SCEPTREPLUS

Final Trial Report

Trial code:	SP 29
Title:	**Weed control in lettuce, outdoor salads and baby leaf**
Crop	Lettuce
Target	Broadleaf weeds and Grass weeds
Lead researcher:	Angela Huckle
Organisation:	RSK ADAS, Boxworth
Period:	April 2018 - January 2019
Report date:	31st January 2019
Report author:	David Norman, Fresh Produce Consultancy Ltd,
ORETO Number: (certificate should be attached)	409

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

31st January 2019
Date

Authors signature

Trial Summary

Introduction

Broadleaf weeds, especially groundsel, continue to be major problems for lettuce growers; small nettle, chickweed and polygonums are also frequent problems. This one year trial aimed to look at new post-planting options for broadleaf weed control for transplanted lettuce, recording efficacy and crop safety. An additional aim was to evaluate the crop safety of AHDB9985 when applied to lettuce for grass weed control.

Methods

A randomized, replicated trial (three replicates) was carried out at a commercial lettuce grower site at Narborough, Norfolk, (G's Norfolk Farms) on a sandy loam soil type, using transplanted romaine lettuce. Treatment AHDB9987 was applied four days after planting the other treatments, aclonifen, AHDB 9987, AHDB 9876, AHDB9985 and the standard chlorpropham (Intruder) were all applied 11 days after planting. There were 18 treatments including untreated controls and a standard, chlorpropham.

Weeds present across the site included groundsel, volunteer oilseed rape and fumitory with some scattered annual nettle.

Results

Table 1, Crop damage (phytotoxicity score)

Higher score, more crop damage, scores over 5 unacceptable.

	Mean Crop Damage 0-10			
Date	**5-sept**	**13-sept**	**19-sept**	**4-oct**
Treatment				
10,18 Untreated	0	0	0	0
1.Aclonifen 1.0	6.67	7.00	7.33	9.00
2.Aclonifen 0.5	6.67	7.00	7.67	8.00
3.Aclonifen 0.25	6.00	7.33	7.33	7.00
4. AHDB9987 2.0	1.33	1.67	5.33	9.00
5. AHDB9987 1.0	0.33	0	2.67	6.00
6. AHDB9987 0.5	0	0	0	2.33
7. AHDB9877 2.0	0.33	0	1.00	0
8. AHDB9877 1.0	0	0	0	0
9. AHDB9877 0.5	0	0	0	0
11. AHDB9876 1.0	8.00	0	0	0
12. AHDB9876 0.5	6.67	0	0.67	0
13. AHDB9876 0.25	4.33	0	0.33	0
14. AHDB 9985 2.0	1.00	0	0.67	0
15. AHDB9985 1.0	0	0	0	0
16. AHDB9985 0.5	0	0	0	0
17. chlorpropham 0.75	0	0	0	0
P value	0.05	0.05	0.05	0.05
d.f	37	37	37	37
Lsd	0.968	0.9931	0.9806	0.7022
	Not significantly different from untreated control (p>0.05)			
	Significantly different from untreated control (p<0.05)			

Table 2, Weed Control Scores
% weed ground cover, higher score, more weeds, over 50% unacceptable.

	% weed cover			
Date	**5-sept**	**13-sept**	**19-sept**	**4-oct**
Treatment				
10,18 Untreated	3.02	15.00	34.17	74.17
1.Aclonifen 1.0	12.91	1.67	2.33	4.67
2.Aclonifen 0.5	12.94	1.00	3.33	5.67
3.Aclonifen 0.25	12.13	1.67	6.67	15.00
4. AHDB9987 2.0	5.42	2.33	5.67	4.00
5. AHDB9987 1.0	2.71	3.67	5.67	11.67
6. AHDB9987 0.5	2.71	5.67	7.67	13.33
7. AHDB9877 2.0	4.62	11.67	13.33	30.00
8. AHDB9877 1.0	2.71	10.00	18.33	26.67
9. AHDB9877 0.5	2.71	11.67	16.67	36.67
11. AHDB9876 1.0	13.66	11.67	16.67	38.33
12. AHDB9876 0.5	7.03	10.00	16.67	38.33
13. AHDB9876 0.25	11.67	11.67	28.33	56.67
14. AHDB 9985 2.0	8.93	11.67	23.33	43.33
15. AHDB9985 1.0	5.42	11.67	20.00	56.67
16. AHDB9985 0.5	2.71	11.67	23.33	63.33
17. chlorpropham 0.75	2.71	13.33	18.33	50.00
P value	0.05	0.05	0.05	0.05
d.f	37	37	37	37
Lsd	7.768	6.012	10.842	16.15
	Not significantly different from untreated control (p>0.05)			
	Significantly different from untreated control (p<0.05)			

Conclusions

All treatments with the exception of AHDB 9985 (a graminicide) gave a significant reduction of weeds at the last two assessment dates, by which time the untreated plots showed an average of 74% weed ground cover. Aclonifen gave the best weed control but levels of crop damage were unacceptable; this active would not be suitable for lettuce post-planting use. AHDB9987 was unsafe at the higher rate of 2.0l/ha, moderately safe at 1.0l/ha and more acceptable at 0.5l/ha. All rates gave a significant reduction in weeds when compared to the untreated control. AHDB9877 gave some crop check (observed as crop leaves stuck together) at the higher rate 2.0l/ha but seemed safe at 1.0 and 0.5l/ha, all rates gave a significant reduction in weeds. AHDB9876 gave some severe crop damage (leaves curled back and puckering) initially at all rates, but much of this seemed to grow out, it gave a significant reduction in weeds. AHDB9985 gave a slight check (leaf puckering) at the higher rate of 2.0l/ha, but the lower rates of 1.5l/ha and 1.0l/ha were safe, this active is for grass weed control only.

Take home message: AHDB 9877 would give growers a useful extra option for post-planting weed control. To ensure crop safety, use would be recommended at 1.0 L/ha or below. AHDB9985 would be a useful addition to aid grass weed control in lettuce if an authorization was gained, label rates were shown to be safe in the trial. Further work would be required with AHDB 9876 as it is new, and gives dramatic crop effects, but the crop does subsequently recover.

Objective

To compare a number of novel contact herbicides applied post-planting for selectivity (crop safety) and efficacy in wholehead lettuce.

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	Lower Farm, Lower Farm Road, Narborough, Norfolk, PE32 1JB
Crop	Romaine Lettuce
Cultivar	Scala
Soil or substrate type	Sandy Loam
Agronomic practice	Commercial Lettuce crop, planted 18/8/2018, 150,000 plants/ha, 3.8cm peat blocks, irrigated day of planting and 4 days later. No pre or post-planting herbicides applied to trial area.
Prior history of site	Previous crop wheat, farm has a rotation of, wheat, sugar beet, onions and potatoes.

Trial design

Item	Details
Trial design:	Randomised block design amended to fit spray tramlines and keep in one variety.
Number of replicates:	3
Row spacing:	25cm x 30cm , 7 rows in 2.0M bed
Plot size: (w x l)	2.0m X 6.0M
Plot size: (m^2)	12(m^2)
Number of plants per plot:	147

Treatment details

AHDB Code	Active substance	Product name/ manufacturers code	Formulation batch number	Content of active substance in product	Formulation type	Adjuvant
Untreated						
AHDB9987	N/D	N/D	N/D	N/D	N/D	n/a
-	aclonifen	Bandur	EV-56006446	600g/l	SC	n/a
AHDB9877	N/D	N/D	N/D	N/D	N/D	n/a
AHDB9876	N/D	N/D	N/D	N/D	N/D	n/a
AHDB9985	N/D	N/D	N/D	N/D	N/D	n/a
n/a	chlorpropham	Intruder	n/a	400g/l	EC	n/a

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	Bandur (aclonifen)	600	1000	B
2	Bandur (aclonifen)	300	500	B
3	Bandur (aclonifen)	150	250	B
4	AHDB 9987	1200	2000	A
5	AHDB 9987	600	1000	A
6	AHDB 9987	300	500	A
7	AHDB 9877	1000	2000	B
8	AHDB 9877	500	1000	B
9	AHDB 9877	250	500	B
10	Untreated	0	0	B
11	AHDB9876	5	1000	B
12	AHDB9876	2.5	500	B
13	AHDB9876	1.25	250	B
14	AHDB9985	240	2000	B
15	AHDB9985	120	1000	B
16	AHDB9985	60	500	B
17	Intruder (chlorpropham)	300	750	B
18	untreated	0	0	B

Application details

	Application A	Application B
Application date	24/08/2018	31/08/2018
Time of day	11.00am	12.30pm
Crop growth stage (Max, min average BBCH)	BBCH 13-14	BBCH 15-16
Crop height (cm)	4cm	6cm
Crop coverage (%)	10%	15%
Application Method	Spray	Spray
Application Placement	Foliar	Foliar
Application equipment	Azo precision Plot sprayer	Azo precision Plot sprayer
Nozzle pressure	2.0 bar	2.0 bar
Nozzle type	Flat fan	Flat Fan
Nozzle size	F04/110	F04/110
Application water volume/ha	400	400
Temperature of air - shade (°C)	14	18
Relative humidity (%)	75%	70%
Wind speed range (m/s)	7.0	2.2
Dew presence (Y/N)	N	N
Temperature of soil - 2-5 cm (°C)	15	19
Wetness of soil - 2-5 cm	moist	moist
Cloud cover (%)	50%	0

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
Broadleaf weeds and grasses	*N/A*	3WEEDT	0 % ground cover	1.17% ground cover	74% ground cover

Assessment details

	Evaluation Timing (DA)*				
Evaluation date	**After conventional herbicides**	**After Bio-herbicides**	**Crop Growth Stage (BBCH)**	**Evaluation type (efficacy, phytotox)**	**Assessment**
05/09/2018	A -12 B - 6	n/a	15-16	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
13/09/2018	A -19 B - 13	n/a	33	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
19/09/2018	A - 25 B - 18	n/a	44	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
04/10/2018	A – 40 B - 33	n/a	49	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers

* DA – days after application

At each assessment a score was made to record phytotoxicity and % weed ground cover, notes were made on weed species present and photographs taken of crop damage symptoms. Note: Romaine lettuce is classified as a non-hearting type in the BBCH scale.

Statistical analysis

The trial was designed as a randomized block design with three replicates including two replicated untreated controls within the 18 treatments. However, to fit into the field tramline spray system and keep in the same variety of lettuce, the replicate blocks were re-aligned to make a longer narrower trial area.

As usual with weed trials the distribution of weeds was fairly uneven so the data for weeds had an angular transformation used. All data were analysed by ANOVA using Genstat 18.2 by Chris Dyer at RSK ADAS. For the % efficacy the data was calculated by abbotts formula, an angular transformation was carried out and then the back transformed means are presented, from which abbotts formula was used to calculate the % reduction in weeds.

Results

Table 3, Mean % weed cover,

Higher figure, more weeds.

	% weed cover			
Date	**5-sept**	**13-sept**	**19-sept**	**4-oct**
Treatment				
10,18 Untreated	3.017	15.00	34.17	74.17
1. Aclonifen 1.0	12.913	1.667	2.33	4.67
2. Aclonifen 0.5	12.938	1.000	3.33	5.67
3. Aclonifen 0.25	12.131	1.667	6.67	15.00
4. AHDB9987 2.0	5.420	2.333	5.67	4.00
5. AHDB9987 1.0	2.710	3.667	5.67	11.67
6. AHDB9987 0.5	2.710	5.667	7.67	13.33
7. AHDB9877 2.0	4.623	11.667	13.33	30.00
8. AHDB9877 1.0	2.710	10.000	18.33	26.67
9. AHDB9877 0.5	2.710	11.667	16.67	36.67
11. AHDB9876 1.0	13.663	11.667	16.67	38.33
12. AHDB9876 0.5	7.027	10.000	16.67	38.33
13. AHDB9876 0.25	11.670	11.667	28.33	56.67
14. AHDB9985 2.0	8.930	11.667	23.33	43.33
15. AHDB9985 1.0	5.420	11.667	20.00	56.67
16. AHDB9985 0.5	2.710	11.667	23.33	63.33
17. Chlorpropham 0.75	2.710	13.333	18.33	50.00
P value	0.05	0.05	0.05	0.05
d.f	37	37	37	37
Lsd	7.768	6.012	10.842	16.15
	Not significantly different from untreated control (p>0.05)			
	Significantly different from untreated control (p<0.05)			

Table 4, Phytotoxicity,

Higher score, more crop damage**.**

	Mean Crop Damage 0-10			
Date	**5-sept**	**13-sept**	**19-sept**	**4-oct**
Treatment				
10,18 Untreated	0	0	0	0
1. Aclonifen 1.0	6.667	7.000	7.333	9.000
2. Aclonifen 0.5	6.667	7.000	7.667	8.000
3. Aclonifen 0.25	6.000	7.333	7.333	7.000
4. AHDB9987 2.0	1.333	1.667	5.333	9.000
5. AHDB9987 1.0	0.333	0	2.667	6.000
6. AHDB9987 0.5	0	0	0	2.333
7. AHDB9877 2.0	0.333	0	1.000	0
8. AHDB9877 1.0	0	0	0	0
9. AHDB9877 0.5	0	0	0	0
11. AHDB9876 1.0	8.000	0	0	0
12. AHDB9876 0.5	6.667	0	0.667	0
13. AHDB9876 0.25	4.333	0	0.333	0
14. AHDB9985 2.0	1.00	0	0.667	0
15. AHDB9985 1.0	0	0	0	0
16. AHDB9985 0.5	0	0	0	0
17. Chlorpropham 0.75	0	0	0	0
P value	0.05	0.05	0.05	0.05
d.f	37	37	37	37
Lsd	0.968	0.9931	0.9806	0.7022
	Not significantly different from untreated control (p>0.05)			
	Significantly different from untreated control (p<0.05)			

Table 5, Efficacy

Mean % weed reduction using back transformed means data, % Abbotts reduction, Lower figure, less weeds.

	% weed reduction from untreated abbotts %			
Date	**5-sept**	**13-sept**	**19-sept**	**4-oct**
Treatment				
10, 18 Untreated	**0.277%**	**14.76%**	**33.79%**	**74.24%**
1. Aclonifen 1.0	-1702.89	88.97	93.16	93.74
2. Aclonifen 0.5	-1709.75	93.23	90.35	93.02
3. Aclonifen 0.25	-1494.22	88.97	80.79	80.12
4. AHDB9987 2.0	-222.02	86.45	84.67	94.80
5. AHDB9987 1.0	19.13	77.39	84.67	85.28
6. AHDB9987 0.5	19.13	64.88	78.54	82.48
7. AHDB9877 2.0	-134.66	24.54	61.50	59.87
8. AHDB9877 1.0	19.13	32.26	47.88	64.28
9. AHDB9877 0.5	19.13	24.54	50.87	50.70
11. AHDB9876 1.0	-1914.44	21.63	51.58	48.77
12. AHDB9876 0.5	-440.43	32.26	52.03	48.77
13. AHDB9876 0.25	-1376.90	21.63	17.19	23.44
14. AHDB9985 2.0	-770.04	25.95	31.07	41.86
15. AHDB9985 1.0	-222.02	21.63	41.28	23.44
16. AHDB9985 0.5	19.13	21.63	31.40	14.40
17. Chlorpropham 0.75	19.13	10.33	45.93	32.65
P value	0.05	0.05	0.05	0.05
d.f	37	37	37	37
Lsd	7.768	6.012	10.842	16.15
	Not significantly different from untreated control (p>0.05)			
	Significantly different from untreated control (p<0.05)			

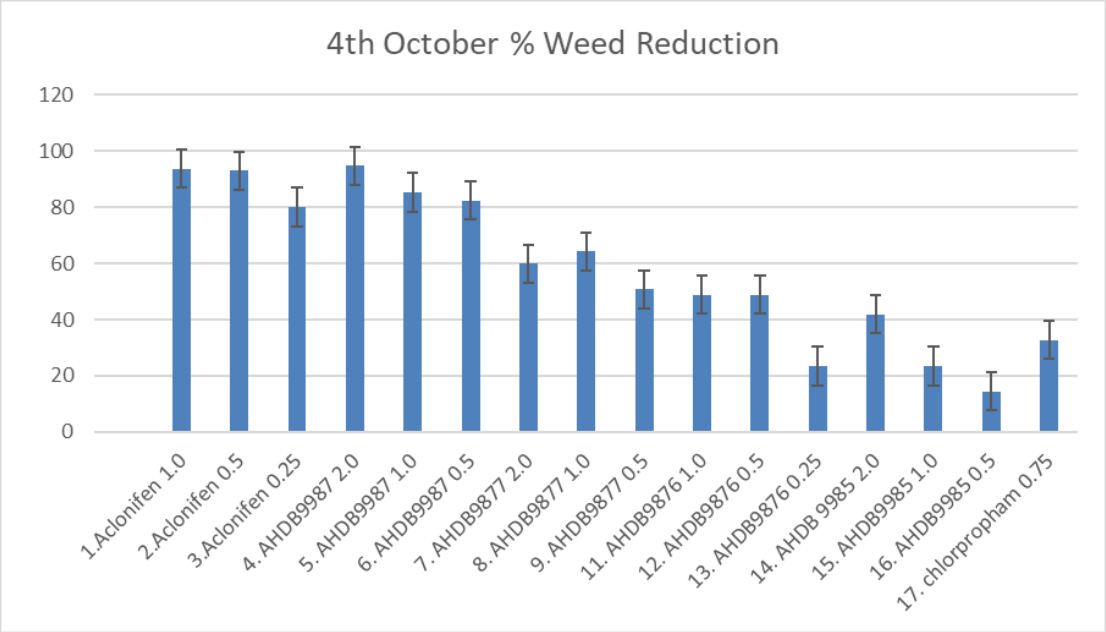


Figure 1. %weed reduction using abbotts formula, 4th October data, lsd 16.15@p=0.05%.

Discussion

Weed levels were generally good at this site and provided some good data on reduction of weed effects by the herbicides. Only the lower rate of AHDB9985 failed to give a significant reduction in weeds at the point of harvest 4th October, but as it is a graminicide, this was not unexpected. All other treatments gave a significant reduction on weeds at the last two assessment dates, by which time the untreated plots showed an average of 74% weed ground cover.

The best weed control was achieved by Aclonifen at 1.0 and 0.5 L/ha, AHDB9987 was also very good at reducing weeds at all rates tested. The poorest weed control was achieved by the lowest rates of AHDB9985 (the graminicide) and the lowest rates of AHDB9876. The main weeds at the site were groundsel, volunteer oilseed rape and fumitory with some scattered annual nettle.

Whilst Aclonifen provided the best weed control, it was also very crop damaging with all rates giving a significant level of phytotoxicity from the time of application through to harvest. The effects were yellow chlorosis of the leaf and necrosis of the older leaves combined with a stunting of growth, to such an extent that that plants would not have made a marketable size.

AHDB9987 gave an initial check which the plants appeared to grow away from, but all rates produced a number of plants in the plot where the leaves stuck together at hearting, with the higher rates producing the most stuck together leaves. This damage would be commercially unacceptable. All rates gave a significant crop damage score even at the point of harvest. It did however give good weed control and in consideration that it was the only active to reduce groundsel numbers, then it may have a place for the lettuce crop at the lower rates.

AHDB9877 gave a little damage at the higher rate, but at the lower rates of 1.0 and 0.5 gave no recordable crop damage and by the second and third assessments had given a significant reduction in weeds, with the 1.0l/ha rate giving a 64% reduction in % weed ground cover. It had especially good effect on OSR and fumitory, which accounted for most of the weed reduction. This active looks to have considerable promise for lettuce.

AHDB9876 gave relatively good weed reduction at the 1.0 and 0.5 rates but fairly poor weed control at 0.25l/ha with only a 23% weed reduction. All rates showed an initial severe symptom of leaf curl back and puckering although this had grown out by the point of harvest. It had relatively little effect on reducing groundsel.

AHDB9985 the graminicide, showed a little leaf puckering at the higher rate of 2.0l/ha. The 1.0 and 0.5l/ha rates showed no crop damage indicating this active would be safe for lettuce at these rates.

The standard chlorpropham performed as expected, giving a 33% reduction in weeds by harvest, sufficient to produce a marketable crop, although the plots looked a little weedy at harvest, with no control of the groundsel and only a little reduction in OSR.

Conclusions

AHDB9877 looks to have significant promise as a lettuce post-planting broadleaf weed herbicide and efforts should be made to pursue approvals.

AHDB9987 should probably be considered mainly as a pre-planting material, given it has some activity on groundsel, it could have a place post-planting at lower rates.

Aclonifen is unsuitable for lettuce post-planting at any rate, pre-planting applications should be explored.

AHDB9876 could have a place for lettuce although post-planting crop safety should be further explored and as it has no residual activity it would not be worth testing pre-planting.

AHDB9985 looks safe for post-planting grass weed control in lettuce at the medium and lower rates.

Acknowledgements

Thanks are given to the hosts, G S Shropshire & Sons, Norfolk Farms for providing the site. To AHDB for providing funding and technical input from Bolette Palle Neve, David Norman and Angela Huckle. Thanks also to the crop protection manufacturers for supporting the work and providing experimental samples.

Appendix

a. Crop diary – events related to growing crop

Crop	Cultivar	Planting Date	Row width
Lettuce	Scala	18/08/2018	7 rows on 2M bed
			30cm row width

Crop Dairy – pesticide/fertiliser applications

Date	Product	Rate/ha	Type/Use
25/08/2018	Karamate (mancozeb) Amistar (azoxystrobin) Hallmark zeon (lambda-cyhalothrin) Mn/Mg	2.0 1.0 0.075 2/3	Mildew Mildew Caterpillar Trace elements
5/09/2018	Invader (mancozeb+dimethomorph) Signum (boscalid+pyraclostrobin) Tracer (spinosad) Mn/Mg	2.0 1.5 0.2 2/2	Mildew Botrytis Caterpillar/thrip Trace elements
13/09/2018	Fubol Gold (mancozeb+metalaxyl) Plenum (pymetrozine) Decis (deltamethrin) Mn/Mg	1.9 0.4 0.25 2/2	Mildew Aphids Caterpillar Trace elements
20/09/2018	Revus (mandipropamid) Movento (spirotetramat) Eribae(alpha cypermethrin) Mn/mg	0.6 0.5 0.125 2/2	Mildew Aphids Caterpillar Trace elements
28/09/2018	Tracer (spinosad) Farmphos Mn/mg	0.2 2.0 2/2	Caterpillar Trace elements Trace elements

b. Trial diary

Date	Event
18-08-2018	Crop planted
24-08-2018	Treatments A applied
31-08-2018	Treatments B applied
05-09-2018	Weeds, phytotox assessment
13-09-2018	Weeds, phytotox assessment
19-09-2018	Weeds, phytotox assessment
04-10-2018	Weeds, phytotox assessment

c. Photographs

Code	Ha, ml	water	Timing		
				T1	4-5 days after planting
				T2	7 days after T1, 12 days after planting
aclonifen	1000.00	400	T2		damaging, severe leaf yellowing some stunting, good weed control
aclonifen	500.00	400	T2		damaging, severe leaf yellowing some stunting, good weed control
aclonifen	250.00	400	T2		damaging, severe leaf yellowing some stunting, good weed control

Photo 1, Crop damage from alconifen, plot 3 lower rate 0.25l/ha centre photo, untreated right.

AHDB9987	2000.00	400	T1	some initial damage which looked to grow out but stuck crop leaves together
AHDB9987	1000.00	400	T1	some initial damage which looked to grow out but stuck crop leaves together, but then so did propachlor
AHDB9987	500.00	400	T1	looked safe but poor weed control

Photo 2. Crop damage from AHDB 9987, centre photo plant with leaf sticking together, untreated right.

AHDB9876	1000.00	400	T2		looked severe damage in early assessment , leaves curled back, but seems to have grown out
AHDB9876	500.00	400	T2		looked moderate damage in early assessment , leaves curled back, but seems to have grown out
AHDB9876	250.00	400	T2		looked moderate damage in early assessment , leaves curled back, but seems to have grown out

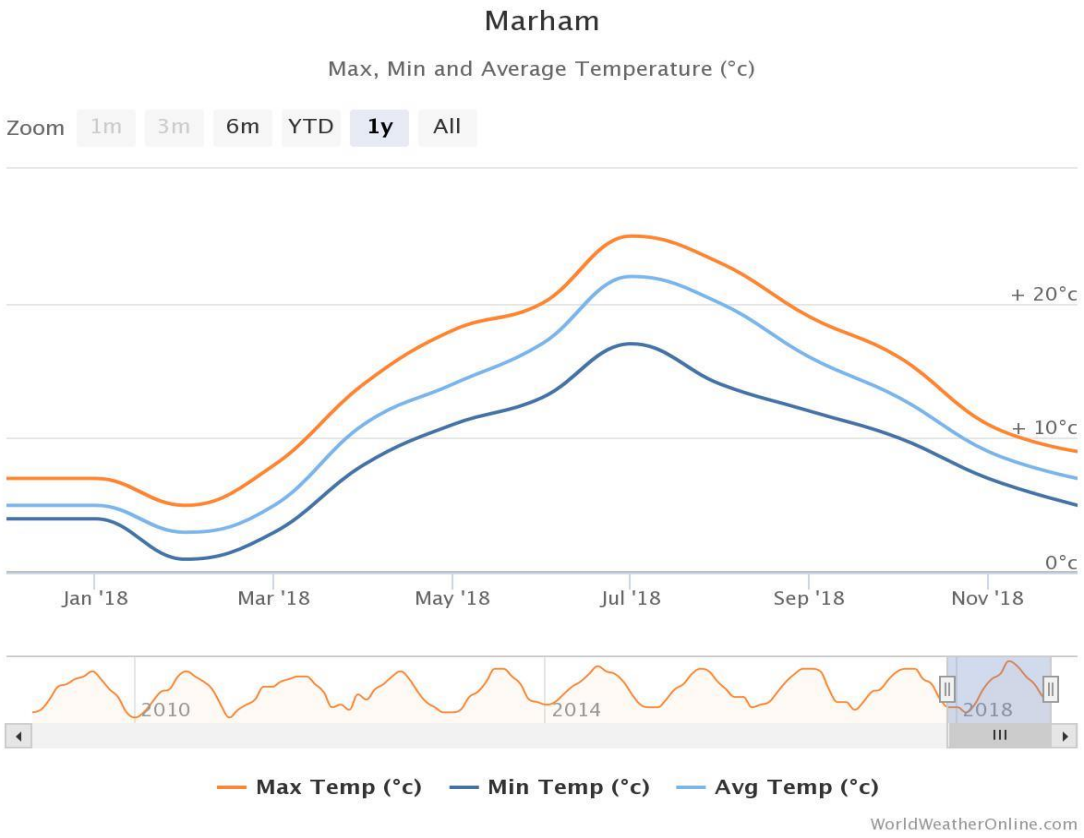
Photo 3, crop damage from AHDB9876 left, plot 11, 1.0l/ha middle photo, untreated right.

Photo 4, Overall trial site, alconifen treated yellow plots clearly visible

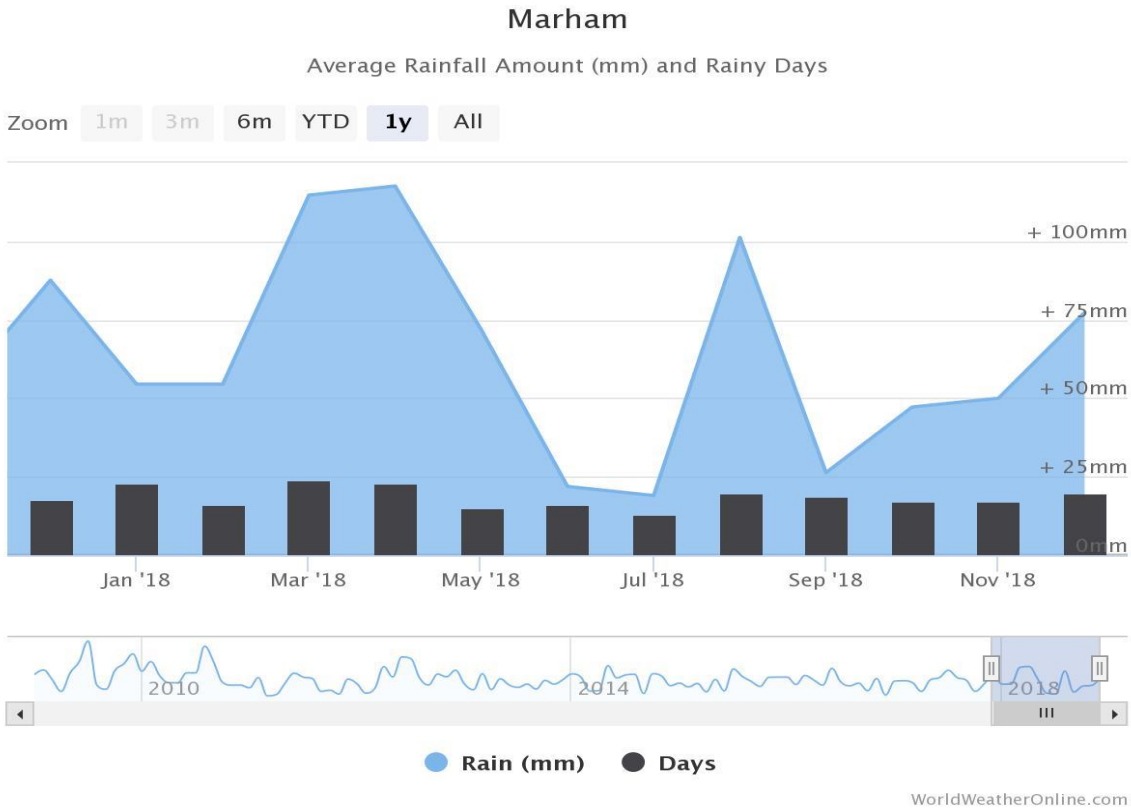
d. Climatological data during study period

After a warmer and drier June and July than average the weather during August was more normal, although it was still warm and the soil was relatively dry at planting. As is usual with the lettuce crop it was irrigated immediately after planting (overnight) and again a few days later to get the crop established. The crop established well and grew normally. The field was irrigated at around weekly intervals during the growing cycle, which is normal for this crop and soil type.

Climate Data, Marham, Norfolk, max/min compared with average



Marham, rainfall data 2018



e. Raw data from assessments

Plot	Rep	Treatment	Damage	% weeds	Damage	%weeds	Damage	%Weeds	Damage	% Weeds

		number	05-Sep	05-Sep	13-Sep	13-Sep	19-Sep	19-Sep	04-Oct	04-Oct
1	1	1	6	2	5	2	8	2	9	4
2	1	2	6	2	7	1	8	2	8	5
3	1	3	6	2	7	2	7	5	7	10
4	1	4	2	2	0	1	5	2	9	2
5	1	5	1	2	0	1	2	2	7	5
6	1	6	0	2	0	2	0	3	2	10
7	1	9	0	2	0	15	0	15	0	30
8	1	Untreated	0	3	0	15	0	40	0	75
9	1	7	0	2	0	15	0	20	0	40
10	1	12	6	1	0	10	0	15	0	25
11	1	16	0	2	0	10	0	20	0	70
12	1	14	0	2	0	10	0	25	0	50
13	2	6	0	0	0	5	0	10	3	10
14	1	11	8	2	0	10	0	20	0	40
15	1	8	0	2	0	10	0	15	0	30
16	2	14	2	5	0	5	0	25	0	30
17	2	3	7	7	8	1	8	5	7	15
18	1	Untreated	0	2	0	20	0	20	0	75
19	2	7	0	0	0	15	3	10	0	25
20	2	8	0	0	0	10	0	30	0	30
21	2	9	0	0	0	15	0	15	0	40
22	2	Untreated	0	0	0	10	0	40	0	80
23	2	11	8	8	0	15	0	20	0	50
24	2	12	7	0	0	10	2	10	0	40
25	1	17	0	2	0	15	0	20	0	50
26	1	13	4	2	0	10	0	40	0	70
27	2	2	7	7	7	1	8	4	8	10
28	1	15	0	2	0	10	0	15	0	40
29	3	6	0	0	0	10	0	10	2	20
30	2	4	0	0	3	1	5	5	9	5
31	2	15	0	2	0	15	0	25	0	70
32	2	17	0	0	0	10	0	15	0	40
33	2	5	0	0	0	5	4	10	7	20
34	2	13	5	7	0	10	0	20	0	30
35	2	1	8	8	9	1	7	2	9	5
36	3	9	0	0	0	5	0	20	0	40
37	3	13	4	4	0	15	1	25	0	70
38	3	14	1	1	0	20	2	20	0	50
39	3	15	0	0	0	10	0	20	0	60
40	2	16	0	0	0	10	0	30	0	50
41	3	17	0	0	0	15	0	20	0	60
42	2	Untreated	0	0	0	10	0	25	0	70

43	3	Untreated	0	0	0	20	0	50	0	70
44	3	8	0	0	0	10	0	10	0	20
45	3	1	6	6	7	2	7	3	9	5
46	3	3	5	5	7	2	7	10	7	20
47	3	11	8	8	0	10	0	10	0	25
48	3	5	0	0	0	5	2	5	4	10
49	3	16	0	0	0	15	0	20	0	70
50	3	7	1	1	0	5	0	10	0	25
51	3	Untreated	0	0	0	15	0	30	0	75
52	3	12	7	7	0	10	0	25	0	50
53	3	2	7	7	7	1	7	4	8	2
54	3	4	2	2	2	5	6	10	9	5

f. Trial design , plot layout and numbers

16	7	18	12	2	4
10	8	1	3	11	5
13	14	15	16	17	18
15	17	5	13	1	9
17	13	2	15	6	4
7	8	9	10	11	12
6	11	8	14	3	10
9	18	7	12	16	14
1	2	3	4	5	6

6m

2m

Discard areas

g. ORETO certificate.

Certificate of

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

This certifies that

RSK ADAS Ltd

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
Stored Crops
Biologicals and Semiochemicals

Date of issue: 1 June 2018
Effective date: 18 March 2018
Expiry date: 17 March 2023

Signature Alison Richardson
Authorised signatory

Certification Number
ORETO 409

HSE
Chemicals Regulation Division

Department of Agriculture and Rural Development