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Autumn survey of wheat bulb fly incidence 2014

by

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This is the autumn 2014 report of a 48-month project (RD-2011-3758) which was extended in August 2014. The work is funded by a contract for £32,907 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 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 as the pest can access bare soil between the rows. Wheat bulb fly is most prevalent in eastern England, the East Midlands and north-eastern England.

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

The specific objectives of the project are:

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 2014 in areas prone to wheat bulb fly. 15 were in eastern England and 15 in northern England. They were chosen to represent some of the main preceding crops leading to a risk of wheat bulb fly damage in each area.

In autumn 2014, one field from the total of 30 surveyed (3%) was considered high risk, containing egg numbers greater than 250/m². At 3%, the overall risk in 2014 is the equal lowest recorded since 1984. In 1995 and 2012, there were also only 3% of sites above threshold and, in 1994, only 6% of sites were above threshold.

Over all sites, the highest risk was after vining peas with a mean of 158 eggs/m^2. The next highest risk was after seed potatoes with 124 eggs/m^2. All other crops had mean egg counts of less than 100 eggs/m^2. It seems likely that dry weather which allowed the harvest to proceed without delay combined with low egg numbers in both autumn 2012 and 2013 resulted in another low count in 2014. Egg numbers in the north were higher than in the east. The mean egg counts for these two regions were 125 eggs/m^2 and 46 eggs/m^2, respectively.

Wheat bulb fly will, therefore, probably pose a limited threat to crops sown before November in the 2014/15 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 north of England, 53% of monitored sites were above this level but, in the east of England, only 13% 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 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 as the pest is able to access bare soil between the rows (Oakley, 2003). The pest is most prevalent in eastern England, the East Midlands and north-eastern England. 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 each year fluctuates greatly, 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 9–50% between 2000 and 2014 (Figure 1).

Harvest in 2014 started early and then progressed steadily without any significant delays. Under these conditions it would not be expected that high numbers of eggs would be laid, particularly as both 2012 and 2013 were also low risk years. However, as some oilseed rape crops were harvested early, it has been suggested that this might provide egg laying sites for wheat bulb fly, although in the past we have generally not found high numbers of eggs following oilseed rape. Overall, it is difficult to predict egg numbers and so this survey will provide valuable information on the potential risk from the pest for the 2014/15 season.

Egg numbers can be estimated by soil sampling and related to threshold levels of 250 eggs/m² (2.5 million eggs/ha) for crops sown in September or October, or 100 eggs/m² (1.0 million eggs/ha) for crops sown from November onwards. At lower infestation levels, economic damage is less likely, although winter cereal crops sown from November onwards or those sown in spring before the end of March can be 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 cypermethrin seed treatment (Signal 300 ES) and a chlorpyrifos egg-hatch spray.

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 preventative insecticidal seed treatment.

3. MATERIALS AND METHODS

A total of 30 fields were selected for sampling in September 2014 in areas prone to wheat bulb fly. Of those sites, 15 sites were sampled in eastern England and 15 in northern England (Table 1). The survey was stratified 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	8
	Lincolnshire	1
	Norfolk	3
	Suffolk	3
	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
Leeks	1	0
Maize	1	0
Oilseed rape	2	3
Onions	3	0
Peas	0	0
Peas (vining)	1	6
Potatoes	3	4
Seed potatoes	0	2
Sugar beet	4	0
Total	15	15

4. RESULTS

In autumn 2014, only one field from the total of 30 surveyed (3%) in eastern and northern England was considered high risk, containing egg numbers greater than 250/m². At 3%, the overall risk in 2014 is the equal lowest recorded since 1984. In 1995 and 2012, there were also only 3% of sites above threshold and in 1994 only 6% were above threshold. This is in stark contrast to 2010, when 40% of monitored sites were over threshold. It seems likely that dry weather, which allowed the harvest to proceed without delay, combined with low egg numbers in both autumn 2012 and 2013 resulted in another low count in 2014. Egg numbers in the north were higher than in the east. None of the sites sampled in the east had egg numbers above the 2.5 million/ha threshold, whereas one site was above this level in the north.

Over all sites, the highest risk was after vining peas, with a mean of 158 eggs/m^2. The next highest risk was after seed potatoes with 124 eggs/m^2. All other crops had mean egg counts of less than 100 eggs/m^2.

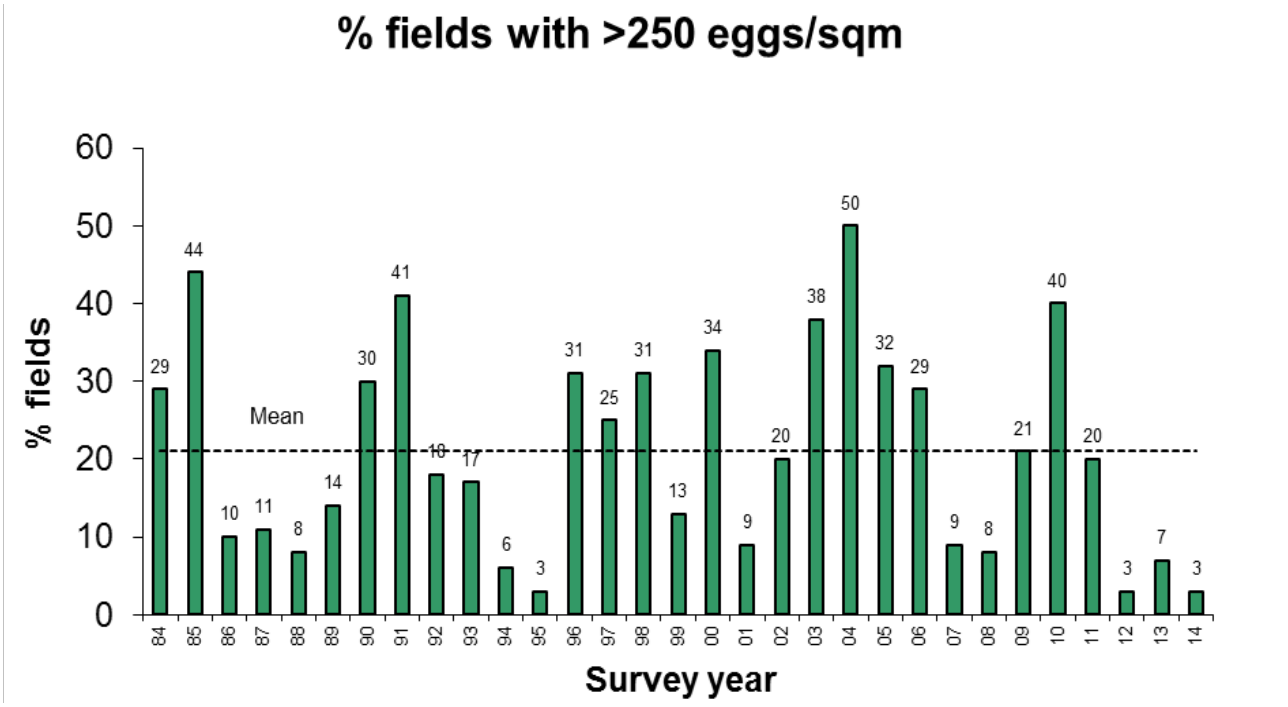

Figure 1. Wheat bulb fly annual risk levels: 1984–2014 and overall mean.

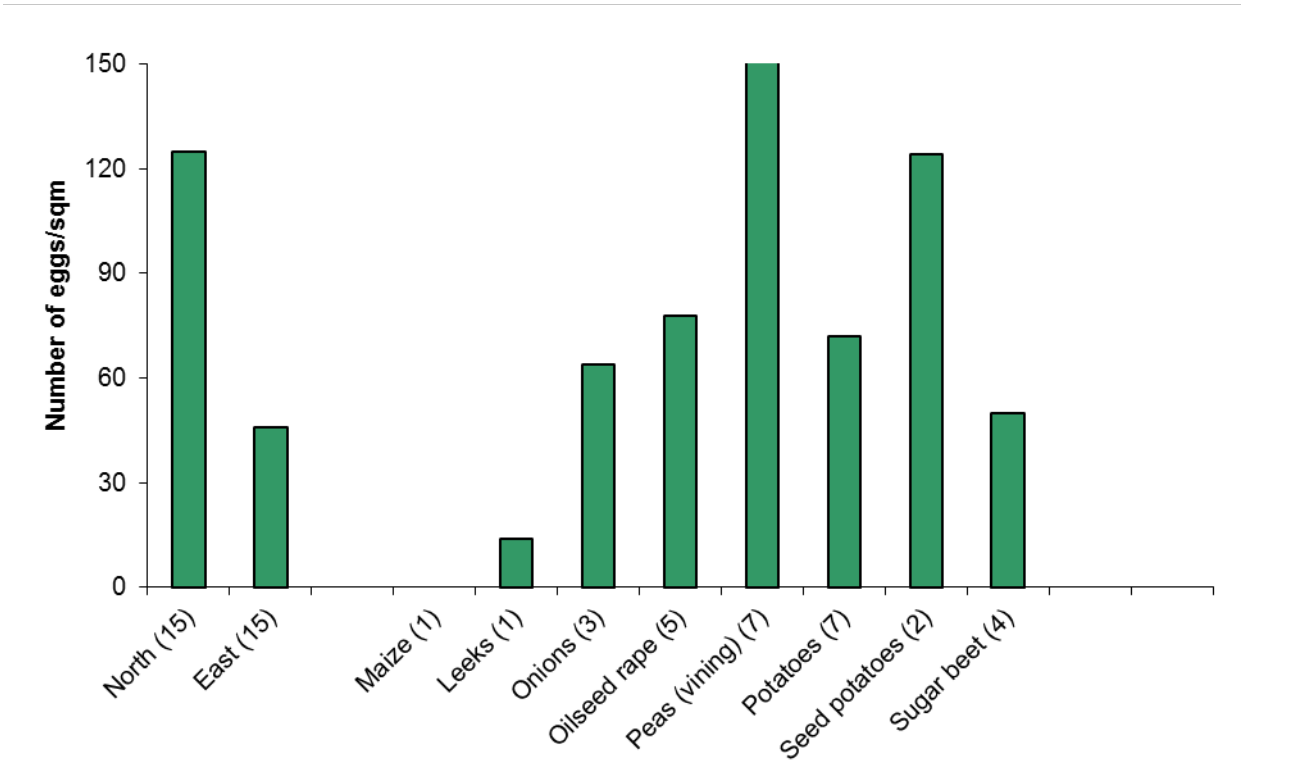

Figure 2. Average wheat bulb fly egg counts by region and preceding crop in autumn 2013 (number of sites in brackets).

4.1. Eastern England

The mean egg number was 46 eggs/m² for sites sampled in eastern England. This is lower than in 2013 (76 eggs/m^2), 2012 (96 eggs/m^2) and much lower than the 179 eggs/m^2 and 309 eggs/m^2 recorded in 2011and 2010, respectively. Therefore, the potential for wheat bulb fly damage in eastern England is low: the lowest it has been since 2010. However, late-sown crops which are likely to have few tillers at the time of egg hatch could still be at risk. The highest egg population of 116 eggs/m² was after onions in Suffolk. Onions also had the highest mean number of eggs of all crops sampled (64 eggs/m^2, Table 3).

In eastern England, none of the sampled fields were in the high or very high risk category (Table 4). Overall, 13% of the fields sampled in eastern England contained egg populations in the moderate, high or very high risk categories. This is much lower than populations recorded from 2006 to 2013.

Table 3. Mean number of eggs/m² and preceding crops in eastern England in autumn 2014 (range of egg populations in brackets).

Rotation or previous crop	Number of fields sampled	Mean number of eggs per m²
Leeks	1	14
Maize	1	0
Oilseed rape	2	48
Onions	3	64
Peas (vining)	1	7
Potatoes	3	38
Sugar beet	4	50
Mean egg count		46 (0-116)

Table 4. Infestation categories and preceding crops in eastern England in autumn 2014.

Rotation or previous crop	Number of fields by rotation and risk category			
	Low (<100 eggs/m²)	Moderate (100-249 eggs/m²)	High (250-499 eggs/m²)	Very high (> 500 eggs/m²)
Leeks	1	0	0	0
Maize	1	0	0	0
Oilseed rape	2	0	0	0
Onions	2	1	0	0
Peas (vining)	1	0	0	0
Potatoes	2	1	0	0
Sugar beet	4	0	0	0
Total	13	2	0	0
% of fields by infestation category	87	13	0	0

4.2. Northern England

The mean egg number was 125 eggs/m² for sites sampled in northern England. This is approximately equivalent to the mean count of 129 eggs/m^2 in 2013. The highest egg population, of 407 eggs/m², was recorded in East Yorkshire after vining peas.

Table 5. Numbers of eggs/m² and preceding crops in northern England in autumn 2014 (range of egg populations in brackets).

Rotation or previous crop	Number of fields sampled	Mean number of eggs per m²
Oilseed rape	3	99
Peas (vining)	6	183
Potatoes	4	88
Seed potatoes	2	62
Mean egg count		125 (43–407)

In northern England, one field (6% of the sites) was in the high risk category and seven fields (47% of sites) in each of the moderate and low categories (Table 6). Overall, eight fields (53% of sites) were in moderate or above risk categories, which is much higher than in 2013 (40%), 2012 (27%) and 2009 (47%) but lower than in 2011and 2010, when 60% of sites were in moderate or above infestation categories in each year.

Table 6. Infestation categories and preceding crops in northern England in autumn 2014.

Rotation or previous crop	Number of fields by rotation and infestation category			
	Low (<100 eggs/m²)	Moderate (100-249 eggs/m²)	High (250-499 eggs/m²)	Very high (> 500 eggs/m²)
Oilseed rape	1	2	0	0
Peas (vining)	1	4	1	0
Potatoes	3	1	0	0
Seed potatoes	2	0	0	0
Total	7	7	1	0
% of fields by infestation category	47	47	6	

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 (1 site out of 30) was over the 250 eggs/m^2 threshold (2.5 million eggs/ha). The overall risk in 2013 is the equal lowest recorded since 1984, with 1995 and 2012. In 1994, 6% of sites were above the 250 eggs/m^2 threshold. This is in stark contrast to 2010, when 40% of monitored sites were over threshold. It seems likely that dry weather, which allowed the harvest to proceed without delay combined with low egg numbers in both autumn 2012 and 2013 resulted in another low count in 2014. Egg numbers in the north were higher than in the east. None of the sites sampled in the east had egg numbers above the 2.5 million eggs/ha threshold, whereas one site was above this level in the north. Egg numbers in the north were higher than in the east. The mean egg counts for these two regions were 125 eggs/m^2 and 46 eggs/m^2 respectively.

Wheat bulb fly is, therefore, likely to 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 eggs/ha is applicable. In the north of England, 53% (8 fields) of monitored sites were above this level and, in the east of England, 13% of sites (2 fields) 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 is given in Table 7.

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

Risk Category	Sowing Date		
	Sep–Oct	Nov–Dec	Jan–Mar
Low >100 eggs/m2 (less than 1.0 million eggs/ha)	Economic damage unlikely. No treatment	No treatment	ST
Moderate 100-249 eggs/m2 (1.0 to 2.5 million eggs/ha)	No treatment	ST	ST
High 250-499 eggs/m2 (2.5 to 5.0 million eggs/ha)	Optional EH	ST Optional EH	ST EH
Very High >500 eggs/m2 (more than 5.0 million eggs/ha)	EH	ST EH	ST EH
Key:	ST = Seed treatment such Austral Plus or Signal 300 ES EH = Egg-hatch spray such as chlorpyrifos		

5.1. Chemical control

Seed treatments (tefluthrin + fludioxinil, Austral Plus or Cypermethrin, Signal 300 ES) are effective on late-sown crops (November onwards) and is the recommended treatment 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. Seed treatments are most effective in shallow-drilled crops (drilled to a depth of 2.5–4 cm) in a firm, even seedbed. If egg counts indicate a high risk of wheat bulb fly damage (more than 250 eggs/m²), a follow-up egg hatch 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 eggs/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.

The guidelines advise that if you intend to use an egg hatch spray from 1 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.

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.

6. REFERENCES

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APPENDIX A

Egg populations ranked in descending order for 15 fields sampled in eastern England in autumn 2014 (shaded sites are potentially at risk if late sown).

County	Previous crop	Number of eggs (number/m^2)	Risk category
Suffolk	Onions	116	Moderate
Cambridgeshire	Potatoes	110	Moderate
Suffolk	Onions	89	Low
Cambridgeshire	Oilseed rape	82	Low
Norfolk	Sugar beet	69	Low
Norfolk	Sugar beet	48	Low
Norfolk	Sugar beet	48	Low
Suffolk	Potatoes	41	Low
Cambridgeshire	Sugar beet	34	Low
Cambridgeshire	Onions	21	Low
Lincolnshire	Leeks	14	Low
Cambridgeshire	Oilseed rape	14	Low
Cambridgeshire	Vining peas	7	Low
Cambridgeshire	Maize	0	Low
Cambridgeshire	Potatoes	0	Low
Mean		46	

APPENDIX B

Egg populations ranked in descending order for 15 fields sampled in northern England in autumn 2014 (shaded sites are potentially at risk if late sown)

County	Previous crop	Number of eggs (number/m^2)	Risk category
East Yorkshire	Vining peas	407	High
North Yorkshire	Vining peas	216	Moderate
East Yorkshire	Vining peas	197	Moderate
North Yorkshire	Potatoes	142	Moderate
East Yorkshire	Vining peas	123	Moderate
East Yorkshire	Oilseed rape	123	Moderate
East Yorkshire	Oilseed rape	111	Moderate
East Yorkshire	Vining peas	111	Moderate
North Yorkshire	Potatoes	74	Low
North Yorkshire	Potatoes	74	Low
East Yorkshire	Seed potatoes	68	Low
East Yorkshire	Oilseed rape	62	Low
North Yorkshire	Potatoes	62	Low
East Yorkshire	Seed potatoes	56	Low
East Yorkshire	Vining peas	43	Low
Mean		125	