SCEPTREPLUS

Final Trial Report

Trial code:	SP30. 2020
Title:	AHDB SCEPTREplus Weed control in cut-flower production
Crop	Sweet Williams
Target	General broadleaf weeds and grasses, 3WEEDT
Lead researcher:	Chloe Whiteside
Organisation:	RSK ADAS Ltd, ADAS Boxworth, Cambridgeshire, CB23 4NN
Period:	June 2020 to September 2020
Report date:	22 January 2021
Report author:	Chloe Whiteside
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

22.01.2021…… ……  ……

Date Authors signature

Trial Summary

Introduction

The demand for UK grown cut-flowers continues to rise, yet the lack of technical information for the wide diversity of traditional and novel species being grown is a major limiting factor behind the expansion of this sector. Included in this is the shortfall of information on herbicides. There are virtually no specific label approvals for the use of herbicides in cut-flower production, and the range of species grown and their differing sensitivities to herbicides further complicates agronomy.

The loss of oxadiazon for residual weed control is of industry concern and prompted several years of study to find alternatives (HNS PO 192, 192a). However, Sweet Williams have proved very sensitive to a wide range of herbicides. One possible way forward is band spraying at drilling (which is made possible by the use of GPS equipped sprayers to identify the location of the drill with precision). This enables a stronger herbicide mix to be applied between the rows and a weaker mix over the row. This approach was successfully tested in vegetables in the SCEPTRE project and is worthy of testing on Sweet Williams. The products selected for testing include herbicides which already have authorisation and were tested in HNS PO 192 and 192a for crop safety, as well as some new coded products applied under experimental permit, which may have potential for use in outdoor ornamentals.

Methods

A trial was sited at a commercial cut-flower grower in Surfleet, Lincolnshire. Sweet Williams were drilled on 3rd July 2020 and treatments were applied to the soil prior to crop emergence on the 7th July 2020. Trial plots were 1.2 m wide and 3.0 m long. An overspray treatment was applied to all plots, including the untreated control, using an Oxford Precision Sprayer with a 1.5 m long boom fitted with 02f110 nozzles, in a water volume of 300 L/ha. Experimental inter-row treatments were applied using a bespoke sprayer built by the Allium and Brassica Centre, which had five 02f100 nozzles spaced 30 cm apart.

A randomised block design was used with 10 treatments including an untreated control replicated four times, totalling 40 plots. Plots were assessed for weed cover and crop damage on three occasions, recording the number of weeds per plot, the weed species per plot and any crop phytotoxicity. Crop emergence was also assessed at four and six weeks after treatment application.

Results

Crop emergence was approximately 11 days post-treatment application, and there was a significant delay from some of the treatments, which persisted throughout the course of the trial (**Table 1**). In addition, although not statistically significant, emergence was also reduced by AHDB 9987 (T4). In the treatments where the crop did emerge, there was no evidence of major crop damage or phytotoxicity throughout the trial period. There was some slight yellowing to the crop early on, but the plants grew away from this.

Weed control was well maintained by the majority of the treatments, and after 12 weeks, all of the treatments had significantly less weeds than the untreated control (**Table 2**).

Table 1. Number of emerged plants per plot at each assessment date.

Inter-row treatment	04 August 4WAT*	17 August 6WAT
T1. Untreated (Goltix 70 SC + Stomp Aqua over plots only)	59.0	97.8
T2. Stomp Aqua	67.0	100.5
T3. Defy	11.0	17.7
T4. AHDB 9987	40.0	60.8
T5. Springbok	36.0	43.0
T6. AHDB 9994	0.0	1.0
T7. AHDB9947	52.8	87.8
T8. AHDB 9900	49.2	79.5

T9. Stomp Aqua + Defy	35.8	56.2
T10. Stomp Aqua + AHDB 9987	50.0	82.5
P value	0.007	<.001
d.f.	27	27
s.e.d.	16.16	21.99
l.s.d.	33.16	45.12
	Not significantly different from untreated control (p>0.05)	
	Significantly different from untreated control (p<0.05)	

*WAT = weeks after treatment

Table 2. % weed cover per plot at each assessment date.

Inter-row treatment	31 July 3WAT*		17 August 6WAT		30 September 12WAT	
	% cover	Abbott's	% cover	Abbott's	% cover	Abbott's
T1. Untreated (Goltix 70 SC + Stomp Aqua over plots only)	2.39	-	16.50	-	55.0	-
T2. Stomp Aqua	3.13	-31.03	18.25	-10.61	7.75	85.91
T3. Defy	0.55	76.83	5.75	65.15	5.75	89.55
T4. AHDB 9987	0.14	94.34	1.75	89.39	8.50	84.55
T5. Springbok	0.20	91.61	1.88	88.64	5.25	90.45
T6. AHDB 9994	0.35	85.22	4.13	75.00	1.75	96.82
T7. AHDB9947	0.51	78.83	6.50	60.61	25.25	54.09
T8. AHDB 9900	0.44	81.66	3.38	79.55	21.75	60.45
T9. Stomp Aqua + Defy	0.85	64.26	4.75	71.21	6.75	87.73
T10. Stomp Aqua + AHDB 9987	0.35	85.22	2.50	84.85	4.75	91.36
P value	0.001		<.001		<.001	
d.f.	27		27		27	
s.e.d.	0.686		3.106		8.78	
l.s.d.	1.407		6.372		18.02	
	Not significantly different from untreated control (p>0.05)					
	Significantly different from untreated control (p<0.05)					
	Positive Abbott's formula percentage reduction					

*WAT = weeks after treatment

Conclusions

- In this trial, a number of the products tested appeared to be crop safe, with no phytotoxic effects and good crop emergence.
- With the products where crop emergence was reduced, it may be possible to reduce the product rate without substantially affecting weed efficacy.
- Weed control was very good with all of the products tested.
- AHDB 9947 is currently approved for use on outdoor bulbs and approval for use on other ornamental crops is currently being investigated.
- AHDB 9994 was too damaging for use on Sweet Williams.
- Applying herbicides as a precision band between the crop rows appears to be a useful method for growers, whereby weeds can be controlled by a range of actives, with reduced impact on the crop.

Take home message

A tank-mix of Stomp Aqua + Defy with a reduced rate of Defy (either half-rate or quarter-rate) could be worth considering as a pre-emergence residual herbicide applied as a precision band in-between the crop row on Sweet Williams. It could also be worth looking at a tank mix of Stomp Aqua + Springbok with a quarter-rate of Springbok as an inter-row treatment. This mix was not tested in the trial and therefore would be at the growers own risk.

Objectives

1. To evaluate the crop safety (emergence and phytotoxicity) of nine residual herbicide treatments for Sweet Williams, applied as precision bands between the rows post-drilling prior to crop emergence.
2. To evaluate the efficacy of the herbicide treatments on broadleaved weeds and grass control.

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(4)	Design and analysis of efficacy evaluation trials	None
PP 1/135(4)	Phytotoxicity assessment	None
PP 1/181(4)	Conduct and reporting of efficacy evaluation trials including good experimental practice	None
PP 1/088(3)	Weeds in flower bulbs and flower tubers	None

There were no deviations from the EPPO guidance.

Test site

Item	Details
Location address	L & D Flowers, Surfleet, Lincolnshire, PE11 4AG 52.8333904, -0.1477029
Crop	Sweet Williams
Soil or substrate type	Sandy clay loam
Agronomic practice	See appendix
Prior history of site	See appendix

Trial design

Item	Details
Trial design:	Fully randomised block
Number of replicates:	4
Row spacing:	0.2 m
Plot size: (w x l)	1.2 m x 3 m
Plot size: (m^2)	3.6
Number of plants per plot:	Various
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 (standard over plots only)	metamitron + pendimethalin	Goltix 70 SC + Stomp Aqua	17108259 + D/Bam12594-STP	700 + 455	Suspension Concentrate + Capsule Suspension	N/A
N/A	pendimethalin	Stomp Aqua	D/Bam12594-STP	455	Capsule Suspension	N/A
N/A	prosulfocarb	Defy	BSN7H3020	800	Emulsifiable Concentrate	N/A

AHDB9987*	N/D	N/D	N/D	N/D	N/D	N/A
N/A	dimethenamid-P & metazachlor	Springbok	BAS76900H	200 + 200	Emulsifiable Concentrate	N/A
AHDB9994*	N/D	N/D	N/D	N/D	N/D	N/A
AHDB9947*	N/D	N/D	N/D	N/D	N/D	N/A
AHDB9900*	N/D	N/D	N/D	N/D	N/D	N/A
N/A	pendimethalin + prosulfocarb	Stomp Aqua + Defy	D/Bam12594-STP + BSN7H3020	455 + 800	Capsule Suspension + Emulsifiable Concentrate	N/A
N/A + AHDB9987*	pendimethalin + N/D	Stomp Aqua + N/D	D/Bam12594-	455 + N/D	Capsule Suspension + N/D	N/A

*applied under experimental permit (permit number 2019/00849)

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 (Goltix 70 SC + Stomp Aqua over plots only)	700 + 341.25	1.0 + 0.75	A
2	Stomp Aqua	1319.5	2.9	A
3	Defy	4000	5.0	A
4	AHDB9987	1200	2.0	A
5	Springbok	500 + 500	2.5	A
6	AHDB9994	1050	1.75	A
7	AHDB9947	1500	3.0	A
8	AHDB9900	50 + 50	0.1	A
9	Stomp Aqua + Defy	1319.5 + 4000	2.9 + 5.0	A
10	Stomp Aqua + AHDB9987	1319.5 + 1200	2.9 + 2.0	A

Application details

	Application A
Application date	07/07/2020
Time of day	10:00
Crop growth stage (Max, min average BBCH)	N/A (pre-emergence)
Crop height (cm)	N/A
Crop coverage (%)	N/A
Application Method	Spray
Application Placement	Onto soil
Application equipment	Oxford Precision Sprayer (knapsack), bespoke sprayer from Allium and Brassica Centre for inter-row treatment
Nozzle pressure	2 bar
Nozzle type	Flat fan
Nozzle size	02f110 over rows, 02f100 inter-row
Application water volume/ha	300 L/ha
Temperature of air - shade (°C)	17.8
Relative humidity (%)	66.4

Wind speed range (m/s)	4.0 – 4.5
Dew presence (Y/N)	N
Temperature of soil - 2-5 cm (°C)	15.8
Wetness of soil - 2-5 cm	Dry
Cloud cover (%)	95

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
Broad leaved weeds and grasses	*N/A*	3WEEDT	0% *(untreated average)*	2.38% *(untreated average)*	55% *(untreated average)*

Assessment details

One herbicide application was planned prior to crop emergence on a newly drilled crop of Sweet Williams (drilled 3rd July 2020). An initial weed assessment was carried out on all plots, as the land had only recently been cultivated there were no weeds present at the time of herbicide application. At each subsequent assessment date (**Table 3**), the total weed cover and weed species present in each plot were recorded, as well the number of emerged Sweet Williams seedlings per plot, and a phytotoxicity score from 0-10, with 0 being 'no damage' and 10 being 'dead' (**Table 4**). Plots scoring 2 or below were deemed to have a commercially acceptable level of damage.

Table 3. Assessments carried out during the trial period

	Evaluation Timing (DA)*				
Evaluation date	**After conventional herbicides**	**After Bio-herbicides**	**Crop Growth Stage (BBCH)**	**Evaluation type (efficacy, phytotox)**	**Assessment**
07/07/20	0	N/A	PRE-EM	Efficacy	Percentage weed cover per plot
31/07/20	+24	N/A		Efficacy	Percentage weed cover per plot
04/08/20	+28	N/A		Efficacy and phytotox	Percentage weed cover per plot Phytotox (scale 0-10, 10 = dead) Total number of emerged Sweet Williams per plot
17/08/20	+41	N/A		Efficacy and phytotox	Percentage weed cover per plot Phytotox (scale 0-10, 10 = dead) Total number of emerged Sweet Williams per plot
30/09/20	+85	N/A		Efficacy and phytotox	Percentage weed cover per plot Phytotox (scale 0-10, 10 = dead)

* DA – days after application

Phytotoxicity was recorded using the following scale:

Table 4. Scale used to assess the extent of phytotoxic damage in treated plots

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 grower

Statistical analysis

The trial design was a randomised block design with four replicates of 10 treatments, including an untreated control (standard treatment applied over the plot only, no additional inter-row treatment).

As the distribution of weeds was uneven across the trial – which is not unexpected in field situations – there was a need to transform these variables prior to analysis; an angular transformation was used.

All data were analysed by ANOVA using Genstat 18.4 by Chris Dyer at RSK ADAS. *Post hoc* analyses were performed on the data using Duncan's multiple range test. For the % efficacy data 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

Crop emergence and phytotoxicity

Crop emergence was approximately 11 days post-treatment application, and there was a significant delay from some of the treatments, which persisted throughout the course of the trial (**Table 5**). The first emergence assessment was carried out 4WAT and there were two treatments where the number of emerged seedlings was significantly reduced; Defy (T3) with 11 emerged seedlings and AHDB 9994 (T6) with none ($p = 0.007$). There were 59 emerged seedlings on average in the untreated plots (T1), all other treatments had less emerged seedlings although these results were not significantly different. The exception was Stomp Aqua (T2) where there were more emerged seedlings per plot (67 on average).

At the next emergence assessment 6WAT, both Defy (T3) and AHDB 9994 (T6) were still significantly lower than the untreated (17.7 and 1.0 emerged seedlings respectively), but further crop emergence had also been significantly reduced in the plots treated with Springbok (T5), with only 43 emerged seedlings compared to 97.8 in the untreated ($p<.001$). Although not statistically significant, emergence was also quite low in plots treated with AHDB 9987 (T4). With 60.8 emerged seedlings, this would not be commercially acceptable.

In the treatments where the crop did emerge, there was no evidence of major crop damage or phytotoxicity throughout the trial period. There was some slight yellowing to the crop early on, but the plants grew away from this.

Table 5. Number of emerged plants per plot at each assessment date.

Inter-row treatment	04 August 4WAT*	17 August 6WAT
T1. Untreated (Goltix 70 SC + Stomp Aqua over plots only)	59.0	97.8
T2. Stomp Aqua	67.0	100.5
T3. Defy	11.0	17.7

T4. AHDB 9987	40.0	60.8
T5. Springbok	36.0	43.0
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T7. AHDB9947	52.8	87.8
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T10. Stomp Aqua + AHDB 9987	50.0	82.5
P value	0.007	<.001
d.f.	27	27
s.e.d.	16.16	21.99
l.s.d.	33.16	45.12
	Not significantly different from untreated control (p>0.05)	
	Significantly different from untreated control (p<0.05)	

*WAT = weeks after treatment

Efficacy

At the start of the trial when the herbicides were applied, there were no weeds present.

The overall percentage weed cover in almost all of the treated plots was significantly lower than the untreated control at the three week assessment (p =0.001). Only Stomp Aqua (T2) had more weed cover than the untreated, although this was not significant.

At the six week assessment, the percentage weed cover was highest in the untreated (16.5%) and all treatments apart from Stomp Aqua (T2) were significantly lower than the untreated control (p<.001). AHDB 9987 (T4) and Springbok (T5) were giving the greatest level of weed control, closely followed by Stomp Aqua + AHDB 9987 (T10).

At the final assessment 12 weeks post-treatment, all treatments gave significant weed control (p<.001) with the lowest number of weeds in the plots treated with AHDB 9994 (T6) and Stomp Aqua + AHDB 9987 (T10) (**Figure 1**).

Table 6 shows the mean percentage weed cover per plot at each assessment date, and the % reduction compared to the untreated control.

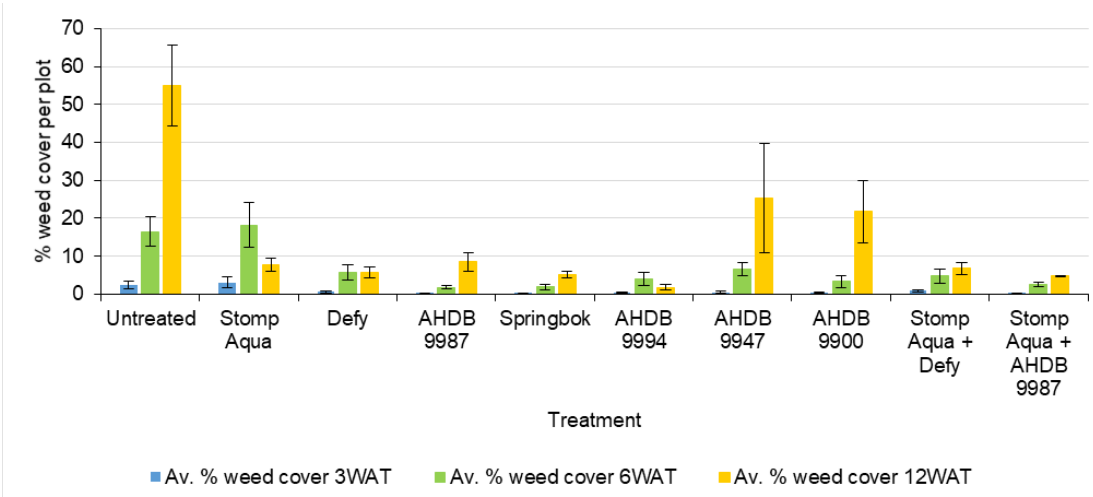

Figure 1: Mean percentage weed cover per plot at each assessment date.

Table 6. % weed cover per plot at each assessment date.

Inter-row treatment	31 July 3WAT*		17 August 6WAT		30 September 12WAT	
	% cover	Abbott's	% cover	Abbott's	% cover	Abbott's
T1. Untreated (Goltix 70 SC + Stomp Aqua	2.39	-	16.50	-	55.0	-

over plots only)						
T2. Stomp Aqua	3.13	-31.03	18.25	-10.61	7.75	85.91
T3. Defy	0.55	76.83	5.75	65.15	5.75	89.55
T4. AHDB 9987	0.14	94.34	1.75	89.39	8.50	84.55
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T8. AHDB 9900	0.44	81.66	3.38	79.55	21.75	60.45
T9. Stomp Aqua + Defy	0.85	64.26	4.75	71.21	6.75	87.73
T10. Stomp Aqua + AHDB 9987	0.35	85.22	2.50	84.85	4.75	91.36
P value	0.001		<.001		<.001	
d.f.	27		27		27	
s.e.d.	0.686		3.106		8.78	
l.s.d.	1.407		6.372		18.02	
	Not significantly different from untreated control (p>0.05)					
	Significantly different from untreated control (p<0.05)					
	Positive Abbott's formula percentage reduction					

*WAT = weeks after treatment

Discussion

In terms of crop safety and phytotoxicity, results were mixed, with some promising treatments and some which were too damaging. The standard mix of Stomp Aqua + Goltix 70 SC was applied to all plots, including the untreated, to reduce the number of weeds emerging within the crop rows. If this had not been done, crop emergence could have been impacted by germinating weeds, which would have skewed the results. Therefore, in this work, we can compare the effect of an additional herbicide treatment applied between the crop rows, with no additional treatment between the rows. There was some yellowing seen to all plots, including the untreated, at germination, which lasted for 2-3 weeks. There was heavy rainfall in the two days following the herbicide application and this suggests that there was an effect from the Stomp Aqua. However, the plants grew away from this and there were no signs of yellowing at the six week or 12 week assessment.

The inter-row treatments were applied at the full label or EAMU rate. As this trial was the first time precision band spraying had been tested in Sweet Williams, it was worth testing at the full rate, to see what the crop could tolerate. In addition, as the treatments were applied as precision bands, and not over the drilled rows, the risk of crop damage should be reduced. However, the heavy rain that followed in the two days after herbicide application may have exacerbated the effect of some of the treatments. Therefore, the results need to be treated with some caution, but this does give information on the crop safety and effects of the products in extreme weather conditions which have become more regular occurrences in recent years.

Stomp Aqua
Crop emergence was greater than the untreated at both the four and six week assessments. This was the only treatment where the number of emerged Sweet Williams was greater than the untreated. However, the percentage weed cover was also higher than the untreated at the three and six week assessments. Whilst Stomp Aqua would be perfectly safe to apply as an inter-row treatment, it may need a tank-mix partner to improve efficacy.

Defy
Crop emergence was significantly reduced at both the four and six week assessments. Weed control was very good, with a significant reduction at all three assessment dates, however Defy at the full rate as an inter-row treatment is too damaging for Sweet Williams. It could be worth considering half the rate as an inter-row treatment, and this shouldn't impact too greatly on the weed control.

AHDB 9987

With this experimental product, crop emergence was ok, but still too low to be commercially acceptable six weeks after treatment. Weed control was very good, so it is possible that a reduced rate as an inter-row treatment would improve crop emergence without reducing efficacy on weed control too much. If successful, this product would be useful to growers as it has good potential for willowherb and groundsel control, which are problematic weeds and difficult to control with the herbicide currently approved for use.

Springbok
Weed control was very good with this product, however crop emergence was significantly reduced at the six week assessment. A reduced rate could be crop safe but this would impact on weed control, so a tank-mix partner may be required, which would need further testing.

AHDB 9994
This experimental product had a severe impact on the germination of the crop, with virtually no plants emerging in any of the plots treated with this product. Weed control was also very good, with almost no weeds in the plots at the end of the trial. It is likely that even testing this product at a reduced rate would be too much for Sweet Williams to tolerate.

AHDB 9947
Results with this experimental product were promising, with good crop emergence. The number of plants per plot was barely different to the untreated at either the four or six week assessment. Weed control was good, although longevity of efficacy was not maintained by the 12 week assessment with weed levels increasing at this point, so could require a tank-mix partner or a follow-up treatment. AHDB 9947 is currently approved for use on outdoor ornamental bulb crops via an EAMU, so it would be useful to pursue an EAMU for wider use on outdoor ornamental crops.

AHDB 9900
Crop emergence was good with this experimental product. Weed control was also good, but similar to AHDB 9947, efficacy was starting to decline by the end of the trial. Depending on the size of the crop after 12 weeks, this may not be too problematic if the crop cover is big enough to mitigate the effect of any new germinating weeds.

Stomp Aqua + Defy
Crop emergence was reasonable with this treatment, but still too low to be considered commercially acceptable. Weed control was very good. The rate of Defy was too high in this tank-mix, however better crop emergence could be achieved by reducing the rate of Defy.

Stomp Aqua + AHDB 9987
Crop emergence was very good with this treatment, as was the weed control. Interestingly the crop emergence in this tank mix was higher than when AHDB 9987 was tested alone, so it would be useful to test this tank-mix again to see if the same results could be replicated.

Overall, weed control was very good with all of the treatments used. There were two experimental products where the efficacy was starting to decline after 12 weeks (AHDB 9947 and AHDB 9900), however if the crop is big enough by that stage this shouldn't be such a problem. It is encouraging that crop emergence did not appear to be adversely affected by some of the experimental treatments, which gives growers confidence that new chemistry could be available in the future. Applying products as an inter-row treatment has also helped greatly with weed control, with weed numbers greatly reduced compared to the untreated. With a sensitive crop such as Sweet Williams, using inter-row treatments in the future could be very beneficial to the grower, as it allows for the use of products which may otherwise be too damaging if they were directly applied over the drilled crop.

For products which currently have an EAMU, growers are advised to test the product on a small area first prior to wide-scale use and adhere to the EAMU. Any use is at the growers own risk.

Conclusions

- In this trial, a number of the products tested appeared to be crop safe, with no phytotoxic effects and good crop emergence.
- With the products where crop emergence was reduced, it may be possible to reduce the product rate without affecting weed efficacy too much.
- Weed control was very good with all of the products tested.
- AHDB 9947 is currently approved for use on outdoor bulbs and approval for use on other ornamental crops is currently being investigated.
- AHDB 9994 was too strong for use on Sweet Williams.
- Applying herbicides as a precision band between the crop rows appears to be a useful method for growers, whereby weeds can be controlled by a range of actives, with reduced impact on the crop.

Acknowledgements

AHDB for funding the work, and also the crop protection companies for their financial contributions as well as providing samples for the trials. Thanks should also be given to James Lacey, the grower who provided the site and crop for the trial as well as technical input.

Appendix

a. Trial diary

03/07/2020	Field drilled by grower.
07/07/2020	Trial set-up completed. Soil sample taken. Plots marked out and overspray applied to all plots, including the discards, by ADAS. Inter-row treatments applied by the Allium and Brassica Centre using their precision sprayer.
09/07/2020	Heavy rain for the last 2 days in Spalding.
21/07/2020	Site Visit. Crop has emerged but is small. There is evidence of phytotoxicity (yellow tipping) which is uniform across the trial including the discard plots. This suggests that the phyto is being caused by the Goltix + Stomp Aqua that was applied across the trial prior to the inter-row applications. Will visit site next week to conduct emergence counts and weed assessment.
31/07/2020	Trial Visit. The crop is smaller than the surrounding commercial crop, emergence counts will be pushed back another week. Yellowing is still evident. Weed assessment completed. There is some groundsel across the trial area, although this is mostly within the wheelings, which were not treated with anything. There is also the occasional volunteer potato, thistle, small nettle, ox tongue, redshank and speedwell emerging (low numbers). The untreated plots have more weeds compared to the treated plots.
04/08/2020	First emergence counts completed 4 weeks after treatment.
17/08/2020	Trial visit complete. Emergence counts and weed assessment completed 6 weeks after treatment. No evidence of phyto now on established plants. Weed cover generally low, although there is a lot of groundsel in the wheelings. There is 1 treatment where no crop has emerged.
26/08/2020	Trial visit complete. Groundsel has been removed from the wheelings, as this could encroach into the plots and start to affect the results.
30/09/2020	Final trial visit. Weed assessment completed 12 weeks after treatment. Weed control has been maintained, with many more weeds in the untreated plots. No more signs of phyto. Trial will now end.

b. Photographs - Trial plots 12 weeks after treatment

Inter-row Untreated

Inter-row Stomp Aqua 2.9 L/ha

Inter-row Defy 5.0 L/ha

Inter-row AHDB 9987 2.0 L/ha

Inter-row Springbok 2.5 L/ha

Inter-row AHDB 9994 1.75 L/ha

	
Inter-row AHDB 9947 3.0 L/ha	Inter-row AHDB 9900 0.1 L/ha
	
Inter-row Stomp Aqua 2.9 L/ha + Defy 5.0 L/ha	Inter-row Stomp Aqua 2.9 L/ha + AHDB 9987 2.0 L/ha

c. Climatological data during study period

Date	Temperature °C (maximum)	Temperature °C (minimum)	Temperature °C (average)
21/07/20	23.5	15.0	20.3
22/07/20	28.5	13.0	19.6
23/07/20	28.0	14.0	19.4
24/07/20	28.5	14.0	20.7
25/07/20	28.0	13.5	19.0
26/07/20	26.0	12.0	17.8
27/07/20	21.5	12.0	16.8
28/07/20	23.5	11.0	16.2
29/07/20	26.0	10.0	17.7
30/07/20	32.0	14.0	22.5
31/07/20	37.0	13.0	25.8
01/08/20	31.5	15.0	22.3
02/08/20	27.0	11.5	18.9
03/08/20	23.0	10.0	16.8
04/08/20	24.5	8.5	17.1
05/08/20	30.0	15.5	21.9
06/08/20	30.0	17.0	22.6
07/08/20	37.0	15.5	25.9
08/08/20	28.0	16.0	22.4
09/08/20	25.0	16.0	19.3
10/08/20	29.5	14.5	21.4
11/08/20	34.0	16.5	23.5
12/08/20	33.0	17.5	24.3
13/08/20	24.5	17.0	19.2
14/08/20	25.0	16.5	19.1
15/08/20	21.0	14.0	17.5
16/08/20	22.5	16.5	18.6
17/08/20	25.5	16.0	19.3
18/08/20	26.5	14.5	19.1
19/08/20	20.5	15.5	18.1
20/08/20	26.0	15.0	20.4
21/08/20	25.0	15.0	18.8
22/08/20	24.0	14.5	18.0
23/08/20	23.5	12.5	17.1
24/08/20	25.5	11.5	17.4
25/08/20	21.5	15.5	16.9
26/08/20	21.0	14.0	16.6
27/08/20	19.0	12.0	14.5
28/08/20	16.5	11.0	12.7
29/08/20	14.0	10.5	11.9
30/08/20	16.0	8.5	12.5
31/08/20	20.0	6.5	13.1
01/09/20	22.0	6.5	13.7
02/09/20	22.5	8.0	14.4

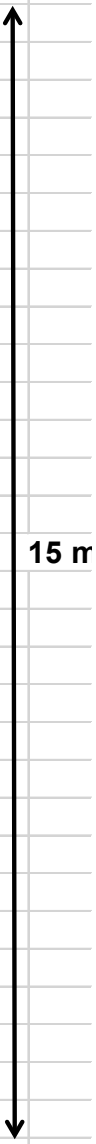
03/09/20	22.0	13.5	17.3
04/09/20	18.5	11.0	13.9
05/09/20	19.5	9.0	13.1
06/09/20	23.5	10.5	15.1
07/09/20	18.5	11.0	14.7
08/09/20	28.0	14.5	20.4
09/09/20	24.0	11.0	18.2
10/09/20	20.5	7.0	13.1
11/09/20	18.0	9.0	13.6
12/09/20	23.0	12.0	16.3
13/09/20	27.5	12.5	18.7
14/09/20	29.5	11.0	18.9
15/09/20	27.5	11.0	18.2
16/09/20	23.0	14.0	17.0
17/09/20	21.0	9.5	14.8
18/09/20	20.5	7.0	13.9
19/09/20	20.5	10.5	15.3
20/09/20	21.0	12.0	15.5
21/09/20	26.5	7.5	16.3
22/09/20	27.0	10.5	17.7
23/09/20	18.0	10.5	14.7
24/09/20	17.0	7.5	10.9
25/09/20	12.0	8.0	9.7
26/09/20	11.0	5.0	8.7
27/09/20	13.5	9.5	10.9
28/09/20	18.5	8.5	11.9
29/09/20	18.0	9.0	13.0
30/09/20	15.0	8.5	12.0

d. Raw data from assessments

Plot number	Block	Trt 1	Emergence no. 4WAT	Emergence no. 6WAT	% Weed cover 3WAT	% Weed cover 6WAT	% Weed cover 12WAT
101	1	4	18	17	0.12	1	6
102	1	5	61	58	0.3	2	7
103	1	9	50	52	0.4	4	10
104	1	7	97	118	0.21	5	68
105	1	8	64	82	0.4	2	45
106	1	10	32	42	0.8	4	5
107	1	3	32	33	1	11	6
108	1	6	0	2	1	9	1
109	1	2	45	58	2.5	16	8
110	1	1	72	98	1	14	45
201	2	1	49	88	5.01	27	70
202	2	2	43	80	7	35	12
203	2	10	62	108	0.3	3	5
204	2	9	38	63	2.01	10	6
205	2	4	36	51	0	1	4
206	2	3	4	12	0.6	6	4
207	2	7	30	50	1.5	11	9
208	2	5	54	70	0.3	1	5
209	2	8	50	70	1.01	8	8
210	2	6	0	2	0.2	4	1
301	3	6	0	0	0.1	2.5	1
302	3	1	53	86	2.51	17	75
303	3	7	29	69	0.31	7	15
304	3	5	22	32	0.2	4	6
305	3	3	8	26	0.6	4	10
306	3	9	7	26	0.2	2	3
307	3	8	44	92	0.13	1.5	22
308	3	4	78	127	0.3	2	9
309	3	10	86	143	0.01	1	5
310	3	2	113	151	2	15	7
401	4	6	0	0	0.11	1	4
402	4	2	67	113	1	7	4
403	4	7	55	114	0	3	9
404	4	1	62	119	1.02	8	30
405	4	9	48	84	0.8	3	8
406	4	3	0	0	0.01	2	3
407	4	4	28	48	0.12	3	15
408	4	10	20	37	0.3	2	4
409	4	8	39	74	0.21	2	12
410	4	5	7	12	0	0.5	3

e. Trial design

	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD
PLOT	DISCARD	105	110	205	210	305	310	405	410	DISCARD
BLOCK		1	1	2	2	3	3	4	4	
TREATMENT		8	1	4	6	3	2	9	5	
PLOT	DISCARD	104	109	204	209	304	309	404	409	DISCARD
BLOCK		1	1	2	2	3	3	4	4	
TREATMENT		7	2	9	8	5	10	1	8	
PLOT	DISCARD	103	108	203	208	303	308	403	408	DISCARD
BLOCK		1	1	2	2	3	3	4	4	
TREATMENT		9	6	10	5	7	4	7	10	
PLOT	DISCARD	102	107	202	207	302	307	402	407	DISCARD
BLOCK		1	1	2	2	3	3	4	4	
TREATMENT		5	3	2	7	1	8	2	4	
PLOT	DISCARD	101	106	201	206	301	306	401	406	DISCARD
BLOCK		1	1	2	2	3	3	4	4	
TREATMENT		4	10	1	3	6	9	6	3	
	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD



f. 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