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Autumn Survey of wheat bulb fly incidence (2011-13)

by

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This is the autumn 2012 report of a 35 month project (RD-2011-3758) which started in August 2011. The work is funded by a contract for £21,450 from HGCA.

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1. ABSTRACT

All cereals, except oats, can be attacked by wheat bulb fly. Eggs are laid in late summer in bare soil following fallows, set-aside or early-harvested crops such as vining peas, particularly if fields are cultivated between mid-July and mid-August. Fields cropped with root crops such as sugar beet, potatoes and onions, are also favoured as egg-laying sites. The pest is particularly prevalent in the eastern half of Britain.

Egg numbers can be estimated by soil sampling and related to threshold levels of 250 eggs/m² (2.5 million eggs/ha) for late-autumn drilled crops, or 100 eggs/m² (1.0 million eggs/ha) for crops sown from late-November onwards.

The specific objectives of the project were:
1. To measure the incidence of wheat bulb fly each autumn in the infested areas
2. To forecast the need for seed treatment or alternative insecticidal treatments

A total of 30 fields were selected for sampling in September 2012 in areas prone to wheat bulb fly. A total of 15 sites were sampled in eastern England and 15 in northern England. The sites were chosen to represent some of the main preceding crops leading to a risk of wheat bulb fly damage in each area.

In autumn 2012, one field (3%) from the total of 30 surveyed in eastern and northern England contained egg numbers greater than 250/m². The overall risk in 2012 is the equal lowest recorded since 1984. In 1995 there were also only 3% of sites above threshold.

Over all sites the highest risk was after onions, with 130 eggs/m^2 but only one such site was sampled in 2012. The next highest risk was after sugar beet, with 125 eggs/m^2 and then fallow (one site only), with 115 eggs/m^2. All other crops had average egg counts of less than 100 eggs/m^2. The risk in the east (96 eggs/m^2) is slightly greater than in the north of England (79 eggs/m^2). It seems likely that due to the cold, wet weather few flies have survived and been able to lay eggs.

Wheat bulb fly will probably pose a limited threat to crops sown before November in the 2012/13 season. Later-sown or slow-developing crops will still potentially be at risk if they have only one or two tillers at the time of wheat bulb fly egg hatch in January/February. For these crops, a lower threshold of 100 eggs/m^2 or 1 million/ha is applicable. In the east of England, 47% of monitored sites were above this level and in the north 27% of sites were above this level. These sites would benefit from an insecticide seed treatment.

2. INTRODUCTION

All cereals, except oats, can be attacked by wheat bulb fly. Eggs are laid in late summer in bare soil following fallows, set-aside or early-harvested crops such as vining peas, particularly if fields are cultivated between mid-July and mid-August. Fields cropped with root crops such as sugar beet, potatoes and onions are also favoured as egg-laying sites (Oakley, 2003). The pest is particularly prevalent in the eastern half of Britain. In outbreak years, more widespread damage occurs.

Eggs are laid in late July and August in England and up to mid-September in Scotland and remain dormant throughout late autumn and early winter. The larvae hatch between January and March. Soon after hatching the larvae invade shoots of cereal crops and the attacked shoots eventually die back to show 'deadheart' symptoms of damage.

The level of risk fluctuates greatly each year, due mainly to July and August rainfall (Young & Cochrane, 1993) and the harvest dates of the previous wheat crops. The longer crops remain in the ground, the longer adult flies have to feed on saprophytic fungi within the cereal ears and mature their eggs. Incidence generally increases following a wet harvest period, such as in 2004, and is lowest after a hot, dry summer, such as in 1995. The proportion of fields having an egg count greater than the 250 eggs/m² threshold ranged from 3% to 44% in the period 1984-1999 (Oakley & Young, 2000) and 9% to 50% between 2000 and 2008 (Figure 1).

Egg numbers can be estimated by soil sampling and related to threshold levels of 250 eggs/m² (2.5 million eggs/ha) for late-autumn drilled crops, or 100 eggs/m² (1.0 million eggs/ha) for crops sown from late-November onwards. At lower infestation levels, economic damage is less likely. Winter cereal crops sown from November onwards, or crops sown in spring before the end of March, are particularly vulnerable. Larvae attack shoots of wheat, barley and rye from January to April, with yield loss depending on tiller density at the time of attack. Crops still at the single shoot stage in February are most vulnerable and may be completely destroyed (Young, 2000). Yield losses up to about 4 t/ha have been recorded following severe damage (Young & Ellis, 1996).

The options for control of wheat bulb fly have been reduced by pesticide reviews and withdrawals and are currently limited to a tefluthrin + fludioxinil seed treatment (Austral Plus), a chlorpyrifos egg hatch spray and a single application of a dimethoate deadheart spray to kill the larvae in the plant. Seed treatment is the most effective option for later-sown crops, for example those at risk following crops such as potatoes, sugar beet, onions or red beet. Young (1992) demonstrated that November and December drillings of winter wheat were more vulnerable to wheat bulb fly damage than earlier sowings and are therefore more likely to benefit from the use of a preventive insecticidal seed treatment.

3. MATERIALS AND METHODS

A total of 30 fields were selected for sampling in September 2012 in areas prone to wheat bulb fly. A total of 15 sites were sampled in eastern England and 15 in northern England (Table 1). The sites were chosen to represent some of the main preceding crops (Table 2) leading to a risk of wheat bulb fly damage in each area.

For each field sampled, 32 cores each of 7.2 cm diameter or 20 cores each of 10 cm diameter were taken to cultivation depth. Fields were sampled in a standard W sampling pattern. Wheat bulb fly eggs were extracted following soil washing and flotation in saturated magnesium sulphate. Egg numbers were expressed as number of eggs per m² (Tables 3-7).

Table 1. Location of sampling sites, by region and county.

Region	County	Number of fields sampled
Eastern England	Cambridgeshire	6
	North Lincolnshire	4
	Norfolk	1
	Suffolk	2
	Hertfordshire	1
	Nottingham border	1
	Total	**15**
Northern England	East Yorkshire	10
	North Yorkshire	5
	Total	**15**

Table 2. Preceding crop or rotation for sampled fields.

Rotation	Eastern England	Northern England
Fallow	0	1
Onions	1	0
Peas (combining)	1	0
Peas (vining)	2	7
Potatoes	4	5
Seed potatoes	0	2
Red beet	3	0
Sugar beet	4	0
Total	**15**	**15**

4. RESULTS

In autumn 2012, only one field (3%) from the total of 30 surveyed in eastern and northern England contained egg numbers greater than 250/m². The overall risk in 2012 is the equal lowest recorded since 1984. In 1995 there were also only 3% of sites above threshold. This is in stark contrast to 2010, when 40% of monitored sites were over threshold. It seems likely that due to the cold, wet weather few flies have survived and been able to lay eggs. The risk in the eastern region was slightly greater than in the north.

Over all sites the highest risk was after onions with 130 eggs/m^2 but only one site was sampled in 2012. The next highest risk was after sugar beet with 125 eggs/m^2 and fallow (one site only) with 115 eggs/m^2. All other crops had mean egg counts of less than 100 eggs/m^2

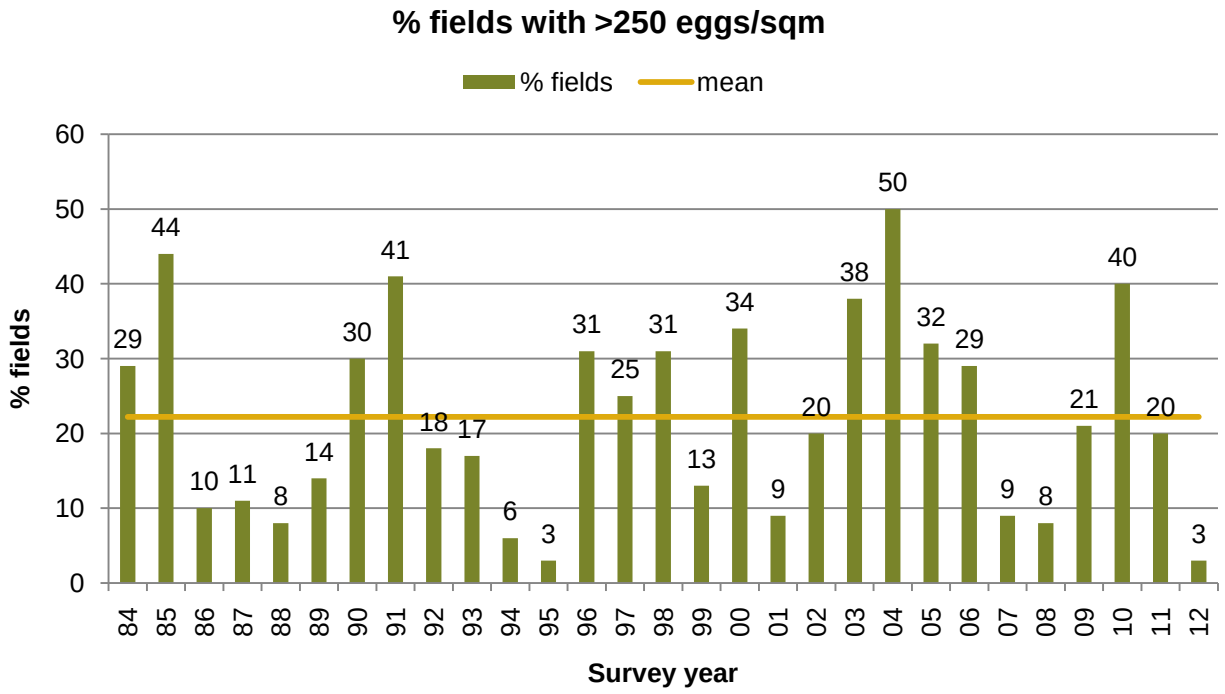

Figure 1. Wheat bulb fly annual risk levels 1984-2012 and overall mean.

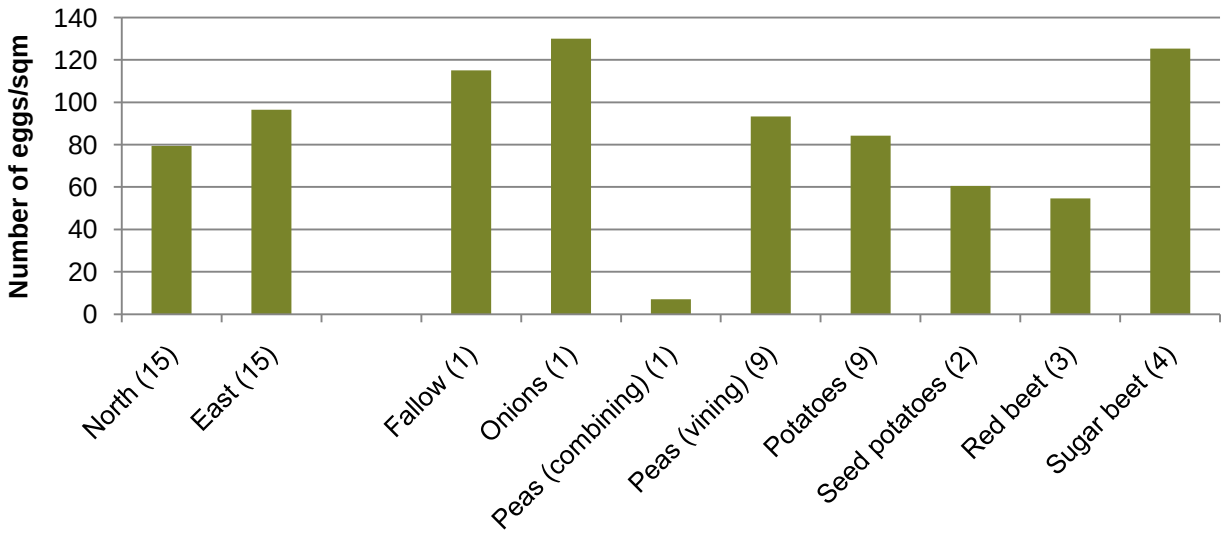

Figure 2. Average wheat bulb fly egg counts by region and preceding crop in autumn 2012 (number of sites in brackets).

4.1. Eastern England

The mean egg number was 96/m² for sites sampled in eastern England. This is much lower than the 179/m^2 recorded in 2011, which was in turn much lower than the 309/m^2 recorded in 2010. The potential for wheat bulb fly damage in eastern England is, therefore, much reduced in comparison with the previous two years. However, late-sown crops which are likely to have few tillers at the time of egg hatch could still be at risk. The highest mean egg numbers were recorded in fields following vining peas (Table 3). The highest egg population of 308/m² was after sugar beet in Suffolk.

In eastern England, 7% of the sampled fields were in the high infestation category and none in the very high category (>500 eggs/m², Table 4). Overall, 47% of the fields sampled in eastern England contained egg populations in the moderate, high or very high infestation categories. This is lower than in 2010 (80%), 2009 (67%) and 2006 (50%) but higher than in 2008 (45%) and 2007 (33%).

Table 3. Mean number of eggs/m² and preceding crops in eastern England in autumn 2012 (range of egg populations in brackets).

Rotation or previous crop	Number of fields sampled	Mean number of eggs per m²
Onions	1	130
Peas (combining)	1	7
Peas (vining)	2	141
Potatoes	4	91
Red beet	3	55
Sugar beet	4	125
Mean egg count		**96 (7-308)**

Table 4. Infestation categories and preceding crops in eastern England in autumn 2012.

Rotation or previous crop	Number of fields by rotation and infestation category			
	Low (0-99 eggs/m²)	Moderate (100-249 eggs/m²)	High (250-500 eggs/m²)	Very high (>500 eggs/m²)
Onions	0	1	0	0
Peas (combining)	1	0	0	0
Peas (vining)	1	1	0	0
Potatoes	2	2	0	0
Red beet	2	1	0	0
Sugar beet	2	1	1	0
Total	8	6	1	0
% of fields by infestation category	53	40	7	0

4.2. Northern England

The mean egg number was 79/m² for sites sampled in northern England. This is approximately 50% lower than in 2011. The highest egg population of 191/m² recorded was in North Yorkshire after vining peas.

Table 5. Numbers of eggs/m² and preceding crops in northern England in autumn 2008 (range of egg populations in brackets).

Rotation or previous crop	Number of fields sampled	Mean number of eggs per m²
Fallow	1	115
Peas (vining)	7	80
Potatoes	5	79
Seed potatoes	2	61
Mean egg count		**79 (25 – 191)**

In northern England, none of the sites were in the high infestation category, 40% in the moderate and 40% in the low category (Table 6). Overall 27% of sites were in moderate or above risk categories, which is much lower than in 2011, 2010 and 2009 when the equivalent figures were 60%, 60% and 47% respectively.

Table 6. Infestation categories and preceding crops in northern England in autumn 2010.

Rotation or previous crop	Number of fields by rotation and infestation category			
	Low (0-100 eggs/m²)	Moderate (100-250 eggs/m²)	High (250-500 eggs/m²)	Very high (> 500 eggs/m²)
Fallow	0	1	0	0
Peas (vining)	6	1	0	0
Potatoes	3	2	0	0
Seed potatoes	2	0	0	0
Total	11	4	0	0
% of fields by infestation category	73	27	0	0

5. DISCUSSION

Egg populations above 250 eggs/m² present a risk of economic damage to late-autumn drilled wheat crops. Egg numbers above 100 eggs/m² justify the use of seed treatment on the latest-drilled crops of wheat or barley.

Only 3% of sites (one site out of 30) were over the 250/m^2 threshold (2.5 million eggs/ha). The overall risk in 2012 is the equal lowest recorded since 1984. In 1995 there were also only 3% of sites above threshold. This is in stark contrast to 2010 when 40% of monitored sites were over threshold. It seems likely that due to the cold, wet weather few flies have survived and been able to lay eggs. The risk in the east is slightly greater than in the north of England. The mean egg counts for these two regions were 96/m^2 and 79/m^2 respectively.

Wheat bulb fly will, therefore, probably pose a limited threat to crops sown before November. Later-sown or slow-developing crops will still potentially be at risk if they have only one or two tillers at the time of wheat bulb fly egg hatch in January/February. For these crops, a lower threshold of 100 eggs/m^2 or 1 million/ha is applicable. In the east of England, 47% of monitored sites were above this level and in the north 27% of sites were above this level. These sites would benefit from an insecticide seed treatment.

A summary of control strategies for late-sown crops in relation to egg numbers in the soil are given in Table 7.

Table 7. Strategies for control of wheat bulb fly on late-autumn sown cereal crops.

Infestation category and egg count	Risk to untreated crops	Control strategy for late-sown crops
Low (less than 100 eggs per m²)	Late-autumn and winter-sown crops may suffer damage	Option to use seed treatment on November-February-sown crops
Moderate (100-250 eggs per m²)	Increased risk of damage	Seed treatment. Monitor progress of infestation in late winter.
High (250-500 eggs per m²)	Damage likely	Seed treatment. Assess need for follow-up egg hatch or deadheart spray
Very high (more than 500 eggs per m²)	Damage highly likely	Seed treatment. Assess need for follow-up egg-hatch or deadheart sprays. Additional control measures may be needed.

5.1. Chemical control

Seed treatments (tefluthrin + fludioxinil, Austral Plus and cypermethrin, Signal 300 ES) are effective on late-sown crops (November onwards) and are the recommended treatments for late-autumn or winter sowings of wheat and barley made before the end of egg hatch in areas and rotations at risk from wheat bulb fly. Treated seed should be drilled at a recommended minimum depth of 3 cm in a firm, even seedbed. If egg counts indicate a high risk of wheat bulb fly damage (more that 250 eggs/m²), a follow-up egg hatch or deadheart spray to the insecticidal seed treatment may be justified. It is important to note that seed treatments may not be sufficiently persistent to fully protect crops sown in September/October.

Chlorpyrifos egg hatch sprays are applied between the start of egg hatch in January and its peak in February or March. These are most likely to be justified on high-risk fields where egg numbers are above 2.5 million/ha. In recent years, egg hatch progress has been monitored by ADAS on behalf

of sponsors from the agrochemical industry, which has enabled spray treatments to be applied at optimum spray timings.

New guidelines for the application of the insecticide chlorpyrifos have been issued by a consortium of approval holders of the chemical (Dow AgroSciences, Headland Agrochemicals and Makhteshim Agan) in a bid to safeguard future use of products containing the active ingredient. These guidelines have been implemented as part of the **'Chlorpyrifos: Say NO to DRIFT'** campaign which has been set up to prove industry support for its continued use under challenging regulatory conditions. It calls for users to adopt new application guidelines aimed at achieving 100% uptake of low-drift nozzles for all applications and extended buffer zones.

They advise that if you intend to use an egg hatch spray from 1st January 2012, the following guidelines should be implemented when applying products containing chlorpyrifos:

- USE LERAP – low drift – three star rated nozzles
- Adopt a 20 metre buffer zone (1 m for dry water bodies).

This is in addition to current label requirements.

Dimethoate[1] sprays are applied at peak invasion of first instar larvae when damage symptoms ('deadhearts') start to appear on cereal shoots. Plant samples can be checked to determine the numbers of wheat bulb fly larvae present. The thresholds vary according to crop growth stage and range from 10% of tillers attacked at single shoot (pre GS20) stages to 15% of tillers attacked at GS21 and 20% of tillers attacked at GS22.

If plants are well-tillered by the time that wheat bulb fly larvae hatch between January and March, it is possible that they will be able to tolerate some pest attack and an insecticide spray may not be required.

[1] Dimethoate is currently undergoing re-registration evaluation.

6. REFERENCES

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APPENDIX A

Egg populations ranked in descending order for 15 fields sampled in eastern England in autumn 2012 (shaded sites are potentially at risk if late sown).

County	Previous crop	Number of eggs (number/m²)	Risk category
Suffolk	Sugar beet	308	High
Lincolnshire	Vining peas	240	Moderate
Cambridgeshire	Onions	130	Moderate
Hertfordshire	Potatoes	123	Moderate
Cambridgeshire	Red beet	116	Moderate
Lincolnshire	Potatoes	110	Moderate
Lincolnshire	Sugar beet	103	Moderate
Suffolk	Potatoes	82	Low
Cambridgeshire	Sugar beet	69	Low
Lincolnshire	Potatoes	48	Low
Nottinghamshire	Vining peas	41	Low
Cambridgeshire	Red beet	34	Low
Norfolk	Sugar beet	21	Low
Cambridgeshire	Red beet	14	Low
Cambridgeshire	Combining peas	7	Low
Mean		**96**	

APPENDIX B

Egg populations ranked in descending order for 15 fields sampled in northern England in autumn 2012 (shaded sites are potentially at risk if late sown).

County	Previous crop	Number of eggs (number/m²)	Risk category
North Yorkshire	Vining peas	191	Moderate
East Yorkshire	Potatoes	115	Moderate
North Yorkshire	Fallow	115	Moderate
East Yorkshire	Potatoes	108	Moderate
East Yorkshire	Vining peas	95	Low
North Yorkshire	Vining peas	95	Low
East Yorkshire	Seed potatoes	70	Low
North Yorkshire	Potatoes	70	Low
East Yorkshire	Potatoes	70	Low
East Yorkshire	Vining peas	70	Low
East Yorkshire	Seed potatoes	51	Low
North Yorkshire	Vining peas	45	Low
East Yorkshire	Vining peas	38	Low
North Yorkshire	Potatoes	32	Low
East Yorkshire	Vining peas	25	Low
Mean		**79**	