January 2016

Project Report No. 551

Cabbage stem flea beetle live incidence and severity monitoring 2015

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AICC agronomists who provided county level data

This is the final report of a 2 month project (2140038118) which started in September 2015. The work was funded by a contract for £14,975 from AHDB Cereals & Oilseeds.

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1. Abstract

Autumn 2015 marks the second season for which neonicotinoid seed treatments have not been available for use on the vast majority of oilseed rape crops in the UK. In order to further understand the impacts of the second year of the neonicotinoid restrictions on the levels of cabbage stem flea beetle (CSFB) damage to oilseed rape crops, a live monitoring survey of adult CSFB damage was conducted in counties across England, Scotland and Wales. Data for the survey was collected using a network of 56 Association of Independent Crop Consultants (AICC) agronomists, and each agronomist was provided with a questionnaire based on the CSFB treatment thresholds set out in AHDB Cereals & Oilseeds Information Sheet 43. 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 again when at the three–four leaf growth stages (Assessment 2). A total of 62,000 ha of oilseed rape was assessed in this survey, which equates to about 11% of the total UK winter oilseed rape area. Only crops which had not been seed-treated with neonicotinoids were assessed. No statistics were calculated, instead this report presents the straight survey results. CSFB damage was present on 65% of crops at Assessment 1 and 69% of crops at Assessment 2. However, at Assessment 1, just 8% of crops had levels of damage in excess of 50% leaf area lost, whilst by Assessment 2 this had reduced to 4%.

CSFB damage was more widely dispersed around the country than in 2014, with the highest levels of damage (crops with severe damage – leaf loss in excess of 75%) reported in Leicestershire, Northamptonshire, Essex, Bedfordshire, Cambridgeshire, and Yorkshire at Assessment 1 and with a hotspot of severe damage also appearing in Buckinghamshire at Assessment 2.

In the most severe cases of damage, there were a number of crop losses recorded. At Assessment 1 there were 0.8% of the crops in the assessment area lost, equivalent to 5,000 ha of the total oilseed rape area, and at Assessment 2 the level of losses rose to 1.0%, equivalent to 6,000 ha of the total winter oilseed rape area. The main areas of crop losses reported in the survey (in order of greatest losses first) were Buckinghamshire, Cambridgeshire, Essex, East Yorkshire, Suffolk, Lincolnshire, Northamptonshire, North Yorkshire, Hampshire and Bedfordshire. There were still a number of crops present at the time of assessment 2 where a decision had yet to be made as to whether they remained viable or not.

CSFB was not the only cause of crop losses this season, with an additional 1.9% of the area, equivalent to 11,000 ha at the national level, reported as lost at Assessment 1 rising to 3.1% reported as lost at Assessment 2, equivalent to 18,000 ha at the national level, due to other reasons, predominantly slug grazing.

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 looked at the risk to bees. Autumn 2014 was the first season in which winter oilseed rape was planted without the use of these seed treatments in the UK, and there were major concerns within the agriculture sector that that withdrawal of neonicotinoids would cause a particular problem for the control of cabbage stem flea beetle (CSFB) in winter oilseed rape, and the impact that this would have on crop establishment. In September 2014 a snapshot survey of CSFB damage was conducted by ADAS, on behalf of AHDB Cereals & Oilseeds, to assess CSFB damage levels across counties in England and Scotland at the end of September 2014 (Project Report 456 – Extension). Data collected by 30 AICC agronomists was used to determine the extent to which crops in the UK had been impacted by CSFB in the absence of neonicotinoid seed treatments. This brief report was subsequently used by AHDB and other industry stakeholders to provide evidence to the EU on the impact of the withdrawal.

Autumn 2015 marks the second season for which neonicotinoid seed treatments have not been available for use on the vast majority of oilseed rape crops. Although, Emergency Use Authorisations for Modesto and Cruiser (neonicotinoid) seed treatments were agreed, for use on up to 5% of the total winter oilseed rape crop in high risk counties. Bedfordshire, Cambridgeshire, Hertfordshire and Suffolk were identified as high risk based, in part, on the 2014 snapshot survey results. In order to gain access to treated seed, growers needed to complete and sign an agreement with their seed supplier, provide details on the location and area of treated seed to be planted, provide a qualified agronomist's recommendation for the use of the seed treatment and provide information to show that CSFB resistance to pyrethoids was also considered. The foliar spray, Insyst (acetamiprid), was granted an Emergency Use Authorisation (valid for 120 days) on oilseed rape against CSFB with the EAU valid up until 25 November 2015.

In order to further understand the impacts of the second year of the neonicotinoid ban on the levels of CSFB damage to oilseed rape crops, ADAS, in collaboration with AICC and on behalf of AHDB Cereals & Oilseeds, have conducted a live monitoring survey of adult cabbage stem flea beetle damage in counties across England, Scotland and Wales.

Aim: To provide detailed and structured evidence on the level of CSFB damage on winter oilseed rape crops that have not received a neonicotinoid seed treatment, providing a second year of data to add to that collected by ADAS in 2014.

3. Materials and methods

3.1. Area of the UK covered by the survey

Data was collected using a network of Association of Independent Crop Consultants (AICC) agronomists, recruited by AICC. A total of 56 agronomists, covering 42 counties in England, Scotland and Wales, were used in order to achieve a high level of representation across each of the counties. For the purpose of continuity, agronomists who participated in the AHDB Cereals & Oilseeds CSFB snapshot survey in 2014 were included in the group of participating agronomists. Additional agronomists were recruited to ensure that there was accurate representation of the oilseed rape growing area. The target was to represent 10% of the oilseed rape area, with higher concentrations of reporters in counties with larger areas of oilseed rape. In counties where a large area of oilseed rape is grown, e.g. Lincolnshire, multiple agronomists were required to report, whilst in regions where only small areas of oilseed rape are grown, one agronomist covered multiple counties e.g. the North West and Scotland.

In those locations where the neonicotinoid seed treatments were given a derogation (Bedfordshire, Cambridgeshire, Hertfordshire and Suffolk), data was only collected from crops that had not received the seed treatment to ensure that results from treated crops did not distort the results from untreated crops.

3.2. Data collection

Each agronomist was provided with a questionnaire for completion in autumn 2015 based on the CSFB treatment thresholds set out in AHDB Cereals & Oilseeds Information Sheet 43, and largely consistent with the format of the questionnaire used in 2014.

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 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.

Damage assessments were completed by estimating what proportion of the crop area walked fell into each of the damage levels, using the standard approach that each agronomist takes to calculate thresholds in order to make spray decisions. Having multiple agronomists in the same county or region meant that it was possible to identify if there was any obvious observer bias and go back and cross check any ‘odd results’. There were five levels of damage that were reported by

the agronomists, which were subsequently categorised as no damage to severe to enhance clarity of reporting. The damage levels and categories are 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	
<24% of leaf area lost	Low	
25–49% of leaf area lost	Moderate	Cotyledon–2 true leaf
50–75% of leaf area lost	High	3–4 true leaves
>75% of leaf area lost	Severe	

The questionnaire was separated into the following key sections:

1. County details
2. CSFB damage at the cotyledon–two leaf stage
3. CSFB damage at the three–four leaf stage
4. Treatments in the county before five true leaves
5. Observations of susceptibility to CSFB damage

Importantly, the questionnaire was designed to capture any potential reasons for crop loss that were not related to CSFB (e.g. dry soils, slugs, pigeons, waterlogging), or where losses were exacerbated by CSFB, to ensure that a clear picture of the impacts of CSFB were captured. The full questionnaire can be found in Appendix 1.

It also important to note that only the initial area planted was considered in this assessment. If any area was re-planted between the first and second assessment dates, these crops were not included as part of the second assessment.

3.3. Data analysis

Data from each agronomist was collated and analysed in MS Excel. In order to calculate the county level impacts, the data from all agronomists reporting in a county was combined to calculate the total area of crop assessed in that county in each of the damage categories. The percentage of the total assessed area at each damage level was calculated and this was assumed to represent the percentage 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. Different levels of damage in each county were highlighted and presented in maps depicting the county level

impact of damage. No statistical analysis was completed on the data, therefore the results presented are observational conclusions.

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 Defra June census figures were used in order to calculate the total area of winter oilseed rape, with the assumption that area of winter oilseed rape planted this year would reduce by 10%. This assumption was based on information from ADAS's crop area estimates (unpublished data). Regional and county level breakdowns were based on Defra regional area estimates and ADAS county level estimates of crop areas derived from historical Defra county level data sets, with crop area changes applied. These figures were combined to calculate the total proportion of the UK winter oilseed rape area affected by CSFB damage.

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. 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 2015 was not directly comparable with that used in 2014, as the 2015 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.

3.4. Caveats to approach

This approach used 56 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 asking contributors to join a series of 'training' sessions run by conference call to ensure that the approach taken was consistent. 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, due to limited data points within each county. An example of this is shown in the data from Buckinghamshire where there was one main reporter, plus two reporters from other counties that

covered small areas of Buckinghamshire. The main reporter had a high proportion of their acreage affected by CSFB in the early stages, possibly due to the coincidence of the timing of drilling on those sites with the influx of CSFB. Due to the high proportion of the reported area coming from that one reporter there was a higher weighting on his data than on the other two reporter's data. .

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. The assessments were completed up to 3-4 true leaves, therefore any crop losses that occurred at later growth stages that could be attributed to CSFB activity are not captured.

4. Results

4.1. National incidence and severity of CSFB damage

It is estimated that the total planted UK winter oilseed rape area for 2016 was 583,000 ha (Defra June survey 2015, with 10% reduction applied). The agronomists assessed a combined area of approximately 62,000ha, or just under 11% of the total national area. These assessments focused only on original plantings, they did not include the impact of CSFB on subsequent re-drillings. The assessments were also only conducted on crops that were not treated with neonicotinoid seed treatments – therefore, where crops are referred to as 'untreated', this means they were not treated with neonicotinoid seed treatments unless otherwise stated. However, where pest pressure was high farmers used a range of alternative control strategies, such as pyrethroid foliar insecticide sprays to minimise damage. Therefore, the damage reported in this study is the damage that occurred in the absence of neonicotinoids, despite alternative control strategies, rather than the level of damage that would have occurred in the absence of any treatment.

4.1.1. Assessment 1 – cotyledon– 2 true leaf

Cabbage stem flea beetle (CSFB) damage was present on 65% of untreated crops assessed at this growth stage, equivalent to 379,000 ha of winter oilseed rape.

The treatment threshold for CSFB at the cotyledon stage is above 25% leaf area damaged. In the majority of regions, the severity of damage was low, with 78% of the national area having 24% of the leaf or less affected by CSFB damage. Of the 22% of the crop area that had damage levels exceeding the treatment threshold, there were 14% of crops that had moderate damage, 7% high levels of damage, with 1% of crops suffering severe damage (Table 2).

Table 2. Proportion of crops in each damage category at a national level – Assessment 1

	No damage	Low	Moderate	High	Severe
Proportion of crops	35%	43%	14%	7%	1%

4.1.2. Assessment 2 – 3–4 true leaves

At the 3–4 true leaf stage, CSFB damage was present on 69% of untreated crops, equivalent to approximately 402,000 ha of winter oilseed rape.

The treatment threshold for crops at 3–4 true leaves is above 50% leaf area damage. For the majority of counties the level of CSFB damage was below this threshold, with 96% of the national area having 50% or less leaf area loss. There were approximately 3% of crops that had high levels of damage, with 1% of crops suffering severe damage (Table 3). Agronomist comments indicate that where damage levels reduced from earlier assessments, this reflected the impact of insecticidal spray applications made between the two assessment timings. Control was not always perfect, but it allowed some crops to grow away from the pests, limiting the level of damage at the second assessment timing.

Table 3. Proportion of crops in each damage category at a national level – Assessment 2

	No damage	Low	Moderate	High	Severe
Proportion of crop	30%	54%	12%	3%	1%

4.2. Regional incidence and severity of CSFB damage

4.2.1. Assessment 1 – cotyledon– 2 true leaf

There was some regional variation in the proportion of winter oilseed rape crops affected by CSFB at Assessment 1, as shown Figure 1. CSFB is not uniformly distributed across the country with higher populations typically occurring in the east and Midlands with lower populations in the west and north. This is borne out by the distribution of damage observed in the survey. Levels of damage were very low in the North East, North West and Wales, with 80% of crops in the North East and North West and 95% of crops in Wales showing no signs of CSFB damage on crops between the cotyledon to two true leaves growth stages. Less than 5% of crops had damage above threshold levels in these regions.

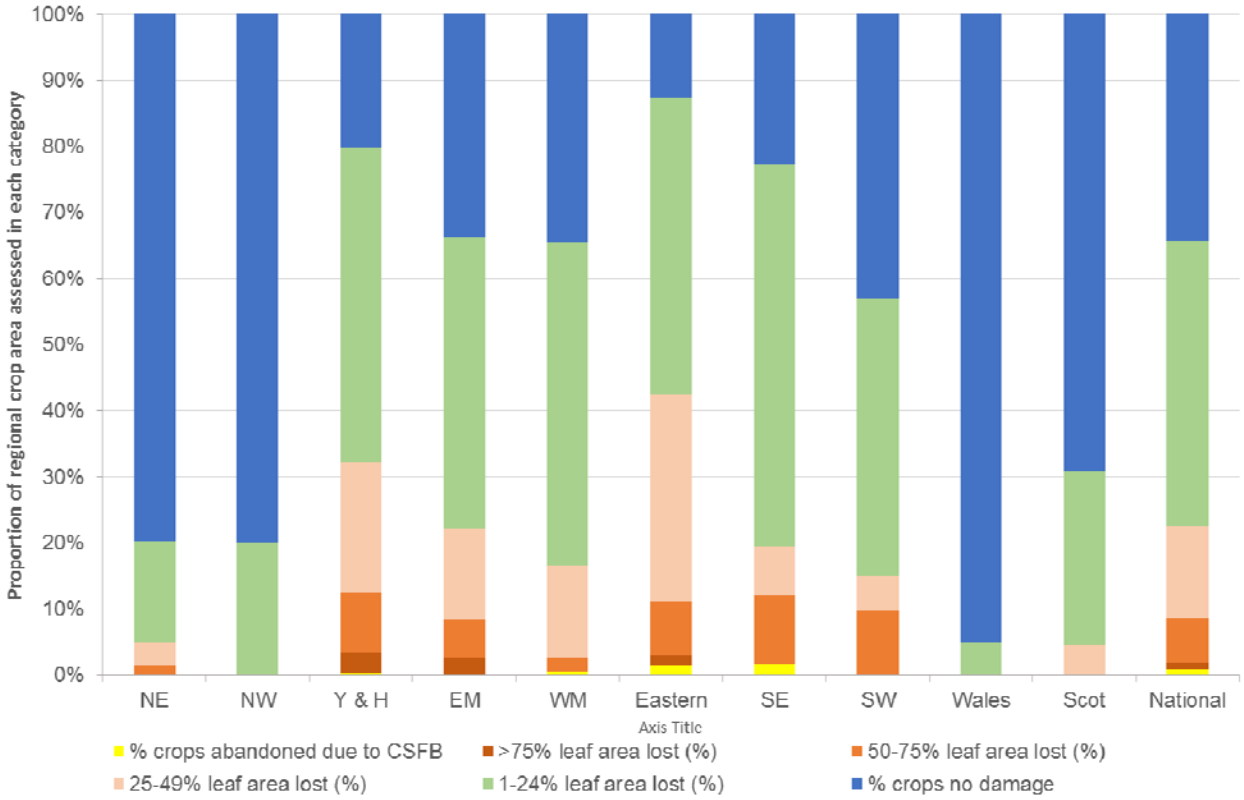


Figure 1. Proportion of crops in each region affected by CSFB at Assessment 1. Yellow bars = Crop lost; Orange bars = Control threshold exceeded; Green bars = Damage below control threshold; Blue bars = No damage seen.

In contrast, 42% of crops in the Eastern region, 32% of crops in Yorkshire and Humber, and about 20% of crops in the South East and East Midlands had above threshold levels of CSFB damage. Above threshold levels of CSFB damage were reported on 10-15% of crops in South West and West Midlands.

4.2.2. Assessment 2 – 3–4 true leaves

Regional variation in the proportion of winter oilseed rape crops affected by CSFB was also reported at Assessment 2 (Figure 2). The majority of crops in all regions had below-threshold levels of CSFB damage at Assessment 2, with between 80–100% of crops in the North East, North West and Wales having no reported CSFB damage. In addition in Scotland and the South West although there were low levels of damage reported no crops were identified as exceeding threshold at this assessment timing.

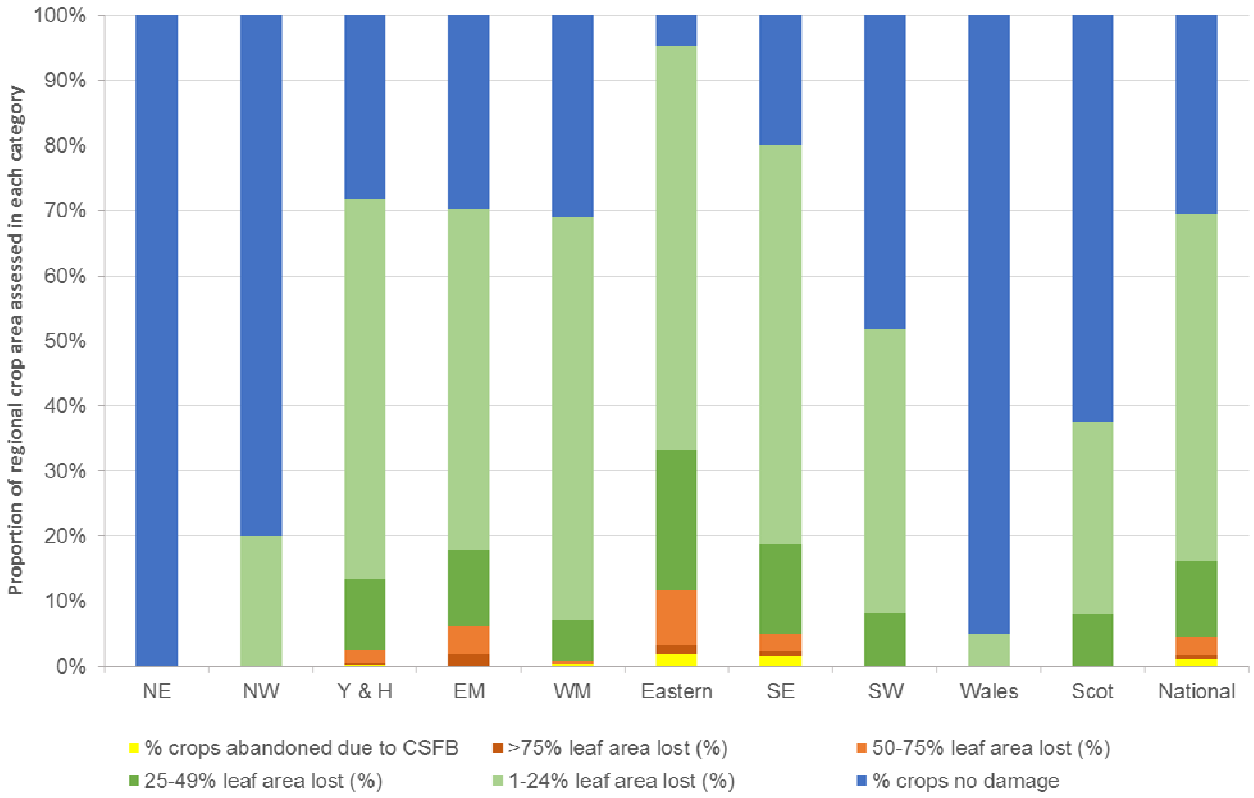


Figure 2. Proportion of crops in each region affected by CSFB at assessment 2. Red bars = Crop lost; Orange bars = Control threshold exceeded; Green bars = Damage below control threshold; Blue bars = No damage seen.

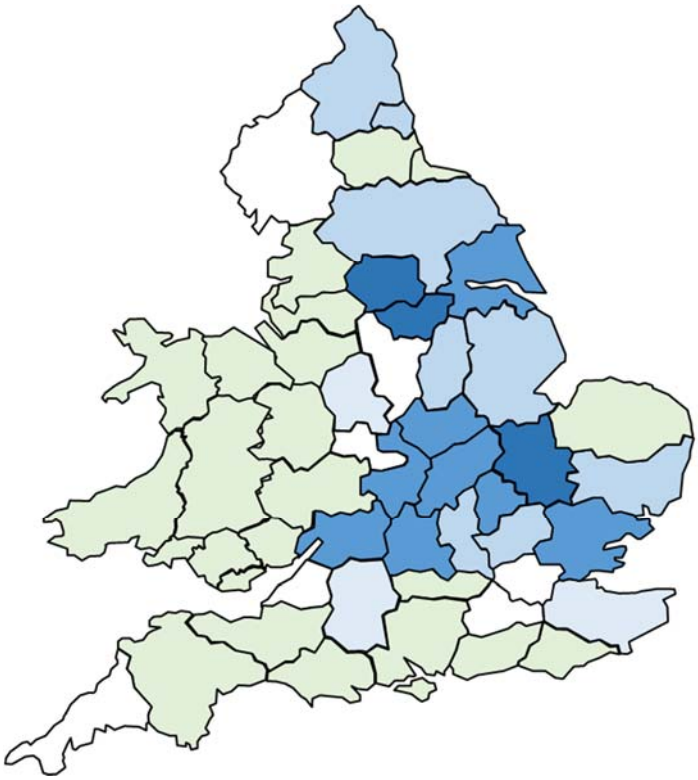
The highest levels of damage at Assessment 2 were reported in the Eastern region, with 10% of crops above CSFB damage thresholds. The only other regions with above threshold damage levels, ranging from 1-6% of area were; Yorkshire, East Midlands, West Midlands and the South East. Severe CSFB damage at Assessment 2 was only reported on crops within the East Midlands, Eastern, South East and Yorkshire and Humber regions, with less than 2% of the area affected in each region.

4.3. County level incidence and severity of CSFB damage

4.3.1. Assessment 1 – cotyledon–2 true leaf

The damage from CSFB at assessment 1 was variable and there are clear county level differences in the level of CSFB damage to crops. There were 17 of the assessed counties that had no crops where damage levels exceeded the spray threshold at the cotyledon–2 true leaf stage, with the majority of those above threshold along the East coast and into the Midlands. There were 10 counties with above threshold damage affecting up to 25% of the crop area, a further 10 with damage affection 26-50% of the county area and two counties where over 50% of the county area had damage levels exceeding threshold. In parts of the Midlands and Cambridgeshire, Essex,

East and West Yorkshire over 25% of crops had damage levels exceeding thresholds with the highest proportion of damage reported in Cambridgeshire and West Yorkshire (Figure 3).

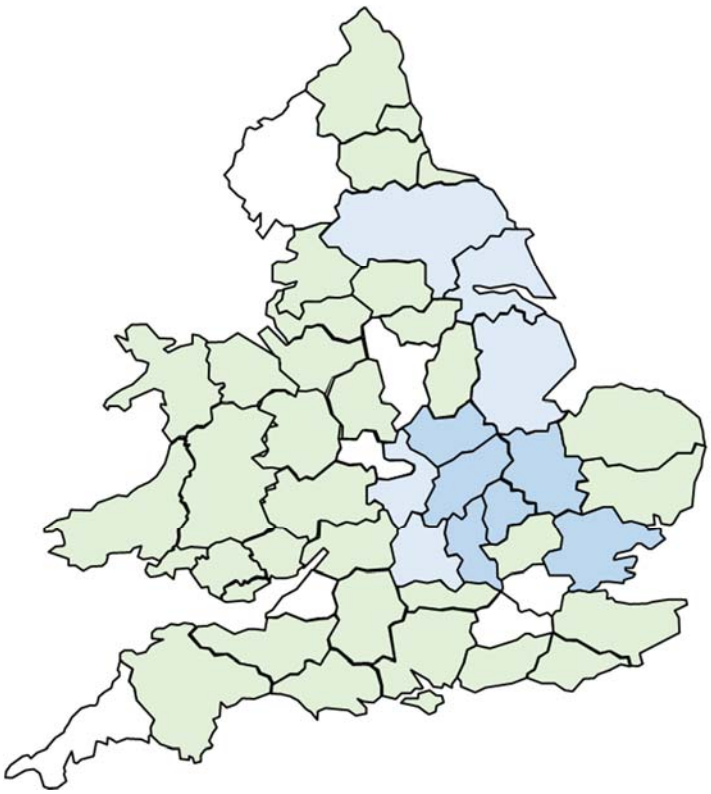


Key	Proportion of county crop area above treatment threshold
	0%
	1-5
	6-25%
	26-50%
	Over 50%
	Not assessed

Figure 3. Map showing proportion of county crop area above threshold Assessment 1 (Scotland not shown 2-5% of crops with damage above treatment threshold)

4.3.2. Assessment 2 – 3–4 true leaves

The level of damage from CSFB observed at assessment 2 was reduced compared to that observed in assessment 1. There were 28 of the assessed counties that had no crops where damage levels exceeded the spray threshold at the 3-4 true leaf stage, with the majority of those above threshold along the East coast and into the Midlands. This reduction in the area of crops damaged reflects the higher threshold for spray applications at assessment 2, the fact that foliar insecticides were applied and took effect between the assessments and the fact that many crops were able to outgrow earlier damage. There were however, some clear county level differences in the level of CSFB damage to crops. There were 6 counties with above threshold damage affecting 5-25% of the county crop area (Cambridgeshire, Northamptonshire, Leicestershire, Essex, Bedfordshire and Buckinghamshire. In addition four counties (Lincolnshire, Yorkshire, Warwickshire and Oxfordshire) had damage levels exceeding threshold on up to 5% of the country crop area (Figure 3).



Key	Proportion of county crop area above treatment threshold
	0%
	1-5
	6-25%
	26-50%
	Over 50%
	Not assessed

Figure 4. Map showing proportion of county crop area above threshold Assessment 2 (Scotland not shown 0% of crops with damage above treatment threshold)

4.4. Crop area lost to CSFB and other causes

Where cabbage stem flea beetle damage was high or severe, a number of crops were lost, with farmers opting to replace them rather than take a poor crop through to harvest. This was especially the case where losses were compounded by other damage, such as slug grazing.

4.4.1. Assessment 1 – cotyledon–2 true leaf

The proportion of the assessed area lost to CSFB at Assessment 1 was 0.8%; this is equivalent to approximately 5,000 ha at the national level. The regions with the highest crop losses in Assessment 1, were the South East and Eastern regions with 1.7% and 1.4% of regional crop area lost to CSFB, respectively. Crop losses of 0.4% were also seen in the West Midlands and Yorkshire and Humber, with a crop loss of 0.1% reported in the East Midlands.

The main counties affected by crop losses were Bedfordshire, Cambridgeshire, Essex, Hampshire, Northamptonshire, Suffolk, and North and East Yorkshire, as shown in Figure 5A, where typically 1–4% of the area was lost. There were some high losses reported in Buckinghamshire, where an estimated 9% of the assessed crop area had been lost by the first assessment. This high level of loss is thought to reflect the fact that one of the three reporters in that county, who covered the largest area in that county, was in a hotspot of damage, with a high proportion of their acreage affected by CSFB in the early stages, possibly due to the coincidence of the timing of drilling on

those sites with the influx of CSFB. There were small additional areas provided by the other two reporters that indicated that damage in their parts of Buckinghamshire was less, with no losses reported. Therefore, it is considered that the 9% crop loss figure based on the weighting is probably an overestimate of the true crop losses in this region.

CSFB damage was not the only cause of crop losses this season, with an additional 1.9%, equivalent to 11,000ha, lost due to other reasons, predominantly slug grazing, although pigeon and rabbit grazing, poor soil structure and weather conditions also resulted in crop losses. Losses due to slugs were also high in Buckinghamshire.

4.4.2. Assessment 2 – 3–4 true leaves

At the second assessment the proportion of the UK crop area lost to CSFB rose slightly to 1.0%, equivalent to approximately 6,000ha. Crop losses at Assessment 2, were highest in the Eastern and South East regions with 2.0% and 1.7% of regional crop area lost to CSFB, respectively. Crop losses of 0.5%, 0.4% and 0.1% were also seen in the West Midlands, Yorkshire and Humber and East Midlands. Crop losses of 1–4% of county area occurred in Bedfordshire, Cambridgeshire, Essex, Hampshire, Lincolnshire, Northamptonshire, Suffolk, North and East Yorkshire (Figure 3B). Buckinghamshire had no additional losses at the second assessment.

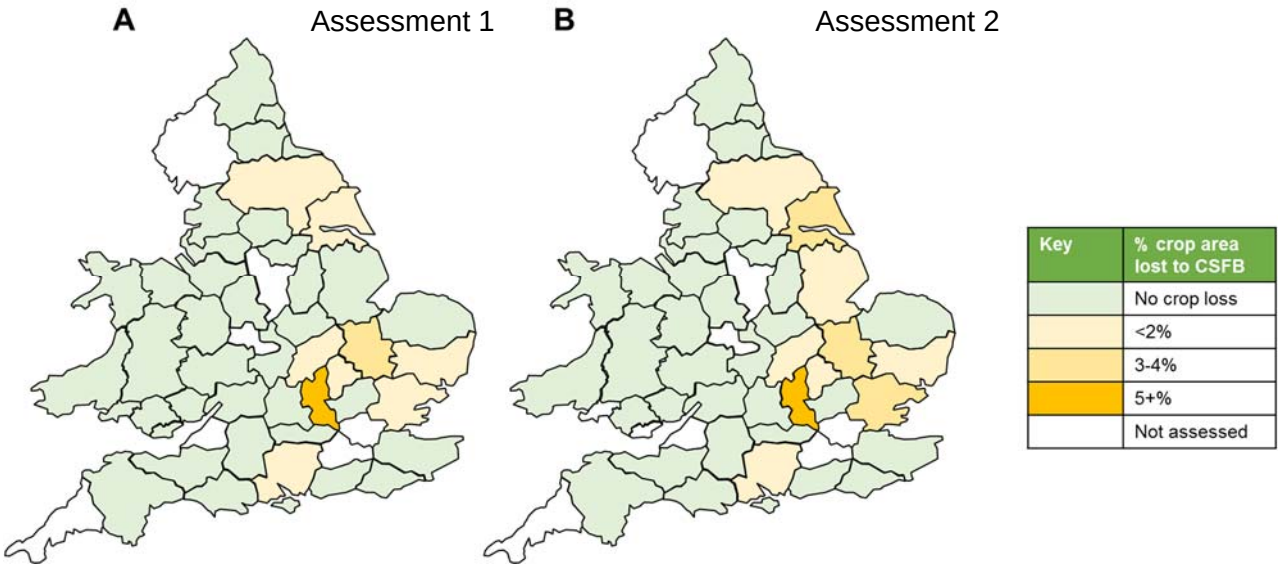


Figure 5. Map showing area of crops lost to CSFB at Assessment 1 (A) and at Assessment 2 (B) – percentages are proportion of county area lost – Scotland although assessed had no crop losses recorded.

The area of crops lost for other reasons also increased to 3.1%, equivalent to 18,000ha. In Cambridgeshire and North Yorkshire the level of crop loss reported as a direct result of CSFB attack was higher than the reported losses due to other factors. In all other counties, crop loss due

to CSFB was either the same as or less than that of the other causes e.g. slug grazing. Slug grazing was identified as being particularly high in Buckinghamshire as compared to the other counties.

4.5. 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 in to context. They were asked to estimate the proportion of the area which had been treated with an insecticide, the number of applications the oilseed rape crop received, identify the most common active ingredient applied and the rate at which it was applied. Specific questions on Insyst and Methiocarb were also included following Emergency Use Authorisations being approved for use in autumn 2015.

The withdrawal of neonicotinoids has meant that farmers have had to find alternative methods of control (or partial control). The main control option identified in the survey was the use of foliar pyrethroid insecticides. An estimated 75% of the assessed winter oilseed rape area had been treated with at least one application of insecticide across the survey period. The areas where treatment of crops was low corresponded with the areas that had no or low CSFB damage. On average, crops received two applications of insecticide, although this ranged from crops which received no insecticide treatments in northern Scotland and Devon (where there was little pest pressure), to crops in the east e.g. Bedfordshire, Cambridgeshire, Essex and Yorkshire which were treated 3–4 times in order to control CSFB. Where declines in damage levels were seen between the first and second assessments, this was attributed by the agronomists, in part, to control provided by early insecticide applications. However, where repeated applications of insecticide were required it implies incomplete or poor control from earlier applications. Each repeated application increases the risk of insecticide resistance developing.

Only two active ingredients, cypermethrin and lambda-cyhalothrin, were mentioned by the agronomists with usage of the two fairly evenly spread across the country.

Only 9% of agronomists had used Insyst on their crops and use of Insyst was variable with no particular pattern emerging between counties.

Methiocarb seed treatment was used by 30% of agronomists, and those who responded reported that methiocarb was used, on average, on 9% of the oilseed rape crop. Only 4% of agronomists observed differences in the crop's susceptibility to CSFB between methiocarb-treated and untreated seed, with these suggesting that methiocarb seed treatment offered some early CSFB protection.

4.6. Crop susceptibility to CSFB damage

In order to understand how factors other than insecticide treatments influenced the oilseed rape crop's susceptibility to CSFB, the reporters were asked to comment on how drilling date, soil type and weather conditions may have influenced the crops susceptibility to CSFB attack. These issues are discussed separately below.

4.6.1. Drilling date

Nationally, 70% of agronomists reported differences in the crop's susceptibility to CSFB due to drilling date. Timing of drilling was particularly highlighted in the West Midlands (30%), South East (16%) and East Midlands (14%), although the level of CSFB activity in the West Midlands was still low. It is apparent that the agronomists thought that the earlier drilled crops were less affected by CSFB, or had the greatest ability to withstand pest pressure, resulting in less damage. The agronomists also reported that the later drilled crops (late August / early September) suffered more damage from CSFB as these crops were at a more vulnerable stage for longer. Of the agronomists in the South East, 21% observed that whilst the earlier drilled crops suffered less leaf damage from CSFB, this pattern was also seen in the later drilled (early September) crops. They noted that it was the middle-range sowings (late-August) that were most affected, owing to heavy rainfall causing the seedbed to slump. In the North West the agronomists reported that earlier sown crops were more susceptible to CSFB damage, possibly reflecting a latter start to drilling in this region.

The North East agronomists reported no difference in susceptibility due to drilling date. The West Midlands and South West also showed a high proportion of agronomists that did not observe any difference in crop's susceptibility to CSFB due to drilling date.

4.6.2. Soil type

Across the UK, 54% of agronomists reported differences in the crop's susceptibility to CSFB due to soil type. It is evident that the lighter and finer soils enabled quicker establishment and plant growth and therefore crops were less affected by CSFB damage. The heavy, clay soils were the most affected owing to cloddy conditions and the restrictive ability of the crop to grow away from damage. However, one agronomist from Lincolnshire noted that in his area lighter soils were more widely affected by CSFB during the early stages. In addition to clay soils, crops drilled into chalk (Essex and East Yorkshire) and limestone soils (Lincolnshire and South Yorkshire) were also identified to be vulnerable to CSFB attacks.

Soil conditions were also an important factor. For example, crops drilled into poor seedbeds were slow to grow and therefore more vulnerable to CSFB for a prolonged period of time, than those drilled into good seedbeds.

In the North East, North West and South West, no difference was observed in susceptibility due to soil type or condition. This is likely to be because the majority of crops in these areas had no to low levels of damage seen.

4.6.3. Weather

Differences in the crop's susceptibility to CSFB due to weather conditions were reported by 57% of agronomists . Although warm and dry conditions allowed the crops to grow quickly, these conditions encouraged CSFB activity and increased damage. For example, dry and mild conditions at the end of September in the West Midlands gave rise to an increase in CSFB activity. When conditions were cooler and wetter, CSFB activity was reduced and therefore resulted in less leaf damage. However, the timing of this cooler, wetter weather was critical, as if this occurred at drilling times, it led to slower crop establishment and slower growth, making the crop more vulnerable to CSFB attack. This was identified as an issue in the South East, Herefordshire and Shropshire. In addition to rainfall and temperature, wind speed was also a factor. For example, calm conditions were associated with more CSFB attacks, whereas more windy conditions were associated with less leaf damage from CSFB.

4.6.4. Other factors

Across the UK, only 39% of agronomists reported differences in the crop's susceptibility to CSFB due to other factors. Seedbed quality and consolidation was frequently identified as influencing CSFB damage, particularly in the East Midlands, Eastern region, South East and Yorkshire. Agronomists considered a well consolidated seedbed, by rolling after sowing, as being one of the most important factors which helped successful establishment of oilseed rape crops and minimising CSFB damage. In the absence of consolidation, the agronomists identified that plant populations tended to be lower and therefore suffered greater CSFB leaf grazing per plant. The use and timing of spray applications was also an important factor in the East Midlands (21%) and South West (14%). Sprays timed in warm, dry conditions gave greater efficiency as flea beetles were more active during this time. Other factors mentioned as important in determining a crop's susceptibility were a presence of CSFB in previous season and the current proximity of the crop to other oilseed rape crops. Farms that suffered from CSFB attacks in the previous year, suffered the most damage this year, and areas adjacent to last year's oilseed rape crop also saw more damage than crops planted away from previous crops (South East, Eastern region and East Yorkshire). The location of oilseed rape crops also has an effect on the level of damage seen. For example, crops

located on low lying land or near the coast showed very little damage and were better able to recover from CSFB damage.

In areas such as the North East, North West and Scotland where levels of damage were low no difference in susceptibility were identified.

5. Conclusion

A total of approximately 62,000 ha of oilseed rape was assessed in this survey, which equates to just under 11% of the total UK winter oilseed rape area. CSFB damage was present on an estimated 65% of crops at cotyledon to two true leaf and 69% of crops between three to four true leaves nationally, although only above threshold levels on 22% of crops at Assessment 1 and 4% of crops at Assessment 2.. The susceptibility of a winter oilseed rape crop to CSFB attack was influenced by a number of factors including:

- Adult CSFB activity, which was higher during mild, fine weather,
- The timing of drilling, with crops that were earlier drilled tending to have suffered less damage as later sown crops were slower to grow and establish and therefore remained vulnerable to attack for longer,
- Seedbed quality and consolidation,
- Previous history of CSFB attack in the area and,
- The proximity to other oilseed rape crops.

On a national scale the level of crop loss due to CSFB at Assessment 1 was 0.8%, equivalent to 5000 ha of oilseed rape, rising slightly to 1.0% at Assessment 2, equivalent to 6000 ha of winter oilseed rape lost at the national level. There was a degree of variance in the level of crop loss to CSFB across the UK, with some counties unaffected and other counties seeing 1-4% of the county crop area lost. CSFB were not the only cause of crop losses this season with an additional 1.9%, equivalent to 11,000ha, reported as lost at Assessment 1 and an additional 3.1% reported as lost in Assessment 2, equivalent to 18,000ha, due to other reasons, in particular slug damage.

The majority of crops at both Assessment 1 (78%) and Assessment 2 (96%) had levels of damage below the treatment threshold at that assessment timing. There was, however, some county variation in terms of the proportion of crops affected by CSFB and the level of damage received. The worst affected counties in 2015, with regards to crop area lost, were Buckinghamshire, Cambridgeshire, Essex, East Yorkshire, Suffolk, Lincolnshire, Northamptonshire, North Yorkshire, Hampshire and Bedfordshire.

Appendix 1. Agronomist Questionnaire

AHDB Cabbage stem flea beetle live monitoring survey

	Section 1: County details	County 1
1	**County being assessed:**	Select
2	**Approximate number of hectares of WOSR considered within the assessment:**	
3	**Approximate proportion (%) variety type (conventional vs hybrid):**	
	Conventional:	
	Hybrid:	

	Section 2: CSFB Damage in this county at cotyledon - 2 true leaves	
4	**Please complete table when over 75% of the WOSR in the county is at cotyledon- 2 true leaves**	
	CSFB shot holing	**% of crops**
	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%**
5	**Approximately what proportion (%) of crops have been abandoned due to CSFB?**	
6	**Approximately what proportion (%) of crops have been abandoned due to other causes?**	
	Please specify other cause.	Select

	Section 3: CSFB Damage in this county at 3 - 4 true leaves	
4	**Please complete table when over 75% of the WOSR in the county is at 3-4 true leaves**	
	CSFB shot holing	**% of crops**
	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%**

5	**Approximately what proportion (%) of crops have been abandoned due to CSFB?**	
6	**Approximately what proportion (%) of crops have been abandoned due to other causes?**	
	Please specify other cause.	Select
	Section 4: Treatments in this county before 5 true leaves	
7	**Approximately what proportion (%) of the crop has received a pyrethroid spray targeted at CSFB this season?**	
8	**Approximately how many pyrethroid sprays have been applied to date to control CSFB this season?**	
9	**What do you think is the most common pyrethroid active and rate being used?**	
	Active:	
	Rate ml/ha:	
10	**Approximately what proportion (%) of the crop has received a foliar treatment of Insyst (acetamiprid)?**	
11	**Approximately what proportion (%) of the crop was seed treated with methiocarb?**	
	Section 5: Observations of susceptibility to CSFB damage in this county	
12	**Did you observe any differences in the crops susceptibility to CSFB due to:**	
	Methiocarb treated and untreated seed	Select
	Please Specify:	
	Drilling date	Select
	Please Specify:	
	Soil type	Select
	Please Specify:	
	Weather	Select
	Please Specify:	
	Any other factors	Select
	Please Specify:	

Appendix 2. Full county breakdowns

Full county breakdown Assessment 1

Table 4. 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 and proportion of crop lost due to CSFB

County	Proportion of total rape area	Total area assessed per county	Proportion of crop area in each damage category					
			No damage	Low	Moderate	High	Severe	Crops lost
	(%)	(ha)	(%)	(%)	(%)	(%)	(%)	%
Bedfordshire	2%	4944	2%	48%	42%	5%	3%	1%
Berkshire	1%	60	0%	100%	0%	0%	0%	0%
Buckinghamshire	2%	1632	5%	77%	14%	5%	0%	9%
Cambridgeshire	5%	2810	7%	38%	36%	19%	1%	4%
Cheshire	<1%	150	80%	20%	0%	0%	0%	0%
Devon/Cornwall	1%	400	95%	5%	0%	0%	0%	0%
Dorset	1%	639	43%	57%	0%	0%	0%	0%
Durham & Cleveland	2%	450	70%	30%	0%	0%	0%	0%
East Sussex	1%	196	74%	26%	0%	0%	0%	0%
Essex	5%	2470	8%	49%	31%	9%	3%	1%
Gloucestershire and Avon	3%	1375	36%	20%	11%	33%	0%	0%
Hampshire	3%	640	84%	16%	0%	0%	0%	1%
Hereford	1%	250	95%	5%	0%	0%	0%	0%
Hertfordshire (incl G London)	1%	500	1%	74%	24%	0%	0%	0%
Isle of Wight	<1%	27	100%	0%	0%	0%	0%	0%
Kent	3%	1689	22%	74%	4%	0%	0%	0%
Lancashire/Cumbria	<1%	250	80%	20%	0%	0%	0%	0%
Leicestershire	4%	3700	19%	32%	28%	14%	7%	0%
Lincolnshire	10%	6789	40%	46%	12%	1%	0%	0%
Merseyside	<1%	100	80%	20%	0%	0%	0%	0%
Norfolk	4%	1185	87%	13%	0%	0%	0%	0%
Northamptonshire	5%	5286	2%	69%	13%	10%	5%	0%
Northumberland & Tyne and Wear	2%	1800	82%	12%	4%	2%	0%	0%
Nottinghamshire/ Derbyshire	4%	4626	72%	22%	6%	0%	0%	0%
Oxfordshire	3%	4077	0%	67%	10%	23%	0%	0%
Scotland – North*	3%	2140	68%	27%	5%	0%	0%	0%
Scotland – South*	3%	100	90%	8%	2%	0%	0%	0%

County	Proportion of total rape area	Total area assessed per county	Proportion of crop area in each damage category					
			No damage	Low	Moderate	High	Severe	Crops lost
	(%)	(ha)	(%)	(%)	(%)	(%)	(%)	%
Shropshire	1%	763	44%	56%	0%	0%	0%	0%
Somerset	1%	275	90%	10%	0%	0%	0%	0%
Staffordshire	1%	600	20%	75%	5%	0%	0%	0%
Suffolk	5%	677	12%	81%	5%	2%	0%	0%
Wales*	1%	58	95%	5%	0%	0%	0%	0%
Warwickshire	2%	2100	32%	39%	26%	4%	0%	0%
West Sussex/Surrey	1%	1092	92%	8%	0%	0%	0%	0%
Wiltshire	3%	1888	30%	65%	5%	0%	0%	0%
Worcester	1%	350	15%	85%	0%	0%	0%	0%
Yorkshire – East	4%	2247	2%	58%	26%	12%	3%	1%
Yorkshire – North	5%	3790	32%	43%	14%	7%	3%	0%
Yorkshire – South and West	4%	185	0%	20%	50%	30%	0%	1%

*Due to relatively small proportion of oilseed rape grown in the individual counties in Scotland and Wales and the low incidence of CSFB the data collection for these counties was amalgamated as Wales, Scotland North and Scotland South.

Full county breakdown Assessment 2

Table 5. 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	Proportion of crop area in each damage category					
			No damage	Low	Moderate	High	Severe	Crops lost
	(%)	(ha)	(%)	(%)	(%)	(%)	(%)	%
Bedfordshire	2%	4944	7%	56%	25%	8%	3%	1%
Berkshire	1%	60	0%	100%	0%	0%	0%	0%
Buckinghamshire	2%	1632	0%	54%	28%	14%	5%	9%
Cambridgeshire	5%	2810	0%	45%	37%	17%	1%	4%
Cheshire	<1%	150	80%	20%	0%	0%	0%	0%
Devon/Cornwall	1%	400	100%	0%	0%	0%	0%	0%
Dorset	1%	639	78%	22%	0%	0%	0%	0%
Durham & Cleveland	2%	450	100%	0%	0%	0%	0%	0%
East Sussex	1%	196	76%	24%	0%	0%	0%	0%
Essex	5%	2470	3%	72%	16%	8%	1%	3%
Gloucestershire and Avon	3%	1375	32%	41%	27%	0%	0%	0%
Hampshire	3%	640	53%	38%	9%	0%	0%	1%
Hereford	1%	250	97%	3%	0%	0%	0%	0%
Hertfordshire (inc. G London)	1%	500	1%	94%	5%	0%	0%	0%
Isle of Wight	<1%	27	100%	0%	0%	0%	0%	0%
Kent	3%	1689	29%	70%	1%	0%	0%	0%
Lancashire/Cumbria	<1%	250	80%	20%	0%	0%	0%	0%
Leicestershire	10%	6789	36%	53%	10%	1%	0%	0%
Lincolnshire	4%	3700	19%	38%	22%	14%	7%	1%
Merseyside	<1%	100	80%	20%	0%	0%	0%	0%
Norfolk	4%	1185	12%	83%	6%	0%	0%	0%
Northamptonshire	5%	5286	0%	76%	15%	5%	2%	0%
Northumberland & Tyne and Wear	2%	1800	100%	0%	0%	0%	0%	0%
Nottinghamshire/ Derbyshire	4%	4626	62%	35%	3%	0%	0%	0%
Oxfordshire	3%	4077	0%	80%	19%	1%	0%	0%
Scotland – North*	3%	2140	61%	30%	8%	0%	0%	0%
Scotland – South*	3%	100	90%	8%	2%	0%	0%	0%
Shropshire	1%	763	34%	66%	0%	0%	0%	0%
Somerset	1%	275	80%	20%	0%	0%	0%	0%
Staffordshire	1%	600	3%	97%	0%	0%	0%	0%

County	Proportion of total rape area	Total area assessed per county	Proportion of crop area in each damage category					
			No damage	Low	Moderate	High	Severe	Crops lost
	(%)	(ha)	(%)	(%)	(%)	(%)	(%)	%
Suffolk	5%	677	4%	96%	0%	0%	0%	0%
Wales*	1%	58	95%	5%	0%	0%	0%	0%
Warwickshire	2%	2100	35%	52%	13%	1%	0%	0%
West Sussex/Surrey	1%	1092	82%	18%	0%	0%	0%	0%
Wiltshire	3%	1888	34%	66%	0%	0%	0%	0%
Worcester	1%	350	3%	97%	0%	0%	0%	0%
Yorkshire – East	4%	2247	0%	82%	16%	2%	0%	1%
Yorkshire – North	5%	3790	46%	45%	6%	2%	0%	0%
Yorkshire – South and West	4%	185	10%	50%	40%	0%	0%	1%

*Due to relatively small proportion of oilseed rape grown in the individual counties in Scotland and Wales and the low incidence of CSFB the data collection for these counties was amalgamated as Wales, Scotland North and Scotland South.