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Cabbage Stem Flea Beetle Live Incidence and Severity Monitoring Autumn 2016 and Spring 2017

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1. Abstract

Autumn 2016 was the third year where neonicotinoid seed treatments were not available for use on oilseed rape crops (although in 2015 there was a derogation allowing use on high risk crops in part of the Eastern region). In order to understand the levels of cabbage stem flea beetle (CSFB; *Psylliodes chrysocephala*) damage in oilseed rape crops, a live monitoring survey of adult CSFB damage was conducted in 34 counties across England and Scotland, no data were provided for Wales as the winter oilseed rape area was very low. This is the third such survey, with previous surveys conducted in autumn 2014 and autumn 2015. Data for the survey were collected using a network of Association of Independent Crop Consultants (AICC) agronomists, and each agronomist was provided with a questionnaire template based on the CSFB treatment thresholds set out by AHDB Cereals & Oilseeds in Information Sheet 55. Agronomists were asked to report oilseed rape crop damage and loss as a result of CSFB once 75% of their crops had reached the cotyledon- two leaf growth stage (assessment 1), again when 75% were at the three-four leaf growth stages (assessment 2) and in the spring to account for over winter losses (assessment 3). A total of 48,700 ha of oilseed rape was assessed in this survey, which equates to about 8% of the forecast UK winter oilseed rape area for 2016/17. At assessment 1 there were 29% of assessed crops that had damage levels that exceeded the spray threshold (25% of leaf lost), whilst at assessment 2 there were 6% of assessed crops that had damage levels exceeding the spray threshold (50% leaf lost). At the end of assessment 3, it was estimated that 1.2% of assessed crops did not survive the winter due to CSFB damage, with an additional 2.6% of assessed crops not surviving the winter due to other causes such as dry soils and slugs.

Autumn 2016 had below average rainfall in most regions with parts of the Eastern region in particular suffering from high soil moisture deficits. The dry soils meant that where oilseed rape crops were planted, a proportion (approximately 2-3%) failed to germinate, and those that did were often slow to grow and therefore were susceptible to grazing from CSFB and slugs. It is estimated that by the end of the assessment period 3 (end of March) 4,200 ha of winter oilseed rape crops in the assessment area had failed due to CSFB (9% of the assessed planted area) with a further 4,400 ha lost due to other causes (slugs, dry soils during establishment, pigeons and waterlogging). Of the crops that were lost, 57% of these crops failed prior to assessment 1, with an additional 21% failing before assessment 2 with the remainder failing over winter prior to assessment 3. When weighted and scaled up to the national area it is estimated that 5.4% (equivalent to an estimated 31,000 ha) of the crop area was lost to CSFB damage, with a further 9.4% of the area lost to other causes including slugs and dry soils. In 2016, the main areas of crop loss (counties which lost >15% of assessed crops due to CSFB damage) were in Bedfordshire/Hertfordshire, Buckinghamshire, Northamptonshire and Cambridgeshire.

2. Introduction

In December 2013 neonicotinoid seed treatments were withdrawn across all EU Member States, following the conclusions of a review by the European Food Safety Authority (EFSA) which concluded that they had the potential to pose a risk to bees. In autumn 2015 Emergency Use Authorisations for Modesto and Cruiser seed treatments were agreed, allowing the use of these neonicotinoid seed treatments on up to 5% of the total winter oilseed rape crop, but only in counties that were deemed to have been at high risk of CSFB damage in the previous year – Bedfordshire, Cambridgeshire, Hertfordshire and Suffolk. In addition there was an approval for the use of the foliar spray Insyst (acetamiprid) against CSFB up until 25th November 2015. In 2016 there were no emergency authorisations for either the seed treatments or foliar acetamiprid applications, therefore farmers were limited to foliar pyrethroids for control. Some growers also reported using methiocarb seed treatments and foliar applications of thiacloprid to provide chemical control of CSFB despite these not being supported on the product label. Where possible non-chemical control options were also used.

Since autumn 2014, adult damage surveys have been conducted to assess the level of leaf damage observed at two growth stages cotyledon–2 leaves and at 3–4 true leaves. In this survey, a third assessment (assessment 3) was carried out by agronomists in February-March to assess over winter losses due to CSFB as well as other factors such as pigeons, slug damage and dry soils. These surveys were carried out by AICC agronomists based on the areas that they walk and then analysed by ADAS on behalf of AHDB Cereals & Oilseeds. The surveys were conducted across the country with data collected from regions where CSFB is active and less active to give an overall national picture of the level of damage. This report summarises the results of the 2016 adult damage survey.

Aim: To provide detailed and structured evidence on the level of CSFB damage on winter oilseed rape crops in 2016 without the availability of a neonicotinoid seed treatment, providing a third year of data to add to that collected by ADAS in 2014 and 2015. This project also included a winter survival assessment conducted by March 2016 in order to identify those crops that failed later in the season as a result of early damage, this assessment had not been conducted in 2014 and 2015.

3. Materials and methods

3.1. Data collection

Data were collected using a network of Association of Independent Crop Consultants (AICC) agronomists. Agronomist recruitment was conducted by AICC. The aim was to get a good distribution of agronomists with more reporting from regions with larger areas of oilseed rape, and fewer from areas with small areas of oilseed rape. In this way the oilseed rape area across the country was proportionally represented. A total of 47 agronomists were used (44 in England, 3 in Scotland) to cover 34 counties, which was equivalent to 8% of the total UK winter oilseed rape area. No data was gathered from Wales due to the small area grown.

Data Reporting

Each agronomist was provided with a questionnaire template based on the CSFB treatment thresholds set out by AHDB Cereals & Oilseeds in Information Sheet 55, and largely consistent with the format of the questionnaire used in 2014 and 2015 (minor improvements were made following feedback). In order to better monitor the impact of CSFB at the key control threshold growth stages, agronomists were asked to report oilseed rape crop damage and loss as a result of CSFB once 75% of their crops had reached the cotyledon- two leaf growth stage (assessment 1) and once again when 75% of their crop had reached the three-four leaf growth stage (assessment 2). Agronomists also provided information on the proportion of assessed crops lost over winter due to CSFB and other causes such as pigeons and slugs (assessment 3). Agronomists reported on the area of winter oilseed rape crops that they walk. If agronomists were walking crops in more than one county they were asked to report on each county separately to allow allocation of damage to the appropriate location. Damage assessments were completed by estimating what proportion of the crop area walked fell into each of the damage categories, using the standard approach that each agronomist takes to calculate thresholds in order to make spray decisions. Damage was classified into five categories; no damage, low (less than 24% leaf area lost), moderate (25-49% leaf area lost), high (50-75% leaf area lost) and severe (more than 75% of the leaf area lost).

The questionnaire was separated into the following key sections:

1. *County details*- county name, area (ha) being assessed, proportion of conventional vs hybrid seed
2. *CSFB damage at the cotyledon- two leaf stage (assessment 1)* - percentage crop damage in each of the above categories and percentage of crops abandoned due to CSFB damage or other causes.
3. *CSFB damage at the three-four leaf stage (assessment 2)* - percentage crop damage in each of the above categories and percentage of crops abandoned due to CSFB damage in each category and percentage lost to other causes.
4. *Crops re-drilled*- what proportion of crops were re-drilled as oilseed rape vs other crops,
5. *Treatments in the county before four true leaves*- number of insecticide sprays applied, product and dose rate of any sprays applied, proportion of the crop receiving foliar application of thiacloprid or methiocarb.
6. *Observations of susceptibility to CSFB damage*- in particular focusing on drilling date, soil type, weather, seed treatments, other.
7. *Winter survival (assessment 3)* - section to be completed in spring 2017.

The full questionnaire can be found in Appendix 1.

3.2. Data Analysis

Data from each agronomist was collated and analysed in MS Excel. In order to calculate the county level impacts the data from each agronomist reporting in that county were combined to calculate the total area of crop assessed in that county in each of the damage categories. The percentage of the total area at each damage level was calculated and this was assumed to represent the percentage area of the county winter oilseed rape area in each of the categories. This effectively weighted the data from each agronomist, therefore the larger the area covered by the agronomist, the larger the impact their assessment would have on the total figure for the county.

In order to calculate the regional and national impacts, the county level impacts were weighted according to the area of winter oilseed rape grown in the county. The AHDB Cereals & Oilseeds Winter Planting Survey (2016) forecasted a 2% reduction in the English oilseed rape area compared to that recorded in the AHDB Planting Survey (2015) and 1% less than the English oilseed rape area harvested in 2016 (Defra, 2016). Regional and county level breakdowns of crop areas were based on Defra regional area estimates for harvest 2016 and ADAS estimates of the proportion of the regional area in each county, which were then aligned with the AHDB Winter Planting Survey 2016. These country level crop areas were used, where relevant, to scale up the assessment results to a national area. It should be noted that although efforts were taken to get a

representative sample across the country, there was some bias in receiving more information from the eastern side of the country than the west, so when the assessment figures are weighted and scaled up the scale of impact is slightly altered at a national level.

All figures are presented as percentage of total UK oilseed rape area, or percentage of regional or county area affected, with percentages presented as rounded figures to one decimal place.

However, where area of crop affected has been calculated this was done using the raw data and was rounded to the nearest 1000 ha. Therefore, due to rounding errors a back calculation of the percentage against the UK oilseed rape area may not calculate the exact same crop area. Full county figures can be found in Appendix 2. The methodology used in 2016 is directly comparable with that used in 2015, but not that used in 2014 as the 2015 and 2016 assessment was done as crops reached specific growth stages whilst the 2014 assessment was done on a single date with crops at a range of growth stages.

3.3. Caveats to approach

This approach used 47 different agronomists to provide farm scale data. Therefore, there is a risk of observer bias and differences in approach to the challenge of measuring damage. This was minimised by using the same reporters, where possible, as used in previous years. The other area of bias potentially comes from the agronomist's location within a county and the way they manage their farms. Each agronomist was reporting on the crops that they walk, and therefore if there was a management practice in place on their farms that either promoted or reduced CSFB populations this could distort the results. Or if a significant proportion of their area was concentrated in a part of the county they represented, that happened to have a low or high population of CSFB, this could also lead to some distortion of results. However, by aiming to select multiple agronomists from counties with large areas of oilseed rape the aim was to minimise the impact of this distortion in the weighted figures. Therefore, the regional and national level figures are more reliable, due to the increased number of data points included, than the county level figures which should be treated with some caution.

It was not always easy to distinguish the main cause of crop damage or losses when multiple pests were present in a crop, e.g. CSFB and slugs. Therefore, agronomists had to make an informed judgement as the main cause of damage in each particular field.

4. Results

4.1. National incidence and severity of CSFB damage

It is estimated that the total planted UK winter oilseed rape area for 2017 was 575,000 ha (AHDB Winter Planting Survey + ADAS estimate for Scotland). The agronomists assessed a combined area of approximately 49,000 ha accounting for approximately 8% of the national winter oilseed rape area. For clarity of reporting, the levels of damage have been categorised as shown in Table 1.

Table 1. Categories of damage as referred to in the results sections and the point where the threshold for spray applications comes into effect

Level of damage	Category	Threshold for spraying
No damage	No damage	Below threshold
<24% of leaf area lost	Low	Below threshold
25-49% of leaf area lost	Moderate	Cotyledon–2 true leaf
50-75% of leaf area lost	High	Cotyledon–4 true leaves
>75% of leaf area lost	Severe	Cotyledon–4 true leaves

4.1.1. Assessment 1 - cotyledon to 2 true leaf

Cabbage stem flea beetle (CSFB) damage was present on just over 73.5% of assessed crops (36,000 ha) at assessment 1. The treatment threshold for CSFB at the cotyledon stage is 25% or more leaf area damaged (moderate up to severe) or where the crop is growing slower than it is being destroyed. There were 28.6% of crops assessed that had damage that exceeded threshold at assessment 1. Of the area assessed there were approximately 16.4% of crops that had moderate damage, 8.1% high levels of damage, with 4.2% of crops suffering severe damage (Table 2).

Crop losses in autumn 2016 occurred as a result of a combination of low rainfall, CSFBs and slugs. The combination of these factors meant that it was difficult for agronomists to identify just what proportion of crops were lost because of CSFB damage. However, it is estimated that 5.6% of the assessed area was lost predominantly due to CSFB damage, with the majority of crop losses coming from crops with high or severe levels of damage.

Table 2. Proportion of crops in each damage category (level of damage & crop losses) – Assessment 1

	No damage	Low	Moderate	High	Severe
Assessed crops – damage levels	26.5%	44.9%	16.4%	8.1%	4.2%
Assessed crops % crop losses to CSFB	0.0%	0.0%	0.6%	2.6%	2.3%
National level – damage levels	34.1%	39.7%	13.7%	7.1%	3.9%
National level % crop losses to CSFB	0.0%	0.0%	0.4%	0.9%	2.0%

When weighted and scaled up to the national level it is estimated that there was 24.8% of the area or just under 142,300 ha of crop with damage above threshold. The main regions suffering damage above threshold levels were Yorkshire, the East Midlands, Eastern region, the South West and South East as shown in Figure 1. Note this chart shows the proportion of the regional area in each category of damage at this assessment timing. The Eastern region and East Midlands have larger areas of winter oilseed rape than any of the other regions at just over 130,000 ha each, compared to just under 80,000 ha in the next largest region the South East.

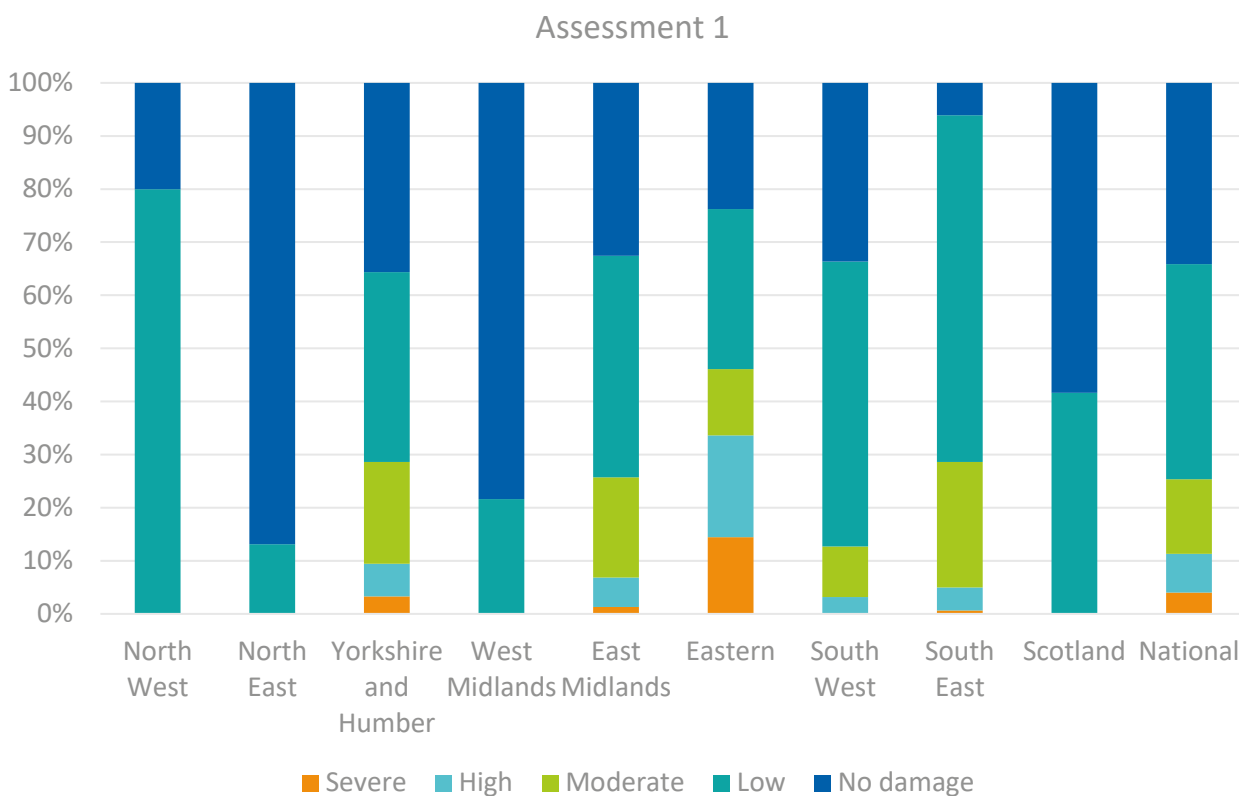


Figure 1. Proportion of regional crop area affected by different levels of CSFB damage at assessment 1. Note Spray threshold at this assessment timing is moderate damage.

It is estimated that 3.3% of the national area of winter oilseed rape was lost predominately to CSFB by assessment 1. An additional 5.9% of the area planted was lost by this assessment to other causes with the main cause of loss being the dry soil conditions causing poor establishment especially where crop losses occurred in the East Midlands, Eastern Region and South East, this was compounded by CSFB and other pest damage e.g. from slugs, making assessment of crop losses to CSFB rather subjective. Slug damage was cited as the main cause= of crop losses in West Midlands, parts of the East Midlands, and Yorkshire.

4.1.2. Assessment 2 – three to four true leaves

At 3–4 true leaves there were 66.3% of assessed crops that showed CSFB damage, however only 6% of assessed crop had damage that exceeded the 3-4 leaf spray threshold (high or severe damage).

The area abandoned due to CSFB damage increased by a further 1.7% of the assessed area, bringing the estimated area of crop lost, predominately due to CSFB, to 7.3% of the assessed area. The main areas of crop losses were in the Eastern region and East Midlands, specifically Bedfordshire, Northamptonshire and Buckinghamshire. Other crop losses (due predominantly to slugs and dry soils) increased by 2.0% at this assessment, bringing the total crop losses from other factors to 6.5%.

When added together the overall crop losses by the end of assessment 2 to CSFB and other factors (e.g. slug damage, pigeon damage, dry soils and poor crop establishment) was 13.8% of the assessed area.

Agronomist and expert comments suggest the use of insecticidal sprays between assessment 1 and 2 could explain why the high to severe categories have reduced, with crops able to grow away from earlier damage.

Table 3. Proportion of crops in each damage category (level of damage & crop losses) – Assessment 2

	No damage	Low	Moderate	High	Severe
Assessed crops – damage levels	23.6%	46.9%	13.5%	4.7%	1.3%
Assessed crops % crop losses to CSFB	0.0%	0.0%	0.4%	0.4%	0.9%
National level – damage levels	28.1%	42.4%	12.6%	4.1%	1.2%
National level % crop losses to CSFB	0.0%	0.0%	0.2%	0.2%	0.8%

When weighted and scaled up to the national level it is estimated that there was 5.4% of the area equivalent to 31,000 ha of crop with damage above threshold. As with assessment 1, the main regions with damage above threshold were Yorkshire, the East Midlands, Eastern Region, South West and South East (Figure 2).

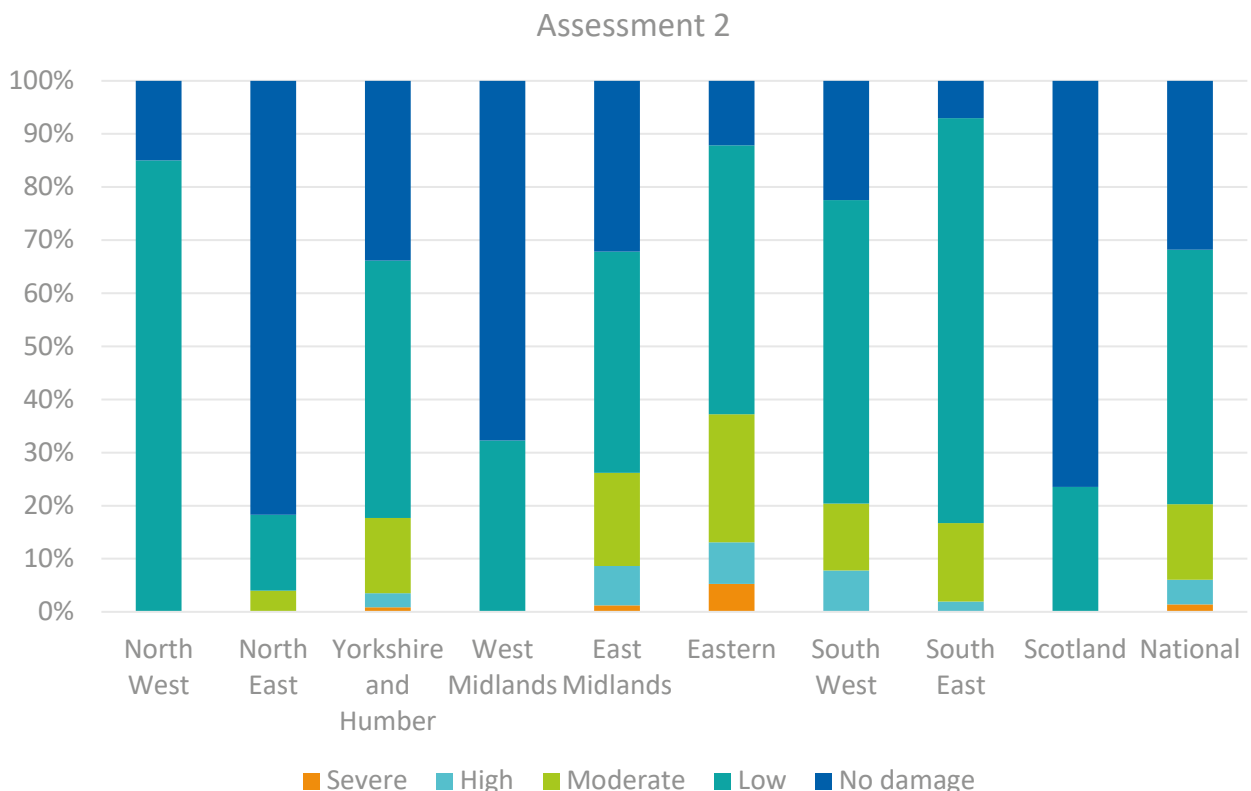


Figure 2. Proportion of regional crop area affected by different levels of CSFB damage at assessment 2. Note spray threshold at this assessment timing is high damage.

An additional 1.2% of the national area was lost due to CSFB (total losses from CSFB at assessment 1 and 2 were equivalent to 4.6% of national area). Overall it was estimated that 12.0% (including the losses to CSFB) of the national area was abandoned prior to assessment 2, the causes of the additional losses were similar to the first assessment with dry soils in the east and slugs in the west affecting crop survival. Figure 3 summarises the total crop losses (combination of assessment 1 and assessment 2) and the regions in which they have occurred.

By assessment 2 the Eastern region, Yorkshire and Humber and the East Midlands had the highest proportion of assessed crops with severe damage, with 18,000 ha nationally in the Eastern region suffering from severe damage, 2,400 ha in Yorkshire and Humber and 1,800 ha in the East. Crop losses were highest in the Eastern region (~12,000 ha lost), with losses also in the East Midlands (~3,000 ha), South East (~2,400 ha) and Yorkshire and Humber (~1,700 ha).

In terms of losses to other causes, the region with the highest area lost was the Eastern region (~175,000 ha), followed by the South East (~8,400 ha) and the East Midlands (4,600 ha).

In the Eastern region in particular agronomists struggled to separate the impacts of weather and CSFB damage and therefore the other losses also include a proportion of crops (<1%) that were lost due to a combination of factors such as pest damage, moisture stress and well as some CSFB activity.

4.1.3. Assessment 3 – Over winter survival of oilseed rape crops

At assessment 3 there were an additional 1.3% (equivalent to 642 ha) of assessed crops that did not survive the winter due to CSFB damage, and these were in the East Midlands (in particular Leicestershire, Lincolnshire and Northamptonshire), the Eastern Region (Bedfordshire and Cambridgeshire), South East (Berkshire and East Sussex) and Yorkshire (North and East). Of this percentage, an estimated 26% (168 ha) were the crops that were re-drilled with oilseed rape in the autumn/winter in response to initial crop failing due to dry seedbeds, CSFB damage or damage from other pests such as slugs.

At the end of March approximately 2.7% of the assessed crops (~1,300 ha) remained at questionable viability, although the decision had been made not to abandon the crop at this stage. This affected crops in the East Midlands (Lincolnshire and Northamptonshire), Eastern region (Bedfordshire, Cambridgeshire and Hertfordshire), South East (Berkshire), South West (Wiltshire) and Yorkshire (East and North Yorkshire), with the largest area of questionable viability being in Northamptonshire (~1,100 ha) due to a combination of slugs, pigeon damage and plant damage from waterlogging.

When weighted and scaled up to the national level, it is estimated that 0.8% of the oilseed rape area (~4,400 ha of crops) was lost between assessment 2 and assessment 3 due to CSFB

damage over winter, with 23% of these being the crops that were re-drilled. An estimated 1.6% of the national crop area was still of questionable viability by end of March, equivalent to 9,000 ha, although CSFB damage was not reported as a cause of poor viability in these crops.

Of the assessed crops an estimated 2.6% (~1,200 ha) was lost over winter due to other factors including pigeons and slugs. When scaled up to a national level this is equivalent to 11,600 ha or 2.0% of the national oilseed rape area.

4.1.4. Total crop losses

Overall, at assessment 1, an estimated 5.6% of assessed crops were lost due to CSFB damage, with an additional 1.7% of assessed crops lost between assessments 1 and assessment 2 and a further 1.3% of assessed crops lost over winter (assessment 3). This brings the total percentage of losses of assessed crops due to CSFB to 8.6%. This is equivalent to 4,200 ha (Figure 3). In terms of losses due to other causes such as slugs, dry soils and pigeon damage, at assessment 1 approximately 4.5% of assessed crops were lost due to other causes, with a further 2.0% lost between assessment 1 and 2 and 2.6% lost overwinter (assessment 3). This brings the total area of assessed crops lost due to other factors to 9.1% by March 2016. This is equivalent to 4,400 ha, bringing the total area of assessed crops lost to 8,600 ha.

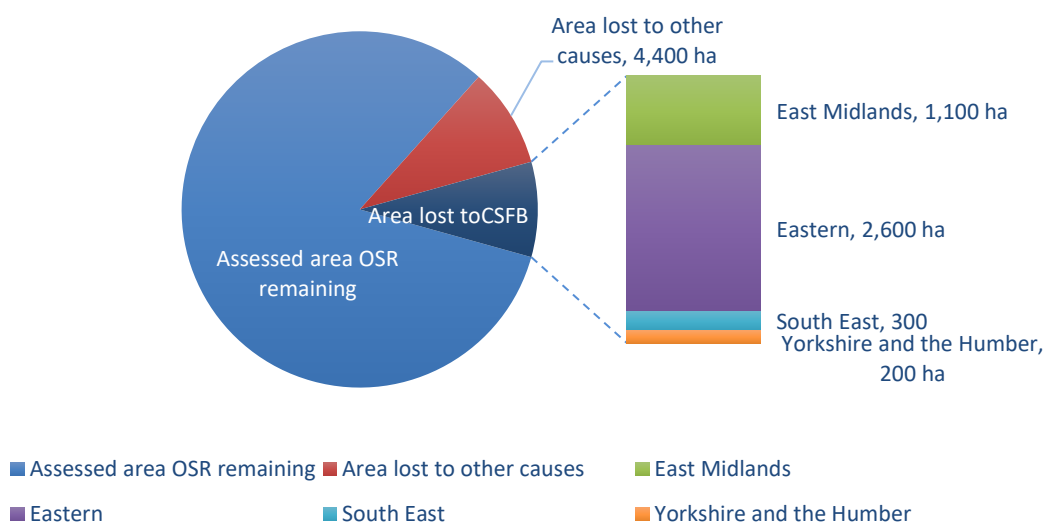


Figure 3. Proportion of crop losses (in assessed area) at the end of March due to CSFB damage and other factors (e.g. pigeons, slugs and waterlogging) compared to the total area, with the actual areas lost (ha) in the affected regions highlighted in separate bar chart

These figures were then weighted and scaled up to a national level, with the area lost due to CSFB at assessment 1 at 19,400 ha, assessment 2 at 7,000 ha and assessment 3 at 4,400 ha, totalling 30,800 ha. In terms of losses due to other causes this totalled 54,000 ha, which is made up of 33,800 ha lost at assessment 1, 8,700 ha lost at assessment 2 and 11,500 ha lost at

assessment 3. When the losses from CSFB and other causes are combined this amounts to 85,000 ha which is equivalent to 14.8% of the national oilseed rape area lost.

As can be seen from figure 4, crop losses to other causes exceeded the losses due to CSFB. There were also about 3,500 ha of crops where CSFB damage levels were low or moderate, but the crops were still written off due to CSFB damage.

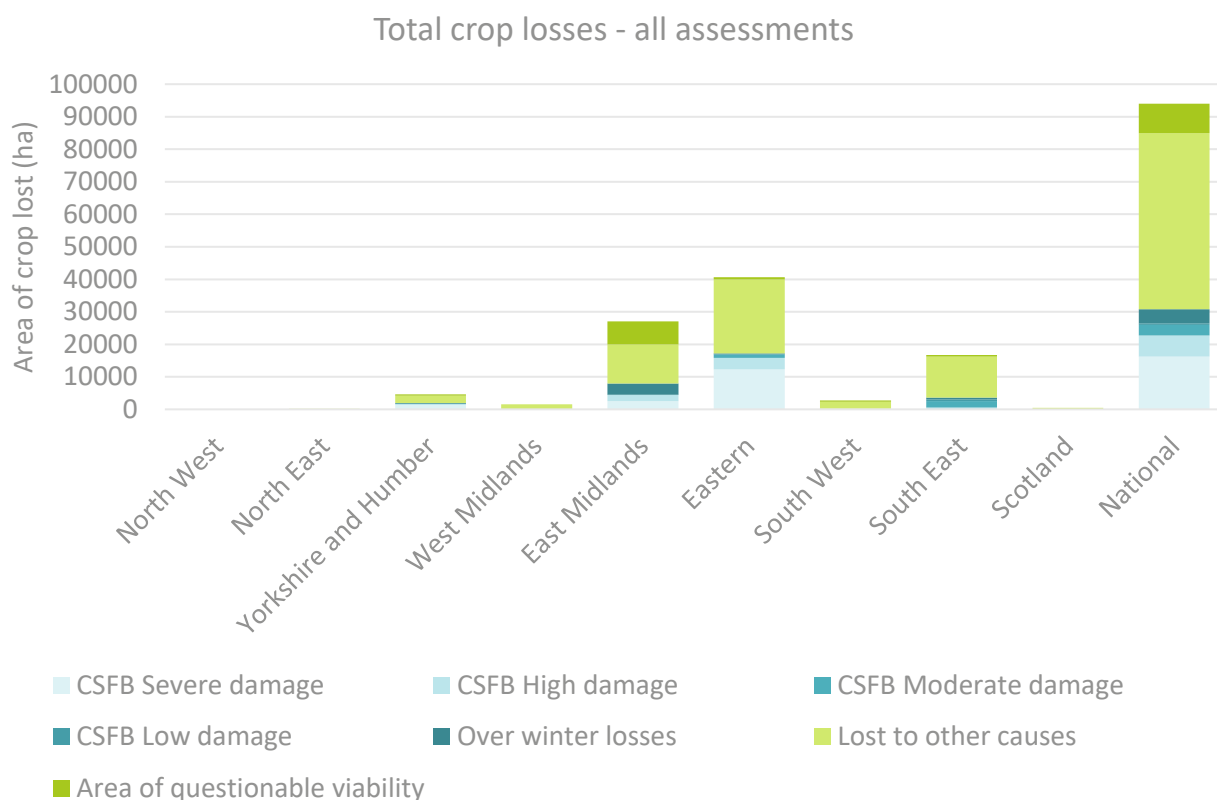


Figure 4. Estimated national - oilseed rape crop losses from planting through to end of assessment 3. CSFB losses in blue - Colours indicate the level of leaf damage at which crop was declared unviable (assessment 1&2). Crop losses and crops remaining of questionable viability due to other causes also shown in green.

4.2. Insecticide treatment of winter oilseed rape crops

Agronomists were asked to provide details of insecticide treatments that were typically being used in the areas that they had assessed, in order to put the severity of CSFB damage into context. An estimated 79% of the assessed winter oilseed rape area had been treated with at least one application of insecticide across the survey period. This is an increase of 4% compared to the total treated area in the autumn 2015 survey. The areas where treatment of crops were low (<2 pyrethroid sprays applied in the autumn) corresponded with the areas that had no or low CSFB damage. In the three counties with the highest levels of CSFB damage (Bedfordshire,

Cambridgeshire and Northamptonshire) there was also a higher usage of insecticides with crops tending to receive 3-4 foliar insecticide applications to try and maintain control of CSFB,

Only two pyrethroid actives, cypermethrin and lambda-cyhalothrin were recommended for application by the agronomists in this project. Lambda cyhalothrin was the preferred active with 93% of those using a pyrethroid selecting it as their preferred active, whilst just 7% stated they preferred cypermethrin. Lambda cyhalothrin dose rates varied between 50-75 ml/ha with most stating that they used it at a rate of 75 ml/ha, whilst cypermethrin was generally applied at a full dose rate of 250 ml/ha. In addition, there were 11% of crops that received a foliar application of thiacloprid and just 2% of the area was estimated to have been treated with a methiocarb seed treatment.

4.3. Crop susceptibility to CSFB damage

4.3.1. Soil condition and type

Soil conditions were reported as influencing level of CSFB damage. Where crops were drilled into good seed beds (having a good tilth, rolled after drilling and adequate moisture) and established quickly they were more able to withstand any damage than slow growing crops in poor cloddy, overly dry/overly wet seed beds where rolling was not carried out post drilling. Where clay seedbeds were dry and lumpy there was poor soil to seed contact and as a result emergence was negatively affected, resulting in low plant numbers and slow crop growth, again leaving them more vulnerable to CSFB damage.

Level of CSFB damage was also linked to level of soil movement prior to drilling, with less CSFB damage tending to be seen on fields where minimum cultivation practices had conserved moisture and not disturbed the soil too much. This was particularly the case in the direr regions.

4.3.2. Drilling date

In locations where CSFB damage was observed, the agronomists noted that it was the later drilled crops that tended to show high to severe levels of damage. The first signs of CSFB were reported to have been seen in crops during the first week of September. Those crops that were drilled during August and had established well, moved through the growth stages quickly meaning there were at the vulnerable early growth stages for very little time. This rapid growth meant these crops were less vulnerable to damage than their later drilled, slower growing counterparts. It was the later drilled crops, especially those that were drilled during early September, when the flea beetles were active, that were reported as having suffered greater damage as the plants were at the vulnerable growth stages for longer when grazing occurred and therefore less able to withstand the damage.

A consolidated seedbed was also considered by some agronomists, to have reduced CSFB damage compared to fields where the seedbed was not rolled after drilling and the soil was loose and open.

4.3.3. Weather

Autumn weather

The air temperatures during August to October were mild, tending to be above the seasonal average, with September temperatures often 3-5 degrees warmer than normal for the time of year across all regions.

The dry conditions during August to September were considered one of the main factors affecting susceptibility to CSFB which led to some crops establishing poorly and developing slowly leaving them more vulnerable to CSFB and other pest damage such as slugs. In the majority of crops that failed it was the dry conditions that were considered to be the main factor affecting crop survival, rather than CSFB, therefore it is not considered appropriate to allocate all crop losses to CSFB. The dry mild conditions in parts of the Eastern Region, South East and East Midlands resulted in soil moisture deficits averaging around 100-110 mm for much of September and October. This meant that soil conditions for drilling were very dry and, once drilled, crops had limited moisture available for establishment. This led to crop losses in these regions due to the dry conditions, with the Eastern region losing 18% of assessed crops due to dry soils, the East Midlands 5% of assessed crops and the South East, 12% of assessed crops.

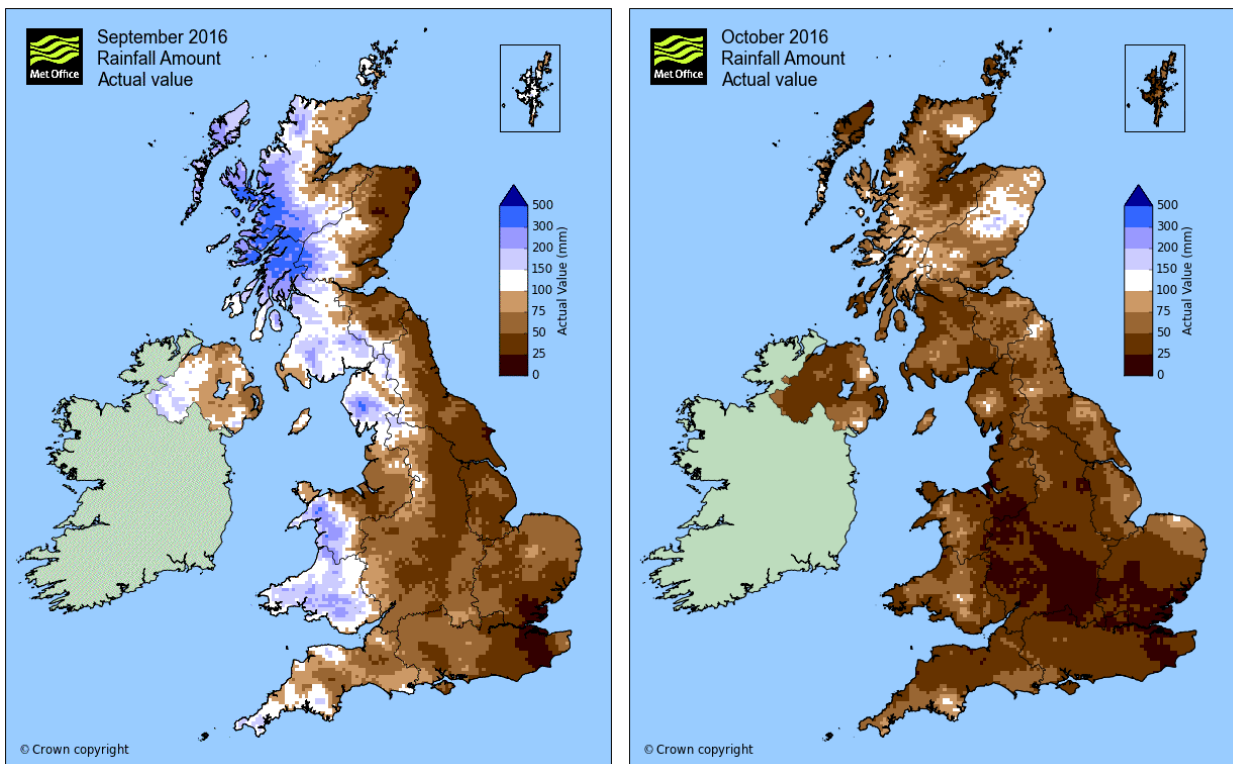


Figure 6. Actual UK rainfall for September and October 2016 showing low rainfall (less than 75mm) across most regions. *Source Met Office*

Weather between December-March (assessment 3 period)

Air temperatures were mild during December-March, averaging, 6°C in December, 4°C in January, 6°C in February and 8°C in March, temperatures tended to be 1-2 degrees above average for this period which aided crop survival (Figure 7 & 8). There were short periods of colder weather with associated frosts in late December –early January and again in late January. There were occasional overnight frosts in late February and late March, but these were generally followed by clear warm days. The winter was largely conducive to crop growth and AHDB March Crop reporting data suggests 96% of the UK oilseed rape crops (which had survived establishment) were in good condition at the end of March, with the remainder (4%) being of questionable viability. By the end of March, crop development was ahead of recent years with around 63% of crops at the green bud stage (GS 3,3), around 35% of crops at the yellow bud stage (GS 3,7) and 2.5% of crops that had the flower buds enclosed (GS 3,1).

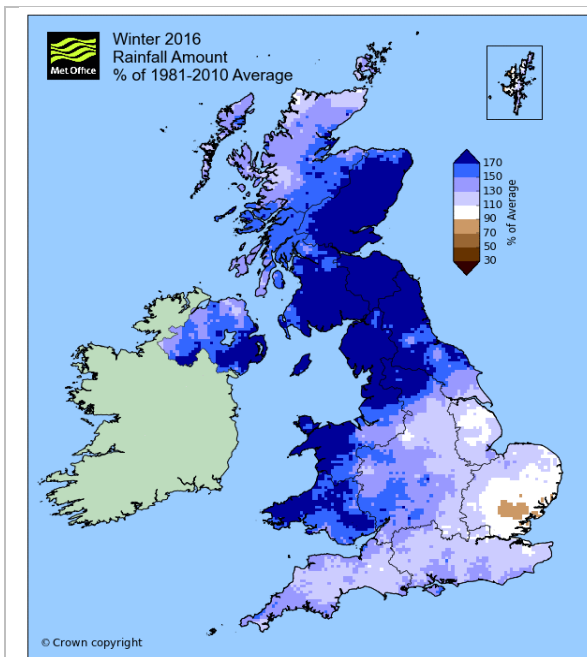


Figure 7. Winter 2016/2017 mean rainfall as % of average compared to 1981-2010 Anomaly data. Source: MET Office. White colouring= average.

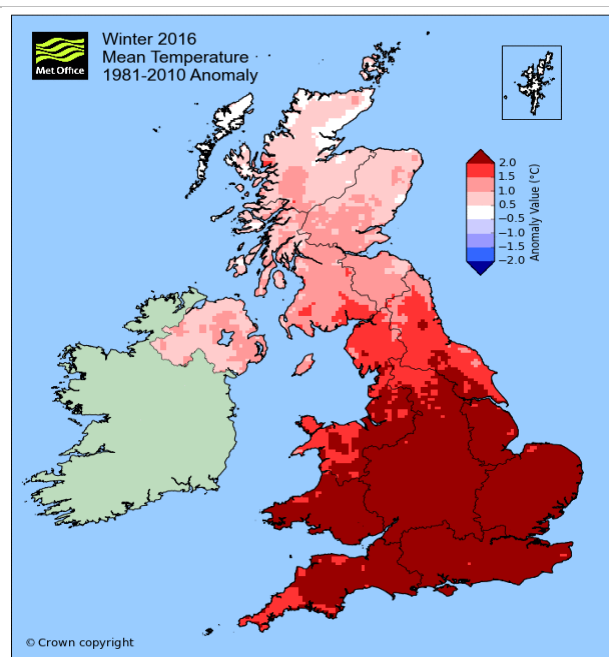


Figure 8. Winter 2016/2017 mean temperature compared to 1981-2010 Anomaly data. Source: MET Office. White colouring= average.

5. Discussion

The results from the 2016 CSFB adult damage survey indicate that CSFB damage was present on 74% of crops assessed at cotyledon stage, this is a slight increase on that seen in 2015, where damage was observed on 65% of crops at cotyledon stage. However, in both situations the level of damage varied across the country, with more severe damage observed in crops in the Eastern region, whilst further west crops rarely suffered sufficient damage to reach spray thresholds.

The cropping situations have been very different in each of the years where adult damage surveys were completed. In autumn 2016, conditions tended to be dry especially in the east. This meant that September drilled crops were slow growing, only moving through the growth stages slowly, this left them vulnerable to CSFB attack for prolonged periods. In 2015, there was a wet harvest, and therefore water availability in seed beds was good, with crops able to establish well and move quickly through the growth stages. Despite different growing conditions the levels of damage observed were similar, although slightly higher in 2016 (data sets not suitable for statistical analysis). In 2015, there were only 22% of assessed crops that had damage levels that exceeded threshold at the cotyledon to 2 true leaf stage, whilst in 2016 there were 28.6% of crops with damage exceeding threshold at the same growth stage. By four true leaves there were only 4% of crops with damage levels exceeding threshold in 2015, whilst in 2016 there were 6% of crops that had damage levels exceeding thresholds (Table 4).

There were larger differences observed in crop losses between 2015 and 2016, with an estimated 0.8% of the planted area lost at assessment 1 in 2015, compared to 5.6% of the planted area lost at the same time in 2016 as a result of CSFB damage. By assessment 2 crop losses in 2015 had increased by 0.2% to 1.0%, whilst in 2016 the increased by 1.7% to 7.3%. In spring 2015 there were anecdotal reports of further crop losses, although no assessment was completed to identify the extent of these losses and the proportion attributable to CSFB, therefore in spring 2017 a third assessment was made to assess over winter survival. This assessment found that a further 1.3% of the crop area had been lost over winter as a result of CSFB.

Table 4. Comparison of results on assessed areas from previous years. It should be noted that a slightly different assessment approach was used in 2014, making direct comparison between the years difficult. Values at a national level are slightly lower due to the weighting process.

	2014	2015	2016
Proportion of crops with damage seen - Assessment 1	NA	65%	74%
Proportion of crops with damage above threshold - Assessment 1	NA	22%	29%
Proportion of crops with damage above threshold – Assessment 2	NA	4%	6%
Crop losses to CSFB damage – Assessment 2	NA	1.0%	7.3%
Crop losses to other causes – Assessment 2	NA	3.1%	6.5%

It should be noted that CSFB is not the only cause of oilseed rape crop losses, even in years before the neonicotinoid seed treatment withdrawal there were years where crop losses were reported due to poor establishment, pigeon damage or slug grazing. In 2015 there were an estimated 3.1% of the planted crops lost to other causes (by assessment 2) including pigeon damage, slug grazing and wet soil conditions. In 2016 the crop losses to other causes were higher, with 6.5% of the planted area lost to other causes mainly dry soils in the east and slugs in the west. An additional 2.6% of the crop area failed over winter due predominantly to pigeon grazing.

The higher overall crop losses to both CSFB and other causes show the impact of difficult weather conditions on the crop. In the year where the weather conditions allowed the crops to establish well and move quickly through the growth stages crops tended to be more resilient to damage, being able to grow away from the grazing with little impact on overall crop health. However, in the year where conditions were such that the crops were slow growing, and took longer to move through the growth stages they were at the vulnerable lower growth stages for longer, leaving them more susceptible to grazing damage.

The susceptibility of a winter oilseed rape crop to CSFB attack was reported as being influenced by a number of factors including;

- **Adult CSFB activity** - Activity was higher during warm, settled weather conditions
- **Drilling timing** - Crops that were earlier drilled tended to suffer less damage, as later sown crops were slower to grow and establish and therefore remained vulnerable to attack for longer – this will be impacted by the season
- **Seedbed quality and consolidation** - Less CSFB damage was seen on soils that were well consolidated,
- **Cultivation method** – In 2016 where moisture was key to establishing crops well those established with minimum tillage practices, and therefore minimal loss of soil moisture tended to establish more quickly and be less vulnerable than those crops established with plough based cultivations, where these caused soils to dry out.
- **Crop Development** – The rate of crop growth and development also influenced the vulnerability of the crop to damage. Those crops that established well and grew quickly were at the vulnerable early growth stages for fewer days than those crops that established poorly and grew slowly. This meant that any grazing by CSFB adults caused proportionally more damage to the slower growing plants than to the more rapidly growing plants.

The areas where CSFB pressure appears to be highest have remained relatively consistent between 2014-2016, tending to be in the Eastern region, East Midlands and South East. In 2014, the main areas that lost crops to CSFB damage were in Hampshire (28% of county area lost), Bedfordshire (12% of county area lost), Cambridgeshire (12% of county area lost) and Suffolk (10% of county area lost). In 2015 the main areas with losses due to CSFB were Buckinghamshire (9% of county area lost by assessment 2), Cambridgeshire (4%), Essex and East Yorkshire (2%). In 2016 the counties with the highest proportion of CSFB losses expressed as a proportion of the total county winter oilseed rape area were Bedfordshire (over 25%), Cambridgeshire (25%), Berkshire (11% t), Northamptonshire (10%) and East Yorkshire (7%).

Insecticide usage was higher in regions with high CSFB infestations in all years with 3-4 applications used in the counties with the highest levels of CSFB damage, whilst in counties with few crops that had damage level exceeding thresholds just 1-2 pyrethroid applications were used.

6. References

AHDB (2015) Winter planting survey results 2015 -

<https://cereals.ahdb.org.uk/markets/survey-results.aspx> [accessed 11/05/2017]

AHDB (2016) Winter planting survey results 2016 -

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Defra (2016) Structure of the Agricultural Industry June 2016

<https://www.gov.uk/government/statistics/farming-statistics-final-land-use-livestock-populations-and-agricultural-workforce-as-at-1-june-2016-england> [accessed 11/05/2017]

MET Office (2017) **UK actual and anomaly graphs** [online]. Available at:

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7. Appendix 1. Agronomist Questionnaire



AHDB Cabbage stem flea beetle live monitoring survey

County details		County 1	
County being assessed:		Select	
Approximate number of hectares of WOSR considered within the assessment:			
Approximate proportion (%) variety type (conventional v's hybrid):			
Conventional:			
Hybrid:			
Assessment 1: CSFB Damage in this county at cotyledon -2 true leaves			
Please complete when over 75% of the WOSR in the county is at cotyledon- 2 true leaves			
CSFB shot holing		% crops	% abandoned
Majority of plants with 0% leaf area lost			
Majority of plants with 1-24% leaf area lost			
Majority of plants with 25-49% leaf area lost			
Majority of plants with 50-75% leaf area lost			
Majority of plants with >75% leaf area lost			
Total		0%	0%
Approximately what proportion (%) of crops have been abandoned or lost due to other causes?			
Please specify other cause.		Select	
Assessment 2: CSFB Damage in this county at 3 - 4 true leaves			
Please complete when over 75% of the WOSR in the county is at 3-4 true leaves			
CSFB shot holing		% of crops	% abandoned
Majority of plants with 0% leaf area lost			
Majority of plants with 1-24% leaf area lost			
Majority of plants with 25-49% leaf area lost			
Majority of plants with 50-75% leaf area lost			
Majority of plants with >75% leaf area lost			
Total		0%	0%
Approximately what proportion (%) of crops have been abandoned due to other causes?			
Please specify other cause.		Select	
Crop redrilled			
Approximately what proportion of crops abandoned/lost were redrilled to WOSR?			
Approximately what proportion of crops abandoned/lost were redrilled to other crops?			

Please specify other crops	Select
Treatments in this county before 5 true leaves	
Approximately what proportion (%) of the crop has received a pyrethroid spray targeted at CSFB this season?	
Approximately how many pyrethroid sprays have been applied to date to control CSFB this season?	
What do you think is the most common pyrethroid active and rate being used?	
Most common active:	
Rate (ml/ha:	
Approximately what proportion (%) of the crop has received a foliar treatment of Biscaya (thiacloprid)	
Approximately what proportion (%) of the crop was seed treated with methiocarb?	
Observations of susceptibility to CSFB damage in this county	
Did you observe any differences in the crops susceptibility to CSFB due to:	
Methiocarb treated and untreated seed	Select
<i>Please Specify:</i>	
Drilling date	Select
<i>Please Specify:</i>	
Soil type	Select
<i>Please Specify:</i>	
Weather	Select
<i>Please Specify:</i>	
Any other factors	Select
<i>Please Specify:</i>	
Assessment 3: Winter survival of OSR	
Approximately what proportion (%) of the crop did not survive the winter due to CSFB?	
Approximately what proportion (%) of this crop that did not survive the winter due to CSFB was a redrilled crop?	
Approximately what proportion of the crop remains of questionable viability (decision has not been taken to abandon at this stage)?	
Approximately what proportion (%) of crop did not survive the winter due to other causes?	
Please specify other cause.	Select

8. Appendix 2

8.1. Full county breakdown assessment 1

Table 5. Proportion of crops at growth stage cotyledon to two true leaf, in each county, with no damage, low (1-24% leaf area lost), moderate (25-49% leaf area lost), high (50-74% leaf area lost) and severe (>75% leaf area lost) levels of damage as a result of CSFB

County		Proportion of total rape area (%)	Total area assessed per county (ha)	Proportion of crop area in each damage category					
				No damage (%)	Low (%)	Moderate (%)	High (%)	Severe (%)	
Midlands	East	Leicestershire	4%	1000	50%	20%	25%	3%	3%
		Lincolnshire	10%	6305	39%	43%	14%	4%	0%
		Northamptonshire	5%	5100	2%	67%	15%	12%	4%
		Nottinghamshire	4%	4800	41%	24%	31%	4%	0%
Eastern		Bedfordshire/Hertfordshire	2%	3850	14%	21%	16%	30%	20%
		Cambridgeshire	5%	1310	0%	20%	15%	38%	27%
		Essex	5%	350	46%	3%	11%	21%	19%
		Norfolk	4%	557	58%	38%	4%	0%	0%
		Suffolk	5%	5080	5%	64%	16%	8%	7%
		Durham & Cleveland	1%	300	70%	30%	0%	0%	0%
North East		Northumberland & Tyne and Wear	2%	1410	98%	2%	0%	0%	0%
		Cumbria, Lancashire & Cheshire	1%	54	20%	80%	0%	0%	0%
West	North	Scotland - North East	3%	329	27%	73%	0%	0%	0%
	Scotl and	Scotland - South East	3%	320	84%	16%	0%	0%	0%
		Berkshire	1%	200	0%	40%	60%	0%	0%
South East		Buckinghamshire	3%	1160	2%	45%	39%	10%	3%
		East Sussex	1%	360	20%	70%	10%	0%	0%
		Hampshire & Isle of White	3%	1077	0%	53%	37%	10%	0%
		Kent	4%	1396	15%	74%	11%	0%	0%
		Oxfordshire	3%	1520	0%	83%	14%	3%	0%
		West Sussex	1%	1660	12%	81%	7%	0%	0%

County	Proportion of total rape area (%)	Total area assessed per county (ha)	Proportion of crop area in each damage category					
			No damage (%)	Low (%)	Moderate (%)	High (%)	Severe (%)	
	Devon	1%	350	95%	5%	0%	0%	0%
South West	Dorset	1%	170	30%	70%	0%	0%	0%
	Gloucestershire and Avon	3%	524	30%	40%	20%	10%	0%
	Somerset	1%	420	80%	20%	0%	0%	0%
	Wiltshire	3%	1494	10%	81%	10%	0%	0%
	Wales	1%	1	100%	0%	0%	0%	0%
Wales	Hereford	1%	250	95%	5%	0%	0%	0%
West Midlands	Shropshire	2%	380	75%	25%	0%	0%	0%
	Staffordshire	1%	357	50%	50%	0%	0%	0%
	Warwickshire	2%	750	100%	0%	0%	0%	0%
	Worcester	1%	147	50%	50%	0%	0%	0%
	Yorkshire - East	4%	1920	4%	43%	35%	13%	6%
Yorkshire and	Yorkshire - North	5%	3177	34%	42%	15%	6%	3%
	Yorkshire - South and West	4%	580	72%	20%	9%	0%	0%
	NATIONAL		575,000	34%	40%	14%	7%	4%

8.2. Full county breakdown assessment 2

Table 6. Proportion of crops at growth stage three-four true leaves, in each county, with no damage, low (1-24% leaf area lost), moderate (25-49% leaf area lost), high (50-74% leaf area lost) and severe (>75% leaf area lost) levels of damage as a result of CSFB attack

County		Proportion of total rape area (%)	Total area assessed per county (ha)	Proportion of crop area in each damage category				
				No damage (%)	Low (%)	Moderate (%)	High (%)	Severe (%)
Midlands	East							
	Leicestershire	4%	1000	50%	15%	15%	20%	0%
	Lincolnshire	10%	6305	34%	44%	19%	3%	1%
	Northamptonshire	5%	5100	2%	61%	23%	11%	3%
	Nottinghamshire	4%	4800	50%	38%	10%	2%	0%
Eastern	Bedfordshire	2%	3850	5%	40%	41%	13%	2%
	Cambridgeshire	5%	1310	0%	50%	38%	0%	11%
	Essex	5%	350	3%	34%	41%	17%	4%
	Norfolk	4%	557	40%	38%	14%	6%	2%
	Suffolk	5%	5080	5%	71%	9%	11%	4%
	Durham & Cleveland	1%	300	60%	30%	10%	0%	0%
North East	Northumberland & Tyne and Wear	2%	1410	96%	4%	0%	0%	0%
	Cumbria, Lancashire & Cheshire	1%	54	15%	85%	0%	0%	0%
West	North	3%	329	55%	45%	0%	0%	0%
Scotl and	Scotland - North East							
	Scotland - South East	3%	320	94%	6%	0%	0%	0%
	Berkshire	1%	200	25%	50%	25%	0%	0%
South East	Buckinghamshire	3%	1160	0%	63%	37%	0%	0%
	East Sussex	1%	360	0%	100%	0%	0%	0%
	Hampshire & Isle of White	3%	1077	14%	67%	16%	3%	0%
	Kent	4%	1396	3%	86%	11%	0%	0%
	Oxfordshire	3%	1520	0%	80%	14%	7%	0%
	West Sussex	1%	1660	22%	78%	0%	0%	0%
	Devon	1%	350	90%	10%	0%	0%	0%

County		Proportion of total rape area (%)	Total area assessed per county (ha)	Proportion of crop area in each damage category				
				No damage (%)	Low (%)	Moderate (%)	High (%)	Severe (%)
South West	Dorset	1%	170	25%	75%	0%	0%	0%
	Gloucestershire and Avon	3%	524	0%	50%	30%	20%	0%
	Somerset	1%	420	90%	10%	0%	0%	0%
	Wiltshire	3%	1494	5%	81%	10%	5%	0%
	Wales	1%	1	0%	0%	0%	0%	0%
Wales	Hereford	1%	250	97%	3%	0%	0%	0%
West Midlands	Shropshire	2%	380	51%	49%	0%	0%	0%
	Staffordshire	1%	357	30%	70%	0%	0%	0%
	Warwickshire	2%	750	100%	0%	0%	0%	0%
	Worcester	1%	147	30%	70%	0%	0%	0%
	Yorkshire - East	4%	1920	4%	79%	16%	2%	0%
Yorkshire and Humber	Yorkshire - North	5%	3177	25%	47%	20%	6%	2%
	Yorkshire - South and West	4%	580	74%	21%	5%	0%	0%
	NATIONAL		575,000	28%	42%	13%	4%	1%

Table 7. Assessment 3 results for each county showing the proportion of the crop that did not survive the winter due to CSFB, the proportion of the crop area lost to CSFB was a crop that was re-drilled, the proportion of the crop at questionable viability and the proportion of the crop that did not survive the winter due to other causes.

	Approximately what proportion (%) of the crop did not survive the winter due to CSFB?	Approximately what proportion (%) of this crop that did not survive the winter due to CSFB was a re-drilled crop?	Approximately what proportion of the crop remains of questionable viability?	Approximately what proportion (%) of crop did not survive the winter due to other causes?
Leicestershire	5.0%	0.0%	0.0%	0.0%
Lincolnshire	0.9%	0.0%	0.7%	1.7%
Northamptonshire	12.2%	35.3%	39.2%	16.3%
Nottinghamshire	0.0%	0.0%	0.0%	0.0%
Bedfordshire/Herts	1.6%	0.0%	0.2%	0.0%
Cambridgeshire	0.4%	0.0%	1.8%	4.2%
Essex	0.0%	0.0%	0.0%	5.7%
Norfolk	0.0%	0.0%	0.1%	0.1%
Suffolk	0.0%	0.0%	0.0%	1.5%
Durham & Cleveland	0.0%	0.0%	0.0%	0.0%
Northumberland & Tyne and Wear	0.0%	0.0%	0.0%	0.0%
Cumbria, Lancashire & Cheshire	0.0%	0.0%	0.0%	2.0%
Scotland - North East	0.0%	0.0%	0.0%	0.0%
Scotland - South East	0.0%	0.0%	0.0%	0.0%
Berkshire	0.0%	0.0%	0.0%	0.0%
Buckinghamshire	3.6%	0.0%	3.4%	0.0%
East Sussex	0.0%	0.0%	0.0%	0.0%
Hampshire & Isle of White	0.6%	0.0%	0.0%	0.9%

	Approximately what proportion (%) of the crop did not survive the winter due to CSFB?	Approximately what proportion (%) of this crop that did not survive the winter due to CSFB was a re-drilled crop?	Approximately what proportion of the crop remains of questionable viability?	Approximately what proportion (%) of crop did not survive the winter due to other causes?
Kent	0.0%	0.0%	0.0%	0.9%
Oxfordshire	0.0%	0.0%	0.0%	1.5%
West Sussex	0.0%	0.0%	0.0%	0.0%
Devon	0.0%	0.0%	0.0%	0.0%
Dorset	0.0%	0.0%	0.0%	0.0%
Gloucestershire and Avon	0.0%	0.0%	0.0%	1.0%
Somerset	0.0%	0.0%	0.0%	0.0%
Wiltshire	0.0%	0.0%	2.4%	0.0%
Wales	0.0%	0.0%	0.0%	0.0%
Hereford	0.0%	0.0%	0.0%	0.0%
Shropshire	0.0%	0.0%	0.0%	0.8%
Staffordshire	0.0%	0.0%	0.0%	1.0%
Warwickshire	0.0%	0.0%	0.0%	0.0%
Worcester	0.0%	0.0%	0.0%	1.0%
Yorkshire - East	0.4%	30.6%	0.8%	1.9%
Yorkshire - North	0.2%	0.0%	0.9%	1.6%
Yorkshire - South and West	0.0%	0.0%	0.0%	1.4%
NATIONAL	0.8%	23.5%	1.6%	2.0%