Final Project Summary

Project title	Cabbage stem flea beetle larval surveys		
Project number	214-0025 (21120004)	**Final Project Report**	PR586
Start date	January 2015	**End date**	November 2016
AHDB Cereals & Oilseeds funding	£33,600	**Total cost**	£33,600

What was the challenge/demand for the work?

Following the restrictions on the use neonicotinoid seed treatments, the 2014 winter oilseed rape (WOSR) crop was the first for which they were not available to protect plants during emergence and establishment. Prior to this, neonicotinoid seed treatments had been widely used to reduce damage from adult cabbage stem flea beetle (CSFB). Since the restrictions came into effect the only chemical control options for CSFB have been foliar applications of pyrethroids and acetamiprid (autumn 2014 only). In autumn 2014, crop losses due to adult CSFB were estimated to be 2.7% of the national crop, with the most damage (% crops lost) occurring in Hampshire/Surrey (14%), Bedfordshire/Hertfordshire (10%), Cambridgeshire (8%) and Suffolk (5%). In autumn 2015, 1% of the national crop was estimated to have been lost to adult CSFB, although serious crop damage was found to be more widely dispersed around the country than in 2014. There was therefore a need to develop a greater understanding of the impact of the neonicotinoid restrictions on CSFB larval pressure in OSR; the range and success of control methods against the pest; the impacts of larvae on yield, larval ecology; and factors that can be used as reliable indicators of larval pressure.

The main objectives of this project were to:

1. Assess the scale and range of larval CSFB populations in high risk counties.
2. Investigate the effectiveness of control methods used for CSFB.
3. Determine those factors that are reliable indicators of larval CSFB presence and pressure.
4. Investigate the relationship between larval CSFB number and their impact on yield.

How did the project address this?

CSFB larval populations were assessed in late winter/early spring 2015 and 2016. In each year, populations were monitored in six counties; Bedfordshire, Cambridgeshire, Hampshire, Hertfordshire, Suffolk and Surrey in 2015; and Bedfordshire, Buckinghamshire, Cambridge, East Yorkshire, Essex and Lincolnshire in 2016. Counties were selected by those that had the highest levels of adult CSFB damage during the preceding autumn. In each county, independent agronomists from the Association of Independent Crop Consultants (AICC) were asked to select fields which had suffered contrasting levels of damage from adult CSFB during the establishment phase of the crop, i.e. one field with high levels of feeding damage ('high risk') and one field with low levels of feeding damage ('low risk'). Plants were sampled from 14 fields in 2015 and 24 fields in 2016. In 2015, a second assessment occurred in April at high risk sites in Bedfordshire, Cambridgeshire, Hampshire, Hertfordshire and Suffolk. This was done to improve understanding of the timing of and factors relating to larval movement from the petioles to the stem. To determine larval populations, 25 WOSR plants were randomly selected from each field and taken to ADAS laboratories where they were dissected and the number and location (petiole or stem) of CSFB larvae and the presence of leaf-scarring was recorded. Agronomists completed a questionnaire for each field to provide additional information relevant to CSFB pressure and control, including previous cropping, establishment methods, drilling date, seed rate, proximity to previous WOSR, adult CSFB pressure, other pest pressure, control measures and yield.

What outputs has the project delivered?

CSFB larval populations

In 2015, significant differences in larval populations were found between counties. Larval number was above the treatment threshold in all counties surveyed except Surrey. The largest population was 28 larvae per plant in Cambridgeshire (Figure. 1). Larval populations dropped significantly between February and April. The majority of larvae were found in the petioles rather than the stems in both February (95%) and April (65%).

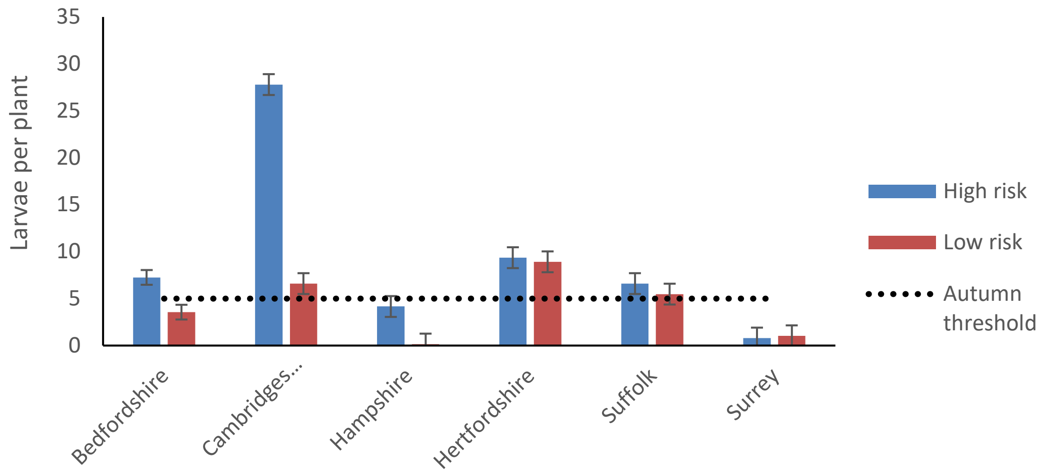

Figure 1. Mean larvae per plant in February 2015 at high and low risk sites in six counties where there was a high incidence of adult CSFB damage. Bars indicate standard errors of the means. Dashed line indicates the autumn treatment threshold (five larvae/plant).

In 2016, significant differences in larval population were again found between counties, with the largest populations in Cambridgeshire and the smallest in Lincolnshire and East Yorkshire (Fig. 2). At half of sites, larval populations were above the autumn treatment threshold of five larvae per plant. The majority of larvae (96%) were found in the petioles rather than the stem. Between the 2015 and 2016 larval surveys, the larval population increased by 20.4% in Cambridgeshire and 131.1% in Bedfordshire (other counties were not assessed in both years).

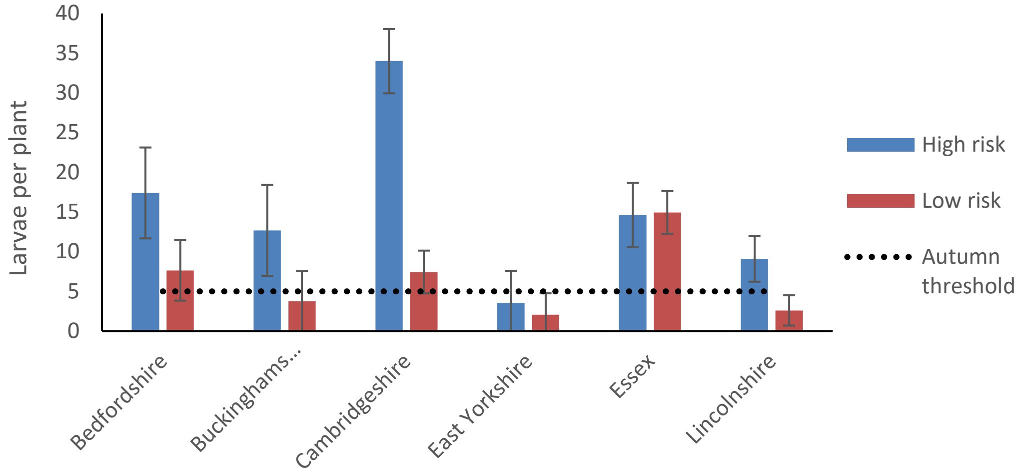

Figure 2. Mean larvae per plant in February/March 2016 at high and low risk sites in six counties where there was a high incidence of adult CSFB damage. Bars indicate standard errors of the means. Dashed line indicates the autumn treatment threshold (five larvae/plant).

CSFB control measures

In both years, control of CSFB at the sites monitored relied almost exclusively on applications of foliar pyrethroids, although the majority of these treatments were not considered by agronomists to provide more than 50% control. CSFB was also shown to be the main target for pest control in OSR, accounting for 69% and 82% of all foliar insecticide applications in 2015 and 2016 respectively.

Predicting CSFB larval pressure

Across sites in both years, larval number was significantly higher at high risk sites than low risk sites, indicating a relationship between adult feeding damage in the autumn and larval populations in late winter/early spring. In 2015, the presence or absence of leaf-scarring was shown to provide a reliable and easily identifiable indicator of larval infestation. Analysis of data from the 2016 survey found that adult feeding damage at the cotyledon to two leaves, and three to four leaf stage, and the number of leaves per plant, were significantly correlated with the number of larvae per plant in February/March. Stepwise regression analysis found that a model consisting of adult feeding damage at the cotyledon to two leaf stage, the number of leaves in February/March, and their interaction, was most accurate at predicting larval number in February/March (explaining 64% of the variance).

Impact on yield

Yield was lower than the average field yield (based on 1-5 years data) at 75% and 83% of sites for which historic yield data were available in 2015 and 2016 respectively. The average yield across all sites was 3.5 t/ha and 3.3 t/ha in 2015 and 2016 respectively, and the average yield reduction was 0.5 t/ha and 0.8 t/ha in 2015 and 2016 respectively. Using data from both years, a significant correlation (df = 1, F = 10.89, P = 0.002) between mean number of larvae/plant in February/March and the reduction in yield was found (Fig. 3).

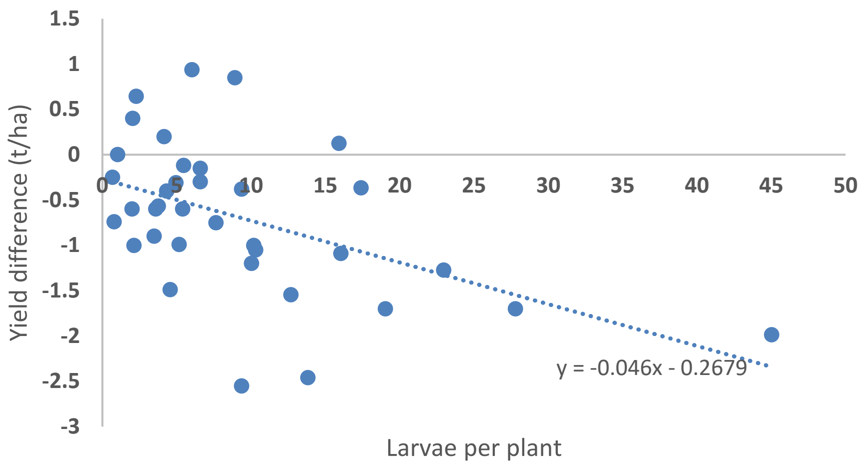

Figure 3. Mean number of larvae per plant (in February/March) plotted against the yield difference (yield minus field average yield). Data shown is for the 2015 and 2016 larval surveys. Dashed line indicates the best fit of the regression analysis. R^2 = 0.243, Percent variance accounted for = 22%.

Who will benefit from this project and why?
UK growers, agronomists and regulatory bodies will benefit from the work as it has provided a better understanding of the extent and range of larval pressures in high risk counties since the neonicotinoid restrictions have been in effect. Further insights have also been gained on the effectiveness of alternative CSFB control measures, the impact of larvae on yield, larval ecology and indicators of the risk of infestation.

If the challenge has not been specifically met, state why and how this could be overcome
N/A

Lead partner	RSK ADAS Ltd
Scientific partners	n/a
Industry partners	AICC
Government sponsor	n/a