SCEPTREPLUS

Final Trial Report

Trial code:	SP05
Title:	Control of *Thrips tabaci* on leek with novel insecticide sprays
Crop	Group: Field vegetables - alliums (Leek)
Target	Onion thrips – *Thrips tabaci* - THRITB
Lead researcher:	Dr Rosemary Collier
Organisation:	University of Warwick, School of Life Sciences, Wellesbourne, Warwick CV35 9EF
Period:	May 2017 – October 2017
Report date:	12/11/17
Report author:	Andrew Jukes
ORETO Number: (certificate should be attached)	381

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this report is an accurate and faithful record of the results obtained.

21 December 2017 Rosemary Collier

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Date Authors signature

Trial Summary

Introduction

The quality of allium crops, including leek, can be reduced by feeding marks caused by onion thrips (*Thrips tabaci*). There are currently a limited number of control options and an over-reliance on a single active, which could lead to resistance in the pest population.

Methods

Leek seed (cv Surfer) was drilled into beds on 10 May 2017 at 12 seeds/m row with a between row spacing of 35cm**.** The trial was designed for four replicates of twelve treatments. The treatments consisted of conventional insecticides and bio-insecticides (none of which contained living organisms) replicated 4 times, Small numbers of thrips and a low level of damage were observed. Spray programmes were started on 15 August. All treatments were applied using a knapsack sprayer (Berthoud Vermorel 2000HP) fitted with 02F110 nozzles in 300l/ha water. Conventional insecticides were sprayed four times at two weekly intervals and bio-insecticides were sprayed eight times at weekly intervals. Assessments of damage due to thrips feeding were made on 23 August, 5 September, 20 September and 4 October. The percentage surface area damaged was estimated for each of the 4 youngest leaves on 10 consecutive plants in each of the middle two rows in each plot. A further assessment of damage due to feeding by leek moth larvae was made on 17 October.

Results

The mean percentage surface area damaged due to onion thrips (all assessed leaves) on four dates (1 week after conventional sprays applied) and the percentage of plants with leek moth feeding holes (after full spray programme) are presented in the table below (Angular transformation was used prior to data analysis but back-transformed data are presented).

	Mean % thrips damage (all leaves)				**% leek moth damage**
Date	**23-Aug**	**06-Sep**	**21-Sep**	**04-Oct**	**17-Oct**
Treatment *bio-insecticide					
Untreated	2.18	3.13	4.32	4.52	8.93
Tracer	2.03	1.75	1.92	3.22	3.84
AHDB9970*	2.90	4.36	6.30	5.81	2.70*
AHDB9951	1.55	2.46	3.26	5.78	5.58
AHDB9950	2.66	3.80	5.41	5.01	7.89
AHDB9968*	3.77	4.86	5.71	7.85	0.21*
AHDB9969	1.83	1.49	1.35*	1.43*	0.11*
AHDB9964*	3.75	4.86	7.55	7.59	0.10*
AHDB9949	2.89	5.35	6.31	6.98	3.52
AHDB9948	2.29	1.60	1.14*	2.08	0.47*
AHDB9967*	1.88	3.17	4.91	5.50	0.99*
AHDB9943	1.77	2.99	4.24	4.56	9.50
	Not significantly different from untreated control (p>0.05)				
	Significantly different from untreated control (p<0.05)				

Conclusions

The level of damage caused by onion thrips was low throughout the trial. Two insecticide treatments (AHDB9969 and AHDB9948) reduced damage significantly compared with the untreated control. Damage caused by leek moth was also low. Treatments AHDB9970 (bio-insecticide), AHDB9968 (bio-insecticide), AHDB9969 (insecticide), AHDB9964 (bio-insecticide), AHDB9948 (insecticide) and AHDB9967 (bio-insecticide) all reduced significantly the numbers of plants damaged by leek moth compared with the untreated control. Further work would be advisable to ensure the most effective treatments identified in this trial are robust under higher pest (thrips) pressure.

Take home message:

Two coded insecticide treatments reduced thrips damage to leek significantly compared with the untreated control. Six treatments, four of which were bio-insecticides, reduced significantly the numbers of plants damaged by leek moth compared with the untreated control. Further work would be advisable to ensure the most effective treatments identified in this trial are robust under higher pest (thrips) pressure.

Objectives

1. To evaluate the effectiveness of conventional and bio-insecticides applied against onion thrips on leek as measured by damage.
2. To monitor the treated crop for phytotoxicity
3. To evaluate the effectiveness of conventional and bio-insecticides against leek moth on leek as measured by damage

Trial conduct

UK regulatory guidelines were followed but EPPO guidelines took precedence. The following EPPO guidelines were followed:

Relevant EPPO guideline(s)		**Variation from EPPO**
PP 1/152(3)	Design and analysis of efficacy evaluation trials	None
PP 1/135(3)	Phytotoxicity assessment	None
PP 1/181(3)	Conduct and reporting of efficacy evaluation trials including GEP	None
PP 1/267(1)	Thrips in allium crops	None

There were no deviations from EPPO guidance:

Test site

Item	**Details**
Location address	University of Warwick Wellesbourne Campus Wellesbourne Warwick CV35 9EF
Crop	Leek
Cultivar	Surfer F1
Soil or substrate type	Sandy loam
Agronomic practice	See Appendix A
Prior history of site	See Appendix A

Trial design

Item	**Details**
Trial design:	(4x4)/3 Trojan Square
Number of replicates:	4
Row spacing:	35 cm
Plot size: (w x l)	1.83 x 5 m
Plot size: (m^2)	9.15
Number of plants per plot:	240 (max)
Leaf Wall Area calculations	n/a

Treatment details

AHDB Code	Active substance	Product name/ manufacturers code	Formulation batch number	Content of active substance in product	Formulation type	Adjuvant
Untreated						
Tracer	Spinosad	Tracer	F055G5Q048	480 g/l	SC	None
AHDB9970	N/D	N/D	N/D	N/D	N/D	None
AHDB9951	N/D	N/D	N/D	N/D	N/D	None
AHDB9950	Spirotetramat	Movento	ECE4101299	150 g/l	OD	None
AHDB9968	N/D	N/D	N/D	N/D	N/D	None
AHDB9969	N/D	N/D	N/D	N/D	N/D	None
AHDB9964	N/D	N/D	N/D	N/D	N/D	None
AHDB9949	N/D	N/D	N/D	N/D	N/D	None
AHDB9948	Cyantraniliprole	Benevia	AUG16CE310	100 g/l	OD	None
AHDB9967	N/D	N/D	N/D	N/D	N/D	None
AHDB9943	N/D	N/D	N/D	N/D	N/D	None

Application schedule

Treatment number	Treatment: product name or AHDB code	Rate of active substance (ml or g a.s./ha)	Rate of product (l or kg/ha)	Application code
1	Control			ABCD
2	Tracer	96 g	200 ml	ABCD
3	AHDB9970	2303 ml	4800 ml	ABCDEFGH
4	AHDB9951	125 g	625 ml	ABCD
5	AHDB9950	75 g	500 ml	ABCD
6	AHDB9968	150 g	1500 ml	ABCDEFGH
7	AHDB9969	75 g	300 g	ABCD
8	AHDB9964	837.5 ml	5000 ml	ABCDEFGH
9	AHDB9949	15.2 g	1600 g	ABCD
10	AHDB9948	75 g	750 ml	ABCD
11	AHDB9967	144 ml	2400 ml	ABCDEFGH
12	AHDB9943	80 g	160 g	ABCD

Application details

	Application A	Application B	Application C	Application D
Application date	15/8/17	21/8/17	30/8/17	4/9/17
Time of day	17.00	15.00	13.30	16.00
Crop growth stage (Max, min average BBCH)	Av. 45	Av. 45	Av. 47	Av. 47
Crop height (cm)	80	80	80	80
Crop coverage (%)	>90	>90	>90	>90
Application Method	Spray	Spray	Spray	Spray
Application Placement	Foliar	Foliar	Foliar	Foliar
Application equipment	Berthoud Vermorel 2000HP			
Nozzle pressure	2 bar	2 bar	2 bar	2 bar
Nozzle type	02F110	02F110	02F110	02F110
Nozzle size	02	02	02	02
Application water volume/ha	300	300	300	300
Temperature of air - shade (°C)	19	19	18	16
Relative humidity (%)	73	95	91	94
Wind speed range (m/s)	Light	Nil	Light	Light
Dew presence (Y/N)	N	N	N	N
Temperature of soil - 2-5 cm (°C)	17	16	16	16
Wetness of soil - 2-5 cm	Dry	Damp	Dry	Damp
Cloud cover (%)	Not recorded	Not recorded	Not recorded	Not recorded

	Application E	Application F	Application G	Application H
Application date	12/9/17	19/9/17	26/9/17	3/10/17
Time of day	13.30	13.30	13.30	14.00
Crop growth stage (Max, min average BBCH)	Av. 47	Av. 47	Av. 49	Av. 49
Crop height (cm)	80	80	80	80
Crop coverage (%)	>90	>90	>90	>90
Application Method	Spray	Spray	Spray	Spray
Application Placement	Foliar	Foliar	Foliar	Foliar
Application equipment	Berthoud Vermorel 2000HP			
Nozzle pressure	2 bar	2 bar	2 bar	2 bar
Nozzle type	02F110	02F110	02F110	02F110
Nozzle size	02	02	02	02
Application water volume/ha	300	300	300	300
Temperature of air - shade (°C)	19	19	17	14
Relative humidity (%)	78	100	99	77
Wind speed range (m/s)	Light	Light	Light	Light
Dew presence (Y/N)	N	N	N	N
Temperature of soil - 2-5 cm (°C)	16	12	14	10
Wetness of soil - 2-5 cm	Damp	Damp	Damp	Damp
Cloud cover (%)	Not recorded	Not recorded	Not recorded	Not recorded

Untreated levels of pests/pathogens at application and through the assessment period

Common name	Scientific Name	EPPO Code	Infestation level pre-application	Infestation level at start of assessment period	Infestation level at end of assessment period
Onion thrips	*Thrips tabaci*	THRITB	2.06[1]	2.18[1]	4.52[1]
Leek moth	*Acrolepiopsis assectella*	ACROAS	Low[2]	N/A	9.75[3]

[1] Mean percentage surface area damaged on youngest four leaves
[2] Non target pest. Not assessed pre-spraying
[3] percentage plants with caterpillar feeding holes

Assessment details

Damage due to onion thrips was assessed by estimating the percentage surface area affected on the 4 youngest leaves on 20 plants per plot (10 consecutive plants were marked in each of the middle two rows). An assessment was made of damage on control and Tracer-treated plots to assess initial levels of damage. Subsequent, whole trial, assessments were completed in the week following conventional insecticide applications. A total of 4 assessments were made. Phytotoxicity was assessed 9 days after the first sprays but no effects were observed in any plots.

Damage due to leek moth was assessed at the end of the trial (21 days after the final conventional treatments and 14 days after the final bio-insecticide treatments). Damage was scored on all plants in the middle 2 rows on a 0-4 scale where 0 = no damage, 1 = superficial damage, 2 = moderate damage (damage in outside leaves), 3 = severe damage (damage extending into inner leaves) and 4 = plant death. No plants were scored 4.

	Evaluation Timing (DA)*				
Evaluation date	After conventional insecticides	After Bio-insecticides	Crop Growth Stage (BBCH)	Evaluation type (efficacy, phytotox)	Assessment
16/8/17	1	1	45	Efficacy	% leaf area with feeding marks
23/8/17	8	2	45	Efficacy	% leaf area with feeding marks
24/8/17	9	3	45	Phytotoxicity	Leaf damage
5/9/17	6	1	47	Efficacy	% leaf area with feeding marks
20/9/17	8	1	47	Efficacy	% leaf area with feeding marks
4/10/17	8	1	49	Efficacy	% leaf area with feeding marks
17/10/17	21	14	49	Efficacy	Leek moth damage score

* DA – days after application

Statistical analysis

This trial was designed as a Trojan square for 12 treatments in a (4*4)/3 design. The analysis was simplified by combining the lower two strata, as the physical structure of the arrangement of plots means that there is no reason to expect different levels of variability between adjacent plots that are contained in the same or different main columns (sets of 3 adjacent plots) of the design.

Given that almost all of the response variables are based either on percentage leaf area affected (thrips) or the proportion of plants with different levels of damage (moths), there was a need to transform these variables prior to analysis. An angular transformation was used.
All data were analysed by ANOVA using the Genstat program by Andrew Mead at Rothamsted Research.

Results

Phytotoxicity

There was no evidence of phytotoxic effects with any treatment.

Thrips damage – mean percentage surface area damaged by thrips

The results for the mean percentage surface area damaged by thrips on four assessment dates are presented in Table 1 and Figure 1 (all leaves combined), Table 2 and Figure 2 (Leaf 2 – second youngest leaf), Table 3 and Figure 3 (Leaf 3 – 3rd youngest leaf) and Table 4 and Figure 4 (Leaf 4 – 4th youngest leaf). Results significantly different from the untreated control are marked *.

Table 1 Mean percentage thrips damage (all leaves)

Date	23-Aug		06-Sep		21-Sep		04-Oct	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment								
Untreated	8.49	2.18	10.19	3.13	11.99	4.32	12.28	4.52
Tracer	8.19	2.03	7.61	1.75	7.96	1.92	10.34	3.22
AHDB9970	9.80	2.90	12.05	4.36	14.54	6.30	13.95	5.81
AHDB9951	7.16	1.55	9.03	2.46	10.40	3.26	13.91	5.78
AHDB9950	9.38	2.66	11.25	3.80	13.44	5.41	12.93	5.01
AHDB9968	11.20	3.77	12.74	4.86	13.83	5.71	16.27	7.85
AHDB9969	7.77	1.83	7.02	1.49	6.66*	1.35	6.87*	1.43
AHDB9964	11.17	3.75	12.74	4.86	15.95	7.55	15.99	7.59
AHDB9949	9.79	2.89	13.37	5.35	14.54	6.31	15.31	6.98
AHDB9948	8.70	2.29	7.27	1.60	6.12*	1.14	8.29	2.08
AHDB9967	7.89	1.88	10.26	3.17	12.81	4.91	13.56	5.50
AHDB9943	7.64	1.77	9.95	2.99	11.88	4.24	12.33	4.56
F value	1.35		2.77		4.96		2.93	
P -value	0.249		0.013		<0.001		0.01	
d.f.	30		30		30		30	
s.e.d.	1.637		1.888		2.055		2.411	
l.s.d.	3.343		3.856		4.198		4.924	

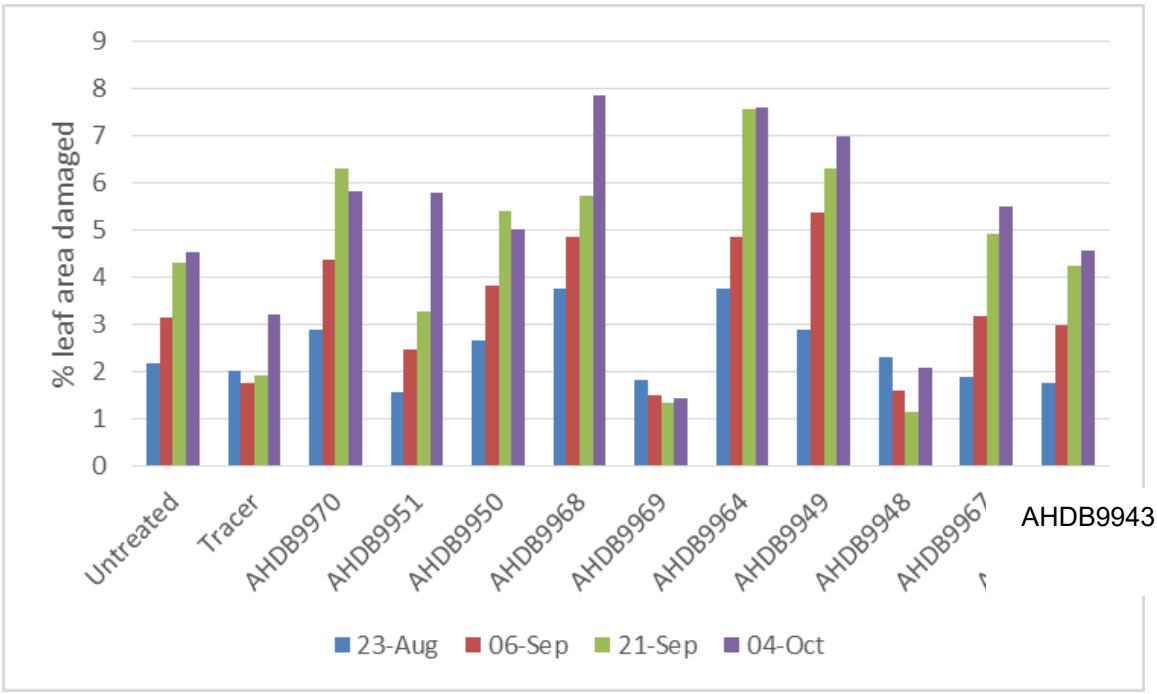

Figure 1 Mean percentage thrips damage (all leaves)

Table 2 Mean percentage thrips damage (Leaf 2)

Date	23-Aug		06-Sep		21-Sep		04-Oct	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment								
Untreated	6.35	1.22	6.46	1.27	9.01	2.45	9.20	2.56
Tracer	2.74	0.23	5.82	1.03	4.76	0.69	7.45	1.68
AHDB9970	5.37	0.88	10.42	3.27	11.18	3.76	11.09	3.70
AHDB9951	3.93	0.47	6.29	1.20	6.98	1.48	11.02	3.65
AHDB9950	6.58	1.31	7.05	1.51	11.32	3.85	9.76	2.88
AHDB9968	8.47	2.17	10.56	3.36	11.36	3.88	12.42	4.63
AHDB9969	3.16	0.30	3.69	0.41	3.00*	0.27	3.56	0.39
AHDB9964	9.47	2.71	12.56	4.73	14.55	6.31	14.38	6.17
AHDB9949	5.62	0.96	10.18	3.12	12.06	4.37	11.42	3.92
AHDB9948	5.36	0.87	4.38	0.58	2.15*	0.14	3.63	0.40
AHDB9967	3.56	0.39	6.36	1.23	10.08	3.07	11.18	3.76
AHDB9943	4.92	0.74	6.74	1.38	10.32	3.21	6.99	1.48
F value	2.24		2.94		4.37		2.94	
P -value	0.039		0.009		<0.001		0.009	
d.f.	30		30		30		30	
s.e.d.	1.933		2.259		2.611		2.765	
l.s.d.	3.948		4.613		5.332		5.646	

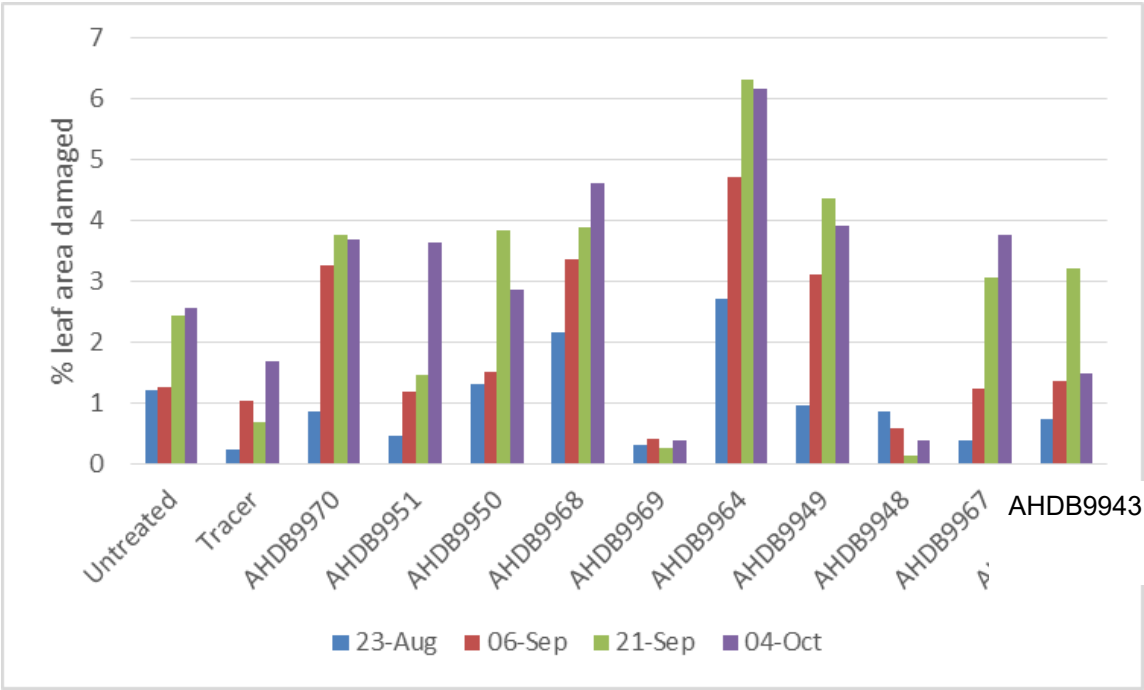

Figure 2 Mean percentage thrips damage (Leaf 2)

Table 3 Mean percentage thrips damage (Leaf 3)

Date	23-Aug		06-Sep		21-Sep		04-Oct	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment								
Untreated	10.36	3.24	11.06	3.68	13.79	5.68	14.39	6.18
Tracer	7.65	1.77	7.18	1.56	8.26*	2.06	12.32	4.55
AHDB9970	11.79	4.18	13.56	5.50	17.71	9.25	16.56	8.12
AHDB9951	8.83	2.36	10.00	3.01	12.02	4.34	16.31	7.89
AHDB9950	10.17	3.12	12.89	4.98	15.22	6.90	14.89	6.61
AHDB9968	12.44	4.64	15.14	6.82	16.54	8.10	19.57	11.22
AHDB9969	7.68	1.79	6.96	1.47	7.43*	1.67	7.54*	1.72
AHDB9964	12.36	4.58	14.61	6.37	18.76	10.34	18.62	10.19
AHDB9949	10.98	3.63	15.94	7.54	16.57	8.13	18.12	9.68
AHDB9948	9.70	2.84	8.37	2.12	5.02*	0.77	9.90	2.96
AHDB9967	8.94	2.42	12.15	4.43	15.18	6.86	15.80	7.42
AHDB9943	7.92	1.90	11.22	3.79	13.41	5.38	15.37	7.03
F value	1.10		3.05		5.96		2.53	
P -value	0.398		0.007		<0.001		0.021	
d.f.	30		30		30		30	
s.e.d.	2.360		2.450		2.519		3.145	
l.s.d.	4.820		5.004		5.145		6.422	

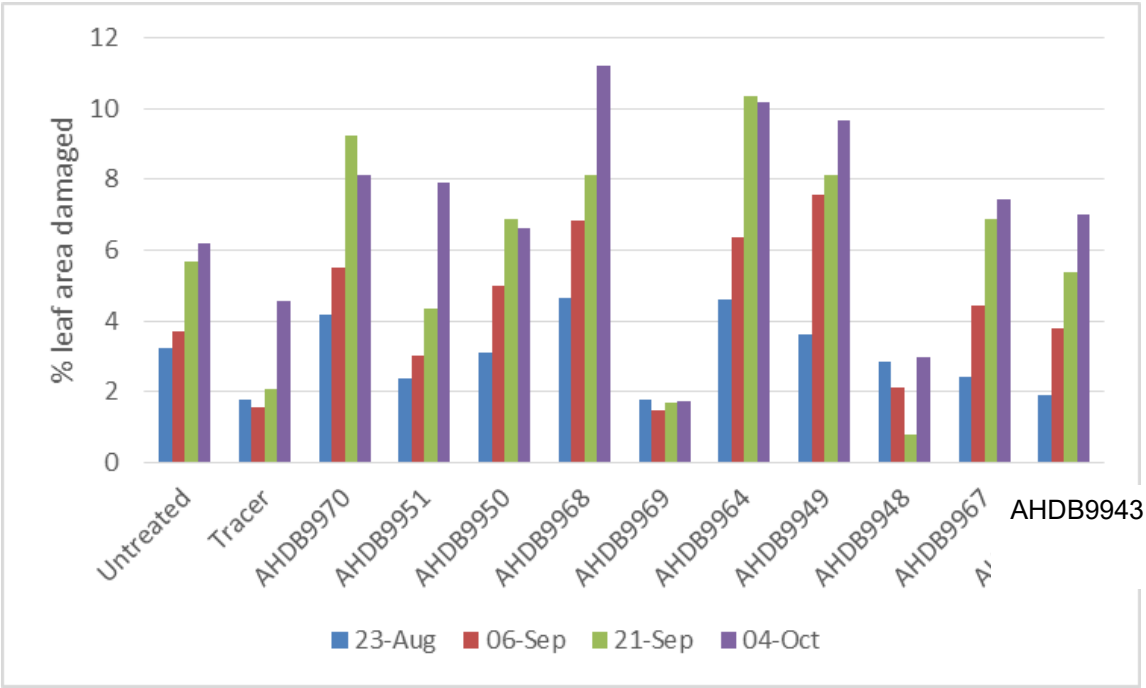

Figure 3 Mean percentage thrips damage (Leaf 3)

Table 4 Mean percentage thrips damage (Leaf 4)

Date	23-Aug		06-Sep		21-Sep		04-Oct	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment								
Untreated	11.46	3.95	15.60	7.23	16.82	8.38	17.67	9.21
Tracer	14.14	5.97	11.91	4.26	12.46	4.65	14.85	6.57
AHDB9970	14.56	6.32	16.69	8.24	20.12	11.83	19.14	10.75
AHDB9951	10.20	3.13	13.52	5.47	15.08	6.77	19.87	11.55
AHDB9950	14.33	6.13	16.30	7.88	18.49	10.06	18.73	10.31
AHDB9968	16.60	8.16	17.44	8.98	18.72	10.30	23.30	15.64
AHDB9969	13.13	5.16	11.27	3.82	10.43*	3.28	10.77*	3.49
AHDB9964	15.88	7.49	16.19	7.78	20.37	12.12	20.90	12.73
AHDB9949	15.34	7.00	18.71	10.29	19.83	11.50	22.06	14.10
AHDB9948	13.48	5.43	10.76	3.49	10.72*	3.46	12.77	4.88
AHDB9967	12.25	4.50	14.98	6.68	17.97	9.52	19.03	10.63
AHDB9943	12.12	4.41	15.10	6.79	16.06	7.65	18.08	9.63
F value	1.51		2.25		4.34		2.90	
P -value	0.179		0.038		<0.001		0.010	
d.f.	30		30		30		30	
s.e.d.	2.177		2.366		2.415		3.052	
l.s.d.	4.447		4.833		4.931		6.234	

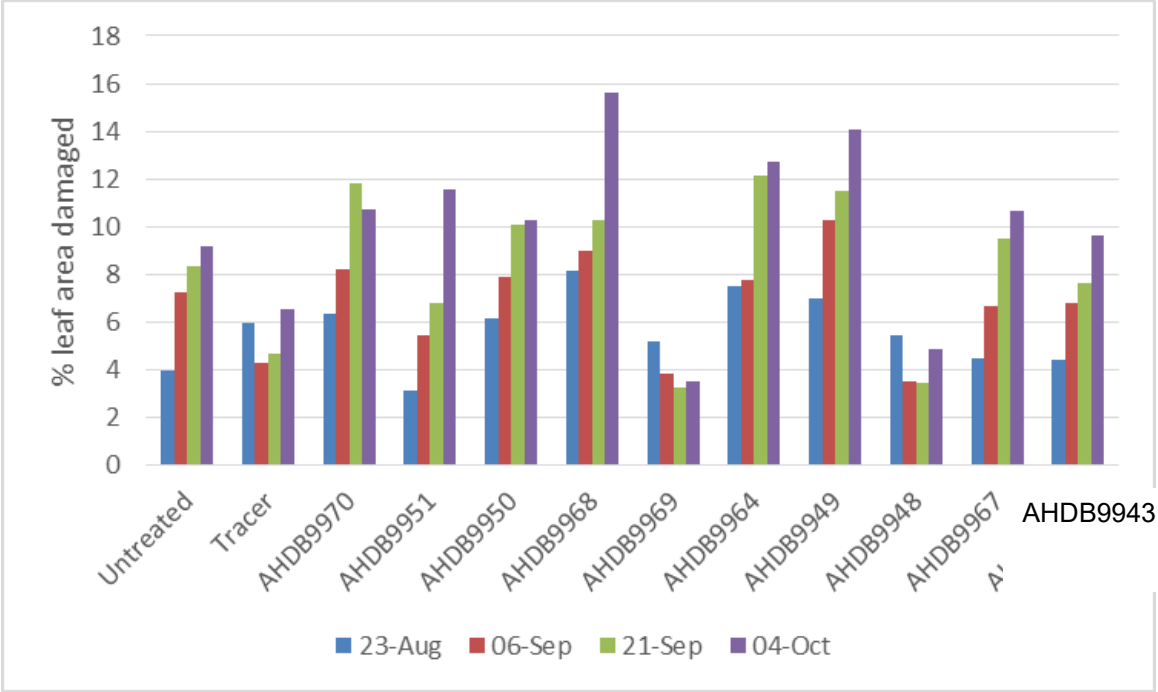

Figure 4 Mean percentage thrips damage (Leaf 4)

Thrips damage – Percentage reduction in damage (Henderson-Tilton formula)

The Henderson-Tilton formula was adapted (see below) to calculate percentage reduction in percentage surface area damaged and is presented in Tables 5 – 8. Percentage reduction in damage was calculated compared with the 23 August assessment and compared with the previous assessment:

% reduction in damage = (1 – (% damage on control before spraying x % damage on treatment after spraying)/(% damage on control after spraying x % damage on treatment before spraying))

Table 5 Percentage reduction in damage (all leaves)

Treatment	Compared with 23 Aug assessment			Compared with previous assessment		
	06-Sep	21-Sep	04-Oct	06-Sep	21-Sep	04-Oct
Tracer	40.0	52.2	23.5	40.0	20.4	-60.0
AHDB9970	-4.8	-10.0	3.2	-4.8	-4.9	12.0
AHDB9951	-10.5	-6.0	-79.5	-10.5	4.0	-69.3
AHDB9950	0.3	-2.7	9.2	0.3	-3.1	11.6
AHDB9968	10.2	23.5	-0.5	10.2	14.8	-31.3
AHDB9969	43.1	62.8	62.3	43.1	34.6	-1.3
AHDB9964	9.7	-1.7	2.4	9.7	-12.7	4.1
AHDB9949	-28.7	-10.1	-16.2	-28.7	14.5	-5.6
AHDB9948	51.3	74.9	56.2	51.3	48.4	-74.4
AHDB9967	-17.2	-31.8	-40.8	-17.2	-12.4	-6.8
AHDB9943	-17.5	-20.9	-24.2	-17.5	-2.9	-2.7

Table 6 Percentage reduction in damage (Leaf 2)

Treatment	Compared with 23 Aug assessment			Compared with previous assessment		
	06-Sep	21-Sep	04-Oct	06-Sep	21-Sep	04-Oct
Tracer	-334.1	-49.9	-250.9	-334.1	65.5	-134.2
AHDB9970	-261.3	-114.4	-102.1	-261.3	40.7	5.8
AHDB9951	-147.2	-57.2	-272.4	-147.2	36.4	-136.9
AHDB9950	-10.7	-46.4	-4.8	-10.7	-32.2	28.4
AHDB9968	-49.7	10.7	-2.1	-49.7	40.3	-14.3
AHDB9969	-31.6	55.0	39.3	-31.6	65.8	-35.1
AHDB9964	-68.9	-16.4	-9.1	-68.9	31.1	6.3
AHDB9949	-214.7	-127.0	-95.6	-214.7	27.9	13.8
AHDB9948	35.6	91.9	78.0	35.6	87.5	-172.7
AHDB9967	-207.6	-296.0	-365.8	-207.6	-28.8	-17.6
AHDB9943	-80.4	-117.1	3.8	-80.4	-20.4	55.7

Table 7 Percentage reduction in damage (Leaf 3)

Treatment	Compared with 23 Aug assessment			Compared with previous assessment		
	06-Sep	21-Sep	04-Oct	06-Sep	21-Sep	04-Oct
Tracer	22.5	33.8	-34.3	22.5	14.5	-102.8
AHDB9970	-15.7	-26.2	-1.8	-15.7	-9.1	19.3
AHDB9951	-12.4	-4.9	-75.3	-12.4	6.7	-67.1
AHDB9950	-40.3	-26.0	-11.0	-40.3	10.2	11.9
AHDB9968	-29.1	0.6	-26.4	-29.1	23.0	-27.2
AHDB9969	27.8	46.7	49.6	27.8	26.3	5.4
AHDB9964	-22.0	-28.4	-16.4	-22.0	-5.2	9.4
AHDB9949	-82.7	-27.6	-39.6	-82.7	30.2	-9.4
AHDB9948	34.4	84.6	45.5	34.4	76.6	-254.6
AHDB9967	-61.2	-61.7	-60.7	-61.2	-0.3	0.6
AHDB9943	-75.3	-61.4	-93.8	-75.3	7.9	-20.1

Table 8 Percentage reduction in damage (Leaf 4)

Treatment	Compared with 23 Aug assessment			Compared with previous assessment		
	06-Sep	21-Sep	04-Oct	06-Sep	21-Sep	04-Oct
Tracer	61.0	63.2	52.8	61.0	5.8	-28.4
AHDB9970	28.8	11.7	27.0	28.8	-23.9	17.4
AHDB9951	4.7	-1.8	-58.0	4.7	-6.9	-55.2
AHDB9950	29.8	22.5	27.9	29.8	-10.3	6.9
AHDB9968	39.9	40.5	17.8	39.9	1.0	-38.0
AHDB9969	59.6	70.1	71.0	59.6	26.0	3.0
AHDB9964	43.3	23.7	27.2	43.3	-34.5	4.5
AHDB9949	19.7	22.5	13.6	19.7	3.5	-11.5
AHDB9948	64.9	70.0	61.5	64.9	14.5	-28.4
AHDB9967	18.9	0.2	-1.3	18.9	-23.0	-1.6
AHDB9943	16.0	18.2	6.3	16.0	2.6	-14.4

Leek moth damage – mean percentage plants damaged by leek moth

The percentage plants with any damage (including superficial) or with just moderate-severe damage (Figure 5) are displayed in Table 9 together with an estimation of the percentage reduction in damage which was calculated using an adapted Abbott's formula (assuming an even distribution of moths across the trial – see below):

% reduction = (1 - % plants damaged in treated/% plants damaged in control)

Table 9 Percentage plants damaged by leek moth

Date	Percentage plants with damage			Percentage plants with moderate to severe damage		
	Ang	Back-trans	% reduction	Ang	Back-trans	% reduction
Treatment						
Untreated	21.65	13.61		17.39	8.93	
Tracer	18.50	10.06	26.1	11.31	3.85	57.0
AHDB9970	16.41	7.98	41.4	9.47*	2.70	69.8
AHDB9951	20.24	11.97	12.0	13.66	5.58	37.5
AHDB9950	21.04	12.90	5.2	16.31	7.89	11.6
AHDB9968	11.01*	3.65	73.2	2.61*	0.21	97.6
AHDB9969	14.89*	6.60	51.5	1.85*	0.11	98.8
AHDB9964	13.73*	5.64	58.6	1.84*	0.10	98.9
AHDB9949	16.74	8.29	39.1	10.81	3.52	60.6
AHDB9948	11.31*	3.85	71.7	3.95*	0.47	94.7
AHDB9967	13.19*	5.21	61.7	5.72*	1.00	88.8
AHDB9943	22.16	14.23	-4.6	17.95	9.50	-6.4
F value	3.05			6.26		
P -value	0.007			<0.001		
d.f.	30			30		
s.e.d.	3.226			3.459		
l.s.d.	6.558			7.065		

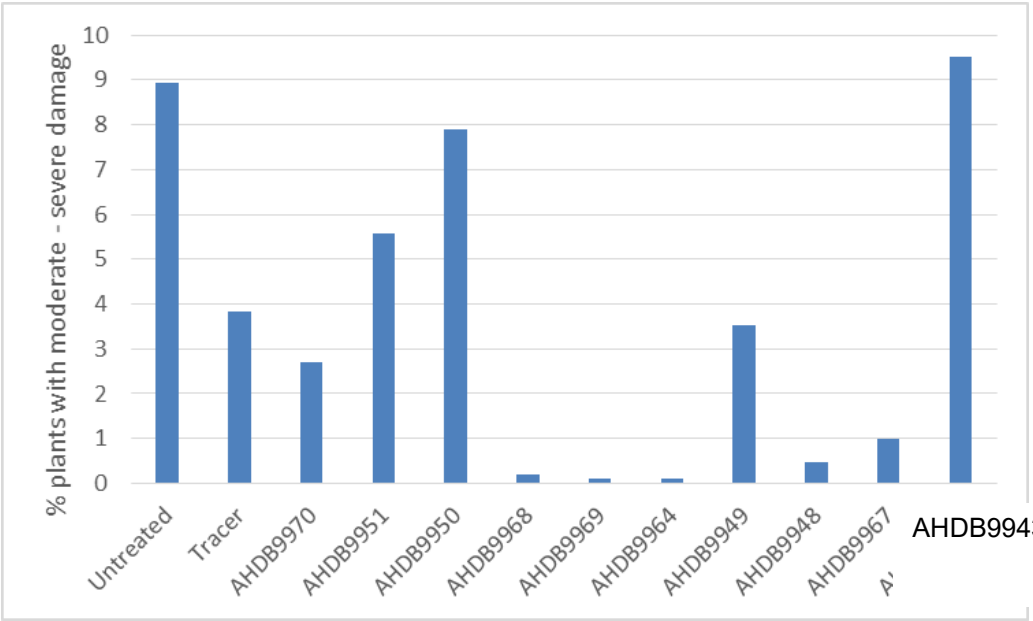

Figure 5 Percentage plants with moderate to severe damage caused by leek moth.

Discussion

The level of damage caused by onion thrips was low throughout the trial but increased in the untreated control on each successive assessment. Three treatments significantly reduced damage compared with the untreated control ($p<0.05$). Most differences occurred on the 3rd assessment (21 September). Tracer reduced damage on Leaf 3 and AHDB9969 and AHDB9948 reduced damage on leaves 2, 3 and 4. The performance of Tracer was not as good as expected but as damage levels were low (and variable across the trial) this is probably not entirely surprising.

More treatments significantly reduced leek moth damage (AHDB9970, AHDB9968, AHDB9969, AHDB9964, AHDB9948 and AHDB9967) compared with the untreated control ($p<0.05$). Tracer reduced damage but not significantly. Again damage was relatively low.

All treatments mixed and sprayed well. No wetter was required. There were no phytotoxic effects.

Conclusions

- Tracer, AHDB9969 and AHDB9948 significantly reduced damage due to onion thrips
- AHDB9970, AHDB9968, AHDB9969, AHDB9964, AHDB9948 and AHDB9967 significantly reduced damage due to leek moth
- No treatments caused phytotoxic effects

Acknowledgements
[As relevant]

Appendix

a. Crop diary – events related to growing crop

Crop	Cultivar	Planting/sowing date	Row width (m)
Leek	Surfer F1	10/5/17	0.35

Previous cropping

Year	Crop
2015	Grass
2016	Companion planting trial – various vegetable crops

Cultivations

Date	Description	Depth
13-Mar	Ploughing	25cm
10-May	Bed forming	15cm

Active ingredient(s) / fertiliser(s) applied to the trial area

Date	Product	Rate	Unit
10-May	Nitram	100	Kg N/ha
16-Jun	Sultan 50SC	2	l/ha

Pesticides applied to the trial area

Date	Product	Rate	Unit
10-May	Wing P	1	l/ha
10-May	Stomp Aqua	1	l/ha
27-Sep	Amistar Top	1	l/ha

Details of irrigation regime

Date	Type, rate and duration	Amount applied (mm)
10-May	Wright Rain, 3 hour	15
7-Jul	Wright Rain, 1 hour	5

Other actions

Date	Action
10-May	Trial area fenced to exclude rabbits
20-Jun	Trial area hand-weeded
1-Sep	Trial area hand-weeded

b. Trial diary

Date	Event
10-May	Seeds drilled
15-Aug	All sprays applied

16-Aug	Initial ("pre-spray") assessment on untreated and Tracer treated plots
21-Aug	Bio-insecticide sprays only
23 Aug	Thrips damage assessment
30-Aug	All sprays applied
04-Sep	Bio-insecticide sprays only
5 Sept	Thrips damage assessment
12-Sep	All sprays applied
19-Sep	Bio-insecticide sprays only applied
20 Sept	Thrips damage assessment
26-Sep	All sprays applied
03-Oct	Bio-insecticide sprays only applied
04-Oct	Thrips damage assessment
17 Oct	Leek moth assessment

c. Climatological data during study period

	Temperature		Rainfall (mm)
Date	Max 09-09	Min 09-09	Total 09-09
01/05/2017	15.0	8.6	0.4
02/05/2017	16.8	3.8	0.0
03/05/2017	12.6	6.7	0.0
04/05/2017	15.8	8.7	0.0
05/05/2017	16.4	5.1	0.0
06/05/2017	11.8	8.0	0.0
07/05/2017	18.6	7.6	0.0
08/05/2017	13.2	4.8	0.0
09/05/2017	12.5	6.8	0.0
10/05/2017	17.3	-1.6	0.0
11/05/2017	19.9	3.0	2.8
12/05/2017	18.2	10.0	1.4
13/05/2017	17.7	10.9	4.6
14/05/2017	18.8	10.5	0.8
15/05/2017	17.5	8.7	1.8
16/05/2017	18.6	13.7	6.4
17/05/2017	15.0	14.4	16.6
18/05/2017	16.8	4.4	4.0
19/05/2017	15.1	9.1	3.4
20/05/2017	15.5	5.4	1.4
21/05/2017	18.7	6.5	0.0
22/05/2017	22.7	7.7	0.0
23/05/2017	21.7	10.8	0.0
24/05/2017	24.9	9.3	0.0

25/05/2017	26.0	9.9	0.0
26/05/2017	26.4	10.4	0.2
27/05/2017	22.8	12.7	0.0
28/052017	22.8	13.3	2.2
29/05/2017	17.8	15.2	6.4
30/05/2017	19.0	12.7	0.0
31/05/2017	21.6	12.7	0.0
01/06/2017	23.5	10.9	0.0
02/06/2017	20.2	11.6	9.6
03/06/2017	19.2	11.1	0.0
04/06/2017	16.7	7.5	2.2
05/06/2017	15.8	7.6	13.8
06/06/2017	16.5	9.5	0.4
07/06/2017	19.2	10.2	2.0
08/06/2017	19.5	12.0	7.8
09/06/2017	19.9	9.5	0.8
10/06/2017	21.6	12.3	0.2
11/06/2017	20.3	13.1	0.0
12/06/2017	17.9	12.3	0.0
13/06/2017	21.4	9.7	0.0
14/06/2017	25.8	8.5	0.0
15/06/2017	22.1	10.7	0.0
16/06/2017	23.0	9.5	0.0
17/06/2017	28.6	13.8	0.0
18/06/2017	30.1	12.7	0.0
19/06/2017	31.2	15.3	0.0
20/06/2017	26.4	16.4	0.0
21/06/2017	32.3	14.0	0.0
22/06/2017	21.9	16.8	0.0
23/06/2017	20.8	11.3	0.0
24/06/2017	25.0	16.1	0.0
25/06/2017	21.2	13.6	0.2
26/06/2017	22.0	8.3	0.4
27/06/2017	20.7	13.4	5.4
28/06/2017	15.1	13.3	0.2
29/06/2017	15.4	10.9	1.0
30/06/2017	19.4	11.1	0.4
01/07/2017	24.0	13.7	0.0
02/07/2017	23.7	11.7	0.2
03/07/2017	24.6	12.7	0.0
04/07/2017	22.5	12.3	0.0
05/07/2017	27.3	9.0	0.0
06/07/2017	29.6	12.9	0.0
07/07/2017	26.7	12.9	0.0
08/07/2017	23.9	14.0	0.0

09/07/2017	27.7	16.1	0.0
10/07/2017	23.4	14.1	0.2
11/07/2017	19.0	12.2	12.8
12/07/2017	21.4	12.4	0.0
13/07/2017	22.3	14.6	0.0
14/07/2017	20.6	14.3	0.0
15/07/2017	23.4	14.2	0.4
16/07/2017	22.7	15.8	0.4
17/07/2017	26.1	7.2	0.0
18/07/2017	27.5	14.3	0.0
19/07/2017	22.9	16.0	18.8
20/07/2017	19.6	12.5	0.0
21/07/2017	20.1	12.3	12.4
22/07/2017	18.8	9.9	5.6
23/07/2017	21.7	12.0	0.8
24/07/2017	21.0	13.7	0.0
25/07/2017	25.3	11.0	3.6
26/07/2017	23.1	13.2	1.6
27/07/2017	19.8	12.6	4.6
28/07/2017	19.9	12.8	0.8
29/07/2017	20.1	13.3	6.8
30/07/2017	21.0	13.0	0.0
31/07/2017	21.3	12.1	0.0
01/08/2017	22.7	11.3	0.2
02/08/2017	20.2	14.1	0.4
03/08/2017	21.0	14.9	0.0
04/08/2017	21.9	13.7	0.2
05/08/2017	19.2	11.8	1.0
06/08/2017	21.2	7.8	0.0
07/08/2017	20.7	14.4	7.2
08/08/2017	14.7	12.8	9.2
09/08/2017	18.6	12.1	2.0
10/08/2017	21.0	6.6	0.0
11/08/2017	19.3	9.0	0.0
12/08/2017	21.2	14.6	0.0
13/08/2017	21.1	7.3	0.0
14/08/2017	21.7	10.5	0.4
15/08/2017	22.8	10.9	0.0
16/08/2017	22.0	8.7	5.6
17/08/2017	22.6	14.3	0.8
18/08/2017	18.6	14.0	18.2
19/08/2017	18.7	10.7	0.0
20/08/2017	20.0	8.4	8.6
21/08/2017	19.5	13.5	0.0
22/08/2017	23.2	15.4	0.0

23/08/2017	21.9	15.0	0.0
24/08/2017	21.0	11.4	0.0
25/08/2017	23.3	8.4	0.0
26/08/2017	24.2	13.4	0.0
27/08/2017	24.8	11.9	0.0
28/08/2017	27.7	12.1	0.0
29/08/2017	18.7	12.1	1.0
30/08/2017	17.1	11.3	0.8
31/08/2017	20.6	6.3	0.0
01/09/2017	19.9	5.7	0.0
02/09/2017	20.8	6.7	0.0
03/09/2017	17.0	9.6	0.6
04/09/2017	23.8	13.9	2.2
05/09/2017	21.2	15.9	4.0
06/09/2017	18.5	9.0	0.0
07/09/2017	18.9	8.0	0.6
08/09/2017	18.4	14.0	0.2
09/09/2017	18.0	8.3	5.2
10/09/2017	16.6	7.6	1.6
11/09/2017	17.5	10.6	11.4
12/09/2017	18.0	8.7	1.6
13/09/2017	16.8	10.6	1.2
14/09/2017	17.0	7.0	0.8
15/09/2017	14.8	6.1	2.6
16/09/2017	15.4	7.4	0.4
17/09/2017	17.3	6.2	1.4
18/09/2017	16.4	7.7	4.0
19/09/2017	16.8	5.8	0.0
20/09/2017	18.8	6.8	1.4
21/09/2017	15.8	13.8	2.8
22/09/2017	17.9	3.2	0.4
23/09/2017	20.6	12.6	0.0
24/09/2017	21.7	10.1	15.6
25/09/2017	17.5	13.8	0.2
26/09/2017	19.3	11.5	0.0
27/09/2017	18.7	12.2	6.2
28/09/2017	19.2	13.8	3.8
29/09/2017	17.8	13.4	0.2
30/09/2017	16.8	9.4	3.4
01/10/2017	18.1	12.7	0.0
02/10/2017	16.0	12.7	0.0
03/10/2017	14.9	8.0	0.0
04/10/2017	15.2	8.4	1.4
05/10/2017	15.7	11.6	0.0
06/10/2017	14.8	5.8	0.4

07/10/2017	17.2	10.5	1.2
08/10/2017	17.2	6.9	1.4
09/10/2017	15.9	12.0	0.0
10/10/2017	18.1	12.3	0.0
11/10/2017	17.8	14.0	0.0
12/10/2017	17.9	8.4	0.0
13/10/2017	20.7	10.9	0.2
14/10/2017	21.2	14.6	0.0
15/10/2017	19.0	11.1	0.2
16/10/2017	20.0	12.7	0.0
17/10/2017	16.5	9.4	0.6
18/10/2017	12.4	9.7	1.0
19/10/2017	16.7	9.7	9.8
20/10/2017	14.3	11.1	1.6
21/10/2017	14.6	11.1	0.2
22/10/2017	13.2	9.3	0.8
23/10/2017	17.1	8.6	0.2
24/10/2017	17.8	12.7	0.0
25/10/2017	16.4	12.1	0.0
26/10/2017	13.6	5.7	0.2
27/10/2017	14.3	4.0	0.0
28/10/2017	15.0	3.4	1.0
29/10/2017	13.0	8.2	0.0
30/10/2017	10.6	-0.9	0.2
31/10/2017	13.6	2.1	0.0

d. Raw data from assessments

Percentage leaf area damaged by onion thrips (plot means)

			Leaf				
Date	Plot	Treatment	1 (youngest)	2	3	4	Mean
16/08/2017	6	1	0	0.5	1	3.25	1.19
	12	2	0	0.75	2.25	4	1.75
	13	2	0	1	4.25	8.75	3.50
	19	1	0	0.5	3	6.25	2.44
	26	1	0	0.75	1.75	6.75	2.31
	31	2	0	2.25	4	8.25	3.63
	40	2	0	0.5	3.25	6.5	2.56
	48	1	0	1.5	2.75	5	2.31
23/08/2017	1	9	0	1.5	7.75	16.5	6.44
	2	3	0	0.25	8.25	12.25	5.19
	3	6	0	4.25	10	13.25	6.88
	4	11	0	0	1.5	4	1.38
	5	8	0	7	10.5	14	7.88
	6	1	0	2	2.25	2.75	1.75
	7	4	0	1.25	5	5.25	2.88
	8	10	0	0.5	3	5.25	2.19
	9	5	0	1	2	7	2.50
	10	12	0	0.25	0.5	2.25	0.75
	11	7	0	0.25	0.75	2.5	0.88
	12	2	0	0.5	0.75	2.75	1.00
	13	2	0	0	1.5	7	2.13
	14	5	0	1	3	5	2.25
	15	11	0	0.25	5.5	8.25	3.50
	16	9	0	0.75	2	4.5	1.81
	17	7	0	0.25	2	5.25	1.88
	18	4	0	0.25	1.5	3.5	1.31
	19	1	0	0	1.25	2.25	0.88
	20	6	0	1.75	3.75	5.5	2.75
	21	12	0	0.5	2	4	1.63
	22	8	0	1.25	1.75	4.75	1.94
	23	3	0	0.25	1	2.5	0.94
	24	10	0	0.5	1.5	2.75	1.19
	25	10	0	1.75	4.5	8.5	3.69
	26	1	0	2.25	7.25	9.25	4.69
	27	7	0	0.25	4.25	8.5	3.25
	28	5	0	2.5	4.75	10.25	4.38
	29	3	0	1.75	5.5	6	3.31
	30	12	0	1	2.5	4.25	1.94

	31	2	0	0.25	2.25	8.75	2.81
	32	9	0	0.5	1.5	2.75	1.19
	33	8	0	5.25	8.75	9.75	5.94
	34	11	0	1.25	2	3.5	1.69
	35	6	0	2.25	2.25	6.75	2.81
	36	4	0	1.25	3.25	2	1.63
	37	12	0	1.5	3.25	8	3.19
	38	8	0	0.25	1	3.5	1.19
	39	4	0	0	0.75	2.25	0.75
	40	2	0	0.5	3	6.25	2.44
	41	6	0	1	4	8	3.25
	42	10	0	1	2.75	6	2.44
	43	7	0	0.5	1	5.25	1.69
	44	3	0	2	3.75	6.25	3.00
	45	11	0	0.75	1.5	3	1.31
	46	5	0	1	3	3.25	1.81
	47	9	0	1.25	4.75	7.25	3.31
	48	1	0	2.25	3.5	3	2.19
06/09/2017	1	9	1.75	9	14.5	18.25	10.88
	2	3	1.5	11.5	13.75	16.75	10.88
	3	6	0.25	7.75	10	16.75	8.69
	4	11	0	2.25	5.5	6.25	3.50
	5	8	3	11.5	15.75	14.75	11.25
	6	1	0.5	3.25	2.75	6.5	3.25
	7	4	0.25	2.5	3.75	7.5	3.50
	8	10	0	1.5	3.75	5	2.56
	9	5	1.25	2.75	6.25	9.5	4.94
	10	12	0	0.5	1.5	3	1.25
	11	7	0	1	4	4.5	2.38
	12	2	0	0.25	0.75	2.25	0.81
	13	2	0	0.75	1.25	3.25	1.31
	14	5	0	0	3	6.75	2.44
	15	11	1	1.5	5.75	6.75	3.75
	16	9	0	2.25	5.25	5.75	3.31
	17	7	0	0	1.5	3.75	1.31
	18	4	0	0.5	1.75	3.75	1.50
	19	1	0	1.25	3	6.25	2.63
	20	6	0	1.25	5	6.75	3.25
	21	12	0	1	3	6.25	2.56
	22	8	0	1.5	2	3.75	1.81
	23	3	0	1.5	3	5.5	2.50
	24	10	0	0	1.5	2.25	0.94
	25	10	0	1.75	2.75	4	2.13

	26	1	0	0.75	3.75	6.25	2.69
	27	7	0	0.75	1.25	4.75	1.69
	28	5	0	2.5	5	9.25	4.19
	29	3	0.25	2.5	5.75	8	4.13
	30	12	0	1.75	4.5	7.5	3.44
	31	2	0	0.25	0.25	3	0.88
	32	9	0	1.5	4.5	6.5	3.13
	33	8	0	6.5	7.75	9	5.81
	34	11	0	1	3.5	7.25	2.94
	35	6	0	4	8.5	9.5	5.50
	36	4	0	0.75	2.25	6.5	2.38
	37	12	0	2.75	7.25	11.75	5.44
	38	8	0	2.25	3.5	5.5	2.81
	39	4	0	1.5	4.75	4.5	2.69
	40	2	0	4.75	6.25	10.25	5.31
	41	6	0.5	2	4.5	4.75	2.94
	42	10	0	0.25	1	3	1.06
	43	7	0	0.5	0.25	2.5	0.81
	44	3	0	1	2.25	4.75	2.00
	45	11	0	0.5	3.25	6.5	2.56
	46	5	0.5	2.75	6	6.25	3.88
	47	9	0	1.75	7.5	12.75	5.50
	48	1	0	0.5	5.5	10.25	4.06
21/09/2017	1	9	3.25	14.5	18	20	13.94
	2	3	0.75	11.25	20.75	22	13.69
	3	6	0	6	12.5	15.25	8.44
	4	11	0	4.75	9.5	11.75	6.50
	5	8	3.5	15.75	18.75	23	15.25
	6	1	0	1.25	3.25	6	2.63
	7	4	0	3	5.25	9.5	4.44
	8	10	0	0.25	2	6	2.06
	9	5	1.25	6.25	6.75	10.25	6.13
	10	12	0	2.5	3.75	8	3.56
	11	7	0	0.75	2.75	6.25	2.44
	12	2	0.75	2.5	4.75	7.75	3.94
	13	2	0	0	0.25	1.25	0.38
	14	5	0	0.75	4.5	7.5	3.19
	15	11	0.25	2.5	7	9.75	4.88
	16	9	0	2.5	7	9.25	4.69
	17	7	0	0	0.5	1.5	0.50
	18	4	0	0	1	4.25	1.31
	19	1	0	0	1.75	3.5	1.31
	20	6	0	0.75	5	8	3.44

	21	12	0	0.5	1	3.5	1.25
	22	8	0	1.5	3.75	4.75	2.50
	23	3	0	1	3	4.5	2.13
	24	10	0	0.25	0	1.75	0.50
	25	10	0	0.25	2.5	7	2.44
	26	1	1.5	10	12.25	15.5	9.81
	27	7	0	1.5	3.25	4.75	2.38
	28	5	1.5	9.25	13.25	17	10.25
	29	3	0.75	7	15.25	19.75	10.69
	30	12	0.5	3.75	6.5	8.75	4.88
	31	2	0	0.75	1.75	4.25	1.69
	32	9	0	2	5.25	7.5	3.69
	33	8	1.5	7.5	14.75	15	9.69
	34	11	0.25	2.5	5.5	8.75	4.25
	35	6	1.5	8.75	11.25	12.5	8.50
	36	4	0	4	8.75	12.25	6.25
	37	12	2	8.5	14	11.5	9.00
	38	8	1.5	4.25	7.25	9	5.50
	39	4	0	1.25	4.25	3	2.13
	40	2	0	0.75	3	7	2.69
	41	6	0	2.5	5	6.5	3.50
	42	10	0	0	0.25	1	0.31
	43	7	0	0	1	1.75	0.69
	44	3	0	0.5	3.5	5.75	2.44
	45	11	0.25	2.75	5.75	8	4.19
	46	5	0	2	4.5	6.75	3.31
	47	9	1.5	2.25	4.75	10.75	4.81
	48	1	0	3.75	8.25	10.75	5.69
04/10/2017	1	9	0.5	9.5	19.5	26.25	13.94
	2	3	0.5	14	20.75	24	14.81
	3	6	0	5	11.25	16.75	8.25
	4	11	0.75	5.25	9	11.75	6.69
	5	8	1.75	6.75	13.25	18.75	10.13
	6	1	0.25	1	4.5	6.75	3.13
	7	4	0.25	5.25	11.5	15.75	8.19
	8	10	0	1.75	6.25	8.5	4.13
	9	5	0	4	9	11.5	6.13
	10	12	0	1	4.5	7	3.13
	11	7	0	1.25	3.25	5	2.38
	12	2	0	1.75	5.25	9	4.00
	13	2	0	0.75	3	4.75	2.13
	14	5	0	1.75	5.25	11	4.50
	15	11	0	2.5	4.75	8.5	3.94

	16	9	0	2.5	7.25	10.5	5.06
	17	7	0	0	1	1.25	0.56
	18	4	0	1.75	4.25	5.75	2.94
	19	1	0	1	2.5	3.5	1.75
	20	6	0	0.5	3	5.75	2.31
	21	12	0	2.25	5.25	7.5	3.75
	22	8	0.5	2.5	5	7	3.75
	23	3	0	0	1.75	4	1.44
	24	10	0	0.25	4	5.5	2.44
	25	10	0	0.5	2.75	4.75	2.00
	26	1	0.5	7	15.25	21.5	11.06
	27	7	0	0.75	3	7.25	2.75
	28	5	0.75	6	9.25	15	7.75
	29	3	0.5	6.5	13.5	17.75	9.56
	30	12	0	0.5	7.75	9.25	4.38
	31	2	0	4.5	6.75	9	5.06
	32	9	0	2.5	7.5	10.5	5.13
	33	8	0	8.5	13.75	16.75	9.75
	34	11	0	6.5	14.5	17	9.50
	35	6	0.75	18	36.5	41	24.06
	36	4	0	5.25	12	16.25	8.38
	37	12	0	2.75	11.5	15.75	7.50
	38	8	2.5	8	10	10	7.63
	39	4	0	3	5.25	10	4.56
	40	2	0	0.75	3.75	4.25	2.19
	41	6	0	1.75	4	7	3.19
	42	10	0	0	0.5	1.75	0.56
	43	7	0	0.25	0.5	2	0.69
	44	3	0	1.75	3	3.5	2.06
	45	11	0	1.75	3.5	6.5	2.94
	46	5	0	1	3.75	5	2.44
	47	9	0.5	2.75	6.5	11.25	5.25
	48	1	0	3	5.25	8.75	4.25

Leek moth damage on 17/10/2017

		Percentage plants in damage categories	
Plot	Treatment	1,2 and 3	2 and 3
1	9	5.88	1.96
2	3	4.35	0.00
3	6	2.08	0.00
4	11	11.32	3.77
5	8	13.79	0.00
6	1	14.75	9.84
7	4	19.12	13.24
8	10	6.25	0.00
9	5	19.30	12.28
10	12	23.81	17.46
11	7	9.09	0.00
12	2	18.37	4.08
13	2	9.09	3.03
14	5	16.67	10.00
15	11	3.33	0.00
16	9	7.27	3.64
17	7	4.55	0.00
18	4	5.71	1.43
19	1	5.41	2.70
20	6	1.64	0.00
21	12	16.13	12.90
22	8	1.47	0.00
23	3	13.64	6.06
24	10	1.96	1.96
25	10	7.27	1.82
26	1	15.69	7.84
27	7	11.67	1.67
28	5	10.53	5.26
29	3	8.77	5.26
30	12	7.69	3.08
31	2	8.57	7.14
32	9	10.00	2.86
33	8	9.84	1.64
34	11	6.85	4.11
35	6	11.48	3.28
36	4	11.90	4.76
37	12	11.32	7.55
38	8	1.89	0.00
39	4	12.86	5.71
40	2	5.88	1.96
41	6	2.22	0.00
42	10	1.52	0.00
43	7	2.86	0.00
44	3	6.45	3.23
45	11	1.67	0.00
46	5	6.78	5.08
47	9	10.42	6.25
48	1	20.93	18.60

Trial number	W2017.016
Sponsor	SCEPTRE Plus
Crop	Leek
Location	LMC

9	3	6	11	8	1	4	10	5	12	7	2
1	2	3	4	5	6	7	8	9	10	11	12
2	5	11	9	7	4	1	6	12	8	3	10
13	14	15	16	17	18	19	20	21	22	23	24
10	1	7	5	3	12	2	9	8	11	6	4
25	26	27	28	29	30	31	32	33	34	35	36
12	8	4	2	6	10	7	3	11	5	9	1
37	38	39	40	41	42	43	44	45	46	47	48

Certificate of

Official Recognition of Efficacy Testing Facilities or Organisations in the United Kingdom

This certifies that

Warwick Crop Centre, School of Life Sciences

complies with the minimum standards laid down in Regulation (EC) 1107/2009 for efficacy testing.

The above Facility/Organisation has been officially recognised as being competent to carry out efficacy trials/tests in the United Kingdom in the following categories:

Agriculture/Horticulture
Biologicals and Semiochemicals

Date of issue: **6 October 2017**
Effective date: **20 March 2017**
Expiry date: **19 March 2022**

Signature Alison Richardson
Authorised signatory

Certification Number
ORETO 381

HSE
Chemicals Regulation Division

Department of
Agriculture and
Rural Development