AgriSearch NI
Driving Excellence & Innovation

afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

cafre
College of Agriculture, Food & Rural Enterprise

Leatherjackets in Grassland - The Challenge 10th March at 8pm

rural Development Programme

Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

The European Agricultural Fund for Rural Development: Europe investing in rural areas

Leatherjacket Mitigation Strategies EIP Project

European Innovation Partnership (EIP)

- Designed to bring farmers, researchers and advisors together to help NI farmers innovate and address specific opportunities and challenges
- Jointly funded by the European Agricultural Fund for Rural Development and DAERA
- Projects started November 2020, end June 2023

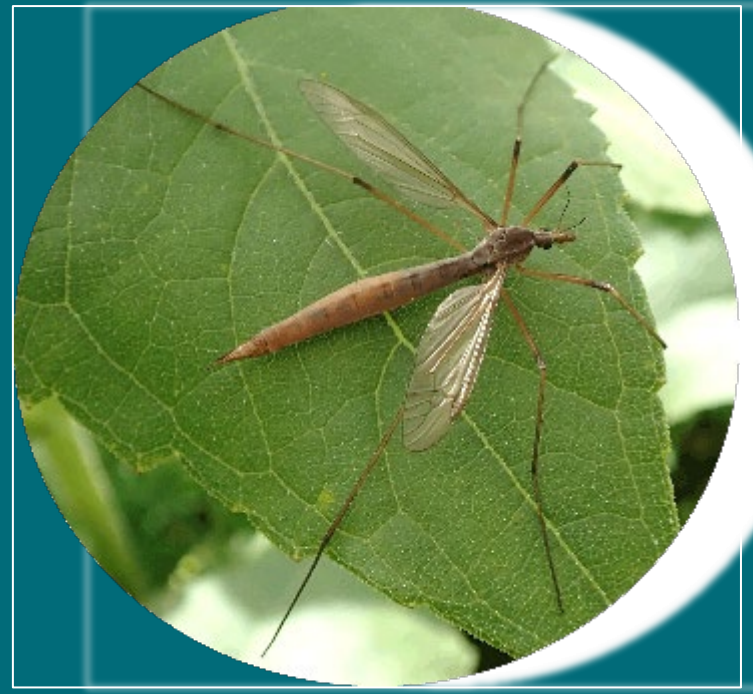
Leatherjacket Mitigation Strategies EIP Project

- Fermanagh Focus
- Prevent avoidable loss of invaluable grazing resources
- Determine factors that influence leatherjacket prevalence and suggest alternative mitigation strategies

Group Members:

- AgriSearch (Lead Partner)
- AFBI – Archie Murchie
- AFBI – Stephen Jess
- AFBI – Francis Lively
- Albert Foster
- Ian Brown
- Geoffrey Read
- John Egerton
- CAFRE Support – Francis Breen

Leatherjackets introduction & project findings – challenges posed



An EIP-Agri Project

Leatherjacket Mitigation Strategies Group

AgriSearch NI
Driving Excellence & Innovation

afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

rural Development Programme

The European Agricultural Fund for Rural Development: Europe investing in rural areas

The European Innovation Partnership (EIP) Scheme is jointly funded by the European Agricultural Fund for Rural Development (EAFRD) and the Department of Agriculture, Environment and Rural Affairs (DAERA)

Species of concern

Tipula paludosa

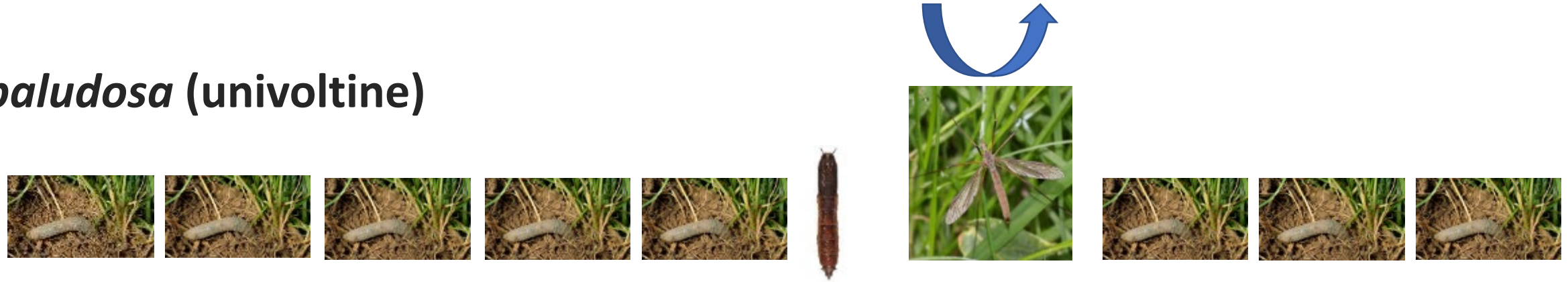
- Generally, most common
- Widely distributed

Tipula oleracea

- Relatively uncommon
- More frequent in western counties of Northern Ireland

Life-cycle (*T. paludosa and T. oleracea*)

T. paludosa (univoltine)



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

T. oleracea (bivoltine)

Leatherjacket damage to grassland

Re-seeds and permanent grassland affected

Populations of > 0.5 M/ha may cause measurable yield loss

Average NI losses 0.5t DM/ha

Beef farm - £109/ha/year

Dairy farm - £220/ha/year

Previous control measures

Chlorpyrifos – EC approval withdrawn in 2016

- Primarily safety to operator
- Broad spectrum – non-target organisms

Alternative control measures

Re-seeding

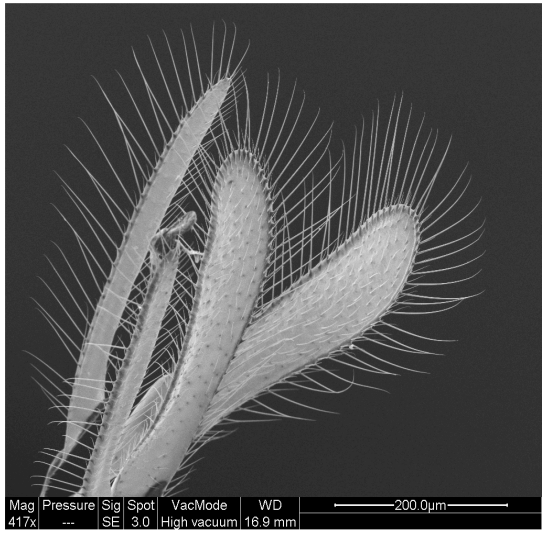
- 10% grassland annually
- PRG and clover
- pH 6.0-6.3
- Recommended list
- High DM yield varieties
- NPK
- Early cultivation - plough July
- Consider Spring re-seed

Biological control - natural

Predation by birds, e.g. rooks and starlings

***Tipula* Iridescent Virus**

Parasitoid wasps



Anaphes sp., was found to have attacked 44% of tipulid eggs examined in Northern Ireland (Blackshaw unpublished data)

Objectives

1. Determine the number and species of leatherjacket present within the study areas
2. Assess impact of leatherjackets within the study areas
3. Assess the correlation between influencing factors and leatherjacket prevalence – with an emphasis on grazing strategies
4. Learn from farmers' experience to identify feasible and practical mitigation strategies

6. Dissemination

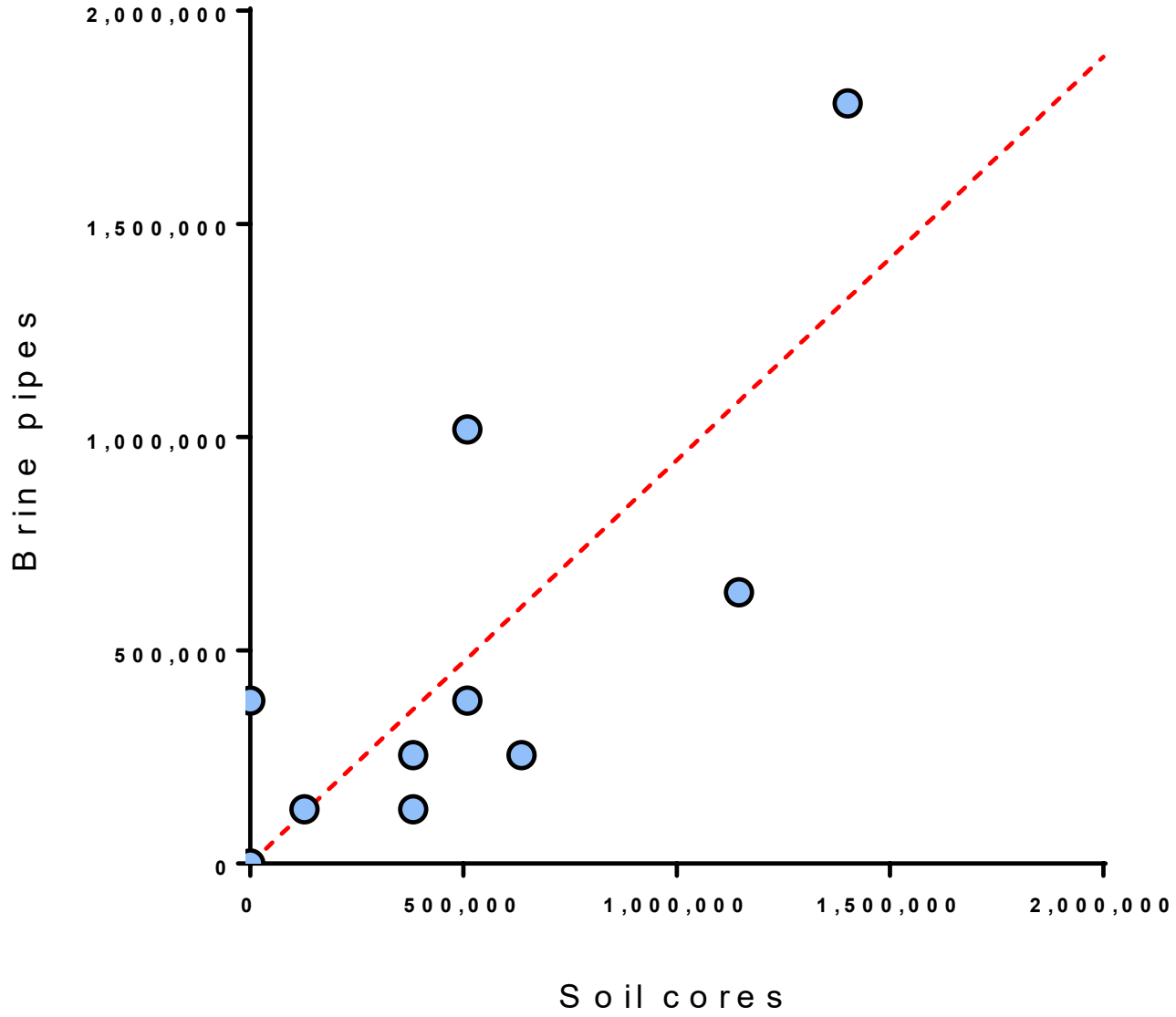
Sampling – soil cores

- 5 fields selected randomly per farm (4 farms)
- 10 cm diameter soil cores
- 10 cores per field
- 20 fields, 200 cores
- Sampled in March

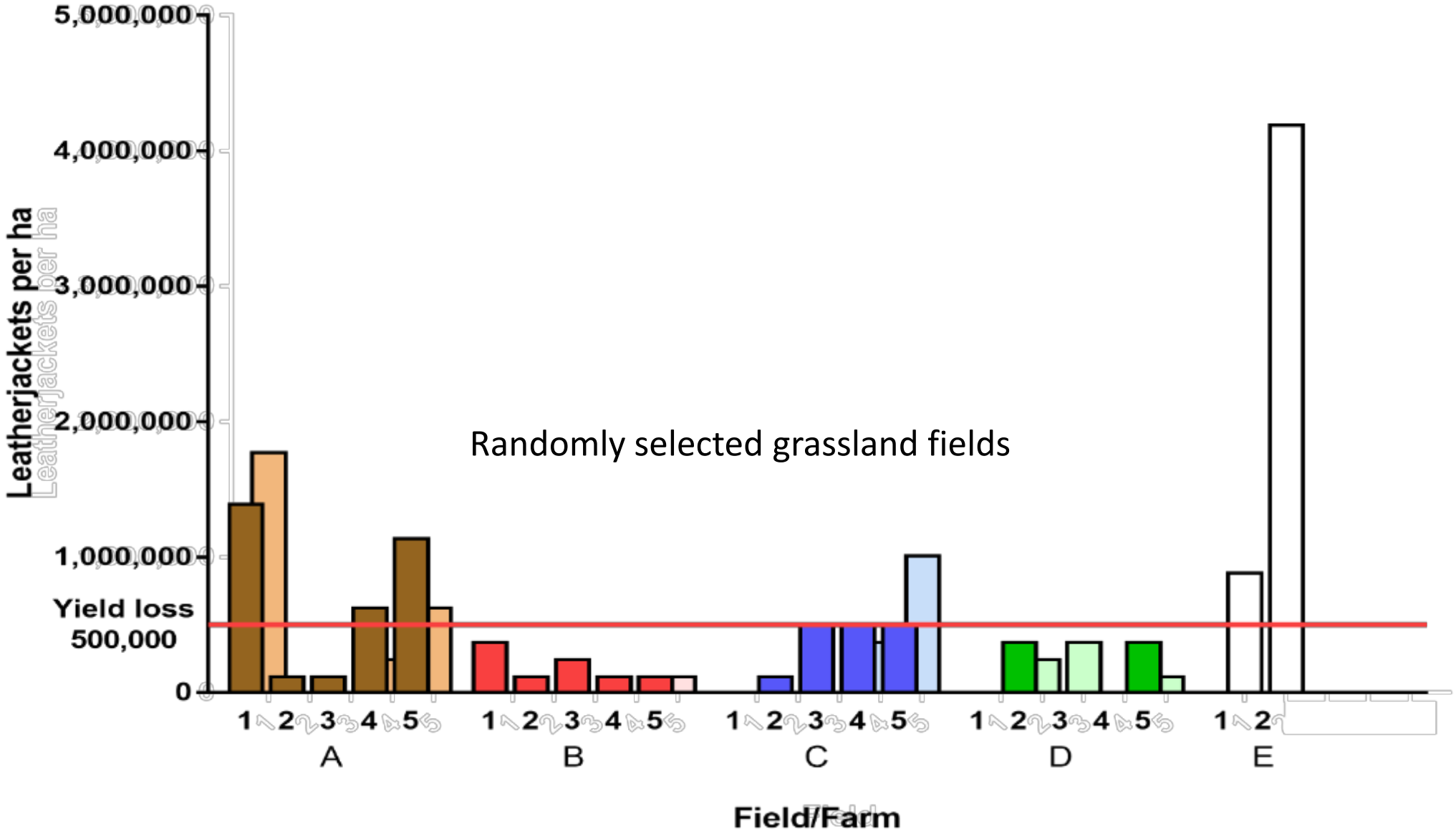
Extraction

Sampling – Brine pipes

Results – soil cores vs brine pipes



Results – cores & brine pipes



Results – adjacent fields

4.2 million

0.89 million

Treated with Agritox (MCPA) for rush control

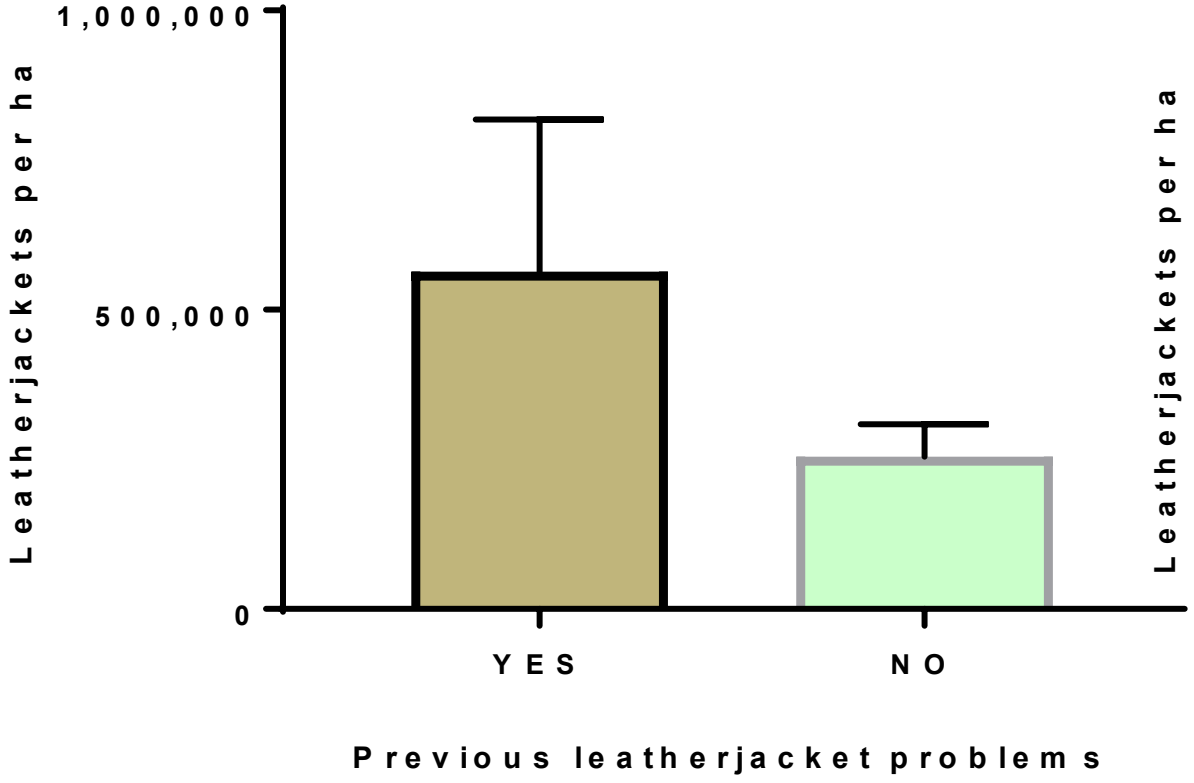
Influencing factors - fields

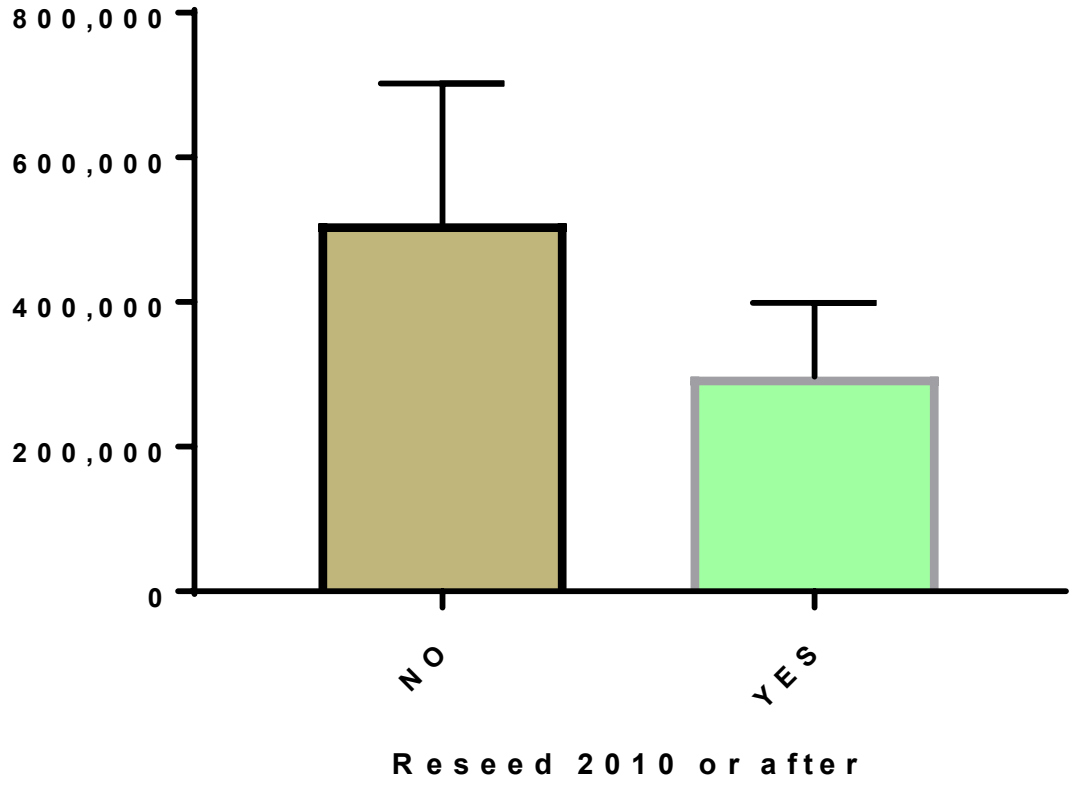
McCracken *et al.* (1995) studied the effects of field characteristics in south-west Scotland to leatherjacket density.

- East-facing pasture;
- Tendency for waterlogging;
- Proximity to the sea;
- Leatherjacket numbers from the previous year;
- One cut of silage (compared to none or more than one cut);
- Application of slurry;
- **High grass height at the time of sampling (Nov-Jan).**

McCracken D. I., Foster G. N., Kelly A. (1995) Factors affecting the size of leatherjacket (Diptera: Tipulidae) populations in pastures in the west of Scotland. *Applied Soil Ecology,* **2**, 203-213.

Indicators?


1,000,000
500,000
0
Leatherjackets per ha
YES
NO
Previous leatherjacket problems


800,000
600,000
400,000
200,000
0
Leatherjackets per ha
NO
YES
Reseed 2010 or after

Challenges (Grazing)

Why do some fields suffer more damage than others?

- Microclimate*
- Soil moisture*
- Annual fluctuations - density-dependence population regulation*

(*R. Blackshaw pers comm.)

- **Management**

How can we mitigate leatherjacket damage?

- Intervention approach (spray and treat)

- Multi-season management approach

What does best practice look like?


Thank you

John Egerton – Rosslea, Fermanagh

- Family Farm
- 72 ha
- Beef Enterprise
  - Suckler to Beef
  - Contract Rearing
- Sheep Enterprise
- Grassland focused

A Range of Population Sizes

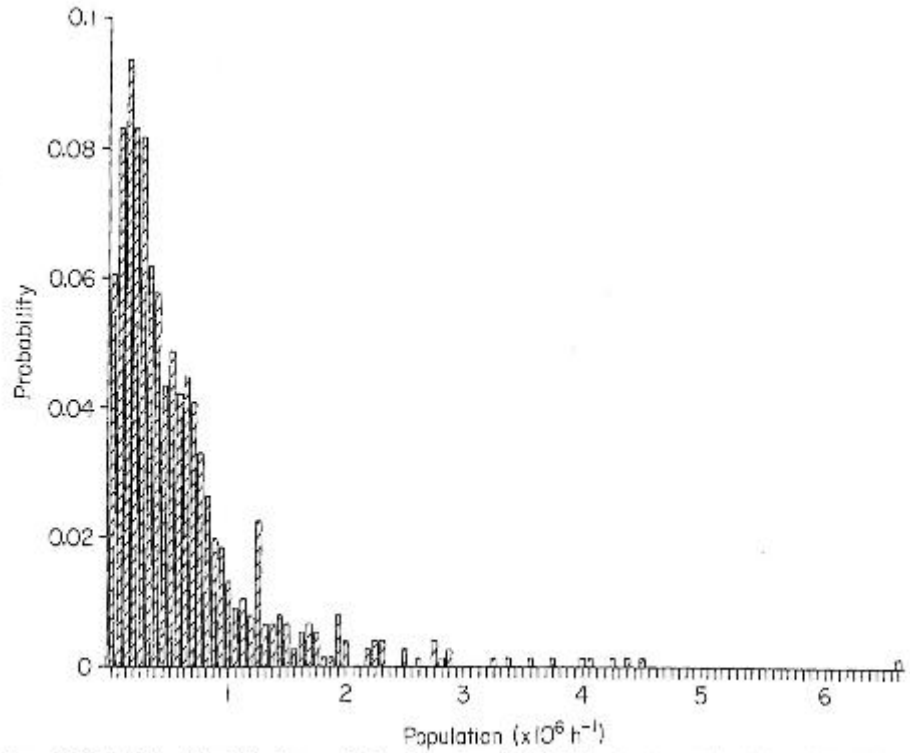


Figure 5. Probability of leatherjacket population classes from 759 fields in Northern Ireland from 1971–1987.

Spatial Differences

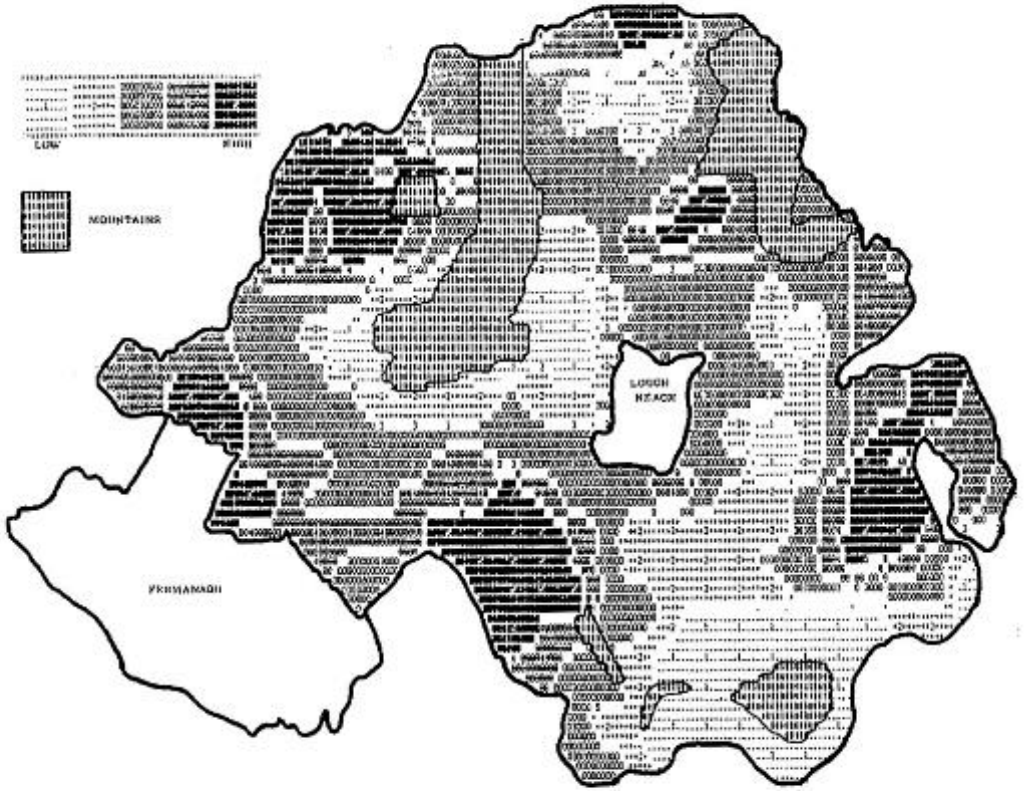


Fig. 1. Distribution of leatherjacket population levels, 1969–1986, in managed grassland.

A Predictive Model

Table 1. *Climate-based multiple-regression model of mean annual leatherjacket numbers ($\times 10^3$ ha^{-1}) in Northern Ireland for the year 1970–1984 (after Blackshaw, 1990)*

Variable	Regression coefficient	*t*-value
Constant	−3780.1	−3.07
March rainfall (mm)	3.30	2.30
July rainfall (mm)	−3.17	−2.90
Winter rainfall* (mm)	−2.49	−3.93
February chill†	1.78	2.56
October temperature (°C)	−46.16	−3.70
December humidity	53.13	4.45

* Winter rainfall = November + December rainfall.
† Chill factor = ((Wind speed × humidity × 35) × air temperature).

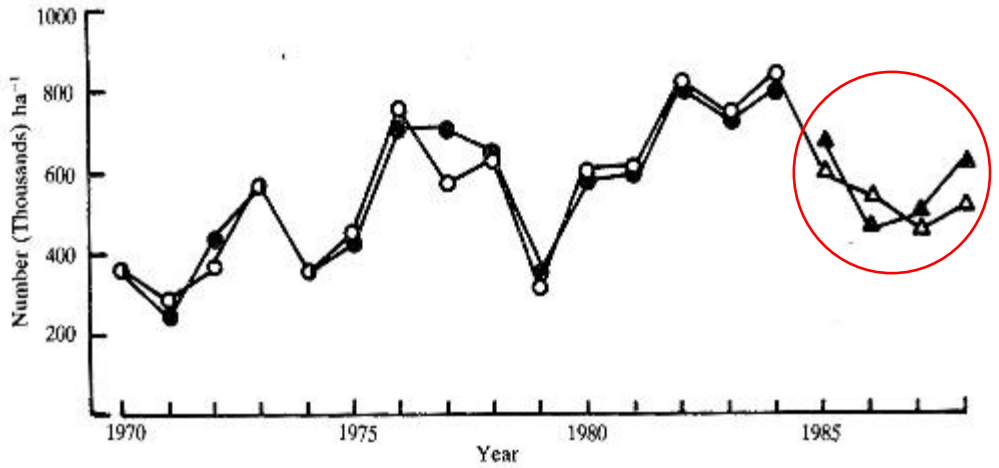


Fig. 1. Observed mean annual population density of leatherjackets from 1970–1984 (○) and from 1985–1988 (△), compared with the expected density after fitting Blackshaw's (1990) climate model for 1970–1984 (●), and predictions based on this model for 1985–1988 (▲). A density of 63.5 thousand ha^{-1} is equivalent to one individual per sample unit of twenty soil cores.

Model Extended to Predict Field Population Sizes

Can Predict High/Low Risk Years (for Spring Barley)

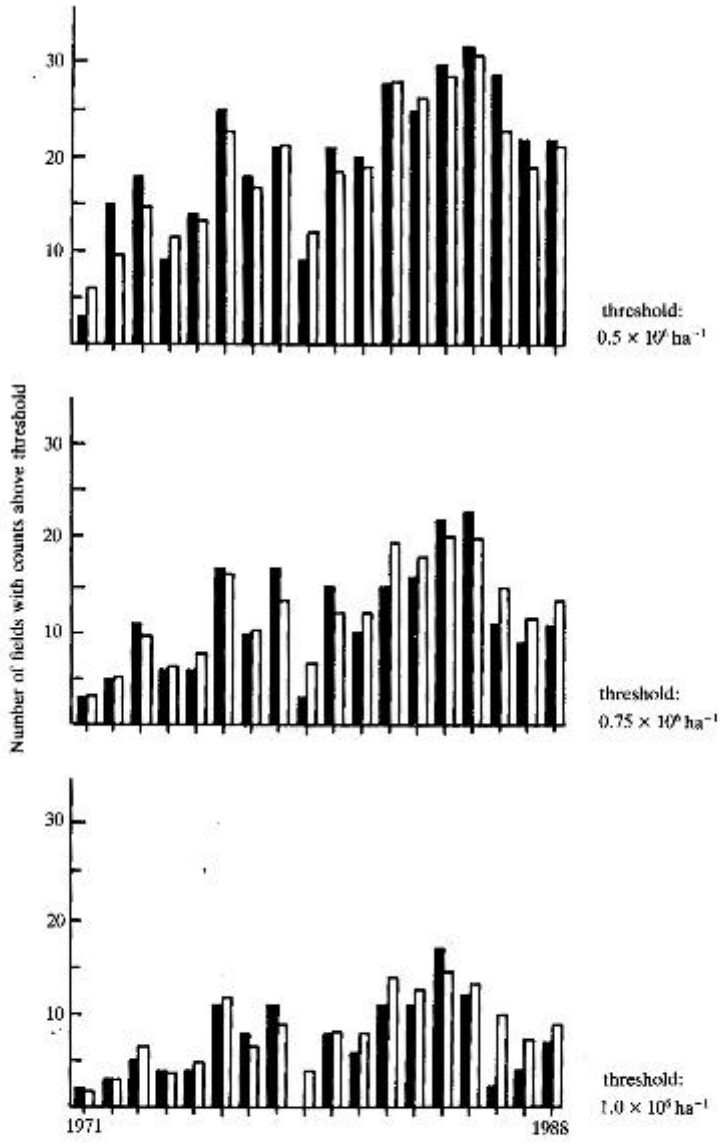


Fig. 2. Observed annual numbers of fields with counts per sample greater than specified threshold values (solid bars), compared with the expected frequency of fields after fitting a family of Adès distributions (open bars) to the data for years 1971–1988. Thresholds are eight per sample (top, equivalent to 0.5×10^6 ha^{-1}); 12 per sample (centre, 0.75×10^6 ha^{-1}); sixteen per sample (foot, 1.0×10^6 ha^{-1}).

What About Grassland?

Earlier Control
Gives Better
Yield
Responses

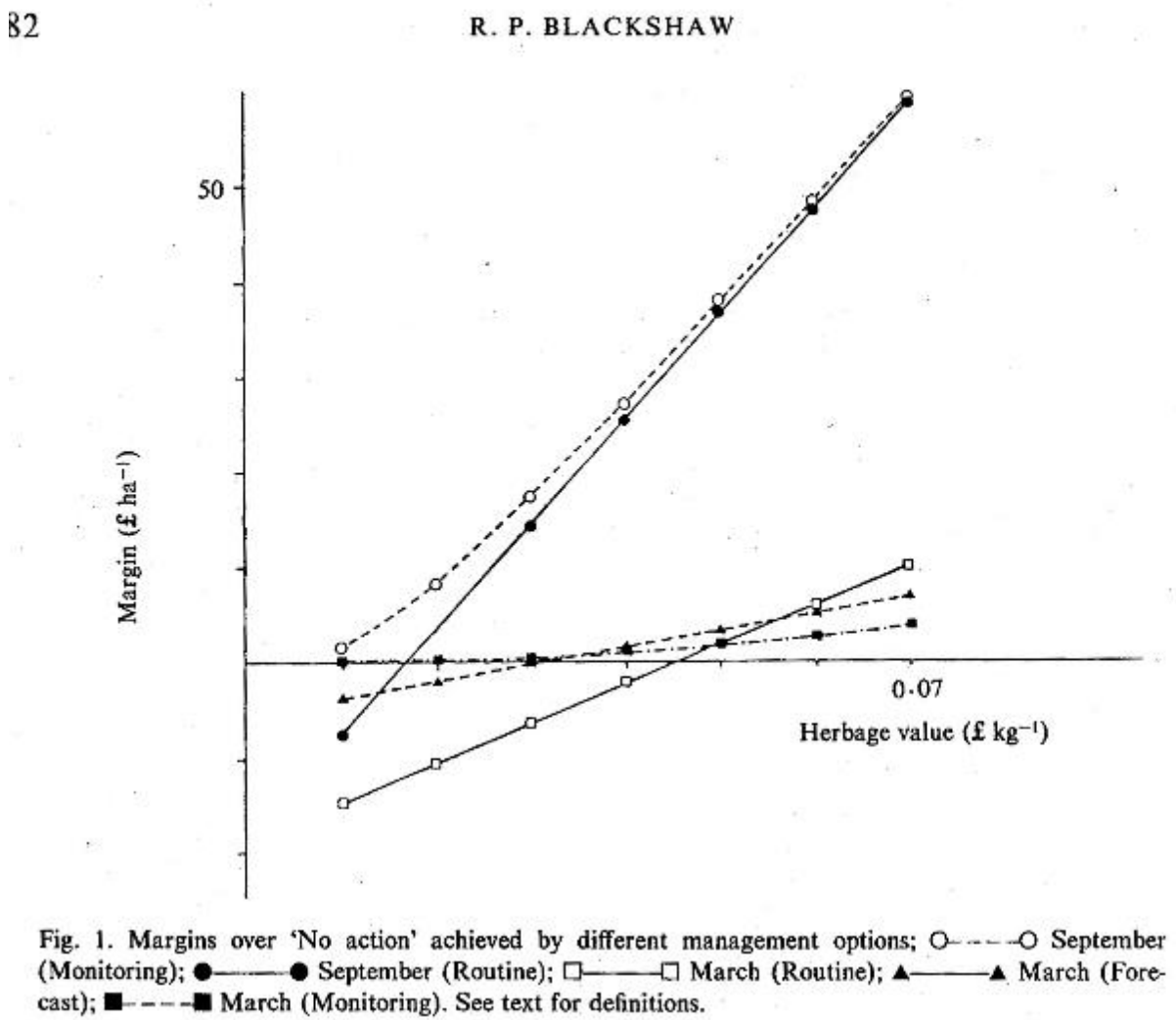


Fig. 1. Margins over 'No action' achieved by different management options; O- - - -O September (Monitoring); ●——● September (Routine); □——□ March (Routine); ▲——▲ March (Forecast); ■- - - -■ March (Monitoring). See text for definitions.

Sequential Sampling for DIY Monitoring?

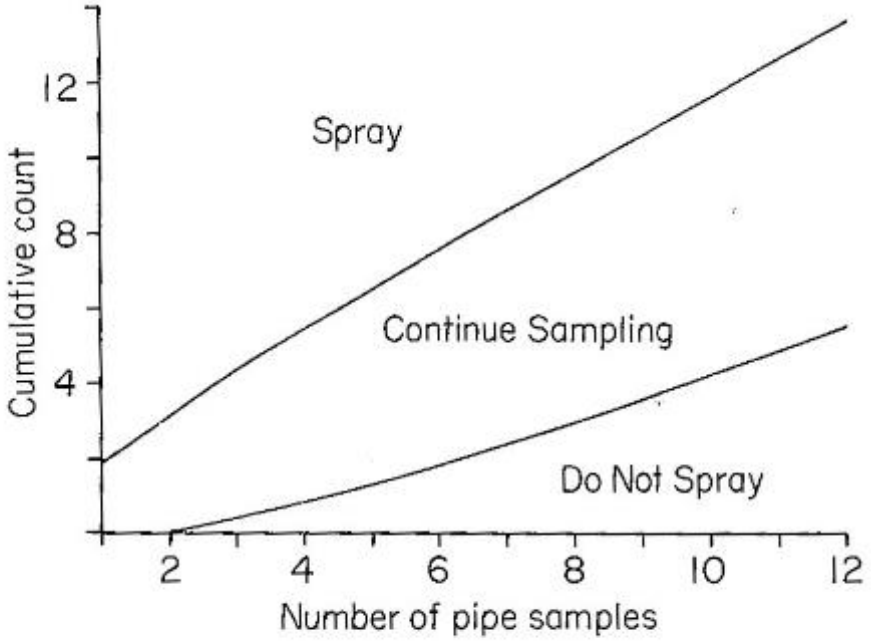


Figure 2. Acceptance curves for a sequential sampling plan for leatherjackets in grassland.

Timing of leatherjacket instars R. P. Blackshaw and J. P. Moore

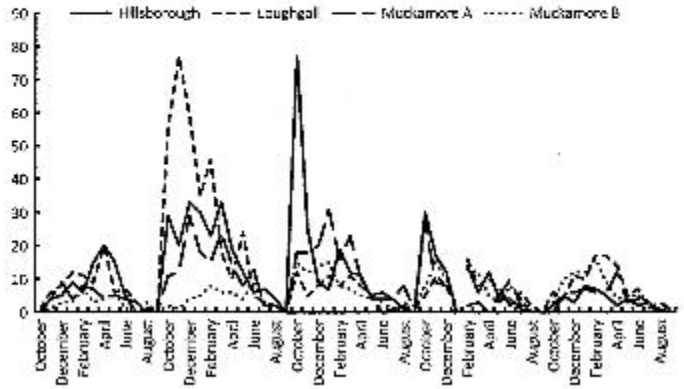


Fig. 1 Monthly counts of leatherjackets from four fields in Northern Ireland over 5 years. Data series starts in October 1981 and finishes in September 1986.

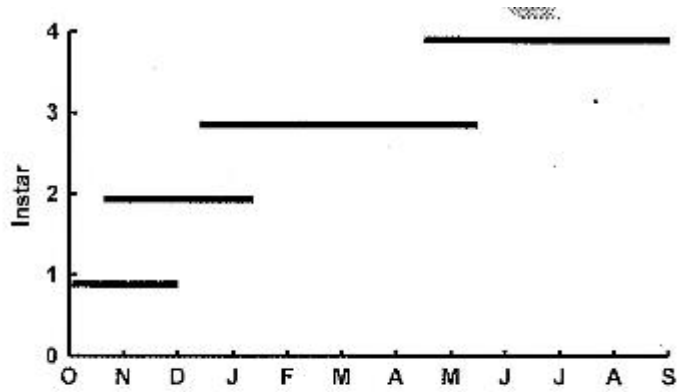


Fig. 3 Timings and duration of leatherjacket instars estimated from data in table 2.

What is the best time to count the beasties?

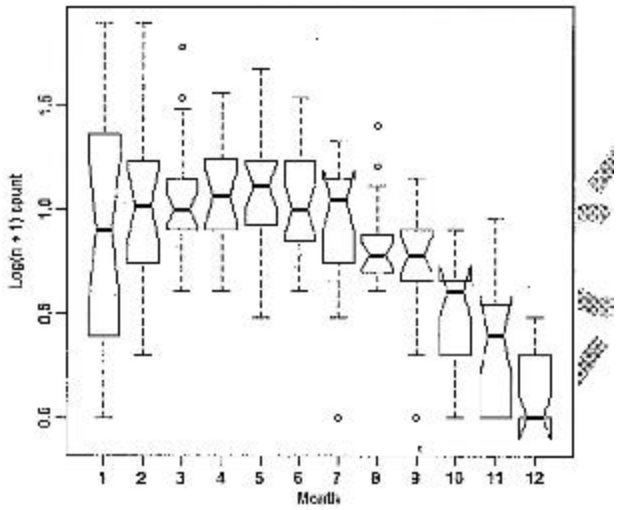


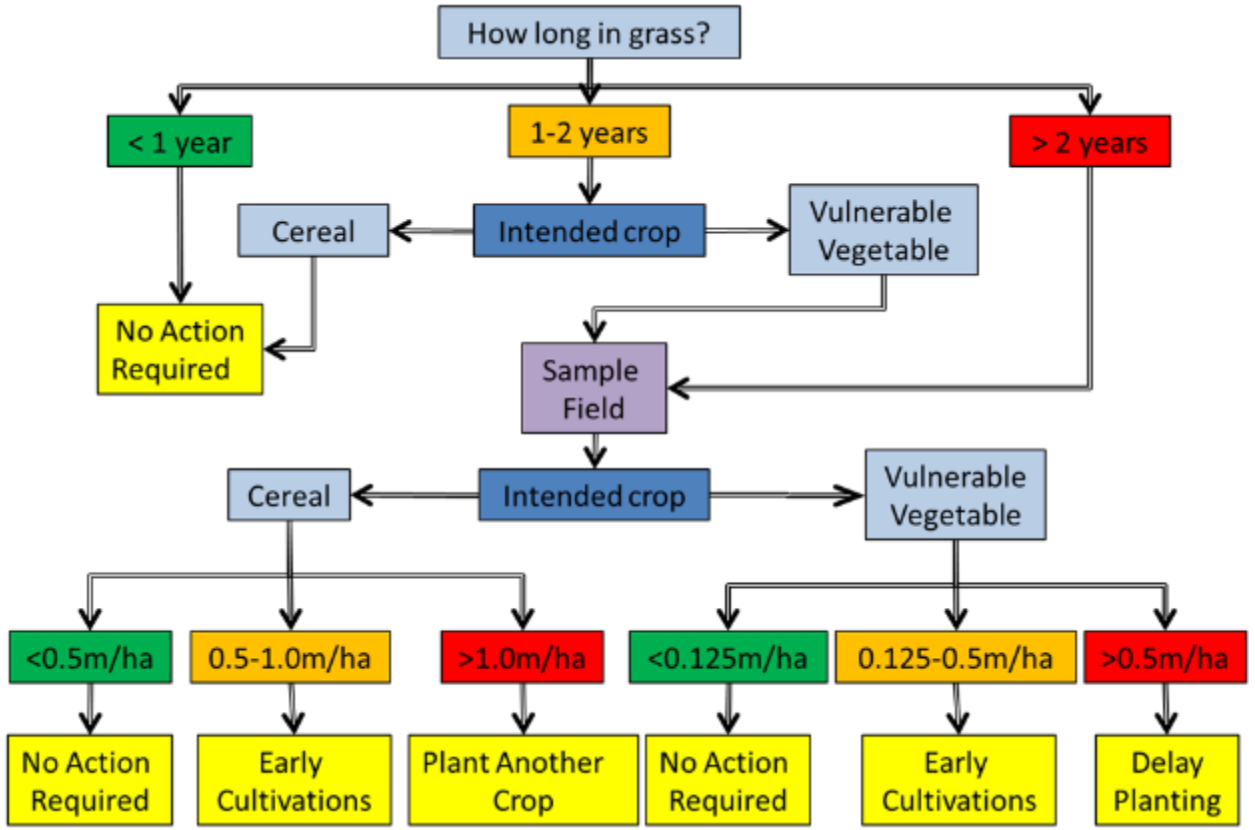
Fig. 2 Distribution of counts by month across four fields and five generations. Indentations indicate 95% confidence intervals. Calendar months follow in order from October which is designated 1 to September, designated 12.

Rod Blackshaw

Summary

- It is possible to predict the level of risk using models based upon weather
- We don’t know if these models will work in Fermanagh and are they timely enough?
- Knowing the risk does not tell you where your problems are
- For best response to insecticides, the earlier the better
- Simple DIY field monitoring methods exist and effort can be further reduced BUT not accurate before November
- (My View) Need to consider a multi-year management approach rather than a control decision.

Decision tree for managing leatherjackets in organic rotations



Rod Blackshaw

Tipula sp. – an agricultural pest.

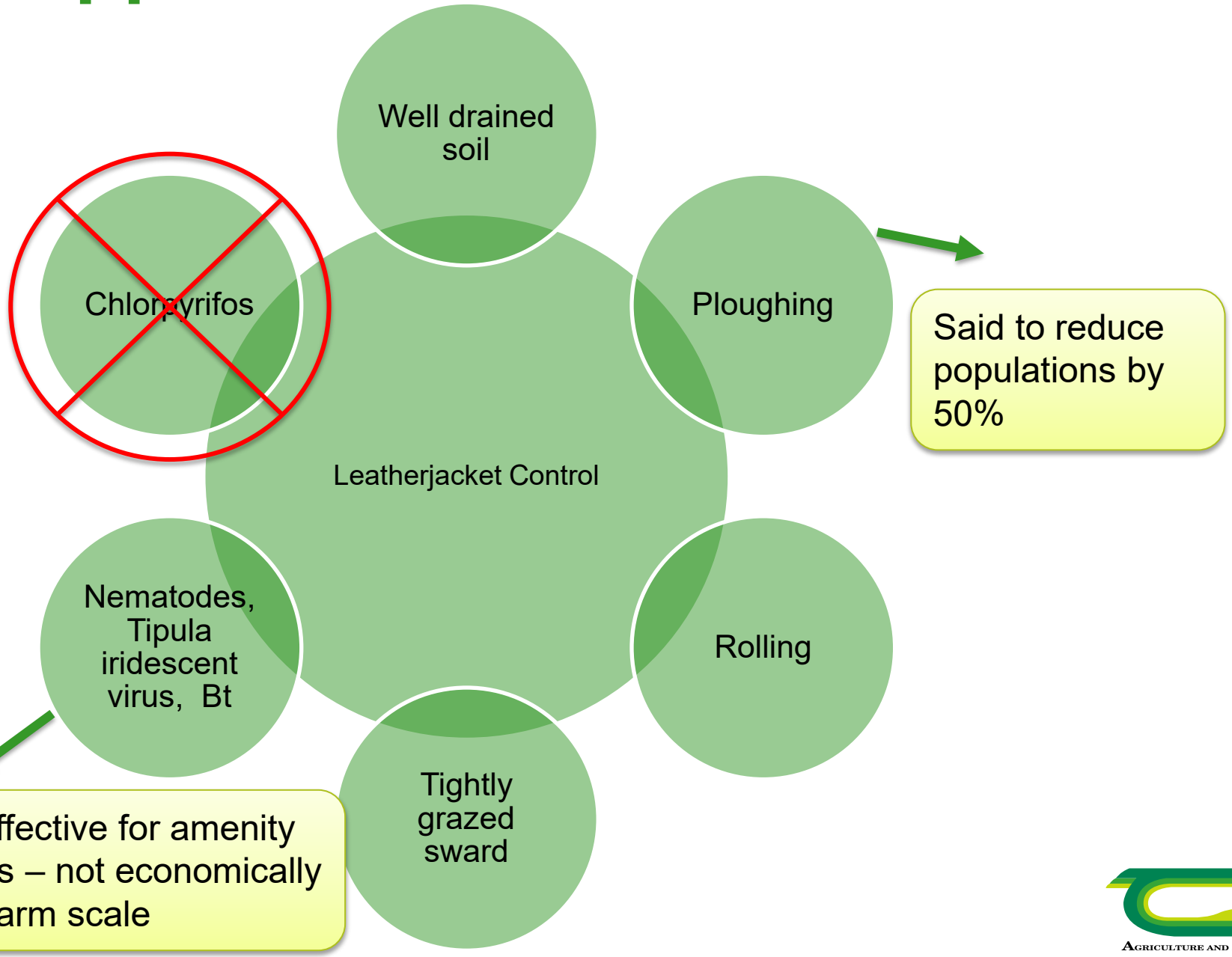
Aisling Moffat

THE UNIVERSITY OF EDINBURGH

teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

SRUC

IPM Approaches for larvae



Agriculture and Food Development Authority

Leatherjackets in Ireland

The Challenges

No survey conducted in the Republic

Need to know – species of agronomic importance for any IPM practices

Research aims:

1. National Survey
2. Species level
3. Soil factors
4. General management advice

Leatherjacket Survey – ROI
Aims 1 & 2

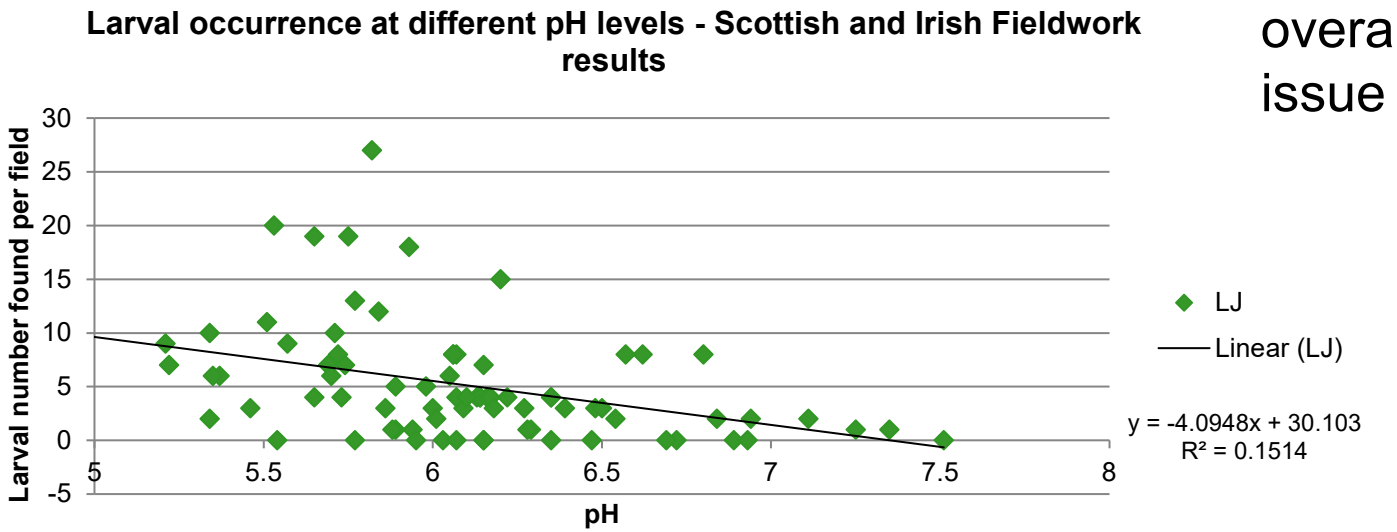
- National Survey – species of agronomic importance –
  - 136 fields sampled
  - >75% *Tipula paludosa*
- Main issues seen in permanent pasture. Build up of populations overtime
- Grasslands above thresholds:
  - Ireland: 17%
  - Scotland: 53%

Soil Factors of importance

Aim 3

Positive Correlation	Negative Correlation	No Correlation
K	Mg	Al
Fe	P	Ca
Zn	pH	C
	Mn	Mo
		N
		Na
		S
		Om

- Initial results indicate that pH, Mg and P are significantly correlated to leatherjacket populations.
- Higher larval populations in acidic soils.
- Could highlight an overall management issue



Agriculture and Food Development Authority

Grassland Management Advice
Aim 4

1. Microbiome samples – will provide the bacterial and fungal communities present per field.
   - Relate to leatherjacket populations
   - Any potential for bio control options
2. Controlled larval feeding experiment
   - Determine associated yield losses
   - Sward composition advice

Grassland Management Advice

Multi-species Grassland Trial

No Leatherjackets

Perennial Ryegrass

Plantain

Chicory

White clover

Red clover

Multi species

Leatherjackets

Perennial Ryegrass

Plantain

Chicory

White clover

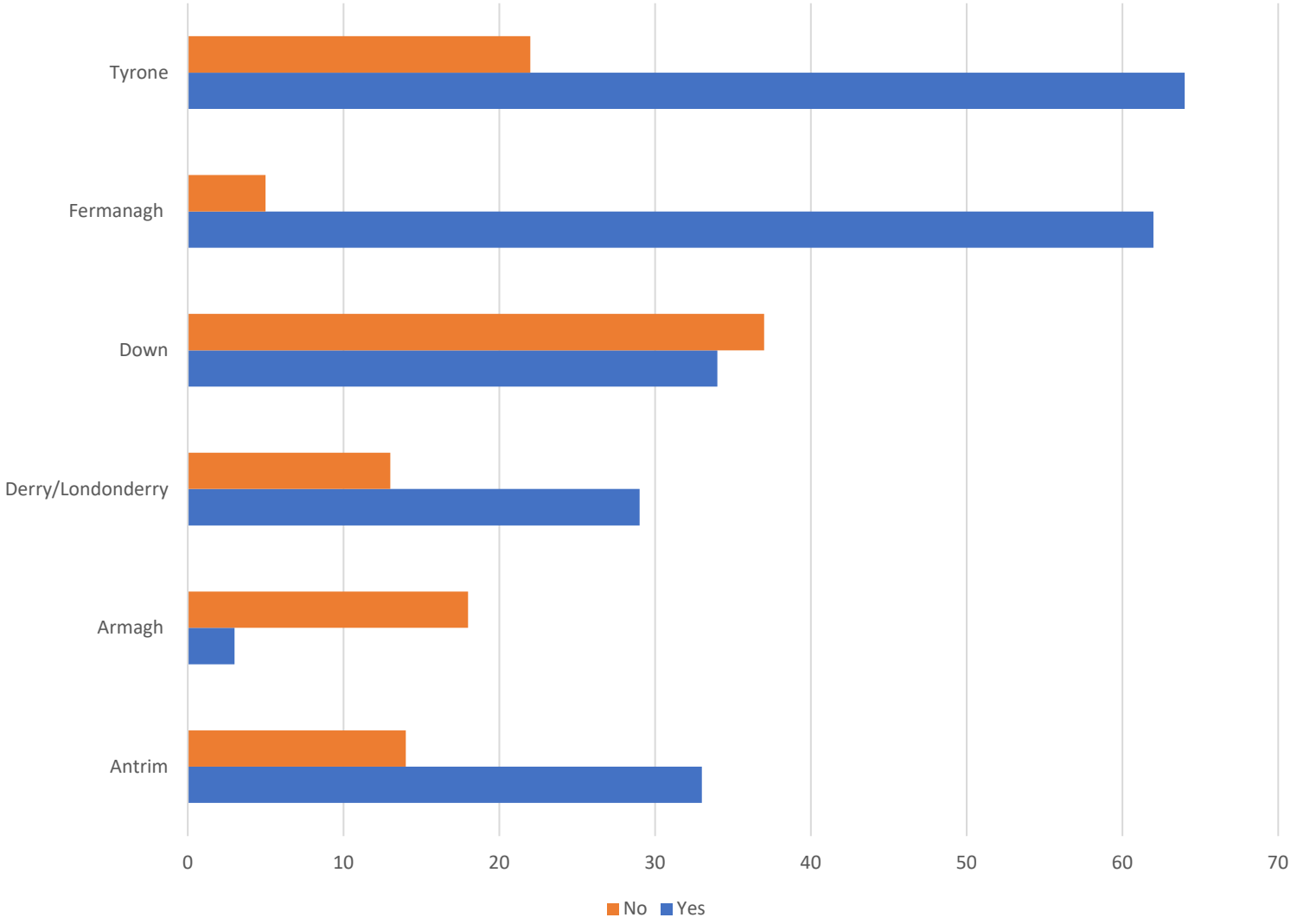
Red clover

Multi species

Conclusions

- Significant yield loss in white clover
- Highest larval populations in plantain, but no significant yield loss
- Multi species – no significant yield loss and feeding increased diversity
- Paired with soil analysis and microbiome work, will add to IPM toolkit for this pest

Northern Ireland Leatherjacket Survey (Online)

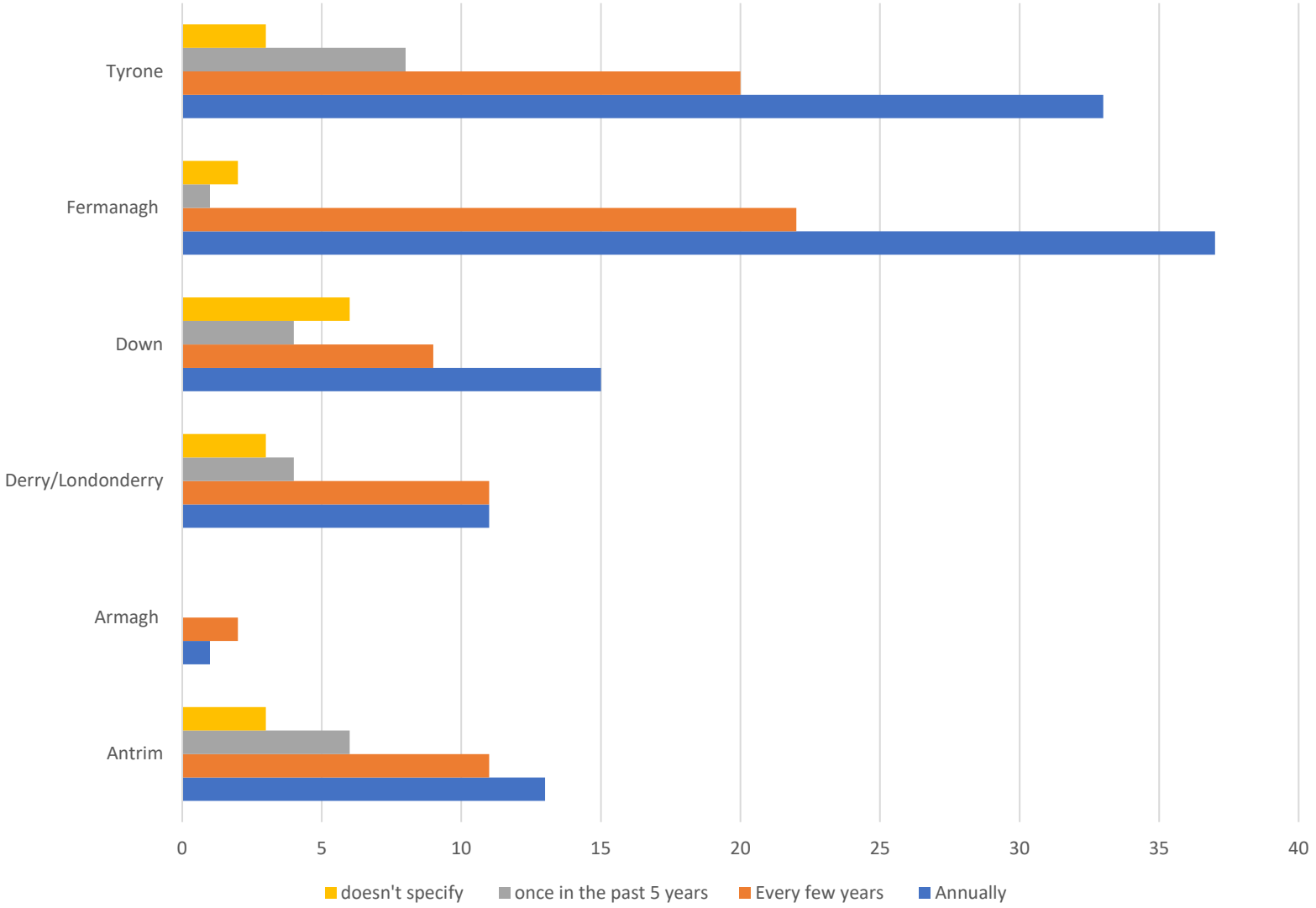


335 Total Respondents

- 226 reported issues with L'jackets
- 109 reported no issues with L'jackets

Percentage Incidence	County
70.21%	Antrim
14.29%	Armagh
69.05%	Derry/Londonderry
47.89%	Down
92.54%	Fermanagh
74.42%	Tyrone

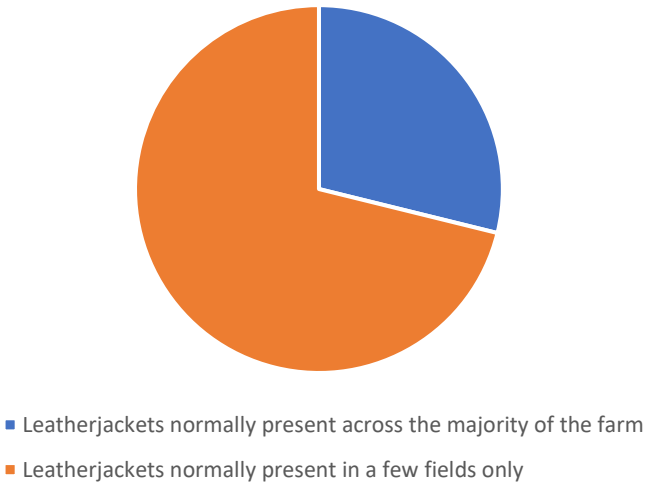
Northern Ireland Leatherjacket Survey (Online)



Of those that reported issues with L'jackets the regularity of an occurrence was variable

Annual	Every few years	County
39.39%	33.33%	Antrim
33.33%	66.67%	Armagh
37.93%	37.93%	Derry/Londonderry
44.12%	26.47%	Down
59.68%	35.48%	Fermanagh
51.56%	31.25%	Tyrone

Northern Ireland Leatherjacket Survey (Online)



- Majority of farms reporting Leatherjacket presence in a few fields only
- Raises the following questions:
  - Why those fields?
  - How did they know Leatherjackets were present?

- How many million per hectare?
- Simple brine sampling method can provide more detailed info on the extent of Leatherjacket presence

How did you know leatherjackets were present in your farm grassland?	Total
Lack of grass/grass dead/dying	97
Dead grass and then dug into soil	42
Visual evidence	33
Craneflies present	12
Issue with reseeds	4
Bird Activity	16
Soil Pits	1
From a Description	1

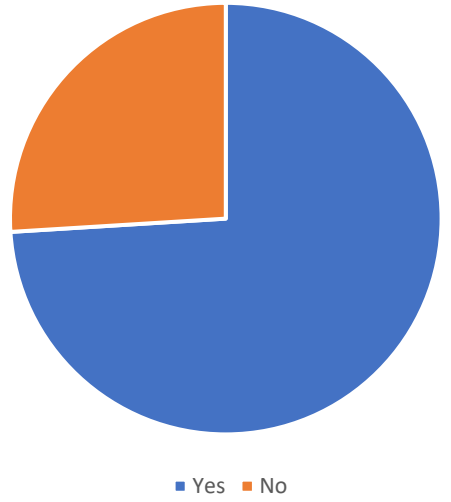
Northern Ireland Leatherjacket Survey (Online)

Do the Affected fields have anything in common	Total
Damp/wet ground	22
Arable/reseeds	24
Nothing common/ mixture of fields	38
Grazing ground	13
Silage ground	7
Meadow	2
Stock move earlier/ heavy grass covers	7
Rough Grazing	7
Heavier land/ heavy clay land	6
Same soil type	4
Older swards	4
No slurry/ fertiliser applied	2
Best ground/ fields in good condition	2
High organic soils	1
Craneflies present in fields the late summer before	1

- Very mixed opinions
- No known commonality – the most popular response
- Wet, heavy ground featured
- Arable/reseeds featured

Did the presence of leatherjackets significantly impact grass growth/grass availability on farm?

- 75% - Yes



Northern Ireland Leatherjacket Survey (Online)

Any actions you have taken to either control the leatherjacket population or reduce the likelihood of leatherjacket infestation	Total
Grassland management	26
Rolling	31
Used spray in past	40
No action	37
reseed/stitch/cultivate/subsoil	10
spread slurry/fertiliser	6
Brassica break crop before reseeding	1
chain harrowing and mushroom compost	1
use dessicants on previous crop stubble	1
improve land drainage	1
encourage bird population	1
sowed lime	1
weed control	1

Again a lot of variability

Most common answer is used spray…

followed by no action – so in absence of spray availability at present there really is a lack of reliable options available

Grassland Management does feature and this is an area the EIP will be looking at in more detail

Discussion

Questions & Answers