



PGRO Final Report

HERBICIDES ON COMBINING PEAS

SLOT TRIALS

Determining the efficacy of two pre-emergence herbicides in combining peas.

Project title	Determining the efficacy of two pre-emergence herbicides in combining peas.
Sponsor project reference	
Country / Region / EPPO zone	United Kingdom EPPO Maritime zone
Target crop	Combining peas (<i>Pisum sativum</i>)
Target pest	Weeds
Experimental permit reference	
GEP	Yes
Report author	Will Evans
Date issued	October 2022
Trial year	2022
Trials by	PGRO Research Ltd Great North Road Thornhaugh Cambridgeshire PE8 6HJ United Kingdom
Sponsor	Several

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Declarations

We the undersigned hereby declare that the report submitted constitutes the Final Report of the study above and that all data reported here represent a true and accurate record of the results obtained. Every reasonable effort was made to ensure that disease, insect, weed pressures and crop husbandry were as relevant to the trial aims as possible.

Becky Howard
R and D manager

Objectives

To determine,

- The efficacy of two pre-emergence herbicide products for the control of weeds in combining peas
- How the efficacy of these two pre emergence herbicides compares against commercial standards Centium, Stomp Aqua, Stallion Sync, Nirvana, and Basagran

Summary

- Weed pressure was low in the trial area with groundsel the only weed recorded for the first two weeks after drilling.
- Black Bindweed was the dominant weed in this trial.
- Black bindweed was controlled well by Stallion Sync Tec, confidential 4 and confidential 5 at earlier assessments but control was not persistent and only confidential 4 gave good control throughout.
- Confidential 1 treatment gave the best control 88%, at the last assessment, with only a 2% of area covered with weeds.
- Very low levels of phytotoxicity were recorded in the early assessment on 14th April. Transient bleaching disappeared by the 4th of May 2022.

Test items and treatments

Table 1. Test items

Name	Active(s)	Batch/lot
Centium	Clomazone	
Stomp Aqua	Pendimethalin	
Stallion Sync	Pendimethalin/ Clomazone	
Nirvana	Pendimethalin/ Imazamox	
Basagran	Bentazone	

Table 2. Treatment list

#	Description	Rate (L/ha)	Timing
1	Untreated	n/a	n/a
2	Centium 360	0.25	Pre-emergence
3	Stomp Aqua	2.9	Pre-emergence
4	Stallion Sync Tec	3.0	Pre-emergence
5	Nirvana	4.5	Pre-emergence
6	Basagran	1.1 kg/L	Post-emergence
7	Confidential 1	n/a	
8	Confidential 2	n/a	
9	Confidential 3	n/a	
10	Confidential 4	n/a	Pre-emergence
11	Confidential 5	n/a	Pre-emergence
12	Untreated 2	n/a	n/a

Table 3. Description of application timings

Timing	Growth stage or description of timing	BBCH
Pre-emergence	Germination	00-09
Post emergence	Leaf development	13-25

Methods

Trial design - Plots measured 18 m² (1.8 x 10 m) and were arranged in a randomised complete block layout with four replications.

Sprayer details - Treatments were applied using a hand operated compressed air boom sprayer with a width of two meters. Lurmark 02F110 nozzles were used, operating at a pressure of 2 bar for a fine/medium droplet quality.

Assessments - Weeds were identified and recorded as number of weeds present per species in 3 x 0.25 m² quadrats. The mean of the 3 were multiplied by 4 to report weeds/m² per plot. Assessments were based on EPPO guidelines PP1/053 (3) + PP1/091 (4). Phytotoxicity was scored on a 0-10 scale, where 10 equated to no phytotoxicity symptoms observed and 0 denoted dead crop (EPPO guidelines PP1/135 (4)).

Analysis – STAR statistical software (Version: 2.0.1) was used to perform statistical analyses of all data using ANOVA methods (95% confidence level).

Trial site and Diary

Table 4. Trials diary

Activity	Timing	BBCH	Date
Drilling			23-Mar-22
Application	Pre-emergence	00-09	28-Mar-22
	Post-emergence	13-25	09-May-22
Weed count	A1	00-09	28-Mar-22
	A2	00-09	05-April-22
	A3	11	14-April-22
Plant count	A4	11-13	20-April-22
Weed count	A5	13-17	04-May-22
Weed ground cover (%)	A6	97	15-July-22

Table 5. Site details for Stubton trial 2022

Test site information	
Town	Stubton
Postcode	NG23 5JH
N	52°59'20.16"
W	0°49'52.53"
Site description	Low weed pressure, mid-field.
Soil analysis	pH: 7.6; P: index 1, K: index 1, Mg: index 2; OM: 4.7%(LOI); Sand: 60%, Silt: 18%. Clay: 22%
Crop	Combining peas (<i>Pisum sativum</i>)
Variety	Blue time

Results

Weed Counts

Groundsel was the only weed recorded at A1 and A2. There were no significant differences between the treatments at either assessment and weed numbers were low (Table 6).

Table 6. Mean number of groundsel plants recorded per square metre at A1 and A2, in combining peas at Stubton in 2022.

Treatment	28th March (A1) Groundsel/m²	5th April (A2) Groundsel/m²
1. Untreated	0.0	0.0
2. Centium	0.0	0.0
3. Stomp Aqua	0.0	0.0
4. Stallion	0.0	0.0
5. Nirvana	0.7	0.3
6. Basagran	0.0	0.0
7. Confidential 1	0.0	0.0
8. Confidential 2	0.3	0.0
9. Confidential 3	0.0	0.0
10. Confidential 4	0.0	0.3
11. Confidential 5	1.0	0.0
12. Untreated 2	0.0	0.0
F value	0.91	1.0
<i>p</i> value	0.54	0.47

There were significant differences in the number of black bindweed and volunteer oilseed rape recorded on 14th April 2022 at Stubton (Table 7).

Table 7. Mean number of weeds recorded per square metre at A3 in combining peas at Stubton in 2022.

14th April (A3)					
Treatment	Groundsel/ m²	Black Bindweed/ m²		Vol OSR/ m²	
1. Untreated	0.0	3.3	bcde	0.7	ab
2. Centium	0.0	1.3	abcd	0.7	ab
3. Stomp Aqua	0.0	5.0	e	2.0	b
4. Stallion	0.0	0.0	a	0.0	a
5. Nirvana	0.0	2.3	abcde	0.3	ab
6. Basagran	0.3	4.3	de	0.0	a
7. Confidential 1	0.0	3.0	abcde	0.3	ab
8. Confidential 2	0.0	3.7	cde	0.0	a
9. Confidential 3	0.0	4.3	de	0.7	ab
10. Confidential 4	0.0	0.7	abc	0.0	a
11. Confidential 5	0.0	0.3	ab	0.0	a
12. Untreated 2	0.0	4.0	de	0.0	a
F value	1	2.61		2.12	
<i>p</i> value	0.47	0.016		0.047	

There were no significant differences in the numbers of weeds recorded between treatments on 4th May 2022 (Table 8, figure 1).

Table 8. Mean number of weeds recorded per square metre on the 4th of May (A5) 2022 in combining peas at Stubton.

Treatment	Groundsel	Black Bindweed	Vol OSR	Sowthistle	Knotgrass	Field Pansy	Orache	Redshank	Spear Thistle
1. Untreated	0.0	18.7	1.0	0.0	0.3	0.0	0.3	0.3	0.0
2. Centium	0.0	14.0	1.0	0.0	0.0	0.0	0.3	0.0	1.3
3. Stomp Aqua	0.0	20.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
4. Stallion	0.0	15.3	2.3	0.0	2.7	0.0	0.3	0.0	0.0
5. Nirvana	0.0	21.3	1.0	0.0	0.7	0.0	0.3	0.0	0.0
6. Basagran	0.0	22.0	0.7	0.3	0.7	0.0	0.0	0.0	0.0
7. Confidential 1	0.3	14.0	1.0	0.3	0.3	0.3	0.3	0.0	0.0
8. Confidential 2	0.0	13.3	1.0	0.0	0.0	0.0	0.7	0.0	0.0
9. Confidential 3	0.0	20.3	2.7	0.0	0.0	0.0	0.3	0.0	0.0
10. Confidential 4	0.3	9.7	0.7	0.0	0.0	0.0	0.3	0.0	0.0
11. Confidential 5	0.0	16.7	0.0	0.0	0.0	0.0	1.7	0.0	0.0
12. Untreated 2	0.0	29.0	1.0	0.3	1.0	0.0	0.7	0.0	0.0
F value	1	1.86	0.64	0.77	0.87	1	1.47	1	1
p value	0.47	0.083	0.78	0.67	0.58	0.47	0.19	0.47	0.47

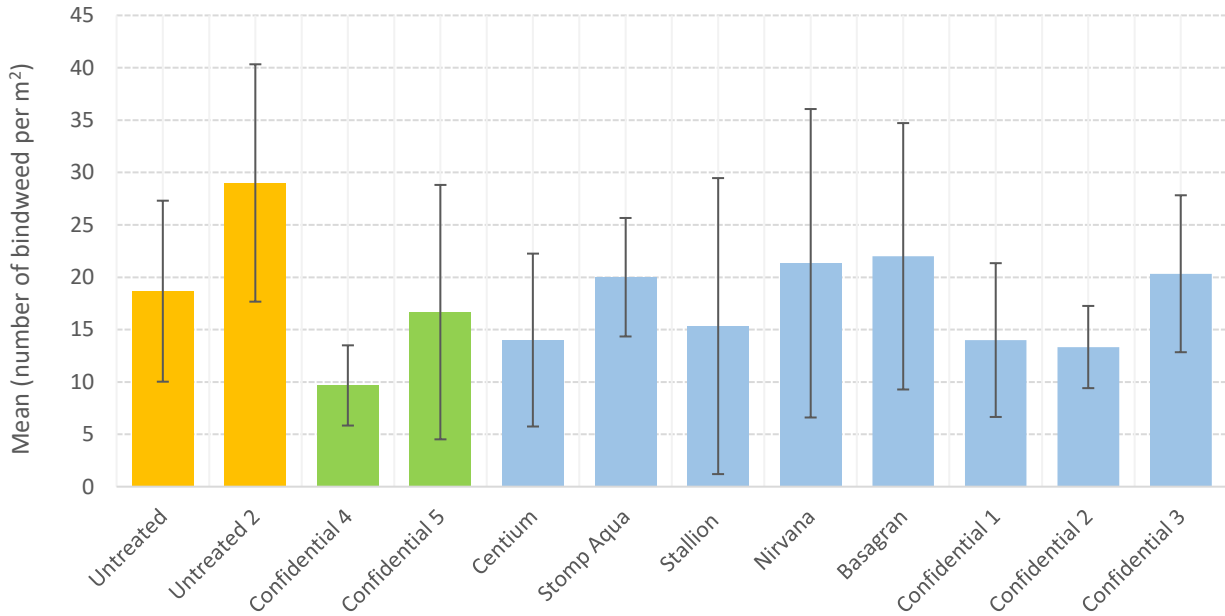


Figure 1. Mean number of black bindweed plants recorded on the 4th of May 2022 in combining peas at Stubton.

Weed Ground Cover

There were significant differences in the percentage ground cover of weeds between the treatments. Treatments 5 to 10 gave significant control of weed cover compared to the Untreated 2 plots, although not compared to the Untreated 1 plots. Highest percentage ground cover with weeds was recorded in treatments 1, 2, 4, 11 and 12 (Table 9).

Table 9. Mean percentage weed ground cover in combining peas at Stubton on 15th July 2022 (A6) Percentage control was calculated from the mean of the two untreated controls.

Treatment	Mean weed ground cover (%)	Percentage control
1. Untreated	16.6 ab	n/a
2. Centium	21.3 ab	-30
3. Stomp Aqua	7.3 a	55
4. Stallion	12.5 ab	23
5. Nirvana	6.6 a	60
6. Basagran	4.3 a	74
7. Confidential 1	2.0 a	88
8. Confidential 2	8.3 a	49
9. Confidential 3	7.0 a	57
10. Confidential 4	4.4 a	73
11. Confidential 5	11.3 ab	31
12. Untreated 2	32.9 b	n/a
F value	3.98	
p value	0.001	

Phytotoxicity

Plots treated with Stallion Sync Tec, Confidential 4 and Confidential 5 showed early signs of slight phytotoxicity. By the 4th of May, all signs of phytotoxicity had disappeared. Symptoms were transient bleaching (Table 10).

Table 10. Mean phytotoxicity scores at A3 and A5.

Treatment	14th April Mean Phytotoxicity	4th May Mean Phytotoxicity
1. Untreated	10.00 a	10
2. Centium	9.92 ab	10
3. Stomp Aqua	10.00 a	10
4. Stallion	9.58 bc	10
5. Nirvana	10.00 a	10
6. Basagran	10.00 a	10
7. Confidential 1	10.00 a	10
8. Confidential 2	10.00 a	10
9. Confidential 3	10.00 a	10
10. Confidential 4	9.33 c	10
11. Confidential 5	9.67 abc	10
12. Untreated 2	10.00 a	10
F value	2.72	
p value	0.013	

Plant Counts (crop)

There were no significant differences between treatments in the number of plants recorded at early emergence (Table 11).

Table 11. Mean number of combining pea plants per square metre on the 20th of April 2022.

20 th April Treatment	Mean Plant count/m ²
1. Untreated	59
2. Centium	61
3. Stomp Aqua	63
4. Stallion	59
5. Nirvana	63
6. Basagran	57
7. Confidential 1	61
8. Confidential 2	48
9. Confidential 3	57
10. Confidential 4	62
11. Confidential 5	53
12. Untreated 2	51
F value	1.52
p value	0.17

Discussion

Weed pressure was low in the trial area with groundsel the only weed recorded for the first two weeks after drilling, but still less than 1 plant/ m² in all treatments.

Black Bindweed and Volunteer Oilseed Rape were recorded in on the 14th April (A3, Table 8) but in low numbers.

At Assessment 5 (Table 9) more weed species were recorded in low numbers except Black Bindweed, which was recorded in high numbers. Black bindweed was controlled well by treatments 4, 10 and 11 at earlier assessments but control was not persistent and only treatment 10 gave good control throughout.

At A6, when ground cover with weeds was recorded, Stomp Aqua and Basagran gave good control of weed cover.

Very low levels of phytotoxicity were recorded in the early assessment on 14th April. Transient bleaching disappeared by the 4th of May 2022.

Appendix

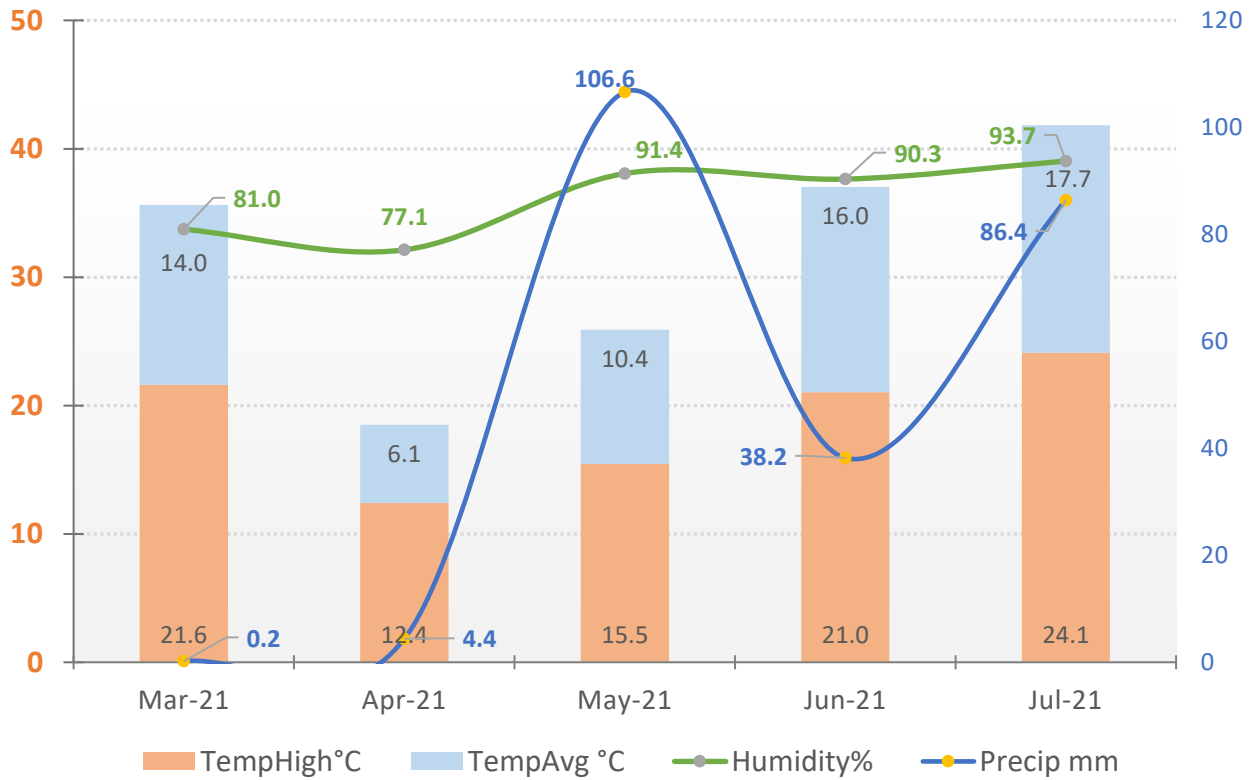
Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
17-Mar	13.14	7.53	96.42	1.8	0
18-Mar	15.49	7.96	96.74	1	0.2
19-Mar	14.59	8.17	91.49	3	0
20-Mar	10.72	5.68	89.16	1.9	0
21-Mar	13.07	5.61	84.65	0.9	0.2
22-Mar	18.38	11.14	88.22	1.6	0
23-Mar	19.34	10.71	82.52	0.6	0
24-Mar	18.18	10.32	73.45	0.7	0
25-Mar	18.42	9.18	76.7	0.4	0
26-Mar	18.2	8.78	85.13	1	0
27-Mar	14.7	8.04	99.71	1.3	0
28-Mar	16.68	8.97	87.59	0.6	0
29-Mar	10.15	6.16	99.8	1.4	0
30-Mar	8.52	4.56	99.78	1.7	1.6
31-Mar	6.9	2.15	96.05	2.6	1.8
01-Apr	7.75	2.78	99.56	1.7	3.6
02-Apr	8.67	2.21	93.96	0.7	1.2
03-Apr	11.35	4.09	82.85	1.2	0.2
04-Apr	13.55	9.98	99.01	2.9	5.8
05-Apr	13.69	11.45	95.52	2.5	0
06-Apr	14.32	10.69	95.75	3.5	1.2
07-Apr	10.79	6.85	99.67	3.4	5.6
08-Apr	11.46	5.26	85.62	1.3	0.2
09-Apr	11.45	4.75	80.73	1.4	0.2
10-Apr	13.09	6.53	75.65	0.8	0
11-Apr	16.06	10.42	70.18	3	0
12-Apr	19.94	12.61	94.91	1.2	1.2
13-Apr	17.6	12.39	98.09	1.5	1.6
14-Apr	17.29	10.48	93.77	0.6	0.2
15-Apr	20.87	14.3	86.15	1.1	0
16-Apr	20.58	13.6	85.56	2	0
17-Apr	19.65	12.88	74.89	1.8	0
18-Apr	16.88	11.92	80.06	1.1	0
19-Apr	16.82	10.42	94.26	1.4	0
20-Apr	16.7	10.55	76.72	2.3	0
21-Apr	17.92	10.29	80.72	2.6	0
22-Apr	16.4	10.87	81.2	4	0
23-Apr	15.83	10.75	93.03	4.3	0
24-Apr	16.1	10.81	81.84	3.8	0
25-Apr	13.79	8.38	91.35	1.8	0

Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
26-Apr	14.98	8.13	87.62	1.4	0
27-Apr	10.6	7.63	81.99	1.4	0
28-Apr	9.96	8.08	99.49	1.6	0
29-Apr	13.11	8.54	79.98	1.1	0
30-Apr	18.38	10.02	73.31	0.6	0
01-May	14.06	11.52	99.87	0.6	0
02-May	16.72	12.41	93.68	0.7	0.4
03-May	13.62	10.57	99.85	0.8	2.6
04-May	17.44	11.77	99.82	1.1	3.6
05-May	20.85	13.17	85.32	0.5	0
06-May	19.16	13.41	93.24	1.1	3.2
07-May	17.74	12.99	99.66	1.5	1
08-May	17.89	11.96	86.21	1.2	0
09-May	20.42	14.58	78.16	2	0
10-May	20.7	16.26	74.25	2.2	0
11-May	16.25	12.31	96.35	1.7	8.6
12-May	17.08	11.89	82.03	1.5	0
13-May	20.17	14.49	80.05	2.1	0
14-May	22.9	15.66	76.83	0.8	0
15-May	21.44	14.96	95.82	2.2	0.6
16-May	23.22	16.23	95.11	1.7	4.6
17-May	24.12	17.79	84.64	1.7	0.6
18-May	21.25	15.86	85.05	1.4	9.8
19-May	20.53	14.91	87.24	0.6	0
20-May	18.11	13.81	94.81	1.2	0.4
21-May	19.19	13.7	88.91	1.1	0
22-May	22.02	15.61	87.39	1.2	0
23-May	18.69	14.49	91.24	0.6	4.6
24-May	18.29	12.78	87.42	1	2
25-May	19.39	13.44	91.9	1.8	0
26-May	19.89	13.92	99.28	1.7	2
27-May	17.99	13.09	74.85	1.6	0.2
28-May	17.65	11.22	83.58	1	0
29-May	16.39	10.19	89.68	1.3	0
30-May	15.8	9.84	98.41	0.9	3.2
31-May	16.14	10.51	99.78	0.6	8.2
01-Jun	18.8	11.3	96.95	0.5	2.4
02-Jun	19.84	13.08	81.5	0.7	0.2
03-Jun	19.78	13.82	93.09	2	0
04-Jun	15.25	12.19	99.88	2.8	0
05-Jun	11.34	10.43	99.73	1.6	19.8
06-Jun	14.35	11.6	99.77	0.6	3.4
07-Jun	21.68	14.23	90.08	0.7	0

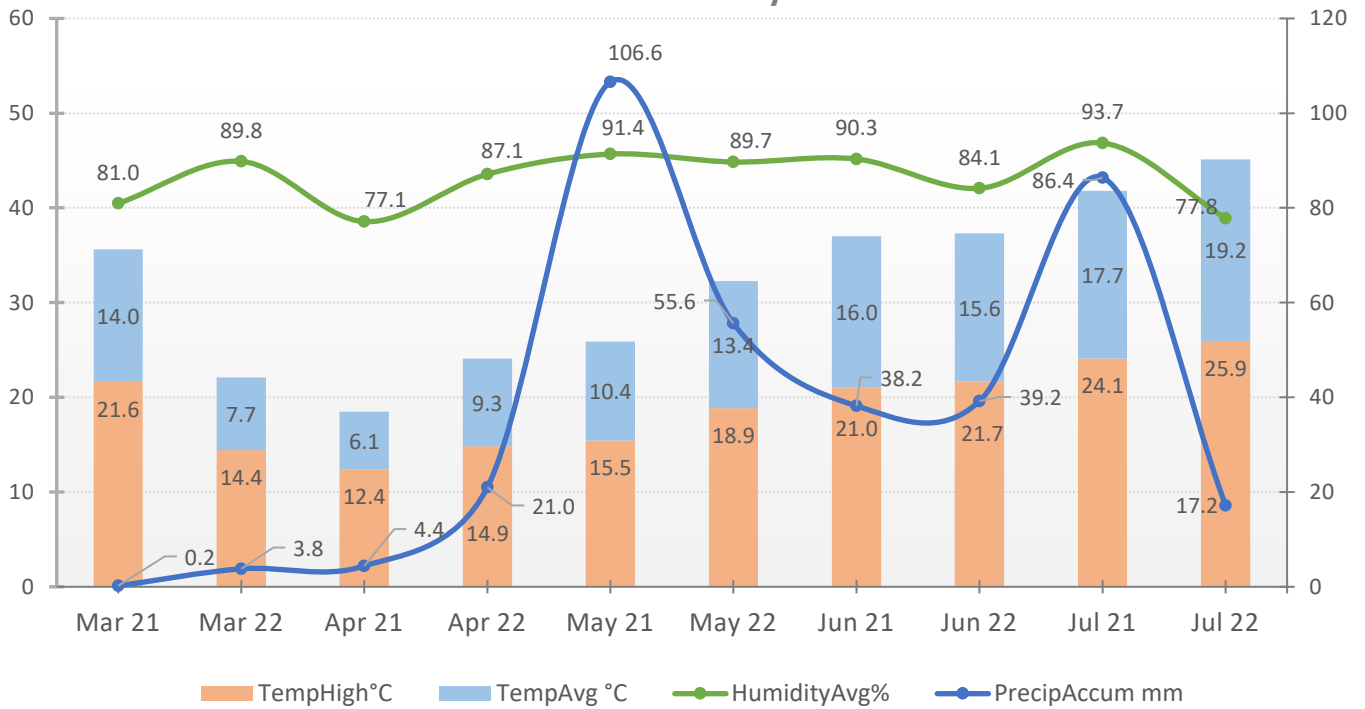
Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
08-Jun	21.4	16.18	94.46	1.2	3.4
09-Jun	19.89	14.81	91.62	1.5	0.2
10-Jun	22.35	17.02	80.46	1.9	0
11-Jun	21.92	15.99	82.81	2	0.6
12-Jun	21.2	14.98	75.84	1.3	0
13-Jun	18.66	14.36	85.74	0.7	0
14-Jun	23.94	16.34	80.27	0.5	0
15-Jun	27.51	17.45	80.3	0.3	0
16-Jun	26.98	19.11	74.95	0.4	0
17-Jun	31.03	23.18	69.44	1.4	0
18-Jun	16.93	13.86	99.78	0.4	7
19-Jun	19.91	13.19	90.82	0.7	0.2
20-Jun	21.73	14.76	81.55	0.7	0
21-Jun	25.51	17.98	69.48	0.5	0
22-Jun	27.96	19.67	75.51	0.3	0
23-Jun	24.98	19.08	76.24	0.6	0
24-Jun	23.17	17.26	90.87	1.3	0
25-Jun	22.45	16.86	71.49	2.4	0
26-Jun	22.74	16.36	69.55	2.6	0
27-Jun	21.45	14.68	81.93	1.5	0.6
28-Jun	22.6	15.8	73.84	2.1	0
29-Jun	23.8	17.42	80.39	1.6	1.4
30-Jun	21.15	15.73	85.73	0.7	0
01-Jul	22.03	15.25	85.93	1.1	0
02-Jul	19.8	14.61	99.06	1.8	2.8
03-Jul	22.21	14.96	88.95	0.8	0
04-Jul	21.95	14.89	79.25	1.1	0
05-Jul	22.47	15.61	78.28	0.9	0
06-Jul	23.06	17.26	93.19	1.3	0
07-Jul	26.42	19.05	79.04	0.9	0
08-Jul	28.64	19.87	74.75	0.8	0
09-Jul	26.93	19.55	73.32	0.7	0
10-Jul	30.07	20.43	68.86	0.6	0
11-Jul	31.68	22.39	67.24	0.4	0
12-Jul	27.7	22.71	72.19	0.5	0
13-Jul	26.95	19.98	67.87	0.6	0
14-Jul	22.88	15.77	78.77	0.6	0.2
15-Jul	24.78	16.71	79.16	1	0
16-Jul	27.79	18.46	70.65	0.3	0
17-Jul	31.1	22.48	60.14	1	0
18-Jul	36.67	27.07	41.27	0.7	0
19-Jul	40.78	29.32	42.76	1.2	0
20-Jul	28.21	23.09	74.16	1.3	0

Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
21-Jul	21.24	18.74	84.11	1	0
22-Jul	21.05	16.81	91.45	1.1	0.6
23-Jul	25.8	20.22	78.92	1.7	0
24-Jul	28.11	21.94	84.77	3.1	0.4
25-Jul	23.65	18.66	89.04	1.8	0.4
26-Jul	21.78	16.06	84.08	0.6	0.2
27-Jul	22.82	17.48	77.2	1.2	0.4
28-Jul	24.42	17.66	74.5	1.1	3.2
29-Jul	24.72	18.46	77.73	0.9	0
30-Jul	25.39	19.75	96	1	0.4
31-Jul	23.28	19.34	99.48	1.1	8.6
01-Aug	26.27	19.73	69.45	0.7	0
02-Aug	28.12	22.49	91.09	2.5	1
03-Aug	27.87	21.76	80.57	1.6	0
04-Aug	24.68	17.26	72.92	0.8	0
05-Aug	22.55	15.05	72.41	0.8	0
06-Aug	24.1	15.71	72.28	0.6	0
07-Aug	26.24	17.87	74.91	0.7	0
08-Aug	28.64	19.22	77.12	0.5	0
09-Aug	28.43	20.59	69.79	0.5	0
10-Aug	29.45	21.01	64.03	0.9	0
11-Aug	32.02	22.42	64.81	0.7	0
12-Aug	31.16	21.68	69.43	1.3	0
13-Aug	32.26	21.71	69.07	1.3	0
14-Aug	32.39	22.53	62.61	1	0
15-Aug	30.96	22.28	69.04	0.6	0

Stubton - Weather summary 2021



Stubton - weather summary 2021 and 2022





Certificate of

Official Recognition of Efficacy Testing Facilities or Organisations in the United Kingdom

This certifies that

PGRO Research Ltd

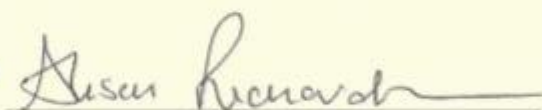
complies with the minimum standards laid down in
Regulation (EC) 1107/2009 for efficacy testing.

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**

Date of issue: 9 January 2018
Effective date: 1 January 2018
Expiry date: 31 December 2022

Signature


Authorised signatory

Certification Number

ORETO 384

