SCEPTREPLUS

Final Trial Report

Trial code:	SP26
Title:	Evaluation of foliar applied biopesticides and conventional fungicides for control of leaf spot caused by *Septoria apiicola* in celery
Crop	Celery
Target	Septoria leaf spot (*Septoria apiicola*), SEPTAP
Lead researcher:	Dr Aoife O' Driscoll
Organisation:	RSK ADAS Ltd.
Period:	May 2018 to October 2018
Report date:	30th November 2018
Report author:	Dr Aoife O' Driscoll
ORETO Number: (certificate should be attached)	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

…30/11/18…… ……

Date Authors signature

Trial Summary

Introduction

The fungal plant pathogen *Septoria apiicola* causes Septoria leaf spot, one of the most destructive diseases of field-grown celery crops. Control of this disease is threatened by the impending loss of thiram which will greatly impact on the number of seed treatments available to propagators and seed houses.

This two year study will investigate new seed treatments and foliar applied products for control of Septoria leaf spot for use in both organic and conventionally produced celery. The research consists of two trials; the first evaluating foliar applied conventional chemical fungicide and biofungicide products for management of Septoria in the field and the second (beginning March 2019) investigating conventional chemical fungicides and novel seed treatment options. The aim of the trial presented here is to evaluate products for foliar application in order to assess products for disease management and thereby increase options available to celery growers for reducing Septoria leaf spot.

Methods

Plant protection products comprising 7 conventional chemical fungicides and 2 biopesticides were tested alongside an untreated control and a positive standard which was a programme of Amistar/Switch in rotation and Amistar/Plover in rotation, in a celery crop of cultivar Victoria. Each plot comprised 10 plants with each treatment replicated 4 times (n: 4x10=40 plants/treatment), with a double untreated control (n=80 plants). The first treatments were applied 5 days after planting (5DA planting) and before the crop was exposed to infection by *S. apiicola* (i.e. products were applied as protectant treatments). Two days after the first treatment application (7 DA planting) plants were inoculated with a freshly prepared spore suspension of *S. apiicola* at a concentration of $5x10^5$ spores/ml, sprayed to just before run off. All tested products were then applied every two weeks with 5 applications of each product made. Products were applied using an Oxford Precision Sprayer at a water volume of 300 L/ha for all products. Leaf spot was first seen in the untreated plots 13 days after inoculation and 3 weeks after the first application of treatments; infection was then assessed fortnightly until 13 weeks after planting (5 assessments in total).

Results

Leaf spot disease incidence and severity was assessed on a % scale where incidence was measured as the number of plants affected and severity was measured as the % leaf area affected. Mean values and results of analysis at the five assessment timings are presented in Table 1 and Table 2 below.

Table 1: Mean % disease incidence of leaf spot in celery at all 5 assessment timings.

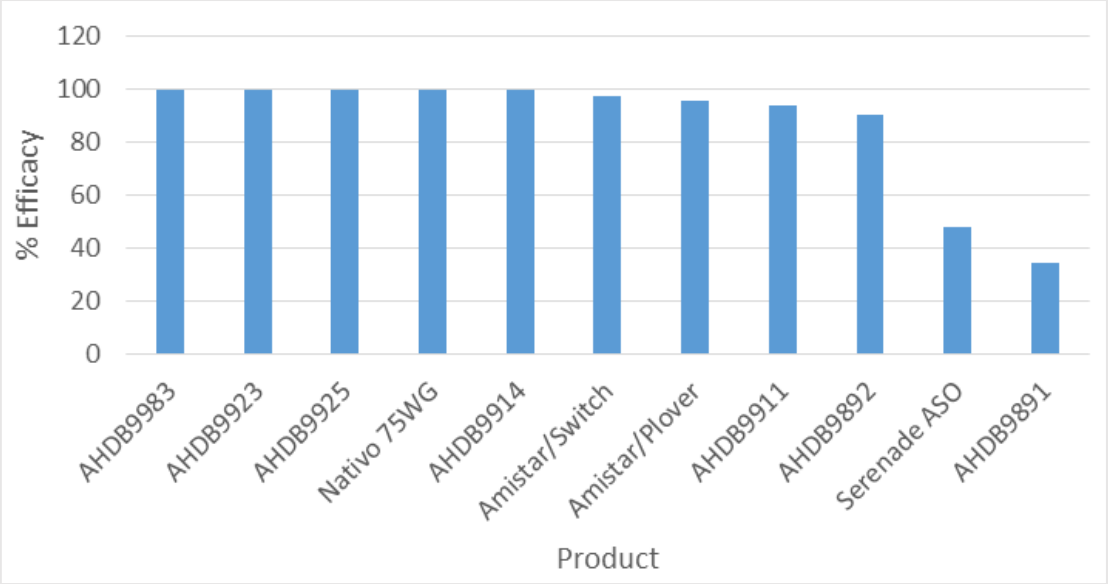
	Mean % disease incidence				
Date	**14/08/18**	**29/08/18**	**13/09/18**	**24/09/18**	**11/10/18**
Treatment					
Untreated	62.5	62.5	97.5	100	100
Amistar/Switch	0	5	17.5	27.5	25
Amistar/Plover	5	10	15	15	17.5
AHDB9983	0	0	0	2.5	2.5
AHDB9914	0	2.5	2.5	7.5	7.5
Nativo 75WG	0	0	2.5	5	5
AHDB9925	0	2.5	2.5	2.5	2.5
AHDB9911	0	0	12.5	17.5	25
AHDB9892	7.5	7.5	7.5	27.5	32.5
AHDB9923	0	2.5	2.5	2.5	2.5
Serenade ASO	60	62.5	75	87.5	90
AHDB9891	70	70	92.5	100	100
P value	>0.001	>0.001	>0.001	>0.001	>0.001
d.f.	37	37	37	37	37
l.s.d.	20.1	17.97	20.52	20.67	26.13
	Not significantly different from untreated control (p>0.05)				
	Significantly different from untreated control (p>0.05)				

Table 2: Mean % disease severity of leaf spot in celery at all 5 assessment timings.

	Mean % disease severity				
Date	**14/08/18**	**29/08/18**	**13/09/18**	**24/09/18**	**11/10/18**
Treatment					
Untreated	1.3	2.3	19.9	34.9	33.1
Amistar/Switch	0	0.1	0.4	1.2	1.35
Amistar/Plover	0.2	0.4	0.8	1.9	2
AHDB9983	0	0	0	0.02	0.1
AHDB9914	0	0.1	0.1	0.2	0.3
Nativo 75WG	0	0	0.8	0.2	0.3
AHDB9925	0	0.02	0.1	0.2	0.3
AHDB9911	0.3	0.3	0.5	0.9	2.9
AHDB9892	0.3	0.4	0.7	3.4	4.4
AHDB9923	0	0.02	0.02	0.075	0.1
Serenade ASO	1	1.8	23.2	23.175	23.8
AHDB9891	1.1	2.1	29.2	29.2	29.8
P value	>0.001	>0.001	>0.001	>0.001	>0.001
d.f.	37	37	37	37	37
l.s.d.	0.5727	0.6203	8.349	13.077	9.045
	Not significantly different from untreated control (p>0.05)				
	Significantly different from untreated control (p>0.05)				

The efficacy of each tested product against leaf spot (presented as the calculated percentage reduction in leaf spot levels compared to untreated) at the final assessment date, is presented in Figure 1.

Figure 1: Efficacy of products, shown as percentage reduction in leaf spot severity at the final assessment timing.



Conclusions

Moderate to high levels of disease developed in untreated plots. The programmes of Amistar/Switch and Amistar/Plover in rotation were effective as expected, giving good control of Septoria leaf spot. At the final assessment, all conventional fungicide products resulted in significant levels of leaf spot control of >90% compared to the untreated plots. The two biopesticides tested were not significantly different from untreated plots during the trial, when the products were applied fortnightly rather than weekly as indicated by the manufacturers, which may have impeded their efficacy. Further work using weekly applications of these products is recommended before drawing firm conclusions. No product tested caused any phytotoxicity to the plants.

Nativo 75WG was one of the best performing products in the trial, giving >99% control in comparison to the untreated plots; an EAMU for this product on celery has recently been gained. A mixture of tebuconazole and trifloxystrobin, Nativo 75WG provides a vitally important additional mode of action in the absence of Plover (difenoconazole). Additionally, AHDB are working with manufacturers to see if they can generate residue data for AHDB9911 or AHDB9892, both of which performed well in the trial and reduced disease severity by 93.4% and 90.4% respectively compared to the untreated controls.

The second trial assessing new and alternative seed treatments products for both organic and conventional celery growers will begin in April 2019, with up to 9 alternative products or treatments being tested.

Take home message:

All nine conventional fungicide treatments provided significant levels of Septoria leaf spot control by the end of the trial. The two biopesticides examined did not provide a significant level of control during the trial, a possible consequence of these products not being rain fast and so may have been washed off the plants. An EAMU for Nativo 75WG to control leaf spot in celery has recently been gained with an EAMU for another product potentially in the pipeline.

Objectives

1. To evaluate the effectiveness of 7 conventional fungicides and 2 biopesticides against leaf spot (*Septoria apiicola*) in celery as measured by disease incidence, severity and % efficacy.
2. To monitor the treated crop for phytotoxicity.

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**
PP 1/152(4)	Design and analysis of efficacy evaluation trials	None
PP 1/135(4)	Phytotoxicity assessment	None
PP 1/181(4)	Conduct and reporting of efficacy evaluation trials including GEP	None
PP1/121(2)	Leafspots of vegetables	None
PP1/276(1)	Principles of efficacy evaluation for microbial plant protection products	None

There were no deviations from EPPO guidance, with the exception that plot sizes were 3.13m^2 rather than 10m^2 stipulated in the guidelines. Plants were spaced closer together in a smaller plot area to ensure an even, dense canopy was available to encourage infection.

Test site

Item	**Details**
Location address	RSK ADAS Ltd. Boxworth, Cambs CB23 4NN
Crop	Celery
Cultivar	Victoria
Soil or substrate type	Compost supplied by G's Fresh.
Agronomic practice	Calcium nitrate application (74 kg/ha) on 23/8/18 and 25/09/18. Manganese sulphate application (4 kg/ha) on 23/8/18 and 31/8/18. Deltamethrin application (12.5 g a.s./ha) on 24/08/18. No herbicides were applied (hand weeded). Plants were watered by overhead irrigation three times daily (06:30, 12:30 and 16:00) for 5 minutes each time.
Prior history of site	N/A

Trial design

Item	**Details**
Trial design:	RRB
Number of replicates:	4
Row spacing:	60cm
Plot size: (w x l)	1.56m x 2m
Plot size: (m^2)	3.13m^2
Number of plants per plot:	10
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	Formulation type	Adjuvant
Untreated	N/A	N/A	N/A	N/A	N/A	N/A
N/A	Azoxystrobin	Amistar	GRA8A00005	250 g/l	SC	None
N/A	Cyprodinil and fludioxonil	Switch	CHE7E60076	37.5% Cyprodinil and 25% w/w fludioxonil	WG	None
N/A	Difenoconazole	Plover	HEM7H00022	250 g/l	EC	None
N/A	Tebuconazole and Trifloxystrobin	Nativo 75WG	EDFI039339	250 g/kg trifloxystrobin and 500 g/kg tebuconazole	WG	None
N/A	*B. subtilis QST713*	Serenade ASO	EZU1710807	1015.1 g/L	SC	None
AHDB9914	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9983	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9892	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9925	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9911	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9923	N/D	N/D	N/D	N/D	N/D	N/D
AHDB9891	N/D	N/D	N/D	N/D	N/D	N/D

Application schedule

Treatment number	Treatment: product name or AHDB code	Rate of active substance (ml or g a.s./ha)	Rate of product (l or kg/ha)	Application code
1	Untreated	N/A	N/A	A, B, C, D, E
2	Untreated	N/A	N/A	A, B, C, D, E
3	Amistar	250g	1.0 l/ha	A, C, E
3	Switch	37.5% and 25%	1.0 kg/ha	B, D
4	Amistar	250g	1.0 l/ha	A, C, E
4	Plover	125g	0.5 l/ha	B, D
5	Nativo 75WG	75g + 150g	0.3 kg/ha	A, B, C, D, E
6	Serenade ASO	10151g	10 kg/ha	A, B, C, D, E
7	AHDB9914	200 + 200	0.8	A, B, C, D, E
8	AHDB9983	56 + 131.25	0.35	A, B, C, D, E
9	AHDB9892	150 + 100	2.0	A, B, C, D, E
10	AHDB9925	40.05 + 10.05	1.5	A, B, C, D, E
11	AHDB9911	350	1.75	A, B, C, D, E
12	AHDB9923	125	1.0	A, B, C, D, E
13	AHDB9936	625	2.5	A, B, C, D, E

Application details

	Application A	Application B	Application C	Application D	Application E
Application date	30/07/18	14/08/18	31/08/18	13/09/18	24/09/18
Time of day	15:00-16:00	15:00-16:00	15:30-16:30	15:00-16:00	15:45-16.45
Crop growth stage (Max, min average BBCH)	11	19	41	53	61
Crop height (cm)	20	25	35	35	60
Crop coverage (%)	85	90	95	100	100
Application Method	Spray	Spray	Spray	Spray	Spray
Application Placement	Foliar	Foliar	Foliar	Foliar	Foliar
Application equipment	OPS	OPS	OPS	OPS	OPS
Nozzle pressure	2.6 Bar	2.6 Bar	2.6 Bar	2.6 Bar	2.6 Bar
Nozzle type	Flat fan	Flat fan	Flat fan	Flat fan	Flat fan
Nozzle size	F02/110	F02/110	F02/110	F02/110	F02/110
Application water volume/ha	300 l/ha	300 l/ha	300 l/ha	300 l/ha	300 l/ha
Temperature of air - shade (°C)	25	25.2	25.9	22.25	18.75
Relative humidity (%)	52	50	47.6	48.8	52
Wind speed range (m/s)	N/A	N/A	N/A	N/A	N/A
Dew presence (Y/N)	N/A	N/A	N/A	N/A	N/A
Temperature of soil - 2-5 cm (°C)	N/A	N/A	N/A	N/A	N/A
Wetness of soil - 2-5 cm	N/A	N/A	N/A	N/A	N/A
Cloud cover (%)	N/A	N/A	N/A	N/A	N/A

Untreated levels of pests/pathogens at application and through the assessment period

Common name	Scientific Name	EPPO Code	Infestation level pre-application	Infestation level at start of assessment period	Infestation level at end of assessment period
Septoria leaf spot	*Septoria apiicola*	SEPTAP	0	0[1]	33.75[2]

[1] Mean percentage surface area damaged on youngest four leaves
[2] Percentage disease severity at the final assessment where n=80 untreated plants

Assessment details

	Evaluation Timing (DA)*				
Evaluation date	**After conventional fungicides**	**After Bio-fungicides**	**Crop Growth Stage (BBCH)**	**Evaluation type (efficacy, phytotox)**	**Assessment**
30/07/18	0	0	11	Baseline assessment	Disease incidence and severity (Septoria)
07/08/18	8	8	19	Phytotoxicity	Phytotoxicity
14/08/18	15	15	19	Efficacy	Disease incidence and severity (Septoria)
22/08/18	23	23	41	Phytotoxicity	Phytotoxicity
29/08/18	30	30	41	Efficacy	Disease incidence and severity (Septoria)
04/09/18	36	36	53	Phytotoxicity	Phytotoxicity
13/09/18	45	45	53	Efficacy	Disease incidence and severity (Septoria)
18/09/18	50	50	61	Phytotoxicity	Phytotoxicity
24/09/18	56	56	61	Efficacy	Disease incidence and severity (Septoria)
03/10/18	65	65	69	Phytotoxicity	Phytotoxicity
11/10/18	73	73	69	Efficacy	Disease incidence and severity (Septoria)

* DA – days after first application

The percentage of leaf spot cause by *Septoria apiicola* was assessed according to the guidelines laid out in the EPPO standard PP1/121(2) Leafspots of vegetables, using Figure 2 as a guide.

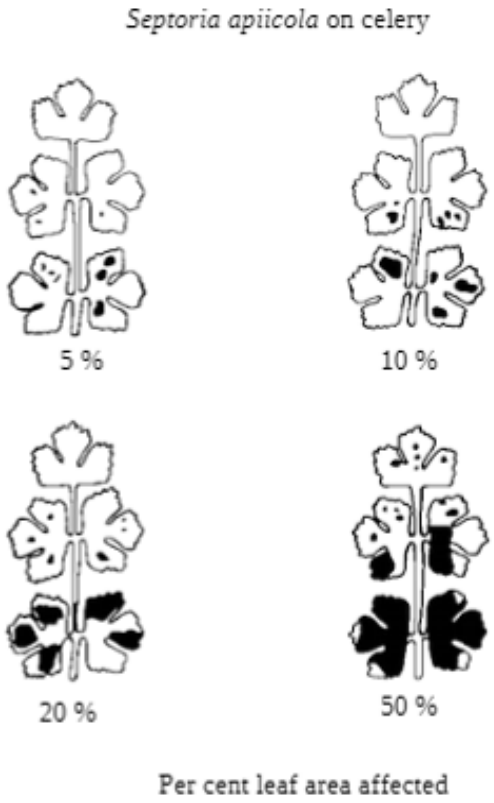


Figure 2 Visual guidelines for assessing disease severity of *Septoira apiicola* on celery laves, taken from EPPO standard PP1/121(2) Leafspots of vegetables.

Statistical analysis

The trial was laid out as a randomised complete block design. Statistical analysis was carried out by Chris Dyer, ADAS statistician by ANOVA using Genstat 12.2 and Duncan's Multiple Range test, using disease incidence and severity values as variables. The analysis assessed for differences between treatments compared to the untreated control as well as differences between the replicate blocks along the length of the polytunnel.
Using disease severity data from the final assessment on the 11th October, % efficacy of each product was calculated using the following formula.

$$\text{Percentage control} = 1 - \frac{\text{Disease severity of treatment}}{\text{Disease severity of untreated}} \times 100$$

Results

Phytotoxicity

There were no phytotoxic symptoms observed with any of the products tested at any of the assessments.

Efficacy

First visible leaf spot symptoms were present in untreated plots 13 days after inoculation, with 100% of untreated plants infected by the fourth assessment (24/09/18), 8 weeks after inoculation. Assessments of Septoria leaf spot incidence and severity at the five assessment timings are shown in Table 3 and Table 4. The efficacy of each product when compared to disease severity in the untreated controls is presented in Figure 3.

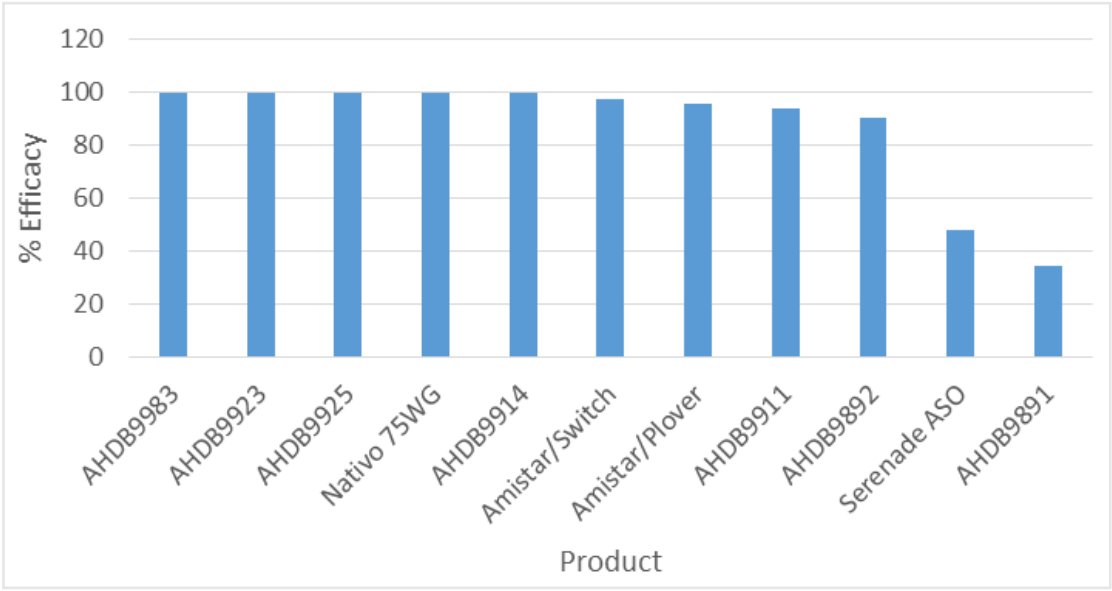
Table 3: Mean % disease incidence of leaf spot in celery at all 5 assessment timings.

	Mean % disease incidence				
Date	**14/08/18**	**29/08/18**	**13/09/18**	**24/09/18**	**11/10/18**
Treatment					
Untreated	62.5	62.5	97.5	100	100
Amistar/Switch	0	5	17.5	27.5	25
Amistar/Plover	5	10	15	15	17.5
AHDB9983	0	0	0	2.5	2.5
AHDB9914	0	2.5	2.5	7.5	7.5
Nativo 75WG	0	0	2.5	5	5
AHDB9925	0	2.5	2.5	2.5	2.5
AHDB9911	0	0	12.5	17.5	25
AHDB9892	7.5	7.5	7.5	27.5	32.5
AHDB9923	0	2.5	2.5	2.5	2.5
Serenade ASO	60	62.5	75	87.5	90
AHDB9891	70	70	92.5	100	100
P value	>0.001	>0.001	>0.001	>0.001	>0.001
d.f.	37	37	37	37	37
l.s.d.	20.1	17.97	20.52	20.67	26.13
	Not significantly different from untreated control (p>0.05)				
	Significantly different from untreated control (p>0.05)				

Table 4: Mean % disease severity of leaf spot in celery at all 5 assessment timings.

	Mean % disease severity				
Date	**14/08/18**	**29/08/18**	**13/09/18**	**24/09/18**	**11/10/18**
Treatment					
Untreated	1.3	2.3	19.9	34.9	33.1
Amistar/Switch	0	0.1	0.4	1.2	1.35
Amistar/Plover	0.2	0.4	0.8	1.9	2
AHDB9983	0	0	0	0.02	0.1
AHDB9914	0	0.1	0.1	0.2	0.3
Nativo 75WG	0	0	0.8	0.2	0.3
AHDB9925	0	0.02	0.1	0.2	0.3
AHDB9911	0.3	0.3	0.5	0.9	2.9
AHDB9892	0.3	0.4	0.7	3.4	4.4
AHDB9923	0	0.02	0.02	0.075	0.1
Serenade ASO	1	1.8	23.2	23.175	23.8
AHDB9891	1.1	2.1	29.2	29.2	29.8
P value	>0.001	>0.001	>0.001	>0.001	>0.001
d.f.	37	37	37	37	37
l.s.d.	0.5727	0.6203	8.349	13.077	9.045
	Not significantly different from untreated control (p>0.05)				
	Significantly different from untreated control (p>0.05)				

Figure 3: Efficacy of products, shown as percentage reduction in leaf spot severity at the final assessment timing.



Discussion

Moderate to high celery spot disease levels were observed in untreated plots by the end of the trial. The standard product treatments of Amistar/Switch in rotation and Amistar/Plover in rotation performed well, reducing disease by approximately 97% and 96% respectively compared to the untreated control; thus the trial had sufficient disease levels for evaluation of products and the standard treatments performed as expected.

By the final assessment, all of the conventional fungicide products tested gave over 90% control of the disease compared to the untreated control, with 5 products providing greater than 99% control. These were AHDB9914, Nativo 75WG, AHDB9925, AHDB9923 and AHDB9983. These products could help to control leaf spot as part of a fungicide control strategy, where different modes of action could be deployed.
Treatment of plants with Serenade ASO or AHDB9891 did not result in significant control of leaf spot in this trial; this is likely a result of watering by overhead irrigation as the biological products used in this trial are no rain fast and so may have been washed off the plants. Additionally, these biological products were applied fortnightly rather than weekly during the trial, which may have impeded their efficacy. Further work using weekly applications of these products would be preferable before drawing firm conclusions.
Phytotoxicity was not observed with any of the treatments. No problems were encountered with the mixing or applying of any of the products

Conclusions

- Disease levels developed to moderate to high levels in untreated plots.
- The standard fungicide programme worked as expected, giving good control of Septoria.
- All nine conventional fungicide treatments provided significant levels of Septoria control by the end of the trial.
- The two biopesticides examined did not provide a significant level of control during the trial, a possible consequence of these products not being rain fast and so may have been washed off the plants. Further work could examine the effect of weekly application.
- No product tested proved phytotoxic to the plant.
- Nativo 75WG was one of the best performing products in the trial, and an EAMU for this product for foliar control of leaf spot on celery has recently been gained. A mixture of tebuconazole and trifloxystrobin, Nativo introduces a vitally important additional mode of action in the absence of Plover (difenoconazole) which will help with resistance management.
- Additionally, AHDB are working with manufacturers to see if they can generate residue data for AHDB9911 or AHDB9892, both of which performed well in the trial and reduced disease severity by 93.4% and 90.4% compared to the untreated control.
- The second trial assessing new and alternative seed treatments products for both organic and conventional celery growers will begin in April 2019, with up to 9 physical and chemical treatments being tested.

Acknowledgements

We would like to thank AHDB and the participating crop protection companies for project funding. David Norman (Fresh Produce Consultancy) for agronomic advice and review of protocols and the final report. G's Fresh for providing soil and plants and Delflands Nurseries for supplying plants.

Appendix

a. Crop diary – events related to growing of the crop

Crop	Cultivar	Planting date
Celery	Victoria	23/07/2018

Fertilisers and insecticides applied to the trial area

Date	Product	Rate	Unit
23/08/2018	Calcium nitrate	74	kg/ha
23/08/2018	Manganese sulphate	4	Kg/ha
24/08/2018	Deltamethrin	0.5	l/ha
31/08/18	Manganese sulphate	4	Kg/ha
25/09/2018	Calcium nitrate	74	kg/ha

No herbicides were applied to the trial- the area was hand weeded as necessary. Overhead irrigation was used to encourage spread of infection via rain splash and plants were watered three times daily at 06:30, 12:30 and 16:00 for 5 minutes.

b. Trial diary

Date	Event
19/06/2018	Pathogenicity test of isolate
03/07/2018	Bulking up of Septoria for inoculum preparation
30/07/2018	Baseline disease assessment.
30/07/2018	Application A
01/08/2018	Celery plants inoculated with a at a concentration of $5x10^5$ spores/ml.
07/08/2018	Phytotoxicity
14/08/2018	Disease assessment
14/08/2018	Application B
22/08/2018	Phytotoxicity
29/08/2018	Disease assessment
31/08/2018	Application C
04/09/2018	Phytotoxicity
13/09/2018	Disease assessment
13/09/2018	Application D
18/09/2018	Phytotoxicity
24/09/2018	Disease assessment
24/09/2018	Application D
03/10/2018	Phytotoxicity
11/10/2018	Final disease assessment

c. Photographs

Trial layout

Untreated

Amistar/Switch

Amistar/Plover

Nativo 75WG

AHDB9911

AHDB9914

AHDB9892

Serenade ASO

AHDB9925 AHDB9923 AHDB9983 AHDB9891

Photographs of individual plots with treatment listed, at the final assessment date, 11th October 2018.

Control plants, in duplicate (left) versus plants treated with Nativo 75WG, in duplicate (right).

d. Climatological data during study period

Date	Max Temp °C	Min Temp °C	Average RH %
27/10/2018	32	18.5	79.9
28/10/2018	23.5	15	67.6
29/07/2018	21	18.5	83.7
30/07/2018	25	18	63.3
31/07/2018	26.5	17.5	52.5
01/08/2018	30.5	17.5	48.5
02/08/2018	33	22	53.6
03/08/2018	32	21.5	59.4
04/08/2018	28	15.5	58.2
05/08/2018	33	18.5	46.5
06/08/2018	29	17.5	92.3
07/08/2018	25.5	20.5	93.0
08/08/2018	21	16.5	93.6
09/08/2018	14	12	94.4
10/08/2018	15.5	10	92.7
11/08/2018	25	13	65.2
12/08/2018	23	19	75.2
13/08/2018	23.5	19	80.4

14/08/2018	25	17	70.3
15/08/2018	26.5	18	67.7
16/08/2018	22.5	18	69.9
17/08/2018	27.5	15	61.4
18/08/2018	28.5	18	67.4
19/08/2018	29.5	20.5	69.4
20/08/2018	29	20.5	69.8
21/08/2018	32.5	20	64.1
22/08/2018	29.5	18.5	68.1
23/08/2018	27	18	64.3
24/08/2018	23	13.5	61.2
25/08/2018	25	12	65.5
26/08/2018	20	14	78.1
27/08/2018	24.5	16	66.8
28/08/2018	26.5	18	65.7
29/08/2018	26	17	69.7
30/08/2018	29	14.5	56.5
31/08/2018	29	12	59.8
01/09/2018	32.5	15	57.2
02/09/2018	33	14.5	53.3
03/09/2018	30	14	56.0
04/09/2018	25.5	16.5	68.0
05/09/2018	25.5	15.5	68.8
06/09/2018	25.5	13.5	69.1
07/09/2018	21	11.5	63.8
08/09/2018	22	12	67.8
09/09/2018	27.5	17	64.5
10/09/2018	23	16	60.3
11/09/2018	24.5	19	73.9
12/09/2018	21.5	15	77.2
13/09/2018	21.5	13.5	72.3
14/09/2018	25	11	63.5
15/09/2018	22.5	15	61.1
16/09/2018	25	14	64.3
17/09/2018	28.5	16	64.9
18/09/2018	30.5	18.5	64.2
19/09/2018	25.5	18.5	64.4
20/09/2018	27	19	65.5
21/09/2018	24	17	78.6
22/09/2018	21	13.5	63.7
23/09/2018	17.5	13.5	75.9
24/09/2018	20	11	75.7
25/09/2018	24	9.5	67.2
26/09/2018	23.5	9.5	64.9
27/09/2018	26	11	65.6
28/09/2018	27	14.5	59.8
29/09/2018	22	10.5	64.6
30/09/2018	22.5	8.5	64.6
01/10/2018	19	9.5	69.9
02/10/2018	21	9	66.4
03/10/2018	23	12	73.1
04/10/2018	21	13.5	75.0
05/10/2018	24.5	13.5	77.4
06/10/2018	25.5	15	74.6
07/10/2018	16	11	82.8
08/10/2018	19.5	8.5	74.3
09/10/2018	20.5	11	75.5
10/10/2018	24	13	73.8

11/10/2018	26	12.5	75.5
12/10/2018	25	16.5	80.2
13/10/2018	24.5	16	79.2
14/10/2018	27	19	77.7
15/10/2018	19.5	13.5	83.5
16/10/2018	16.5	14	87.1
17/10/2018	27	15	86.4

e. Raw data from assessments

Plot No	Assessment Date Assessment Type Treatment Name	14/08/18 Incidence (%)	14/08/18 Severity (%)	29/08/18 Incidence (%)	29/08/18 Severity (%)	13/09/18 Incidence (%)	13/09/18 Severity (%)	24/09/18 Incidence (%)	24/09/18 Severity (%)	11/10/18 Incidence (%)	11/10/18 Severity (%)
9	Amistar/Plover	0	0	20	0.8	30	1.1	30	1.3	30	1.7
21	Amistar/Plover	20	0.6	20	0.6	30	2.3	30	6.4	40	6.2
33	Amistar/Plover	0	0	0	0	0	0	0	0	0	0
45	Amistar/Plover	0	0	0	0	0	0	0	0	0	0.1
10	Amistar/Switch	0	0	0	0	20	0.4	20	0.8	20	1
14	Amistar/Switch	0	0	20	0.4	30	0.9	50	1.6	50	2.6
39	Amistar/Switch	0	0	0	0	0	0	100	1	100	1.3
48	Amistar/Switch	0	0	0	0	20	0.2	30	1.1	20	1.5
12	AHDB9891	40	1	40	1.4	70	11	100	16.7	100	22.8
22	AHDB9891	80	1.125	80	2.4	100	19.2	100	34.5	100	35.5
27	AHDB9891	80	1.125	80	2.2	100	38.5	100	43.5	100	31.5
47	AHDB9891	80	1	80	2.4	100	22	100	22	100	23.5
2	AHDB9983	0	0	0	0	0	0	100	1	100	0.3
16	AHDB9983	0	0	0	0	0	0	0	0	0	0
29	AHDB9983	0	0	0	0	0	0	0	0	0	0
41	AHDB9983	0	0	0	0	0	0	0	0	0	0
11	AHDB9911	0	0	0	0	0	0	100	0.3	100	0.3
15	AHDB9911	20	1.1	40	1	50	2.1	60	3.3	90	11.6
38	AHDB9911	0	0	0	0	0	0	0	0	0	0
43	AHDB9911	0	0	0	0	0	0	0	0	0	0
13	AHDB9914	0	0	0	0	0	0	0	0	0	0
17	AHDB9914	0	0	0	0	0	0	0	0	0	0
35	AHDB9914	0	0	100	0.5	100	0.5	20	0.6	20	0.8
49	AHDB9914	0	0	0	0	0	0	100	0	100	0.3
6	Nativo 75WG	0	0	0	0	100	0.3	100	0.5	100	0.5
19	Nativo 75WG	0	0	0	0	0	0	0	0	0	0
36	Nativo 75WG	0	0	0	0	0	0	0	0	0	0
40	Nativo 75WG	0	0	0	0	0	0	100	0.3	100	0.5
3	AHDB9892	100	0.5	100	0.7	100	1.6	20	4	40	5.1
18	AHDB9892	20	0.6	20	0.8	20	1	90	9.6	90	12.4
31	AHDB9892	0	0	0	0	0	0	0	0	0	0

Plot No	Assessment Date Assessment Type Treatment Name	14/08/18 Incidence (%)	14/08/18 Severity (%)	29/08/18 Incidence (%)	29/08/18 Severity (%)	13/09/18 Incidence (%)	13/09/18 Severity (%)	24/09/18 Incidence (%)	24/09/18 Severity (%)	11/10/18 Incidence (%)	11/10/18 Severity (%)
46	AHDB9892	0	0	0	0	0	0	0	0	0	0
1	AHDB9923	0	0.1	100	0.1	100	0.1	100	0.3	100	0.3
25	AHDB9923	0	0	0	0	0	0	0	0	0	0
34	AHDB9923	0	0	0	0	0	0	0	0	0	0
51	AHDB9923	0	0	0	0	0	0	0	0	0	0
8	Serenade ASO	30	0.5	40	1	40	1.3	50	2.8	60	12.6
23	Serenade ASO	60	0.8	60	1.6	80	12.8	100	20.2	100	23
32	Serenade ASO	70	1.125	70	2.1	100	30.5	100	34	100	41.5
50	Serenade ASO	80	1.375	80	2.4	80	11.8	100	15.7	100	16
4	AHDB9925	0	0	100	0.1	100	0.5	100	0.7	100	1.1
26	AHDB9925	0	0	0	0	0	0	0	0	0	0
30	AHDB9925	0	0	0	0	0	0	0	0	0	0
42	AHDB9925	0	0	0	0	0	0	0	0	0	0
5	Untreated	80	1.6	80	2.6	90	12.1	100	27	100	36
7	Untreated	100	3	100	3.8	100	6.8	100	13.5	100	14.6
20	Untreated	90	1.1	90	2.7	100	23.5	100	45	100	47
24	Untreated	40	0.4	60	1.8	80	7.4	100	16.2	100	24.5
28	Untreated	50	0.5	50	1.7	100	28.5	100	47	100	44
37	Untreated	60	0.6	60	2	100	32.5	100	41	100	37
44	Untreated	70	0.7	70	1.9	100	31.2	100	42	100	35
52	Untreated	70	0.8	70	2.1	90	17.5	100	27.5	100	26.5

f. 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 Alison Richardson
Authorised signatory

Certification Number
ORETO 409

HSE
Chemicals Regulation Division

Department of Agriculture and Rural Development