borers
Assimilate sappers	Aphids, saddle gall midge, orange wheat blossom midge

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Using tolerance to develop ‘smarter’ thresholds

- Utilising the existing crop
  - Pollen beetle
  - Slugs
- Growing robust crops that can tolerate pests
  - Stem borers e.g. wheat bulb fly

Ramsden MW, Kendall SL, Ellis SA, Berry PM. (2017). A review of economic thresholds for invertebrate pests in UK arable crops. Crop Protection 96, 30-43.

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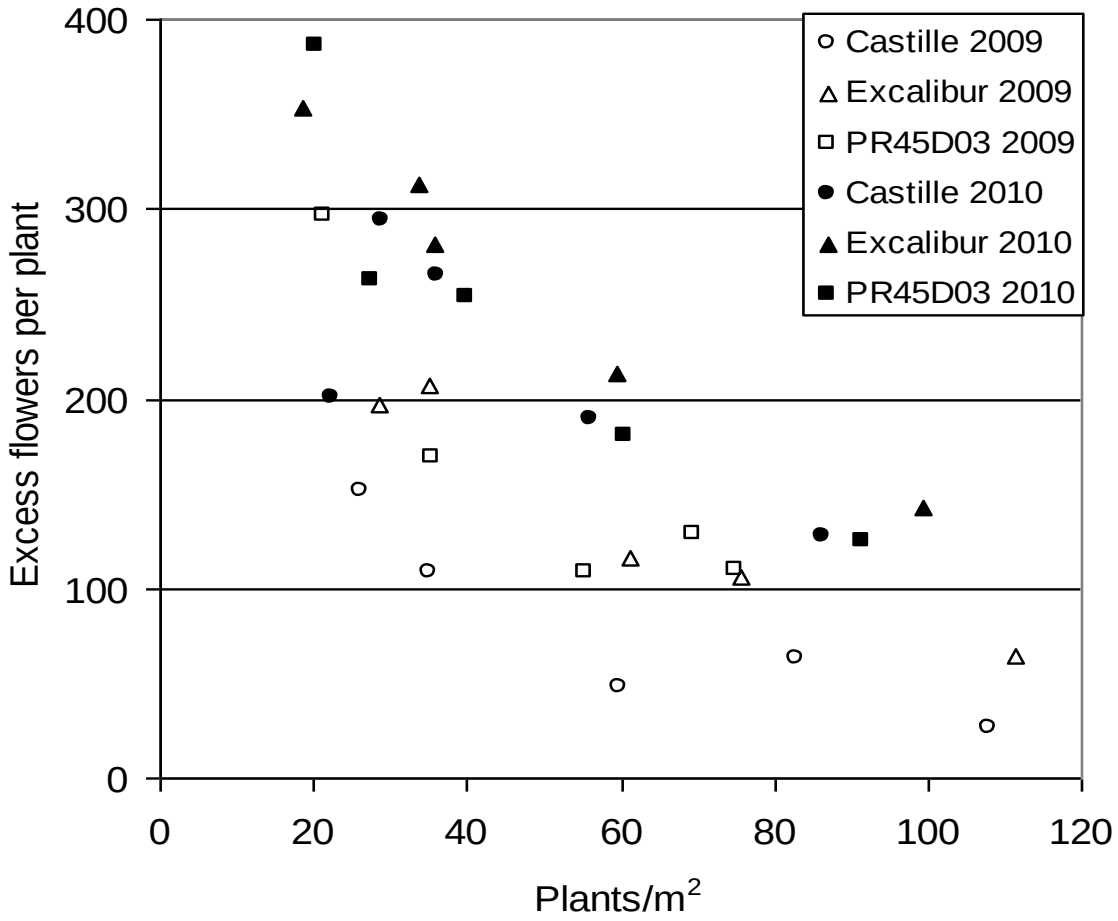
Excess flower number is inversely related to plant number



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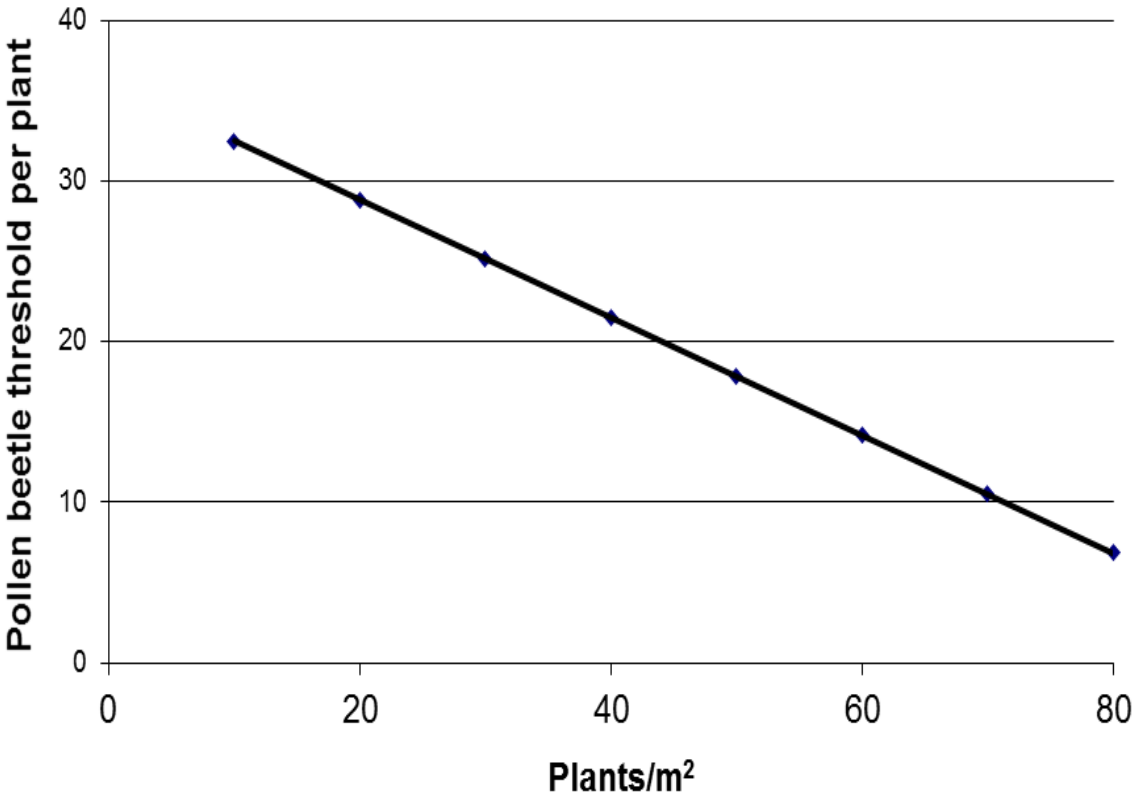
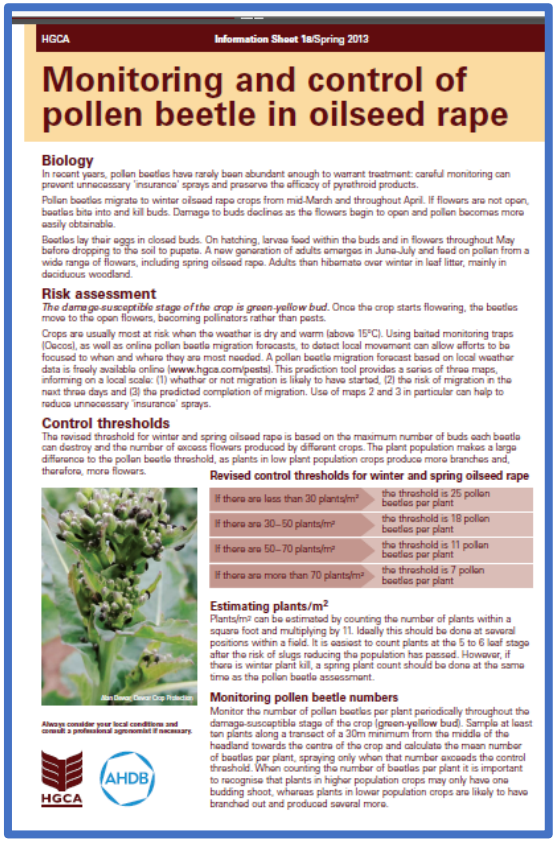
Pollen beetle threshold varies with plant number





HGCA Information Sheet 1a/Spring 2013

Monitoring and control of pollen beetle in oilseed rape

Biology

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.

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

Beetles lay their eggs in closed buds. On hatching, larvae feed within the buds and in flowers throughout May before dropping to the soil to pupate. A new generation of adults emerges in June-July and feed on pollen from a wide range of flowers, including spring oilseed rape. Adults then hibernate over winter in leaf litter, mainly in deciduous 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 pollinators rather than pests.

Crops are usually most at risk when the weather is dry and warm (above 15°C). Using baited monitoring traps (Decos), as well as online pollen beetle migration forecasts, to detect local movement can allow efforts to be focused to when and where they are most needed. A pollen beetle migration forecast based on local weather data is freely available online (**www.hgca.com/pests**). This prediction tool provides a series of three maps, informing on a local scale: (1) whether or not migration is likely to have started, (2) the risk of migration in the next three days and (3) 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 beetle can destroy and the number of excess flowers produced by different crops. The plant population makes a large difference to the pollen beetle threshold, as plants in low plant population crops produce more branches and, therefore, more flowers.

Revised control thresholds for winter and spring oilseed rape

If there are less than 30 plants/m²	the threshold is 25 pollen beetles per plant
If there are 30–50 plants/m²	the threshold is 18 pollen beetles per plant
If there are 50–70 plants/m²	the threshold is 11 pollen beetles per plant
If there are more than 70 plants/m²	the threshold is 7 pollen beetles per plant

Always consider your local conditions and consult a professional agronomist if necessary.

Estimating plants/m²

Plants/m² can be estimated by counting the number of plants within a square foot and multiplying by 11. Ideally this should be done at several positions within a field. It is easiest to count plants at the 5 to 6 leaf stage after the risk of slugs reducing the population has passed. However, if there is winter plant kill, a spring plant count should be done at the same time as the pollen beetle assessment.

Monitoring pollen beetle numbers

Monitor the number of pollen beetles per plant periodically throughout the damage-susceptible stage of the crop (green-yellow bud). Sample at least ten plants along a transect of a 30m minimum from the middle of the headland towards the centre of the crop and calculate the mean number of beetles per plant, spraying only when that number exceeds the control threshold. When counting the number of beetles per plant it is important to recognise that plants in higher population crops may only have one budding shoot, whereas plants in lower population crops are likely to have branched out and produced several more.

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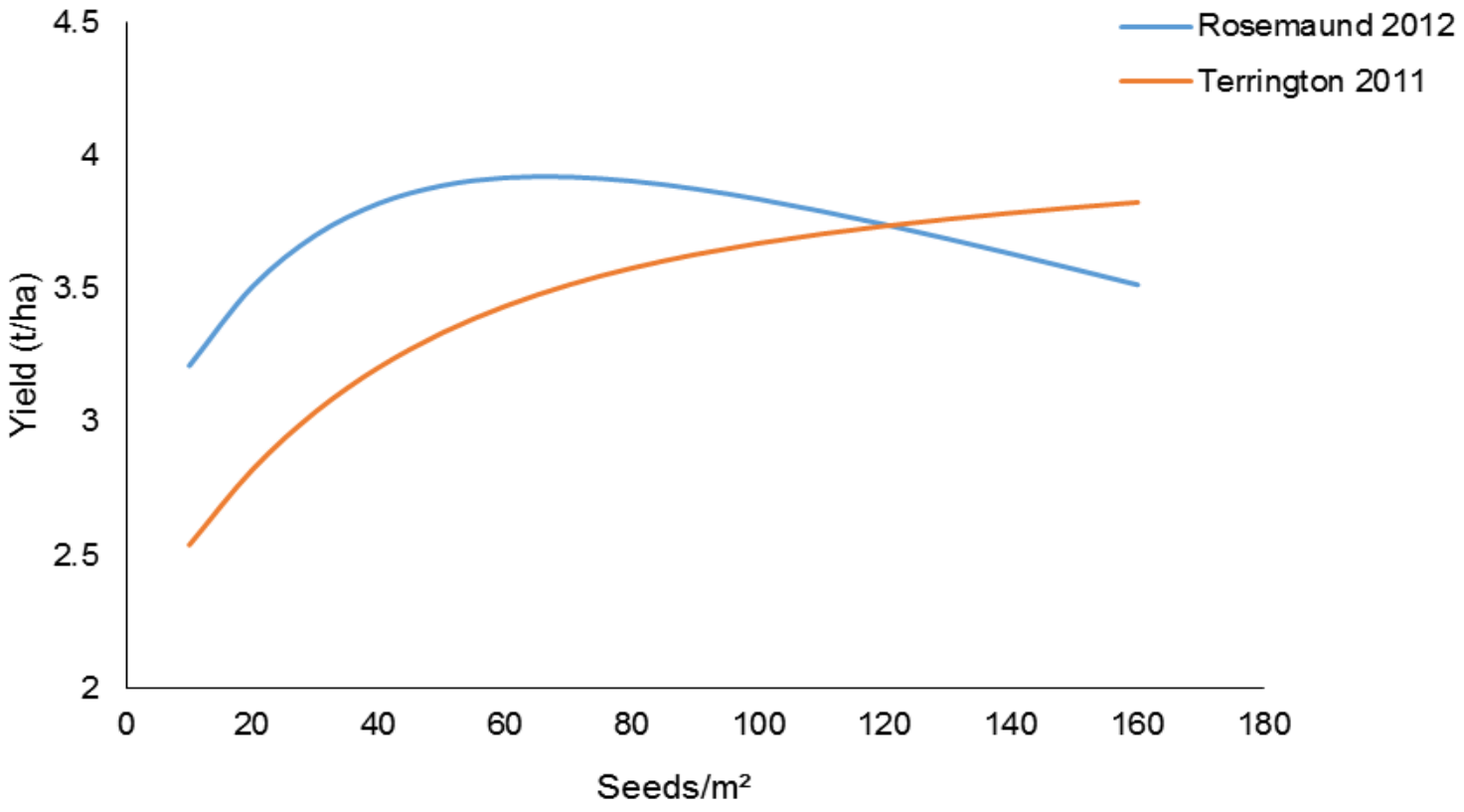
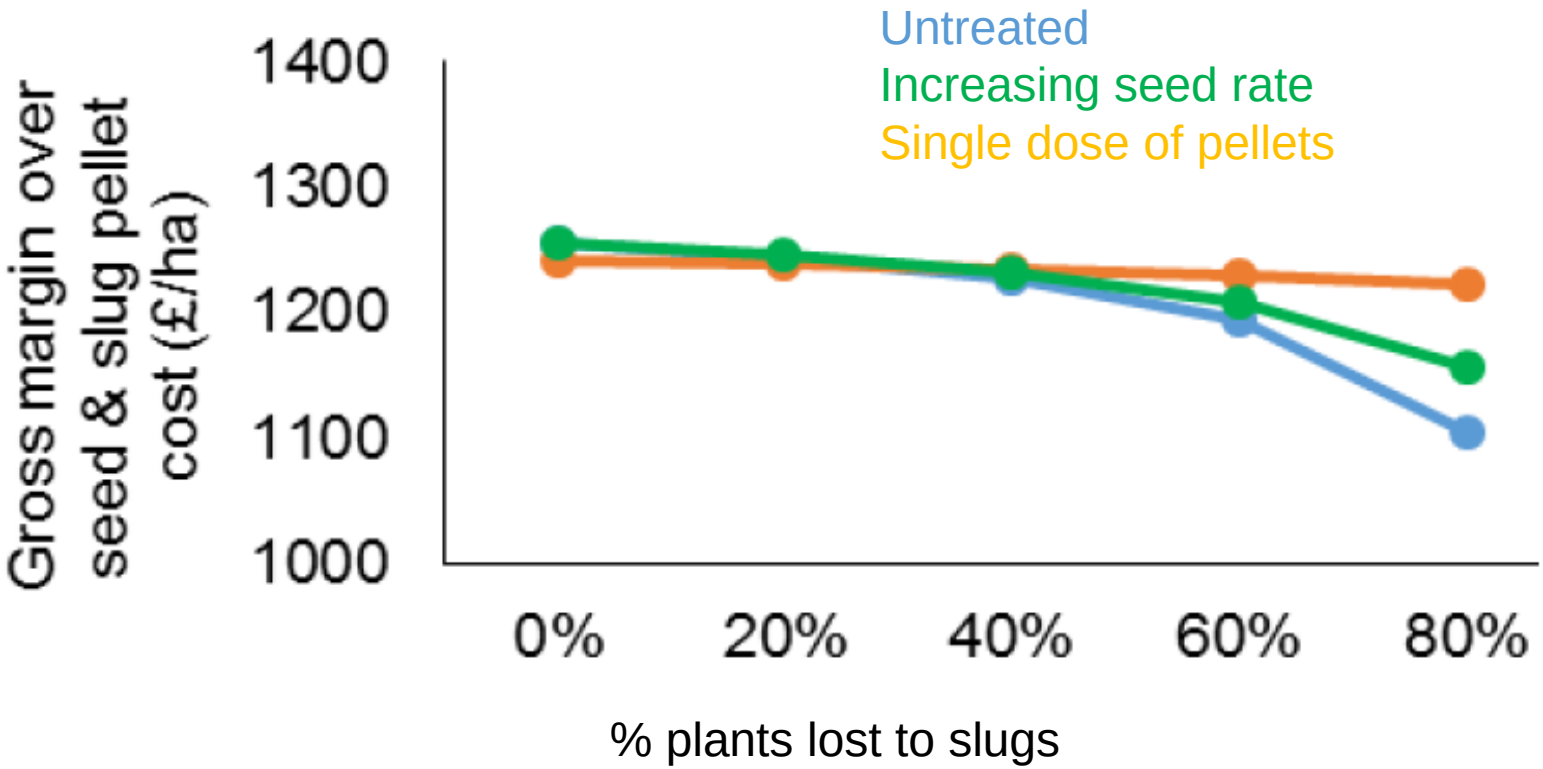
Seed rate experiments



Should I increase seed rate or apply slug pellets in OSR?



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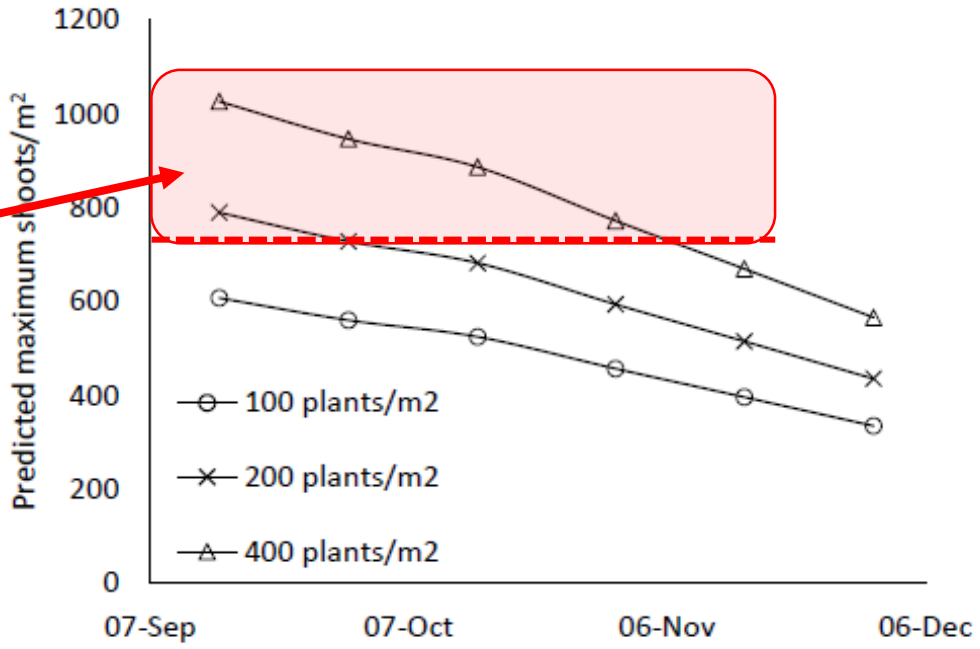
Preliminary wheat bulb fly threshold scheme

Egg count (million per ha)	Minimum shoot number/m²
1.25	720
2.50	940
5.00	1380
7.50	1820



AHDB Project Report No. 598

Crop management guidelines for minimising wheat yield losses from wheat bulb fly. Storer, Ellis & Berry 2018

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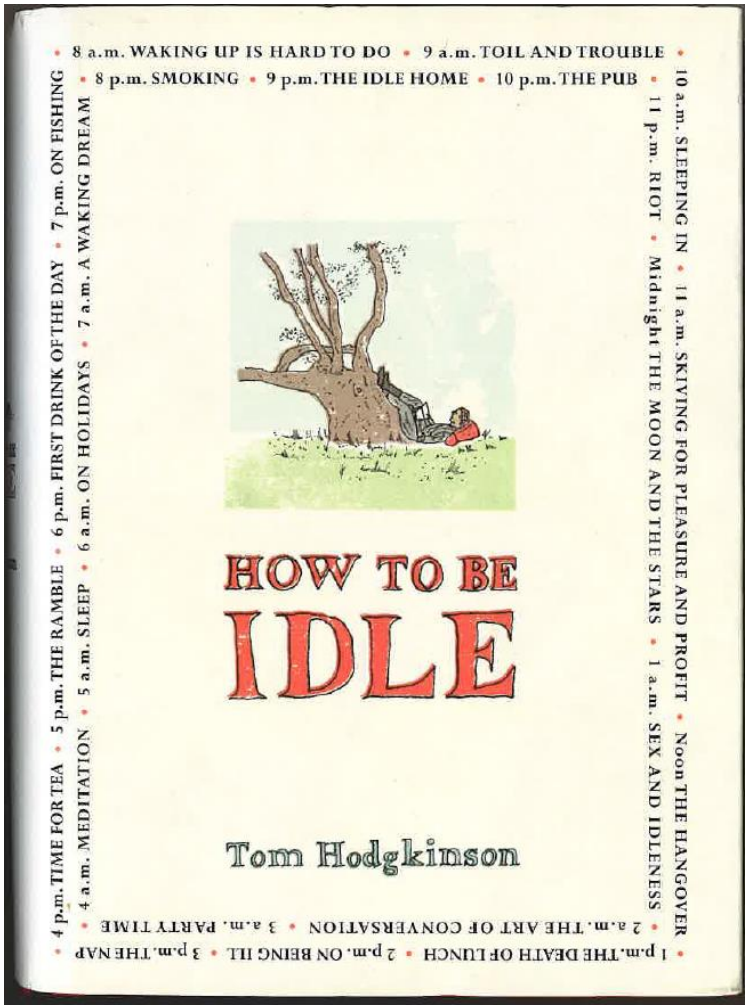
How will thresholds evolve?

- User friendly
- Inexpensive to use
- Based on sound science
- Take account of crop tolerance
- Combine pests in feeding groups
- Incorporate models of pest development
- Incorporate remote sensing of crop



There's a revolution brewing, and the great thing is that to join it all you have to do is absolutely nothing.'

Tom Hodgkinson, 2004

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Thank you