SCEPTREPLUS

Final Trial Report

Trial code:	2018. SP18
Title:	AHDB SCEPTREplus narcissus post-cropping season herbicide screen
Crop:	Bulbs & Outdoor Flowers (Narcissus)
Target:	General broadleaf weeds and grasses, 3WEEDT PP1/088(3) Weeds in flower bulbs and flower tubers
Lead researcher:	Angela Huckle
Organisation:	RSK ADAS
Period:	1st March 2018 – 31st April 2019
Report date:	30th June 2019
Report author:	Angela Huckle Emily Lawrence
ORETO Number: (certificate should be attached)	ORETO 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

24th July 2019 ……
Date Authors signature

Trial Summary

Introduction

Post-cropping is an important time for weed control in narcissus; when post-harvest weed control is neglected, significant reductions in flower yields can be seen the year following harvest. However, ongoing changes in herbicide authorisation have limited the actives available to growers for use in narcissus crops. The risk posed by a narrower list of available actives is that weeds may build resistance to them, with the consequent reduction in their efficacy compounding the issue of loss of weed control. Also, while the currently available ingredients list offers some safe and effective products, gaps in the weed control spectrum remain.

The search for new actives for weed control in narcissus has been driven most notably by the recent loss of linuron. This active has been a key component of narcissus herbicide programmes, used widely by commercial growers, including in tank mixes to complement the weed control spectrums of other actives. Since linuron's withdrawal in June 2018, finding new actives offering similar efficacy has been a priority for the sector.

The objective of this trial was to identify crop safe herbicides for post-harvest weed control in narcissus, aiming to expand the options available to growers, and avoiding the risk of resistance to the available actives developing. This work included both approved and potential new actives, which may be used to supplement the currently available chemistry, including offering a replacement for linuron.

Methods

The trial was sited at a commercial narcissus grower in Lincolnshire. The crop (var. Tamsyn) was planted in August 2016, with the first trial treatment applied on March 9th 2018. The treatments were applied as a foliar spray, with a 2m boom and an Oxford Precision Sprayer knapsack at 200 L/ha water volume, with plots 2m wide by 6m long. Most Application A treatments were applied on 9th March 2018, however, the application of treatments 7 and 8 was delayed by two days, while a technical fault with the spray equipment was resolved. The trial received a further herbicide treatment (Application B); a standard spray across the whole trial area while crop dormant.

A fully randomised block design was used, with four replicates of eight treatments—including an untreated control for comparison—totaling 32 plots. Phytotoxicity was assessed; the overall quality of the crop in treated and untreated plots were compared on four occasions. Plots were also assessed for weed control on two occasions, with species present and population levels recorded. In addition, aspects of crop physiology were recorded, namely emergence rates, plant height and bud counts.

Results

Table 1. Mean crop phytotoxicity scores for various herbicide treatments. Scored from 0 to 10; 0 = complete crop death, 10 = no quality reduction, scores >8 deemed commercially acceptable quality.

Treatment	Assessment timing			
	26th Mar (App. A + 2 weeks)	**6th Apr** (App. A + 4 weeks)	**20th Apr** (App. A + 6 weeks)	**4th May** (App. A + 8 weeks)
Untreated	9.5	9.7	9.0	10.0
AHDB9921	7.0	7.0	7.5	8.0
Kerb Flo + Stomp Aqua	10.0	10.0	9.0	10.0

Treatment	Assessment timing			
	26th Mar (App. A + 2 weeks)	**6th Apr** (App. A + 4 weeks)	**20th Apr** (App. A + 6 weeks)	**4th May** (App. A + 8 weeks)
Kerb Flo + Stomp Aqua + AHDB9987	9.7	9.7	9.0	10.0
Lector + Wing-P	9.5	9.3	9.0	10.0
Lector + Wing-P Centium 360 CS	9.5	9.3	9.0	10.0
Butryflow + Stomp Aqua	10.0	9.7	9.0	10.0
Butryflow + Stomp Aqua + AHDB9987	9.0	9.0	9.0	10.0
F prob. value	<0.001	<0.001	<0.001	NS
d.f.	21	21	21	21
S.E.D.	0.263	0.350	0.250	-
L.S.D.	0.547	0.729	0.520	-

Conclusions

- All treatments trialed appeared commercially acceptable in terms of crop safety by the conclusion of the trial.
- Poor weed emergence at trial site prevented generation of informative efficacy data—future testing would be valuable.

Take Home Message

All treatments tested appear suitable to take forward to further trials, as well as warranting investigation for EAMU authorisation. Further assessment to examine treatment efficacy is recommended.

Objectives

To assess a range of herbicides for their safety and efficacy when applied immediately post-harvest to a crop of narcissus.

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
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 PP 1/214(4)	Principles of acceptable efficacy	None
EPPO PP 1/224(2)	Principles of efficacy evaluation for minor uses	None

There were no deviations from EPPO guidance.

Test site

Item	Details
Location address	Field: Hall Drain (Jack Buck Farms) Off Carrington Rd Moulton Seas End Spalding PE12 6LB Grid reference: TF 31339 26715
Crop	Narcissus
Cultivar	Tamsyn
Soil or substrate type	Loamy and clayey soils of coastal flats with naturally high groundwater.
Agronomic practice	N/A
Prior history of site	N/A

Trial design

Item	Details
Trial design:	Fully randomised block
Number of replicates:	4
Plot size:	2m x 6m
Number of plants per plot:	Approx. 420
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 (g/L)	Formulation type
N/A	propyzamide	Kerb Flo	3A2888R301	400.00	Suspension Concentrate
N/A	pendimethalin	Stomp Aqua	ST10630416	455.00	Capsule Suspension
AHDB9987	N/D	N/D	N/D	N/D	N/D

AHDB code	Active substance	Product name/ manufacturers code	Formulation batch number	Content of active substance in product (g/L)	Formulation type
N/A	florasulam	Lector	N/K	50.00	Suspension Concentrate
N/A	clomazone	Centium 360 CS	N/K	360.00	Capsule Suspension
N/A	bromoxynil	Butryflow	309021589	401.58	Suspension Concentrate
AHDB9921	N/D	N/D	N/D	N/D	N/D
N/A	dimethenamid-P	Wing-P	0014243535	212.50	Emulsifiable Concentrate
N/A	glyphosate	Roundup PowerMax	AXJ272910O	72% w/w	Water Soluble Granule
N/A	metribuzin	Sencorex Flow	EM4H004177	600	Suspension Concentrate

Application schedule

Treatment number	Treatment: product name or AHDB code	Rate of active substance (ml or g a.s./ha)	Rate of product (L/ha)	Application code
1	Untreated	-	-	-
2	AHDB9921	4.69 3.75	0.75	A
3*	Kerb Flo + Stomp Aqua	1200.00 1319.50	3.00 2.90	A
4	Kerb Flo + Stomp Aqua + AHDB9987	1200.00 1319.50 1200.00	3.00 2.90 2.00	A
5	Lector + Wing-P	5.00 743.75	0.10 3.50	A
6	Lector + Wing-P Centium 360 CS	5.00 743.75 90.00	0.10 3.50 0.25	A
7	Butryflow + Stomp Aqua	401.58 1319.50	1.00 2.90	A
8	Butryflow + Stomp Aqua + AHDB9987	401.58 1319.50 1200.00	1.00 2.90 2.00	A

* Grower standard.

(standard)	Sencorex Flow + Stomp Aqua + Roundup PowerMax	150.00 1319.50 1800.00	0.25 2.90 3.00	B

Application details

	Application A (Treatment 2-6)	Application A (cont.) (Treatment 7-8)	Application B*
Application date	09/03/2018	11/03/2018	05/11/2018
Time of day	11:20-13:00	11:50-12:05	10:30-11:35
Crop growth stage (Max, min average BBCH)	BBCH 66 (flowering)	BBCH 66 (flowering)	BBCH 00 (dormant bulb)

Crop height (cm)	40	40	N/A
Crop coverage (%)	45	45	N/A
Application Method	spray	spray	spray
Application Placement	foliar	foliar	soil
Application equipment	Oxford Precision Sprayer (knapsack)	Oxford Precision Sprayer (knapsack)	Oxford Precision Sprayer (knapsack)
Nozzle pressure	2.4 bar	2.4 bar	2.4 bar
Nozzle type	flat fan	flat fan	flat fan
Nozzle size	02F110	02F110	02F110
Application water volume/ha	200	200	200
Temperature of air (°C)	8.4-9.1	11.4	12.0-12.9
Relative humidity (%)	82.3-90.4	82.4	78.2-88.1
Wind speed range (mph)	4.9-5.2	5.4	7.2-7.4
Dew presence (Y/N)	Y	Y	Y
Temperature of soil – 10 cm (°C)	4.0	4.0	N/K
Wetness of soil – 2-5 cm	Wet	Wet	Damp
Cloud cover (%)	50	50	5

* Standard applied across whole trial area.

Untreated levels of pests/pathogens at application and through the assessment period

Common name	**Scientific Name**	**EPPO Code**	**Infection level pre-application/ start of assessment period**	**Infection level mid-assessment period** (6 weeks)
Broad leaved weeds and grasses	*N/A*	3WEEDT	<1% *(untreated average)*	<1% *(untreated average)*

Assessment details

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)**
26/03/2018	17	65	Phytotoxicity Weeds	Crop quality compared to UTC; visual comparison, scored 0-9. Weed cover estimate (whole plot score, %). Present species recorded.
06/04/2018	28	66	Phytotoxicity	*As above.*
20/04/2018	42	67	Phytotoxicity	*As above.*

			Weeds	*As above.*
04/05/2018	56	92	Phytotoxicity	*As above.*
11/01/2019	308	51	Emergence Budding	Emergence rate estimate (whole plot score, %). Average leaf height recorded. Count of buds per metre.
23/01/2019	320	53	Emergence Budding	*As above.* *As above.*
06/02/2019	334	55	Budding	*As above.*

* DA – days after Application A

Statistical analysis

The trial design was a fully randomised block design, with four replicates of eight treatments, including an untreated control.

All data were analysed by ANOVA using Genstat 16.0 by Emily Lawrence at RSK ADAS Ltd.

Results

Phytotoxicity

The results for the mean phytotoxicity per treatment are presented in Table 2 and Figure 1.

Phytotoxicity was recorded using the following scale:

Crop phytotoxicity score	Equivalent to crop damage (% quality reduction)
0	100%, complete crop kill
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	0%, no damage

*8 = minimum level of acceptable quality, i.e. damage unlikely to reduce yield, and acceptable to grower.

Plots treated with AHDB9921 showed a loss of foliar turgor at the earlier assessments, though this effect was transient and the crop appeared to recover. At eight weeks after Application A treatment, all treatments appeared crop safe. While differences between treatments at earlier assessment timings were statistically significant, the commercial significance of these results is minimal, with scores marginal and the eventual recovery of the crop from any minor effects.

Table 2. Mean crop phytotoxicity scores for various herbicide treatments. Scored from 0 to 10; 0 = complete crop death, 10 = no quality reduction, scores >8 deemed commercially acceptable quality.

Treatment	Assessment timing			
	26th Mar (App. A + 2 weeks)	**6th Apr** (App. A + 4 weeks)	**20th Apr** (App. A + 6 weeks)	**4th May** (App. A + 8 weeks)
Untreated	9.5	9.7	9.0	10.0
AHDB9921	7.0	7.0	7.5	8.0
Kerb Flo + Stomp Aqua	10.0	10.0	9.0	10.0
Kerb Flo + Stomp Aqua + AHDB9987	9.7	9.7	9.0	10.0
Lector + Wing-P	9.5	9.3	9.0	10.0
Lector + Wing-P Centium 360 CS	9.5	9.3	9.0	10.0
Butryflow + Stomp Aqua	10.0	9.7	9.0	10.0
Butryflow + Stomp Aqua + AHDB9987	9.0	9.0	9.0	10.0
F prob. value	<0.001	<0.001	<0.001	NS
d.f.	21	21	21	21
S.E.D.	0.263	0.350	0.250	-
L.S.D.	0.547	0.729	0.520	-

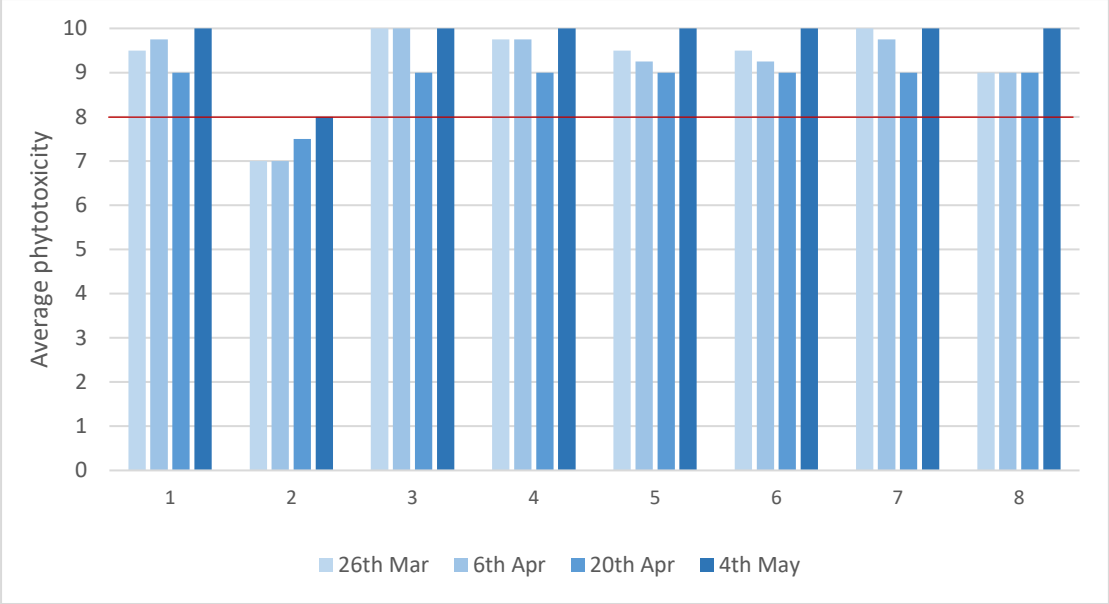


Figure 1. Mean phytotoxicity scores for narcissus treated with various herbicides. Scores of 8 or above deemed acceptable quality (as indicated by red line).

Crop physiology

The results for the mean percentage emergence and leaf height per treatment are presented in Table 3, and bud counts presented in Table 4. During this trial, no significant differences were found between herbicide treatments in terms of impact on crop quality, based on comparison of % emergence, leaf height, and bud count.

Table 3. Mean % emergence and leaf heights for various herbicide treatments.

Treatment	Assessment timing			
	Emergence (%)		Leaf height	
	11th Jan	23rd Jan	11th Jan	23rd Jan
Untreated	81.3	91.3	11.2	15.9
AHDB9921	75.0	90.0	11.1	17.1
Kerb Flo + Stomp Aqua	65.5	87.5	10.9	15.8
Kerb Flo + Stomp Aqua + AHDB9987	77.5	86.3	11.2	16.9
Lector + Wing-P	80.0	92.5	11.2	15.1
Lector + Wing-P Centium 360 CS	81.3	83.8	10.3	15.8
Butryflow + Stomp Aqua	80.0	86.3	10.4	15.0
Butryflow + Stomp Aqua + AHDB9987	81.3	88.8	10.0	15.8
F prob. value	0.547	0.447	0.188	0.324
d.f.	21	21	21	21

S.E.D.	8.206	0.674	3.242	0.936
L.S.D.	17.066	1.402	6.742	1.946

Table 4. Mean bud counts for various herbicide treatments.

Treatment	**Assessment timing**		
	11th Jan	**23rd Jan**	**6th Feb**
Untreated	33.8	79.3	110.0
AHDB9921	30.8	77.8	95.5
Kerb Flo + Stomp Aqua	29.0	76.8	104.3
Kerb Flo + Stomp Aqua + AHDB9987	28.3	65.0	106.8
Lector + Wing-P	41.3	69.3	98.8
Lector + Wing-P Centium 360 CS	29.3	75.8	94.0
Butryflow + Stomp Aqua	31.5	76.5	99.8
Butryflow + Stomp Aqua + AHDB9987	33.3	78.3	110.8
F prob. value	0.501	0.220	0.352
d.f.	21	21	21
S.E.D.	6.118	5.763	8.330
L.S.D.	12.724	11.986	17.324

Weed control

The results for the mean percentage weed cover values per treatment are presented in Table 5. During the trial period, there was very little weed emergence in the plots—no significant differences in efficacy could be observed between treatments.

Table 5. Mean percentage weed cover values (transformed) for various herbicide treatments.

Trt. No.	**Mean weed cover (%)**			
	26th Mar (App. A + 2 weeks)		**20th April** (App. A + 6 weeks)	
	Ang.	**Back-trans**	**Ang.**	**Back-trans**
Untreated	5.09	0.78	5.09	0.78
AHDB9921	3.09	0.29	3.09	0.29
Kerb Flo + Stomp Aqua	4.30	0.56	4.04	0.49

Trt. No.	Mean weed cover (%)			
	26th Mar (App. A + 2 weeks)		20th April (App. A + 6 weeks)	
	Ang.	Back-trans	Ang.	Back-trans
Kerb Flo + Stomp Aqua + AHDB9987	3.70	0.42	3.78	0.44
Lector + Wing-P	3.43	0.36	3.17	0.31
Lector + Wing-P Centium 360 CS	2.00	0.12	2.00	0.12
Butryflow + Stomp Aqua	2.48	0.18	3.17	0.31
Butryflow + Stomp Aqua + AHDB9987	0.83	0.02	0.83	0.02
p value		0.242		0.316
d.f.		21		21
L.S.D.		3.293		3.381

Conclusions

- All treatments trialed appeared commercially acceptable in terms of crop safety by the conclusion of the trial.
- Poor weed emergence at trial site prevented generation of informative efficacy data—future testing would be valuable.

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 too to the trial's host grower—Julian Perowne of Jack Buck (Farms) Ltd.—for provision of the site and crop, and his technical input.

Appendix

a. Crop diary (events related to growing crop)

Field name:	HALL DRAIN
Trial duration:	09/03/2018–06/02/2019

Crop	Cultivar	Planting date	Row width (m)
Narcissus	Tamsyn	17/08/2016	~0.5m

Previous cropping

Year	Crop
2017	Bulbs
2016	Peas
2015	Wheat

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

Date	Product	Application rate
07/01/2019	Nitram (34.5%)	125 kg/ha

Pesticides applied to trial area

Date	Product	Rate
16/11/2018	Shotput Intruder Clinic Up	0.5 kg/ha 2.0 L/ha 4.0 L/ha

Details of irrigation regime

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

b. Table showing sequence of events by date – this relates to treatments and assessments

Date	Event
17/08/2016	Field planted.
09/03/2018	Trial marked out. Application A treatments applied (treatments 1 to 6).
11/03/2018	Application A treatments applied (treatments 7 and 8).
26/03/2018	Assessment: phytotoxicity, weed cover + species presence.
06/04/2018	Assessment: phytotoxicity.
20/04/2018	Assessment: phytotoxicity, weed cover + species presence.
04/05/2018	Assessment: phytotoxicity.
05/11/2018	Application B treatments applied (standard across trial).
11/01/2019	Assessment: emergence, leaf heights, bud counts.
23/01/2019	Assessment: emergence, leaf heights, bud counts.
06/02/2019	Assessment: bud count.

c. Climatological data during study period.

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
09/03/2018	5.5	10.0	83.8
10/03/2018	6.0	13.0	94.6
11/03/2018	4.0	11.5	93.6
12/03/2018	5.0	8.0	97.0
13/03/2018	3.5	10.5	93.6
14/03/2018	0.5	11.5	89.0
15/03/2018	6.0	9.5	91.7
16/03/2018	4.0	13.0	94.4

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
17/03/2018	-1.0	3.5	84.8
18/03/2018	-1.5	0.5	82.5
19/03/2018	-0.5	5.0	77.0
20/03/2018	0.0	8.5	86.5
21/03/2018	-2.0	11.0	79.4
22/03/2018	6.0	13.5	77.6
23/03/2018	5.0	12.0	77.5
24/03/2018	4.0	11.0	88.7
25/03/2018	3.0	14.0	83.5
26/03/2018	0.0	13.0	80.4
27/03/2018	4.0	10.0	92.5
28/03/2018	2.0	7.0	95.1
29/03/2018	-0.5	10.5	93.6
30/03/2018	3.0	10.5	96.7
31/03/2018	4.0	7.0	99.4
01/04/2018	3.0	6.5	98.6
02/04/2018	3.0	10.0	99.8
03/04/2018	6.0	13.5	95.2
04/04/2018	5.0	13.0	93.7
05/04/2018	2.5	12.0	80.8
06/04/2018	3.0	12.0	85.7
07/04/2018	4.0	16.5	91.1
08/04/2018	7.0	10.0	97.1
09/04/2018	6.5	10.0	99.6
10/04/2018	6.0	11.0	100.4
11/04/2018	5.5	8.0	101.1
12/04/2018	6.0	7.0	101.6
13/04/2018	6.0	10.0	100.8
14/04/2018	7.5	16.0	93.1
15/04/2018	6.5	15.5	95.2
16/04/2018	7.0	15.5	91.1
17/04/2018	8.5	17.5	83.3
18/04/2018	10.5	22.5	83.2
19/04/2018	7.5	27.0	83.4
20/04/2018	10.0	23.0	86.2
21/04/2018	8.0	21.5	83.8
22/04/2018	11.0	22.5	85.4
23/04/2018	7.5	15.5	80.7
24/04/2018	10.0	13.0	90.0
25/04/2018	6.5	12.5	94.7
26/04/2018	5.0	14.0	88.4
27/04/2018	5.5	8.5	97.0
28/04/2018	6.0	8.0	99.8
29/04/2018	6.0	7.5	95.7

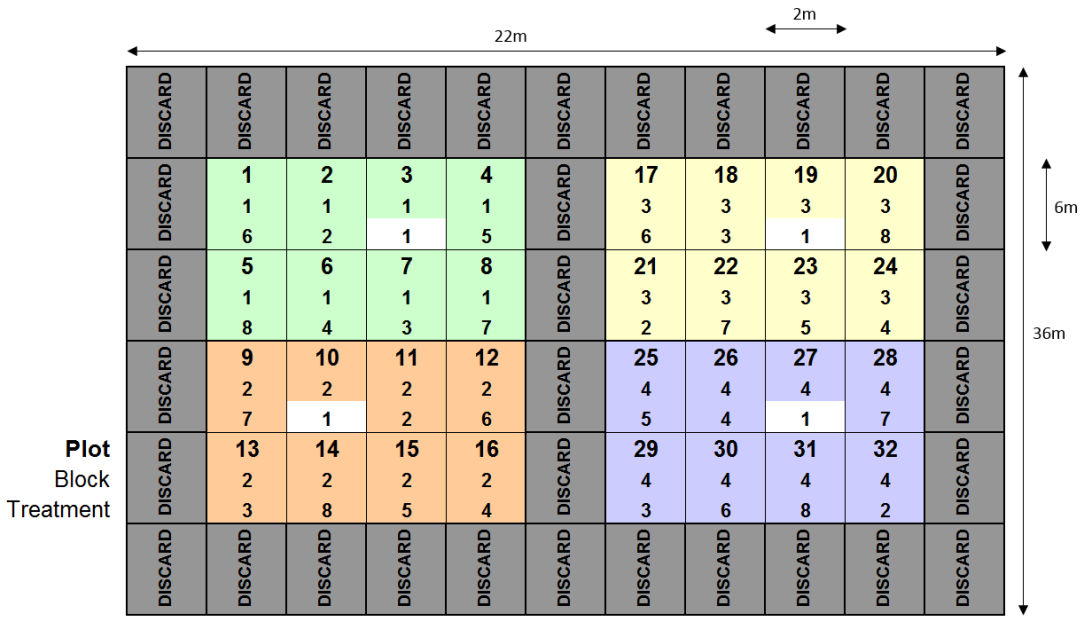
Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
30/04/2018	4.5	9.5	86.3
01/05/2018	1.5	17.0	80.1
02/05/2018	5.5	12.5	91.1
03/05/2018	3.5	16.5	87.2
04/05/2018	6.0	18.0	89.2
05/05/2018	7.0	23.0	85.1
06/05/2018	7.0	22.5	84.7
07/05/2018	8.5	25.5	82.9
08/05/2018	9.0	26.5	79.8
09/05/2018	9.0	23.0	77.4
10/05/2018	8.0	17.5	80.1
11/05/2018	6.5	20.0	75.4
12/05/2018	9.0	17.5	88.1
13/05/2018	9.5	16.5	92.8
14/05/2018	6.5	20.5	79.8
15/05/2018	8.0	22.5	77.3
16/05/2018	7.5	13.5	80.3
17/05/2018	4.5	18.0	80.1
18/05/2018	4.5	20.5	77.9
19/05/2018	5.0	22.5	85.8
~			
05/11/2018	7.5	14.0	90.3
06/11/2018	7.0	14.5	96.0
07/11/2018	8.0	14.5	92.3
08/11/2018	4.5	13.5	91.0
09/11/2018	4.5	11.0	95.2
10/11/2018	7.5	13.5	94.9
11/11/2018	6.0	12.0	95.0
12/11/2018	6.5	13.5	93.3
13/11/2018	6.5	12.5	91.0
14/11/2018	6.0	13.5	92.4
15/11/2018	6.0	14.0	96.3
16/11/2018	8.5	10.5	99.9
17/11/2018	5.5	11.5	94.3
18/11/2018	4.5	10.5	91.8
19/11/2018	5.0	8.0	89.0
20/11/2018	4.0	6.0	87.6
21/11/2018	0.0	6.5	94.1
22/11/2018	-1.5	6.0	96.8
23/11/2018	1.5	8.0	96.6
24/11/2018	4.5	8.5	94.2
25/11/2018	2.5	8.5	95.0
26/11/2018	3.5	8.0	95.9
27/11/2018	2.5	7.5	96.3

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
28/11/2018	7.0	13.0	94.8
29/11/2018	8.0	13.5	89.3
30/11/2018	5.5	10.0	87.8
01/12/2018	5.0	11.0	93.3
02/12/2018	9.5	13.5	91.1
03/12/2018	2.0	12.0	90.8
04/12/2018	-0.5	6.5	95.8
05/12/2018	3.0	10.5	97.7
06/12/2018	9.5	12.0	93.5
07/12/2018	5.0	12.5	88.4
08/12/2018	6.0	10.5	83.5
09/12/2018	3.0	8.5	85.6
10/12/2018	2.5	7.5	93.6
11/12/2018	0.0	6.0	96.0
12/12/2018	1.0	7.0	87.7
13/12/2018	1.0	6.0	85.1
14/12/2018	1.0	4.0	87.5
15/12/2018	0.0	3.5	86.9
16/12/2018	1.5	7.0	93.2
17/12/2018	2.5	8.0	92.7
18/12/2018	6.0	9.0	91.1
19/12/2018	3.5	8.5	93.7
20/12/2018	3.5	9.0	91.2
21/12/2018	6.0	10.0	94.1
22/12/2018	6.0	10.0	89.1
23/12/2018	4.5	6.5	94.9
24/12/2018	-0.5	5.5	95.9
25/12/2018	-0.5	6.5	97.9
26/12/2018	6.5	9.0	96.1
27/12/2018	7.0	8.5	95.9
28/12/2018	4.0	9.0	92.8
29/12/2018	3.5	12.0	91.1
30/12/2018	3.5	11.5	93.6
31/12/2018	5.5	10.0	88.9
01/01/2019	4.0	10.0	85.0
02/01/2019	1.5	5.5	88.5
03/01/2019	-1.0	4.5	88.3
04/01/2019	-1.0	3.5	89.4
05/01/2019	3.5	5.0	88.0
06/01/2019	4.0	9.0	90.6
07/01/2019	5.5	10.0	88.1
08/01/2019	4.0	8.0	80.2
09/01/2019	1.5	5.5	88.5
10/01/2019	0.5	6.5	91.4

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
11/01/2019	5.0	7.5	88.5
12/01/2019	6.0	9.5	87.9
13/01/2019	6.5	11.0	82.0
14/01/2019	3.0	8.0	86.8
15/01/2019	2.0	10.0	86.6
16/01/2019	2.0	9.5	89.2
17/01/2019	0.0	4.0	84.5
18/01/2019	-2.5	2.5	88.0
19/01/2019	0.5	4.5	86.5
20/01/2019	-4.0	5.5	88.9
21/01/2019	1.0	7.0	87.8
22/01/2019	0.0	5.5	89.7
23/01/2019	-3.5	3.0	91.9
24/01/2019	-4.5	3.0	93.5
25/01/2019	-0.5	11.0	93.0
26/01/2019	6.0	9.5	87.7
27/01/2019	2.5	6.0	81.5
28/01/2019	-2.0	4.5	78.6
29/01/2019	-2.0	3.5	88.1
30/01/2019	-1.5	4.5	89.0
31/01/2019	-4.5	1.5	91.4
01/02/2019	0.0	5.5	84.8
02/02/2019	-1.0	3.0	89.7
03/02/2019	-5.0	5.5	83.5
04/02/2019	1.5	9.0	88.1
05/02/2019	-2.5	7.5	92.4
06/02/2019	3.5	10.5	90.6
07/02/2019	4.0	8.0	85.8
08/02/2019	4.5	11.0	88.4
09/02/2019	4.5	10.0	77.7
10/02/2019	0.5	7.0	88.4
11/02/2019	0.0	9.0	86.6
12/02/2019	-1.0	9.0	89.4
13/02/2019	4.5	12.5	85.8
14/02/2019	0.5	11.5	86.7
15/02/2019	-1.5	12.0	86.3
16/02/2019	3.0	12.5	87.1
17/02/2019	5.0	13.5	84.2
18/02/2019	4.5	10.5	89.3
19/02/2019	3.0	10.5	84.2
20/02/2019	6.5	12.5	82.3
21/02/2019	6.5	16.0	84.5
22/02/2019	2.0	14.0	87.3
23/02/2019	6.0	14.5	89.5

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
24/02/2019	2.0	14.5	85.6
25/02/2019	-1.5	15.0	81.4
26/02/2019	-1.0	15.0	80.9
27/02/2019	-0.5	16.0	82.5
28/02/2019	0.5	11.5	87.5
01/03/2019	6.0	9.5	86.9
02/03/2019	5.5	14.0	83.8
03/03/2019	6.5	11.5	86.4
04/03/2019	3.5	10.0	76.8
05/03/2019	1.0	11.5	80.6
06/03/2019	7.5	12.0	89.8
07/03/2019	4.0	9.0	84.2
08/03/2019	-0.5	9.0	86.0
09/03/2019	5.5	10.5	78.8
10/03/2019	2.5	8.0	84.7
11/03/2019	2.0	9.5	75.8
12/03/2019	3.5	9.5	87.3
13/03/2019	4.0	10.0	77.7
14/03/2019	6.0	12.0	75.6
15/03/2019	7.0	13.5	76.2
16/03/2019	6.0	11.5	84.2
17/03/2019	2.5	8.5	80.6
18/03/2019	2.0	13.0	83.4
19/03/2019	3.5	13.0	84.6
20/03/2019	6.5	15.5	85.3
21/03/2019	6.0	19.5	82.9

d. Trial design.



e. 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

HSE
Chemicals Regulation Division

Department of Agriculture and Rural Development