A further investigation into the impact of the ban on neonicotinoid seed dressings on oilseed rape production in England, 2015-16

A report jointly funded by Rural Business Research and the Institute of Agri-Food Research and Innovation at Newcastle University

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The views expressed in this report are those of the authors and are not necessarily shared by other members of RBR or Newcastle University.

Summary

The UK oilseed rape area has fallen from a peak of 756,000 ha in 2011/12. An increased incidence of damage caused by cabbage stem flea beetle (CSFB) is being reported as a major reason for this decline following the ban on the use of neonicotinoid dressed seed in December 2013. A survey of 204 Farm Business Survey (FBS) farms in 2015/16 aimed to investigate the effects that the neonicotinoid seed dressing ban was having on area of crop grown, the damage being caused by the pest and alternative strategies and chemicals being used to combat CSFB. This study showed an area reduction in England of 13% less than that grown for harvest 2015. The total recorded area lost to CSFB in England was 5% of area planted which was higher than the 3% recorded in the previous season (2014/15). Crop losses varied by county with the highest level of 16% being recorded in Suffolk. The level of active substance used was much lower i.e. about half of the amount applied in 2014/15 and there was a clear difference in insecticide use on farms within the Derogation Area (DA) which had used treated vs non-neonicotinoid treated seed (0.01kg/ha compared to 0.04 kg/ha). The financial cost of CSFB control in England was lower than in the previous season (£18.4m in 2015/16 vs £22m in 2014/15) largely due to a reduced usage of insecticide.

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Introduction

The European Commission from the 1st December 2013 suspended the use of neonicotinoid seed dressings (Regulation EU 540/2011) including imidacloprid (Chinook), clothianidin (Modesto) and thiamethoxam (Cruiser) on bee attractive crops such as oilseed rape. Other neonicotinoids such as thiacloprid and acetamiprid are still allowed as foliar sprays as they are deemed to be safer to bees (Blacquiere *et al*., 2012). This ban has had major effects on the viability of oilseed rape production in England particularly with respect to the control of cabbage stem flea beetle (CSFB). Neonicotinoids had become an important weapon for farmers since their first approval in 2000 for use as a seed dressing on oilseed rape. In 2014 in excess of 725,000 ha of oilseed rape had a seed treatment with neonicotinoids accounting for 87% of this treated area (Garthwaite *et al*., 2015).

A survey of 204 Farm Business Survey (FBS) farms was previously carried out in 2015 (Scott and Bilsborrow 2015) to investigate the effects that the neonicotinoid seed dressing ban was having on area of crop grown, the damage being caused by the pest and alternative strategies and chemicals being used to combat CSFB. The report showed that an estimated 17% of growers had suffered crop losses in the 2014/15 growing season due to CSFB with the area lost estimated at 16,000 ha or 3% of the area grown. At a national level in excess of 1.1 million ha was estimated to have been sprayed against CSFB with 33,957 kg of active substance (a.s.) used which represents a 2.5 fold increase in the use of autumn insecticides to combat the threat of CSFB. The cost of the ban to oilseed rape growers was put at £22 million based on the additional cost of chemicals used to control CSFB, the cost of replanting and the cost of lost crop.

In 2015 a derogation for neonicotinoid dressed seed was approved (22nd July 2015) by DEFRA for use on 5% of the total oilseed rape area equating to about 30,000 ha in the high risk counties of Suffolk, Cambridgeshire, Bedfordshire and Hertfordshire (Derogation Area).

The aim of this second report was to carry out a follow up assessment covering the 2015/16 growing season (the second season where neonicotinoid seed dressings have not been available) using most of the farms used in the first survey to see whether the nature of the problem was increasing or not.

Methodology

Sample selection and method

A sample of 204 farms was selected from the 451 Farm Business Survey (FBS) farms that grew winter oilseed rape (both high erucic acid and double low varieties) for the 2014 harvest. Farms were selected in proportion to the number of growers by region, and where possible, by county. The growers were asked 12 questions (Annex 1 – Sample questionnaire). 179 farmers were surveyed by structured interview, either by telephone or face-to-face, and 25 growers were surveyed by postal questionnaire. Growers were asked about areas of WOSR grown for the 2016 harvest, the reasons for any changes in the area of WOSR grown (from the previous year i.e. 2015 harvest) and strategies and chemicals used to combat actual, or expected, CSFB attacks. The surveys were conducted in the spring of 2016.

Sample characteristics

The sample distribution is described by merged county in Table 1. Adjacent counties were merged to give a minimum sub-sample size of at least 10 farms for analysis (Figure 1). Table 2 and Table 3 describe the sample distribution by England region and EU region respectively. The North West region, with only 5 farms is merged with the West Midlands region (20 farms) to ensure a sub-sample size of at least 10 farms. Of the 204 farms interviewed, 146 were also surveyed in the 2015 survey.

Farms in the Derogation Area (DA) had the option to apply to use neonicotinoid treated seed. Twenty-eight sample farms were in the DA; of these 5 did not grow WOSR in 2015/16, 8 farms requested and used neonicotinoid treated seed, and 15 farms did not request treated seed. Two farms that used treated seed also grew WOSR with non-neonicotinoid seed. Table 4 describes the sample distribution with reference to the DA and use of neonicotinoid treated seed.

Twenty-five of the 204 sampled farms, while growing WOSR in the 2014 harvest year grew no WOSR for harvest in 2016. The total area of WOSR grown for 2016 harvest on sample farms was 8,374 ha.

A comparison of sample farms with the 2015 Defra June survey data (DEFRA 2015) shows that the sample represents 1.5% of growers and 1.6% of the WOSR area grown in England.

Weighting of sample data

The sample data were weighted up to population level using weights calculated from the 2015 June survey population data of areas of WOSR grown (Annex 4 – Defra 2015 June census data - winter oilseed rape) and the 2015 areas of WOSR grown by sample farms. When weighted up the sample data is estimated to be within 1% of the 2015 June survey total WOSR area (DEFRA 2015).

Table 1 Sample distribution by merged county, 2015

Merged Counties	No. of farms	Area of WOSR (ha)	Estimated population no. of farms	Estimated WOSR population area (ha)	% growers	% area grown
Chesh, Staffs & Shrops	12	329	804	21,058	6%	4%
Derby, Leics, Notts & Northants	19	588	1,307	39,291	10%	7%
Dorset, Devon & Cornwall	12	317	806	21,324	6%	4%
East Riding of Yorkshire	11	339	792	24,502	6%	5%
Gloucs, Wilts & Somerset	13	624	699	37,707	5%	7%
Heref, Worcs & Warwick	13	320	864	20,537	6%	4%
Essex, Kent, Sussex & Hants	20	925	1,344	61,320	10%	12%
Lincolnshire	23	1,000	1,605	64,308	12%	12%
Norfolk	14	500	865	29,149	6%	6%
North Yorkshire	11	229	803	16,569	6%	3%
North'land & Durham	14	402	939	25,780	7%	5%
Oxs, Bucks & Berks	14	1,121	892	65,346	7%	12%
Derogation counties:						
Beds, Herts & Cambs	18	1,216	1,167	72,706	9%	14%
Suffolk	10	465	673	29200	5%	6%
Total	204	8,374	13,560	528,795	100%	100%

Table 2 Sample distribution by Government Office Region, 2015

Government Office Region	No. of farms	Area of WOSR (ha)	Estimated population no. of farms	Estimated WOSR population area (ha)	% growers	% area grown
North East	14	402	939	25,780	7%	5%
North West	5	153	342	9,879	3%	2%
Yorkshire & Humber	22	567	1,595	41,070	12%	8%
East Midlands	42	1,588	2,912	103,599	21%	20%
West Midlands	20	496	1,327	31,717	10%	6%
East of England	48	2,354	3,121	142,773	23%	27%
South East	28	1,873	1,819	114,947	13%	22%
South West	25	941	1,506	59,030	11%	11%
Total	204	8,374	13,560	528,795	100%	100%

Table 3 Sample distribution by EU Region, 2015

EU region	No. of farms	Area of WOSR (ha)	Estimated population (no. of farms)	Estimated WOSR population area (ha)	% growers	% area grown
North England	41	1,122	2,875	76,729	21%	15%
East England	118	5,815	7,853	361,319	58%	68%
West England	45	1,437	2,832	90,747	21%	17%
Total	204	8,374	13,560	528,795	100%	100%

Table 4 Sample distribution by Derogation Area and seed treatment, 2015

		No. of farms	Area of WOSR (ha)	Estimated population (no. of farms)	Estimated WOSR population area (ha)	% sample	% area grown
Derogation Area	Treated seed	8	571	526	38853	4%	7%
	Untreated seed	15	1109	1314	63052	10%	12%
Non-DA farms		156	6694	11720	426890	86%	81%
Total		179	8374	13560	528795	100%	100%

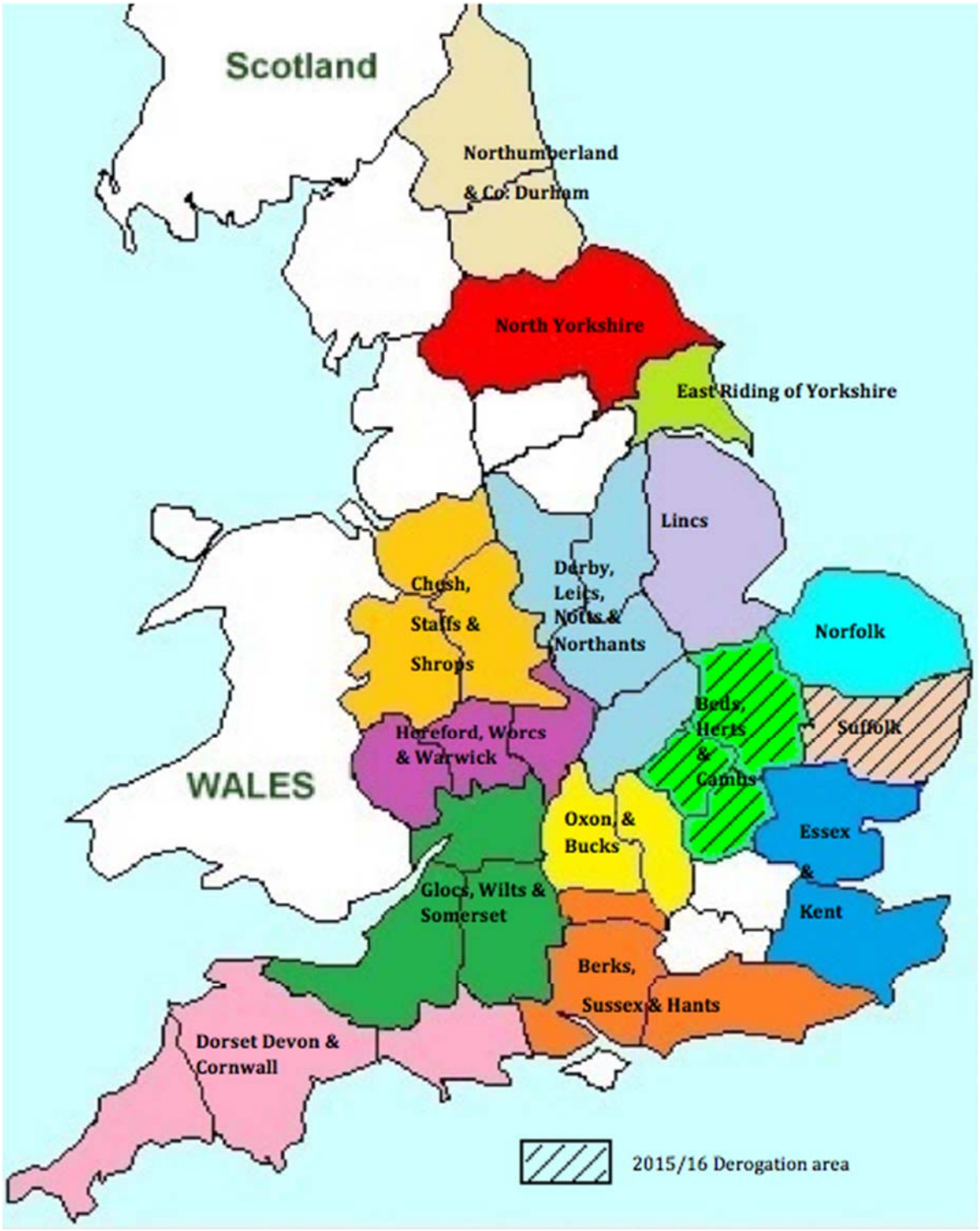

Figure 1 Merged counties

Results

Change in area of WOSR grown 2015 to 2016

Of the 204 farms surveyed, 25 grew no oilseed rape in 2016, leaving 179 growers with an area of 8,374 ha. The area of WOSR grown for harvest 2016 was 1209 ha (13%) less than that grown for harvest 2015. Defra's provisional estimates for the area of WOSR harvested in England 2016 is 537,000 ha, an 11% reduction on the area harvested in 2015 (Defra 2016).

The net reduction in WOSR area on sample farms is a composite of: a 36% decrease in area (1996 ha, on 104 farms) and an increase of 23% (787 ha, on 75 farms). Table 5 details the changes in WOSR area by sample numbers and area. Of the 146 identical farms surveyed in both years (2015 and 2016) there was a 1,224 ha (13%) reduction in area of WOSR planted. The overall area of WOSR grown in the DA was 22% lower in 2016 than in 2015.

Table 5 Changes in area of WOSR grown 2014/15 to 2015/16 on sampled farms

All farms	No. of farms	% farms	Area change (ha)	% change
Decrease in area	104	51%	-1,996	-36%
Increase in area	75	37%	787	23%
Unchanged area	25	12%	0	0%
Total	204		-1,209	-13%
Derogation Area farms				
Decrease	16	57%	-629	-46%
Increase	10	36%	167	22%
Unchanged area	2	7%	0	0%
Total	28		-462	-22%

Table 6 shows the estimated changes in WOSR cropping area at the national level between 2014/15 and 2015/16.

Table 6 Estimated changes in area of WOSR grown in England 2014/15 to 2015/16

All farms	No. of farms	% farms	Area change (ha)	% change
Decrease in area	7,038	52%	-129,991	-36%
Increase in area	5,205	38%	48,468	23%
Unchanged area	1,317	10%	0	0%
Total	13,560		-81,523	-14%
Derogation Area farms				
Decrease in area	1,047	57%	-40,620	-47%
Increase in area	692	38%	9,975	22%
Unchanged area	101	6%	0	0%
Total	1,840		-30,645	-24%

Reasons for changes in area of WOSR grown 2015 to 2016

The main reason given for changes in area of WOSR grown, whether an increase or decrease, was rotation, price, and concerns about CSFB in decreasing order of importance (Table 7). There were 182 responses from 135 farms providing a reason for changing area.

Table 7 Reasons for changes in area of WOSR grown

All farms						
	Rotation	Price	CSFB	Greening	Other	NA
Decrease in area grown	57	26	17	3	8	8
Increase in area grown	43	5	3	0	0	12

Derogation Area farms						
	Rotation	Price	CSFB	Greening	Other	NA
Decrease in area grown	12	4	3	1	3	1
Increase in area grown	5	0	1	0	0	1

Was CSFB infestation/damage greater in 2015/16 than in 2014/15?

Of the 179 farms growing WOSR in 2015/16, 41% reported that the incidence or damage caused by CSFB was the same as it was in the previous year, 26% of farms reported greater damage and 13% reported less. All farms in the Derogation Area (DA) reported some level of damage, whereas 22% of farms outside the DA reported no infestation or damage due to CSFB. Of the 28 farms in the DA there was no reported decrease in the level of pest infestation with treated seed. Six farms commented that slugs were a greater problem for WOSR crops than CSFB.

Table 8 Comparison of CSFB infestation 2015/16 vs 2014/15

CSFB incidence/damage in 2015/16 was:	DA farms		Non-DA farms	All farms	%
	Treated seed[1]	Untreated seed[2]			
Same level as in 2014/15	2	5	66	73	41%
Greater than 2014/15	3	6	37	46	26%
Less than 2014/15	3	4	17	24	13%
No incidence/damage in 2015/16	0	0	34	34	19%
Unanswered	0	0	2	2	1%
Total	8	15	156	179	100%

[1,2] *Results are from small sample sizes (n=8[1],n=15[2])*

Use of insecticides to combat CSFB

Across the sample 72% of farms applied insecticide to combat CSFB. Within the Derogation Area (DA) this was higher at 87% while for non-DA farms the figure was 69% (Table 9). Of the eight farms in the DA that used neonicotinoid treated seed, 75% also used insecticides against CSFB. In area terms, insecticides were used on

6,334 ha or 76% of the area of WOSR grown which was split with 1,335 ha (79% of area) on DA farms and 4,999 ha (75% of area) on non-DA farms (Table 10).

Table 9 Use of insecticides against CSFB

No. of farms	DA farms	Non-DA farms	All farms
Insecticides used against CSFB	20	108	128
Insecticides not used against CSFB	3	48	51

Table 10 Area sprayed with insecticides against CSFB

Area (ha)	DA farms	Non-DA farms	All farms
Insecticides used against CSFB	1335	4999	6334
Insecticides not used against CSFB	345	1695	2040

Changes in Agronomic practices to combat CSFB

A number of growers altered agronomic practices in an attempt to minimize or avert CSFB crop damage. The most commonly cited measure (36% of all changes to agronomic practice) was an earlier drilling date; interestingly a later drilling date was cited in 8% of responses. Increased spray applications was the second most cited reason for changes in agronomic practices carried out.

Table 11 Changes in agronomic practice to avert CSFB damage

Agronomic practice	DA farms	% of all responses	Non-DA farms	% of all responses	All farms	% of all responses
Drilled earlier	11	61%	15	27%	26	36%
Increased spray applications	2	11%	12	22%	14	19%
Increased seed rate	3	17%	5	9%	8	11%
Increased monitoring of crop	0	0%	5	9%	5	7%
Drilled later	1	6%	5	9%	6	8%
High-vigour variety	0	0%	3	5%	3	4%
DAP fertiliser	0	0%	2	4%	2	3%
Wider spacing when drilling	0	0%	2	4%	2	3%
Companion crop	0	0%	1	2%	1	1%
Phosphate seed dressing	0	0%	1	2%	1	1%
Extra base fertiliser	0	0%	1	2%	1	1%
Decreased seed rate	1	6%	0	0%	1	1%
Other	0	0%	3	5%	3	4%

Insecticides used to control CSFB

Of the 179 sample farms growing WOSR, 128 farms (71.9%) reported using insecticides to control CSFB. The most commonly used chemicals were the synthetic pyrethroids cypermethrin and lambda-cyhalothrin

Use of Agronomist in insecticide choice

Growers were asked if they had used the services of an agronomist in their choice of insecticide to combat CSFB. Only 10% of farms said they had not used an agronomist, and of those 18 farms, 5 were BASIS qualified, i.e. only 7% of growers did not use qualified advice or are not qualified themselves (Table 12).

Table 12 Use of an agronomist to advise on insecticide use to combat CSFB

Used an agronomist	DA farms	%	Non-DA farms	%	All farms	%
Yes	21	91%	139	89%	160	89%
No	1	4%	17	11%	18	10%
Unanswered	1	4%	0	0%	1	1%

Quantity of insecticide used against CSFB

The quantities used were calculated on the basis of: "*chemical used*" * "*declared rate of application*" * "*area sprayed*" * "*number of applications*".
Sample farms used a total of 2175 litres of insecticide against CSFB. Three chemicals used are solids and use is measured in kg, but overall these accounted for only a small proportion of insecticides used. The quantities used by active substance and insecticide group (pyrethroids, pyridine azomethine, neonicotinoids and spinosyn) for sample farms is presented in Table 13 and Table 14.

Table 13 Quantity of insecticide used against CSFB on sample farms

Insecticide	DA farms	Non-DA farms	All farms
Cypermethrin (litres)	311	1030	1340
Lambda-cyhalothrin (litres)	62	437	499
Alpha-cypermethrin (litres)	0	89	89
Zeta-cypermethrin (litres)	4	139	143
Pyrethroid (litres)	0	26	26
Fenvalerate (litres)	0	23	23
Tau-fluvalinate (litres)	53	0	53
Pymetrozine (kg)	26	17	43
Spinosyn (litres)	2	0	2
Thiacloprid (kg)	41	18	59
Acetamiprid (kg)	8	25	33

Table 14 Quantity of insecticide group used against CSFB on sample farms

Insecticide group	DA farms	Non-DA farms	All farms
Pyrethroid (litres)	429	1743	2172
Pyridine azomethine (kg)	26	17	43
Spinosyn (litres)	2	0	2
Neonicotinoid (kg)	49	43	92

The sample data is weighted up to give an estimated 136,619 litres in addition to 8,323 kg (of the solid based products thiacloprid, acetamiprid and pymetrozine) of insecticide used at a national level to combat CSFB which was almost half of the total amount used in 2014/15 (212,009 litres in addition to 27,963 kg). The quantities of insecticides used against CSFB are presented in Table 15 by chemical name, and by chemical group in Table 16.

Table 15 Quantity of insecticide used against CSFB – national estimates

	DA farms		Non-DA farms	All farms
Insecticide	Treated seed[1]	Untreated seed[2]		
Cypermethrin (litres)	1,236	18,321	65,614	85,170
Lambda-cyhalothrin (litres)	1,653	2,441	26,038	30,132
Alpha-cypermethrin (litres)	0	0	6,114	6,114
Zeta-cypermethrin (litres)	214	0	8,177	8,391
Pyrethroid (litres)	0	0	2,116	2,116
Fenvalerate (litres)	0	0	1,692	1,692
Tau-fluvalinate (litres)	0	2,878	0	2,878
Pymetrozine (kg)	0	1,439	1,164	2,603
Spinosyn (litres)	0	126	0	126
Thiacloprid (kg)	0	2,415	1,344	3,758
Acetamiprid (kg)	581	0	1,380	1,961

[1,2] *Results are from small sample sizes (n=8[1],n=15[2])*

Table 16 Quantity of insecticide group used against CSFB – national estimates

	DA farms		Non-DA farms	All farms
Insecticide group	Treated seed[1]	Untreated seed[2]		
Pyrethroid (litres)	3,103	23,639	109,751	136,493
Pyridine azomethine (kg)	0	1,439	1,164	2,603
Spinosyn (litres)	0	126	0	126
Neonicotinoid (kg)	581	2415	2,724	5,720

[1,2] *Results are from small sample sizes (n=8[1],n=15[2])*

Table 17 Quantity of active substance used per hectare against CSFB

	DA farms		Non-DA farms	All farms
	Treated seed[1]	Untreated seed[2]		
Total active substance used (kg)	8	49	222	280
Area WOSR grown (ha)	571	1109	6694	8374
Active substance applied (kg/ha)	0.01	0.04	0.03	0.03

[1,2] *Results are from small sample sizes (n=8[1],n=15[2]).*

Quantity of active substance used against CSFB

Using manufacturer's information the estimated quantities of insecticide used can be converted into kilograms of active substance. This allows a direct comparison of this study's estimates with other sources of information on pesticide use on oilseed rape e.g. Pesticide Usage Survey (PUS) (Garthwaite *et al*., 2013). The estimated total active substance used against CSFB for the 2015/16 crop year was 17,536 kg compared with 33,957 kg in 2014/15. Pyrethroids accounted for 85% of total active substance used against CSFB with cypermethrin representing 54% of the total. Within the Derogation Area there was a clear difference in the use of insecticide where neonicotinoid treated seed had been used (average application rate of 0.04 vs 0.01 kg/ha of active substance - Table 17).

Table 18 Quantity of active substance used against CSFB

	DA farms		Non-DA farms	All farms	% of total
Active substance by Insecticide (kg)	Treated seed[1]	Untreated seed[2]			
Cypermethrin	136	2,015	7,293	9,444	54%
Lambda-cyhalothrin	165	270	2,454	2,889	16%
Alpha-cypermethrin	0	0	780	780	4%
Zeta-cypermethrin	21	0	821	842	5%
Pyrethroid	0	0	233	233	1%
Fenvalerate	0	0	42	42	0%
Tau-fluvalinate	0	662	0	662	4%
Pymetrozine	0	719	582	1,301	7%
Spinosyn	0	19	0	19	0%
Thiacloprid	0	580	322	902	5%
Acetamiprid	145	0	276	421	2%
Total	468	4,265	12,803	17,536	100%

[1,2] *Results are from small sample sizes (n=8[1],n=15[2]).*

Table 19 Quantity of active substance used against CSFB by insecticide group

Active substance by Insecticide group (kg)	DA farms		Non-DA farms	All farms	% of total
	Treated seed[1]	Untreated seed[2]			
Pyrethroid	*323*	*2,947*	11,623	14,892	85%
Pyridine azomethine	*0*	*719*	582	1,301	7%
Spinosyn	*0*	*19*	0	19	0%
Neonicotinoid	145	580	598	1,323	8%
Total	468	4,265	12,803	17,536	100%

[1,2] *Results are from small sample sizes (n=8[1],n=15[2])*

Area lost to CSFB

Of the 179 sampled growers that grew WOSR in 2015/16, 44 farms (25%) reported crop damage due to CSFB (Table 20). Of the 44 farms with crop damage, 7 reported minimal damage and so recorded no loss of crop area to CSFB. The remaining 37 farms (21% of sampled farms) recorded a total area lost to CSFB of 419 ha (5% of area planted). However this may have been over-estimated as, of the 44 farms that reported crop loss, 8 acknowledged that the crop declared lost to CSFB may in part, have been due to slugs and a later drilling date than ideal.

The area lost to CSFB varies considerably from zero losses in some areas in the west to an estimated 16% of sample farms in Suffolk (Table 21). The 14% losses in GOR NE and merged counties of Northumberland and Durham are somewhat distorted by a single farm that lost 61% of the planted crop, and while the loss was reportedly due to CSFB, the farmer feels that the crop that was lost may have been weakened by the use of a pre-emergence herbicide, in that the adjoining crop, not treated with the pre-emergence spray, was untouched by CSFB.

Table 20 Number of farms with crop damage and area of crop lost to CSFB

	DA farms		Non-DA farms	All farms
	Treated seed[1]	Untreated seed[2]		
Crop damage	2	5	37	44
No crop damage	6	10	119	135
Area lost to CSFB (ha)	16	83	286	385
Area WOSR grown (ha)	658	1,022	6,694	8,374
% of crop area lost	2%	8%	4%	5%

[1,2] *Results are from small sample sizes (n=8[1],n=15[2])*

Table 21 Number of sample farms and area of crop lost to CSFB

Merged county	Farms with crop damage	Farms with no crop damage	Area lost to CSFB (ha)	Area of WOSR grown (ha)	% of area lost
Beds, Herts & Cambs	4	11	24	1216	2%
Chesh, Staffs & Shrops	1	11	0	329	0%
Derby, Leics, Notts & Northants	2	17	3	588	1%
Dorset, Devon & Cornwall	1	7	9	317	3%
East Riding of Yorkshire	2	7	43	339	13%
Gloucs, Wilts & Somerset	1	11	5	624	1%
Heref, Worcs & Warwick	0	11	0	320	0%
Essex, Kent, Sussex & Hants	5	11	57	925	6%
Lincolnshire	6	16	26	1000	3%
Norfolk	4	7	48	500	10%
North Yorkshire	5	5	19	229	8%
North'land & Durham	3	10	55	402	14%
Oxs, Bucks & Berks	7	6	55	1121	5%
Suffolk	3	5	75	465	16%
All	44	135	419	8374	5%

Weighted sample data estimates that 28,759 ha i.e. 5% of the oilseed rape area grown in England was lost to CSFB in 2015/16 (Table 22) which is much higher than the 16,000 ha in 2014/15.

Table 22 Number of farms and area of crop lost to CSFB by merged county – national estimate

Merged county	Farms with crop loss	Farms with no crop loss	Area lost to CSFB (ha)	Area of WOSR grown (ha)	% of area lost
Beds, Herts & Cambs	310	722	1836	72706	3%
Chesh, Staffs & Shrops	60	744	15	21058	0%
Derby, Leics, Notts & Northants	120	1187	206	39291	1%
Dorset, Devon & Cornwall	87	512	790	21324	4%
East Riding of Yorkshire	147	515	3678	24502	15%
Gloucs, Wilts & Somerset	75	625	373	37707	1%
Heref, Worcs & Warwick	0	778	0	20537	0%
Essex, Kent, Sussex & Hants	324	784	3831	61320	6%
Lincolnshire	418	1100	1875	64308	3%
Norfolk	289	429	2671	29149	9%
North Yorkshire	354	449	1242	16569	7%
North'land & Durham	195	657	3377	25780	13%
Oxs, Bucks & Berks	466	366	3473	65346	5%
Suffolk	216	342	5392	29200	18%
All	3061	9209	28759	528795	5%

Where crop loss was extensive and conditions allowed some growers were able to re-drill the crop. Of the 419 ha lost by 37 farms, some 335 ha (on 17 farms) was re-drilled, i.e. 79% of the area initially lost. The total area lost on the sample farms that was not re-drilled was 86 ha. Weighting up of sample data indicates that 22,912 ha were re-drilled across England (9,214 ha in the previous season). Given an estimate of 28,759 ha originally lost to CSFB, this leaves 5,847 ha of WOSR crop area completely lost compared with 6,604 ha in 2014/15.

Prices for the insecticides used were canvassed from local suppliers so may be subject to some variation both across the country and with scale of use. The cost of insecticide application and the costs of re-drilling (seed plus cultivations) are taken from Nix (2016). Crop losses, for the area lost and not re-drilled, are calculated on the basis of the area lost and the estimated 2016 harvest Gross Margin per hectare (Nix 2015). Costs of implementing other changes in agronomic practice have not been included in these estimates.

This study estimates that the cost of CSFB control in the 2015/16 WOSR crop in England was £18.4m (down from £22m in the previous season) (Table 23). The cost of agrochemicals used to control CSFB (Annex 3) is estimated to be £4.3m (down from £7.8m in 2014/15) with a cost of application of £8.5m (down from £11.4m). The 5,847 ha of crop area lost to CSFB and not re-drilled is estimated to have cost growers £2.9m (slightly higher than in 2014/15 at £2.3m) and the 22,912 ha that was lost to CSFB and then re-drilled is estimated to have cost a further £2.6m (much higher than the £0.7m in the previous season).

Table 23 Estimated total costs of CSFB to the 2015/16 WOSR crop

	Area (ha)	Quantity	Cost £/ha	£
Chemicals used to control CSFB		144,942		4,344,226
Cost of applying chemicals to control CSFB	768,127		11[1]	8,449,400
Crop lost and not redrilled	5,847		503[2]	2,940,820
Cost of redrilling lost area	22,912		115[3]	2,634,880
Total				18,369,369

[1] "Farmer's average cost" of chemical application (Nix 2015)
[2] WOSR GM/ha (Nix 2015)
[3] WOSR seed (£52/ha) plus "farmer's average cost" of drilling (£63/ha) (Nix 2016)

Discussion

Twenty-five of the 204 farms surveyed in 2016 did not grow WOSR in 2015/16 and 146 of the remaining farms were part of the survey carried out in the previous season (Scott and Bilsborrow 2015). The area of oilseed rape grown in the UK has decreased annually from a peak of 756,000 ha (2011/12 season) to 579,000 ha (2015/16 season) (DEFRA 2016). The current FBS survey identifies a reduction in WOSR area planted in England of 13% less than that grown for harvest 2015 which is consistent with official DEFRA figures which show a reduction in area of 11% between the two seasons (DEFRA 2016). The reduction in crop area was greatest in Suffolk (36%) East Riding of Yorkshire (26%) the merged counties of Essex, Kent, Sussex and Hampshire (21%) and the merged Derogation Area (DA) counties of Cambridgeshire, Hertfordshire and Bedfordshire (16%).

A previous RBR report on the incidence of CSFB in England (Scott and Bilsborrow 2015) for the 2014/15 season had identified cabbage stem flea beetle risk as the third most important reason for the reduction in WOSR area grown behind 'crop rotation', and a 'reduced commodity price'. Despite a significant price increase (£100/tonne) between harvest 2015 and harvest 2016, CSFB was again identified as the third most important reason for the declining WOSR area in England.

Of the 179 farms growing WOSR in 2015/16, 41% reported that the incidence or damage caused by CSFB was the same as in the previous season, 26% of farms reported greater damage and 13% reported less (19% reported no loss). All 28 farms in the DA reported some level of CSFB damage and there was no reported decrease in the level of pest infestation with the use of treated seed. The total recorded area lost to CSFB in England was 419 ha (5% of area planted) which was higher than the 3% recorded in 2015 (Scott and Bilsborrow 2015).

An AHDB live monitoring survey of damage caused by CSFB was also carried out in autumn of 2014 and 2015 (using a network of AICC agronomists and covering 5% of total UK area in 2014/15 and 11% in 2015/16). The area of crop lost to CSFB was reported at 1% for 2015/16 (Alves *et al.,* 2015) which was much lower than the 2.7% loss reported in the previous season (Wynn *et al*., 2014). The crop losses in the AHDB survey were also more widely dispersed around the country than in the previous 2014 survey. The losses reported at 1% were much lower than the 5% reported in the FBS survey but could partially be explained by the fact that the assessment was done at the 3-4 leaf stage of crop growth and much earlier in the season than in the current FBS survey.

In 2015 approval was given for the use of neonicotinoid seed dressing on up to 5% of UK total oilseed rape crop area (amounting to about 30,000 ha) in the counties of Suffolk, Cambridgeshire, Bedfordshire and Hertfordshire due to the identified high risk and damage caused by CSFB in these areas. Suffolk had the highest recorded losses (16% of crop area) but the other 3 designated area counties i.e. Bedfordshire, Cambridgeshire and Hertfordshire only reported an amalgamated loss of 2% of crop area. The merged counties of Northumberland and Durham reported a loss of 14% of crop area but this was somewhat distorted by a single farm that lost 61% of the planted crop, and while the loss was reportedly due to CSFB, it may have been aided by the use of a pre-emergence herbicide which weakened the crop. As in the previous season high losses were again recorded in East Riding of Yorkshire.

Where crop loss to CSFB was extensive and conditions allowed, some growers were able to re-drill the area; the area re-drilled accounted for 79% of the 28,759 ha initially lost. The assumption in this study is that all crops were re-drilled with OSR either winter or spring depending on the timing of crop loss. This re-drilled area was much higher than the corresponding figure for the previous year (9,214 ha) (Scott and Bilsborrow 2015). This resulted in 5,874 ha of WOSR crop area completely lost in England which was slightly less than the area in 2014/15 (6,604 ha).

Insecticides were used on 72% of farms to combat CSFB which is in agreement with the 75% of area treated in the AHDB survey (Alves *et al*., 2015)). The area treated was greater within the DA than in the non-DA; 87% vs 69%. Within the DA there was a clear difference in the use of insecticide where neonicotinoid treated seed had been used (average application rate of 0.04 vs 0.01 kg/ha of active substance). The synthetic pyrethroids, cypermethrin and lambda-cyhalothrin were the main products used, accounting for 54% and 16% of active substance use respectively. There was significant variation in use of insecticide by county. Suffolk, which had the highest area of crop lost to CSFB (16%) only accounted for 7.2% of total insecticide used vs CSFB in England. This was much higher in the merged counties of Cambridgeshire, Bedfordshire and Hertfordshire (14.4%) but highest of all in Lincolnshire (24%) which reported only 3% of crop loss to CSFB i.e. lower than the national average.

An estimated 136,619 litres in addition to 8,323 kg of insecticide product which equates to 17,536 kg of active substance was used at a national level to combat CSFB which is almost half of the level used in the previous season (Scott and Bilsborrow 2015). The reasons for the reduction in insecticide use are unknown especially when reported CSFB damage and crop losses were greater than in the previous season but a reduced crop area and an awareness of increasing levels of resistance to pyrethroids are likely to have been contributory factors. CSFB resistance to pyrethroids was first identified in Germany in 2008 (Heimbach and Muller 2012) with resistance now becoming widespread throughout Europe and the UK (Hojland *et al*., 2015) but is partial so growers will still get some control. The reduced susceptibility of CSFB is associated with a *kdr* (L1014F) target site resistance mutation, which is also common in other pyrethroid resistant insect species (Zimmer *et al*., 2014).

This study estimates that the financial cost of CSFB control in England was lower than in the previous season (£18.4m in 2015/16 vs £22m in 2014/15) largely due to a reduced usage of insecticide. The cost of agrochemicals used was lower at £4.3m (down from £7.8m in 2014/15) with the cost of application also down at £8.5m (£11.4m in 2014/15). The 5,847 ha of crop area lost to CSFB and not re-drilled is estimated to have lost growers £2.9m (slightly higher than the £2.3m in 2014/15), and the increased area of 22,912 ha that was lost to CSFB and then re-drilled is estimated to have cost a further £2.6m (much higher than the £0.7m in the previous season).

Conclusions

The UK oilseed rape area has now fallen for the fourth successive year from a peak of 756,000 ha in 2011/12. This study showed an area reduction (for crop harvested in 2016) in England of 13% less than that grown for harvest 2015 with the biggest reductions occurring in Suffolk (36%) the other merged DA counties of Cambridgeshire, Hertfordshire and Bedfordshire (16%) East Riding of Yorkshire (26%) and the merged counties of Essex, Kent, Sussex and Hampshire (21%). The total recorded area lost to CSFB in England was 5% of area planted which was higher than the 3% recorded in the previous season. However the level of active substance used was much lower i.e. about half of the amount applied in 2014/15. The financial cost of CSFB control in England was lower than in the previous season (£18.4m in 2015/16 vs £22m in 2014/15) largely due to a reduced usage of insecticide.

Disclaimer

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Annex 1 – Sample questionnaire

Winter Oilseed rape plantings autumn 2015

farm number

1.1 What area of WOSR did you plant in autumn 2015? ha

1.2 How much did you grow last year (2015 harvest)? ha

2 If this differs, in broad terms, from last year why? (please list up to 4 reasons)

3 **Question 3 applies only to the derogation area; Bedfordshire, Cambridgeshire, Hertfordshire & Suffolk**

3.1 Did you request neonicotinoid treated seed?

	ha	Kg
3.2 If so, how much?		
3.3 How much did you get?		

4.1 Did you use/employ an agronomist for your WOSR Cabbage Stem Flea Beetle (CSFB) insecticide recommendations? (yes or no)
Any comment?

on area planted with seed NOT TREATED WITH NEONICOTINOID DRESSING

4.2 Was pest incidence/damage greater in this crop than in the previous season? (same, greater, less, no damage)
Any comment?

5.1 Did you use any insecticides **SPECIFICALLY** to combat actual or predicted CSFB attacks? (yes or no)

5.2 Did you change agronomic practices to avert possible CSFB damage? If so please list up to 4

		chemical 1
6.a If chemicals were used **SPECIFICALLY** against CSFB which ones?	chemical name	
7.a What rate were the insecticides applied at?	application rate litre/ha or gm/ha	
8.1.a What area was treated?	area (ha)	
8.2.a (If multiple applications please record areas and incidence; e.g. 40ha x 3 applications)	number of applications	
8.3.a If the same chemical (in q 6) is used at the same rate	area (ha)	
8.4.a for different areas or a different number of applications please use these cells	number of applications	
8.5.a If the same chemical (in q 6) is used at the same rate	area (ha)	
8.6.a for different areas or a different number of applications please use these cells	number of applications	

		chemical 2
6.b	chemical	
7.b	application rate litre/ha	
8.1.b	area (ha)	

8.2.b	number of	
8.3.b	area (ha)	
8.4.b	number of	
8.5.b	area (ha)	
8.6.b	number of	

		chemical 3
6.c	chemical name	
7.c	application rate litre/ha or gm/ha	
8.1.c	area (ha)	
8.2.c	number of applications	
8.3.c	area (ha)	
8.4.c	number of applications	
8.5.c	area (ha)	
8.6.c	number of applications	

		chemical 4
6.d	chemical name	
7.d	application rate litre/ha or gm/ha	
8.1.d	area (ha)	
8.2.d	number of applications	
8.3.d	area (ha)	
8.4.d	number of applications	
8.5.d	area (ha)	
8.6.d	number of applications	

9	Despite the use of insecticide did you lose any crop area due to CSFB? (yes or no)	
	Any comment?	
10	If so, what area? (ha)	
11	Was any CSFB crop damage so severe that you have had to redrill? (yes or no)	
	Any comment?	
12	If so what area? (ha)	
	Any further comments	

Thank you for your assistance

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Annex 2 – Concentration of active substance in insecticides used against CSFB

name as recorded	chemical	family	concentration of	
			g/l or g/kg	%
A-Cyper	alpha-cypermethrin	pyrethroid	400	40
Acetamiprid	acetamiprid	neonicotinoid	250	25
Afrisect	cypermethrin	pyrethroid	100	11
Afrisect 10 (Cypermerthrin)	cypermethrin	pyrethroid	100	11
Alert	alpha-cypermethrin	pyrethroid	100	11
Alert (cypermethrin)	alpha-cypermethrin	pyrethroid	100	11
alphacypermethrin	alpha-cypermethrin	pyrethroid	100	11
biscaya	thiacloprid	neonicotinoid	240	24
Cleancrop Corsair	lambda-cyhalothrin	pyrethroid	50	5
Corsair	lambda-cyhalothrin	pyrethroid	50	5
Corsair	lambda-cyhalothrin	pyrethroid	50	5
Corsair (50g/L Lambda-cyhalothrin)	lambda-cyhalothrin	pyrethroid	50	5
Cypermethrin	cypermethrin	pyrethroid	100	11
Cypermethrin (Toppel 10)	cypermethrin	pyrethroid	100	11
Cypermethrin (Toppel 100)	cypermethrin	pyrethroid	100	11
Cypermethrin (Toppel)	cypermethrin	pyrethroid	100	11
Fury	zeta-cypermethrin	pyrethroid	100	10
Fury 10 EW	zeta-cypermethrin	pyrethroid	100	10
Hallmark	lambda-cyhalothrin	pyrethroid	100	10
Hallmark Zeon	lambda-cyhalothrin	pyrethroid	100	10
Hallmark Zeon (lambda-cylaothrin)	lambda-cyhalothrin	pyrethroid	100	10
Insyst (acetamiprid)	acetamiprid	neonicotinoid	200	20
Karis	cypermethrin	pyrethroid	100	10
Karis 10cs	lambda-cyhalothrin	pyrethroid	100	10
Kendo	lambda-cyhalothrin	pyrethroid	130	13
Lambda cyhalothrin	lambda-cyhalothrin	pyrethroid	100	10
Lambda Cyhalothrin (Clayton Sparta)	lambda-cyhalothrin	pyrethroid	50	5
Lambda Cyhalothrin (Karis 10 CS)	lambda-cyhalothrin	pyrethroid	100	10
lambda-cyhalothrin (10 %)	lambda-cyhalothrin	pyrethroid	100	10
lambda-cyhalothrin (5%)	lambda-cyhalothrin	pyrethroid	50	5
Minuet	zeta-cypermethrin	pyrethroid	100	11
Permasect	cypermethrin	pyrethroid	100	11
Permasect C	cypermethrin	pyrethroid	100	11
Plenum	pymetrozine	pyridine azomethine	500	50
Pymetrozine	pymetrozine	pyridine azomethine	500	50
Pyrethroid	pyrethroid	pyrethroid	100	11
spinetorum	spinosyn	spinosyn	15	15
Supersect (Pyrethroid)	pyrethroid	pyrethroid	100	11
Sven (Esfenvalerate)	fenvalerate	pyrethroid	25	2.5
tau-fluvalinate	tau-fluvalinate	pyrethroid	230	23
thiacloprid	thiacloprid	neonicotinoid	240	24
zeta cypermethrin	zeta-cypermethrin	pyrethroid	100	10

Annex 3 – Insecticide price assumptions

Chemical	Quantity	Cost (£/litre or £/kg)	Total cost (£)
Cypermethrin	85,856	10	858,559
Lambda-cyhalothrin	30,543	85	2,596,195
Alpha-cypermethrin	6,114	21	128,386
Zeta-cypermethrin	8,391	21	176,208
Pyrethroid	2,116	10	21,161
Fenvalerate	1,692	20	33,842
Tau-fluvalinate	2,878	35	100,717
Pymetrozine	2,603	56	145,760
Spinosyn	126		-
Thiacloprid	3,758	50	187,923
Acetamiprid	1,961	70	137,292
Total	146,039		4,386,042

Annex 4 – Defra 2015 June census data - winter oilseed rape area

Title: Winter oilseed holdings and area in England by size band
Source: Defra Survey of Agriculture and Horticulture - June 2015
Coverage: England (see data notes below for detailed coverage)

Size band	Number of holdings	Area (hectares)
greater than 0 to under 5 hectares	348	1158
5 to under 10 hectares	1014	8087
10 to under 20 hectares	2953	44152
20 to under 50 hectares	5412	176122
50 to under 100 hectares	2683	185816
100 hectares and over	1150	189339
Total	13560	604675

Data source: Results are from the Defra June Survey of Agriculture, a large sample survey sent to a representative sample of holdings across England. As the results are based on a sample survey, they are subject to a degree of sampling error and do not take into account other sources of survey errors, such as non-response bias or administrative data errors.
For details of the survey methodology, please go to: https://www.gov.uk/structure-of-the-agricultural-industry-survey-notes-and-guidance

You may also be interested in research undertaken by the Observatory at: https://www.gov.uk/government/statistical-data-sets/agri-environment-indicators
Data notes: Results relate to commercial holdings. Commercial holdings are those with significant levels of farming activity. These significant levels are classified as any holding with more than 5 hectares of agricultural land, 1 hectare

of orchards, 0.5 hectares of vegetables or 0.1 hectares of protected crops, or more than 10 cows, 50 pigs, 20 sheep, 20 goats or 1,000 poultry.

Produced by Farming Statistics, Department for Environment, Food and Rural Affairs. Tel: 01904 455332, email: farming-statistics@defra.gsi.gov.uk