Wheat bulb fly: survey of incidence in England; risk assessment as the basis for autumn 2011 seed treatment usage

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Summary

The aim of the study was to establish the annual incidence of wheat bulb fly in the autumn to enable farmers to make informed decisions on the need to use an insecticidal seed treatment. The survey results highlight crops at greatest risk enabling action to be taken to reduce potential losses. A total of 41 fields (26 fields in eastern England; 15 in northern England) at risk from wheat bulb fly were sampled for eggs in autumn 2011

In autumn 2011, 20% of the 41 fields sampled were within the high risk infestation category with egg populations greater than 250/m². This compares with the long-term mean for the period 1984-2010 of 23% of fields within this category (Figure 1). Overall egg numbers this season are similar to those recorded in 2009 and much lower than in 2010.

The mean egg population in eastern England in autumn 2011 was 179 eggs/m². This is lower than 2010 and 2009 when the average egg counts were 309/m^2 and 229/m^2 respectively. The survey indicated that 19% of fields (5 from 26) were in the high risk/very high risk category with more than 250 eggs/m². This compares with 55%, 28%, 7%, 11% and 41% in autumn 2010, 2009, 2008, 2007 and 2006 respectively. Therefore the average risk in 2011 is markedly lower than in 2010. In 2011 the highest risk fields were following vining peas and potatoes although only two vining pea sites were sampled and one had the highest egg number recorded in 2011 (876 eggs/m^2). A total of 12 fields (46% of total) were within the moderate infestation category with egg counts between 100-250 eggs/m². The remaining nine (35% of total) fields in eastern England had low egg numbers below 100 eggs/m².

In northern England, the mean egg population was 161 eggs/m². This is very similar to 2010 (160 eggs/m^2), higher than in 2009 when the mean egg numbers were 133/m^2, similar to 2008 when there were 154 eggs/m^2 but much higher than a mean of 31 eggs/m^2 in 2007. Of the 15 fields sampled three (20%) were in the high category, six (40%) in the moderate category and six (40%) in the low risk category. The highest egg count recorded in this region was 414/m² after potatoes in North Yorkshire.

Insecticidal seed treatments are worthwhile on late-autumn drilled wheat and barley crops if egg numbers exceed 250 eggs/m². A lower threshold of 100-250 eggs/m² is appropriate for the latest-drilled wheat crops. Overall in eastern England in autumn 2011 17 of the 26 sampled fields (65% of total) contained moderate or high egg populations. In northern England, nine out of 15 sampled fields (60%) contained moderate or high egg populations.

Please note that the survey results are provided for guidance, but they do not preclude the presence of moderate or high-risk egg populations for cereal crops in any rotations at risk from wheat bulb fly.

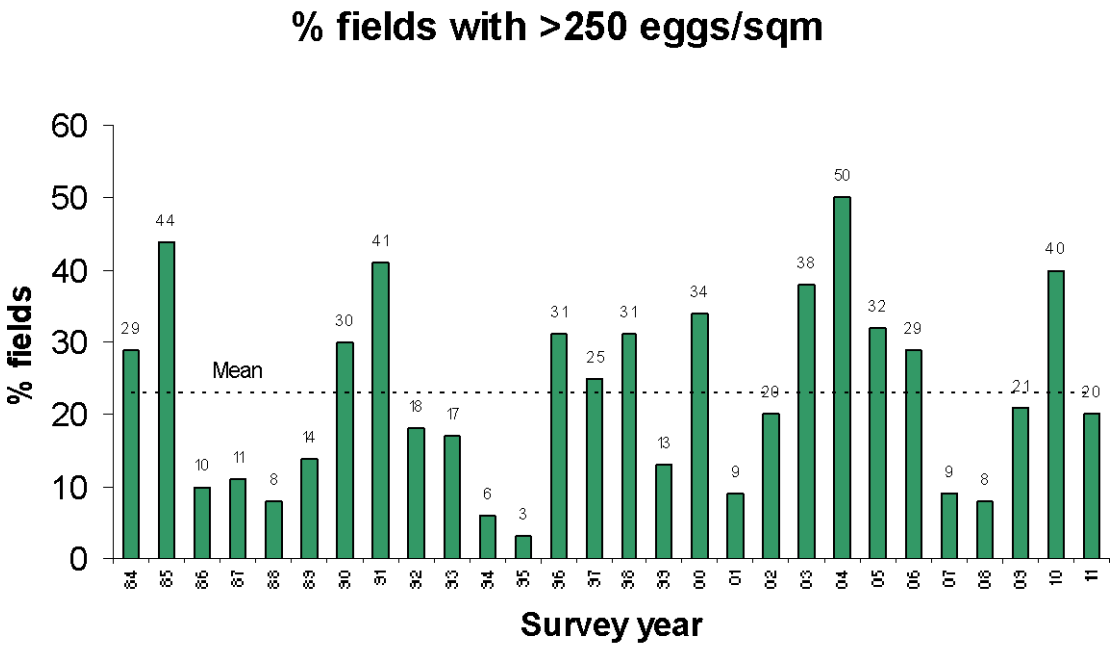

Figure 1. Wheat bulb fly annual risk levels 1984-2011 and overall mean.

In autumn 2011, 20% of fields from the total of 41 surveyed in eastern and northern England contained egg numbers greater than 250/m². This is much lower than the 40% recorded in 2010 and is below the long-term mean of 23% for the period 1984-2011. Therefore in 2011 crops are at a much lower risk from wheat bulb fly than was the case in 2010. There was also little difference between the risk in eastern and northern region which is in contrast to 2010 when the risk in eastern region was much greater than in the north.

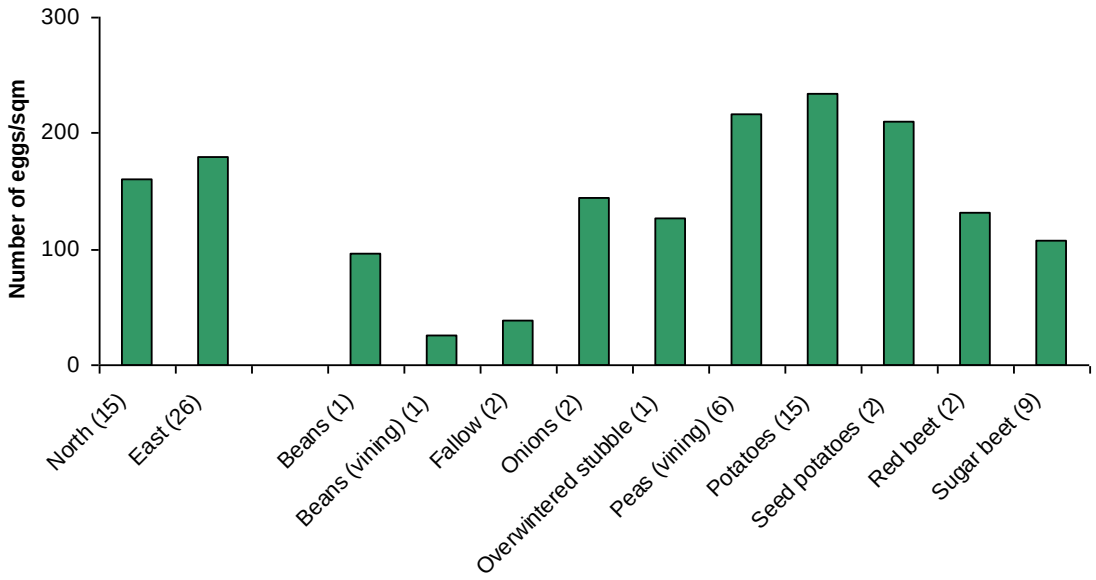

Figure 2. Average wheat bulb fly egg counts by region and proceeding crop in autumn 2011 (number of sites in brackets).

In autumn 2011, mean egg counts for eastern and northern England were 179/m² and 161/m² respectively. The count for eastern England was much lower than in 2010 when 309 eggs/m^2 were recorded and lower than for 2009 when the average egg count was 229 eggs/m². In northern England the count was almost identical to 2010 when a mean count of 160/m^2 was recorded. The highest risk across both eastern and northern regions in 2011 was after potatoes followed by vining peas and seed potatoes although the vining pea data is heavily influenced by the highest egg count recorded in 2011 (876/m^2) in North Lincolnshire. For comparison, the summary for wheat bulb fly risk in autumn 2010 is shown in Figure 3. In general, egg numbers are lower in 2011 than in 2010. Also in 2011, egg numbers in both eastern and northern regions are similar whereas in 2010 numbers in eastern region were much higher than in the north.

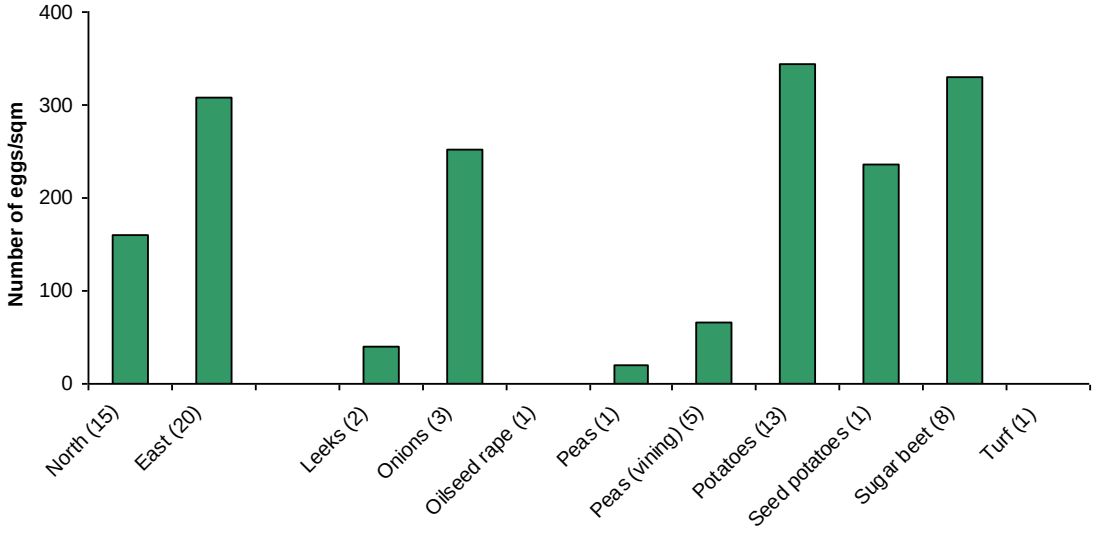

Figure 3. Average wheat bulb fly egg counts by region and proceeding crop in autumn 2010 (number of sites in brackets).

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 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 250 eggs/m² threshold ranged from 3 to 44% in the period 1984-1999 (Oakley & Young, 2000) and 9-50% 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.

Sampling method and sites

A total of 41 fields were selected for sampling in September 2011 in areas prone to wheat bulb fly. A total of 26 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 4-7).

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

Region	County	Number of fields sampled
Eastern England	Cambridgeshire	12
	North Lincolnshire	8
	Norfolk	2
	Suffolk	4
	Total	26
Northern England	East Yorkshire	8
	North Yorkshire	7
	Total	15

Table 2. Preceding crop or rotation for sampled fields.

Rotation	Eastern England	Northern England
Beans	1	0
Beans (vining)	0	1
Fallow	1	1
Onions	2	0
Overwintered stubble	0	1
Peas (vining)	2	4
Potatoes	9	6
Seed potatoes	0	2
Red beet	2	0
Sugar beet	9	0
Total	26	15

Results

Eastern England

The mean egg number was 179/m² for sites sampled in eastern England. This is much lower tan the 309/m^2 recorded in 2010 so the potential for wheat bulb fly damage in eastern England is much lower than was the case last year although late sown crops which are likely to have few tillers at the time of egg hatch will be at significant risk. The highest mean egg numbers were recorded in fields following potatoes (Table 3). The highest egg population of 876/m² was after vining peas in North Lincolnshire.

In eastern England, 15% of the sampled fields were in the high infestation category with 4% of sites in the very high category (> 500 eggs/m² ,Table 4). Overall, 65% 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%) and 2009 (67%) but higher than in 2008 (45%) 2007 (33%) and 2006 (50%).

Table 3. Mean number of eggs/m² and preceding crops in eastern England in autumn 2011 (range of egg populations in brackets).

Rotation or previous crop	Number of fields sampled	Mean number of eggs per m²
Beans	1	96
Fallow	1	75
Onions	2	144
Peas (vining)	2	500
Potatoes	9	219
Red beet	2	131
Sugar beet	9	107
Mean egg count		179 (19-876)

Table 4. Infestation categories and preceding crops in eastern England in autumn 2010.

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)
Beans	1	0	0	0
Fallow	1	0	0	0
Onions	0	2	0	0
Peas (vining)	0	1	0	1
Potatoes	1	5	3	0
Red beet	1	1	0	0
Sugar beet	5	3	1	0
Total	9	12	4	1
% of fields by infestation category	35	46	15	4

Northern England

The mean egg number was 161/m² for sites sampled in northern England. The highest egg population of 414/m² recorded was in North Yorkshire after potatoes

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
Beans (vining)	1	25
Fallow	1	0
Overwintered stubble	1	127
Peas (vining)	4	76
Potatoes	6	257
Seed potatoes	2	210
Mean egg count		161 (0 – 414)

In northern England, 20% of sites were in the high infestation category, 40% in the moderate and 40% in the low category (Table 6). Overall 60% of sites were in moderate or above risk categories which is identical to 2010 and higher than in 2009 when the

equivalent figure was 47%. The 2011 result is in marked contrast to 2007 when all sites were in the low category.

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)
Beans (vining)	1	0	0	0
Fallow	1	0	0	0
Overwintered stubble	0	1	0	0
Peas (vining)	3	1	0	0
Potatoes	0	4	2	0
Seed potatoes	1	0	1	0
Total	6	6	3	0
% of fields by infestation category	40	40	20	0

Economic importance and risk factors

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.

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

Chemical control

Seed treatment (tefluthrin + fludioxinil, Austral Plus) is 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. 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/m^2), 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.

Dimethoate 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 GS 20) stages to 15% of tillers attacked at GS 21 and 20% of tillers attacked at GS 22.

Note that chlorpyrifos and dimethoate products approved for control of wheat bulb fly are classified as LERAP 'A' products which are not eligible for buffer zone reductions.

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.

Further information and references

HGCA (2003). Pest management in cereals and oilseed rape – a guide, 23 pp.

HGCA Topic Sheet No. 99 (Summer 2007). Predicting and controlling wheat bulb fly, 2 pp.

Oakley, J.N. & Young, J. E. B. (2000). Economics of pest control in cereals in the UK. *The BCPC Conference – Pests and Diseases 2000,* 663-670.

Oakley, J. N. (2003). Wheat bulb fly. In – *'Pest management in cereals and oilseed rape – a guide'*. HGCA, 24pp.

Young, J. E. B. (1992). Control of wheat bulb fly in winter wheat. I. Chemical methods. II. Varietal susceptibility. *HGCA Project Report No. 67*.

Young, J. E. B. (2000). Dealing with wheat bulb fly. *HGCA Topic sheet No. 38*, 2 pp.

Young, J. E. B. & Cochrane, J. (1993). Changes in wheat bulb fly (*Delia coarctata*) populations in East Anglia in relation to crop rotations, climatic data and damage forecasting. *Annals of Applied Biology,* 123, 485-498.

Young, J. E. B. & Ellis, S. A. (1996). *Impact of changes in arable agriculture on the biology and control of wheat bulb fly.* Research Review No. 33, HGCA, London.

Appendix 1. Egg populations ranked in descending order for 26 fields sampled in eastern England in autumn 2011 (shaded sites are potentially at risk if late sown).

County	Previous crop	Number of eggs (number/m²)	Risk category
North Lincolnshire	Vining peas	876	Very high
Cambridgeshire	Potatoes	391	High
North Lincolnshire	Potatoes	376	High
Cambridgeshire	Potatoes	356	High
Cambridgeshire	Sugar beet	336	High
North Lincolnshire	Potatoes	204	Moderate
Cambridgeshire	Red beet	192	Moderate
Cambridgeshire	Potatoes	192	Moderate
Cambridgeshire	Potatoes	171	Moderate
North Lincolnshire	Sugar beet	171	Moderate
North Lincolnshire	Potatoes	160	Moderate
Cambridgeshire	Sugar beet	158	Moderate
Suffolk	Onions	151	Moderate
Cambridgeshire	Sugar beet	137	Moderate
Cambridgeshire	Onions	137	Moderate
North Lincolnshire	Vining peas	123	Moderate
North Lincolnshire	Potatoes	103	Moderate
Cambridgeshire	Beans	96	Low
Cambridgeshire	Fallow	75	Low
Cambridgeshire	Red beet	69	Low
North Lincolnshire	Sugar beet	56	Low
Suffolk	Sugar beet	41	Low
Suffolk	Sugar beet	27	Low
Suffolk	Potatoes	21	Low
Norfolk	Sugar beet	19	Low
Norfolk	Sugar beet	14	Low
Mean		179	

Appendix 2. Egg populations ranked in descending order for 15 fields sampled in northern England in autumn 2011 (shaded sites are potentially at risk if late sown).

County	Previous crop	Number of eggs (number/m²)	Risk category
North Yorkshire	Potatoes	414	High
North Yorkshire	Potatoes	382	High
North Yorkshire	Seed potatoes	331	High
North Yorkshire	Potatoes	248	Moderate
North Yorkshire	Potatoes	197	Moderate
East Yorkshire	Vining peas	197	Moderate
East Yorkshire	Potatoes	191	Moderate
East Yorkshire	Over wintered stubble	127	Moderate
North Yorkshire	Potatoes	108	Moderate
East Yorkshire	Seed potatoes	89	Low
East Yorkshire	Vining peas	70	Low
North Yorkshire	Vining peas	38	Low
East Yorkshire	Vining beans	25	Low
East Yorkshire	Vining peas	0	Low
North Yorkshire	Fallow	0	Low
Mean		161	