SCEPTREPLUS

Final Trial Report

Trial code:	SP 29
Title:	**Weed control in lettuce**
Crop	Group: Spinach and Lettuce
Target	General broadleaf weeds and grasses, 3WEEDT EPPO1/089(3) Weeds in leafy salads
Lead researcher:	Angela Huckle
Organisation:	RSK ADAS, Boxworth
Period:	1st June 2020 – 31st March 2021
Report date:	11th February 2021
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

2nd November 2020
Date

Authors signature

Trial Summary

Introduction

Weed control in lettuce has become increasingly difficult following the revocation of several important herbicides in recent years. Since the loss of propachlor several years ago, weed control has relied heavily on pendimethalin and chlorpropham, with chlorpropham being especially crucial for growing lettuce on organic soils. With the revocation of the chlorpropham approval on 8th October 2020, new actives are needed urgently for the 2021 growing season.

This trial therefore concentrated on the comparison of a number of novel potential pre and post-planting residual and contact herbicides with the potential to replace the loss of approval for the main lettuce herbicide chlorpropham, with assessments for crop safety and weed control efficacy in outdoor transplanted lettuce.

Methods

A randomised, replicated trial (three replicates) was carried out at a commercial lettuce grower site at Field P38, Redmere Farm, Shippea Hill, Ely, Cambridgeshire, by kind permission of Cambs Farms Growers Ltd. This was on an organic soil type, using transplanted iceberg lettuce cv. Kuala.

Pre-planting treatments were applied on the day of planting just in front of the planter on 5th August, post-planting treatments were applied seven days after planting on 12th August, with some plots receiving a second post-planting treatment 14 days after planting on 19th August. There were 12 treatments in total including two untreated controls. There were nine pre-planting treatments followed by post-planting treatments of various rates of either one or two applications of AHDB 9886. The standard pre-planting treatment at this site would be Stomp Aqua at 1.5 l/ha.

Results

Table 1. Weed control scores at each assessment. Calculated from backtransformed data, Shown as % weed reduction, in comparison with untreated, higher figure indicates better weed reduction. f/b = followed by

	Mean % weed reduction				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
1,12 Untreated	0	0	0	0	0
2 AHDB 9918, 0.48 f/b AHDB 9886, 1.0	56	68	79	57	43
3 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0	43	68	76	71	51
4 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9986, 1.0	56	86	91	82	62
5 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	43	68	85	50	51
6 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.0	72	83	88	81	62
7 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.5	56	86	85	70	58
8 AHDB 9886, 1.5 f/b AHDB 9886, 1.0	56	75	73	39	39
9 Stomp Aqua 1.5 f/b AHDB 9886, 1.5	56	68	67	42	51
10 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	43	78	73	55	47

	Mean % weed reduction				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
f/b AHDB 9866, 1.0					
11 Nil f/b AHDB 9886, 1.0 f/b AHDB 9886, 1.0	50	68	77	48	47
P value	0.05	0.05	0.05	NS	NS
d.f	35	35	35	35	35
Lsd					
		Not significantly different from untreated control (p>0.05)			
		Significantly different from untreated control (p<0.05)			

Table 2. Crop damage scores, at each assessment. Scored 0-10; 0 = no damage, 10 = crop death, scores were generally low, and scores of 2 or below are acceptable to the grower. f/b = followed by

	Mean Crop Damage 0-10				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
1,12 Untreated	0	0	0	0	0
2 AHDB 9918, 0.48 f/b AHDB 9886, 1.0	0	0	0	1	0
3 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
4 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9986, 1.0	0	0	0	0	1
5 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
6 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.0	0	0	1	1	1
7 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.5	0	1	0	2	3
8 AHDB 9886, 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
9 Stomp Aqua 1.5 f/b AHDB 9886, 1.5	0	0	0	1	3
10 Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9866, 1.0	0	0	0	1	0
11 Nil f/b AHDB 9886, 1.0 f/b AHDB 9886, 1.0	0	0	1	0	0
P value	NS	NS	NS	0.05	0.05
d.f	35	35	35	35	35
Lsd	n/a	n/a	0.319	0.793	1.586
		Not significantly different from untreated control (p>0.05)			
		Significantly different from untreated control (p<0.05)			

Conclusions

- All of the herbicide applications significantly reduced percentage weed ground cover when compared to the untreated controls at all assessment dates.

- The most effective weed control was given by treatment 4, AHDB 9918 0.48 l/ha + Stomp Aqua 1.5 l/ha pre-planting followed by AHDB 9886 at 1.0 l/ha post-planting.

- The poorest weed control was given by treatment 8, AHDB 9886 1.0 l/ha pre-planting followed by AHDB 9886 1.0 l/ha post-planting.

- Treatments 7 and 9 showed the most crop damage which contained the higher rate of 1.5 l/ha AHDB 9886 applied post-planting.

- Treatment 4 which had two applications post-planting of AHDB 9886 1.0 l/ha and treatment 6 and 7 which both contained Wing-P pre-planting also showed a low level of crop damage.

Take home message:
All of the treatments gave a significant reduction in weed % ground cover.
AHDB 9918 would be a useful pre-planting treatment for transplanted lettuce.
AHDB 9886 has a relatively poor weed control effect when applied pre-planting but looks safe up to 1.0 l/ha post-planting and gives a good reduction of weeds at this timing.

Data is being generated by AHDB to support an application for approval the use of AHDB 9886 in lettuce post-planting.

Steps should be taken to explore the possibility of an approval for AHDB 9918 on lettuce as a pre-planting application, including data requirements.

Objectives

To compare a number of novel pre and post planting herbicides with the potential to replace the loss of approval for the main lettuce herbicide chlorpropham, with assessments for (crop safety) and efficacy in outdoor iceberg lettuce. This one year trial was commissioned to look at new pre and post-planting options for broadleaf weed control for transplanted 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

There was one deviation from EPPO guidance:

PP1/89(3) Section 1.4, Design and lay-out of trial:

"Replicates: at least 4"

Study only had 3 replicates – the large number of treatments provides an acceptable number of residual degrees of freedom.

Test site

Item	**Details**
Location address	Redmere Farm, Redmere Drove, Shippea Hill, Ely, Cambridgeshire, CB7 4ST
Crop	Transplanted lettuce
Cultivar	Kuala
Soil or substrate type	Organic Loam, 20% OM.
Agronomic practice	Commercial lettuce crop, planted 5th August 2020, 140,000 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, potatoes and lettuce.

Trial design

Item	**Details**
Trial design:	Fully randomised block design.
Number of replicates:	3
Row spacing:	25cm x 30cm
Plot size: (w x l)	2.0m X 6.0M
Plot size: (m^2)	12(m^2)
Number of plants per plot:	140
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
AHDB 9886	N/D	N/D	N/D	N/D	N/D
AHDB 9918	N/D	N/D	N/D	N/D	N/D
Stomp Aqua	pendimethalin	Stomp Aqua	ST12610518	455g/l	CS
Wing-P	Pendithemalin + Dimethenamid-P	Wing-P	0020398036	250g/l 212.5g/l	EC

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	Untreated	0	0	A, B, C
12	Untreated	0	0	A, B, C
2	AHDB 9918 AHDB 9886	240 500	0.48 1.0	A B
3	AHDB 9918 Pendimethalin AHDB 9886	240 682.5 500	0.48 1.5 1.0	A A B
4	AHDB 9918 Pendimethalin AHDB 9886 AHDB 9886	240 682.5 500 500	0.48 1.5 1.0 1.0	A A B C
5	Stomp Aqua AHDB 9886	682.5 500	1.5 1.0	A B
6	AHDB 9918 Pendimethalin Dimethanamid-P AHDB 9886	240 312.5 265.63 500	0.48 1.5 1.0	A B C
7	AHDB 9918 Pendimethalin Dimethanamid-P AHDB 9886	240 312.5 265.63 750	0.48 1.5 1.5	A B C
8	AHDB 9886 AHDB 9886	750 500	1.5 1.0	A B
9	Pendimethalin AHDB 9886	312.5 500	1.5 1.0	A B
10	Pendimethalin AHDB 9886 AHDB 9886	312.5 500 500	1.5 1.0 1.0	A B C
11	AHDB 99886 AHDB 9886	500 500	1.0 1.0	B C

Application details

	Application A	Application B	Application C
Application date	05/08/2020	12/08/2020	19/08/2020
Time of day	10:30– 11:00	10.30 – 11:00	08:30-8:45
Crop growth stage (Max, min average BBCH)	Pre-plant	BBCH 13-14	BBCH 14-15
Crop height (cm)	0	2cm	3cm
Crop coverage (%)	0	10%	15%
Application Method	Spray	Spray	Spray
Application Placement	Soil	Foliar	Foliar
Application equipment	OPS	OPS	OPS
Nozzle pressure	2.5 bar	2.5 bar	2.5 bar
Nozzle type	Flat fan	Flat Fan	Flat fan
Nozzle size	F04/110	F04/110	F04/110
Application water volume/ha	400	400	400
Temperature of air - shade (°C)	24	30	18
Relative humidity (%)	44	41.85	84
Wind speed range (mph)	0-2	2.2	4-6
Dew presence (Y/N)	N	N	N
Temperature of soil - 2-5 cm (°C)	Not available	Not available	n/a
Wetness of soil - 2-5 cm	moist	moist	moist
Cloud cover (%)	30%	65%	80%

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	13% ground cover	80% ground cover

Assessment details

	Evaluation Timing (DA)*				
Evaluation date	**After conventional herbicides**	**After Bio-herbicides**	**Crop Growth Stage (BBCH)**	**Evaluation type (efficacy, phytotox)**	**Assessment**
18/08/2020	A+7	n/a	14	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
28/08/2020	A+ 23 B + 6	n/a	18	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
01/09/2020	A + 27 B + 20 C + 14	n/a	41	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
15/09/2020	A + 41 B + 34 C + 28	n/a	45	Efficacy Phytotox	Phytotox scale 10=dead 0=nil Weeds % ground covers
29/09/2020	A + 55 B + 48 B-35	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 weed cover and crop damage symptoms. Note: Iceberg lettuce is classified as a leafy vegetable forming heads in the BBCH scale.

Statistical analysis

The trial was designed as a randomised block design with three replicates including two replicated untreated controls within the 12 treatments. The pre-planting treatments were applied in front of the planter and marked out, then the commercial planter planted through the trial area and the plot boundaries were re-marked ready for the post-planting treatments.

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. Crop damage scores were relatively low and data analysis was only able to be undertaken for the third, fourth and fifth assessment dates, where sufficient scores were recorded.

Results

Phytotoxicity

Phytotoxicity results are presented in Table 4 for the post-planting trial. These were scored on a scale from 0 to 10, with 0 being 'no effect' and 10 being 'dead'. Plots scored 2 or below were deemed to have a commercially acceptable level of damage.

The full data set is in the Appendix.

Phytotoxicity was recorded using the following scale:

Crop tolerance score	Equivalent to crop damage (% phytotoxicity)
0	*(no damage)* 0%
1	10%
*2	20%
3	30%
4	40%
5	50%
6	60%
7	70%
8	80%
9	90%
10	*(complete crop kill)* 100%

* ≥2 = acceptable damage, i.e. damage unlikely to reduce yield and acceptable to the farmer.

Phytotoxicity

Table 3. Crop damage scores for each assessment. Scored 0-10; 0 = no damage, 10 = crop death, scores were generally low, and scores of 2 or below are acceptable to the grower. angular transformed data presented.

	Mean Crop Damage 0-10				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
1,12 Untreated	0	0	0	0	0
2 AHDB 9918, 0.48 f/b AHDB 9886, 1.0	0	0	0	1	0
3 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
4 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9986, 1.0	0	0	0	0	1
5 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
6 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.0	0	0	1	1	1
7 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.5	0	1	0	2	3
8 AHDB 9886, 1.5 f/b AHDB 9886, 1.0	0	0	0	0	0
9 Stomp Aqua 1.5 f/b AHDB 9886, 1.5	0	0	0	1	3
10 Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9866, 1.0	0	0	0	1	0
11 Nil f/b AHDB 9886, 1.0 f/b AHDB 9886, 1.0	0	0	1	0	0
P value	NS	NS	NS	0.05	0.05

	Mean Crop Damage 0-10				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
d.f	35	35	35	35	35
Lsd	n/a	n/a	0.319	0.774	1.586
		Not significantly different from untreated control (p>0.05)			
		Significantly different from untreated control (p<0.05)			

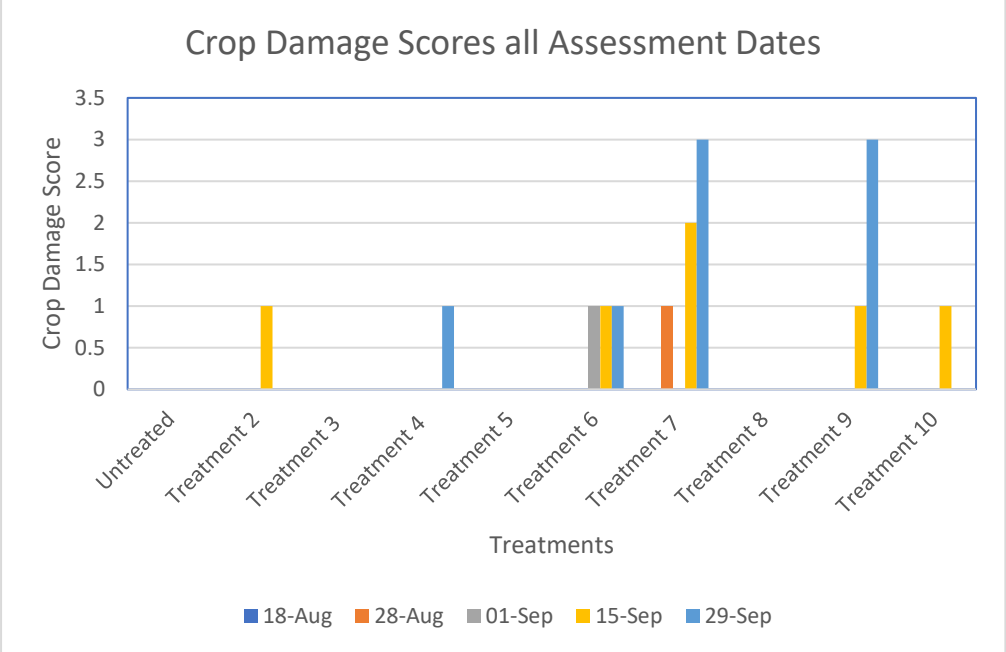


Figure 1. Crop damage scores at all assessment dates as indicated.

Weed control

Table 4. Weed control scores at each assessment timing. Shown as % weed ground cover, higher score, more weeds - over 50% unacceptable. Data is back transformed.

	Mean % weed ground cover				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
1,12 Untreated	12	26	55	90	82
2 AHDB 9918, 0.48 f/b AHDB 9886, 1.0	5	8	12	40	50
3 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0	7	8	13	27	43
4 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9986, 1.0	5	4	5	17	33
5 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	7	8	8	47	43
6 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.0	3	4	7	18	33
7 AHDB 9918, 0.48 + Wing-P 1.25	5	4	8	28	37

	Mean % weed ground cover				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
f/b AHDB 9886, 1.5					
8 AHDB 9886, 1.5 f/b AHDB 9886, 1.0	5	7	15	57	53
9 Stomp Aqua 1.5 f/b AHDB 9886, 1.5	5	8	18	53	43
10 Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9866, 1.0	7	6	15	42	47
11 Nil f/b AHDB 9886, 1.0 f/b AHDB 9886, 1.0	6	8	13	47	47
P value	0.05	0.05	0.05	NS	NS
d.f	35	35	35	35	35
Lsd	4.46	4.24	7.56	20.38	15.80
		Not significantly different from untreated control (p>0.05)			
		Significantly different from untreated control (p<0.05)			

Weed control as % reduction by Abbotts formula

Table 5. Mean % weed reduction at all assessment dates, using back transformed means data for % Abbotts reduction**.**

	Mean % weed reduction Abbotts formula				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
1,12 Untreated	0	0	0	0	0
2 AHDB 9918, 0.48 f/b AHDB 9886, 1.0	56	68	79	57	43
3 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0	43	68	76	71	51
4 AHDB 9918, 0.48 + Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9986, 1.0	56	86	91	82	62
5 Stomp Aqua 1.5 f/b AHDB 9886, 1.0	43	68	85	50	51
6 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.0	72	83	88	81	62
7 AHDB 9918, 0.48 + Wing-P 1.25 f/b AHDB 9886, 1.5	56	86	85	70	58
8 AHDB 9886, 1.5 f/b AHDB 9886, 1.0	56	75	73	39	39
9 Stomp Aqua 1.5 f/b AHDB 9886, 1.5	56	68	67	42	51
10 Stomp Aqua 1.5 f/b AHDB 9886, 1.0 f/b AHDB 9866, 1.0	43	78	73	55	47
11 Nil f/b AHDB 9886, 1.0 f/b AHDB 9886, 1.0	50	68	77	48	47
P value	0.05	0.05	0.05	NS	NS
d.f	35	35	35	35	35

	Mean % weed reduction Abbotts formula				
Date	**18 Aug**	**28 Aug**	**01 Sept**	**15 Sept**	**29 Sept**
Treatment l/ha					
Lsd	4.46	4.24	7.56	20.38	15.80
		Not significantly different from untreated control (p>0.05)			
		Significantly different from untreated control (p<0.05)			

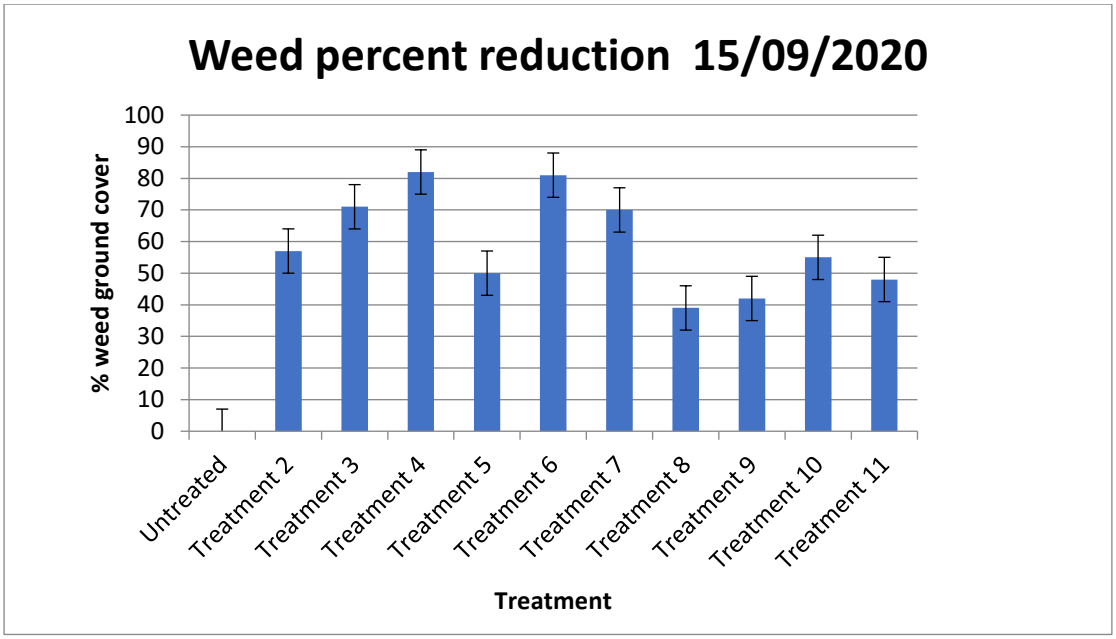


Figure 2, Percentage weed reduction using abbotts formula, for 15th September 2 weeks before harvest. lsd 20.38@p=0.05%.

Discussion

Weed levels were very high at this site and provided good test conditions for the trial herbicides. The main weeds were Fat Hen (Chenopodium album), redshank (*Persicaria maculosa*), small nettle *(Urtica urens*), common chickweed *(Stellaria media*) and groundsel (*Senecio vulgaris*).

All of the treatments significantly reduced weeds as expressed by % weed ground cover. Treatment 4 gave the best weed control which was AHDB 9918 0.48 l/ha plus Stomp Aqua 1.5 l/ha pre-planting followed by AHDB 9886 1.0 l/ha post-planting. Treatments 6 also gave particularly good weed control which was AHDB9918 0.48 l/ha plus Wing-P 1.25 l/ha pre-planting, followed by AHDB9886 1.0 l/ha post-planting. Both treatments gave a small amount of crop damage which was expressed as slightly reduced plant size at the point of harvest.

The only unacceptable crop damage was caused by the higher rate of AHDB 9886, 1.5 l/ha applied post-planting. Any other recording of crop damage was at a very low level.

The poorest weed control was given by AHDB 9886 applied 1.5 l/ha pre-planting. All the other pre-planting treatments gave good levels of weed control.

AHDB9918 and Wing-P both showed some reduction of groundsel (Senecio vulgaris), while none of the other treatments reduced groundsel at all. Fat hen (Chenopodium album) was the dominant weed at this site, with redshank (Persicaria maculosa) also very common.

Conclusions

- All of the herbicide applications significantly reduced percentage weed ground cover when compared to the untreated controls at all assessment dates.
- The most effective weed control was given by treatment 4, AHDB 9918 0.48 l/ha + Stomp Aqua 1.5l/ha pre-planting followed by AHDB 9886 at 1.0l/ha post-planting.
- The poorest weed control was given by treatment 8, AHDB 9886 1.0l/ha pre-planting followed by AHDB 9886 1.0l/ha post-planting.
- Treatments 7 and 9 showed the most crop damage which contained the higher rate of 1.5l/ha AHDB 9886 applied post-planting.
- Treatments 4 which had two applications post-planting of AHDB 9886 1.0l/ha and treatment 6 and 7 which both contained Wing-P pre-planting also showed some small amount of crop damage.

All of the treatments gave a significant reduction in weed % ground cover.
AHDB 9918 looks a useful pre-planting treatment.
AHDB 9886 had a relatively poor weed control effect when applied pre-planting but looks safe up to 1.0l/ha post-planting and gives a good reduction of weeds. The higher rate of 1.5l/ha ANDB 9886 does not appear crop safe.

Data is being generated by AHDB to support an application for approval the use of AHDB9886 in lettuce post-planting.

Steps should be taken to explore the possibility of an approval for AHDB 9918 on lettuce as a pre-planting application, including data requirements.

Acknowledgements

Thanks are given to the hosts, G's Growers, Cambs Farms Growers, Farms for providing the site. To AHDB for providing funding and to technical input from Bolette Palle Neve, Joe Martin, David Norman and Angela Huckle. Thanks also to the crop protection manufacturers for supporting the work and providing experimental samples and Syngenta for providing the climatological data.

Appendix

a. Crop diary – events related to growing crop

Crop	Cultivar	Planting Date	Row width
Iceberg Lettuce	Kuala	05/08/2020	25cmx30cm

Crop Dairy – pesticide/fertiliser applications

Date	Product	Rate/ha	Type/Use
13/08/2020	Invader (mancozeb+dimethomorph) Hallmark zeon (lambda-cyhalothrin) Gazelle SG (acetamiprid) Mn/Mg	2.0 0.075 0.25 2/2	Mildew Caterpillar aphids Trace elements
21/08/2020	Fubol Gold (mancozeb+metalaxyl-m) Decis Proetch (deltamethrin) Mn/Mg	1.9 0.42 2/2	Mildew Caterpillar/thrip Trace elements
28/08/2020	Infinito (fluopicolide+propamocarb hydrochloride) Hallmark zeon (lambda-cyhalothrin) Mn/Mg	1.6 0.075 2/2	Mildew Caterpillar Trace elements
02/09/2020	Decis Protech (deltamethrin) Movento (spirotetramat) Mn/Mg	0.42 0.5 4/4	Caterpillar/thrip Aphid Trace elements
09/09/2020	Revus (mandipropamid) Eribae (alpha-cypermethrin) Headland Vertex (nutrients)	0.6 0.125 3.0	Mildew Caterpillar Trace elements
15/09/2020	Paraat (dimethomorph) Headland Vertex (nutrients)	0.36 3.0	Mildew Trace elements

b. Trial diary

Date	Event
05-08-2020	Crop planted
05-08-2020	Treatments A applied
12-08-2020	Treatments B applied
19-08-2020	Treatments C applied
18-08-2020	Weeds, phytotox assessment
28-08-2020	Weeds, phytotox assessment
01-09-2020	Weeds, phytotox assessment
15-09-2020	Weeds, phytotox assessment
29-09-2020	Weeds, phytotox assessment (point of normal harvest)

c. Photographs

Photo 1, Untreated , 21 days after planting 26/08/2020.

Photo 2. Treatment 4, 21 days after planting 26/08/2020

Photo 3, Whole trial, 29092020 at point of harvest, untreated bottom left.

Photo 4, Untreated at point of harvest 29-09-2020.

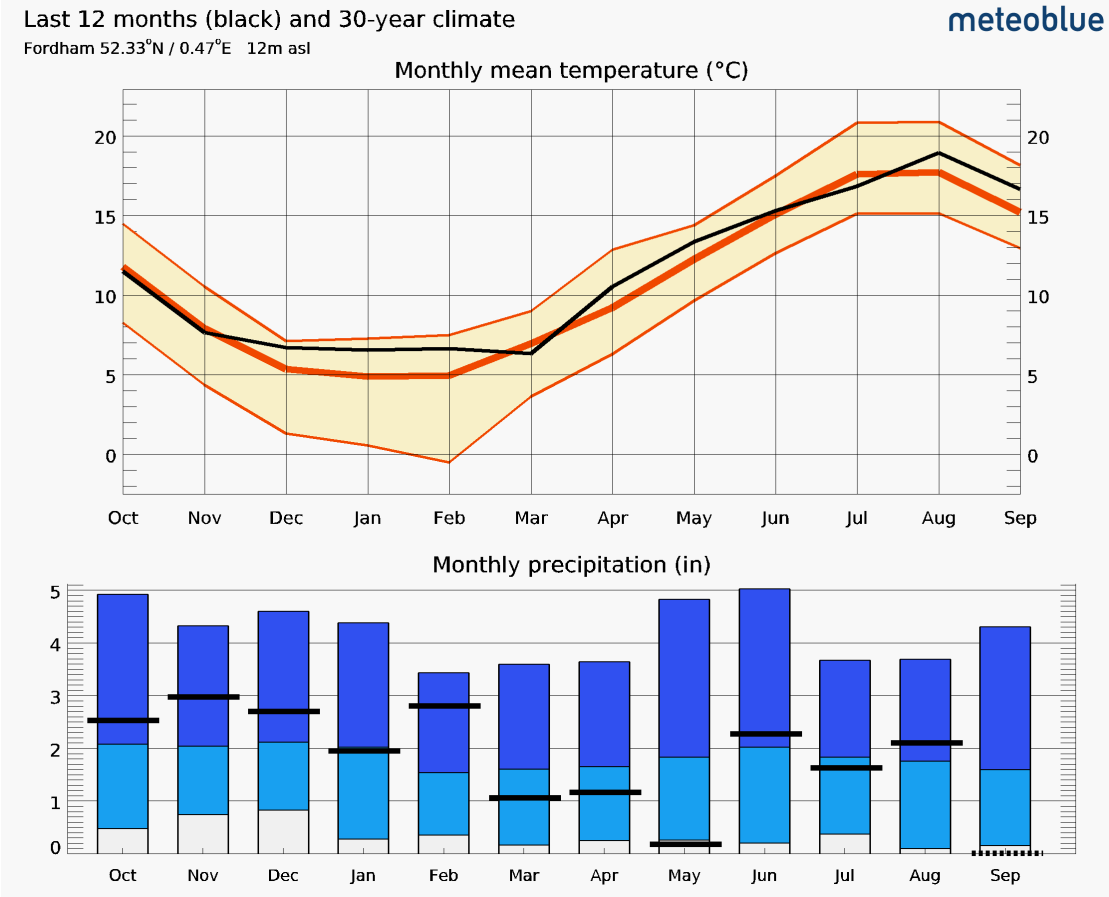
Photo 5, Treatment 4, point of harvest 29-09-2020

d. Climatological data during study period

The soil was moist and warm at planting, the site was irrigated just after planting and the crop established quickly. The mean temperature for August was 1.3°C above the long term mean. August started with low pressure and showery weather, turning warmer in the second week but with thundery outbreaks. Rainfall was 135% of average with a couple of heavy thunderstorms affecting the trial site with around 40mm within the first 12 days after planting on 17th August, this after the establishment irrigation caused some temporary flooding, across the centre of the trial, but this soon drained away and did not materially affect the results. There were further thundery showers on the 17th and 28th August.

September was a relatively settled month with some warm sunshine, maximum mean temperatures were 1.0-1.5°C above the 30 year mean.

Climate Data, Shippea Hill, Cambridgeshire, actual temperature (black line) compared with 30 year mean and normal range is given by the colored area. Actual rainfall is give by the black line, with the dark blue area being greater than the 30 year average and the light blue line being les than the 30 year average.



e. Raw data from assessments.

Rep	Treatment	Weed 18/08	Phyto 18/08	Weed 28/08	Phyto 28/08	Weed 01/09	Phyto 01/09	Weed 15/09	Phyto 15/09	Weed 29/09	Phyto 29/09
1	1	10	2	25	0	40	0	70	0	60	0
1	2	5	0	10	0	10	0	30	1	50	0
1	3	10	0	10	0	15	0	25	0	50	0
1	4	5	0	5	0	5	0	15	0	30	0
1	5	5	0	10	0	5	0	50	0	40	0
1	6	5	0	5	0	10	0	25	0	30	0
1	7	5	0	5	1	10	0	40	2	40	4
1	8	5	0	5	0	20	0	60	0	50	0
1	9	5	0	10	0	25	0	50	1	40	4
1	10	10	0	10	0	20	0	80	0	60	0
1	11	10	0	10	0	20	1	90	0	60	0
1	12	15	0	30	0	60	0	100	0	100	0
2	1	15	0	30	0	70	0	100	0	100	0
2	2	5	0	10	0	15	0	60	1	50	0
2	3	5	0	10	0	15	0	30	0	40	0
2	4	5	0	3	0	5	0	15	0	40	4

2	5	5	0	5	0	10	0	40	1	30	0
2	6	2	0	5	0	5	0	20	1	40	0
2	7	5	0	3	1	5	0	20	2	30	3
2	8	5	0	10	0	10	0	60	0	60	0
2	9	5	0	5	0	10	0	30	1	40	3
2	10	5	0	5	0	15	0	25	1	50	0
2	11	5	0	10	0	15	1	30	0	40	0
2	12	10	0	30	0	60	0	90	0	90	0
3	1	15	0	20	0	50	0	90	0	80	0
3	2	5	0	5	0	10	0	30	0	50	0
3	3	5	0	5	0	10	0	25	0	40	0
3	4	5	0	3	0	5	0	20	0	30	0
3	5	10	0	10	0	10	0	50	0	60	0
3	6	3	0	3	0	5	2	10	2	30	3
3	7	5	0	3	1	10	0	25	2	40	2
3	8	5	0	5	0	15	0	50	0	50	0
3	9	5	0	10	0	20	0	80	1	50	2
3	10	5	0	3	0	10	0	20	2	30	0
3	11	3	0	5	0	5	0	20	0	40	0
3	12	5	0	20	0	50	0	90	0	60	0

f. Trial layout plan, plot numbers at top of plot, treatment numbers in bold.

12	24	36
12	**5**	**6**
11	23	35
11	**4**	**10**
10	22	34
10	**1**	**3**
9	21	33
9	**8**	**5**
8	20	32
8	**12**	**4**
7	19	31
7	**2**	**9**
6	18	30
6	**11**	**1**
5	17	29
5	**3**	**7**
4	16	28
4	**6**	**11**

3	15	27
3	7	12
2	14	26
2	9	8
1	13	25
1	10	2

i. 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