

# SCEPTREPLUS

## Final Trial Report

<b>Trial code:</b>	SP 02. 2019
<b>Title:</b>	<b>AHDB SCEPTREplus Herb post-emergence herbicide screen</b>
<b>Crop</b>	<b>Group: Leafy Vegetables</b> <b>Coriander</b> – <i>Coriandrum sativum</i> <b>Parsley</b> – <i>Petroselinum crispum</i> <b>Chives</b> – <i>Allium schoenoprasum</i>
<b>Target</b>	<b>General broadleaf weeds and grasses; 3WEEDT</b> EPPO1/89(3) Weeds in leafy and brassica vegetables
<b>Lead researcher:</b>	Angela Huckle
<b>Organisation:</b>	RSK ADAS
<b>Period:</b>	27 <sup>th</sup> March 2019 – 31 <sup>st</sup> December 2019
<b>Report date:</b>	29 <sup>th</sup> February 2019
<b>Report author:</b>	Angela Huckle Oliver Thomas
<b>ORETO Number: (certificate should be attached)</b>	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

3<sup>rd</sup> April 2020  
Date



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Authors signature

## Trial Summary

### Introduction

The limited range of herbicides currently available to herb growers leaves gaps in the weed control spectrum, and problems are experienced with a wide range of weeds, particularly since the loss of linuron in June 2018. Groundsel (*Senecio vulgaris*) sow thistles (*Cirsium arvense*), scentless mayweed (*Tripleurospermum inodorum*), and small nettle (*Urtica urens*) are particularly problematic for growers. As well as competing with the crop for nutrients and water, these weeds can also become contaminants if missed by hand weeding, and are very similar in leaf shape to the herb being grown.

The wide range of herb species grown presents a challenge for growers to identify herbicides which are crop safe to each particular species; there is often little information from manufacturers as herbs are very minor crops. While the herb sector is small, these crops are highly valuable. Any defects or discolouration can lead to rejection, as many herbs are sold as fresh cut products, so knowledge of the crop safety of potential new herbicides is very important.

It is a high priority for growers to find potential replacement products for linuron which are safe for their crops. Therefore the objective of this trial was to identify crop safe and effective pre-emergence herbicides for two of the most widely grown herbs; coriander (*Coriandrum sativum*) and parsley (*Petroselinum crispum*), and chives (*Allium schoenoprasum*). Aiming to expand the options available to growers for weed control.

### Method

A randomised replicated contact and residual/contact herbicide trial on Coriander and Parsley was carried out at a commercial grower site in Sussex, on light sand to silty loam soil. The trial field was drilled on 27<sup>th</sup> June 2019, with coriander cv. Cruiser and parsley cv. Laura. Eight treatments were applied at a post-emergence timing (T1) with a 1.5 m boom, using an Oxford Precision Sprayer (Knapsack) sprayer at 200 L/ha water volume. The crop was at one to two true leaves at application. A randomised block design was used, with three replicates of nine treatments. All replicates contained one untreated control plot, and a total of 27 plots for both cultivars, each measuring 1.8 m x 3.0 m (5.4 m<sup>2</sup>).

The trial was assessed on three separate occasions, focussing on weed numbers and species, and crop phytotoxicity (safety). Weed control was assessed at zero, 11 and 26 days after treatment application, by counting each individual weed per plot. This was done for all weed species present as the weed population was low. It was difficult to gauge an accurate figure for percentage weed cover, and therefore this was not included. Crop phytotoxicity was scored at 11, 26 and 41 days after treatment application, and was scored on a 0-10 scale. The effects were also described e.g. crop loss, yellowing, twisting or scorching for example. Plant populations were also assessed two weeks post application.

A further randomised replicated post-emergence contact herbicide trial on chives cv. Fine-Leaved was carried out at a commercial grower site in Basingstoke, on light sand to silt loam soil. The existing chive crop was mowed on 20<sup>th</sup> June 2019 and allowed to re-grow. Herbicides were applied a week after mowing when the crop was at two to three true leaves.

One treatment application (T1) was applied to all trial plots, at a post-emergence timing of two to three true leaves. The treatments were applied using an Oxford Precision Sprayer (Knapsack) with a 1.5 m boom, and an application rate of 200 L/ha of water. A randomised block design was used, with three replicates of nine treatments, with each plot within all replicates placed above each other, up the growing bed. All replicates contained an untreated control plot, which was used as a bench mark for assessment and statistical comparison. There were a total of 27 plots within the trial, each measuring 1.8 m x 3.0 m (5.4m<sup>2</sup>).

The trial was assessed for treatment efficacy and crop safety on three separate occasions; nine, 14 and 22 weeks post treatment application. All assessments were carried out under the same conditions as those with the Coriander and Parsley.

## Results and discussion

There were low levels of weed in all of the trials with no strong statistically significant differences, therefore no conclusions could be drawn with regards to efficacy. However, significant differences in crop safety were apparent and give a guide to products which could be investigated for EAMU authorisation (**Table 1** and **2**).

Emerger 0.5 L/ha and Stomp 2.2 L/ha + Emerger 0.5 L/ha are safe to use on coriander and chives, but cause a slight stunting when applied over parsley at two true leaf stage. Emerger at the higher rate of 0.75 L/ha is safe to coriander and chives, but causes a greater level of stunting to parsley when used at this rate in the trial. Therefore for parsley it would be advisable to use a rate no higher than 0.5 L/ha for this herb. Where there were effects on the crop these persisted up to the point of harvest.

Stomp 2.2 L/ha + AHDB9898 caused stunting to both coriander and parsley, and therefore for these herbs, Stomp 2.2 L/ha + Emerger 0.5 L/ha is the preferable combination.

AHDB9855 was safe to use on chives, but caused significant leaf distortion to parsley. Although the product caused no significant levels of crop damage to coriander, it also gave slight leaf distortion on this herb and this may be unacceptable.

AHDB9860 was only included in the chive trial. At 2.0 L/ha the product caused yellowing but it was safe to use on the crop at the lower rate of 1.0 L/ha, and only caused very slight yellowing.

AHDB 9981 0.5 L/ha did moderately stunt parsley at, and also stunt coriander but a lower rate of 0.3 L/ha could be safer and still maintain weed control. Stunting and delay to harvest could be accommodated to take advantage of the useful wider range of weed control offered by the product. Such as cleavers, fat-hen, fumitory, groundsel, black nightshade and sowthistle

The weather was hot (25 – 29°C) at the time of application, so this may have increased effects on the crop from some of the herbicides in the trial including AHDB9981.

Emerger 0.5 L/ha applied either alone or in a tank-mix with Stomp Aqua was the safest to the widest range of herbs in these trials and therefore it would be useful to gain authorisation of the product for use in coriander, parsley and chives. Emerger would add useful activity on annual meadow grass, chickweed, fat-hen, mayweed, nettles and sowthistle and would therefore be a good addition for herb growers. But growers should be aware of crop safety when using the herbicide, especially in parsley as it is on the margin of crop safety and can cause a slight stunt, even at the 0.75 L/ha rate.

**Table 1.** Summary of crop safety and efficacy in coriander and parsley assessed at harvest – 26 days after treatment application (DAA) for coriander and parsley. Phytotoxicity; 0 -100; 0 = completely healthy crop, 100 = complete crop death. Scores <20 deemed commercially acceptable damage, and those >20 are highlighted in red.

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)		Mean number of weeds per plot	
	Coriander 26 DAA	Parsley 26 DAA	Coriander 26 DAA	Parsley 26 DAA
Untreated	0.0	0.0	6.7	35.0
Stomp Aqua 2.20 L/ha Emerger 0.50 L/ha	10.0	23.3	5.3	23.3
Stomp Aqua 2.20 L/ha AHDB9898 0.30 L/ha	20.0	40.0	7.0	14.3
Emerger 0.50 L/ha	10.0	26.7	4.0	14.3
Emerger 0.75 L/ha	3.3	30.0	4.7	29.3

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)		Mean number of weeds per plot	
	Coriander 26 DAA	Parsley 26 DAA	Coriander 26 DAA	Parsley 26 DAA
AHDB9855 0.30 L/ha	10.0	36.7	7.0	17.7
AHDB9855 0.60 L/ha	10.0	33.3	8.0	24.3
AHDB9981 0.50 L/ha	46.7	66.7	2.3	13.0
AHDB9981 0.75 L/ha	53.3	86.7	4.7	16.0
F prob. value	<0.001	0.001	0.764	0.017
d.f.	16	16	16	16
L.S.D.	15.49	2.86	6.947	12.41

**Table 2.** Summary of crop safety and efficacy in chives assessed at harvest - 22 days after treatment application (DAA) for chives. Phytotoxicity; 0 -100; 0 = completely healthy crop, 100 = complete crop death. Scores <20 deemed commercially acceptable damage, and those >20 are highlighted in red.

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)	Mean number of weeds per plot
	22 DAA	22 DAA
Untreated	0.0	5.0
AHDB9860 1.00 L/ha	13.3	2.7
AHDB9860 2.00 L/ha	30.0	2.3
Emerger 0.75 L/ha	3.3	2.7
Emerger 1.75 L/ha	0.0	4.0
AHDB9855 0.75 L/ha	0.0	3.0
AHDB9855 1.50 L/ha	6.7	1.3
AHDB9981 1.00 L/ha	0.0	3.0
AHDB9981 2.00 L/ha	10.0	1.0
F prob. value	<0.001	0.734 (NS)
d.f.	16	16
L.S.D.	10.53	4.589

## Conclusions

- Emerger 0.5 L/ha was safe to use over parsley, coriander and chives, causing only a slight stunt to parsley at this rate.
- Emerger was also safe to use in parsley and coriander at a post-emergence timing when applied in a tank-mix with Stomp Aqua 2.2 L/ha
- The higher rate of Emerger - 0.75 L/ha was safe for use over coriander and chives only.

- AHDB9981 caused stunting at all rates used in the trials, but may be safer at a lower rate and offers a useful range of weed control
- AHDB 9860 2.0 L/ha caused yellowing of chives, but was safer at 1.0 L/ha. This product was not tested post-emergence over parsley and coriander
- AHDB 9855 was only safe to use on chives.

### **Take home message**

Emerger 0.5 L/ha applied either alone or in a tank-mix with Stomp Aqua was the safest to the widest range of herbs in these trials an authorisation for the product for use in coriander, parsley and chives would improve weed control for herb growers. AHDB9981 would also fill gaps in control of cleavers, groundsel and black nightshade.

## Objectives

To compare a number of herbicide products and tank-mixes at one post-emergence application timing for selectivity (crop safety) and efficacy in Coriander, Parsley and Chives.

## Trial conduct

This study will be conducted in compliance with the requirements of the UK Official Recognition of Efficacy Testing scheme.

Protocol conforms to **EPPO1/89(3)** for **Weeds in brassicas and leafy vegetables**, with the following deviations:

*“Replicates: at least 4”*

Current study to have only 3 replicates – large number of treatments provides acceptable number of residual degrees of freedom.

The following EPPO guidelines were followed:

Relevant EPPO guideline(s)		Variation from EPPO
EPPO PP1/135(4)	Phytotoxicity assessment	None
EPPO PP1/152(4)	Guideline on design and analysis of efficacy evaluation trials	None
EPPO PP1/225 (2)	Minimum effective dose	None
EPPO PP1/181 (4)	Conduct and reporting of efficacy evaluation trials including good experimental practice	None
EPPO PP1/214(3)	Principles of acceptable efficacy	None
EPPO PP1/224(2)	Principles of efficacy evaluation for minor uses	None

ADAS has Efficacy Testing Certificate No. ORETO 409.

## Test site

Item	Details	
	Coriander and Parsley	Chives
Location address	<b>Flemmings Middle</b> Jury Farm House Jury Lane Donnington Chichester West Sussex PO20 7PX	<b>ORN</b> Trowe's Lane Swallowfield Wokingham South East Berkshire RG7 1RN
Crop and cultivar	<b>Coriander</b> – Cruiser <b>Parsley</b> – Laura	<b>Chive</b> – Fine Leaved
Substrate type	Sandy silt loam	Sandy loam
Agronomic practice	See Appendix A	See Appendix A
Prior history of site	See Appendix A	See Appendix A

## Trial design

Item	Details	
	Coriander and Parsley	Chives
Trial design:	Fully Randomised Block	Fully Randomised Block
Number of replicates:	3	3
Row spacing:	17 mm and 13 mm	13 mm
Plot size: (w x l)	1.8 m x 3 m	1.8 m x 3 m
Plot size: (m <sup>2</sup> )	5.4	5.4
Number of plants per plot:	N/K	N/K

## Treatment details - CORIANDER and PARSLEY

AHDB Code	Active substance	Product name/ manufacturer code	Formulation batch number	Content of active substance in product (g/L or g/kg)	Formulation type
N/A	pendimethalin	Stomp Aqua	ST12600518	455	Capsule Suspension
AHDB 9898	N/D	N/D	N/D	N/D	N/D
N/A	aclonifen	Emerger	EV56006446	600	Suspension Concentrate
AHDB 9855	N/D	N/D	N/D	N/D	N/D
AHDB 9981	N/D	N/D	N/D	N/D	N/D

## 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	-	-	-
2	Stomp Aqua + Emerger	1001 + 300	2.20 + 0.50	T1
3	Stomp Aqua + AHDB9898	1001 +	2.20 + 0.50	T1
4	Emerger	300	0.50	T1
5	Emerger	450	0.75	T1
6	AHDB9855		0.30	T1
7	AHDB9855		0.60	T1
8	AHDB9981		0.50	T1
9	AHDB9981		0.75	T1

## Application details

	T1 Application
Application date	25/07/2019
Time of day	17:20 – 18:40
Crop growth stage (Max, min average BBCH)	BBCH12 (2 True Leaves)
Crop height (cm)	3
Crop coverage (%)	20
Application Method	Spray
Application Placement	Soil
Application equipment	Oxford Precision Sprayer (Knapsack)

	T1 Application
Nozzle pressure	2-3Bar
Nozzle type	Flat Fan
Nozzle size	02F110
Application water volume/ha	200
Temperature of air - shade (°C)	29.2 – 24.4
Relative humidity (%)	59.3 – 77.6
Wind speed range (m/s)	4.1 – 2.9
Dew presence (Y/N)	N
Temperature of soil - 2-5 cm (°C)	N/K
Wetness of soil - 2-5 cm	Dry
Cloud cover (%)	85

### Treatment details – CHIVES

AHDB Code	Active substance	Product name/ manufacturer code	Formulation batch number	Content of active substance in product (g/L or w/w)	Formulation type
AHDB 9860	N/D	N/D	N/D	N/D	N/D
N/A	aclonifen	Emerger	EV56006446	600	SC
AHDB 9855	N/D	N/D	N/D	N/D	N/D
AHDB 9981	N/D	N/D	N/D	N/D	N/D

### 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	-	-	-
2	AHDB9860		1.00	T1
3	AHDB9860		2.00	T1
4	Emerger	450	0.75	T1
5	Emerger	1050	1.75	T1
6	AHDB9855		0.75	T1
7	AHDB9855		1.5	T1
8	AHDB9981		1.00	T1
9	AHDB9981		2.00	T1

### Application details

	T1 Application
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Application date	26/06/2019
Time of day	14:40 – 15:00
Crop growth stage (Max, min average BBCH)	BBCH12 (2 True Leaves)
Crop height (cm)	9
Crop coverage (%)	35
Application Method	Spray
Application Placement	Soil
Application equipment	Oxford Precision Sprayer (Knapsack)
Nozzle pressure	2-3Bar
Nozzle type	Flat Fan
Nozzle size	02F110
Application water volume/ha	200
Temperature of air - shade (°C)	26.0 – 24.0
Relative humidity (%)	68.0 – 60.9
Wind speed range (m/s)	0.36 – 0.39
Dew presence (Y/N)	N
Temperature of soil - 2-5 cm (°C)	N/K
Wetness of soil - 2-5 cm	Dry
Cloud cover (%)	65

### Untreated levels of broad leaved weeds and grasses at through the assessment period - CORIANDER and PARSLEY

Common name	Scientific Name	EPPO Code	Mean number of weeds per plot		
			Weed level early-assessment period (At T1)	Weed level mid-assessment period (2 weeks)	Weed level end-assessment period (4 weeks)
<b>Coriander</b> Broad leaved weeds and grasses	N/A	3WEEDT	0.3	4.3	6.7
<b>Parsley</b> Broad leaved weeds and grasses	N/A	3WEEDT	10	19	35

### Untreated levels of broad leaved weeds and grasses at through the assessment period – CHIVES

Common name	Scientific Name	EPPO Code	Weed level early-assessment period (1 weeks)	Weed level mid-assessment period (2 weeks)	Weed level end-assessment period (3 weeks)
Broad leaved weeds and grasses	N/A	3WEEDT	2.3 (weeds per plot)	5.7 (weeds per plot)	5.0 (weeds per plot)

### Assessment details – CORIANDER and PARSLEY

Evaluation date	Evaluation Timing	Crop Growth Stage	Evaluation type	What was assessed and how (e.g. dead or live pest; disease)
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	(DA)*	(BBCH)	(efficacy, phytotox)	incidence and severity; yield, marketable quality)
25/07/2019	0	13	Efficacy	Total weed numbers per species per plot, all treatments
05/08/2019	11	42	Efficacy Phytotox Populations	Total weed numbers per species per plot, all treatments Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots Plant populations counted either side of 0.5m rod, twice in all plots
20/08/2019	26	48	Efficacy Phytotox	Total weed numbers per species per plot, all treatments Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots
04/09/2019	41	50 (Harvest)	Phytotox	Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots, PARSLEY ONLY

\* DA – days after application

### Assessment details – CHIVES

Evaluation date	Evaluation Timing (DA)*	Crop Growth Stage (BBCH)	Evaluation type (efficacy, phytotox)	What was assessed and how (e.g. dead or live pest; disease incidence and severity; yield, marketable quality)
04/07/2019	9	19	Efficacy Phytotox	Total weed numbers per species per plot, all treatments Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots
09/07/2019	14	42	Efficacy Phytotox	Total weed numbers per species per plot, all treatments Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots
17/07/2019	22	50 (Harvest)	Efficacy Phytotox	Total weed numbers per species per plot, all treatments Crop damage (0-10 Scale; 0=no effect, 10=complete crop kill), all plots

\* DA – days after application

### Statistical analysis

Both trial sites were laid out in a randomised block design, with treatments replicated three times for each herb species. An untreated control plot was included in each replicate, to provide comparison for treatment efficacy and crop safety.

As the distribution of weeds was low, only analysis of variance (ANOVA) was performed on the data as the statistician advised that transformation of the data would be inappropriate. Chris Dyer at RSK ADAS performed all the statistical analysis by ANOVA using GenStat 18.4.

### Results

#### Phytotoxicity

The results of phytotoxicity assessments from three dates for coriander and four dates for parsley and chives are presented in **Tables 3 to 5** below. These were scored on a scale from 0 to 10, with 0 being 'no effect', and 10 being 'dead'. These scores were then converted to a percentage score based on the table below. Plots deemed to have commercially acceptable level of damage were scored 2 or below – see below for full scale:

Crop Tolerance Score	Equivalent to Crop Damage (% Phytotoxicity)
10	Complete Crop Kill

9	90%
8	80%
7	70%
6	60%
5	50%
4	40%
3	30%
2*	20%*
1	10%
0	No Damage

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

### Coriander

Nearly all the post-emergence treatments were safe to coriander with the exception of AHDB9981 which caused stunting, and the effect increased with increasing rate of application (Table 3). Stomp Aqua + AHDB9898 also caused a slight stunting. Those which were safest to use over the crop were Stomp Aqua 2.2 L/ha + Emerger 0.5 L/ha, Emerger applied alone at either 0.5 L/ha or 0.75 L/ha and AHDB9855. Though AHDB9855 did cause a little leaf distortion.

The weather was hot (25 – 29°C) at the time of application, so this may have increased effects on the crop from AHDB9981.

**Table 3.** Summary of crop safety in **Coriander** throughout trial period, assessed at 11 and 26 days after treatment application. Phytotoxicity; 0 -100; 0 = completely healthy crop, 100 = complete crop death. Scores <20 deemed commercially acceptable damage, and those >20 are highlighted in red.

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)	
	11 DAA	26 DAA
Untreated	0.0	0.0
Stomp Aqua 2.20 L/ha Emerger 0.50 L/ha	6.7	10.0
Stomp Aqua 2.20 L/ha AHDB9898 0.30 L/ha	6.7	20.0
Emerger 0.50 L/ha	6.7	10.0
Emerger 0.75 L/ha	0.0	3.3
AHDB9855 0.30 L/ha	3.3	10.0
AHDB9855 0.60 L/ha	3.3	10.0
AHDB9981 0.50 L/ha	46.7	46.7
AHDB9981 0.75 L/ha	50.0	53.3
F prob. value	<0.001	<0.001
d.f.	16	16
L.S.D.	12.07	15.49

### Parsley

Parsley is a more sensitive crop than coriander and a greater effect was seen on the crop from all the herbicides in the trial causing significant increases in the phytotoxicity score which persisted until harvest (**Table 4**). The main effect was stunting but AHDB9981 caused an appearance of a reduction in crop stand especially at the higher rate, and AHDB9855 caused leaf distortion as a crinkling appearance. The treatments which caused the lowest degree of stunting were Stomp Aqua 2.2 L/ha + Emerger 0.5 L/ha and Emerger 0.5 L/ha.

As with the coriander trial, the hot weather at the time of application may have increased the effect on the crop.

**Table 4.** Summary of crop safety in **Parsley** throughout trial period, assessed at 11, 26 and 41 days after treatment application. Phytotoxicity; 0 -100; 0 = completely healthy crop, 100 = complete crop death. Scores <20 deemed commercially acceptable damage, and those >20 are highlighted in **red**.

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)		
	11 DAA	26 DAA	41 DAA
Untreated	0.0	0.0	0.0
Stomp Aqua 2.20 L/ha Emerger 0.50 L/ha	20.0	23.3	26.7
Stomp Aqua 2.20 L/ha AHDB9898 0.30 L/ha	43.3	40.0	46.7
Emerger 0.50 L/ha	20.0	26.7	26.7
Emerger 0.75 L/ha	30.0	30.0	36.7
AHDB9855 0.30 L/ha	33.3	36.7	43.3
AHDB9855 0.60 L/ha	23.3	33.3	40.0
AHDB9981 0.50 L/ha	66.7	66.7	63.3
AHDB9981 0.75 L/ha	83.3	86.7	86.7
F prob. value	<0.001	0.001	<0.001
d.f.	16	16	16
L.S.D.	24.87	2.86	16.78

### Chives

Nearly all the treatments were safe to chives with the exception of AHDB9860 2.0 L/ha which caused yellowing of the crop (**Table 5**).

**Table 5.** Summary of crop safety in **Chives** throughout trial period, assessed at 9, 14 and 22 days after treatment application. Phytotoxicity; 0 -100; 0 = completely healthy crop, 100 = complete crop death. Scores <20 deemed commercially acceptable damage, and those >20 are highlighted in **red**.

Treatment	Mean Phytotoxicity Score as a Percentage (Days after application)		
	9 DAA	14 DAA	22 DAA
Untreated	0.0	0.0	0.0
AHDB9860 1.00 L/ha	0.0	6.7	13.3
AHDB9860 2.00 L/ha	0.0	<b>26.7</b>	<b>30.0</b>
Emerger 0.75 L/ha	0.0	0.0	3.3
Emerger 1.75 L/ha	0.0	0.0	0.0
AHDB9855 0.75 L/ha	0.0	0.0	0.0
AHDB9855 1.50 L/ha	0.0	0.0	6.7
AHDB9981 1.00 L/ha	0.0	0.0	0.0
AHDB9981 2.00 L/ha	0.0	0.0	10.0
F prob. value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
d.f.	<b>16</b>	<b>16</b>	<b>16</b>
L.S.D.	<b>0.00</b>	<b>7.26</b>	<b>10.53</b>

### *Efficacy*

#### **Coriander**

There were low levels of weed with only a mean of 6.7 weeds per plot in the untreated control by the last assessment timing, therefore there were no significant differences at any of the assessments (**Table 6**).

**Table 6.** Summary of treatment efficacy in **Coriander** through average overall weed counts, assessed at zero, 11 and 26 days after treatment application. Figures in **bold** are significantly different from the untreated.

Treatment	Mean number of weeds per plot		
	At T1	11 DAA	26 DAA
Untreated	0.3	4.3	6.7
Stomp Aqua 2.20 L/ha Emerger 0.50 L/ha	1.3	3.0	5.3
Stomp Aqua 2.20 L/ha BAS 656 12H 0.30 L/ha	2.0	3.3	7.0
Emerger 0.50 L/ha	0.3	2.7	4.0
Emerger 0.75 L/ha	0.0	3.7	4.7
AHDB9855 0.30 L/ha	0.3	4.3	7.0
AHDB9855 0.60 L/ha	0.3	5.7	8.0
AHDB9981 0.50 L/ha	0.0	1.3	2.3
AHDB9981 0.75 L/ha	1.0	3.7	4.7

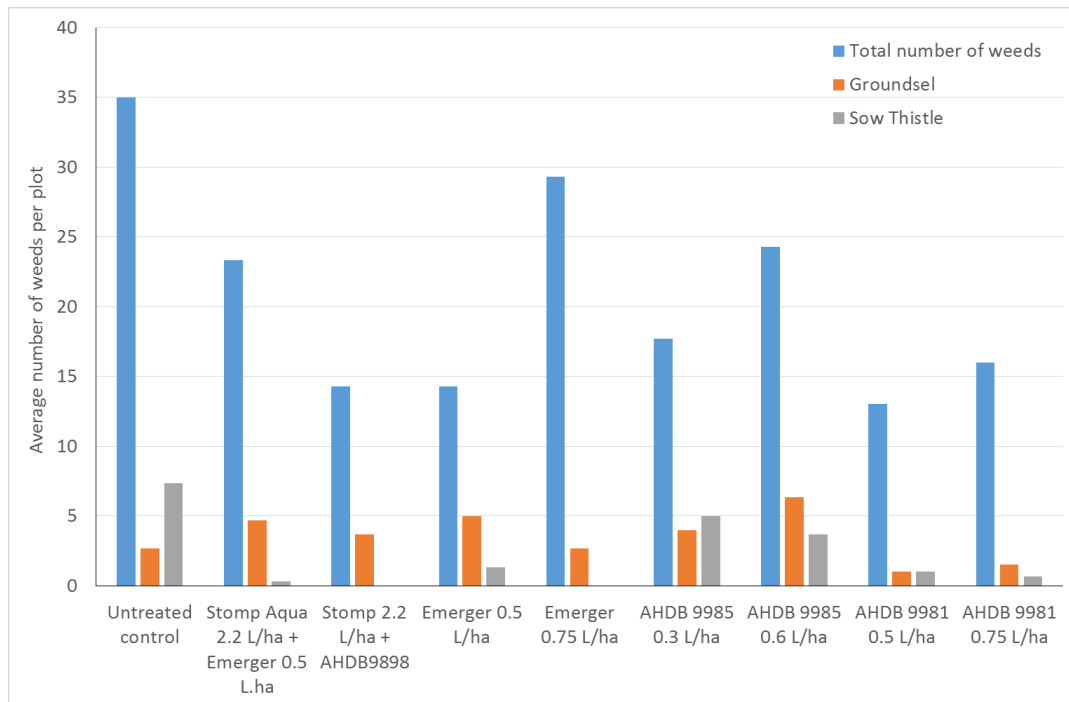
Treatment	Mean number of weeds per plot		
	At T1	11 DAA	26 DAA
F prob. value	<b>0.022</b>	<b>0.763</b>	<b>0.764</b>
d.f.	<b>16</b>	<b>16</b>	<b>16</b>
L.S.D.	<b>1.130</b>	<b>4.687</b>	<b>6.947</b>

### Parsley

There were low levels of weed with a mean of only 35 weeds per plot in the untreated control by the last assessment timing, therefore there were no strong significant differences at  $P < 0.001$ . However, there were differences ( $p = 0.01$ ) at the assessments carried out at 11 and 26 days after application. At the final assessment; AHDB9981, Emerger 0.5 L/ha, Stomp Aqua + AHDB9898 and AHDB9855 0.3 L/ha gave a reduction in weed numbers (**Table 7** and **Figure 1**). Due to the low levels of weeds and variation in the weed numbers between plots at the post-emergence application timing, these results should be treated with caution. For example there is greater weed control at the lower Emerger rate used, which is unexpected.

**Table 7.** Summary of treatment efficacy in **Parsley** through average overall weed counts, assessed at zero, 11 and 26 days after treatment application. Figures in **bold** are significantly different from the untreated.

Treatment	Mean number of weeds per plot		
	At T1	11 DAA	26 DAA
Untreated	10.0	19.0	35.0
Stomp Aqua 2.20 L/ha Emerger 0.50 L/ha	8.3	<b>10.7</b>	23.3
Stomp Aqua 2.20 L/ha BAS 656 12H 0.30 L/ha	<b>3.3</b>	<b>8.3</b>	<b>14.3</b>
Emerger 0.50 L/ha	4.0	<b>6.7</b>	<b>14.3</b>
Emerger 0.75 L/ha	13.0	<b>10.7</b>	29.3
AHDB9855 0.30 L/ha	<b>3.0</b>	<b>8.3</b>	<b>17.7</b>
AHDB9855 0.60 L/ha	6.0	<b>11.7</b>	24.3
AHDB9981 0.50 L/ha	5.0	<b>6.3</b>	<b>13.0</b>
AHDB9981 0.75 L/ha	9.0	<b>4.0</b>	<b>16.0</b>
F prob. value	<b>0.029</b>	<b>0.019</b>	<b>0.017</b>
d.f.	<b>16</b>	<b>16</b>	<b>16</b>
L.S.D.	<b>5.918</b>	<b>7.059</b>	<b>12.41</b>



**Figure 3.** Weed numbers in the parsley trial at 26 days after the post-emergence application. F pr = 0.017, LSD, 12.41

### Chives

Weed numbers were very low in this trial, and there were no significant differences between treatments (**Table 8**).

**Table 8.** Summary of treatment efficacy in **Chives** through average overall weed counts, assessed at 9, 14 and 22 days after treatment application. Figures in **bold** are significantly different from the untreated.

Treatment	Mean number of weeds per plot		
	App + 9 Days	App + 14 Days	App + 22 Days
Untreated	2.3	5.7	5.0
AHDB9860 1.00 L/ha	7.7	3.0	2.7
AHDB9860 2.00 L/ha	2.0	2.0	2.3
Emerger 0.75 L/ha	3.3	3.3	2.7
Emerger 1.75 L/ha	5.7	8.0	4.0
AHDB9855 0.75 L/ha	3.7	3.3	3.0
AHDB9855 1.50 L/ha	0.3	0.7	1.3
AHDB9981 1.00 L/ha	3.0	4.0	3.0
AHDB9981 2.00 L/ha	1.7	1.3	1.0
F prob. value	<b>0.484 (NS)</b>	<b>0.357 (NS)</b>	<b>0.734 (NS)</b>
d.f.	<b>16</b>	<b>16</b>	<b>16</b>
L.S.D.	<b>6.678</b>	<b>6.149</b>	<b>4.589</b>

## Discussion

There were low levels of weed in all of the trials with no strong statistically significant differences, therefore no conclusions could be drawn with regards to efficacy. However, significant differences in crop safety were apparent and give a guide to products which could be investigated for EAMU authorisation.

Emerger 0.5 L/ha and Stomp 2.2 L/ha + Emerger 0.5 L/ha are safe to use on coriander and chives, but cause a slight stunting when applied over parsley at two true leaf stage. Emerger at the higher rate of 0.75 L/ha is safe to coriander and chives, but causes a greater level of stunting to parsley when used at this rate in the trial. Therefore for parsley it would be advisable to use a rate no higher than 0.5 L/ha for this herb. Where there were effects on the crop these persisted up to the point of harvest.

Stomp 2.2 L/ha + AHDB9898 caused stunting to both coriander and parsley, and therefore for these herbs, Stomp 2.2 L/ha + Emerger 0.5 L/ha is the preferable combination.

AHDB9855 was safe to use on chives, but caused significant leaf distortion to parsley. Although the product caused no significant levels of crop damage to coriander, it also gave slight leaf distortion on this herb and this may be unacceptable.

AHDB9860 was only included in the chive trial. At 2.0 L/ha the product caused yellowing but it was safe to use on the crop at the lower rate of 1.0 L/ha, and only caused very slight yellowing.

AHDB 9981 did moderately stunt parsley, and also stunt coriander but a lower rate of 0.3 L/ha could be safer and still maintain weed control. Stunting and delay to harvest could be accommodated to take advantage of the useful wider range of weed control offered by the product. Such as cleaves, fat-hen, fumitory, groundsel, black nightshade and sowthistle

The weather was hot (25 – 29°C) at the time of application, so this may have increased effects on the crop from some of the herbicides in the trial including AHDB9981.

Emerger 0.5 L/ha applied either alone or in a tank-mix with Stomp Aqua was the safest to the widest range of herbs in these trials and therefore it would be useful to gain authorisation of the product for use in coriander, parsley and chives. Emerger would add useful activity on annual meadow grass, chickweed, fat-hen, mayweed, nettles and sowthistle and would therefore still be a good addition for herb growers. But growers should be aware of crop safety when using the herbicide, especially in parsley as it is on the margin of crop safety and can cause a slight stunt, even at the 0.75 L/ha rate.

## Conclusions

- Emerger 0.5 L/ha was safe to use over parsley, coriander and chives, causing only a slight stunt to parsley at this rate.
- Emerger was also safe to use in parsley and coriander at a post-emergence timing when applied in a tank-mix with Stomp Aqua 2.2 L/ha
- The higher rate of Emerger - 0.75 L/ha was safe for use over coriander and chives only.
- AHDB9981 caused stunting at all rates used in the trials, but may be safer at a lower rate and offers a useful range of weed control
- AHDB 9860 2.0 L/ha caused yellowing of chives, but was safer at 1.0 L/ha. This product was not tested post-emergence over parsley and coriander
- AHDB 9855 was only safe to use on chives.

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## Appendix

### a. Crop diary – events related to growing crop

Crop	Cultivar	Planting Date	Row Width
Coriander	Cruiser	27/06/2019	17mm spacing, 8 rows 75mm apart, 1.8 meter beds

Crop	Cultivar	Planting Date	Row Width
Parsley	Laura	27/06/2019	13mm spacing, 8 rows 75mm apart, 1.8 meter beds

Crop	Cultivar	Planting Date	Row Width
Chive	Fine Leaved	20/06/2019	13mm spacing, 8 rows 75mm apart, 1.8 meter beds

### b. Previous cropping – CORIANDER and PARSLEY

Date	Crop
25/03/2019 –06/04/2019	Coriander, Chervil and Dill
2018	Potatoes

### Previous cropping – CHIVES

Date	Crop
2017	Parsley
2018	Chives

### c. Active ingredients/fertiliser applied to trial – CORIANDER and PARSLEY

Date/Timing	Product	Rate (kg/ha or L/ha)
25/03/2019	MOP	300
27/06/2019	CAN + S	250
2 True Leaf Stage	CAN + S	330

### Active ingredients/fertiliser applied to trial– CHIVES

Date/Timing	Product	Rate (kg/ha or L/ha)
Seed Drill in 2018	CAN + S	350
05/03/2019	MOP	300
After Each Mow	CAN + S	450-500

### d. Pesticides applied to trial area – CORIANDER and PARSLEY

Date	Product	Rate (L/ha)
21-Day HI	Signum (Parsley ONLY)	1.5
14-Day HI	Switch (Parsley ONLY)	0.8

**Pesticides applied to trial area – CHIVES**

None.

**e. Details of irrigation regime – CORIANDER, PARSLEY and CHIVES**

Irrigation regime was weather-dependent – no official scheme followed.

**f. Trial diary**

<b>CORIANDER and PARSLEY</b>	
<b>Date</b>	<b>Event</b>
27 <sup>th</sup> June 2019	Trial plots drilled
25 <sup>th</sup> July 2019	T1 applications First efficacy assessment
5 <sup>th</sup> August 2019	Second efficacy and first phytotoxicity assessments. Plant populations assessed
20 <sup>th</sup> August 2019	Third efficacy and second phytotoxicity assessments
4 <sup>th</sup> September 2019	Third phytotoxicity assessment (Parsley only)

<b>CHIVES</b>	
<b>Date</b>	<b>Event</b>
20 <sup>th</sup> June 2019	Trial plots mowed
26 <sup>th</sup> June 2019	T1 applications
4 <sup>th</sup> July 2019	First efficacy and phytotoxicity assessments
9 <sup>th</sup> July 2019	Second efficacy and phytotoxicity assessment
17 <sup>th</sup> July 2019	Third efficacy and phytotoxicity assessment

**g. Climatological data during study period**

<b>CORIANDER and PARSLEY</b>			
<b>Date</b>	<b>Temperature °C (minimum)</b>	<b>Temperature °C (maximum)</b>	<b>Rainfall (mm)*</b>
27 June 2019	16	23	
28 June 2019	17	24	
29 June 2019	19	26	
30 June 2019	19	22	
01 July 2019	16	21	
02 July 2019	16	21	
03 July 2019	16	24	
04 July 2019	18	25	
05 July 2019	19	26	
06 July 2019	19	23	
07 July 2019	18	24	
08 July 2019	18	24	
09 July 2019	20	23	
10 July 2019	20	22	

11 July 2019	19	22	
12 July 2019	19	23	
13 July 2019	20	23	
14 July 2019	18	24	
15 July 2019	18	25	
16 July 2019	19	24	
17 July 2019	19	23	
18 July 2019	20	22	
19 July 2019	18	20	
20 July 2019	18	21	
21 July 2019	17	21	
22 July 2019	19	23	
23 July 2019	20	31	
24 July 2019	23	29	
25 July 2019	17	33	
26 July 2019	18	24	
27 July 2019	16	24	
28 July 2019	14	26	
29 July 2019	11	25	
30 July 2019	17	20	
31 July 2019	17	22	
01 August 2019	11	27	
02 August 2019	14	30	
03 August 2019	13	24	
04 August 2019	14	26	
05 August 2019	17	25	
06 August 2019	16	22	
07 August 2019	16	24	
08 August 2019	11	24	
09 August 2019	18	26	
10 August 2019	17	20	
11 August 2019	16	21	
12 August 2019	12	21	
13 August 2019	8	22	
14 August 2019	15	18	
15 August 2019	14	23	
16 August 2019	11	18	
17 August 2019	16	22	
18 August 2019	14	21	
19 August 2019	14	22	
20 August 2019	11	23	
21 August 2019	8	25	
22 August 2019	8	22	
23 August 2019	10	30	
24 August 2019	10	30	
25 August 2019	14	31	
26 August 2019	12	30	
27 August 2019	13	33	
28 August 2019	18	22	
29 August 2019	11	22	
30 August 2019	13	22	

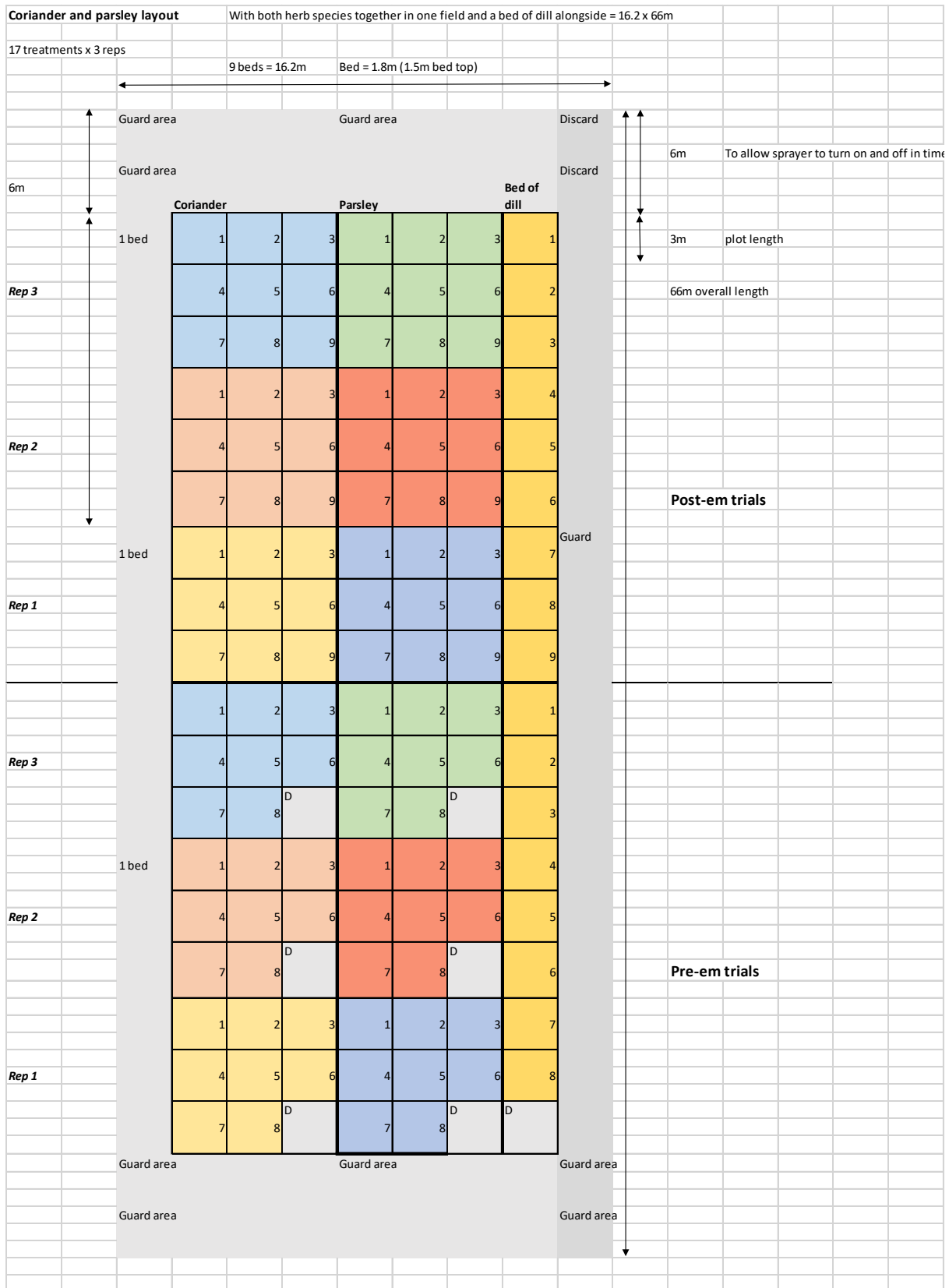
31 August 2019	11	22	
01 September 2019	10	22	
02 September 2019	7	20	
03 September 2019	16	20	
04 September 2019	16	22	

No Rainfall Data Available\*

**No climatological data for Chives.**

**h. Raw data from assessments**

**i. Trial design- CORIANDER and PARSLEY**





j. 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   
*Authorised signatory*

Certification Number

ORETO 409

