



PGRO Final Levy Report

Vining peas – downy mildew

Determining the efficacy of Revus, Phorce, Soriale and Arizona on downy mildew in vining peas

Project title	Determining the efficacy of Revus, Phorce, Soriale and Arizona on downy mildew in vining peas
Test items	Revus, Phorce, Soriale, Arizona
Country / Region / EPPO zone	United Kingdom EPPO Maritime zone
Target crop	Vining peas (<i>Pisum sativum</i>)
Target pest	Downy mildew (<i>Peronospora viciae</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.



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Plant Pathologist

Objectives

To determine and compare the efficacy of Revus, Phorce, Soriale and Arizona on control of vining pea downy mildew.

Summary

- Soriale, a product containing potassium phosphonates, significantly reduced infection levels with downy mildew after the first application.
- Revus slightly reduced infection levels in comparison to the control after the first application, but in this trial, control was not significant.
- None of the products showed any downy mildew control after the second application.

Test items and treatments

Table 1. Test items.

Name	Active(s)	Conc.	Formulation	Batch/lot	MAPP
Revus	Mandipropamid	250 g/l	SC	GRA9F00022	17443
Phorce	N:P ₂ O ₅ :K ₂ O	5%, 38%, 15%	EC Fertiliser	n/a	n/a
Soriale	Potassium phosphonates	755 g/l	SC	1611649065	19166
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	Revus	0.6 l/ha	150 g/ha	T1 + T2
3	Phorce	1 l/ha	0.05 + 0.38 + 0.15 g/ha	T1 + T2
4	Soriale	1.86 l/ha	1404 g/ha	T1 + T2
5	Arizona	1.5 l/ha	750 g/ha	T1 + T2
6	Undisclosed (X)			T1 + T2
7	Undisclosed (Y)			T1 + T2
8	Undisclosed (Z)			T1 + T2

Table 3. Description of application timings.

Timing	Growth stage or description of timing	BBCH
T1	Early flower	(18) 59
T2	Full flower / 1 st pod	63-65

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. At the T1 application, Lurmark 03F1 10 nozzles were used, operating at a pressure of 2 bar for a medium droplet quality in a water volume of 280 l/ha. At the T2 application, Lurmark 02F1 10 nozzles were used, operating at a pressure of 2 bar for a fine/medium droplet quality in a water volume of 200 l/ha.

Assessments - Downy mildew (*Peronospora viciae*) 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 applications and two weeks 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.

Analysis – SAS 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.

Table 4. Trials diary.

Activity	Timing	BBCH	Date
Applications	T1	18 (59)	09/06/2021
	T2	63-65	23/06/2021
Assessments	A0	18 (59)	09/06/2021
	A1	63-65	23/06/2021
	A2	72	05/07/2021
Phytotoxicity	A1	63-65	23/06/2021
	A2	72	05/07/2021

Trial site

Table 5. Site details for Kilham trial.

	Test site information
Town	Kilham
Postcode	YO25 4EE
N	54°6'9.75"
W	0°23'5.44"
Site description	Large, slightly exposed field on a stony clay loam
Soil analysis	pH: 8.1, P: index 2, K: index 2, Mg: index 2
Crop	Vining pea (<i>Pisum sativum</i>)
Variety	Celebration
Drill date	01/04/2021, seed rate 170 kg/ha
Inputs	Nirvana (3 l/ha) and Centium 360 CS (0.15 l/ha) on 03/04/2121 Benta 480 SL (1 l/ha) and Tropotox (2 l/ha) on 19/05/2121 Aphox (0.14 l/ha) and Hallmark Zeon (0.075 l/ha) on 17/06/2121



Figure 1. Trial site at last assessment (05/07/21).



Figure 2. Downy mildew symptoms present on leaf and tendrils (05/07/21).

Results

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

Foliar downy mildew was present at the time of the first application at infection levels of around 3-5% total leaf area.

At the first assessment, only the application of Soriale significantly reduced infection levels in comparison to the control. Although infection levels were also slightly reduced by Revus, Phorce and Arizona, none of these products influenced pea downy mildew infection levels significantly.

The final assessment, 12 days after the second application, showed no significant treatment effects compared to the control.

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

Treatment	23/06/21	05/07/21
1	3.91 ^a	3.48
2	3.40 ^{ab}	3.16
3	2.97 ^{ab}	3.28
4	2.78 ^b	2.72
5	3.02 ^{ab}	3.32
6	3.55 ^{ab}	2.9
7	3.58 ^{ab}	2.53
8	3.81 ^a	3.05
Wald χ^2	21.64	ns
p-value	0.0029	

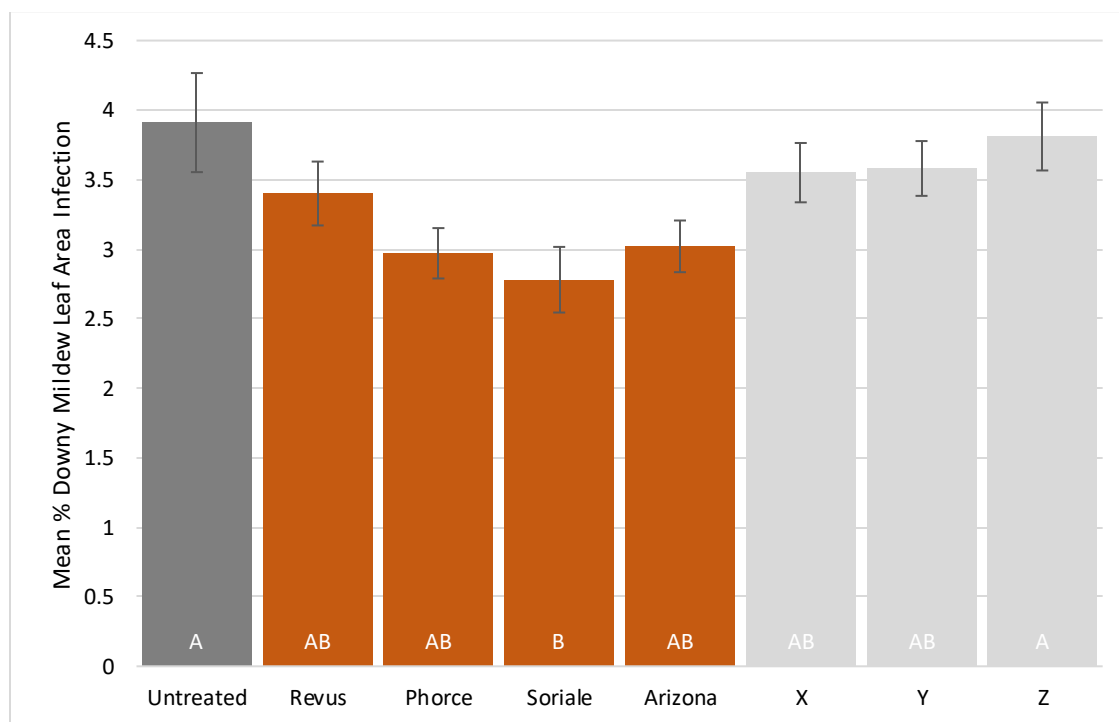


Figure 3. Mean % area of leaf infection with pea downy mildew (23/06/21).

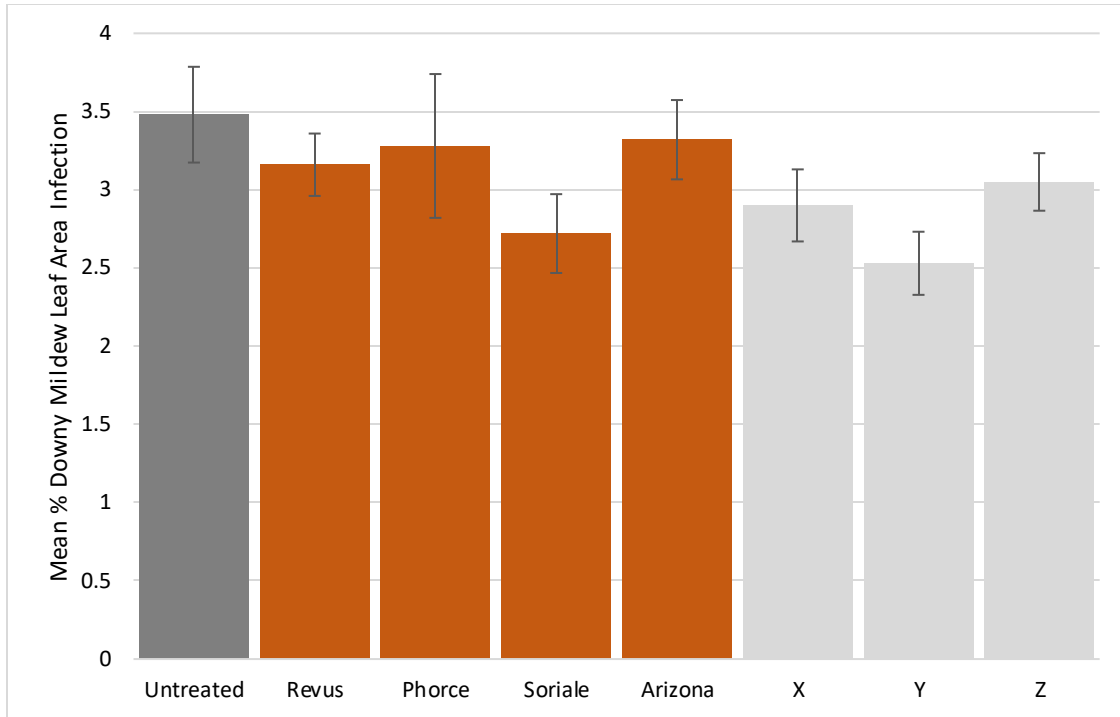


Figure 4. Mean % area of leaf infection with downy mildew (05/07/21).

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

Discussion

This trial was performed in vining peas to establish and compare the efficacy of Revus, Phorce, Soriale and Arizona on the control of downy mildew.

The crop selected was a variety with high susceptibility to downy mildew (Celebration). A dry and cold April passed to take a stressed crop into late spring conditions that were ideal for downy mildew development. Downy mildew was well established at the beginning of the trial and remained at a considerable level for the entire duration. Treatments were applied according with commercial practices at start of flowering and 14 days later.

Only the application of Soriale, a product containing potassium phosphonates, significantly reduced infection levels after the first application. It is known that the active substance in phosphonates, phosphonic acid, has effect on fungal diseases, particularly downy mildew. However, residues of phosphonic acid are regularly detected in crops above the maximum residue levels which hinders the use of phosphonates in crop protection. A recent publication in the EFSA journal describes changes made to maximum residue levels in several crops due to evidence “that the long-term intake of residues resulting from the use of potassium phosphonates according to the reported agricultural practices is unlikely to present a risk to consumer health” (EFSA Journal, September 2020, <https://doi.org/10.2903/j.efsa.2020.6240>). However, legume crops are not mentioned.

Revus, which is approved in vining peas for the control of foliar downy mildew, slightly reduced infection levels in comparison to the control, but in this trial, control was not significant. Given the overall minor reductions in downy mildew by all products trialled and the lack of any significant treatment effects after the second application, it remains unlikely that any of the applications would have been effective in preserving yield. Whether infection levels of under 5% leaf area in the control plots would have impacted on vining pea yield is uncertain. Pod infection levels could not be assessed in this trial so any effects on product quality remain unknown.

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

Appendix

Weather data, Driffield, about 6 miles from Kilham

Date	Temperature			Humidity	Wind speed	Precipitation
	High	Avg	Low	Avg	Avg	Sum
01/06/2021	20.1 °C	12.3 °C	7.2 °C	84%	2.4 km/h	0.00 mm
02/06/2021	19.4 °C	13.3 °C	8.6 °C	79%	3.6 km/h	0.00 mm
03/06/2021	19.9 °C	14.8 °C	10.5 °C	83%	2.5 km/h	0.00 mm
04/06/2021	19.7 °C	14.4 °C	10.8 °C	74%	1.6 km/h	0.00 mm
05/06/2021	22.5 °C	15.5 °C	8.6 °C	72%	1.8 km/h	0.00 mm
06/06/2021	19.3 °C	14.8 °C	9.5 °C	82%	1.1 km/h	0.00 mm
07/06/2021	23.1 °C	14.6 °C	7.4 °C	88%	2.0 km/h	11.20 mm
08/06/2021	23.0 °C	16.2 °C	8.7 °C	74%	1.9 km/h	0.00 mm
09/06/2021	26.1 °C	18.4 °C	9.4 °C	74%	2.2 km/h	0.00 mm
10/06/2021	23.0 °C	18.6 °C	13.6 °C	79%	3.2 km/h	0.00 mm
11/06/2021	22.0 °C	17.7 °C	11.3 °C	75%	4.6 km/h	0.00 mm
12/06/2021	22.2 °C	14.8 °C	10.6 °C	73%	2.5 km/h	0.00 mm
13/06/2021	24.6 °C	17.7 °C	9.6 °C	76%	1.9 km/h	0.00 mm
14/06/2021	19.8 °C	16.1 °C	10.5 °C	77%	2.9 km/h	0.00 mm
15/06/2021	20.8 °C	14.5 °C	7.0 °C	72%	3.1 km/h	0.00 mm
16/06/2021	27.0 °C	18.8 °C	8.3 °C	69%	3.2 km/h	0.00 mm
17/06/2021	20.3 °C	16.0 °C	13.8 °C	83%	1.8 km/h	2.49 mm
18/06/2021	15.8 °C	13.5 °C	11.4 °C	88%	3.3 km/h	10.69 mm
19/06/2021	19.1 °C	13.8 °C	10.3 °C	82%	1.8 km/h	0.99 mm
20/06/2021	16.6 °C	12.8 °C	9.9 °C	82%	2.7 km/h	2.49 mm
21/06/2021	15.1 °C	11.4 °C	7.8 °C	82%	3.8 km/h	2.59 mm
22/06/2021	17.0 °C	12.4 °C	5.9 °C	70%	3.7 km/h	0.00 mm
23/06/2021	21.4 °C	13.9 °C	3.9 °C	75%	1.7 km/h	0.00 mm
24/06/2021	21.8 °C	16.6 °C	11.8 °C	81%	2.0 km/h	1.50 mm
25/06/2021	14.0 °C	13.2 °C	11.5 °C	90%	5.0 km/h	5.11 mm
26/06/2021	19.5 °C	14.2 °C	10.8 °C	81%	1.8 km/h	0.00 mm
27/06/2021	20.2 °C	15.1 °C	10.9 °C	83%	3.0 km/h	0.00 mm
28/06/2021	17.9 °C	14.3 °C	11.2 °C	83%	1.5 km/h	0.00 mm
29/06/2021	19.6 °C	14.4 °C	9.3 °C	81%	3.5 km/h	0.00 mm
30/06/2021	14.9 °C	12.6 °C	9.2 °C	84%	4.2 km/h	0.00 mm
01/07/2021	17.3 °C	13.4 °C	9.3 °C	82%	2.4 km/h	0.00 mm
02/07/2021	21.5 °C	15.8 °C	11.4 °C	82%	1.9 km/h	0.00 mm
03/07/2021	20.5 °C	15.6 °C	12.3 °C	93%	1.4 km/h	6.10 mm
04/07/2021	23.7 °C	17.2 °C	13.6 °C	87%	2.4 km/h	6.91 mm
05/07/2021	19.8 °C	15.7 °C	13.2 °C	86%	3.3 km/h	6.81 mm
06/07/2021	19.5 °C	15.2 °C	11.9 °C	85%	4.1 km/h	16.99 mm
07/07/2021	21.5 °C	16.4 °C	13.2 °C	86%	3.3 km/h	3.10 mm
08/07/2021	23.8 °C	17.1 °C	11.7 °C	80%	1.5 km/h	0.00 mm
09/07/2021	24.0 °C	17.5 °C	11.2 °C	79%	1.7 km/h	0.00 mm
10/07/2021	20.9 °C	15.4 °C	12.8 °C	91%	1.7 km/h	0.20 mm



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