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A review of AHDB impact assessments following the neonicotinoid seed treatment restrictions in winter oilseed rape

Caroline Nicholls

Agriculture and Horticulture Development Board, Stoneleigh Park, Kenilworth, Warwickshire, CV8 2TL

AHDB Cereals & Oilseeds is a division of the Agriculture and Horticulture Development Board (AHDB).

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1. Abstract

On 1 December 2013, restrictions on the neonicotinoids, clothianidin, imidacloprid and thiamethoxam on winter oilseed rape were enforced by the European Commission. Oilseed rape is the third most widely grown crop in the UK after wheat and barley. The average annual value of the crop over the past five seasons is £804M. The area of oilseed rape production has fallen in recent years due to lower returns and higher risks such as losses from cabbage stem flea beetle.

Oilseed rape emergence coincides with cabbage stem flea beetle migration. Oilseed rape can suffer severe damage from both adult and larval forms of cabbage stem flea beetle. The pest is distributed widely throughout the UK and in the last two years an estimated 76% (2014) and 70% (2015) of the UK crop was affected by adult cabbage stem flea beetle. Population levels of the pest have been linked to weather conditions occurring at different times of the year.

Cabbage stem flea beetle control is part of an integrated pest management approach, however, there are practical implications associated with non-chemical control options and the pest has developed resistance to the currently available chemical control.

The national area of crop lost to adult cabbage stem flea beetle in autumn 2014 was estimated at 5% (equating to approximately 31,000 ha across England). Approximately 9,000 ha (1.5%) of the national area was also reported to have been replanted after being lost. A loss of 22,000 ha (3.5%) of the crop area in England is valued at approximately £23M. 62% of the national area of crop lost is estimated to have occurred in the East, valued at approximately £13M. In autumn 2015, the estimated crop loss in England was 3%. Any additional crop losses after 1 December, such as from cabbage stem flea beetle larvae, are not reported due to lack of evidence. However, results from Defra-funded research indicate that the mean cabbage stem flea beetle larvae population in England has increased since 2014.

The national average of CSFB damage exceeding control thresholds at the end of September in 2014 (9%) and at emergence (cotyledon to two leaves) in 2015 (22%) is estimated at approximately 15.5%. This likely to be a conservative estimate as the 2014 assessments were made at a snapshot in time at the end of September when 32% of the crop had grown past the susceptible growth stage and was not assessed.

The Eastern region of the country has been identified as an area consistently suffering from adult CSFB and larvae. Bedfordshire, Cambridgeshire, Essex, Hertfordshire and Suffolk are counties consistently being reported to have high levels of adult CSFB or larvae.

Additionally, the 2014 AHDB Winter Planting Survey reported that theoretically approximately 38,000 ha of additional winter oilseed rape may have been planted if neonicotinoids had not been restricted. The largest proportions of this additional area would have been planted in the East and South East of England.

2. Introduction

This report examines evidence gathered by the Agriculture and Horticulture Development Board (AHDB) on the effects of the neonicotinoid restrictions on winter oilseed rape (OSR). On 1 December 2013, a restriction on the use of the neonicotinoids, clothianidin, imidacloprid and thiamethoxam was enforced by the European Commission (European Commission, 2013). The first winter OSR crop affected by the new regulations was planted in autumn 2014. Since the implementation of the restrictions, AHDB has funded two UK national autumn assessments of damage caused by adult cabbage stem flea beetle (CSFB), the common name of *Psylliodes chrysocephala*, and conducted two English national surveys on the planting area and crop losses from CSFB.

The two UK national autumn assessments funded by AHDB were led by ADAS. The first assessment was carried out in autumn 2014 and from here on is referred to as the 'autumn 2014 snapshot assessment'. In this assessment, a network of 23 local independent agronomists from the Association of Independent Crop Consultants (AICC), covering 30 counties, were used. They provided estimates of incidence and severity based on crops walked in the period 22–29 September 2014. Assessments were based on approximately 32,000 ha of winter OSR, equivalent to 5% of the national area. Further details of the methodology can be found in Project Report 546 – Extension 'Cabbage stem flea beetle snapshot assessment – incidence and severity at end September 2014' (Wynn *et al.*, 2014).

The second assessment was carried out in autumn 2015 and from here on is referred to as the 'autumn 2015 assessment'. A network of 56 AICC agronomists, covering 42 counties in England, Scotland and Wales, was used. In this particular assessment, more agronomists were used as the reporting was carried out based on the area of OSR in each county, therefore, there were higher concentrations of reporters in counties with larger areas of OSR. The target was to represent 10% of the OSR area. In order to better monitor the impact of CSFB at the key control threshold growth stages, agronomists were asked to report OSR crop damage and loss as a result of CSFB once 75% of crops had reached the cotyledon–two leaf growth stage and once again when 75% of crops had reached the three–four leaf growth stage. Further details of the methodology can be found in Project Report 551 'Cabbage stem flea beetle live incidence and severity monitoring 2015' (Alves *et al.*, 2015).

The two English national surveys on the planting area and crop losses from CSFB were carried out by AHDB. The data were collected through the 2014 and 2015 AHDB Winter Planting Surveys. Growers were asked additional if their OSR planting area had changed because of the neonicotinoid restrictions and also if they had lost crop to CSFB and, if so, how much they had lost. Further details of the methodology can be found in Project Report 541 'Assessing the impact of the restrictions on the use of neonicotinoid seed treatments' (Nicholls, 2015) and 'Assessing changes in cropping due to cabbage stem flea beetle' (Nicholls, 2016, in press).

2.1. Oilseed rape

Oilseed rape is the third most widely grown crop in the UK after wheat and barley, making it the UK's most widely grown break crop (Defra, 2016). Break crops in the rotation can provide cultural control of pests and pathogens of other crop types. There are many benefits to growing OSR, including its early harvest which can help spread the harvest work load and may also allow early entry for the following crop. Growing OSR can also offer unique market opportunities including cooking oil, biofuels and animal feed.

The OECD-FAO Agricultural Outlook 2015 predicts a long term upward trend in consumption of oilseed products demonstrating that there is a long term demand for oilseeds (Figure 1).

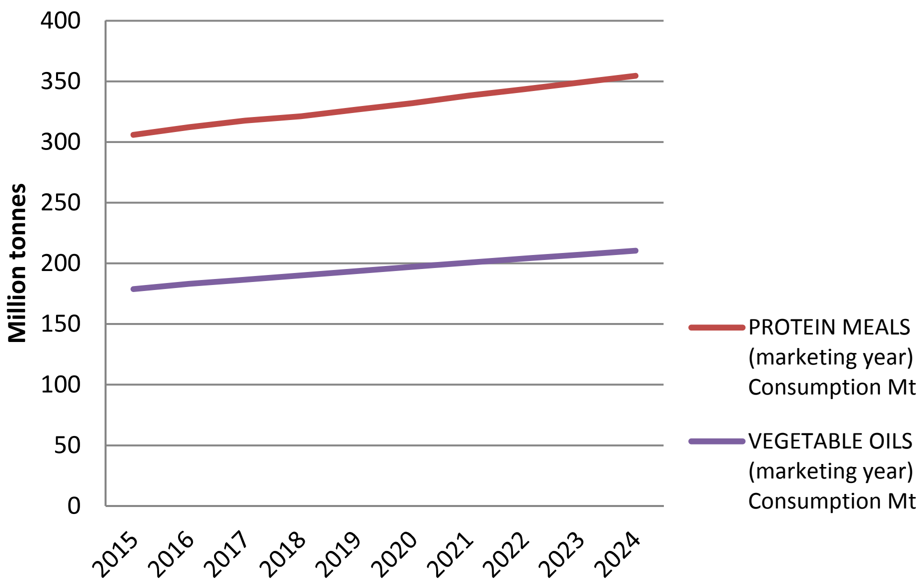


Figure 1. Trend in consumption of protein meals and vegetable oils (OECD and FAO, 2015)

2.1.1. Oilseed rape growth statistics

- The 5-year average harvest area for OSR in the UK is 700,000 ha (Defra, 2016). Figure 2 shows the distribution of OSR in the UK.
- The 5-year average OSR yield is 3.6 t/ha (Defra, 2016).
- The 5-year average production is 2,489,000 tonnes.
- The 1 July 2011 to 18 March 2016 average delivered Erith (nearby delivery) OSR price is £323 per tonne (AHDB Market Intelligence, 2016).
- Based on these figures, the average annual value of the crop over the past five seasons is £804M.

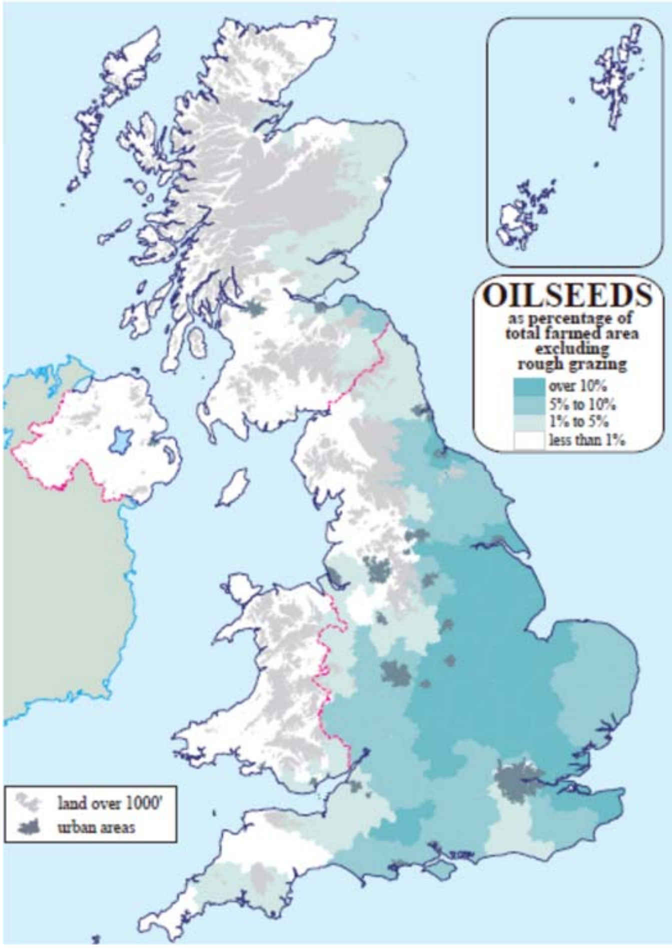


Figure 2. Distribution of OSR grown in the UK (2012) (AHDB, 2012).

In 2015, record yields were reported in wheat and OSR. For OSR, regions reporting record yields included Scotland, the North East, the East Midlands and the West Midlands. The East and the North West and Merseyside both recorded a decrease in yields compared to 2014 harvest (Defra, 2016). It is important to realise that the OSR yield is calculated using the harvested area so crop abandonment due to CSFB adults or larvae is not included in the recorded yield results.

2.1.2. UK area of OSR

The area of OSR production has increased since 1984 but has fallen in recent years due to lower returns and higher risks (Figure 3). One such risk includes increased levels of crop abandonment, e.g. from CSFB, a level of risk not previously encountered in northern European agriculture. Understanding why OSR continues to be widely grown requires an understanding of the costs of not planting an area or the potential returns of growing an alternative break crop. Although OSR prices are volatile, demand is robust and growing. If prices recover from recent lows then the balance between risk and reward may improve (BCPC, 2016).

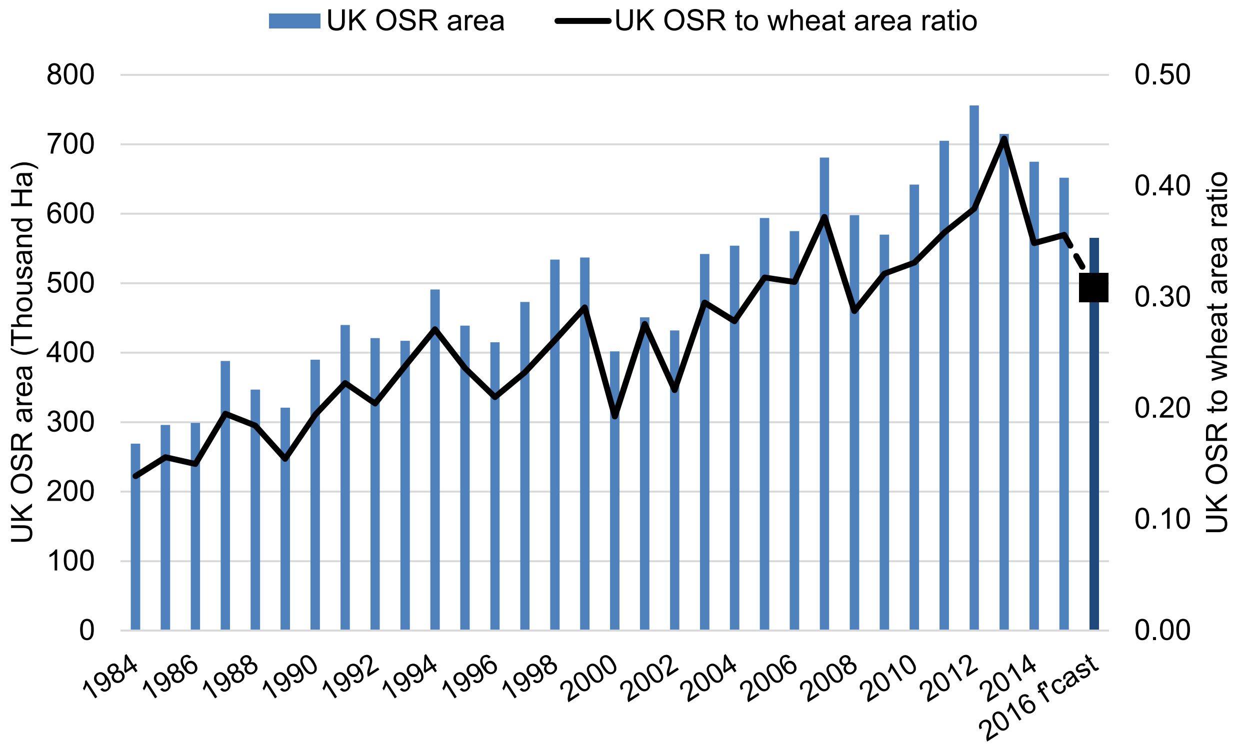


Figure 3. UK oilseed rape area and UK oilseed rape to wheat area ratio 1984 to 2015, plus 2016 forecast (AHDB Market Intelligence, 2016)

The 2014 AHDB Winter Planting Survey reported that 11% of respondents said they would have planted additional areas of winter OSR if neonicotinoid seed treatments had been available. In the Eastern region and South East, 15% and 14% of respondents respectively, said they reduced their OSR cropping area.

The difference between the area these respondents intended to plant and actually planted was a total of just over 3,200 ha. When scaled up to a national level using the 2014 June Survey of Agriculture by Defra of the harvest area, this is theoretically equivalent to approximately 38,000 ha.

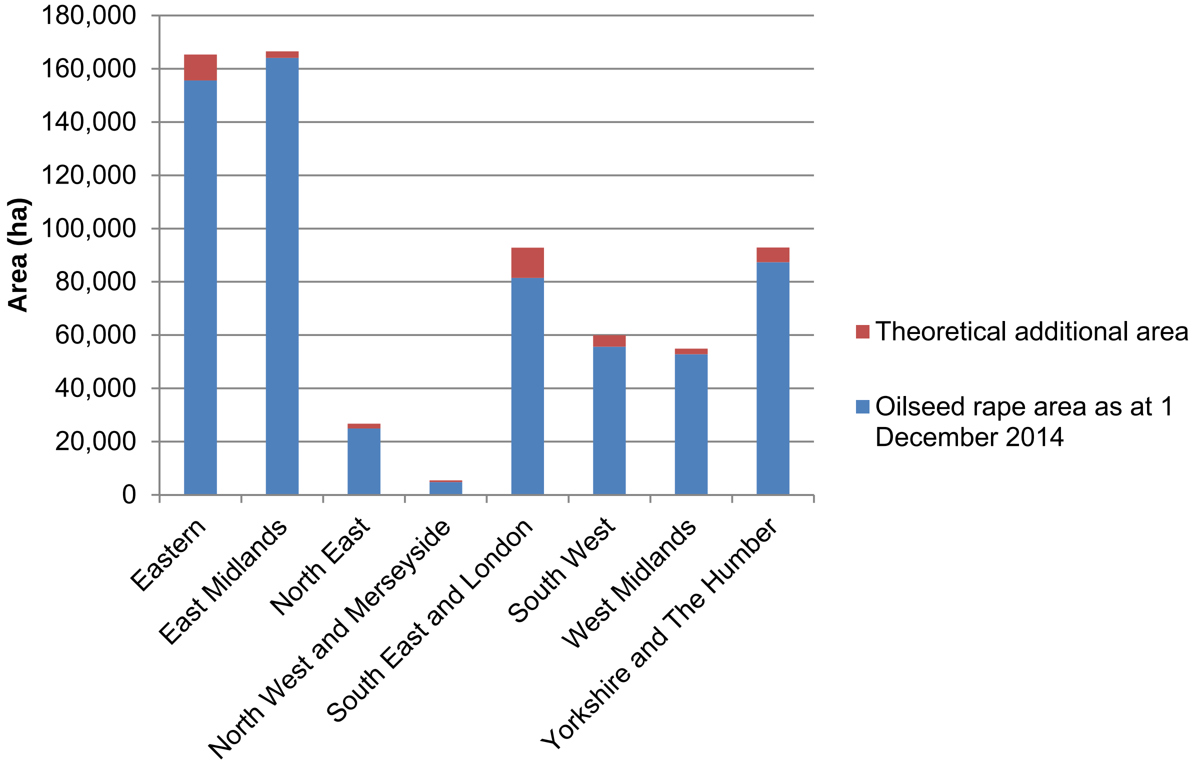


Figure 4. Regional breakdown of the additional area that might have been planted for harvest 2015 if neonicotinoid seed treatments had been available compared to the estimate of the oilseed rape area from the 2014 AHDB Winter Planting Survey.

The 2015 AHDB Winter Planting Survey (Nicholls, 2016. In press) showed, albeit with limited data, the area planted in England could have been between 2% and 4% higher if neonicotinoid seed treatments had not been restricted.

OSR is generally planted in August. This is the optimum time to drill the crop, however, drilling at this time means that crop emergence may coincide with CSFB migration. Delaying drilling until September could increase the chance of a significant yield reduction. This is because crops sown in mid-August usually take about 10 days to emerge compared with 14 days for crops sown in the second half of September (based on average temperatures for England). Slow emergence can put the crop at greater risk from adverse weather and other pests (AHDB Cereals & Oilseeds, 2014).

2.2. Cabbage stem flea beetle

The CSFB can cause severe damage to OSR both in its adult form and larval form (AHDB Cereals & Oilseeds, 2015). Figure 5 demonstrates the typical life cycle of the CSFB.

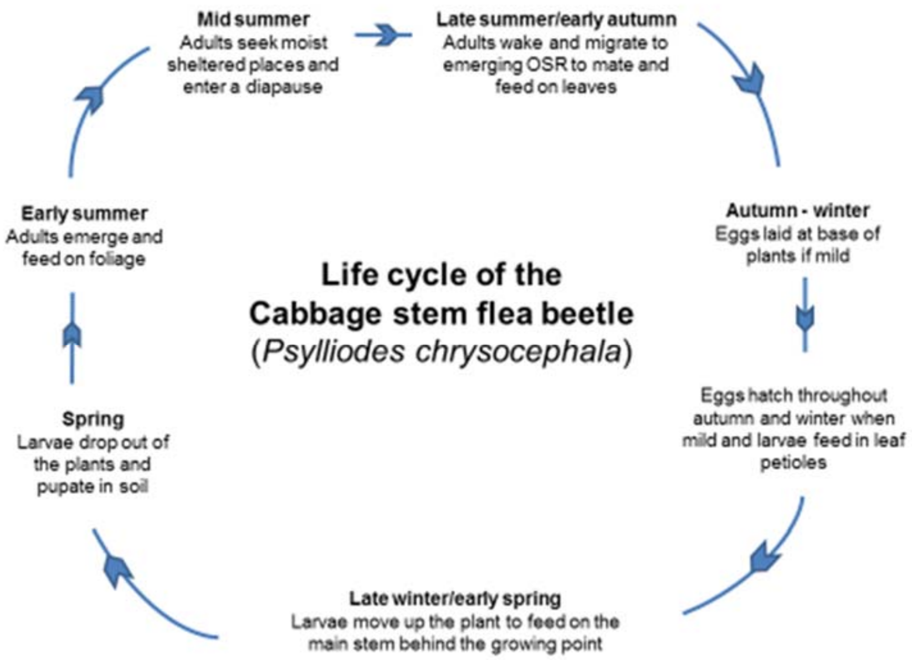


Figure 5. Life cycle of the cabbage stem flea beetle

2.2.1. Adult cabbage stem flea beetle

Adult CSFB emerge from the soil in late May and early June and feed on foliage. In mid-summer they seek moist sheltered places where they enter a diapause (resting period) which comes to an end in late august. The adult beetles break diapause and migrate into OSR crops during crop emergence to feed. This is the stage at which the crop is most vulnerable because as well as feeding on the leaves, the beetles can also destroy the growing point, killing the plant. In high pressure instances they can kill seedlings even before they emerge from the ground (AHDB Cereals & Oilseeds, 2015). Figure 6 shows a young OSR plant with symptoms of adult CSFB feeding damage.

The ovaries of the female beetles mature over a period of about 12–14 days of feeding. The beetles then mate and the females lay eggs in cracks in the soil around young seedlings. Each female can lay up to 1000 eggs throughout the autumn and winter. In mild winters, egg laying may continue through winter into spring, as too will feeding. The time to egg-hatch is about 35–70 days depending on the temperature prevailing, so eggs laid on early emerging crops are likely to hatch faster than those laid in later emerging crops, assuming that temperatures drop in the interim (Saringer, 1984).

Figure 6. Grazing symptoms on young oilseed rape plant

2.2.2. Cabbage stem flea beetle larvae

Larvae feed on the surviving plants through until spring. They bore into leaf petioles successively mining the older and then younger leaf petioles and finally entering the stems and growing points. They can cause crop stunting, loss of vigour and destroy the growing point, killing the plant (Figure 7). In spring, larvae drop to the ground to pupate before hatching in the summer (AHDB Cereals & Oilseeds, 2015).

Figure 7. Stunted plants in spring (left), larvae in plant stem (right)

2.2.3. Distribution

CSFB is distributed widely throughout the UK, with autumn assessments suggesting that in the last two years 76% and 70% of the UK crop was affected by adult CSFB in 2014 in 2015 respectively (Wynn *et al.*, 2014; Alves *et al.*, 2015). The severity, however, may vary and in the last two autumns has been reported to be more abundant in particular regions, including the East, South East, and North East of England (Wynn *et al.*, 2014; Alves *et al.*, 2015).

2.3. Control

The decision to control any pest should form part of an integrated pest management (IPM) approach. The principles of IPM help sustain healthy biodiversity on farmland (Voluntary Initiative, 2015). The main components of IPM include crop rotation, cultivation techniques, seed rate, drilling date, varietal choice, pest monitoring, control thresholds, enhancing natural predators, and chemical control.

2.3.1. Cultural control

There are a number of cultural control options which may help reduce the damage caused by CSFB. However, there are practical issues affecting some of the options. The main issue being the weather. The options which require access to land will be weather-limited. Access to the land can be termed as ‘Machinery Work Days’ and relates to the soil moisture content; if the soil is too wet or too dry then working the land may cause structural damage to the soil. Another practical issue may be time constraints as autumn is an especially busy time of year. The procedures at this time of year include time critical activities, working around the weather, such as harvest, cultivations, seed bed preparation, sowing, and crop protection against pests, weeds and disease. With regard to varietal choice in an IPM approach, there is current no published evidence showing varietal tolerance or resistance to CSFB. There is also no evidence of the frequency of OSR grown on farm, having a significant effect on CSFB populations.

Cultivations

Non-soil inversion methods (e.g. minimum tillage) have potential for reducing mortality of natural predators and, therefore, have the potential to be incorporated into an IPM approach (Defra, 2004).

In the autumn 2014 snapshot assessment and autumn 2015 assessment, AICC agronomists reported that crops drilled into dry/cloddy seed beds were slower to emerge with reduced vigour and therefore thought to be more vulnerable to adult CSFB damage (Wynn *et al.*, 2014; Alves *et al.*, 2015).

Seed rate

Plant density has been found to affect larval infestation with the number of larvae per plant increasing at lower plant densities (Williams, 2010). However, the same paper reported that vigorous hybrid cultivars, with larger petioles at lower plant densities, provided sufficient food for larvae preventing infestation of the main stem. In the autumn 2014 snapshot assessment and autumn 2015 assessment AICC agronomists also reported that lower plant populations suffered from greater adult CSFB grazing due to what they described as greater CSFB activity per plant (Wynn *et al.*, 2014; Alves *et al.*, 2015). There are risks associated with increasing seed rates if establishment a crop with a high plant population is achieved in spring as a thick crop may become more susceptible to disease and also more vulnerable to pollen beetle (AHDB Cereals & Oilseeds, 2013).

Drilling date

With regard to attack from adult CSFB, in the autumn 2014 snapshot assessment, 70% of AICC agronomists reported that drilling early reduced the crop’s vulnerability to early attack (Alves et al, 2015). They reported that across the majority of counties in England, the earlier the crop was sown the less susceptible it was to adult CSFB. The reason they gave was that they thought the crop had grown beyond the most susceptible stage by the time adult CSFB migrated into the crop (Wynn *et al.*, 2014). In the autumn 2015 assessment, AICC agronomists again reported that earlier drilled OSR was less affected by adult CSFB or had the greatest ability to withstand pest pressure

(Alves *et al.*, 2015). Both the autumn 2014 snapshot assessment and the autumn 2015 assessment also reported that later September drilled crops were also less affected (than late August/early September drilled) possibly because the peak migration of adult CSFB has passed.

Although early drilling was reported to have helped the crop better cope with adult feeding damage, it may also lengthen the period of CSFB feeding and egg laying, and therefore the risk of larval damage. This is because eggs laid on early emerging crops are likely to hatch faster (Saringer, 1984).

Natural predators

Defra-funded research has shown that there is probably only one main species of carabid beetle (*Trechus quadristriatus*) that feeds on CSFB eggs and young larvae before they enter OSR plants. Defra research has also found one main species of larval parasitoid (*Tersilochus microgaster*) (Defra, 2004). All parasitoids may be vulnerable to pyrethroid insecticides (AHDB, 2014). The same Defra project showed that minimum tillage has potential for conserving carabids and parasitoids within an IPM approach (Defra, 2004).

Two entomopathogenic fungi (*Beauveria bassiana* and *Metarhizium anisopliae*) are known to infect CSFB but their impact on the field populations is not known (Hokkanen *et al*., 2003).

2.3.2. Chemical control

Seed treatments

Before neonicotinoid seed treatments were withdrawn, data from the last three arable pesticide usage surveys has shown that an average of approximately 75% of the UK OSR area was treated with neonicotinoid seed treatments (Garthwaite *et al.*, 2011; Garthwaite *et al.*, 2013; Garthwaite *et al.*, 2015). This area treated is not far off from the area affected by CSFB as AHDB research suggests that around 70% to 76% of the UK OSR area is affected by the pest annually (Wynn *et al.*, 2014; Alves *et al.*, 2015). The neonicotinoid insecticide was applied to the seed coat prior to planting so that for the first 6–8 weeks of the crops life CSFBs were controlled and feeding was reduced (Nicholls, 2013). AHDB funded research in 1999 also showed a reduction in CSFB larval numbers from a neonicotinoid seed treatment (Oakley, 2000). This could have been be due to adult CSFBs dying before mating or egg laying.

Assessing the need to spray

Although research states that adult CSFB migration occurs towards the end of August and beginning of September, there is currently no commercially available tool to help precisely predict CSFB migration. Historic research carried out in Europe suggests that CSFB require temperatures above 16°C for flight but there is no published research that allows the modelling of migration under a range of realistic scenarios based on UK climatic conditions (Williams, 2010). It is therefore not currently possible for growers to predict precisely when adult CSFB will migrate into UK OSR or how long the migration period will last.

There are no spray thresholds at emergence but monitoring local pest pressure may give an indication of whether treatment is necessary. AHDB recommends the following guidance to growers:

- Check the number of adult CSFB in the previous crop's harvested seed
- Use water traps to check CSFB numbers
- Assess damage to volunteer OSR plants

(AHDB Cereals & Oilseeds, 2015)

Once the cotyledons have emerged, an assessment of shot-holing can be used to determine the need for a spray. There is currently only one chemical mode of action control option, broad spectrum foliar sprays from the pyrethroid group of insecticides. AHDB recommends that growers consider applying a spray if:

- Adults have eaten over 25% of leaf area at the cotyledon–2 true leaf growth stage
- Adults have eaten over 50% of the leaf area at the 3–4 true leaf stage
- The crop is growing more slowly than it is being eaten

(AHDB Cereals & Oilseeds, 2015)

AHDB guidance also states that where control from a pyrethroid is poor, a repeat spray with a pyrethroid-based product should be avoided (AHDB Cereals & Oilseeds, 2015).

Chemical control forms part of an IPM approach as a last resort to control pests after other IPM options are implemented where practically possible. Where chemical control is applied, minimising the risk of resistance is also an important component of IPM. Reducing the risk of resistance is identified in the EU Directive 2009/128/EC in Annex III ‘General principles of integrated pest management’ which is referred to in the UK National Action Plan for the sustainable use of pesticides. The text states that “*Where the risk of resistance against a plant protection measure is known and where the level of harmful organisms requires repeated application of pesticides to the crops, available anti-resistance strategies should be applied to maintain the effectiveness of the products. This may include the use of multiple pesticides with different modes of action”.*

2.3.3. Resistance to pyrethroids

Foliar applications of pyrethroid insecticides are currently the only available chemical mode of action for control of CSFB (AHDB Cereals & Oilseeds, 2015). For many growers, this is no longer a viable method of control as in 2014, AHDB-funded research confirmed that there was widespread resistance in CSFB to pyrethroid insecticides. Not only was knock-down resistance (kdr) confirmed, but also an unknown metabolic-based resistance mechanism which confers strong pyrethroid resistance (Foster & Williamson, 2016). This latter resistance mechanism has only been confirmed in the UK, unlike kdr which is also present in Europe (Højland *et al.*, 2016). Figure 8 shows the distribution of samples sent in for resistance testing in 2015, most of which came from eastern England.

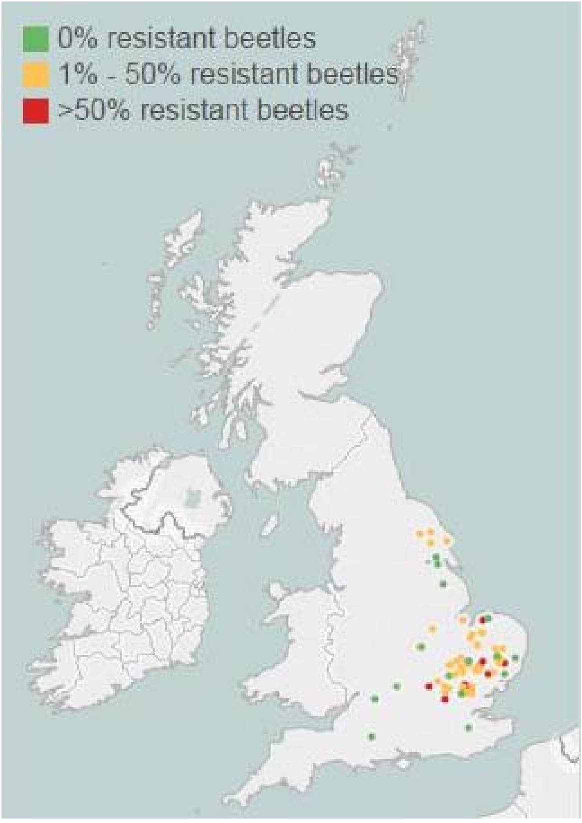


Figure 8. Incidence of cabbage stem flea beetle resistance to pyrethroid insecticides (Rothamsted Research, 2016)

3. Incidence and severity of cabbage stem flea beetle

There is very little research on the incidence and severity of damage caused by adult CSFB in the UK. This is because up until recent years, it is the larvae of the CSFB that has been considered most damaging to the crop. In 1984, however, it was documented that CSFB were important in parts of Bedfordshire, Buckinghamshire, Cambridgeshire, Essex, Lincolnshire, Northamptonshire, Oxfordshire and Suffolk (MAFF, 1984). The damage caused by the larvae has been studied for over 30 years including AHDB funded research which has shown yield penalties from as little as two larvae per plant in the autumn (Green, 2008).

Since the 1980s Defra has funded Fera to survey winter OSR twice a year (spring and autumn, Figures 9 and 10) for the presence of CFSB larvae (CropMonitor, 2016). The graphs published on CropMonitor show a rise in CSFB larvae since 2009/10.

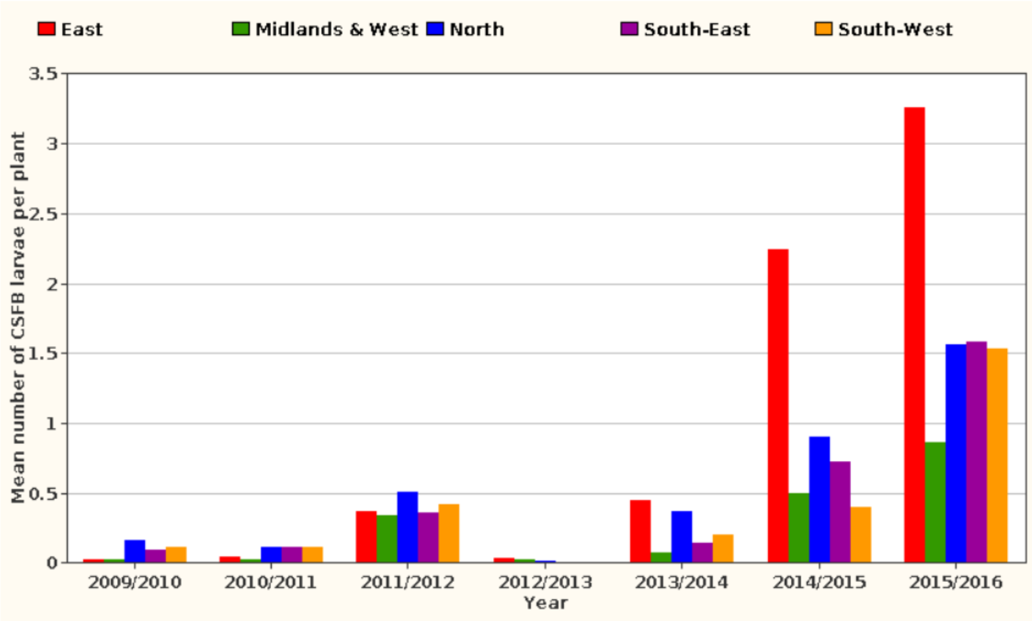


Figure 9. The mean number of cabbage stem flea beetle larvae found per plant over the last 7 years in the autumn assessment (Crop Monitor, 2016)

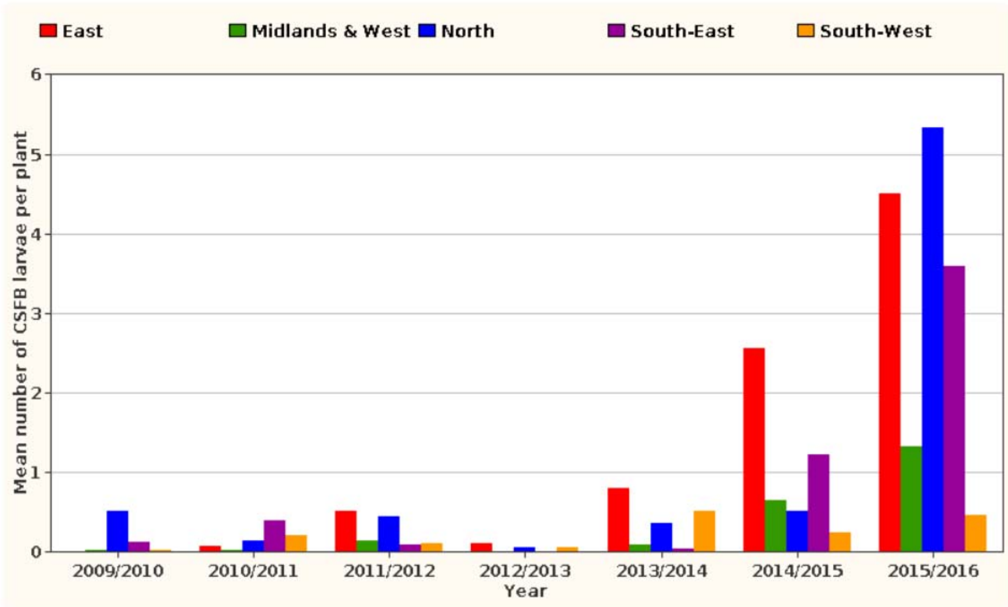


Figure 10. The mean number of cabbage stem flea beetle larvae found per plant over the last 7 years in the spring assessment (Crop Monitor, 2016)

The same data-set can allow us to see the fluctuation of larvae numbers recorded over the last 10 years. Figure 11 shows how the mean larvae population has increased since 2014, coinciding with the neonicotinoid restrictions. There is a particular increase in the East where the number of larvae recorded in 2014 was 17 times higher than the 10-year mean.

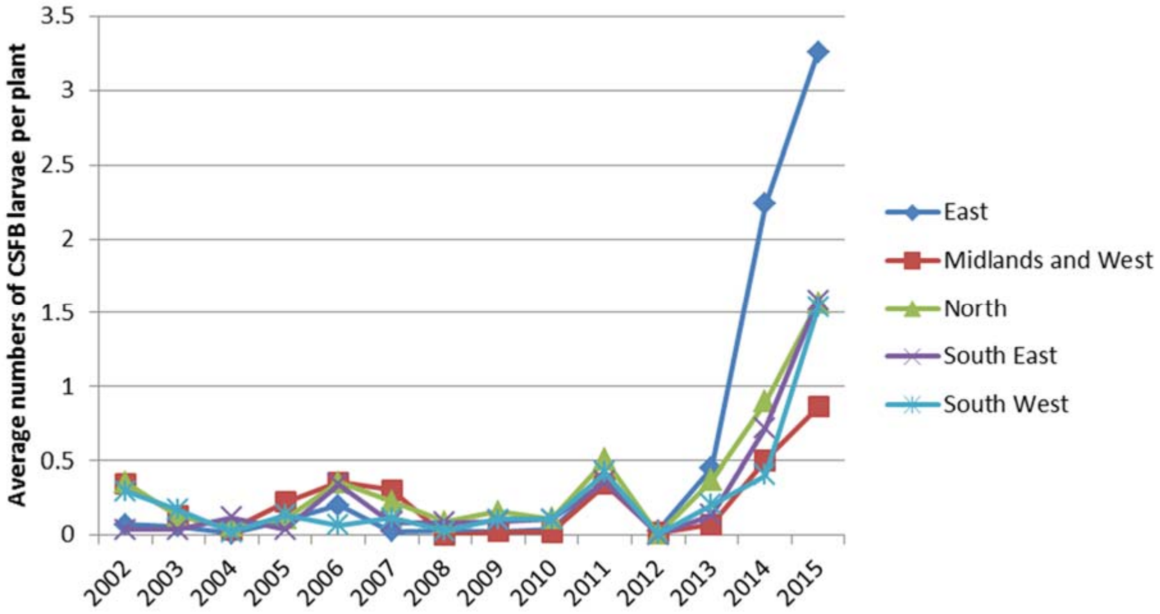


Figure 11. Mean numbers of cabbage stem flea beetle per plant by region (Crop Monitor, 2016)

In autumn 2015, the current AHDB five larvae per plant threshold was exceeded at more sites than in any previous year (annual report for Defra project CH0207, unpublished). Figure 12 shows the mean CSFB larvae per plant shown as the county mean for farms sampled in 2015.

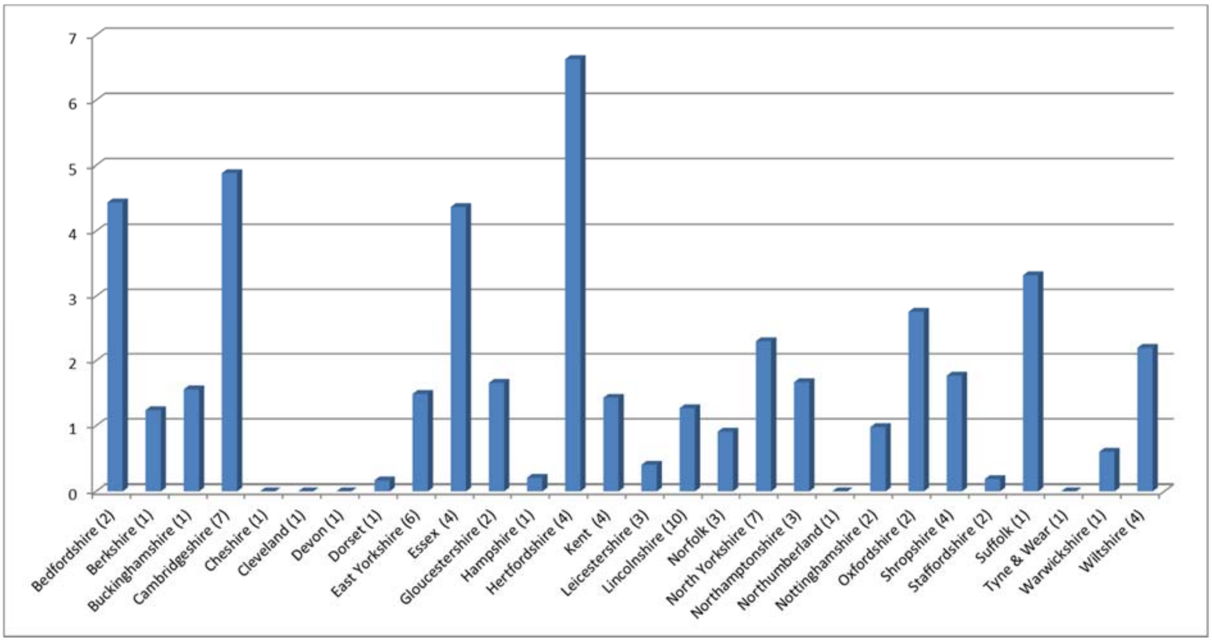


Figure 12. Mean cabbage stem flea beetle larvae per plant shown as the mean for farms sampled in 2015 (number of farms sampled per county in brackets) (annual report for Defra project CH0207, unpublished)

In winter 2015, AHDB funded ADAS to monitor larval populations in Bedfordshire, Cambridgeshire, Hertfordshire and Suffolk. The results support Fera data with larvae populations above five per plant found in each of these counties (White, 2016).

3.1. Adult cabbage stem flea beetle damage following withdrawal of neonicotinoids

Population levels of CSFB have been reported to be linked to weather conditions occurring at different times of the year (Saringer, 1984). This means that damage in OSR created by the pest will vary from year to year depending on what weather is experienced. This could also be linked to why CSFB are more abundant in certain parts of the country.

3.1.1. Adult cabbage stem flea beetle damage on a national scale

In the autumn 2014 snapshot assessment, around 18,000 ha (3%) of the national crop was reported as having been lost to adult CSFB (Figure 13) (Wynn *et al.*, 2014). A further 273,000 ha (41%) of the crop remained at a vulnerable growth stage (cotyledon to 4 true leaf stage) and was affected by CSFB at the end of September. Of the 41% of crop affected, it was estimated that at this point in time, 42,000 ha (6%) of the crop had CSFB damage levels exceeding foliar spray thresholds. Approximately 214,000 ha (32%) of the crop had grown past four true leaves at the time the assessments were made so any damage occurring earlier in growth was not recorded. The autumn 2014 snapshot assessments, therefore, did not take into account the level of crop damage that occurred before the end of September or any exceeded thresholds that may have occurred in the estimated 32% of the crop which had passed four true leaves. The level of damage recorded may therefore underestimate the true extent of damage that occurred before the end of September.

Because 214,000 ha (32%) of crop had grown beyond four leaves and was not assessed for damage, it is difficult to estimate how much additional crop may have had damage levels exceeding thresholds at earlier growth stages.

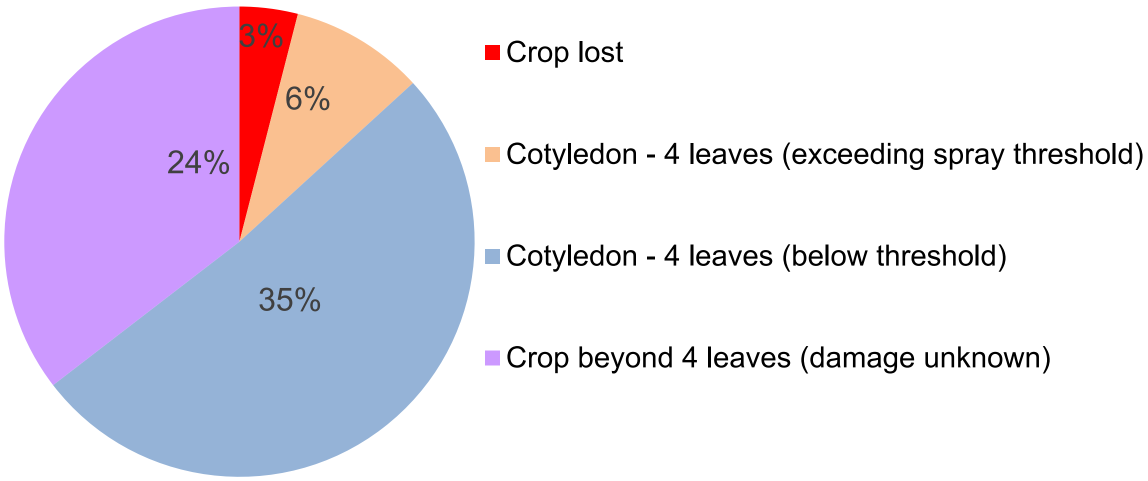


Figure 13. National assessment of cabbage stem flea beetle damage as recorded at the end of September 2014 (Wynn *et al.*, 2014).

The 2014 AHDB Winter Planting Survey reported that the national crop loss was 5% (equating to approximately 31,000 ha across England), and that 1.5% of the national area was reported to have been replanted after being lost (Nicholls, 2015). Based on 2015 yield data and the current value of the crop (average price delivered Erith, July 2015 – mid-March 2016), a loss of 3.5% of the national crop area is valued at approximately £23M. Crop losses occurring after 1 December would not have been accounted for in the 2014 AHDB Winter Planting Survey. With regard to how the weather may have affected adult CSFB migration, according to the Met Office, the mean temperature in England in September 2014 was 14.9°C, 1.2°C above the 1981–2010 long-term average (Met Office, 2014).

In autumn 2015, 5% of the OSR area in England was granted a 120 day emergency approval for the use of neonicotinoid treated seed in Bedfordshire, Cambridgeshire, Hertfordshire and Suffolk. In the autumn 2015 assessment, crops treated with neonicotinoids were not included in the assessments. At crop emergence (cotyledon to two leaves) CSFB damage was present on approximately 379,000 ha (65%); 1% was reported to have been lost and an additional 21% (7% severe and 14% high) reported as having damage exceeding threshold levels (Figure 14, left side). At three to four leaves, 1% of the national area was reported to have been lost and an additional 3% with damage exceeding threshold levels. This project only looked at crop losses experienced in the very early growth stages (emergence to 4 true leaves) it therefore did not record any subsequent losses after the four true leaf stage or losses from CSFB larvae.

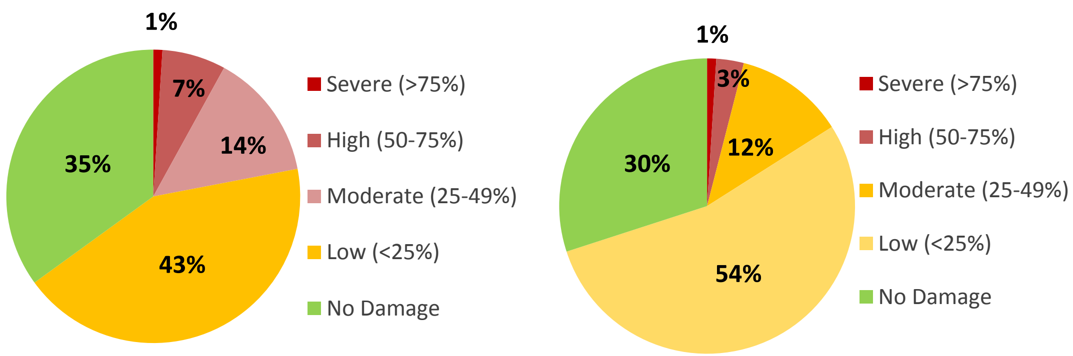


Figure 14. National assessment results from autumn 2015 at emergence (left) and 3-4 leaf growth stage (right). Red indicates thresholds exceeded, amber indicates damage not exceeding thresholds, green indicates no damage recorded.

The 2015 AHDB Winter Planting Survey reported that the national crop loss in England was 3% as of 1 December 2015 (approximately 19,000ha). Crop losses occurring after 1 December would not have been accounted for in the 2015 AHDB Winter Planting Survey.

With regards to the CSFB relationship with the weather, according to the Met Office, the provisional mean temperature in England in September 2015 was 12.6 °C, which is 1.1 °C below the 1981–2010 long-term (Met Office, 2015). These lower temperatures may not have been favourable for adult CSFB migration with the minimum temperature for flight 16°C (Williams, 2010).

The national average of CSFB damage exceeding control thresholds at the end of September in 2014 (9%) and at emergence (cotyledon to two leaves) in 2015 (22%) is estimated at approximately 15.5%. This likely to be a conservative estimate as the 2014 assessments were made at a snapshot in time at the end of September when 32% of the crop had grown past the susceptible growth stage and was not assessed.

3.1.2. Adult cabbage stem flea beetle damage on a regional scale

In the autumn 2014 snapshot assessment, the majority of crop losses and control threshold exceedances recorded occurred in the East (Figure 15).

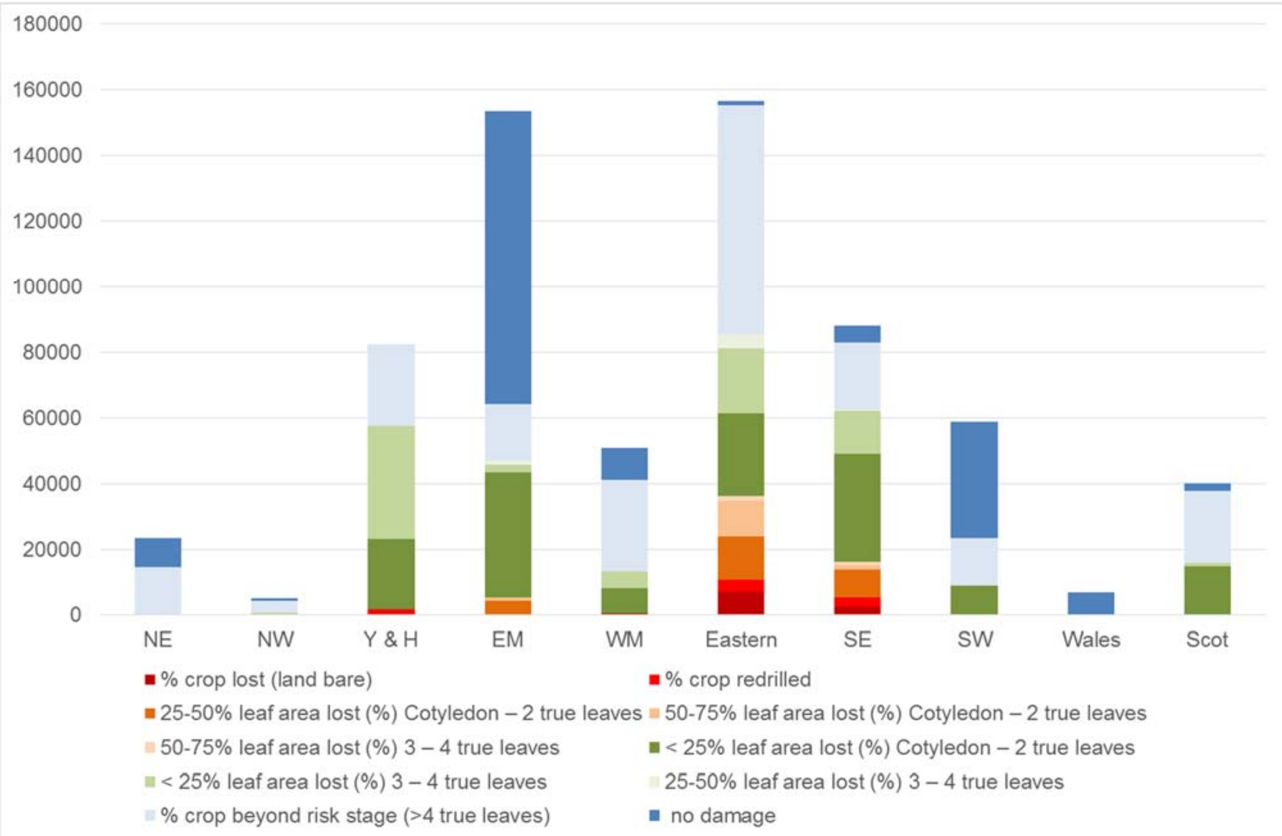


Figure 15. Regional area (ha) impacted by cabbage stem flea beetle and the severity of impact. Red bars = Crop lost; Orange bars = Control threshold exceeded; Green bars = Below control threshold; Blue bars = No damage seen or crops beyond at risk growth stages

The 2014 AHDB Winter Planting Survey report also showed that by 1 December 2014, 62% of the national area of crop lost is estimated to have occurred in the East (Figure 16). This crop area lost is estimated at a value of approximately £13M (using the lower Eastern region yields and the Erith price to calculate the value).

With regard to the regional weather conditions, in East Anglia the mean temperature recorded by the Met Office in September 2014 was 15.6°C, close to the reported 16°C CSFB temperature requirement for flight (Met Office, 2014; Williams, 2010).

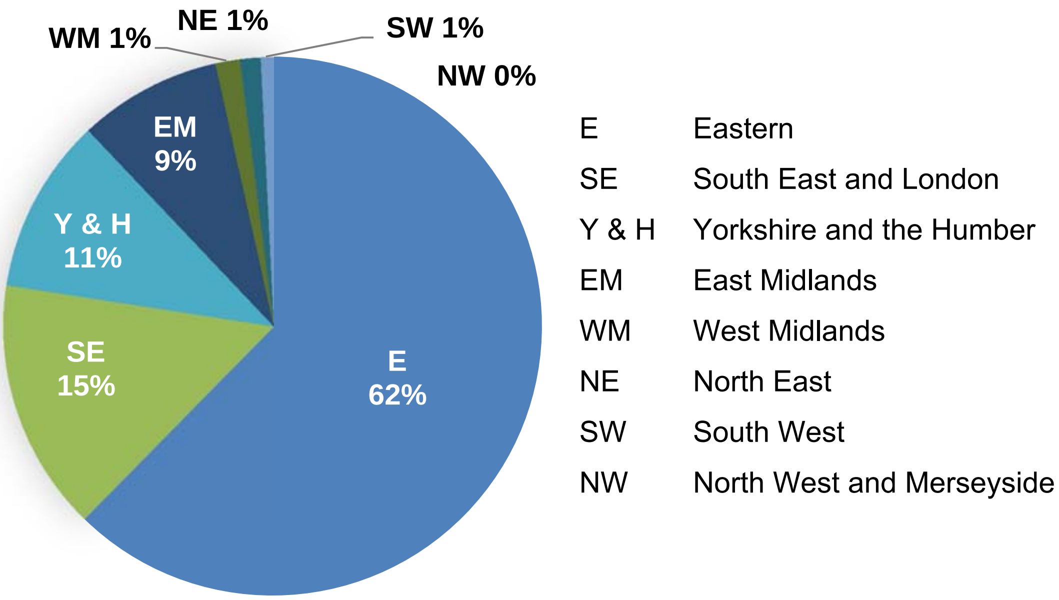


Figure 16. Estimated crop loss by region in December 2014 (Nicholls, 2015)

In the autumn 2015 assessment, the majority of crop losses and control threshold exceedances recorded also occurred in the East (Figures 17 and 18).

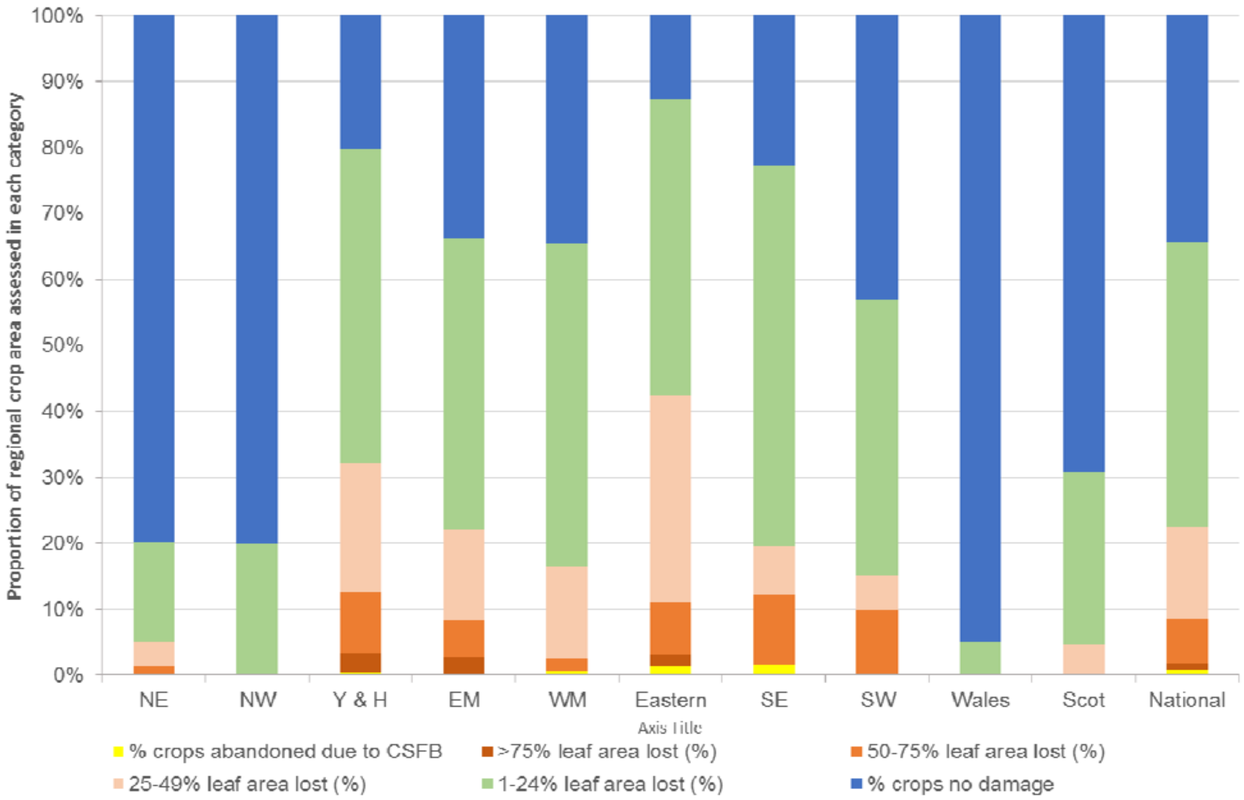


Figure 17. Proportion (%) of crops in each region affected by cabbage stem flea beetle at cotyledon – 2 leaves in autumn 2015.

Yellow bars = Crop lost; Orange bars = Control threshold exceeded; Green bars = Damage below control threshold; Blue bars = No damage seen

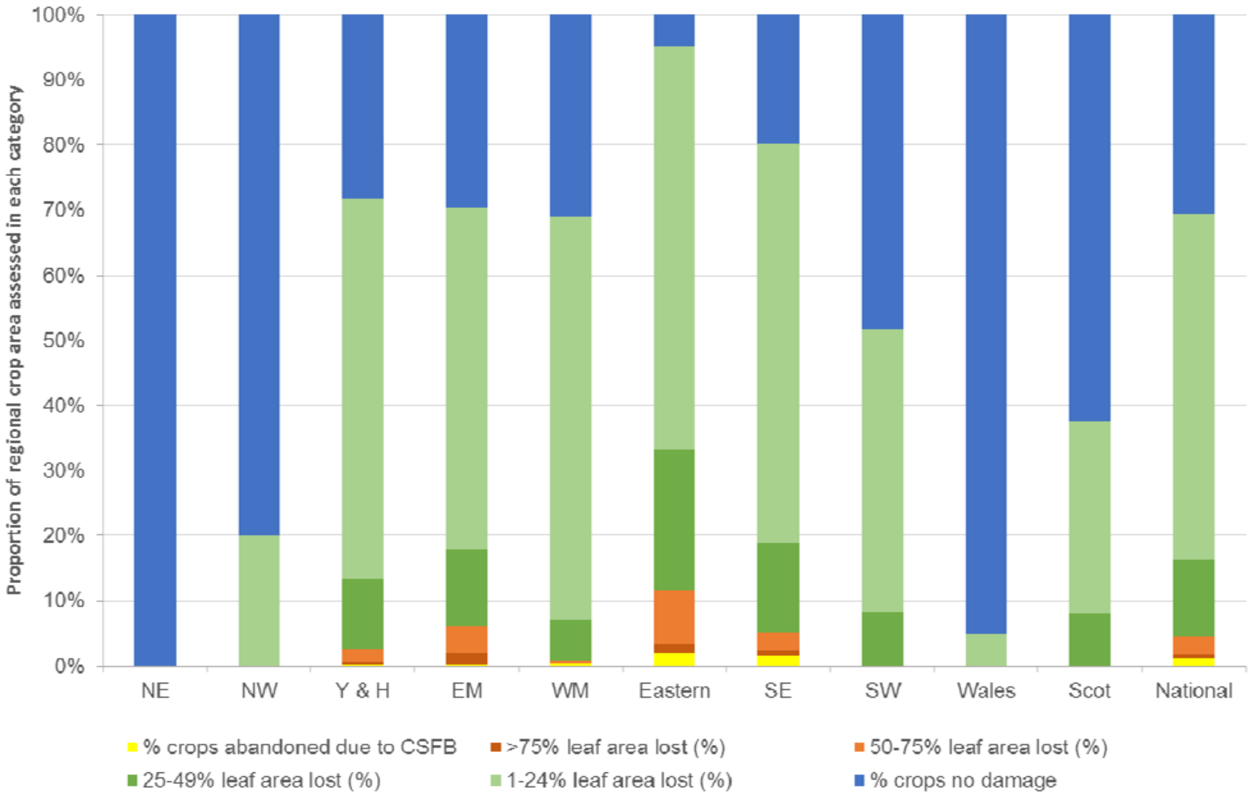


Figure 18. Proportion (%) of crops in each region affected by cabbage stem flea beetle at 3-4 leaves in autumn 2015.
Red bars = Crop lost; Orange bars = Control threshold exceeded; Green bars = Damage below control threshold; Blue bars = No damage seen

The 2015 AHDB Winter Planting Survey report showed that by 1 December 2015, 6% of the crop in the Eastern region had been lost to adult CSFB (Figure 19).

With regards to climatic conditions during September 2015. Mean temperatures in East Anglia and England South East and Central South were also below average both at 13.2^{o}C, below the reported 16^{o}C flight requirement for CSFB (Met Office, 2015).

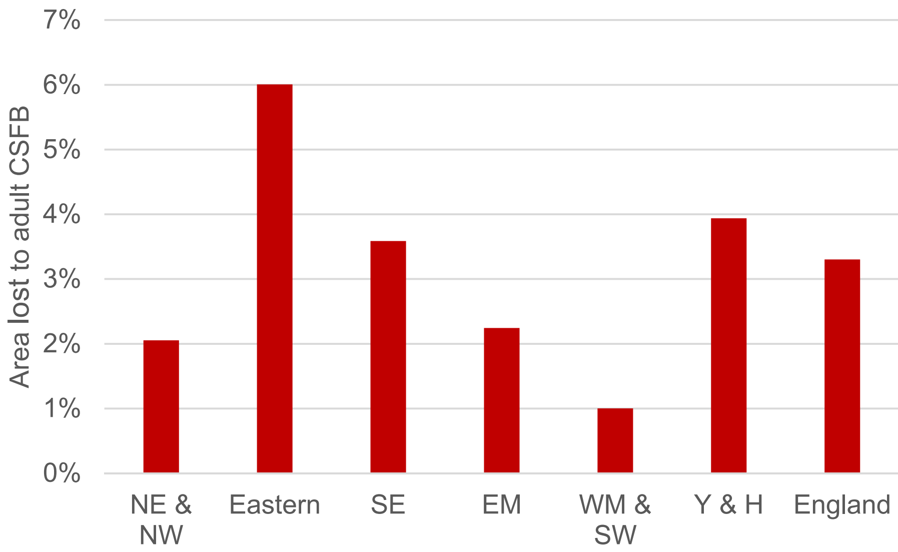


Figure 19. Estimated crop loss by region in December 2015 (AHDB unpublished data)

3.1.3. Cabbage stem flea beetle on a county scale

In the autumn 2014 snapshot assessment, 3% of the crop was reported lost, 24% was reported unaffected and 32% was reported to have had grown beyond the growth stages for the associated control threshold (beyond four true leaves) and was therefore not assessed for damage. This meant that 41% of the crop was reported still at the cotyledon to four true leaf stage with signs of damage.

The counties in Figure 20 are those which were recorded as having crop lost or incidences where thresholds were exceeded in crops at the cotyledon to four leaf stage. The counties that were reported to have had 10% or more of the crop exceeding control thresholds at cotyledon to four leaves include Hampshire/Surrey, Bedfordshire/Hertfordshire, Suffolk, Cambridgeshire, Northampton, and Essex.

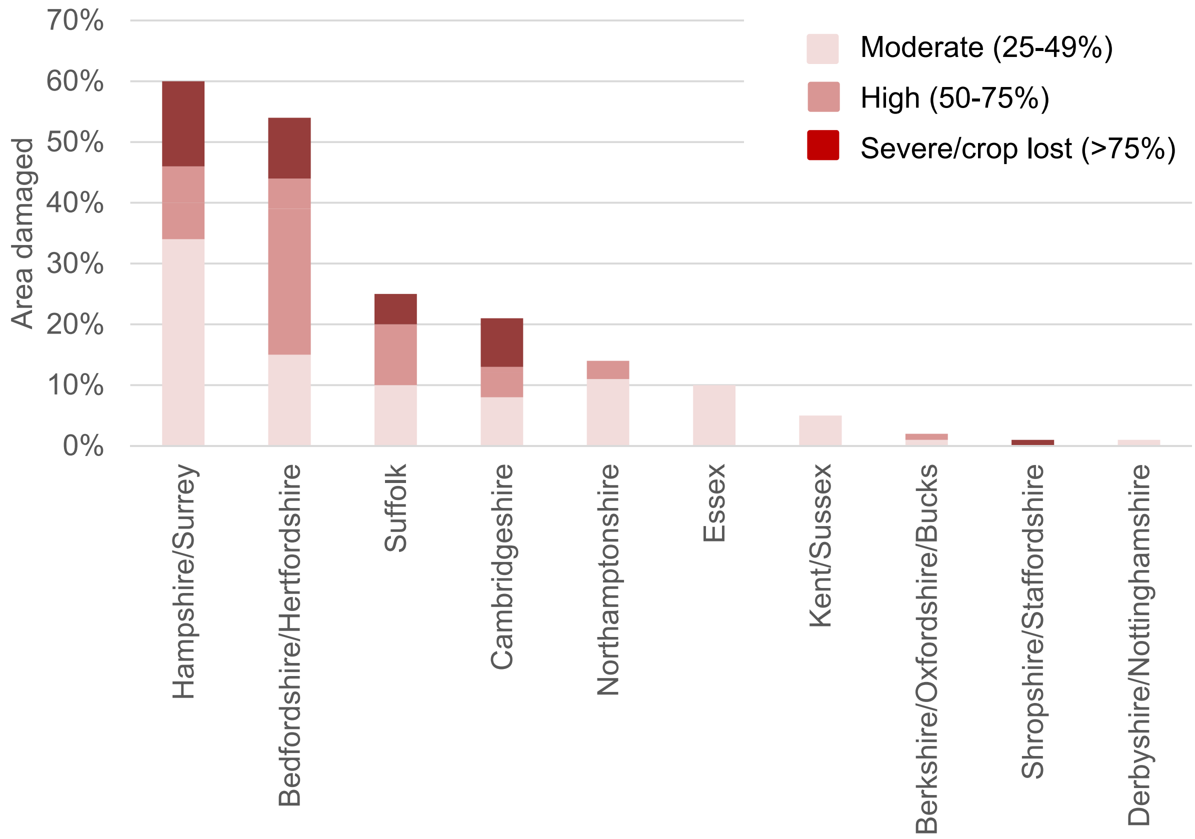


Figure 20. Counties reported as exceeding thresholds at cotyledon – 4 leaves during the last week of September (autumn 2014 snapshot assessment)

Figure 21 shows the CSFB damage observations reported by county at cotyledon to two leaves and also at three to four leaves from the autumn 2015 assessment. The black dots represent the level of crop abandonment reported. The counties which were reported to have had 10% or more of the crop exceeding control thresholds at cotyledon to two leaves and also at three to four leaves include Cambridgeshire, Essex, Buckinghamshire and Lincolnshire.

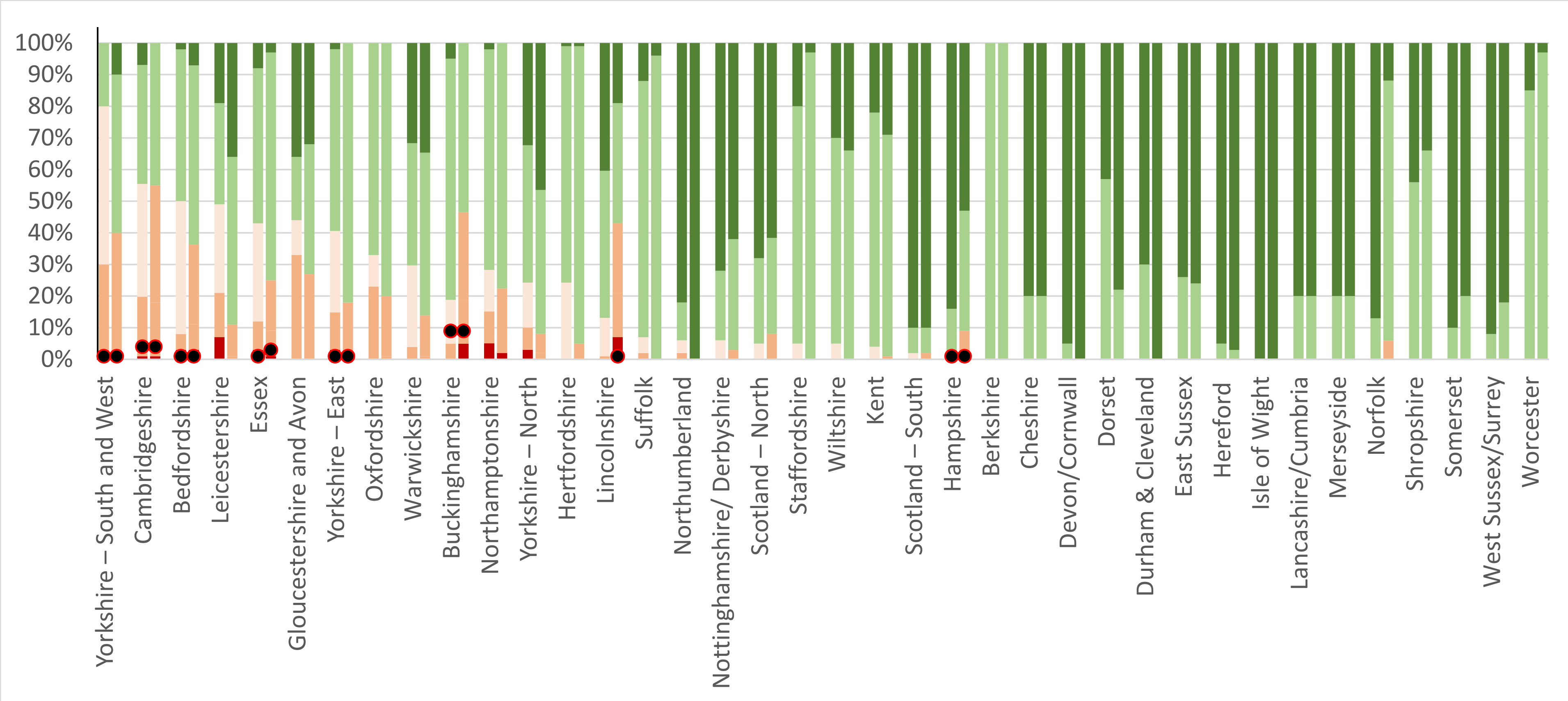
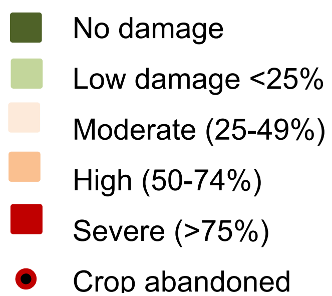


Figure 21. Level of damage reported at county level at cotyledon – 2 leaves (left bar of pair) and at 3-4 leaves (right bar or pair) in autumn 2015.



4. Summary

The area of OSR has fallen since 2013, probably because of the high levels of risk associated with growing the crop. The 2014 AHDB Winter Planting Survey reported that 11% of the survey respondents (equivalent to 38,000ha) said they would have planted additional areas of OSR had neonicotinoid seed treatments been available. Most of this additional area was reported to have come from the East and South East of England. The 2015 AHDB Winter Planting Survey reported that the area in England could have been between 2% and 4% higher if the use of neonicotinoids had not been restricted.

Both the adult CSFB and the larvae can be damaging to OSR but protecting the crop at emergence from the adult CSFB can also help reduce the damage caused by the larvae. Controlling the pest through cultural control options can be practically challenging due the weather and may also have negative affect on other aspects of growing the crop such as yield penalties and other pests and disease. CSFB migrate into OSR as it emerges but altering the drilling date to avoid peak CSFB migration may result in additional yield penalties.

Neonicotinoid seed treatments have been used to help control adult CSFB by reducing feeding on the crop. The neonicotinoid seed treatments can also reduce larval numbers. With regards to foliar insecticide sprays, there are thresholds in place during the early growth stages to help growers know when a spray is needed. For many growers, however, the thresholds are unworkable as the only control option is pyrethroid insecticides to which CSFB have developed resistance too. There is therefore currently no viable chemical control option for CSFB.

The national area of crop lost to adult CSFB in autumn 2014 was estimated at 5% (equating to approximately 31,000 ha across England). Approximately 9,000 ha (1.5%) of the national area was also reported to have been replanted after being lost. A loss of 22,000 (3.5%) of the crop area in England is valued at approximately £23M. 62% of the national area of crop lost is estimated to have occurred in the East, valued at approximately £13M. In autumn 2015 the estimated crop loss in England was 3%. Any additional crop losses after 1 December, such as from CSFB larvae were not reported due to lack of evidence.

The national average of CSFB damage exceeding control thresholds at the end of September in 2014 (9%) and at emergence (cotyledon to two leaves) in 2015 (22%) is estimated at approximately 15.5%. This likely to be a conservative estimate as the 2014 assessments were made at a snapshot in time at the end of September when 32% of the crop had grown past the susceptible growth stage and was not assessed. The four AHDB reports together with Defra-funded research have also consistently identified the East of the country as a region suffering from damaging levels of adult CSFB and larvae.

With regards to county level information, two AHDB reports together with Defra funded research have also shown some counties consistently being reported to have high levels of adult CSFB or larvae. These counties include Bedfordshire, Cambridgeshire, Essex, Hertfordshire and Suffolk. This does not mean to say that other counties, not listed, may not suffer from severe damage in the future. It is difficult to make robust conclusions on most at risk counties based on only two years of recent data (2014 and 2015) and one year of historic information (1984) as damage levels can vary year on year.

To achieve control in years where severe damage may occur, a range of insecticide options is required. This is not just to ensure adequate control but also to ensure effective resistance management strategies can be put in place to minimise the use of all types of insecticide. For growers with pyrethroid resistant CSFB, there are currently no viable chemical control options. With research showing a significant rise in larvae numbers, the population of CSFB and therefore risk of significant crop damage may rise over coming years.

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