



PGRO Levy Final Report Combining peas – powdery mildew

Determining the efficacy of Thiopron, Signum, Caramba 90 and Arizona on powdery mildew in combining peas.

Trial 1 of 1

Project title	Determining the efficacy of Thiopron, Signum, Caramba 90 and Arizona on powdery mildew in combining peas.
Test items	Thiopron, Signum, Caramba 90, Arizona
Country / Region / EPPO zone	United Kingdom EPPO Maritime zone
Target crop	Combining peas (<i>Pisum sativum</i>)
Target pest	Powdery mildew (<i>Erysiphe pisi</i>)
GEP	Yes
Report author	Lea Herold
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Trial year	2021

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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.



Dr. Lea Herold
Plant Pathologist

Objectives

To determine and compare the efficacy of Thiopron, Signum, Caramba 90 and Arizona for powdery mildew control in combining peas.

Summary

After the first application, only Caramba 90 reduced powdery mildew levels significantly. After the second application, all products reduced powdery mildew levels significantly. Arizona was the weakest product, Caramba 90 the strongest. The lower disease pressure translated into faster senescence of the crop, although not significantly.

Test items and treatments

Table 1. Test items.

Name	Active(s)	Conc.	Formulation	Batch/lot	MAPP
Thiopron	Sulphur	825 g/l	SC	20315303	19147
Signum	Boscalid + pyraclostrobin	267 + 67 g/kg	WG	12000743	11450
Caramba 90	Metconazole	90 g/l	EC	0014690009	15524
Arizona	Folpet	500 g/l	SC	401105113	15318

Table 2. Treatment list.

Trt	Description	Rate(s)	Ai(s)	Timing
1	Control (untreated)	n/a	n/a	n/a
2	Thiopron	6 l/ha	4950 g/ha	T1 + T2
3	Signum	1 kg/ha	267 + 67 g/ha	T1 + T2
4	Caramba 90	0.8 l/ha	72 g/ha	T1 + T2
5	Arizona	1.5 l/ha	750 g/ha	T1 + T2
6	Undisclosed (A)			T1
7	Undisclosed (B)			T1
8	Undisclosed (C)			T1 + T2
9	Undisclosed (D)			T1 + T2
10	Undisclosed (E)			T1 + T2
11	Undisclosed (F)			T1 + T2
12	Undisclosed (G)			T1 + T2

Table 3. Description of application timings.

Timing	Growth stage or description of timing	BBCH
T1	Peas fully formed	79
T2	10% of pods ripe	81

Methods

Trial design - Plots measured 20 m² (2x10 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. Application were made with Lurmark 02F1 10 nozzles operating at a pressure of 2 bar for a fine/medium droplet quality in a water volume of 200 l/ha.

Assessments – Powdery mildew (*Erysiphe pisi*) was assessed as percentage leaf area infection on 25 plants per plot (based on EPPO guidelines PP1/172 (2), PP1/121 (2), PP1/124(2) and PP1/054 (3)). Assessments were made just prior to T2 applications and one week after the final application. Phytotoxicity was scored after each application. A 0-10 scale was used to assess phytotoxicity where 0 equated to no phytotoxicity symptoms observed and 10 denoted dead crop. Crop senescence was scored as % senescence (100% = fully senesced) 11 days after the final assessment.

Analysis – SAS and STAR statistical software was used to perform statistical analyses of all data. Disease data were analysed using pseudo-binomial logistic regression as described by McCullagh and Nelder, 1989. Senescence data were analysed using ANOVA.

Table 4. Trials diary.

Activity	Timing	BBCH	Date
Applications	T1	79	19/07/2021
	T2	81	26/07/2021
Assessments	A1	81	26/07/2021
	A2	83	02/08/2021
	A3	85-87	13/08/2021
Phytotoxicity	A1	81	26/07/2021
	A2	83	02/08/2021

Trial site

Table 5. Site details for Stubton trial (PC:08-21).

Test site information	
Town	Stubton
Postcode	NG23 5DA
N	53°1'58.23"
W	0°40'42.92"
Soil analysis	P/K/Mg = 13.6/100/81 mg/l, OM% = 5.5%, pH=7.9, sandy loam
Site description	Slightly thin crop of combining peas located amongst other trials in the same field. Some hedgerow shelter from prevailing wind.
Crop	Combining peas (<i>Pisum sativum</i>)
Variety	Sakura
Drill date	15/04/2021
Inputs	Nirvana at 4.5 l/ha, Centium at 0.2 l/ha on 23/04/2021



Figure 1. Powdery mildew infection in control plots, 26/07/2021.



Figure 2. High levels of powdery mildew infection in control plots (left), plants nearly free of powdery mildew infection in one of the plots having received an effective product (right), 02/08/2021.

Results

No issues were encountered with regards to handling or blending with any of the products trialled.

At the first application, very few lesions of powdery mildew were present in the crop.

At the first assessment after one application had been made, Caramba 90 significantly reduced infection levels with powdery mildew in comparison to the control. Signum, Thioproton and Arizona reduced levels of infection but not significantly.

At the second assessment, one week after the second application, all four products significantly reduced infection levels in comparison to the control. Caramba 90 gave the strongest reduction, Arizona the weakest.

Table 6. Mean % area of leaf infection with powdery mildew at all assessment timings.

Treatment	26/07/21	2/08/21
1	5.52 ^{ab}	27.88 ^a
2	2.85 ^{bc}	5.88 ^{bc}
3	10.40 ^{ab}	3.31 ^{cd}
4	1.28 ^c	2.75 ^{cd}
5	8.80 ^a	9.56 ^b
6	4.72 ^{ab}	26.48 ^a
7	7.20 ^a	23.34 ^a
8	0.72 ^c	0.69 ^d
9	0.68 ^c	0.94 ^d
10	0.48 ^c	0.13 ^d
11	0.43 ^c	0.19 ^d
12	0.25 ^c	0.25 ^d
Wald χ^2	133.61	484.02
p-value	<0.0001	<0.0001

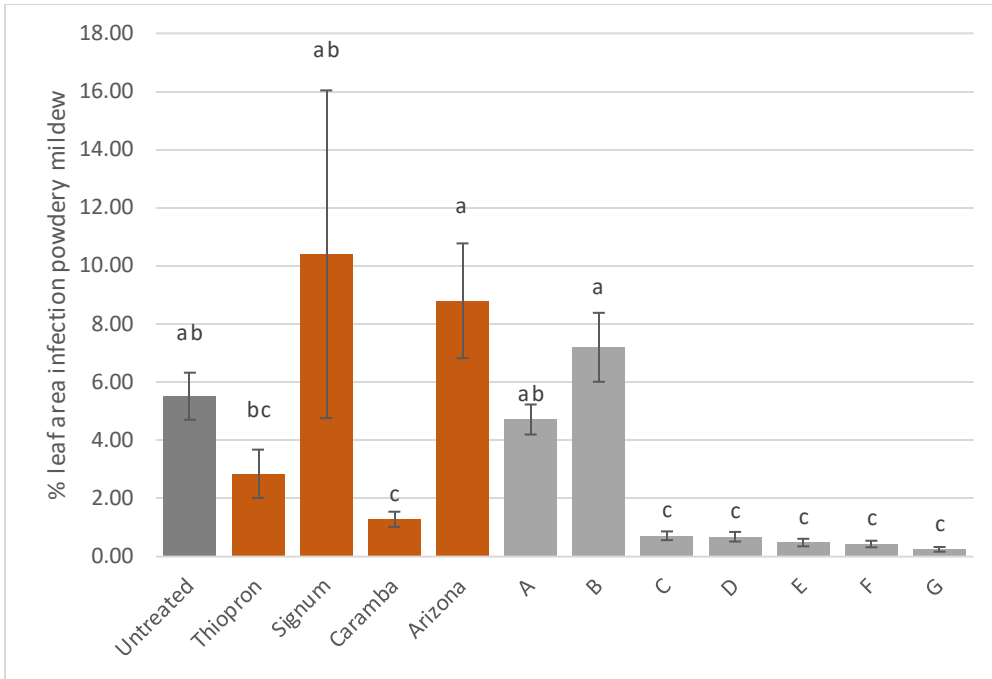


Figure 3. Mean % area of leaf infection with pea powdery mildew (26/07/21).

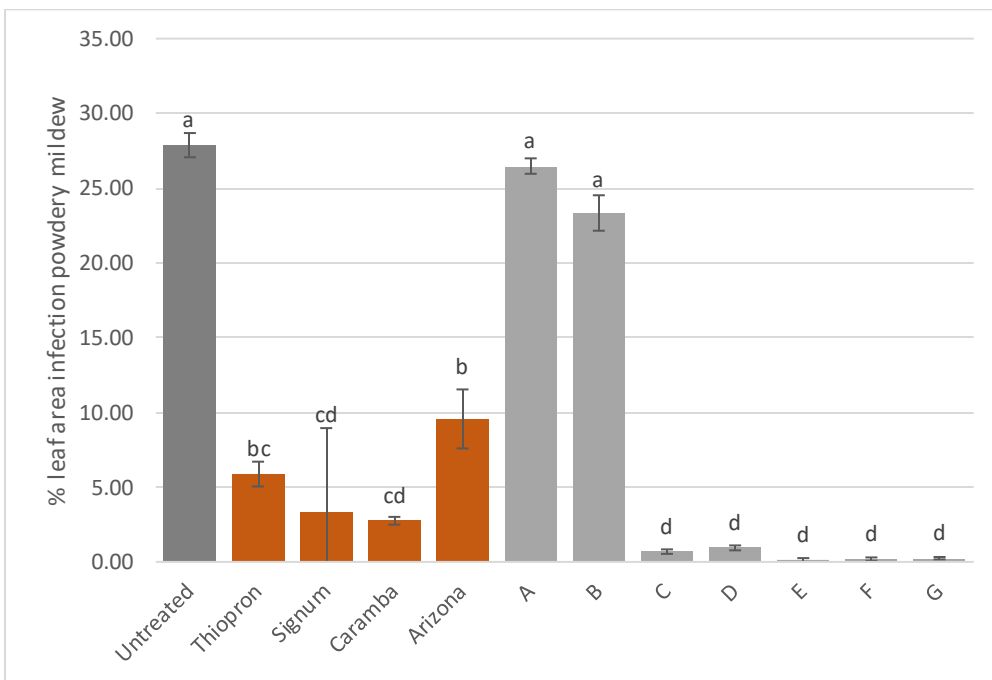


Figure 4. Mean % area of leaf infection with pea powdery mildew (02/08/21).

No phytotoxicity was observed at any point during the trial.

Table 7. Mean scores of phytotoxicity after each application. 0 = no phytotoxicity, 10 = dead crop.

Treatment	23/06/21	05/07/21
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0

Plot senescence about two weeks before the crop would be ready for harvest varied between treatments, although not significantly. Thiopron, Signum and Caramba 90 treated plot showed more than 10% greater senescence than control plots. Arizona treated plots were at similar maturity as control plots.

Table 8. Mean % plot senescence.

Treatment	13/08/21
1	66.25
2	80.00
3	87.50
4	80.00
5	70.00
6	72.50
7	70.00
8	86.25
9	85.00
10	83.75
11	83.75
12	85.00
F value	1.42
p-value	Not significant

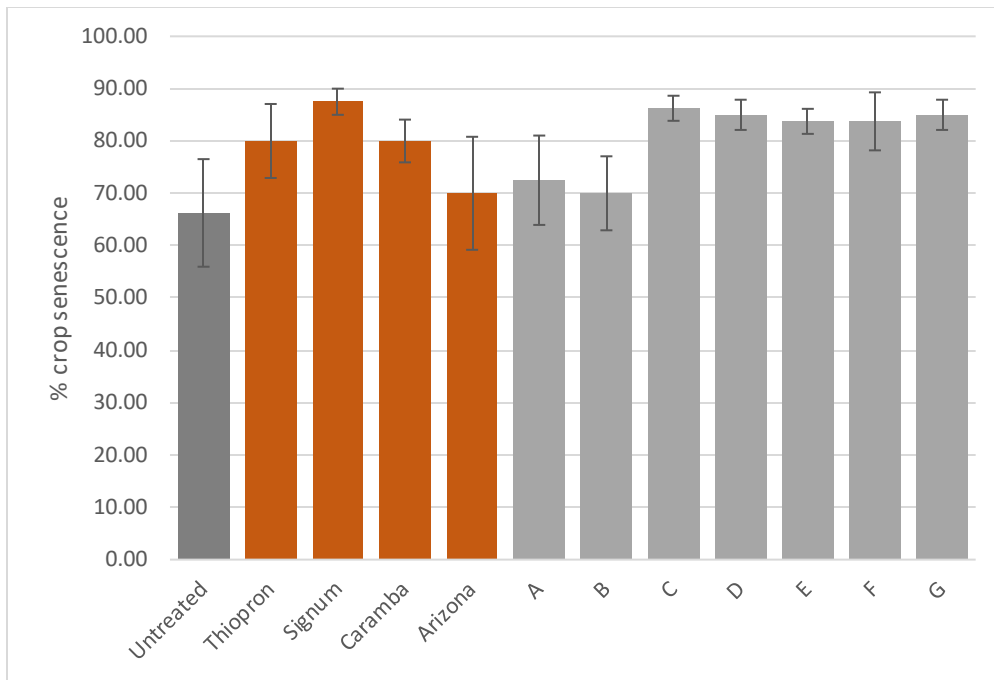


Figure 5. Mean % crop senescence (13/08/2021).

Discussion

This trial was performed in combining peas to establish and compare the efficacy of Thiopron, Signum, Caramba 90 and Arizona on the control of pea powdery mildew.

The crop selected was a variety with high susceptibility to powdery mildew (Sakura). The crop was drilled late (mid April) because later drilled crops are of higher risk to powdery mildew development. Powdery mildew needs warm days and cool, humid night for development. These conditions were met in late July and early August. Treatments were applied according with commercial practices at start of disease development and 7-10 days later.

One week after the second application, control plots showed nearly 30% leaf area infection with downy mildew.

Thiopron significantly reduced infection levels by powdery mildew after the second application, averaging at just over 5% leaf area infection. Signum significantly reduced infection levels by powdery mildew after the second application, averaging at just under 5% leaf area infection, but differences between replicates were high. Caramba 90 significantly reduced infection levels by powdery mildew after the second application, averaging at just under 5% leaf area infection. Arizona significantly reduced infection levels by powdery mildew after the second application, averaging at just over 10% leaf area infection. Some of the undisclosed trialled products kept the crop nearly disease free.

Powdery mildew delays crop maturity and differences, although not significantly, in crop senescence were observed a few weeks before harvest. Roughly speaking, the lower the disease pressure, the furthest matured the crops were.

Thiopron is approved, under an EAMU, for powdery mildew control in combining peas. Signum, approved in combining peas for other diseases has a 21 day harvest interval and Caramba 90, also approved in combining peas for other diseases has a 14 day harvest interval. This year, time of last application to harvest was greater than 21 days. Arizona is not approved in combining peas.

Powdery mildew is of increasing concern in combining and vining peas in recent years due to hotter summers. Thiopron, Signum and Caramba 90 all provided control of powdery mildew.

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

Appendix

Weather data, Stubton

Date	Air temperature [°C]			Relative humidity [%]	Precipitation [mm]	Leaf Wetness [min]	Wind speed [m/s]	Soil temp. [°C]
	avg	max	min	avg	sum	time	avg	avg
13/08/2021	18.31	24.62	12.55	76.46	0	0	2.4	19
12/08/2021	18.46	24.57	12.83	77.23	0	0	1.8	19.3
11/08/2021	17.9	24.37	12.43	85.93	0	0	1.2	18.8
10/08/2021	17.68	24.99	11.17	85.33	0	15	1.1	18.3
09/08/2021	15.64	22.71	9.97	87.92	0.2	695	1.3	17
08/08/2021	15.52	18.53	10.77	99.84	10.8	765	2.1	17.4
07/08/2021	16.47	22.48	11.71	88.53	0.4	240	1.7	17.8
06/08/2021	17	22.3	13.11	95.41	0.6	815	1.8	18.5
05/08/2021	16.43	22.68	11.05	89.88	5.2	345	0.7	18.4
04/08/2021	17.6	24.84	11.75	80.25	0	70	0.3	18.9
03/08/2021	14.79	22.51	7.96	96.38	1.4	705	0.3	17.4
02/08/2021	15.37	21.74	9.97	82.1	0	170	0.2	17.7
01/08/2021	14.62	18.15	10.83	99.06	2	790	0.7	17.8
31/07/2021	16.61	20.77	13.12	98.88	0	655	1.5	18
30/07/2021	14.73	21.91	11.44	99.61	6.8	1100	1.1	17.6
29/07/2021	16.01	21.65	10.78	81.42	0	550	2.3	16.8
28/07/2021	15.73	21.24	10.81	95.99	8.6	1025	1.4	18.8
27/07/2021	17.97	24.71	14.64	96.3	8.4	605	0.5	20.5
26/07/2021	19.66	26.82	13.92	82.91	0	0	0.4	21.1
25/07/2021	17.19	21.89	13.82	99.69	0	0	1	19.8
24/07/2021	16.96	20.76	13.67	99.25	0	0	1.7	19.8
23/07/2021	16.55	20.08	13.61	99.83	0	865	0.9	20.5
22/07/2021	20.18	30.03	12.32	86.99	5	360	0.4	23.4
21/07/2021	20.5	28.29	14.51	90.8	0	0	0.7	23.8
20/07/2021	21.82	30.72	14.19	89.21	0	0	0.3	23.6
19/07/2021	20.87	28.37	12.99	86.97	0	0	0.6	23
18/07/2021	21.91	30.91	13.37	82.94	0	0	0.6	22.8
17/07/2021	21.39	30.04	11.43	84.17	0	0	0.2	21.8
16/07/2021	18.3	26.96	9.56	92.07	0	0	0.6	19.9
15/07/2021	16.72	22.57	11.07	99.34	0	0	1.1	19.1
14/07/2021	18.05	24.15	12.8	98.14	0	0	1.2	19.4
13/07/2021	16.91	20.98	13.81	99.84	0.2	960	1	19
12/07/2021	16.52	20.42	14.2	99.82	2.8	1225	0.2	19
11/07/2021	17.05	22.94	11.47	96.73	1.4	0	0.3	18.9
10/07/2021	17.87	23.57	13.19	92.25	0.2	820	0.2	19.9
09/07/2021	17.86	24.98	12.29	91.73	31	255	0.2	19.4
08/07/2021	18.02	23.42	13.42	92.57	0.2	710	0.4	18.9
07/07/2021	16.52	22.69	13.69	99.75	6	615	1.4	17.9
06/07/2021	15.3	19.86	12.8	99.2	8.4	640	1.9	17.3



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