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Autumn survey of wheat bulb fly incidence 2020

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This is the autumn 2020 report of a 27-month project that started in August 2019. The work was funded by a contract for £32,000 from AHDB.

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1. Abstract

All cereals, except oats, can be attacked by wheat bulb fly (WBF). Eggs are laid in late summer in bare soil following fallows or early harvested crops, 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. WBF is most prevalent in eastern England and north-eastern England.

The specific objectives of the project are:

1. To measure the incidence of wheat bulb fly in autumn 2019–21 in the east and north east of England.
2. To forecast the need for seed treatment in autumn 2019–21.
3. To test the Young and Cochrane model for prediction of WBF risk using historic met data and that for autumn 2019–21.
4. To investigate the potential for PCR analysis to predict WBF risk (2019 only)

This report covers objectives 1 and 2.

A total of 30 fields were sampled for WBF eggs in September 2020 in areas prone to the pest, with 15 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 WBF damage in each area.

For crops sown in September and October the economic damage threshold (the egg population that might be expected to have an economic impact on yield) is 250 eggs/m² (2.5 million eggs/ha). In autumn 2020, two of the sampled fields were considered at very high risk (egg numbers >500/m²), one at high risk (egg numbers 250-500/m^2), four at moderate risk (egg numbers 100-249/m^2 and 23 at low risk (egg numbers <100/m^2). This was equivalent to 7%, 3%, 13% and 77% of fields in the very high, high, moderate and low risk infestation categories respectively. This is identical to the breakdown of sites between risk categories in 2019. A total of 10% of sites had egg numbers above the 250 eggs/m^2 threshold for crops sown in September and October. This represents a relatively low risk as in recent years. WBF adults feed on saprophytic fungi in wheat ears. It is possible that good progress with the wheat harvest in 2020 meant there was less time for these fungi to develop, which in turn meant less food for adult WBF females and as a result they produced fewer eggs than in a wetter season when their food source is likely to be more plentiful. Interestingly in the east of England egg counts in organic soil were higher than in mineral soil. The mean egg count from the organic soils was 306 eggs/m^2 whereas from the mineral soils it was 21 eggs/m^2. Although the mean in organic soils was heavily influenced by one very high and one high count after sugar beet and one very high count after French beans results suggest that the potential for WBF damage in eastern England is organic soils is greater than in mineral soils.

Average egg numbers in the east were higher than in the north with 173 eggs/m^2 in the east and 111 eggs/m^2 in the north. The counts in the east were heavily influenced by the two very high counts after sugar beet and French beans and a high count also after sugar beet. Over all sites, the highest risk was after French beans with a mean of 535 eggs/m^2 although only two sites were sampled, one of which had a low count. The next highest risk was after sugar beet with a mean of 175 eggs/m^2 across eight sites sampled.

Late-sown (November onwards) or slow developing crops are at greater risk from WBF than those that are early sown (September/October) due to slower tiller development. As a result, a lower threshold of 100 eggs/m^2 or 1 million eggs/ha is applicable for these crops. In the north of England 27% of sites were above this level and 20% of sites in the east. All fields in the moderate category would benefit from a seed treatment if sown from November onwards.

Crops sown between January and March would benefit from a seed treatment if any WBF eggs are found.

2. Introduction

All cereals except oats can be attacked by wheat bulb fly (WBF). 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 (AHDB, 2016). The pest is most prevalent in eastern England and north-eastern England. In outbreak years, widespread damage can occur.

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, they invade shoots of cereal crops and the attacked shoots wither or become yellow and stunted. These symptoms are known as ‘deadhearts’.

The level of WBF 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/m^2 damage threshold (the egg population that might be expected to have an economic impact on yield) ranged from 3% to 44% in the period 1984–1999 (Oakley & Young, 2000) and from 0% to 50% between 2000 and 2020 (Figure 1).

By 22 September harvest of winter wheat crops was near completion with only small areas left to harvest mostly in Scotland. The 2020 wheat harvest progressed well with little to impede combines in the first few weeks of August. Regions in the south began harvest in ripe crops as early as the end of July (week ending 27 July) but wheat harvest really picked up pace from week ending 3 August onwards across all regions. The arrival of storm Francis at the end of September brought many combines to a halt during what was the peak period in wheat harvest and caused some widespread lodging issues with an estimated 1% of the national wheat area lodged. In some instances where regions received localised heavy showers, this resulted in crops laying completely flat (e.g. in Scotland), challenging harvesting conditions and a reduction yields. This did not last long however, as strong winds managed to dry out crops and many could continue where they had left off bringing progress back in line with recent years and ahead of that in 2017. Wheat harvest in the southern counties was completed by week ending 7 September with the remaining regions completed by mid-late September. This suggested that the risk from wheat bulb fly would be low again as in the last two years and this survey will help determine if this is the case and provide valuable information on the potential risk from the pest for the 2020/21 season.

The overall objective of the autumn survey of wheat bulb fly incidence is to establish the annual incidence of wheat bulb fly in autumn 2019-2021 and the risk of subsequent damage and to validate the Young and Cochrane model of WBF risk prediction.

Specific objectives are:

1. To measure the incidence of wheat bulb fly in autumn 2019-2021 in the east and north east of England.
2. To forecast the need for seed treatment in autumn 2019-2021.
3. To test the Young and Cochrane model for prediction of WBF risk using historic met data and that for autumn 2019-21.
4. To investigate the potential for PCR analysis to predict WBF risk (2019 only)

This report only covers objectives 1 and 2.

Egg numbers can be estimated by soil sampling and related to damage 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 of up to about 4 t/ha have been recorded following severe damage (Young & Ellis, 1996).

The options for control of WBF have been reduced by pesticide reviews and withdrawals and is currently limited to a cypermethrin seed treatment (Signal 300 ES).

Seed treatment is the most effective option for late-sown crops, for example those at risk following potatoes, sugar beet, onions or red beet. Young (1992) demonstrated that November and December drillings of winter wheat were more vulnerable to WBF 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 sampled in September 2020 in areas prone to WBF, with 15 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. WBF eggs were extracted following soil washing and flotation in saturated magnesium sulphate. Egg numbers were expressed as number of eggs per m^2.

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

Region	County	Number of fields sampled
Eastern England	Cambridgeshire	8
	Norfolk	7
	Total	15
Northern England	East Yorkshire	14
	North Yorkshire	1
	Total	15

Table 2. Preceding crop for sampled fields.

Preceding crop	Eastern England	Northern England
Beetroot	1	0
French beans	2	0
Linseed	1	0
Onions	2	0
Potatoes	1	1
Potatoes seed	0	3
Sugar beet	8	0
Vining beans	0	1
Vining peas	0	10
Total	15	15

4. Results

In autumn 2020, two of the sampled fields were considered at very high risk (egg numbers >500/m²), one at high risk (egg numbers 250-500/m²), four at moderate risk (egg numbers 100-249/m² and 23 at low risk (egg numbers <100/m²). This was equivalent to 7%, 3%, 13% and 77% of fields in the very high, high, moderate and low risk infestation categories respectively. This is identical to the breakdown of sites between risk categories in 2019. A total of 10% of sites had egg numbers above the 250 eggs/m² threshold for crops sown in September and October (Figure 1). The overall risk in 2020 is equal to or lower than 14 other years since monitoring began in 1984 and well below the average of 20% of sites above the 250 eggs/m² threshold for monitoring since 1984. As in recent years it is possible that the rapid winter wheat harvest meant there was little time for saprophytic fungi to develop in cereal ears, which in turn meant less food for adult WBF females. As a result they produced less eggs than in a wetter season their fungal food source is more plentiful.

Average egg numbers in the east of England were 173/m² which is higher than in the north of England where 111/m² were recorded (Figure 2). Over all sites, the highest risk was after French beans with a mean of 535 eggs/m² although only two sites were sampled, one of which had a low egg count. The next highest risk was after sugar beet with 175 eggs/m². The highest individual count was 1000 eggs/m² after French beans in followed by 850 eggs/m² after sugar beet. Both sites were in Norfolk.

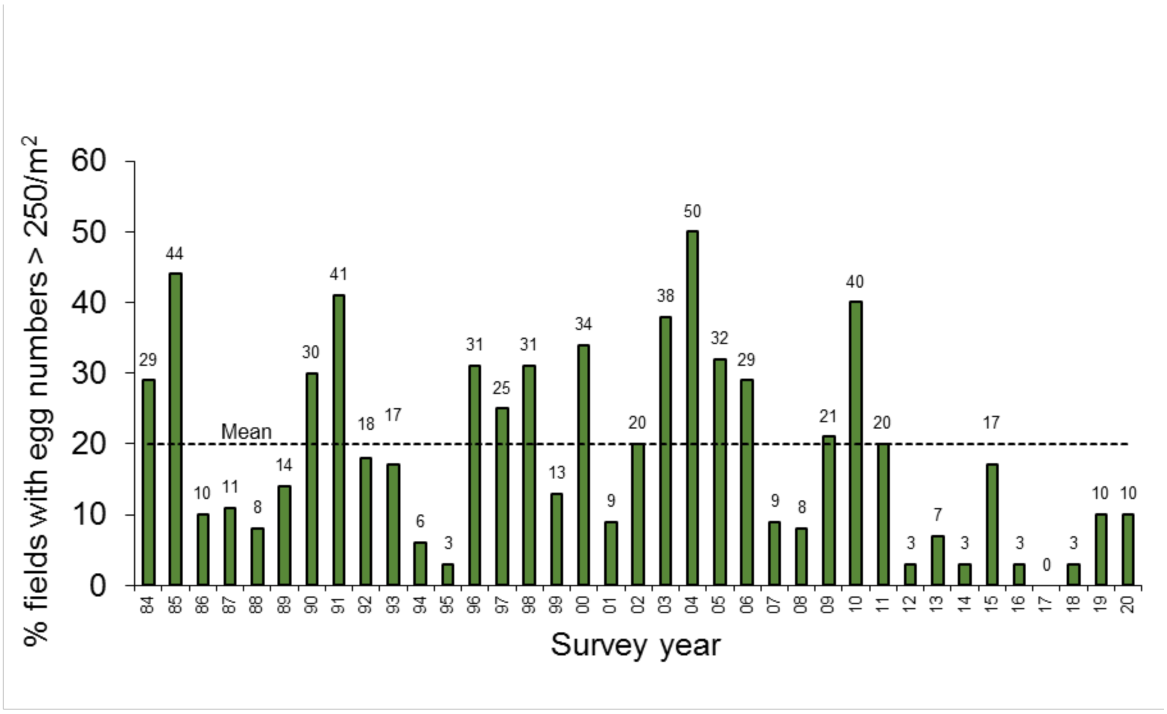

Figure 1. Wheat bulb fly annual risk levels 1984–2020 and overall mean (dashed line). Fields at risk have >250 eggs/m^2

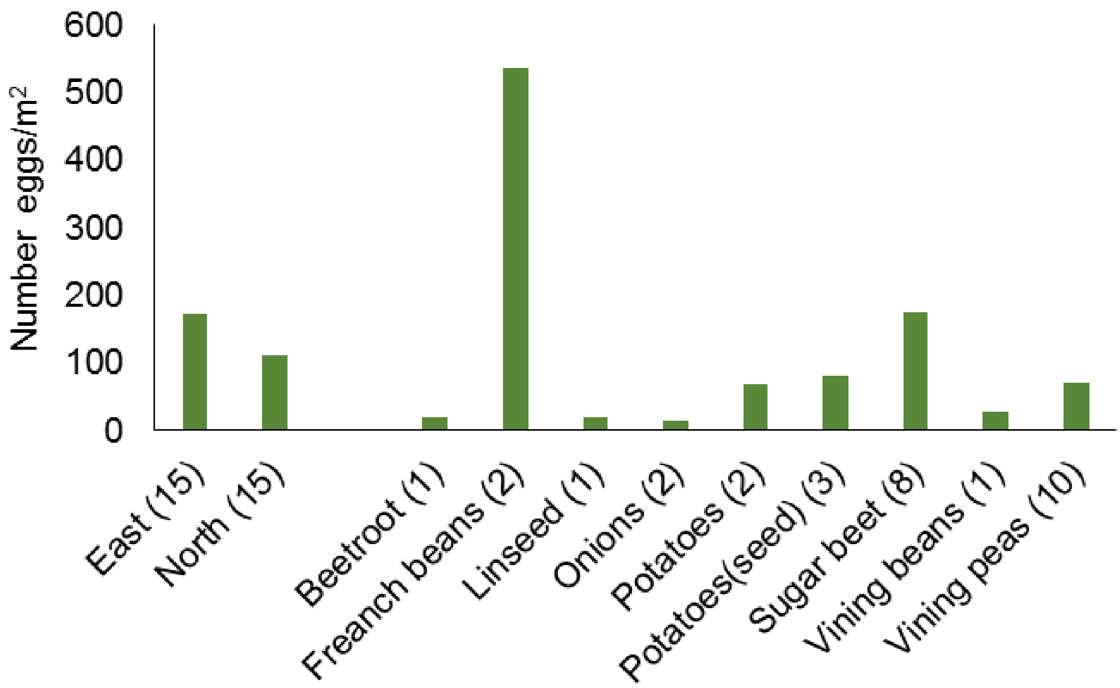

Figure 2. Average egg counts by region and previous crop in autumn 2019 (number of sites in brackets).

4.1. Eastern England

The mean egg number was 173 eggs/m² for sites sampled in eastern England. This is the third highest count since 2010 with higher numbers of eggs recorded in 2011 (179/m^2) and 2010 (309/m^2). However it should be noted that this result is heavily influenced by two very high counts of 1000 and 850 eggs/m^2 in Norfolk and a high count of 404 eggs/m^2 in Cambridgeshire. All the remaining twelve sites had counts of less than 69 eggs/m^2. It was also interesting that the eight samples taken from organic soils had a much higher mean egg count (306/m^2) than the seven samples from mineral soils (21/m^2). The three highest egg counts in the eastern region were all recorded in organic soils. Therefore, the potential for WBF damage in eastern England in organic soils is greater than in mineral soils although the two very high and one high counts again have a significant impact on the mean egg count for organic soils.

Overall the risk to crops sown at a conventional timing (before November) is still relatively low with three sites (20%) with egg numbers above the 250 eggs/m^2 threshold. However, late-sown crops (November onwards) which are likely to have few tillers at the time of egg hatch, could still be at risk from lower egg numbers.

The highest egg counts of 1000 eggs/m^2 was after French beans in Norfolk, the second highest of 850 eggs/m^2 was after sugar beet in Norfolk and the third highest of 404 eggs/m^2 was after sugar beet in Cambridgeshire. In total 12 of the 15 sites sampled (80%) had egg numbers lower than 100 eggs/m^2. French beans had the highest mean number of eggs of all crops sampled (535 eggs/m^2, Table 3). This value was heavily influenced by the very high counts discussed above. Sugar beet had the next highest count of 175 eggs/m^2 and this was also heavily influenced by a high count of 404 eggs/m^2.

Table 3. Mean eggs/m² and preceding crops in eastern England in autumn 2020 (range in brackets).

Preceding crop	Number of fields sampled	Mean number of eggs per m²
Beetroot	1	21
French beans	2	535
Linseed	1	21
Onions	2	14
Potatoes	1	55
Sugar beet	8	175
Mean egg count		173 (0–1000)

In eastern England, two of the sampled fields were in the very high risk category (13%) and one in the high risk category (7%, Table 4). The remaining 12 sites were all in the low category (80%).

Table 4. Infestation categories and preceding crops in eastern England in autumn 2019.

Preceding 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)
Beetroot	1	0	0	0
French beans	1	0	0	1
Linseed	1	0	0	0
Onions	2	0	0	0
Potatoes	1	0	0	0
Sugar beet	6	0	1	1
Total	12	0	1	2
% of fields by infestation category	80	0	7	13

4.2. Northern England

The mean egg number was 111 eggs/m² for northern England (Table 5). The highest egg population of 148 eggs/m² was recorded in East Yorkshire after vining peas. The highest overall risk was also after potatoes and seed potatoes with 80 eggs/m^2 although only one seed potato crop was sampled.

Table 5. Numbers of eggs/m² and preceding crops in northern England in autumn 2020 (range in brackets).

Preceding crop	Number of fields sampled	Mean number of eggs per m²
Potatoes	1	80
Potatoes (seed)	3	80
Vining beans	1	43
Vining peas	10	70
Mean egg count		111 (31–148)

In northern England none of the sampled fields was in the very high risk or high risk categories, four were in the moderate category (27%) and 11 in the low risk category (73%, Table 6). Overall, four fields (27%) were in risk categories of moderate or above, which is lower than recorded in 2018 (33%), 2015: (87%), 2014: (53%), 2013: (40%), 2011: (60%), 2010: (60%) and 2009: (47%). This represents a low risk to crops sown after November.

Table 6. Infestation categories and preceding crops in northern England in autumn 2020.

Preceding 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)
Potatoes	1	0	0	0
Potatoes (seed)	2	1	0	0
Vining beans	1	0	0	
Vining peas	7	3	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 winter wheat crops drilled in September and October. Egg numbers above 100 eggs/m² justify the use of seed treatment on the late-drilled crops of winter wheat or barley sown from November onwards.

5.1. Early sown crops (September/October)

In 2020, only three of the fields sampled (10%) were over the 250 eggs/m^2 damage threshold (2.5 million eggs/ha) for crops sown in September or October. The overall risk has been equal to or lower than this in 14 other years since monitoring began in 1984. As in recent years it is possible that this is due to a low level of saprophytic fungi in the wheat ears which provide food for wheat bulb fly adults. The level of fungi in the ears is likely to be influenced by whether the harvest was early or late. If wet weather delays the harvest this would provide the environmental conditions and the time necessary for the development of saprophytic fungi. The 2020 wheat harvest was for the most part relatively straightforward and progress was in line with the early harvests of recent years. As a result there was little time and insufficient moisture for fungal development in wheat ears. With a limited food supply WBF adults will produce fewer eggs than in a season in which their food is plentiful.

Mean egg numbers in the east were 173 eggs/m^2 in the north they were 111 eggs/m^2. This result was heavily influenced by two very high counts of 1000 eggs/m^2 and 850 eggs/m^2 after French beans and sugar beet and a high count of 404 eggs/m^2 after sugar beet in the east of England.

5.2. Late-sown crops (November onwards)

Late-sown (November onwards) or slow developing crops are at greater risk from WBF attack than those that are early sown (September/October) due to slower tiller development. As a result, a lower threshold of 100 eggs/m^2 or 1 million eggs/ha is applicable for these crops. In the east of England 20% of monitored fields were above this level and in the north 27% of fields were above this level. All fields in the moderate infestation category or above would benefit from a seed treatment if sown after November. Where egg numbers are high or very high then some WBF damage might be expected.

A summary of control strategies for WBF in relation to egg numbers and sowing date is given in Table 7.

Table 7. Wheat bulb fly egg numbers that would justify a seed treatment in crops sown between September and March.

Risk category	Sowing date		
	Sep–Oct	Nov–Dec	Jan–Mar
Low (<100 eggs/m^2)	Economic damage unlikely; no treatment	Economic damage unlikely; no treatment	Seed treatment
Moderate (100–249 eggs/m^2)	Economic damage unlikely; no treatment	Seed treatment	Seed treatment
High (250–500 eggs/m^2)	No available treatment	Seed treatment	Seed treatment
Very high (>500 eggs/m^2)	No available treatment	Seed treatment	Seed treatment

5.3. Chemical control

Seed treatment (Cypermethrin, Signal 300 ES) 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 WBF. The label treatment claim for this product is for a 'reduction of wheat bulb fly'. Treated seed should be drilled at a recommended maximum depth of 4 cm in a firm, even seedbed. It is important to note that seed treatments may not be sufficiently persistent to fully protect crops sown in September or October.

If plants are well-tillered by the time that WBF larvae hatch between January and March, it is possible that they will be able to tolerate some pest attack.

5.4. Non-chemical control

With the loss of chlorpyrifos egg hatch sprays non-chemical control of WBF is becoming increasingly important, particularly for those crops sown before November for which seed treatments will have limited efficacy. Seed treatment is the only chemical control option currently available for WBF and these are only effective for crops sown after November. As only a small proportion of wheat crops are sown after this date alternative control strategies are urgently required for this pest.

The impact of WBF can be reduced by sowing early and increasing the seed rate. This is likely to result in a more robust crop which is well tillered before the start of WBF egg hatch and so can tolerate and compensate for larval invasion. Taking account of crop tolerance is fundamental to improving pest risk assessment and achieving a rational approach to pesticide use which is cost effective and minimises the impact on the environment and the potential for the development of resistance (Ellis *et al*., 2009). This approach was the subject of an AHDB Cereals & Oilseeds funded project entitled ‘Crop management guidelines for minimising wheat yield losses from wheat bulb fly’ (21120032) (Storer et al, 2018). A WBF threshold scheme was developed that used information from the autumn survey of WBF incidence in September, egg viability, the maximum shoot number the crop could achieve by late winter, and the number of shoots that a single WBF larvae could destroy. This model showed that typical variation in the maximum shoot number had a large effect on the chance of yield loss because well grown crops produce excess shoots which can be sacrificed without affecting yield. A model of shoot production was developed based on thermal time and plant population that was embedded within the WBF threshold scheme. This was done to allow a prediction of yield loss from WBF to be made in time for decisions about sowing date and seed rate. A review of literature showed that most WBF mortality occurs in the larval stage between egg hatch and plant invasion. The lowest level of mortality recorded was 56% and this value was used to help calculate the numbers of shoots likely to be lost to the pest. The literature also suggested that the number of shoots destroyed by an individual WBF larva was typically four. Independent tests showed the shoot production model performed reasonably well, but it should be recognised that it does not deal with site specific factors that may limit tillering (e.g. soil capping). Some field experiments were deliberately done at sites which historically have been at high risk of WBF damage, however there was insufficient pest pressure against which to effectively test the threshold scheme due to nationally low levels of pest oviposition. The project has developed prototype guidelines summarising how sowing date and plant population should be adjusted, and insecticide seed treatments targeted, for different WBF risk situations. .

In order for the threshold scheme described above to be adopted, a more reliable and up-to-date estimate of the minimum final ear number required for high yielding wheat crops was considered necessary. This was the subject of a desk study (Storer et. al, 2019) which investigated whether the minimum final ear number changes in different regions and under different environmental conditions. A positive association between yield and final ear number was identified for UK wheat crops. For crops expected to yield up to 11 t/ha, a target final ear number of 500 ears/m^2 was deemed a conservative default value. For crops expected to exceed 11 t/ha, a higher target final ear number of 600 ears/m^2 was deemed appropriate. Although there was evidence that the ear number associated with specific yields may vary between varieties and geographic regions, it was not strong enough to recommend its inclusion in the threshold scheme. Before the scheme can be adopted, further research is necessary. In particular, it is important to quantify varietal differences in relation to shoot number at growth stage 31 and final ear number. Despite this, significant steps have been made in developing a control strategy to help combat WBF in the absence of chemical control.

The primary method for risk determination for WBF is soil sampling, egg extraction, and egg counting. This process is labour-intensive and requires the use of bulky extraction equipment and taxonomic expertise for egg identification, and so can only be undertaken by a specialised laboratory. Soil sampling is effective but laborious and often too late to influence decisions for winter wheat crops. Objective 3 of the current project is 'To test the Young and Cochrane model for prediction of WBF risk using historic met data and that for autumn 2019-21'

The WBF risk prediction model was developed by Young & Cochrane in 1993. This model uses January air temperature, January soil temperature, July air temperature, and rainfall during the preceding October to predict wheat bulb fly egg density, with a reported predictive power (accuracy) of 59%. In objective 3 of the current study, the effectiveness of the Young & Cochrane model was tested by using it to predict WBF risk from 2005 – 2019. Model predictions were then compared with the results of the 2005 – 2019 AHDB WBF surveys. Following this, an updated risk prediction model was developed by combining the 2005 – 2019 data with the original 1952 – 1991 data included in the Young & Cochrane model and by incorporating a wider range of meteorological parameters. This updated model has a predictive power of 70%, an 11% increase when compared with the original Young & Cochrane model and uses the following meteorological parameters to predict wheat bulb fly risk: preceding September sun days, preceding October rain days, January mean temperature, January frost, April maximum temperature, May maximum temperature, April rainfall, and July minimum temperature. Improving the predictive power of decision support models is likely to increase the confidence in their findings, and therefore uptake by farmers and agronomists. This updated risk prediction model will provide an additional component to a potential IPM strategy for the pest.

The potential to estimate WBF prevalence using water trapping, rather than laborious egg counts from soil samples, was assessed by reviewing literature and testing at 12 sites (Storer et al., 2018). The literature on this topic demonstrated that this approach should work, however the field tests were inconclusive due to low WBF egg levels in the seasons of testing. The AHDB Cereals and oilseeds funded PhD ‘Enhancing management of wheat bulb fly via the use of lure and kill and assessment of egg numbers RD-2007-3361’ developed a real time PCR assay to determine WBF risk as an alternative to large scale soil sampling. The technique uses a much smaller soil sample than is required for traditional egg counts and was able to show good correlation between mean quantity of WBF DNA and WBF eggs/m^2 (R^2 =0.997). A reduction in soil sample size shows a significant advantage over the current soil sampling methodology. The final objective of this project is to validate PCR methodology on English soil samples taken from those sites selected for the autumn survey of WBF incidence. This work is collaborative with SRUC in Scotland.

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Appendix A

Egg populations ranked in descending order for 15 fields sampled in eastern England in autumn 2020

County	Previous crop	Number of eggs (number/m^2)	Soil type	Risk category
Norfolk	French beans	1000	Organic	Very high
Norfolk	Sugar beet	850	Organic	Very high
Cambridgeshire	Sugar beet	404	Organic	High
Cambridgeshire	French beans	69	Organic	Low
Norfolk	Sugar beet	69	Mineral	Low
Cambridgeshire	Potatoes	55	Organic	Low
Cambridgeshire	Sugar beet	27	Organic	Low
Norfolk	Sugar beet	27	Mineral	Low
Cambridgeshire	Beetroot	21	Mineral	Low
Cambridgeshire	Linseed	21	Organic	Low
Cambridgeshire	Onions	21	Organic	Low
Norfolk	Sugar beet	14	Mineral	Low
Cambridgeshire	Onions	7	Mineral	Low
Cambridgeshire	Onions	7	Mineral	Low
Norfolk	Sugar beet	0	Mineral	Low
Mean		173		

Appendix B

Egg populations ranked in descending order for 15 fields sampled in northern England in autumn 2020

County	Previous crop	Number of eggs (number/m²)	Risk category
East Yorkshire	Vining peas	148	Moderate
North Yorkshire	Vining peas	130	Moderate
North Yorkshire	Seed potatoes	105	Moderate
North Yorkshire	Vining peas	105	Moderate
East Yorkshire	Potatoes	80	Low
East Yorkshire	Seed potatoes	68	Low
East Yorkshire	Seed potatoes	68	Low
North Yorkshire	Vining peas	68	Low
East Yorkshire	Vining peas	56	Low
East Yorkshire	Vining peas	49	Low
East Yorkshire	Vining beans	43	Low
East Yorkshire	Vining peas	43	Low
East Yorkshire	Vining peas	37	Low
East Yorkshire	Vining peas	31	Low
East Yorkshire	Vining peas	31	Low
Mean		111	