



# PGRO Final Report FIELD BEANS DISEASES TRIAL 2022

Determining the efficacy of a fungicide to control downy mildew, chocolate spot and rust in spring field beans.

Project title	Determining the efficacy of a fungicide to control downy mildew, chocolate spot and rust in spring field beans.
Sponsor project reference	
Country / Region / EPPO zone	United Kingdom EPPO Maritime zone
Target crop	Field beans ( <i>Vicia faba</i> )
Target pest	Downy mildew ( <i>Peronospora viciae</i> ), chocolate spot ( <i>Botrytis fabae</i> ) and rust ( <i>Uromyces viciae-fabae</i> )
Experimental permit reference	
GEP	Yes
Report author	Dina Gomez
Date issued	November 2022
Trial year	2022
Trials by	PGRO Research Ltd Great North Road Thornhaugh Cambridgeshire PE8 6HJ United Kingdom
Sponsor	Confidential

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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.



Dina Gomez,  
Technical Officer

## Objectives

To determine

- The efficacy of a confidential fungicide to control downy mildew, chocolate spot and rust in spring beans.
- How the efficacy of the confidential product compared with the standards Amistar, Custodia, Elatus Era, Signum and Sunorg Pro.

## Summary

- Confidential 1 fungicide provided good control of downy mildew and rust compared to the untreated plots.
- Control of downy mildew and rust using Confidential 1 fungicide was comparable with the standard fungicides tested in this trial (Amistar, Sunorg Pro, Elatus Era, Signum and Custodia).
- Chocolate spot was present only at very low levels in this trial. Untreated plots had very little infection. This was most likely due to low rainfall and warm temperatures and possibly due to the higher levels of downy mildew and rust which may have masked chocolate spot infection.
- Confidential 1 fungicide led to reduced chocolate infection and was comparable to the standard fungicides and better than the poorest performing treatment.

## Test items and treatments

**Table 1.** Test items

Name	Active(s)	Conc.	Formulation	Batch/lot	MAPP
Amistar	azoxystrobin	250 g/l	SC	n/a	18039
Custodia	azoxystrobin + tebuconazole	120 + 200 g/l	SC	n/a	16393
Elatus Era	benzovindiflupyr + prothioconazole	75 + 150 g/l	EC	SBMID02111	17889
Signum	Boscalid + pyraclostrobin	26.7 + 6.7 %	WG	n/a	11450
Sunorg Pro	metconazole	90 g/l	EC	n/a	15433

**Table 2.** Treatment list

Trt	Description	Rate(s) /ha	Ai(s) g/ha	Timing
1	Untreated	n/a	n/a	n/a
2	T1 Amistar T2 Sunorg	1.0 l 1.0 l	250 90	T1 + T2
3	T1 Elatus Era T2 Elatus Era	0.66 l 0.66 l	49.5 +99 49.5 + 99	T1 + T2
4	T1 Signum T2 Sunorg	1.0 kg 1.0 l	267 + 67 90	T1 + T2
5	T1 Custodia T2 Signum	1.0 l 1.0 kg	120 + 200 267 + 67	T1 + T2
6	T1 Confidential 1 T2 Confidential 1	n/a	n/a	T1 + T2

**Table 3.** Description of application timings

Timing	Growth stage or description of timing	BBCH
T1	First flat pods visible	69-70
T2	30-50% of filling pods	73-75

## Methods

**Trial design** - Plots measured 18 m<sup>2</sup> (1.8x10 m) and were arranged in a randomised complete block layout with four replications according to EPPO guideline PP1/152(4).

**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. Spray volumes were 200 l/ha.

**Assessments** – Downy mildew, chocolate spot and rust were assessed as percentage leaf area infected at the top, middle and bottom of the plant on 25 plants per plot (based on EPPO guidelines PP1/65(4), PP1/054(3), PP1/124(2)). Assessments were made just prior each treatment application, 19 days after T1 application and 8 days after T2 application (Table 4). Phytotoxicity was scored with each assessment using a scale from 0 to 10, where 10 = No phytotoxicity and 0 denoted dead crop according to EPPO guideline PP1/135(4).

**Analysis** - data were analysed using Analysis of Variance in STAR.

**Table 4.** Trials diary

Activity	Timing	BBCH	Date
Applications	T1	69-70	16-Jun-22
	T2	73-75	07-Jul-22
Assessments	A1	69-70	16-Jun-22
	A2 (+ phyto)	72-74	05-Jul-22
	A3 (+ phyto)	79-82	15-Jul-22

## Trial site

**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	Field beans ( <i>Vicia faba</i> )
Variety	Lynx
Drill date	17 March 2022
Inputs	Nirvana (4.4 l/ha) pre-emergence (30-Mar)



**a**



**b**

**Figure 1.** a. Evaluation plot. b. downy mildew, chocolate spot and rust symptoms on field beans.

## Results

During preparation and application none of the products tested showed any signs of precipitation and mixed well in water.

**Downy mildew** (Table 6, Figure 2): The infection recorded in untreated plots at the time of T1 application was: top 5.1%, middle 2.2% and bottom 0.1% of the plant section infected.

At A2, 19 days after T1, the disease was concentrated in the bottom part of the plant, with 66.2% in the untreated control. All treatments apart from treatment 5 (T1 Custodia, T2 Signum) gave significant control of downy mildew in the bottom of the plants compared to the untreated plots at A2. Treatment 2 (T1 Amistar, T2 Sunorg Pro) provided the best control in this section of the plant.

In the middle section, all treatments significantly reduced downy mildew compared to the untreated control. The disease was less severe in the top part of the plant and treatment 2 (T1 Amistar, T2 Sunorg Pro) significantly reduced the severity of the disease compared to the untreated control.

At A3, 8 days after T2, a similar trend of disease distribution in plants was observed, although differences were significant only at the bottom of the plants where downy mildew levels were higher than at the middle and top. All treatments reduced downy mildew compared to the untreated control in the bottom section, but only treatment 2 (T1 Amistar, T2 Sunorg Pro) was significantly different from the untreated plots. There were no significant differences between any of the treatments in the middle and top sections, although downy mildew levels were generally lower in all of the treated plots.

**Chocolate spot** (Table 7, Figure 3): There was a low level of chocolate spot prior to T1 in untreated plots, with 1.6% at the bottom, 1.7% at the middle and 0.5% at the top (leaf area infection).

At A2, chocolate spot incidence and severity were less than 1.7% leaf area infection, mainly at the bottom and middle of the plants. The untreated control plots had lower infection of chocolate spot, probably due to high levels of downy mildew and rust infection in these plots, masking and restricting infection with chocolate spot. Treatment 2 (T1 Amistar, T2 Sunorg Pro) had higher levels of chocolate spot infection compared with other treatments.

The level of chocolate spot infection at A3 was slightly higher, but with a similar distribution on plants as observed in A2, the best and consistent control of chocolate spot in all the sections of the plant, was treatment 4 (T1 Signum T2 Sunorg Pro). The confidential product had a good control too, comparable to the standard products and the untreated plots.

**Rust** (Table 8, Figure 4): Infection in the untreated plots was recorded just prior to T1. The disease was concentrated mostly in the bottom section of the plant with 3.2 % leaf area infection, 1.2 % at the middle and 0.2 % at the top.

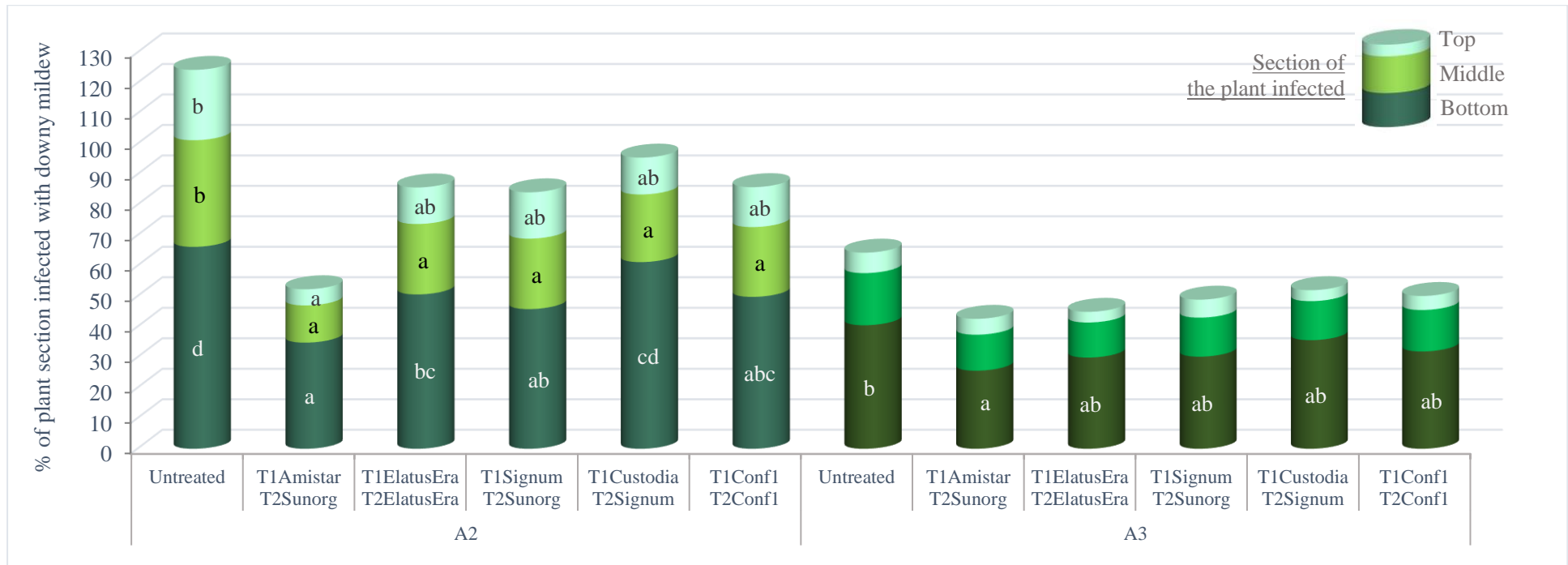
At A2, disease severity was highest in the middle section, and significant reduction of rust was provided by all treatments compared to the untreated control in all sections of the plants.

Rust infection at A3 was higher in the middle part of the plant. All treatments significantly reduced rust after T2 compared to the untreated control. The confidential product had better control after the second treatment application.

**Table 6.** Mean % area infected with downy mildew on the top, middle and bottom part of the plant at all assessment timings, on field beans.

No.	Treatment	16 Jun (A1)			5-Jul (A2)			15 Jul (A3)		
		top	middle	bottom	top	middle	bottom	top	middle	bottom
1	Control, Untreated	5.1	2.2	0.1	23.1 b	35.0 b	66.2 d	6.7	17.1	40.5 b
2	T1Amistar T2Sunorg Pro				5.3 a	12.2 a	34.8 a	5.2	11.8	25.6 a
3	T1ElatusEra T2ElatusEra				12.0 ab	23.1 a	50.6 bc	3.5	11.5	29.9 ab
4	T1Signum T2Sunorg Pro				15.2 ab	23.1 a	45.8 ab	5.9	12.8	30.2 ab
5	T1Custodia T2Signum				12.1 ab	22.2 a	61.2 cd	3.6	12.8	35.6 ab
6	T1Conf 1 T2Conf 1				13.1 ab	22.9 a	49.8 abc	4.6	13.6	31.9 ab
	F-value				3.89	6.3	8.98	0.75	1.47	3.06
	p-value				0.0018	0	0	0.5848ns	0.1983ns	0.0097

Means with the same letter are not significantly different, ns = not significant



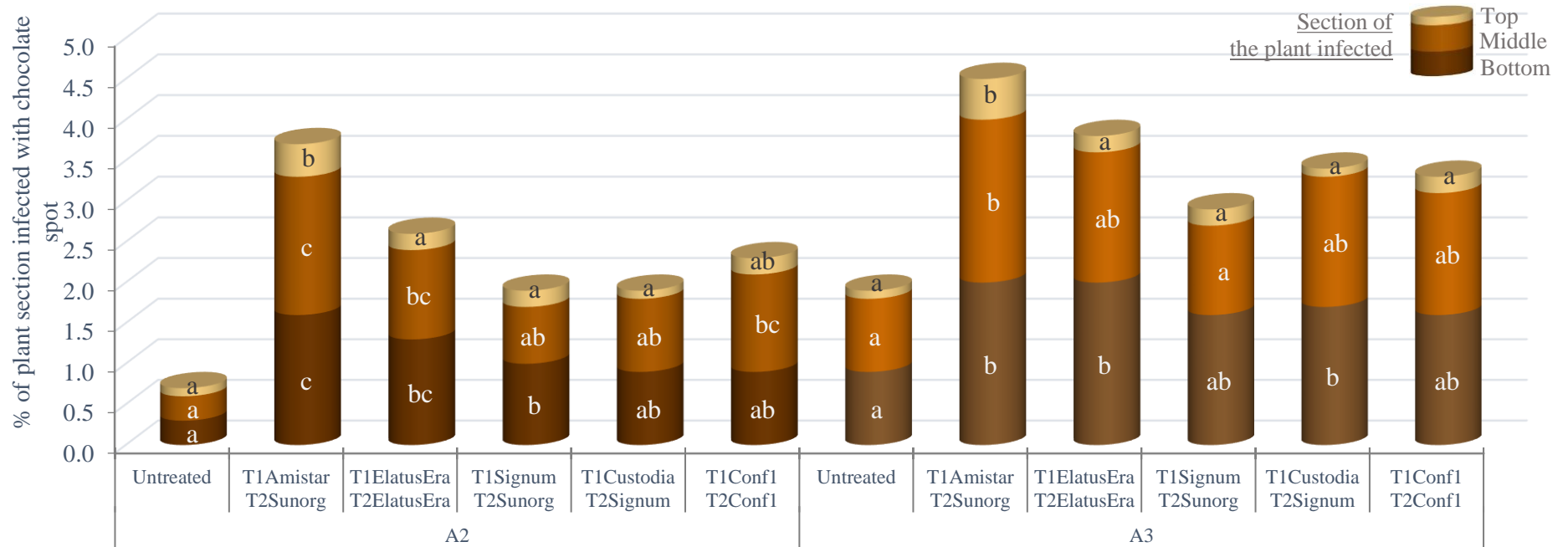
**Figure 2.** Mean % area infected with downy mildew at A2 and A3, on field beans.



**Table 7.** Mean % area infected with chocolate spot on the top, middle and bottom part of the plant at all assessment timings, on field beans.

No.	Treatment	16 Jun (A1)			5-Jul (A2)			15 Jul (A3)		
		top	middle	bottom	top	middle	bottom	top	middle	bottom
1	Control, Untreated	0.5	1.7	1.6	0.1 a	0.3 a	0.3 a	0.1 a	0.9 a	0.9 a
2	T1Amistar T2Sunorg Pro				0.4 b	1.7 c	1.6 c	0.5 b	2.0 b	2.0 b
3	T1ElatusEra T2ElatusEra				0.2 a	1.1 bc	1.3 bc	0.2 a	1.6 ab	2.0 b
4	T1Signum T2Sunorg Pro				0.2 a	0.7 ab	1.0 b	0.2 a	1.1 a	1.6 ab
5	T1Custodia T2Signum				0.1 a	0.9 ab	0.9 ab	0.1 a	1.6 ab	1.7 b
6	T1Conf 1 T2Conf 1				0.2 ab	1.2 bc	0.9 ab	0.2 a	1.5 ab	1.6 ab
	F-value				6.31	9.25	9.55	5.49	5.3	5.55
	p-value				0	0	0	0.0001	0.0001	0.0001

Means with the same letter are not significantly different, ns = not significant

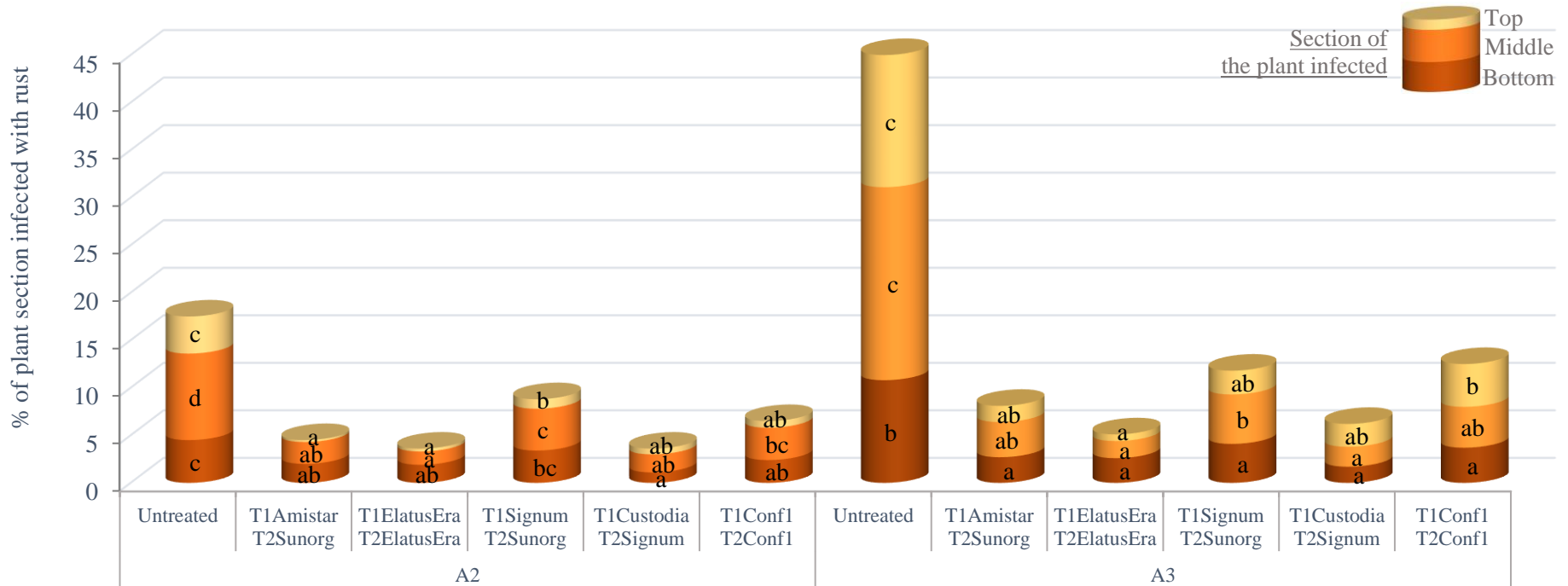


**Figure 3.** Mean % area infected with chocolate spot at A2 and A3, on field beans.

**Table 8.** Mean % area infected with rust on the top, middle and bottom part of the plant at all assessment timings, on field beans.

No.	Treatment	16 Jun (A1)			5-Jul (A2)			15 Jul (A3)		
		top	middle	bottom	top	middle	bottom	top	middle	bottom
1	Control, Untreated	0.2	1.2	3.2	3.9 c	9.1 d	4.5 c	18.7 c	20.3 c	10.8 b
2	T1Amistar T2Sunorg Pro				0.2 a	2.3 ab	2.0 ab	1.7 ab	3.7 ab	2.7 a
3	T1ElatusEra T2ElatusEra				0.3 a	1.4 a	1.9 ab	0.7 a	1.8 a	2.6 a
4	T1Signum T2Sunorg Pro				1.0 b	4.4 c	3.4 bc	2.5 ab	5.2 b	4.1 a
5	T1Custodia T2Signum				0.6 ab	1.9 ab	1.1 a	2.4 ab	2.1 a	1.7 a
6	T1Conf 1 T2Conf 1				0.7 ab	3.4 bc	2.4 ab	4.5 b	4.3 ab	3.7 a
	F-value				74.93	45.96	9.55	63.96	87.17	28.51
	p-value				0	0	0	0	0	0

Means with the same letter are not significantly different, ns = not significant



**Figure 4.** Mean % area infected with rust at A2 and A3, on field beans.

**Phytotoxicity:**

No phytotoxic symptoms were observed in any of the treatments at either assessment (Table 9).

**Table 9.** Mean phytotoxicity after T1 and T2 application. 10 = no phytotoxicity 0 = dead plant

No.	Treatment	5 Jul (A2)	15-Jul (A2)
1	Control, Untreated	10	10
2	T1Amistar T2Sunorg Pro	10	10
3	T1ElatusEra T2ElatusEra	10	10
4	T1Signum T2Sunorg Pro	10	10
5	T1Custodia T2Signum	10	10
6	T1Conf 1 T2Conf 1	10	10

**Yield:**

There were no significant differences in yield (tonnes per hectare) at 15% moisture content between any of the treatments (Table 10), although yield in the untreated plots was slightly lower than in all of the treated plots.

**Table 10.** Mean yield (t/ha) at 15% moisture content.

No.	Treatment	t/ha
1	Untreated	1.87
2	T1Amistar T2Sunorg Pro	2.08
3	T1ElatusEra T2ElatusEra	2.03
4	T1Signum T2Sunorg Pro	2.02
5	T1Custodia T2Signum	2.17
6	T1Conf 1 T2Conf 1	2.01
	F-value	0.35
	<i>p</i> -value	0.874ns

Means with the same letter are not significantly different, ns = not significant

## Discussion

This trial was performed in field beans, variety Lynx, one of the top-performing commercial varieties and selected for moderate susceptibility to downy mildew and susceptibility to rust (PGRO Descriptive List 2022). The aim was to evaluate the efficacy of a confidential fungicide against standard fungicides, for the control of downy mildew, chocolate spot and rust.

The weather in 2022 led to high levels of downy mildew, low levels of chocolate spot and moderate levels of rust infection; 2022 had dry May and July months compared to 2021 and higher temperatures (average °C) from April onwards in 2022 contrasted with the 2021 season (Appendix graphs).

The confidential fungicide (treatment 6) performed well against downy mildew, chocolate spot and rust after T1 and T2 application, and was comparable to the standard treatments.

No phytotoxicity or any unusual events were recorded in this trial. All products appeared to be crop safe.

There were no significant differences in yield between any of the treatments, possibly due to the short life cycle of the crop in 2022. The conditions in July were a combination of high mean maximum temperature 25.9 °C (high maximum of 40.78°C on 19<sup>th</sup> July), low mean accumulated precipitation 17.2 mm and low mean relative humidity 77.8%, that prompted very rapid crop senescence (Appendix).

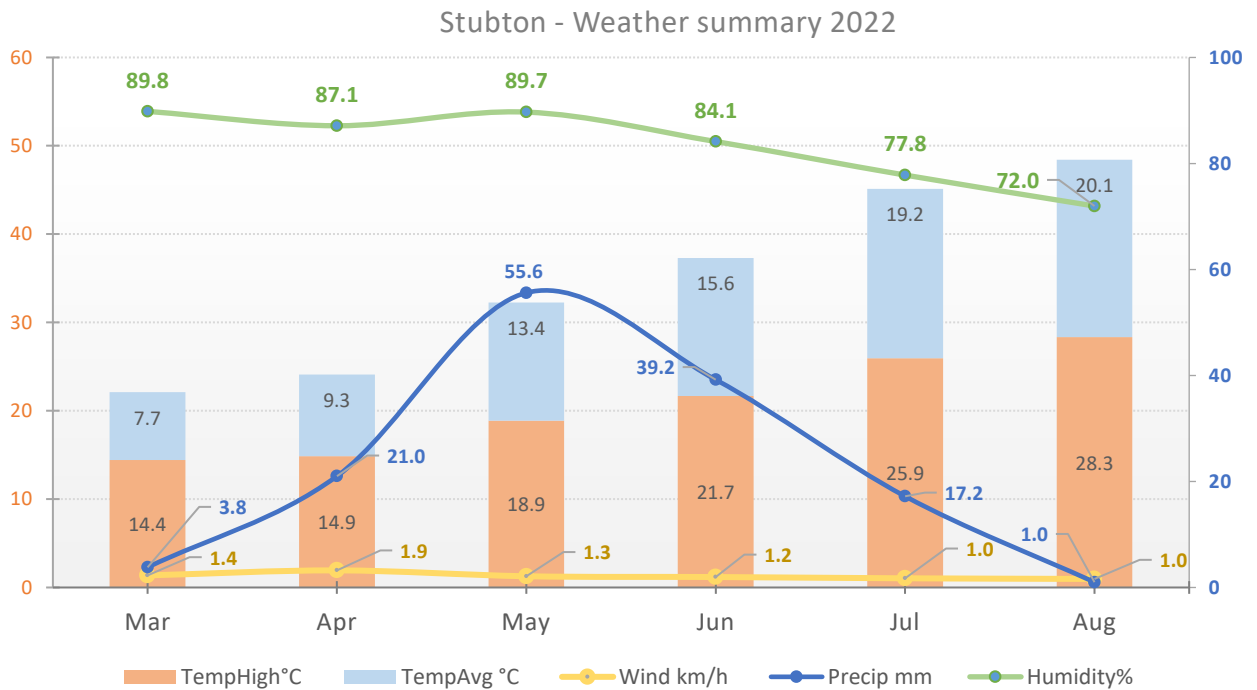
## Appendix

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
26-Apr	14.98	8.13	87.62	1.4	0

Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
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
08-Jun	21.4	16.18	94.46	1.2	3.4

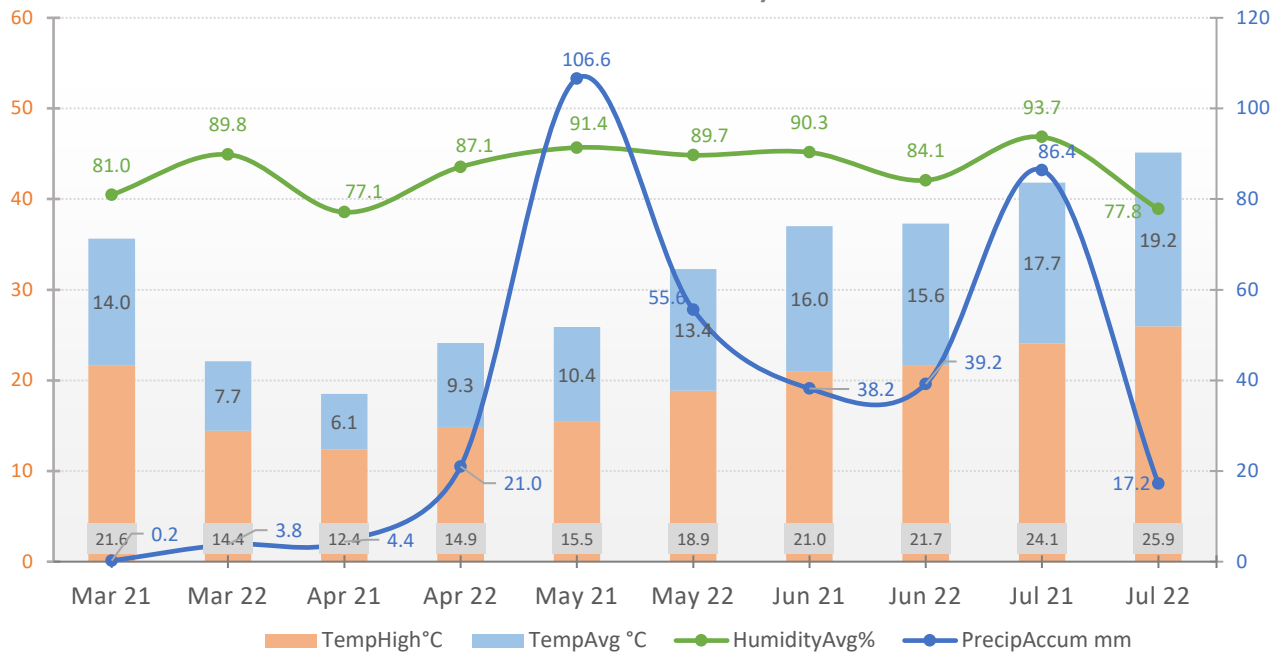
Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
09-Jun	19.89	14.81	91.62	1.5	0.2
10-Jun	22.35	17.02	80.46	1.9	0
11-Jun	21.92	15.99	82.81	2	0.6
12-Jun	21.2	14.98	75.84	1.3	0
13-Jun	18.66	14.36	85.74	0.7	0
14-Jun	23.94	16.34	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
21-Jul	21.24	18.74	84.11	1	0

Weather data Stubton 2022					
Date	Temperature		Humidity	Wind Speed	Precipitation Accum.
	High °C	Avg °C	Avg %	Avg km/h	Sum mm
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





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

