SCEPTREPLUS

Final Trial Report

Trial code:	2018. SP18
Title:	AHDB SCEPTREplus narcissus dormant 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 October 2017 – 31st April 2018
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

The limited range of herbicides available to narcissus growers for safe application during the dormant season leaves gaps in the weed control spectrum. At the time of trial, only eleven products were approved for autumn pre-emergence use on narcissus, with several offering only limited control. While narcissus is a small sector, this crop is highly profitable, so the control of weeds—which host pests and disease, interfere with harvest, and reduce yield and quality—is of high importance to the industry.

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 safe herbicides for weed control in dormant narcissus crops, 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 2017, three months before the first trial treatment was applied on November 7th of that year. The treatments were applied with a 2m boom and an Oxford Precision Sprayer knapsack at 200 L/ha water volume, with plots 2m wide by 6m long. The initial treatment (Application A) was applied over the still dormant crop, with the follow-up treatment (Application B) applied over early emergent leaves.

A fully randomised block design was used, with four replicates of fifteen treatments—including an untreated control for comparison—totaling 60 plots. Phytotoxicity was assessed; the overall quality of the crop in treated and untreated plots was compared on four occasions—twice after each of the two treatment applications. Plots were also assessed for weed control on three occasions, with present species and population levels recorded. In addition, aspects of crop physiology were recorded, namely plant height, and counts of buds and flowers.

Results

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

Treatment	Assessment timing					
	19th Dec (App. A + 6 weeks)	**10th Jan** (App. A + 9 weeks)	**23rd Jan** (App. B + 2 weeks)	**23rd Feb** (App. B + 6 weeks)	**28th Mar** (harvest)	
					Foliage	Flowers
Untreated	8.5	8.8	9.0	10.0	9.5	10.0
Senc. Flow + Stomp Aq.	8.0	9.0	9.5	8.5	8.8	9.8
Senc. Flow + Intruder	8.5	8.8	9.8	8.0	8.3	8.5
Senc. Flow + metobromuron	8.5	8.5	8.5	8.5	7.3	9.3

Senc. Flow + metobromuron	7.8	9.5	9.5	8.3	8.5	7.8
Senc. Flow + metobromuron	8.0	8.5	8.3	7.8	8.3	9.5
Senc. Flow + Stomp Aq. + metobromuron	8.0	8.5	9.3	8.5	9.0	10.0
Senc. Flow + Stomp Aq. + metobromuron	7.8	8.8	9.0	8.3	8.3	9.5
Stomp Aq. + Intruder + metobromuron	7.8	8.8	9.8	7.8	8.8	9.8
Senc. Flow + Stomp Aq. + Centium	8.0	8.5	8.8	8.0	9.0	10.0
Senc. Flow + Stomp Aq. + 9987	9.0	9.0	9.5	8.8	8.3	8.3
Senc. Flow + Stomp Aq. + 9920	8.3	8.5	9.0	8.3	9.3	10.0
Senc. Flow + Stomp Aq., *then* Centium	8.5	9.0	9.5	9.0	8.8	10.0
Senc. Flow + Stomp Aq., *then* 9987	8.0	8.5	9.0	8.3	8.5	10.0
Senc. Flow + Stomp Aq., *then* 9921	8.3	9.0	7.8	7.5	9.0	9.5
F prob. value	0.514	0.666	0.017	0.022	0.025	0.003
d.f.	42	42	42	42	42	42
S.E.D.	0.5206	0.4603	0.5274	0.570	0.5175	0.584
L.S.D.	1.0506	0.9290	1.0644	1.151	1.0445	1.178

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 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 residual herbicides for their safety and efficacy when applied during the dormant season to a crop of narcissus, and to test a limited range of herbicides for their safety and efficacy when applied at early post-emergence.

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: Ebbage (Jack Buck Farms) Washway Rd Moulton Seas End Spalding PE12 6LP Grid reference: TF 32909 29770
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	metribuzin	Sencorex Flow	EM4H004177	600	Suspension Concentrate
N/A	pendimethalin	Stomp Aqua	OO13054353	455	Capsule Suspension
AHDB9920	N/D	N/D	N/D	N/D	N/D
AHDB9921	N/D	N/D	N/D	N/D	N/D
N/A	clomazone	Centium 360 CS	N/K	360	Capsule Suspension
N/A	metobromuron	Fresco	661674	400	Suspension Concentrate
AHDB9987	N/D	N/D	N/D	N/D	N/D
N/A	chlorpropham	Intruder	354F	400	Emulsifiable 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	Sencorex Flow + Stomp Aqua	450.0 1319.5	0.75 2.90	A
3	Sencorex Flow + Intruder	450.0 800.0	0.75 2.00	A
4	Sencorex Flow + metobromuron	450.0 1500.0	0.75 3.75	A
5	Sencorex Flow + metobromuron	450.0 1000.0	0.75 2.50	A
6	Sencorex Flow + metobromuron	1740.0 1000.0	2.90 2.50	A
7	Sencorex Flow + Stomp Aqua + metobromuron	450.0 1319.5 1000.0	0.75 2.90 2.50	A
8	Sencorex Flow + Stomp Aqua + metobromuron	300.0 910.0 1300.0	0.50 2.00 3.25	A
9	Stomp Aqua + Intruder + metobromuron	1319.5 400.0 1000.0	2.90 1.00 2.50	A
10	Sencorex Flow + Stomp Aqua + Centium 360 CS	450.0 1319.5 90.0	0.75 2.90 0.25	A
11	Sencorex Flow + Stomp Aqua + AHDB9987	450.0 1319.5 1200.0	0.75 2.90 2.00	A
12	Sencorex Flow + Stomp Aqua + AHDB9920	450.0 1319.5 400.0	0.75 2.90 1.00	A
13	Sencorex Flow + Stomp Aqua	450.0 1319.5	0.75 2.90	A
	Centium 360 CS	90.0	0.25	B
14	Sencorex Flow + Stomp Aqua	450.0 1319.5	0.75 2.90	A
	AHDB9987	1200.0	2.00	B
15	Sencorex Flow + Stomp Aqua	450.0 1319.5	0.75 2.90	A
	AHDB9921	4.7 3.8	0.75	B

Application details

	Application A	Application B
Application date	07/11/2017	10/01/2018
Time of day	11:50-14:15	14:10-14:40
Crop growth stage (Max, min average BBCH)	BBCH 00 (dormant bulb)	BBCH 12-13
Crop height (cm)	N/A	7
Crop coverage (%)	N/A	15
Application Method	spray	spray
Application Placement	soil	foliar
Application equipment	Oxford Precision Sprayer (knapsack)	Oxford Precision Sprayer (knapsack)
Nozzle pressure	2.4 bar	2.4 bar
Nozzle type	flat fan	flat fan
Nozzle size	02F110	02F110
Application water volume/ha	200	200
Temperature of air (°C)	11.4-11.5	7.7
Relative humidity (%)	80.7-84.0	92.4-93.0
Wind speed range (mph)	16.0-17.5	1.8-3.0
Dew presence (Y/N)	Y	Y
Temperature of soil – 10 cm (°C)	9.0	6.0
Wetness of soil – 2-5 cm	Damp	Wet
Cloud cover (%)	95	100

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** (13 weeks)
Broad leaved weeds and grasses	*N/A*	3WEEDT	>>1% *(untreated average)*	0.9% *(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)
19/12/2017	42	09	Phytotoxicity	Phytotox (crop quality compared to UTC; visual comparison, scored 0-9)
			Weeds	Weed population count (whole plot area). Present species recorded.
			Plant height	Plant height (20 plants per plot).
10/01/2018	64	12-13	Phytotoxicity	Phytotox (*as above*).
			Weeds	Weed population count (whole plot area). Present species recorded.
			Plant height	Plant height (20 plants per plot).
23/01/2018	77	14-15	Phytotoxicity	Phytotox (*as above*).
07/02/2018	92	55	Bud count	Count of flower buds per metre.
			Weeds	Weed cover estimate (whole plot score, %). Present species recorded.
23/02/2018	108	60	Phytotoxicity	Phytotox (*as above*).
			Flower count	Count of open flowers per plot.
28/03/2018	141	65	Phytotoxicity	Phytotox (x2) (crop foliage and flower quality assessed separately, compared to UTC and scored 0-9).

* DA – days after Application A

Statistical analysis

The trial design was a fully randomised block design, with four replicates of fifteen 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.

At nine weeks after Application A treatment, all treatments appeared crop safe. Following the Application B treatments, a few treatments showed differences from the untreated crop, though most treatments appear crop safe. Treatment with AHDB9921 showed some foliar twisting in the emergent crop, though this effect was transient and the crop appeared to recover. However, growers were concerned about the stress this may cause the developing bulbs. While differences between treatments were statistically significant, the commercial significance of these differences is minimal.

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					
	19th Dec (App. A + 6 weeks)	**10th Jan** (App. A + 9 weeks)	**23rd Jan** (App. B + 2 weeks)	**23rd Feb** (App. B + 6 weeks)	**28th Mar** (harvest)	
					Foliage	Flowers
Untreated	8.5	8.8	9.0	10.0	9.5	10.0
Senc. Flow + Stomp Aq.	8.0	9.0	9.5	8.5	8.8	9.8
Senc. Flow + Intruder	8.5	8.8	9.8	8.0	8.3	8.5
Senc. Flow + metobromuron	8.5	8.5	8.5	8.5	7.3	9.3
Senc. Flow + metobromuron	7.8	9.5	9.5	8.3	8.5	7.8
Senc. Flow + metobromuron	8.0	8.5	8.3	7.8	8.3	9.5
Senc. Flow + Stomp Aq. + metobromuron	8.0	8.5	9.3	8.5	9.0	10.0
Senc. Flow + Stomp Aq. + metobromuron	7.8	8.8	9.0	8.3	8.3	9.5
Stomp Aq. + Intruder + metobromuron	7.8	8.8	9.8	7.8	8.8	9.8
Senc. Flow + Stomp Aq. + Centium	8.0	8.5	8.8	8.0	9.0	10.0
Senc. Flow + Stomp Aq. + 9987	9.0	9.0	9.5	8.8	8.3	8.3
Senc. Flow + Stomp Aq. + 9920	8.3	8.5	9.0	8.3	9.3	10.0
Senc. Flow + Stomp Aq., *then* Centium	8.5	9.0	9.5	9.0	8.8	10.0
Senc. Flow + Stomp Aq., *then* 9987	8.0	8.5	9.0	8.3	8.5	10.0
Senc. Flow + Stomp Aq., *then* 9921	8.3	9.0	7.8	7.5	9.0	9.5
F prob. value	0.514	0.666	0.017	0.022	0.025	0.003
d.f.	42	42	42	42	42	42
S.E.D.	0.5206	0.4603	0.5274	0.570	0.5175	0.584
L.S.D.	1.0506	0.9290	1.0644	1.151	1.0445	1.178

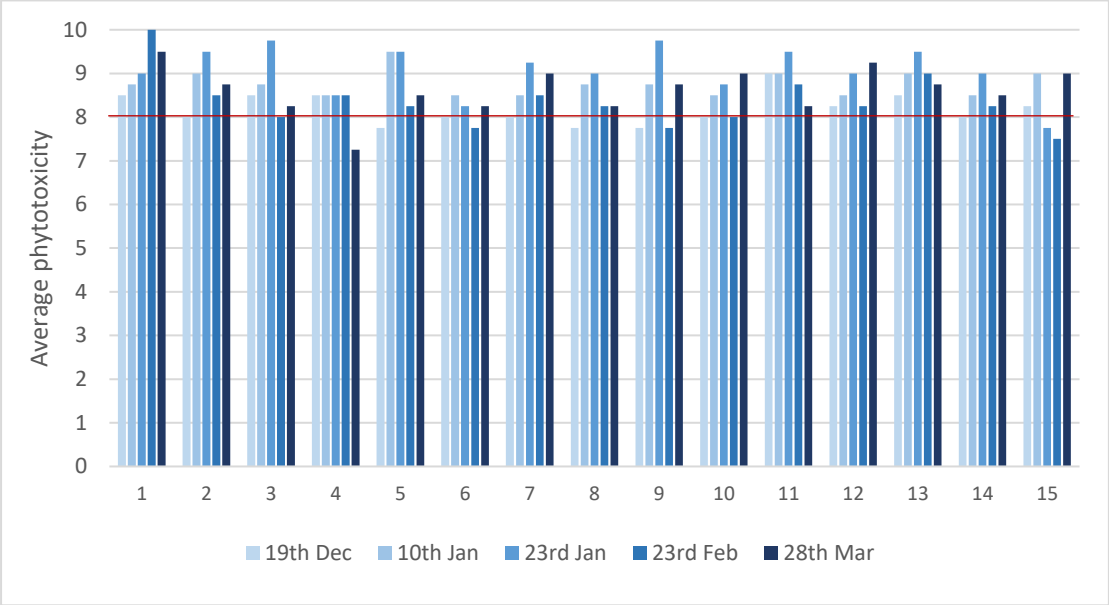


Figure 1. Mean phytotoxicity scores for narcissus treated with various herbicides. Scores of 8 or above deemed acceptable quality (as indicated by red line).

Crop physiology

During this trial, no significant differences were found between herbicide treatments in terms of impact on crop quality, based on comparison of leaf height, and of bud and flower counts (Table 3).

Table 3. Mean leaf height measurements, and bud and flower counts for various herbicide treatments.

Treatment	Assessment timing			
	Leaf height		Buds per metre	Open flower count
	19th Dec (App. A + 6 weeks)	**10th Jan** (App. A + 9 weeks)	**7th Feb** (App. B + 4 weeks)	**23rd Feb** (App. B + 6 weeks)
Untreated	2.6	6.8	3.0	1.5
Senc. Flow + Stomp Aq.	2.7	6.4	3.8	1.8
Senc. Flow + Intruder	2.8	6.8	2.8	1.8
Senc. Flow + metobromuron	2.3	6.3	3.3	1.0
Senc. Flow + metobromuron	2.7	6.5	2.8	0.8
Senc. Flow + metobromuron	2.4	6.5	5.0	0.5
Senc. Flow + Stomp Aq. + metobromuron	2.5	7.0	5.0	3.0
Senc. Flow +	2.3	6.4	4.0	0.8

Treatment	Assessment timing			
	Leaf height		Buds per metre	Open flower count
	19th Dec (App. A + 6 weeks)	10th Jan (App. A + 9 weeks)	7th Feb (App. B + 4 weeks)	23rd Feb (App. B + 6 weeks)
Stomp Aq. + metobromuron				
Stomp Aq. + Intruder + metobromuron	3.0	6.4	4.3	1.5
Senc. Flow + Stomp Aq. + Centium	2.7	6.2	4.0	1.5
Senc. Flow + Stomp Aq. + 9987	3.0	6.6	3.0	2.0
Senc. Flow + Stomp Aq. + 9920	2.8	6.5	4.5	2.8
Senc. Flow + Stomp Aq., *then* Centium	2.9	7.3	3.8	0.8
Senc. Flow + Stomp Aq., *then* 9987	3.0	6.4	4.5	1.8
Senc. Flow + Stomp Aq., *then* 9921	3.1	6.9	3.5	1.0
F prob. value	NS	NS	NS	NS
d.f.	42	42	42	42
S.E.D.	0.2815	0.4730	1.641	0.992
L.S.D.	0.5680	0.9545	3.311	2.002

Weed Control
During the trial period, three assessments of weed cover were carried out. However, with weed emergence in the trial area near zero, there was no opportunity to assess product efficacy in this trial.

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 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 crop growth)

Field name:	EBBAGE
Trial duration:	07/11/2017–23/03/2018

Crop	Cultivar	Planting date	Row width (m)
Narcissus	Tamsyn	11/08/2017 (9 t/ha)	~0.5m

Previous cropping

Year	Crop
2017	Brassicas
2016	Peas
2015	Celeriac

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

Date	Product	Rate
N/A	-	-

Pesticides applied to trial area

Date	Product	Rate (L/ha)
19/10/2017	Clinic Ace Reglone Activator 90	5.0 2.5 0.1
22/03/2018	Tracker	1.0

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
11/08/2017	Field planted.
07/11/2017	Trial marked out. Application A treatments applied.
19/12/2017	Assessment: weed count, crop safety (phytotoxicity), leaf height.
10/01/2018	Application B treatments applied. Assessment: weed count, phytotoxicity, leaf height.
23/01/2018	Assessment: phytotoxicity.
07/02/2018	Assessment: bud count, weed cover + species presence.

23/02/2018	Assessment: phytotoxicity, flower count, flower quality.
28/03/2018	Assessment: phytotoxicity (foliage, flowers).

c. Climatological data during study period.

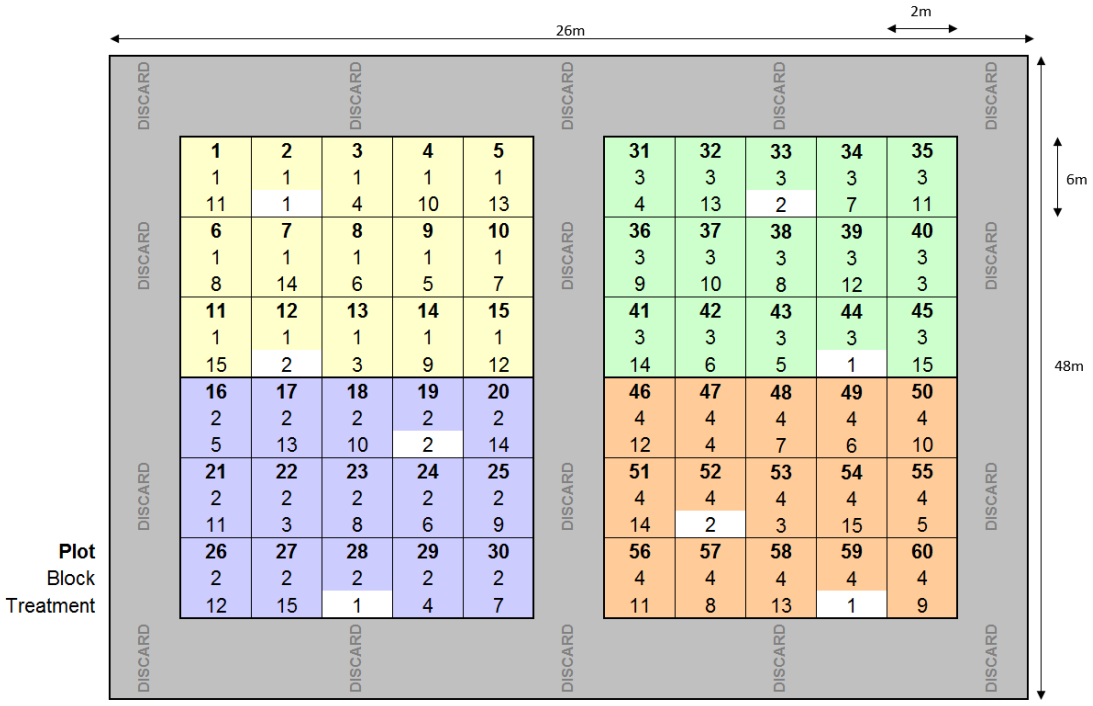
Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
06/11/2017	8.5	23.5	66.2
07/11/2017	6.0	11.5	84.5
08/11/2017	1.0	10.0	92.2
09/11/2017	1.0	13.5	93.4
10/11/2017	6.0	10.5	87.3
11/11/2017	3.0	10.5	94.0
12/11/2017	2.5	7.0	89.0
13/11/2017	1.0	7.5	88.3
14/11/2017	4.0	12.5	95.2
15/11/2017	6.0	10.0	101.6
16/11/2017	0.5	13.5	96.2
17/11/2017	-0.5	9.0	95.7
18/11/2017	0.5	9.5	93.0
19/11/2017	-1.0	7.0	92.1
20/11/2017	4.5	13.0	96.8
21/11/2017	10.0	13.0	97.1
22/11/2017	12.0	15.0	90.5
23/11/2017	4.5	13.0	87.8
24/11/2017	0.5	8.5	92.1
25/11/2017	0.0	5.5	94.7
26/11/2017	1.5	6.5	94.0
27/11/2017	2.5	8.5	93.5
28/11/2017	0.5	6.0	93.9
29/11/2017	0.5	5.0	96.5
30/11/2017	-0.5	2.5	92.7
01/12/2017	0.5	4.5	98.1
02/12/2017	1.5	7.5	97.9
03/12/2017	4.0	9.0	100.6
04/12/2017	0.0	9.5	99.1
05/12/2017	6.5	8.0	93.0
06/12/2017	7.0	10.0	90.4
07/12/2017	2.0	11.5	91.3
08/12/2017	-1.0	3.5	90.2
09/12/2017	-2.0	2.0	93.7
10/12/2017	-2.0	2.5	99.4
11/12/2017	-0.5	4.0	95.7
12/12/2017	-3.0	2.0	97.4
13/12/2017	1.0	6.5	98.6

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
14/12/2017	1.5	5.5	94.1
15/12/2017	1.0	5.0	97.2
16/12/2017	-1.0	3.5	96.2
17/12/2017	-3.0	6.5	101.3
18/12/2017	-0.5	5.5	99.0
19/12/2017	-0.5	8.5	100.9
20/12/2017	4.5	11.5	102.0
21/12/2017	7.0	11.0	101.8
22/12/2017	6.5	10.5	101.8
23/12/2017	6.5	8.5	100.9
24/12/2017	7.0	10.5	97.7
25/12/2017	7.0	10.5	94.4
26/12/2017	2.5	7.0	95.7
27/12/2017	0.0	3.0	96.0
28/12/2017	-0.5	3.5	93.9
29/12/2017	-1.5	4.5	97.2
30/12/2017	2.5	12.5	92.4
31/12/2017	5.5	11.5	92.5
01/01/2018	3.5	6.5	94.2
02/01/2018	1.5	9.5	97.5
03/01/2018	6.0	9.5	84.7
04/01/2018	5.0	10.0	92.8
05/01/2018	0.5	6.5	97.5
06/01/2018	-0.5	7.0	96.8
07/01/2018	1.0	5.0	86.6
08/01/2018	1.0	3.0	88.9
09/01/2018	2.5	4.5	99.3
10/01/2018	4.5	7.0	102.1
11/01/2018	5.5	7.5	102.1
12/01/2018	4.5	7.5	102.1
13/01/2018	4.5	6.5	96.2
14/01/2018	3.0	5.0	92.6
15/01/2018	3.0	10.5	96.1
16/01/2018	1.5	6.0	90.0
17/01/2018	1.0	7.0	88.2
18/01/2018	1.5	8.5	92.7
19/01/2018	0.5	5.5	92.9
20/01/2018	0.0	3.5	99.0
21/01/2018	-1.0	2.0	102.0
22/01/2018	2.5	9.5	96.0
23/01/2018	3.0	13.0	96.1
24/01/2018	5.0	13.5	93.4
25/01/2018	2.0	9.5	91.8
26/01/2018	-1.5	8.0	99.6

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
27/01/2018	0.0	10.0	99.8
28/01/2018	6.5	16.5	92.1
29/01/2018	2.5	10.5	91.0
30/01/2018	0.5	8.5	94.2
31/01/2018	2.0	7.5	90.3
01/02/2018	0.0	7.5	90.9
02/02/2018	2.5	7.0	91.0
03/02/2018	1.0	4.5	100.0
04/02/2018	1.5	5.0	93.8
05/02/2018	-2.5	4.0	94.5
06/02/2018	-2.0	3.5	95.4
07/02/2018	-3.0	5.0	90.2
08/02/2018	-2.0	6.5	94.1
09/02/2018	-0.5	5.5	95.0
10/02/2018	-1.5	8.5	99.3
11/02/2018	0.5	9.0	89.2
12/02/2018	-0.5	7.0	89.2
13/02/2018	0.5	5.0	95.6
14/02/2018	-0.5	5.5	97.7
15/02/2018	2.0	9.5	87.9
16/02/2018	-0.5	10.0	90.6
17/02/2018	-0.5	10.0	94.6
18/02/2018	-1.0	8.5	99.0
19/02/2018	5.0	10.0	102.0
20/02/2018	3.0	8.5	98.2
21/02/2018	1.5	7.5	98.4
22/02/2018	-2.5	7.0	93.0
23/02/2018	-3.0	5.5	93.0
24/02/2018	-2.0	8.0	87.7
25/02/2018	-2.0	6.0	82.7
26/02/2018	-3.0	4.0	85.2
27/02/2018	-4.5	5.0	92.3
28/02/2018	-15.0	1.0	90.6
01/03/2018	-5.0	-1.5	87.5
02/03/2018	-2.5	0.0	86.9
03/03/2018	-2.0	1.5	98.1
04/03/2018	0.5	7.5	100.6
05/03/2018	1.5	12.5	96.3
06/03/2018	1.5	9.5	93.2
07/03/2018	0.5	13.0	92.0
08/03/2018	0.5	8.0	94.0
09/03/2018	-1.5	9.5	96.0
10/03/2018	6.5	14.0	99.4
11/03/2018	4.0	14.0	97.1

Date	Temperature °C (minimum)	Temperature °C (maximum)	Relative humidity, average (%)
12/03/2018	5.0	8.0	101.1
13/03/2018	4.0	12.5	95.0
14/03/2018	1.0	12.5	90.4
15/03/2018	6.0	10.0	94.1
16/03/2018	3.0	15.0	96.2
17/03/2018	-1.0	3.5	87.7
18/03/2018	-1.5	0.5	83.5
19/03/2018	-0.5	6.0	77.3
20/03/2018	-3.0	9.0	87.5
21/03/2018	-4.0	13.0	80.5
22/03/2018	6.0	16.0	78.2
23/03/2018	3.0	13.5	78.4
24/03/2018	3.5	12.0	89.3
25/03/2018	0.5	17.0	81.7
26/03/2018	-2.5	16.0	79.6
27/03/2018	3.5	11.0	93.9
28/03/2018	0.0	9.0	96.7

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