

SCEPTREPLUS

Final Trial Report

Trial code:	SP06
Title:	Herbicide screens for improving weed control in sweetcorn
Crop	Sweetcorn – Field vegetables
Target	General broadleaf weeds and grasses
Lead researcher:	Angela Huckle
Organisation:	RSK ADAS
Period:	May 2017 - December 2017
Report date:	21 December 2017
Report author:	Angela Huckle
ORETO Number: (certificate should be attached)	374

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

12th December 2017

Angela Huckle



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Date

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Authors signature

Grower Summary

Introduction

The limited range of herbicides available for use on sweetcorn leaves gaps in the weed control spectrum. Until recently there were two main options available to growers, but pre-emergence weed control has become more difficult due to by the lack of availability of Cadou Star (flufenacet + isoxaflutole) since 2014. This leaves growers mainly dependent on just one pre-emergence product, pendimethalin. Calaris (mesotrione + terbuthylazine) can be used as a pre-emergence option but growers prefer to keep this as a post-emergence alternative to Callisto (mesotrione) + Fomet (nicosulfuron).

There are more product options for post-emergence application with four approved for use in the crop, but these mainly target broad-leaved weeds. Consequently, there is a reliance on nicosulfuron, a sulfonylurea, for grass control, which is of concern for the risk of developing ALS-inhibitor herbicide resistance as has occurred widely in arable crops (Hull et al., 2014). Therefore, herbicides for grass control with different modes of action are required to help growers guard against this.

The aim was to screen herbicides in order to increase the weed control options available to sweetcorn growers. Both pre- and post-emergence products were tested, with the emphasis on pre-emergence herbicides which also give some control of grass weeds.

Methodology

Two separate identical trials were sited at a commercial sweetcorn grower in west Sussex. Treatments were applied once at either pre or post-emergence timings at both sites. There were two separate pre-emergence timings; benfluralin and tri-allate were applied and then incorporated with a small rotavator before drilling, while the other 13 pre-emergence treatments were applied within 24 hours after drilling. The six post-emergence treatments were applied at growth stage V2-V3 at approximately four weeks after drilling. Until this point no herbicides were applied to these plots. The treatments were applied with a 1.5m Oxford precision knapsack sprayer at 200 L/ha water volume with plots 1.65m wide by 8m long. A randomised block design was used with three replicates of each treatment plus two untreated controls and a pre and post emergence grower standard for comparison. Therefore there were 75 plots in total. Plots were assessed for weed control on four occasions, using counts of weed species at the first two assessments while the weeds were at seedling stage, and then % weed ground cover was used once the weeds were larger for the latter two assessments. Crop damage was also recorded at the same time that the weed control was assessed to give four phytotoxicity assessments. Gross yield was assessed from cobs picked from 6m of the two central rows at harvest stage; numbers of cobs picked, and the total weight of all the cobs was recorded.

Results

Eight pre-emergence treatments significantly reduced weed ground cover at both sites up to eight weeks after drilling when compared to the untreated control ($p < 0.001$). These were: AHDB9987, AHDB9992 and AHDB9988 applied alone, and Dual Gold, aclonifen, Avadex Factor, AHDB9987 and AHDB9947 when applied in a tank-mix with Stomp Aqua. AHDB9986 was the only post-emergence product which significantly reduced weed ground cover for up to six weeks after application when applied at a growth stage of 3-4 leaves (V2-V3). Of the experimental treatments the best weed control was achieved by Stomp Aqua + Dual Gold and Stomp Aqua + AHDB9947 applied pre-emergence and AHDB9986 post-emergence at site 1. At site 2, AHDB9988, Stomp Aqua + AHDB9987 and Stomp Aqua + Dual Gold gave the best control. All these gave greater weed control when compared with the current standards. Different products performed better at each site as the weed spectrums were different. Site 1 weed spectrum was mainly barnyard grass, fat hen, sowthistle and shepherds purse, while the site 2 weed spectrum was mainly annual meadow grass, redshank, fat hen, groundsel and mayweed.

Benfluralin caused unacceptable stunting of the sweetcorn which continued through to harvest. AHDB9947 gave no phytotoxic effects when applied alone, but when mixed with Stomp Aqua it gave a check to crop growth exhibited as a slight stunting at both trial sites. The crop recovered, but yields were lower than anticipated from these plots at site 1 considering weed control was good. Post-emergence applications, Laudis, AHDB9992, AHDB9988, and AHDB9990 all appeared to check the crop at site 1 at the final assessment six weeks after application and gave scores just under acceptable damage. When applied pre-emergence AHDB9988 checked the growth of the crop for six weeks after application at site 2, but then the crop had recovered by the final assessment eight weeks later, and no checks were seen at site 1. This growth check by AHDB9988 may still be acceptable as this one was one of the best performing products for weed control and yield appeared to be unaffected by the earlier check to growth.

The standard pre and post-emergence treatments performed as expected and were comparable to commercial practice. There were no issues with mixing or application of any products. No wetters were used except for AHDB9986 where it is specified by the manufacturer.

Table 1 Summary of results – crop drilled on 24 May (Site 1) and 25 May (Site 2)

Date	Crop Damage 0-10 4WAT (post-em)		Weed control % weed cover 2WAT (post-em)		Weed control % weed cover 4WAT (post-em)	
	19-Aug	20-Aug	4 July		19-Aug	
	Site 1	Site 2	Site 1	Site 1	Site 1	Site 2
Treatment						
Untreated control	10.0	10.0	58.80	60.36	61.20	63.50
Standard pre-em Stomp Aqua 3.3 L/ha	9.6	9.0	20.70	18.54	21.40	30.70
Standard post-em Callisto 0.75 L/ha + Fornet 6OD 0.5 L/ha	9.0	9.3	16.10	14.94	10.00	15.60
Bonalan 4.0 L/ha (incorporated)	6.7	7.8	53.70	30.95	61.10	62.30
Avadex Factor 3.6 L/ha (incorporated)	8.1	9.3	60.80	36.79	61.50	61.10
Dual Gold 1.4 L/ha	9.7	9.0	15.30	30.48	25.80	50.00
AHDB9987	10.0	9.0	21.00	24.48	26.90	41.10
Aclonifen 1.5 L/ha	9.7	9.0	27.40	33.17	27.20	53.10
AHDB9947 lower	8.7	10.0	38.60	16.74	52.90	24.60
AHDB9947 higher	8.7	9.3	31.90	34.70	45.10	62.40
Avadex Factor 3.6 L/ha	8.7	8.0	55.40	43.46	60.00	63.50
AHDB9992	9.7	10.0	20.40	14.86	26.10	16.60
AHDB9988/AHDB9991	10.0	9.3	6.50	1.56	11.10	7.90
Stomp Aqua 3.3 L/ha + Dual Gold 1.4 L/ha	10.0	10.0	1.10	12.16	8.50	13.60
Stomp Aqua 3.3 L/ha + AHDB9987	9.7	9.0	16.90	9.61	27.70	12.90
Stomp Aqua 3.3 L/ha+ aclonifen 1.5 L/ha	9.7	9.3	19.00	16.70	31.20	24.00
Stomp Aqua 3.3 L/ha + AHDB9947	9.3	8.7	15.80	13.76	18.30	19.90
Stomp Aqua 3.3 L/ha + Avadex Factor 3.6 L/ha	9.3	8.7	21.30	20.64	23.40	29.90
AHDB9989	8.7	7.3	33.90	40.72	44.00	54.80
Laudis 2.25 L/ha	7.7	8.7	40.20	24.93	53.80	37.60
AHDB9992	7.0	9.0	52.60	25.04	58.00	38.60
AHDB9988	7.0	9.3	36.30	19.53	48.10	24.40
AHDB9990	7.7	8.0	40.40	45.63	54.80	63.50
AHDB9986	9.7	8.7	10.80	19.21	7.20	17.80
F pr. value	<0.001	0.014	<0.001	<0.001	<0.001	<0.001
d.f.	49	49	49	49	49	49
s.e.d.	0.6724	NS	8.77	6.059	8.49	8.04
l.s.d.	1.3520	NS	17.62	12.176	17.08	16.15

Crop Damage – Red = unacceptable, Yellow = marginal, Green = safe

Weed control – Red = > 50% weed cover, Yellow = 25-50% weed cover, Green = <25% weed cover

Bold = significantly different to the untreated

Conclusions and Take Home Messages

- Stomp Aqua + Dual Gold was one of the best performing treatments at both sites and an EAMU (2834/17) has been secured for use on sweetcorn.
- Pre-emergence treatments AHDB9988, Stomp Aqua + AHDB9987 and Stomp Aqua + aclonifen show promise in controlling typical weeds in sweetcorn.
- Of the post-emergence applications AHDB9986 shows promise in controlling weeds in sweetcorn with no phytotoxic effects
- AHDB9988 gives a check to the crop when applied post-emergence but this may be commercially acceptable.
- While AHDB9992 was one of the best performing pre-emergence products it now appears to be unlikely to be progressed to a UK approval.
- Further studies should be undertaken on the newer products aclonifen and AHDB9987 to test how they perform in early season crops which are more sensitive and grown under temporary covers, as well as test how the most promising products perform in programs.

Objectives

1. To evaluate the effectiveness of 15 pre-emergence herbicide treatments and six post-emergence treatments against grasses and broadleaved weeds in sweetcorn as measured by weed control efficacy and gross yield
2. To compare performance against the commercial standards (pendimethalin at pre-emergence, and mesotrione + nicosulfuron at post-emergence)
3. To monitor the treated crops for phytotoxicity

Trial conduct

UK regulatory guidelines were followed but EPPO guideline 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	No
PP 1/135(4)	Phytotoxicity assessment	No
PP 1/181(4)	Conduct and reporting of efficacy evaluation trials including good experimental practice	No
PP 1/214 (3)	Principles of acceptable efficacy	No
PP 1/224 (2)	Principles of efficacy evaluation for minor uses	No
PP 1/50(3)	Weeds in Maize	Yes

There were two deviations from EPPO guidance in **PP1/50(3) Weeds in Maize; Section 1.4, Design and lay-out of trial:**

“Replicates: at least 4”

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

“plots taken to harvest must be at least 20m²”

Study had plots of 13.2m² – larger plots would have taken up too much of the commercial site; the available area gave adequate representation, and harvest yield assessments were secondary to weed assessments.

Weed control results have been presented as overall global scores instead of as individual weed species.

Test site

Item	Details
Location address	Site 1 – Barfoots - Milepond farm, Birdham Road, Chichester, W. Sussex Site 2 – Barfoots - Sefter Farm, Pagham Road, Chichester, W. Sussex
Crop	Sweetcorn
Cultivar	Site 1 – 3511 Site 2 - Earlybird
Soil or substrate type	Silty clay loam
Agronomic practice	As per commercial practice except herbicides – See Appendix A
Prior history of site	See Appendix A

Trial design

Item	Details
Trial design:	Randomised block
Number of replicates:	3
Row spacing:	0.5 m (2 rows per plot)
Plot size: (w x l)	1.65 m x 8 m
Plot size: (m ²)	13.2 m ²
Number of plants per plot:	Approximately 64 (Drilled at 45,000 seeds/ha)
Leaf Wall Area calculations	N/A

Treatment details

AHDB Code	Active substance	Product name or manufacturers code	Formulation batch number	Content of active substance in product	Formulation type
N/A (Standard)	pendimethalin	Stomp Aqua	OO13054353	455 g/L	Capsule suspension
N/A (Standard)	mesotrione	Callisto	SAV5D15030	100 g/L	Suspension concentrate
N/A (Standard)	nicosulfuron	Fornet 6OD	15FHF017	60 g/L	Oil dispersion
N/A	benfluralin	Bonalan	F447G2P002	150 g/L	Emulsifiable concentrate
N/A	tri-allate	Avadex Factor	SITAL6004	450 g/L	Capsule suspension
N/A	s-metolachlor	Dual Gold	SMO5D0172	960 g/L	Emulsifiable concentrate
AHDB9987	N/D	N/D	N/D	N/D	N/D
N/A	aclonifen	Bandur	EV56006446	600 g/L	Suspension concentrate
AHDB9947	N/D	N/D	N/D	N/D	N/D
AHDB9992	N/D	N/D	N/D	N/D	N/D
AHDB9988	N/D	N/D	N/D	N/D	N/D
AHDB9989	N/D	N/D	N/D	N/D	N/D
AHDB9990	N/D	N/D	N/D	N/D	N/D
AHDB9986	N/D	N/D	N/D	N/D	N/D
N/A	tembotrione	Laudis	EFKE002919	44 g/L	Oil dispersion

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 + 2	Untreated control	N/A		N/A		N/A
3	Standard pre-em Stomp Aqua	1501.5 ml	a.s./ha	3.3	L/ha	B
4	Standard post-em Callisto Fornet 6OD	75 ml 30 ml	a.s./ha a.s./ha	0.75 0.5	L/ha L/ha	C
5	Bonalan	600 ml	a.s./ha	4.0	L/ha	A
6	Avadex Factor	1620 ml	a.s./ha	3.6	L/ha	A
7	Dual Gold	1344 ml	a.s./ha	1.4	L/ha	B
8	AHDB9987	1200 ml	a.s./ha	2.0	L/ha	B
9	aclonifen	900 ml	a.s./ha	1.5	L/ha	B
10	AHDB9947	1250 ml	a.s./ha	2.5	L/ha	B
11	AHDB9947	1750 ml	a.s./ha	3.5	L/ha	B
12	Avadex Factor	1620 ml	a.s./ha	3.6	L/ha	B
13	AHDB9992	625 ml + 375 ml	a.s./ha	2.0	L/ha	B
14	AHDB9988	900 ml + 108 ml	a.s./ha	1.8	L/ha	B
15	Stomp Aqua + Dual Gold	1501.5 ml + 1344 ml	a.s./ha a.s./ha	3.3 1.4	L/ha L/ha	B
16	Stomp Aqua + AHDB9987	1501.5 ml + 1200 ml	a.s./ha a.s./ha	3.3 2.0	L/ha L/ha	B
17	Stomp Aqua + aclonifen	1501.5 ml + 900 ml	a.s./ha a.s./ha	3.3 1.5	L/ha L/ha	B
18	Stomp Aqua + AHDB9947	1501.5 ml + 1750 ml	a.s./ha a.s./ha	3.3 3.5	L/ha L/ha	B
19	Stomp Aqua + Avadex Factor	1501.5 ml + 1620 ml	a.s./ha a.s./ha	3.3 3.6	L/ha L/ha	B
20	AHDB9989	100 ml + 80 ml + 2.5ml	a.s./ha	1.0	L/ha	C
21	Laudis	99 ml	a.s./ha	2.25	L/ha	C
22	AHDB9992	625 ml + 375 ml	a.s./ha	2.0	L/ha	C
23	AHDB9988	900 ml + 108 ml	a.s./ha	1.8	L/ha	C
24	AHDB9990	12.5 g	a.s./ha	0.05	kg/ha	C
25	AHDB9986	45 g + 1.5 g	a.s./ha	0.15	kg/ha	C

Application details – Site 1

	Application A	Application B	Application C
Application date	24/05/2017	24/05/2017	19/06/2017
Time of day	12:30-13:00	16:15 – 18:20	07:50 to 09:05
Crop growth stage (Max, min average BBCH)	Pre-drilling	Dry seed (00)	V2-V3 3 to 4 leaves (14)
Crop height (cm)	N/A	N/A	20
Crop coverage (%)	N/A	N/A	Not recorded
Application Method	spray then incorporation	spray	spray
Application Placement	soil	soil	foliar
Application equipment	Oxford Precision knapsack	Oxford Precision knapsack	Oxford Precision knapsack
Nozzle pressure (bar)	2.4	2.4	2.4
Nozzle type	Flat fan	Flat fan	Flat fan
Nozzle size	02 F110	02 F110	02 F110
Application water volume/ha	200	200	200
Temperature of air - shade (°C)	22.1	25.6	25.6
Relative humidity (%)	68.3	61.7	62.9
Wind speed range (m/s)	1.16 – 1.56	1.07 – 1.16	0.63 to 0.81
Dew presence (Y/N)	N	N	N
Temperature of soil - 2-5 cm (°C)	24	27	22
Wetness of soil - 2-5 cm	Damp (dry surface)	Damp (dry surface)	Dry
Cloud cover (%)	25	5	0

Application details – Site 2

	Application A	Application B	Application C
Application date	25/05/2017	25/05/2017	20/06/2017
Time of day	11:55 – 12:33	17:15 – 18:05	07:54 to 09:00
Crop growth stage (Max, min average BBCH)	Pre-drilling	Dry seed (00)	V2-V3 3 to 4 leaves (14)
Crop height (cm)	N/A	N/A	20
Crop coverage (%)	N/A	N/A	Not recorded
Application Method	spray then incorporation	spray	spray
Application Placement	soil	soil	foliar
Application equipment	Oxford Precision knapsack	Oxford Precision knapsack	Oxford Precision knapsack
Nozzle pressure (bar)	2.4	2.4	2.4
Nozzle type	Flat fan	Flat fan	Flat fan
Nozzle size	02 F110	02 F110	02 F110
Application water volume/ha	200	200	200
Temperature of air - shade (°C)	22.2	24.8	24.6
Relative humidity (%)	66.5	48.1	71.5
Wind speed range (m/s)	2.46-2.51	3.57	0.54
Dew presence (Y/N)	N	N	N
Temperature of soil - 2-5 cm (°C)	26	26	22
Wetness of soil - 2-5 cm	Damp (dry surface)	Damp (dry surface)	Dry
Cloud cover (%)	0	0	100 (Hazy)

Untreated levels of weeds at application and through the assessment period - Site 1

Common name	Scientific Name	EPPO Code	Infection level pre-application	Infection level at start of assessment period	Infection level at mid assessment period (post-em application)	Infection level at end of assessment period
Broad leaved weeds and grasses	N/A	3WEEDT	0	Untreated 1 63 weeds per m ²	Untreated 1 28.3 % weed cover per plot	Untreated 1 76.7 % weed cover per plot
				Untreated 2 80 weeds per m ²	Untreated 2 29.4 % weed cover per plot	Untreated 2 76.7 % weed cover per plot

Untreated levels of weeds at application and through the assessment period - Site 2

Common name	Scientific Name	EPPO Code	Infection level pre-application	Infection level at start of assessment period	Infection level at mid assessment period (post-em application)	Infection level at end of assessment period
Broad leaved weeds and grasses	N/A	3WEEDT	0	Untreated 1 194 weeds per m ²	Untreated 1 12 % weed cover per plot	Untreated 1 83.3 % weed cover per plot
				Untreated 2 121 weeds per m ²	Untreated 2 12.1 % weed cover per plot	Untreated 2 76.7 % weed cover per plot

Assessment details – Site 1

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)
07/06/2017	14 DA	12	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Counts of weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
20/06/2017	27 DA	15	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Counts of weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
04/07/2017	41 DA and 15 DA	17	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Percentage of main weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
20/07/2017	57 DA and 31 DA	55	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Percentage of weed cover, whole plot score
07/09/2017	106 DA and 80 DA	79	gross yield	no of cobs, weight of cobs

* DA – days after application

Assessment details – Site 2

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)
08/06/2017	14 DA	12	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Counts of weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
19/06/2017	25 DA	15	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Counts of weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
04/07/2017	40 DA and 14 DA	17	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Percentage of main weed species per quadrat, 3 x 25cm x 25cm quadrats per plot)
19/07/2017	55 DA and 29 DA	55	phytotox and efficacy	Phytotox (scale 0-10, 0 = Dead) Percentage of weed cover, whole plot score
31/08/2017	98 DA and 82 DA	79	gross yield	no of cobs, weight of cobs

* DA – days after application

Statistical analysis

The trial design was a randomised block design, with three replicates of 25 treatments including a double untreated control and grower standards.

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 the Genstat program by Chris Dyer at RSK ADAS. For the % efficacy data calculated by Abbots formula, an angular transformation was carried out and then the back transformed means are presented from which Abbots Formula was used to calculate the % reduction in weeds.

Results

Phytotoxicity

The results of phytotoxicity assessments from three dates are presented in Table 1. These were scored on a scale of 1 to 10, with 1 being dead, and 10 being no effect. Those scores at 8 or above were deemed to be commercially acceptable damage. Photos in Appendix D.

Phytotoxicity was be recorded using the following scale:

Crop tolerance score	Equivalent to crop damage (% phytotoxicity)
0	complete crop kill 100%
1	80-95% damage
2	70-80%
3	60-70%
4	50-60%
5	40-50%
6	25-40%
7	15-25%
8	10-15% #
9	5-10%
10	no damage

#8 = acceptable damage, i.e. damage unlikely to reduce yield and acceptable to the farmer.

Five products gave phytotoxicity effects up to the final assessment at Site 1 with the most severe being stunting caused by Bonalan (benfluralin) at both sites. Although the post-emergence treatments gave a check, this did not continue at a moderately severe level to harvest and the effect on the crop later than four weeks after treatment was more of an effect from a reduction in vigour due to weed competition.

Table 1 Mean phytotoxicity scores through the trial. (Scores 8 or above deemed acceptable damage). Those below 8 and this unacceptable are marked in **bold**.

Date	20-Jun	19-Jun	4-Jul		19-Aug	20-Aug
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
Treatment						
Untreated control	10.0	10.0	10.0	10.0	10.0	10.0
Standard pre-em Stomp Aqua	10.0	9.1	10.0	9.3	9.6	9.0
Standard post-em Callisto Fornet 60D	N/A	N/A	8.3	8.7	9.0	9.3
Bonalan	7.7	7.3	7.7	7.7	6.7	7.8
Avadex Factor	10.0	10.0	9.0	10.0	8.1	9.3
Dual Gold	10.0	9.7	10.0	9.7	9.7	9.0
AHDB9987	9.7	9.7	9.7	8.3	10.0	9.0
aclonifen	9.7	9.0	10.0	9.0	9.7	9.0
AHDB9947 lower	9.0	9.0	9.3	9.3	8.7	10.0
AHDB9947 higher	8.3	10.0	9.3	10.0	8.7	9.3
Avadex Factor	10.0	9.7	8.7	9.0	8.7	8.0
AHDB9992	10.0	9.3	10.0	9.7	9.7	10.0
AHDB9988/AHDB9991	9.3	7.0	9.7	7.8	10.0	9.3
Stomp Aqua + Dual Gold	9.7	9.7	9.7	9.7	10.0	10.0
Stomp Aqua + AHDB9987	9.0	9.7	9.3	8.3	9.7	9.0
Stomp Aqua + aclonifen	9.0	10.0	9.3	10.0	9.7	9.3
Stomp Aqua + AHDB9947	6.7	7.3	8.3	8.0	9.3	8.7
Stomp Aqua + Avadex Factor	10.0	9.0	9.7	9.7	9.3	8.7
AHDB9989	N/A	N/A	8.7	8.3	8.7	7.3
Laudis	N/A	N/A	8.3	9.0	7.7	8.7
AHDB9992	N/A	N/A	8.7	8.7	7.0	9.0
AHDB9988/AHDB9991	N/A	N/A	7.3	9.3	7.0	9.3
AHDB9990	N/A	N/A	9.7	8.3	7.7	8.0
AHDB9986	N/A	N/A	9.3	8.7	9.7	8.7
F pr. value	<0.001	<0.001	<0.001	0.181	<0.001	0.014
d.f.	49	49	49	49	49	49
s.e.d.	0.486	0.5842	0.751	NS	0.6724	NS
l.s.d.	3.343	1.1745	1.509	NS	1.3520	NS

Weed control – mean percentage weed cover

The results for the mean percentage of weed cover per treatment are presented in Table 2 and Table 3, and Figures 1 to 4. Results significantly different from the untreated control are in **bold**.

Table 2 Mean percentage of weed cover per plot. Site 1. Treatments in **bold** are significantly different from the untreated control

Date	20-Jun		4-Jul		19-Aug	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment						
Untreated control	32.06	28.18	58.80	73.18	61.20	76.77
Standard pre-em Stomp Aqua	9.58	2.77	20.70	12.49	21.40	13.28
Standard post-em Callisto Fornet 6OD	N/A*	N/A*	16.10	7.65	10.00	3.00
Bonalan	20.65	12.44	53.70	64.94	61.10	76.71
Avadex Factor	29.89	24.83	60.80	76.15	61.50	77.23
Dual Gold	4.49	0.61	15.30	6.96	25.80	18.98
AHDB9987	6.26	1.19	21.00	12.88	26.90	20.47
aclonifen	12.19	4.46	27.40	21.13	27.20	20.90
AHDB9947 lower	12.12	4.41	38.60	38.91	52.90	63.63
AHDB9947 higher	15.62	7.25	31.90	27.93	45.10	50.13
Avadex Factor	28.43	22.67	55.40	67.73	60.00	75.00
AHDB9992	6.87	1.43	20.40	12.20	26.10	19.31
AHDB9988/AHDB9991	1.56	0.07	6.50	1.29	11.10	3.74
Stomp Aqua + Dual Gold	0.00	0.00	1.10	0.04	8.50	2.17
Stomp Aqua + AHDB9987	5.57	0.94	16.90	8.41	27.70	21.59
Stomp Aqua + aclonifen	6.97	1.47	19.00	10.65	31.20	26.89
Stomp Aqua + AHDB9947	6.24	1.18	15.80	7.38	18.30	9.83
Stomp Aqua + Avadex Factor	7.93	1.90	21.30	13.19	23.40	15.79
AHDB9989	N/A*	N/A*	33.90	31.06	44.00	48.26
Laudis	N/A*	N/A*	40.20	41.73	53.80	65.14
AHDB9992	N/A*	N/A*	52.60	63.03	58.00	71.89
AHDB9988/AHDB9991	N/A*	N/A*	36.30	35.05	48.10	55.38
AHDB9990	N/A*	N/A*	40.40	42.06	54.80	66.74
AHDB9986	N/A*	N/A*	10.80	3.54	7.20	1.55
F pr. value	<0.001		<0.001		<0.001	
d.f.	49		49		49	
s.e.d.	5.927		8.77		8.49	
l.s.d.	11.911		17.62		17.08	

* The results are not presented at this point for comparison as these treatments are post-emergence and had not been applied at this assessment timing.

Figure 1 Mean percentage of weed cover at the post-emergence application timing (therefore only pre-emergence treatments shown). Site 1. $P < 0.001$, s.e.d. = 5.927, l.s.d. = 11.911

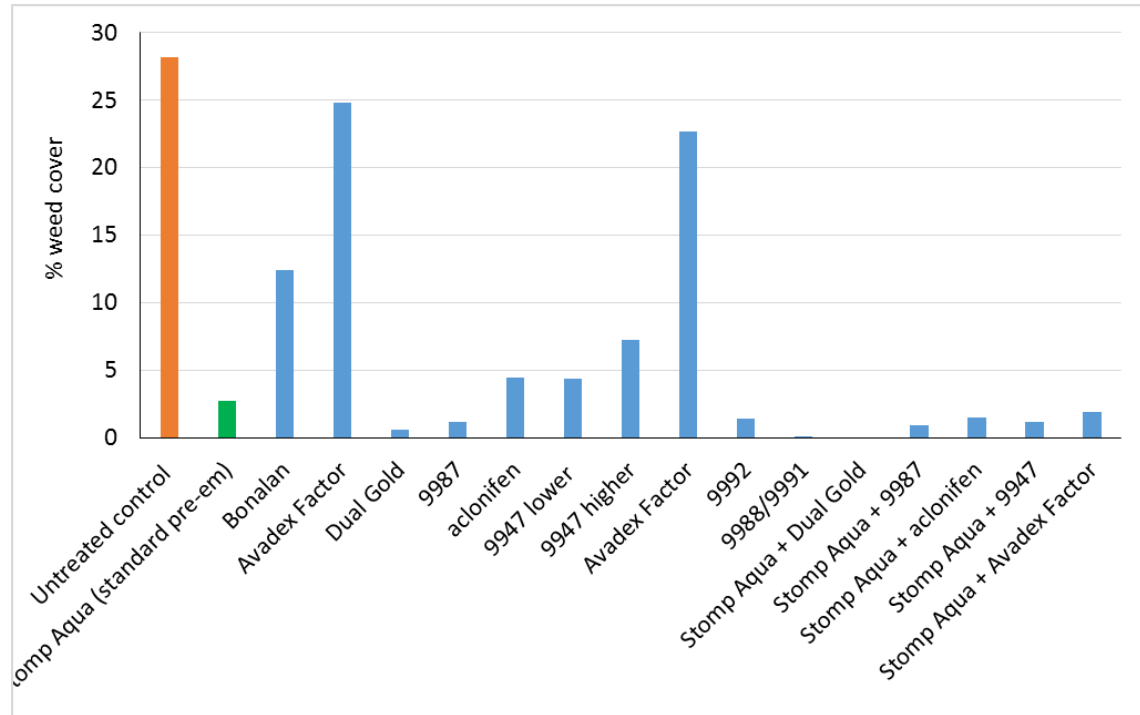


Figure 2 Mean percentage of weed cover at two and four weeks after the post-emergence application timings. Site 1. 6 weeks $P < 0.001$, s.e.d. = 8.77, l.s.d. = 17.62; 8 weeks $P < 0.001$, s.e.d. = 8.49, l.s.d. = 17.08

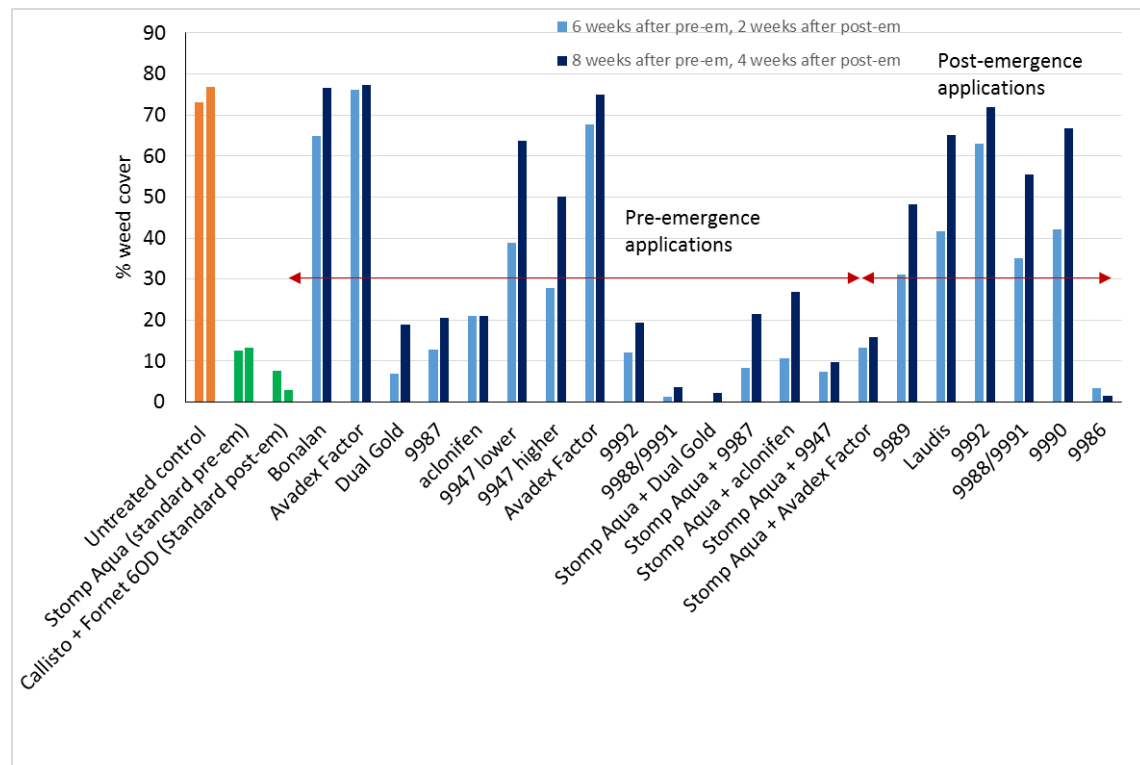


Table 3 Mean percentage of weed cover per plot. Site 2. Treatments in **bold** are significantly different from the untreated control

Date	19-Jun		4-Jul		19-Aug	
	Ang	Back-trans	Ang	Back-trans	Ang	Back-trans
Treatment						
Untreated control	19.83	11.52	60.36	75.54	63.50	80.16
Standard pre-em Stomp Aqua	7.16	1.55	18.54	10.11	30.70	26.01
Standard post-em Callisto Fornet 60D	N/A*	N/A*	14.94	6.64	15.60	7.20
Bonaian	14.27	6.08	30.95	26.44	62.30	78.38
Avadex Factor	13.27	5.26	36.79	35.87	61.10	76.71
Dual Gold	9.83	2.92	30.48	25.73	50.00	58.68
AHDB9987	4.92	0.74	24.48	17.17	41.10	43.16
aclonifen	10.37	3.24	33.17	29.93	53.10	63.91
AHDB9947 lower	3.77	0.43	16.74	8.30	24.60	17.29
AHDB9947 higher	15.64	7.26	34.70	32.40	62.40	78.54
Avadex Factor	15.36	7.02	43.46	47.31	63.50	80.16
AHDB9992	9.35	2.64	14.86	6.58	16.60	8.16
AHDB9988/AHDB9991	0.00	0.00	1.56	0.07	7.90	1.91
Stomp Aqua + Dual Gold	5.23	0.83	12.16	4.44	13.60	5.49
Stomp Aqua + AHDB9987	5.14	0.81	9.61	2.79	12.90	5.00
Stomp Aqua + aclonifen	6.18	1.16	16.70	8.26	24.00	16.50
Stomp Aqua + AHDB9947	4.47	0.61	13.76	5.66	19.90	11.57
Stomp Aqua + Avadex Factor	5.90	1.06	20.64	12.42	29.90	24.89
AHDB9989	N/A*	N/A*	40.72	42.56	54.80	66.79
Laudis	N/A*	N/A*	24.93	17.77	37.60	37.22
AHDB9992	N/A*	N/A*	25.04	17.92	38.60	38.84
AHDB9988/AHDB9991	N/A*	N/A*	19.53	11.17	24.40	17.09
AHDB9990	N/A*	N/A*	45.63	51.09	63.50	80.16
AHDB9986	N/A*	N/A*	19.21	10.83	17.80	9.37
F pr. value	<0.001		<0.001		<0.001	
d.f.	49		49		49	
s.e.d.	3.308		6.059		8.04	
l.s.d.	6.648		12.176		16.15	

* The results are not presented at this point for comparison as these treatments are post-emergence and had not been applied at this assessment timing.

Figure 3 Mean percentage of weed cover at the post-emergence application timing (therefore only pre-emergence treatments shown). Site 2. $P < 0.001$, s.e.d. = 3.308, l.s.d. = 6.648

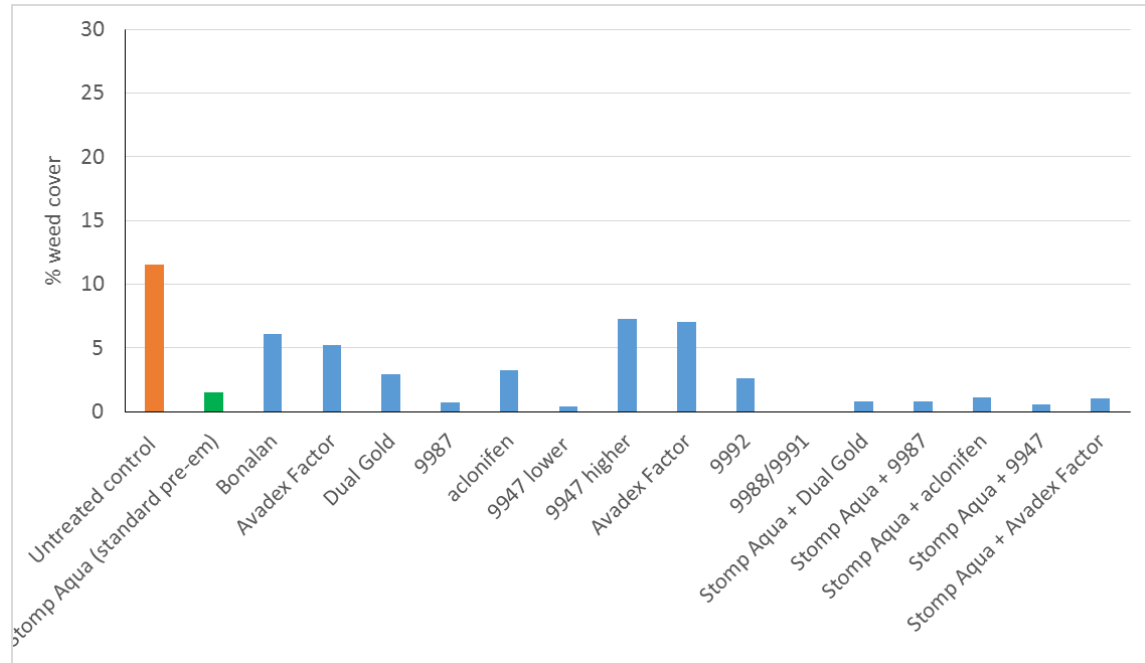
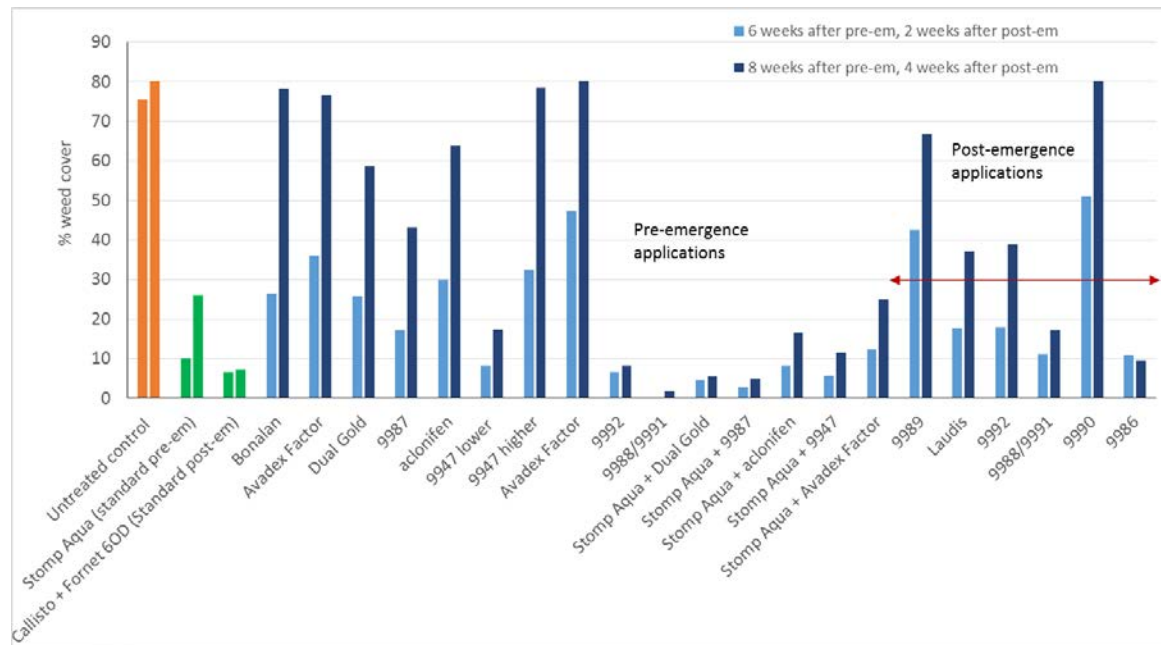


Figure 4 Mean percentage of weed cover at two and four weeks after the post-emergence application timings. Site 2. 6 weeks $P < 0.001$, s.e.d. = 6.059, l.s.d. = 12.176; 8 weeks $P < 0.001$, s.e.d. = 8.04, l.s.d. = 16.15



Weed control – % reduction in weed compared to untreated (Abbotts formula)

Table 4 Percentage reduction in weed cover using Abbotts formula

Date	20-Jun	19-Jun	4-Jul		19-Aug	20-Aug
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
Treatment						
Standard pre-em Stomp Aqua	90.15	86.51	82.93	86.62	82.70	67.55
Standard post-em Callisto Fornet 60D	N/A	N/A	89.55	91.21	96.09	91.02
Bonaian	55.86	47.19	11.26	65.00	0.08	2.22
Avadex Factor	11.89	54.26	0.00	52.52	0.00	4.30
Dual Gold	97.84	74.67	90.49	65.94	75.28	26.80
AHDB9987	95.78	93.62	82.40	77.27	73.34	46.16
aclonifen	84.17	71.86	71.13	60.38	72.78	20.27
AHDB9947 lower	84.35	96.24	46.83	89.01	17.12	78.43
AHDB9947 higher	74.27	36.89	61.83	57.11	34.70	2.02
Avadex Factor	19.55	39.06	7.45	37.37	2.31	0.00
AHDB9992	94.93	77.08	83.33	91.29	74.85	89.82
AHDB9988/AHDB9991	99.75	100.00	98.24	99.91	95.13	97.62
Stomp Aqua + Dual Gold	100.00	92.79	99.95	94.12	97.17	93.15
Stomp Aqua + AHDB9987	96.66	93.04	88.51	96.31	71.88	93.76
Stomp Aqua + aclonifen	94.78	89.92	85.45	89.07	64.97	79.42
Stomp Aqua + AHDB9947	95.81	94.72	89.92	92.51	87.20	85.57
Stomp Aqua + Avadex Factor	93.26	90.81	81.98	83.56	79.43	68.95
AHDB9989	N/A	N/A	57.56	43.66	37.14	16.68
Laudis	N/A	N/A	42.98	76.48	15.15	53.57
AHDB9992	N/A	N/A	13.87	76.28	6.36	51.55
AHDB9988/AHDB9991	N/A	N/A	52.10	85.21	27.86	78.68
AHDB9990	N/A	N/A	42.53	32.37	13.06	0.00
AHDB9986	N/A	N/A	95.16	85.66	97.98	88.31

Gross yield results

Table 5 Means of gross yield in tons per hectare, cobs per hectare and average weight per cob. Data not transformed. Figures significantly different from the untreated are in **bold**

Date	Tons/ha		Cobs/ha		Average cob weight (g)	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
Treatment						
Untreated control	1.88	1.54	16330	16498	95.20	82.5
Standard pre-em Stomp Aqua	5.42	4.25	23569	22896	229.10	185.5
Standard post-em Callisto Fornet 60D	5.45	5.05	22896	25253	238.70	201.5
Bonalan	3.27	2.26	22896	18182	140.70	130.3
Avadex Factor	1.99	3.28	20875	22222	91.10	150.3
Dual Gold	5.76	3.40	23906	22222	241.10	152.5
AHDB9987	5.05	3.53	22222	23232	229.40	154.8
aclonifen	4.88	3.98	21886	24242	223.60	165.7
AHDB9947 lower	2.93	4.35	20539	24242	144.10	181.1
AHDB9947 higher	3.40	2.60	19192	20202	170.60	124.9
Avadex Factor	2.02	1.75	16162	15825	107.00	101.9
AHDB9992	5.35	4.50	23569	22222	226.10	201.2
AHDB9988/AHDB9991	6.50	4.98	26263	22559	247.50	222.8
Stomp Aqua + Dual Gold	5.99	5.68	23569	25253	254.40	227.5
Stomp Aqua + AHDB9987	5.15	4.93	23232	24916	221.90	200.4
Stomp Aqua + aclonifen	5.59	4.82	23906	23232	234.20	209.5
Stomp Aqua + AHDB9947	4.92	4.43	22222	24242	219.70	184.7
Stomp Aqua + Avadex Factor	5.59	5.00	23232	23569	240.60	215.3
AHDB9989	3.87	3.38	22896	21212	168.90	154.5
Laudis	3.20	4.33	21212	22222	150.00	196.1
AHDB9992	1.75	3.60	13805	21549	113.40	173.8
AHDB9988/AHDB9991	2.83	5.70	18182	25253	130.90	227.4
AHDB9990	2.96	2.33	22896	18519	129.20	122.0
AHDB9986	5.93	4.15	24242	22559	244.70	185.8
F pr. value	<0.001	<0.001	<0.001	0.034	<0.001	<0.001
d.f.	49	49	49	49	49	49
s.e.d.	0.914	0.643	3380.8	2989.8	33.09	20.92
l.s.d.	1.837	1.292	6793.9	6009.1	66.49	42.04

Discussion

Eight pre-emergence treatments significantly reduced weed ground cover at both sites up to eight weeks after drilling when compared to the untreated control ($p < 0.001$). These were: AHDB9987, AHDB9992 and AHDB9988 applied alone, and Dual Gold, aclonifen, Avadex Factor, AHDB9987 and AHDB9947 when applied in a tank-mix with Stomp Aqua. AHDB9986 was the only post-emergence product which significantly reduced weed ground cover for up to six weeks after application when applied at a growth stage of 3-4 leaves (V2-V3). Of the experimental treatments the best weed control was achieved by Stomp Aqua + Dual Gold and Stomp Aqua + AHDB9947 applied pre-emergence and AHDB9986 post-emergence at site 1. At site 2, AHDB9988, Stomp Aqua + AHDB9987 and Stomp Aqua + Dual Gold gave the best control. All these gave greater weed control when compared with the current standards. Different products performed better at each site as the weed spectrums were different. Site 1 weed spectrum was mainly barnyard grass, fat hen, sowthistle and shepherds purse, while site 2 weed spectrum was mainly annual meadow grass, redshank, fat hen, groundsel and mayweed.

Benfluralin caused unacceptable stunting of the sweetcorn which continued through to harvest. AHDB9947 gave no phytotoxic effects when applied alone, but when mixed with Stomp Aqua it gave a check to crop growth exhibited as a slight stunting at both trial sites. The crop recovered, but yields were lower than anticipated from these plots at site 1 considering weed control was good. Post-emergence applications, Laudis, AHDB9992, AHDB9988, and AHDB9990 all appeared to check the crop at site 1 at the final assessment six weeks after application and gave scores just under acceptable damage. When applied pre-emergence AHDB9988 checked the growth of the crop for six weeks after application at site 2, but then the crop had recovered by the final assessment eight weeks later, and no checks were seen at site 1. This check may still be acceptable as this one was one of the best performing products for weed control and yield appeared to be unaffected by the earlier check to growth.

The standard pre and post-emergence treatments performed as expected and were comparable to commercial practice. There were no issues with mixing or application of any products. No wetters were used except for AHDB9986 where it is specified by the manufacturer.

Conclusions

- Stomp Aqua + Dual Gold was one of the best performing treatments at both sites and an EAMU (2834/17) has been secured for use on sweetcorn.
- Pre-emergence treatments AHDB9988, Stomp Aqua + AHDB9987 and Stomp Aqua + aclonifen show promise in controlling typical weeds in sweetcorn.
- Of the post-emergence applications AHDB9986 shows promise in controlling weeds in sweetcorn with no phytotoxic effects
- AHDB9988 gives a check to the crop when applied post-emergence but this may be commercially acceptable.
- AHDB9992 was one of the best performing pre-emergence products but now appears to be unlikely to be progressed to a UK approval.
- Further studies should be undertaken on the newer products aclonifen and AHDB9987 to test how they perform in early season crops which are more sensitive and grown under temporary covers, as well as test how the most promising products perform in programs.

Acknowledgements

Barfoots and their farm team (Neil Cairns, Grant Lumsden, James Rome, Jim Smith and Jack Strange) for hosting the field trials and their assistance.

Emily Lawrence of RSK ADAS for applying the sprays, and assistance with assessments

Appendix

a. Crop diary – events related to growing crop

Site 1 (Mile Pond)

Crop	Cultivar	Sowing date	Row width (m)
Sweetcorn	3511	24 May 2017	0.5

Previous cropping

Year	Crop
2016	N/D
2015	N/D

Active ingredients(s)/fertiliser(s) applied to trial area

Date	Product	Rate	Unit
14/03/2017	Mop	212.236	kg/ha
30/04/2017	30.0.0. 19s	330.0	kg/ha
08/05/2017	Tsp	198.261	kg/ha
24/05/2017	Chafer 16.5-33-0	150.0	L/ha
04/07/2017	Nuram	165.0	L/ha

Pesticides applied to trial area (Spring weed cleanup)

Date	Product	Rate	Unit
17/02/2017	Azural	3.0	L/ha
17/02/2017	Activator	0.5	L/ha

Details of irrigation regime

Date	Type, rate and duration	Amount applied (mm)
	N/D	

Site 2 (Saltham West)

Crop	Cultivar	Sowing date	Row width (m)
Sweetcorn	Earlybird	25 May 2017	0.5

Previous cropping

Year	Crop
2016	N/D
2015	N/D

Active ingredients(s)/fertiliser(s) applied to trial area

Date	Product	Rate	Unit
30/04/2017	Mop	197.246	kg/ha
30/04/2017	30.0.0. 19s	330.0	kg/ha
14/06/2017	Chafer 16.5-33-0	150.0	L/ha

Pesticides applied to trial area (Spring weed cleanup)

Date	Product	Rate	Unit
17/02/2017	Azural	3.0	L/ha

Details of irrigation regime

Date	Type, rate and duration	Amount applied (mm)
	N/D	

b. Trial diary – events relating to trial management

Site 1 (Mile Pond)

Date	Action
24/05/2017	Trial marked out and Treatment A pre-emergence applied, then these plots rotovated. Markers removed Field drilled by grower and marked out again, then Treatment B applied pre-emergence, Temp and RH data logger set up in centre of site.
07/06/2017	Weed levels and crop safety assessed
19/06/2017	Weed levels and crop safety assessed T3 post-emergence spray applied
05/07/2017	Weed levels and crop safety assessed
20/07/2017	Weed levels and crop safety assessed
07/09/2017	Harvested trial for yield assessment (No. of cobs & weight) Site cleared following harvest.

Site 2 (Saltham West)

Date	Action
24/05/2017	Trial marked out and Treatment A pre-emergence applied, then these plots rotovated. Markers removed Field drilled by grower and marked out again, then Treatment B applied pre-emergence, Temp and RH data logger set up in centre of site.
08/06/2017	Weed levels and crop safety assessed
20/06/2017	Weed levels and crop safety assessed T3 post-emergence spray applied
04/07/2017	Weed levels and crop safety assessed
19/07/2017	Weed levels and crop safety assessed
31/08/2017	Harvested trial for yield assessment (No. of cobs & weight) Site cleared following harvest.

c. Table showing climatological data during study period – air max, air min and rainfall.
Rainfall is only available from when the weather station was put out in the field by

Barfoots. *Approx Rainfall after drilling was communicated by the farm manager, hence this figure

Site 1 (Mile Pond)

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
24/05/2017	14.5	27	No data
25/05/2017	11	25.5	No data
26/05/2017	15.5	27	6.5*
27/05/2017	11.5	19	No data
28/05/2017	10.5	22.5	No data
29/05/2017	13	18.5	No data
30/05/2017	14	19.5	No data
31/05/2017	12.5	21.5	No data
01/06/2017	10.5	24	No data
02/06/2017	12	26	No data
03/06/2017	13.5	22	No data
04/06/2017	8.5	20	No data
05/06/2017	11.5	19	No data
06/06/2017	10.5	17	No data
07/06/2017	11.5	18	No data
08/06/2017	13.5	18	No data
09/06/2017	12.5	19	No data
10/06/2017	13.5	21.5	No data
11/06/2017	14	20	No data
12/06/2017	12.5	20.5	No data
13/06/2017	8.5	22	No data
14/06/2017	10.5	26	No data
15/06/2017	12	23	No data
16/06/2017	11	24	No data
17/06/2017	12.5	26.5	No data
18/06/2017	14.5	29.5	No data
19/06/2017	15.5	31	No data
20/06/2017	15	32	No data
21/06/2017	19	30.5	No data
22/06/2017	16.5	25.5	No data
23/06/2017	14	23	No data
24/06/2017	16	20	No data
25/06/2017	14.5	23	No data
26/06/2017	11	24.5	No data
27/06/2017	14.5	23.5	No data
28/06/2017	14	17.5	No data
29/06/2017	12	18	No data
30/06/2017	12.5	24	No data
01/07/2017	15	25	No data
02/07/2017	15.5	28.5	No data

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
03/07/2017	13.5	23.5	No data
04/07/2017	11	25	No data
05/07/2017	10.5	30.5	No data
06/07/2017	17	32.5	No data
07/07/2017	14	29	No data
08/07/2017	13.5	29.5	No data
09/07/2017	13.5	32.5	No data
10/07/2017	12	29	No data
11/07/2017	12.5	19.5	No data
12/07/2017	14	23.5	No data
13/07/2017	13.5	26.5	No data
14/07/2017	12.5	24	No data
15/07/2017	12.5	23	No data
16/07/2017	17	27	No data
17/07/2017	16.5	31.5	No data
18/07/2017	16	33	No data
19/07/2017	17	20.5	No data
20/07/2017	14.5	21	No data
21/07/2017	14	22.5	No data
22/07/2017	12.5	19.5	No data
23/07/2017	9.5	21.5	No data
24/07/2017	12	20	No data
25/07/2017	10.5	24.5	No data
26/07/2017	12	19	3.24
27/07/2017	14	20.5	0.00
28/07/2017	14.5	20	1.24
29/07/2017	15	18.5	6.00
30/07/2017	15	20.5	4.00
31/07/2017	13.5	22	0.00
01/08/2017	10.5	23	0.00
02/08/2017	14.5	17.5	4.15
03/08/2017	15	20	3.75
04/08/2017	14.5	21	0.60
05/08/2017	11.5	22.5	0.75
06/08/2017	8.5	21	0.00
07/08/2017	13.5	21	0.00
08/08/2017	11.5	20	0.00
09/08/2017	12	16	13.5
10/08/2017	11.5	19.5	0.00
11/08/2017	8.5	20.5	0.75
12/08/2017	14.5	20.5	0.00
13/08/2017	11	23	0.00
14/08/2017	8.5	23	0.00
15/08/2017	13.5	23.5	0.00

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
16/08/2017	10	21.5	0.00
17/08/2017	16	21	2.15
18/08/2017	14.5	20.5	0.00
19/08/2017	11	18.5	1.15
20/08/2017	8.5	21	7.15
21/08/2017	15	19.5	0.55
22/08/2017	17	20.5	0.00
23/08/2017	16	21	0.00
24/08/2017	11.5	21	0.00
25/08/2017	9.5	22	0.00
26/08/2017	12	23	0.00
27/08/2017	12	24.5	0.00
28/08/2017	11.5	24.5	0.00
29/08/2017	13.5	24	0.00
30/08/2017	11	16.5	3.15
31/08/2017	7	19.5	0.15
01/09/2017	8	19.5	0.00
02/09/2017	9	21	0.00
03/09/2017	9.5	14.5	4.00
04/09/2017	14.5	19	3.50
05/09/2017	14	18.5	1.00
06/09/2017	11	17.5	0.00
07/09/2017	11	19	0.50
08/09/2017	16.5	19	0.00

Site 2 (Saltham West)

** High temp as it was in the van before being put out on this day (drilling day)

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
25/05/2017	16.0	42.5**	No data
26/05/2017	13.0	26.0	6.5*
27/05/2017	12.0	20.0	No data
28/05/2017	11.0	22.0	No data
29/05/2017	13.0	18.5	No data
30/05/2017	13.5	20.0	No data
31/05/2017	12.0	21.5	No data
01/06/2017	10.5	22.5	No data
02/06/2017	12.0	25.5	No data
03/06/2017	13.5	21.5	No data
04/06/2017	9.0	20.0	No data
05/06/2017	11.5	19.5	No data
06/06/2017	11.0	16.5	No data
07/06/2017	11.5	18.0	No data

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
08/06/2017	13.5	18.0	No data
09/06/2017	12.0	18.5	No data
10/06/2017	13.5	21.0	No data
11/06/2017	14.0	20.0	No data
12/06/2017	12.5	20.0	No data
13/06/2017	8.5	22.0	No data
14/06/2017	11.0	25.0	No data
15/06/2017	12.5	22.5	No data
16/06/2017	12.0	23.0	No data
17/06/2017	12.5	27.0	No data
18/06/2017	14.5	29.0	No data
19/06/2017	15.5	31.0	No data
20/06/2017	15.5	30.5	No data
21/06/2017	18.0	29.5	No data
22/06/2017	16.0	25.0	No data
23/06/2017	13.5	23.0	No data
24/06/2017	16.0	19.5	No data
25/06/2017	14.5	22.5	No data
26/06/2017	12.0	24.0	No data
27/06/2017	13.5	22.5	No data
28/06/2017	14.0	17.5	No data
29/06/2017	12.0	18.5	No data
30/06/2017	13.5	22.5	No data
01/07/2017	15.0	23.5	No data
02/07/2017	16.0	27.0	No data
03/07/2017	14.5	23.5	No data
04/07/2017	12.5	24.5	No data
05/07/2017	12.5	27.5	No data
06/07/2017	16.5	30.0	No data
07/07/2017	14.5	27.5	No data
08/07/2017	15.5	27.5	No data
09/07/2017	14.5	29.5	No data
10/07/2017	14.0	27.5	No data
11/07/2017	14.5	18.5	No data
12/07/2017	15.0	23.0	No data
13/07/2017	14.5	24.0	No data
14/07/2017	13.5	23.0	No data
15/07/2017	13.5	22.5	No data
16/07/2017	17.0	27.0	No data
17/07/2017	16.5	29.0	No data
18/07/2017	15.5	30.0	No data
19/07/2017	17.5	20.5	No data
20/07/2017	14.5	21.0	No data
21/07/2017	13.5	21.5	No data

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
22/07/2017	13.5	18.5	No data
23/07/2017	11.5	19.0	No data
24/07/2017	13.0	19.0	No data
25/07/2017	12.5	22.5	No data
26/07/2017	14.0	20.0	3.24
27/07/2017	14.0	21.0	0.00
28/07/2017	15.0	20.0	1.24
29/07/2017	15.0	18.5	6.00
30/07/2017	15.0	20.0	4.00
31/07/2017	14.5	22.0	0.00
01/08/2017	12.0	22.0	0.00
02/08/2017	15.5	17.5	4.15
03/08/2017	15.5	19.5	3.75
04/08/2017	15.0	21.0	0.60
05/08/2017	13.5	21.0	0.75
06/08/2017	10.5	20.5	0.00
07/08/2017	14.0	20.5	0.00
08/08/2017	12.5	19.0	0.00
09/08/2017	12.5	17.0	13.5
10/08/2017	12.0	17.5	0.00
11/08/2017	10.0	19.5	0.75
12/08/2017	15.5	20.0	0.00
13/08/2017	12.5	20.5	0.00
14/08/2017	10.0	21.0	0.00
15/08/2017	13.5	22.0	0.00
16/08/2017	11.0	20.5	0.00
17/08/2017	16.5	20.5	2.15
18/08/2017	14.5	20.0	0.00
19/08/2017	12.5	18.0	1.15
20/08/2017	10.0	20.0	7.15
21/08/2017	15.0	20.0	0.55
22/08/2017	17.0	20.0	0.00
23/08/2017	16.5	20.0	0.00
24/08/2017	12.0	19.5	0.00
25/08/2017	10.5	20.0	0.00
26/08/2017	12.5	21.0	0.00
27/08/2017	12.0	22.5	0.00
28/08/2017	13.0	22.5	0.00
29/08/2017	14.0	22.5	0.00
30/08/2017	12.0	17.0	3.15
31/08/2017	8.0	20.0	0.15
01/09/2017	12.5	33.5	0.00
02/09/2017	19.0	23.5	0.00
03/09/2017	18.0	21.0	4.00

Date	Temperature °C (minimum)	Temperature °C (maximum)	Rainfall (mm)
04/09/2017	17.5	25.0	3.50

d. Trial plans and relevant photos of crop damage and overviews of site

Site 1 Trial plan – Milepond

25m															
		1.5m		1.65m											
DISCARD															
Plot		1	2	3	4	5		6	7	8	9	10			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	1	1	1	1	1	DISCARD	DISCARD
Treatment			1	18	25	17	8		11	10	5	22	13		
Plot		11	12	13	14	15		16	17	18	19	20			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	1	1	1	1	1	DISCARD	DISCARD
Treatment			19	24	3	4	20		21	6	12	2	16		
Plot		21	22	23	24	25		26	27	28	29	30			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD
Treatment			23	14	15	9	7		9	4	11	12	19		
Plot		31	32	33	34	35		36	37	38	39	40			
Block	DISCARD	DISCARD	2	2	2	2	2	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD
Treatment			22	17	10	23	14		25	2	7	8	16		
Plot		41	42	43	44	45		46	47	48	49	50			
Block	DISCARD	DISCARD	2	2	2	2	2	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD
Treatment			3	6	1	21	13		18	5	15	20	24		
Plot		51	52	53	54	55		56	57	58	59	60			
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	3	3	3	3	3	DISCARD	DISCARD
Treatment			19	8	18	16	17		12	23	10	2	13		
Plot		61	62	63	64	65		66	67	68	69	70			
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	3	3	3	3	3	DISCARD	DISCARD
Treatment			21	1	11	22	9		4	6	14	5	3		
Plot		71	72	73	74	75									
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	Wing-P	Wing-P	Wing-P			DISCARD	
Treatment			24	20	7	25	15								
DISCARD															

Site 2 Trial plan – Saltham West

25m																
			1.5m		1.65m											
DISCARD																
Plot			1	2	3	4	5		6	7	8	9	10			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	1	1	1	1	1	DISCARD	DISCARD	
Treatment			25	1	12	9	18		5	8	6	10	22			
Plot			11	12	13	14	15		16	17	18	19	20			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	1	1	1	1	1	DISCARD	DISCARD	
Treatment			20	24	13	23	19		16	2	17	21	3			
Plot			21	22	23	24	25		26	27	28	29	30			
Block	DISCARD	DISCARD	1	1	1	1	1	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD	
Treatment			7	15	4	14	11		25	11	22	1	8			
Plot			31	32	33	34	35		36	37	38	39	40			
Block	DISCARD	DISCARD	2	2	2	2	2	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD	
Treatment			20	2	18	6	16		10	12	13	4	15			
Plot			41	42	43	44	45		46	47	48	49	50			
Block	DISCARD	DISCARD	2	2	2	2	2	TRAMLINE	2	2	2	2	2	DISCARD	DISCARD	
Treatment			5	21	24	9	17		23	14	7	3	19			
Plot			51	52	53	54	55		56	57	58	59	60			
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	3	3	3	3	3	DISCARD	DISCARD	
Treatment			19	20	25	7	13		23	12	17	11	22			
Plot			61	62	63	64	65		66	67	68	69	70			
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	3	3	3	3	3	DISCARD	DISCARD	
Treatment			6	21	10	5	4		3	8	16	2	18			
Plot			71	72	73	74	75									
Block	DISCARD	DISCARD	3	3	3	3	3	TRAMLINE	Wing-P	Wing-P	Wing-P					
Treatment			14	24	1	9	15									
DISCARD																

Site 1 Photo of trial site - Milepond



Site 2 Photo of trial site – Saltham West



Photos to illustrate crop damage

		
Stunting from Bonalan (scored 6)	Stunting from Stomp Aqua + 9947 (Scored 7, so just under acceptable)	Standard pre-emergence – Stomp Aqua showing no crop effect – score 9



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
Biologicals and Semiochemicals
Stored Crops**

Date of issue: 16 December 2016

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Expiry date: 17 March 2018

Signature

Authorised signatory

Certification Number

ORETO 374



Chemicals Regulation Division



Department of
**Agriculture and
Rural Development**