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Monitoring of Phytophthora infestans strains for sensitivity against benthiavalicarb

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Euroblight meeting May 2022, Ascona, Switzerland

MONITORING PROGRAMME

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- Benthiavalicarb
  - Active ingredient developed by Kumiai in Europe
  - Commercialized in potatoes and onions in combination with mancozeb by Certis
- 2004: market introduction of Valbon = benthiavalicarb + mancozeb
- 2019: market introduction of Versilus = benthiavalicarb 150 g/kg WG
- Certis and Kumiai have conducted a monitoring programme to test late blight strains for sensitivity against benthiavalicarb
- The research is part of the FRAC – CAA monitoring programme

FRAC – CAA Potato Guidelines

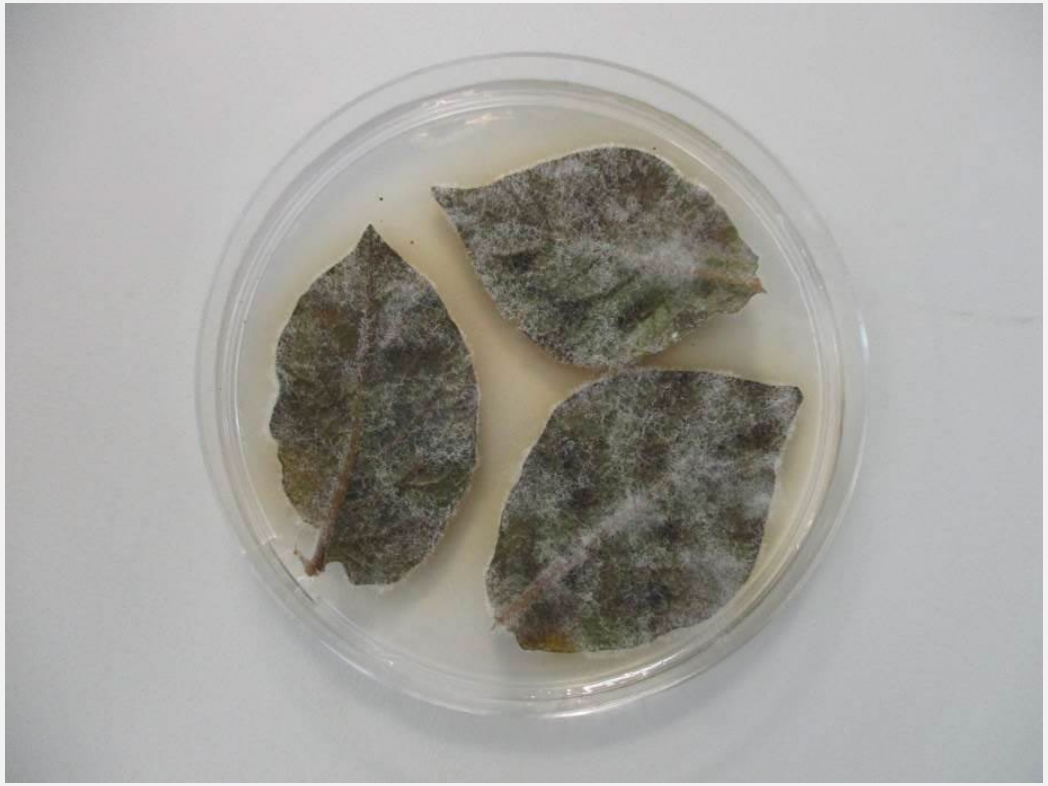
CODE	TARGET SITE OF ACTION	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS
40	Cellulose synthesis	CAA-fungicides (Carboxylic acid amides)	cinnamic acid amides	dimethomorph flumorph pyrimorph	Low to medium risk. Resistance management required.
			valinamide carbamates	benthiavalicarb iprovalicarb valifenalate	
			mandelic acid amides	mandipropamid	

Use Recommendations:

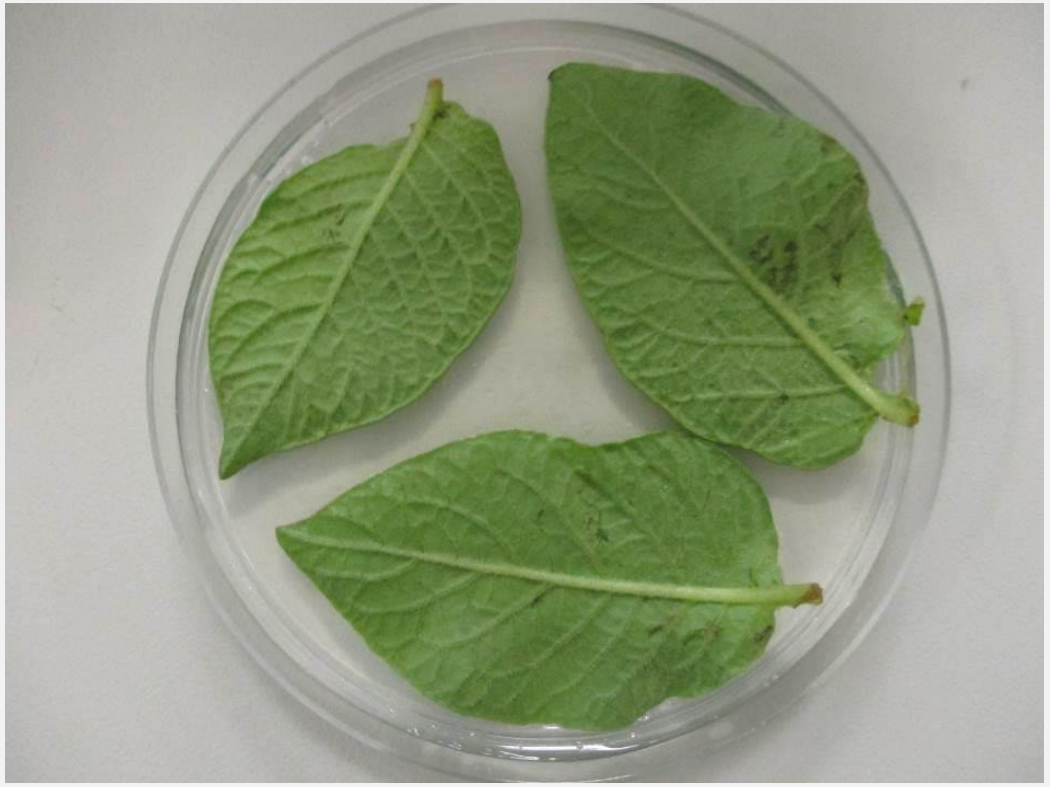
- Apply CAA fungicides preferably in a preventive manner
- Apply a maximum of 50 % of the total number of intended applications for late blight control
- Alternation with fungicides having other modes of action is recommended in spray programs

DETACHED LEAF ASSAY FOR SENSITIVITY TESTING

JAS – Certis Belchim research station, Nimes



Untreated.



Treated with spray solution of 3 ppm benthiavalicarb

- Dose rates benthiavalicarb: 0.3, 1.0, 3, 10, 30, 100 ppm
- 3 replicate leaves upside down in petri dishes for each dose rate for each isolate
- Treatment of leaves in a Potter spray tower (3 ml/dish).
- After drying of the leaves, inoculation with spore suspension and incubation at 19°C during 5 - 6 days.

ISOLATES OF PHYTOPHTHORA INFESTANS

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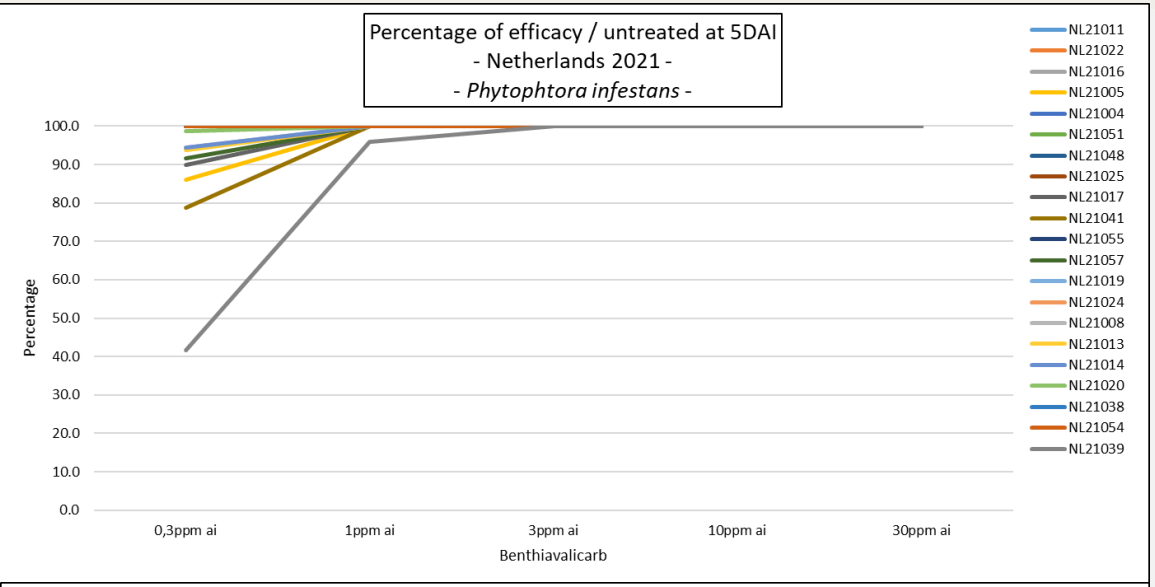
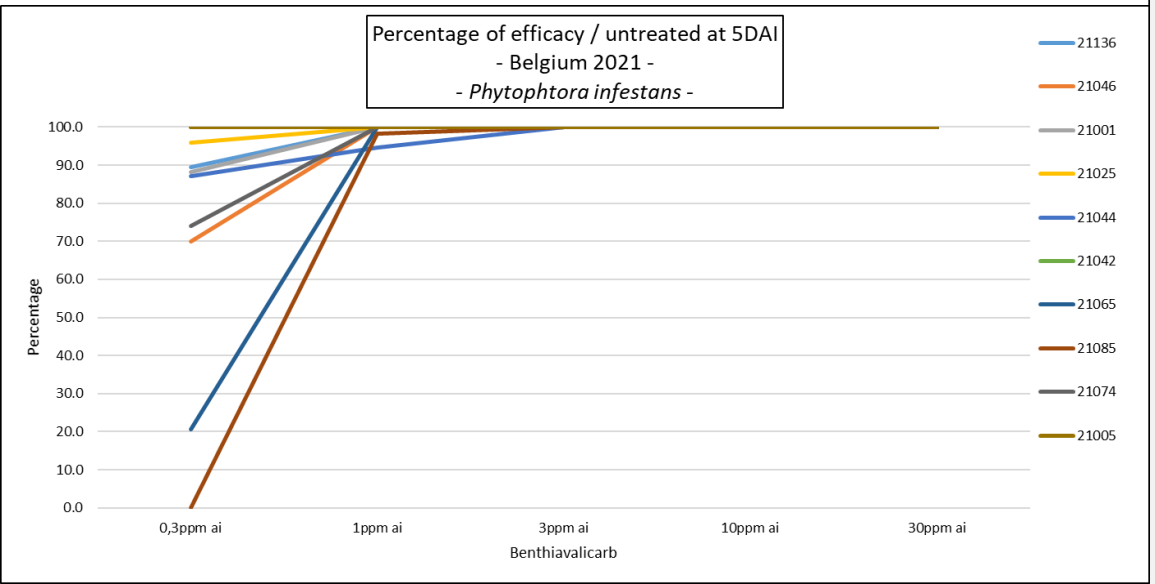
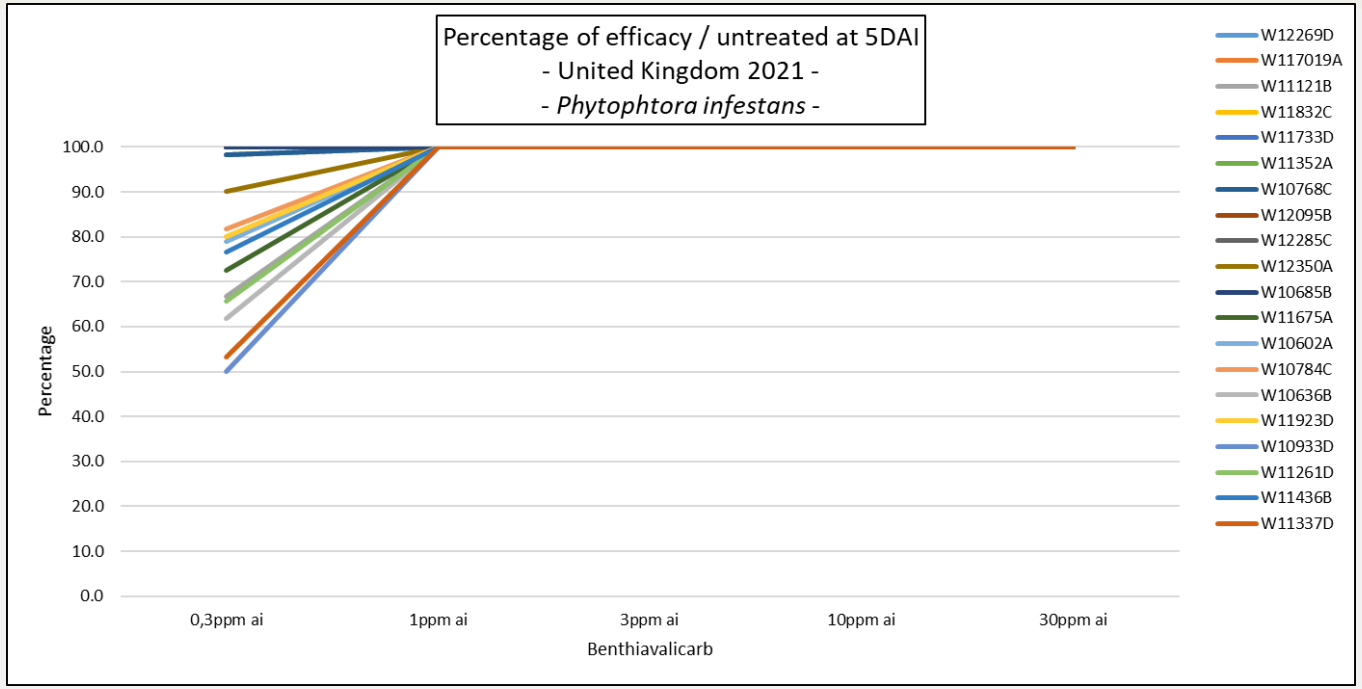
Year	UK	Netherlands	Belgium	Germany
Laboratory	JHI, David Cooke	WUR, Trudy vd Bosch and Geert Kessel	CRA Wallonie, Vincent Cesar	Hochschule Osnabruck, Hilke Schick
2016	20	29		4
2017	20	23	10	
2019	19	10	10	19
2020	17	20	10	
2021	20	22	10	

- Some isolates were taken at the end of the season from trial locations with continuous benthiavalicarb applications
- Genotyping of all isolates was conducted by David Cooke, James Hutton institute.

Monitoring results 2021 benthiavalicarb







Conclusions:

- As compared to previous years, the isolates seemed to be slightly more sensitive!
- No obvious explanation. It might have been related to slight changes in testing method (nothing was identified by JAS).

Benthiavalicarb sensitivity monitoring 2021

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	2021	Rate ppm benthiavalicarb and efficacy (%)					
Country	Sample No	Genotype	0.3	1	3	10	30
UK	W11121B	EU_6_A1	66.7	100.0	100.0	100.0	100.0
UK	W10768C	EU_6_A1	98.3	100.0	100.0	100.0	100.0
UK	W12095B	EU_6_A1	100.0	100.0	100.0	100.0	100.0
UK	W12285C	EU_6_A1	100.0	100.0	100.0	100.0	100.0
UK	W12350A	EU_6_A1	90.0	100.0	100.0	100.0	100.0
UK	W10636B	EU_6_A1	61.7	100.0	100.0	100.0	100.0
UK	W11923D	EU_6_A1	80.0	100.0	100.0	100.0	100.0
Belgium	21001	EU_13_A2	88.2	100.0	100.0	100.0	100.0
NL	NL21004	EU_13_A2	100.0	100.0	100.0	100.0	100.0
Belgium	21136	EU_36_A2	89.5	100.0	100.0	100.0	100.0
Belgium	21046	EU_36_A2	69.9	100.0	100.0	100.0	100.0
Belgium	21025	EU_36_A2	95.8	100.0	100.0	100.0	100.0
Belgium	21044	EU_36_A2	87.1	94.6	100.0	100.0	100.0
Belgium	21065	EU_36_A2	20.7	100.0	100.0	100.0	100.0
Belgium	21074	EU_36_A2	74.1	100.0	100.0	100.0	100.0
UK	W10685B	EU_36_A2	100.0	100.0	100.0	100.0	100.0
UK	W11675A	EU_36_A2	72.6	100.0	100.0	100.0	100.0
UK	W10784C	EU_36_A2	81.7	100.0	100.0	100.0	100.0
UK	W10933D	EU_36_A2	50.0	100.0	100.0	100.0	100.0
UK	W11337D	EU_36_A2	53.3	100.0	100.0	100.0	100.0
NL	NL21005	EU_36_A2	86.0	100.0	100.0	100.0	100.0
NL	NL21008	EU_36_A2	94.4	100.0	100.0	100.0	100.0
NL	NL21011	EU_36_A2	100.0	100.0	100.0	100.0	100.0
NL	NL21016	EU_36_A2	100.0	100.0	100.0	100.0	100.0
NL	NL21019	EU_36_A2	100.0	100.0	100.0	100.0	100.0
NL	NL21020	EU_36_A2	98.7	100.0	100.0	100.0	100.0
NL	NL21051	EU_36_A2	100.0	100.0	100.0	100.0	100.0
NL	NL21055	EU_36_A2	100.0	100.0	100.0	100.0	100.0
NL	NL21057	EU_36_A2	91.7	100.0	100.0	100.0	100.0
UK	W12269D	EU_37_A2	98.3	100.0	100.0	100.0	100.0
UK	W117019A	EU_37_A2	100.0	100.0	100.0	100.0	100.0
UK	W11733D	EU_37_A2	100.0	100.0	100.0	100.0	100.0
UK	W11261D	EU_37_A2	65.6	100.0	100.0	100.0	100.0
NL	NL21014	EU_37_A2	94.3	100.0	100.0	100.0	100.0
NL	NL21041	EU_37_A2	78.8	100.0	100.0	100.0	100.0
UK	W11832C	EU_39_A1	80.0	100.0	100.0	100.0	100.0
NL	NL21013	Other	93.8	100.0	100.0	100.0	100.0
NL	NL21017	Other	89.8	100.0	100.0	100.0	100.0
NL	NL21022	Other	100.0	100.0	100.0	100.0	100.0
NL	NL21024	Other	100.0	100.0	100.0	100.0	100.0
NL	NL21025	Other	100.0	100.0	100.0	100.0	100.0
NL	NL21039	Other	41.7	95.8	100.0	100.0	100.0
NL	NL21054	Other	100.0	100.0	100.0	100.0	100.0
Belgium	21042	Other	100.0	100.0	100.0	100.0	100.0
Belgium	21085	Other	0.0	98.3	100.0	100.0	100.0
Belgium	21005	Other	100.0	100.0	100.0	100.0	100.0
UK	W11352A	Other	100.0	100.0	100.0	100.0	100.0
UK	W10602A	Other	79.0	100.0	100.0	100.0	100.0
UK	W11436B	Other	76.7	100.0	100.0	100.0	100.0
NL	NL21038	Other	100.0	100.0	100.0	100.0	100.0
NL	NL21048	Other	100.0	100.0	100.0	100.0	100.0

- **No** reduced sensitivity of Phytophthora infestans towards benthiavalicarb
- Similar results to other CAA fungicides (FRAC –CAA report)
- No relationship between sensitivity and genotype of Phytophthora infestans.
- No shift in sensitivity of isolates taken from field trials with multiple benthiavalicarb treatments

Trends 2016 – 2021:

- Decline of EU_13_A2 and increase of EU_36_A2.
- No shift in sensitivity of isolates to benthiavalicarb (CAA, FRAC Code 40)
  - EC50 around 0.3 ppm and MIC ≤3 ppm

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	2016	Rate ppm benthiavalicarb and efficacy			
Country	Sample No	Genotype	0.3	1	3
UK	UK 12598B	EU_6_A1	0.0	83.3	100.0
UK	UK 12606A	EU_6_A1	0.0	83.3	100.0
UK	UK 13154B	EU_6_A1	0.7	86.7	100.0
UK	UK 12842C	EU_6_A1	14.0	100.0	100.0
UK	UK 12682B	EU_6_A1	39.1	96.6	100.0
NL	NL16021	EU_6_A1	43.2	100.0	100.0
UK	UK 12646A	EU_6_A1	50.0	100.0	100.0
UK	UK 13310C	EU_6_A1	53.3	91.7	100.0
UK	UK 12894C	EU_6_A1	60.0	95.0	100.0
UK	UK 16070 untreated ref field trial	EU_6_A1	73.3	91.7	100.0
UK	UK 13062A	EU_6_A1	75.0	100.0	100.0
UK	UK 12758C	EU_6_A1	80.0	100.0	100.0
UK	UK 12614A	EU_6_A1	94.9	100.0	100.0
UK	UK 12634A	EU_6_A1	100.0	100.0	100.0
NL	NL16039	EU_13_A2	33.3	99.2	100.0
NL	NL16059 field trial benthiavalicarb	EU_13_A2	48.2	96.5	100.0
NL	NL16061 field trial benthiavalicarb	EU_13_A2	53.4	100.0	100.0
UK	UK 13194B	EU_13_A2	55.0	95.0	100.0
UK	UK 13166C	EU_13_A2	63.3	98.3	100.0
NL	NL16057 field trial benthiavalicarb	EU_13_A2	85.0	96.7	100.0
NL	NL16069 field trial benthiavalicarb	EU_13_A2	89.8	100.0	100.0
DE	DE16004 Field trial benthiavalicarb	EU_13_A2	98.1	99.3	100.0
NL	NL16043 Field trial benthiavalicarb	EU_13_A2	98.7	100.0	100.0
NL	NL16001	EU_13_A2	99.3	100.0	100.0
UK	UK 13102A	EU_13_A2	100.0	100.0	100.0
NL	NL16010	EU_13_A2	100.0	100.0	100.0
NL	NL16011	EU_13_A2	100.0	100.0	100.0
NL	NL16037	EU_13_A2	100.0	100.0	100.0
NL	NL16047 field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
NL	NL16055 field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
NL	NL16063 field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
NL	NL16068 field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
DE	DE16001 field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
DE	DE16002 Field trial benthiavalicarb	EU_13_A2	100.0	100.0	100.0
NL	NL16054 field trial benthiavalicarb	EU_36_A2	33.3	100.0	100.0
NL	NL16034	EU_36_A2	52.8	86.1	100.0
NL	NL16015	EU_36_A2	81.0	99.3	100.0
NL	NL16042	EU_36_A2	83.0	97.6	100.0
NL	NL16014	EU_36_A2	85.0	100.0	100.0
NL	NL16006	EU_36_A2	90.0	100.0	100.0
NL	NL16032	EU_36_A2	100.0	100.0	100.0
NL	NL16035	EU_36_A2	100.0	100.0	100.0
NL	NL16038	EU_36_A2	100.0	100.0	100.0
UK	UK 16077 field trial benthiavalicarb	EU_37_A2	15.0	100.0	100.0
NL	NL16051 field trial benthiavalicarb	misc	47.4	86.4	100.0
UK	UK 13134B	misc	50.0	100.0	100.0
UK	UK 13210D	misc	56.7	100.0	100.0
DE	DE16009 field trial benthiavalicarb	misc	70.0	98.3	100.0
NL	NL16018	misc	89.6	100.0	100.0
NL	NL16012	misc	90.3	100.0	100.0
NL	NL16019	misc	92.9	100.0	100.0
UK	UK 12638B	misc	93.3	100.0	100.0
NL	NL16016	misc	93.3	100.0	100.0
UK	UK 13214D	misc	100.0	100.0	100.0
UK	UK 13226C	misc	23.3	95.0	100.0
NL	NL16008	misc	80.0	100.0	100.0
NL	NL16033	misc	98.3	100.0	100.0

2017 Rate ppm benthiavalicarb and efficacy (%)						
Country	Isolate ID	Genotype	0.3 ppm	1 ppm	3 ppm	10 ppm
Belgium	17001	EU 1_A1	1.7	47.8	100.0	100.0
Belgium	17002	EU 1_A1	100.0	100.0	100.0	100.0
Belgium	17013	EU 1_A1	58.5	78.9	100.0	100.0
UK	W110B	EU 1_A1	96.7	96.7	100.0	100.0
UK	W318B	EU 6_A1	100.0	100.0	100.0	100.0
UK	W37C	EU 6_A1	84.8	100.0	100.0	100.0
UK	W219A	EU 6_A1	87.9	99.2	100.0	100.0
UK	W102A	EU 6_A1	86.7	100.0	100.0	100.0
UK	W425A	EU 6_A1	95.0	100.0	100.0	100.0
UK	W144C	EU 6_A1	98.1	98.1	100.0	100.0
UK	W375A	EU 6_A1	86.7	100.0	100.0	100.0
UK	W193B	EU 6_A1	84.2	98.2	100.0	100.0
UK	W201D	EU 6_A1	92.8	92.8	100.0	100.0
UK	W342C	EU 6_A1	88.3	95.0	100.0	100.0
UK	W433C	EU 8_A1	86.7	100.0	100.0	100.0
Belgium	17003	EU 13_A2	67.8	81.1	98.3	100.0
Belgium	17028	EU 13_A2	100.0	100.0	100.0	100.0
UK	W151C	EU 13_A2	93.3	100.0	100.0	100.0
NL	NL17015	EU 13_A2	46.7	95.0	100.0	100.0
NL	NL17016	EU 13_A2	60.0	95.0	100.0	100.0
NL	NL17034	EU 13_A2	57.1	82.3	100.0	100.0
NL	NL17046	EU 13_A2	70.0	100.0	100.0	100.0
NL	NL17067	EU 13_A2	98.3	100.0	100.0	100.0
UK	W797B	EU_36_A2	89.5	100.0	100.0	100.0
NL	NL17005	EU_36_A2	71.0	100.0	100.0	100.0
NL	NL17019	EU_36_A2	80.8	100.0	100.0	100.0
NL	NL17021	EU_36_A2	88.7	96.3	100.0	100.0
NL	NL17055	EU_36_A2	30.0	88.3	100.0	100.0
NL	NL17060	EU_36_A2	28.3	63.3	100.0	100.0
NL	NL17063	EU_36_A2	90.0	96.7	100.0	100.0
NL	NL17064	EU_36_A2	33.3	90.0	100.0	100.0
NL	NL17066	EU_36_A2	79.8	85.0	100.0	100.0
NL	NL17085	EU_36_A2	73.3	96.7	100.0	100.0
Belgium	17008	EU_37_A2	89.3	100.0	100.0	100.0
Belgium	17009	EU_37_A2	100.0	100.0	100.0	100.0
Belgium	17015	EU_37_A2	83.8	97.6	100.0	100.0
Belgium	17017	EU_37_A2	81.7	97.7	98.3	100.0
Belgium	17031	EU_37_A2	86.7	99.3	100.0	100.0
UK	W383A-S	EU_37_A2	86.7	97.7	98.3	100.0
NL	NL17010	EU_37_A2	43.3	96.7	100.0	100.0
NL	NL17054	EU_37_A2	37.3	100.0	100.0	100.0
NL	NL17059	EU_37_A2	75.9	100.0	100.0	100.0
NL	NL17073	EU_37_A2	83.3	100.0	100.0	100.0
NL	NL17084	EU_37_A2	73.3	100.0	100.0	100.0
UK	A03300016A	EU 39_A1	93.3	96.7	100.0	100.0
UK	W292D	misc	77.1	77.3	98.3	100.0
UK	W136A	misc	100.0	100.0	100.0	100.0
UK	W649B	misc	83.3	89.6	100.0	100.0
UK	W417C	misc	88.3	100.0	100.0	100.0
NL	NL17001	misc	93.1	100.0	100.0	100.0
NL	NL17004	misc	81.7	100.0	100.0	100.0
NL	NL17053	misc	50.6	100.0	100.0	100.0
NL	NL17056	misc	26.4	100.0	100.0	100.0

	2019	Rate ppm benthiavalicarb and efficacy (%)				
Country	Sample No	Genotype	0.3	1	3	10
Belgium	19-099: 1348 Lou	EU_1_A1	23.3	56.7	100.0	100.0
UK	W00003757A	EU_6_A1	18.0	95.0	100.0	100.0
UK	W00003856A	EU_6_A1	84.7	100.0	100.0	100.0
UK	W00003948A	EU_6_A1	63.3	91.7	100.0	100.0
UK	W00003708B	EU_8_A1	9.0	99.3	100.0	100.0
Belgium	19-071: 4520 Ant	EU_13_A2	78.3	100.0	100.0	100.0
UK	W00003872B	EU_13_A2	89.9	91.7	100.0	100.0
UK	W00005018C	EU_13_A2	56.3	100.0	100.0	100.0
Belgium	19-017: 1470 Bai	EU_36_A2	86.3	94.9	100.0	100.0
Belgium	19-008: 4540 Am	EU_36_A2	43.8	100.0	100.0	100.0
Belgium	19-006: 7950 Chi	EU_36_A2	67.9	93.3	100.0	100.0
Belgium	19-004: 5380 Bie	EU_36_A2	53.1	96.7	100.0	100.0
Belgium	19-023: 5030 Ern	EU_36_A2	8.3	85.0	100.0	100.0
UK	W00003617C	EU_36_A2	13.3	91.7	100.0	100.0
UK	W00003690B	EU_36_A2	18.3	88.3	100.0	100.0
UK	W00003823C	EU_36_A2	35.9	96.7	100.0	100.0
UK	W00008640D	EU_36_A2	33.3	76.7	95.0	100.0
UK	W00008558A	EU_36_A2	100.0	100.0	100.0	100.0
NL	NL19001	EU_36_A2	48.5	100.0	100.0	100.0
NL	NL19002	EU_36_A2	3.3	100.0	100.0	100.0
NL	NL19011	EU_36_A2	31.1	96.3	100.0	100.0
NL	NL19012	EU_36_A2	35.1	100.0	100.0	100.0
NL	NL19014	EU_36_A2	49.6	100.0	100.0	100.0
NL	NL19016	EU_36_A2	88.2	100.0	100.0	100.0
NL	NL19027	EU_36_A2	37.2	100.0	100.0	100.0
NL	NL19055	EU_36_A2	47.6	95.0	100.0	100.0
NL	NL19058	EU_36_A2	14.5	100.0	100.0	100.0
Germany	N15/19	EU_36_A2	60.0	100.0	100.0	100.0
Germany	N16/19	EU_36_A2	95.2	100.0	100.0	100.0
UK	W00003864B	EU_37_A2	76.6	100.0	100.0	100.0
UK	W00004771B	EU_37_A2	79.7	100.0	100.0	100.0
UK	W00003055A	EU_37_A2	89.5	100.0	100.0	100.0
UK	W00003261C	EU_37_A2	59.7	100.0	100.0	100.0
Germany	N3/19	EU_41_A2	91.7	100.0	100.0	100.0
Germany	N5/19	EU_41_A2	55.0	100.0	100.0	100.0
Germany	N7/19	EU_41_A2	95.0	100.0	100.0	100.0
Germany	N10/19	EU_41_A2	74.3	98.1	100.0	100.0
Germany	N11/19	EU_41_A2	100.0	100.0	100.0	100.0
Germany	N12/19	EU_41_A2	79.9	100.0	100.0	100.0
UK	W00004060C	Other	66.7	73.3	100.0	100.0
UK	W00004706C	Other	100.0	100.0	100.0	100.0
UK	W00004995D	Other	63.3	68.3	90.0	100.0
Belgium	19-094: 5380 Fer	Other	43.3	100.0	100.0	100.0
Belgium	19-028: 4340 Oth	Other	100.0	100.0	100.0	100.0
Belgium	19-046: 7190 Ma	Other	51.2	100.0	100.0	100.0
NL	NL19005	Other	16.7	100.0	100.0	100.0
Germany	N1/19	Other	100.0	100.0	100.0	100.0
Germany	N2/19	Other	90.0	100.0	100.0	100.0
Germany	N4/19	Other	100.0	100.0	100.0	100.0
Germany	N6/19	Other	80.0	100.0	100.0	100.0
Germany	N8/19	Other	95.0	100.0	100.0	100.0
Germany	N9/19	Other	100.0	100.0	100.0	100.0
Germany	N13/19	Other	100.0	100.0	100.0	100.0
Germany	N14/19	Other	100.0	100.0	100.0	100.0

	2020	Rate ppm benthiavalicarb and efficacy (%)				
Country	Sample No	Genotype	0.3	1	3	10
UK	W9738B	EU_1_A1	68.5	70.4	100.0	100.0
UK	W9761C	EU_6_A1	63.0	81.5	100.0	100.0
UK	W9555A	EU_6_A1	31.0	70.0	100.0	100.0
UK	W9621C	EU_6_A1	68.5	100.0	100.0	100.0
UK	W9696A	EU_6_A1	100.0	100.0	100.0	100.0
UK	W9720B	EU_6_A1	100.0	100.0	100.0	100.0
Belgium	20016	EU_13_A2	54.1	100.0	100.0	100.0
UK	W9738D	EU_36_A2	89.5	100.0	100.0	100.0
UK	W9845B	EU_36_A2	41.7	100.0	100.0	100.0
UK	W9928B	EU_36_A2	56.1	100.0	100.0	100.0
UK	W9654D	EU_36_A2	79.4	95.0	100.0	100.0
NL	NL20001	EU_36_A2	8.3	63.3	100.0	100.0
NL	NL20006	EU_36_A2	7.4	68.0	99.3	100.0
NL	NL20007	EU_36_A2	47.3	81.9	96.4	100.0
NL	NL20024	EU_36_A2	0.0	100.0	100.0	100.0
NL	NL20032	EU_36_A2	7.0	31.5	100.0	100.0
Belgium	20008	EU_36_A2	66.7	100.0	100.0	100.0
Belgium	20018	EU_36_A2	60.0	83.3	100.0	100.0
Belgium	20024	EU_36_A2	10.8	73.3	100.0	100.0
Belgium	20025	EU_36_A2	44.8	100.0	100.0	100.0
Belgium	20026	EU_36_A2	36.7	96.7	100.0	100.0
UK	W9613A	EU_37_A2	83.7	100.0	100.0	100.0
UK	W9704A	EU_37_A2	55.0	100.0	100.0	100.0
NL	NL20017	EU_37_A2	58.3	99.3	96.7	100.0
NL	NL20018	EU_37_A2	57.4	78.1	98.3	100.0
NL	NL20019	EU_37_A2	87.7	100.0	100.0	100.0
NL	NL20021	EU_37_A2	81.4	90.0	100.0	100.0
NL	NL20022	EU_37_A2	53.6	80.0	100.0	100.0
NL	NL20023	EU_37_A2	35.0	66.0	100.0	100.0
Belgium	20007	EU_37_A2	58.3	96.7	100.0	100.0
Belgium	20021	EU_37_A2	8.3	100.0	100.0	100.0
Belgium	20027	EU_37_A2	83.3	98.3	100.0	100.0
UK	W9787C	Other	75.0	99.3	100.0	100.0
UK	W9829B	Other	68.4	100.0	100.0	100.0
UK	W9878C	Other	8.3	100.0	100.0	100.0
UK	W9498A	Other	80.0	80.0	100.0	100.0
UK	W9605B	Other	100.0	100.0	100.0	100.0
NL	NL20003	Other	1.7	26.7	100.0	100.0
NL	NL20009	Other	73.4	61.5	100.0	100.0
NL	NL20011	Other	33.3	84.9	91.0	100.0
NL	NL20013	Other	86.3	96.1	100.0	100.0
NL	NL20014	Other	35.3	42.0	96.4	100.0
NL	NL20016	Other	33.3	37.0	99.3	100.0
NL	NL20020	Other	100.0	100.0	100.0	100.0
NL	NL20029	Other	5.7	73.3	100.0	100.0
NL	NL20030	Other	34.1	76.9	100.0	100.0
Belgium	20030	Other	3.3	60.0	100.0	100.0

	2021	Rate ppm benthiavalicarb and efficacy (%		
Country	Sample No	Genotype	0.3	1	3
UK	W11121B	EU_6_A1	66.7	100.0	100.0
UK	W10768C	EU_6_A1	98.3	100.0	100.0
UK	W12095B	EU_6_A1	100.0	100.0	100.0
UK	W12285C	EU_6_A1	100.0	100.0	100.0
UK	W12350A	EU_6_A1	90.0	100.0	100.0
UK	W10636B	EU_6_A1	61.7	100.0	100.0
UK	W11923D	EU_6_A1	80.0	100.0	100.0
Belgium	21001	EU_13_A2	88.2	100.0	100.0
NL	NL21004	EU_13_A2	100.0	100.0	100.0
Belgium	21136	EU_36_A2	89.5	100.0	100.0
Belgium	21046	EU_36_A2	69.9	100.0	100.0
Belgium	21025	EU_36_A2	95.8	100.0	100.0
Belgium	21044	EU_36_A2	87.1	94.6	100.0
Belgium	21065	EU_36_A2	20.7	100.0	100.0
Belgium	21074	EU_36_A2	74.1	100.0	100.0
UK	W10685B	EU_36_A2	100.0	100.0	100.0
UK	W11675A	EU_36_A2	72.6	100.0	100.0
UK	W10784C	EU_36_A2	81.7	100.0	100.0
UK	W10933D	EU_36_A2	50.0	100.0	100.0
UK	W11337D	EU_36_A2	53.3	100.0	100.0
NL	NL21005	EU_36_A2	86.0	100.0	100.0
NL	NL21008	EU_36_A2	94.4	100.0	100.0
NL	NL21011	EU_36_A2	100.0	100.0	100.0
NL	NL21016	EU_36_A2	100.0	100.0	100.0
NL	NL21019	EU_36_A2	100.0	100.0	100.0
NL	NL21020	EU_36_A2	98.7	100.0	100.0
NL	NL21051	EU_36_A2	100.0	100.0	100.0
NL	NL21055	EU_36_A2	100.0	100.0	100.0
NL	NL21057	EU_36_A2	91.7	100.0	100.0
UK	W12269D	EU_37_A2	98.3	100.0	100.0
UK	W117019A	EU_37_A2	100.0	100.0	100.0
UK	W11733D	EU_37_A2	100.0	100.0	100.0
UK	W11261D	EU_37_A2	65.6	100.0	100.0
NL	NL21014	EU_37_A2	94.3	100.0	100.0
NL	NL21041	EU_37_A2	78.8	100.0	100.0
UK	W11832C	EU_39_A1	80.0	100.0	100.0
NL	NL21013	Other	93.8	100.0	100.0
NL	NL21017	Other	89.8	100.0	100.0
NL	NL21022	Other	100.0	100.0	100.0
NL	NL21024	Other	100.0	100.0	100.0
NL	NL21025	Other	100.0	100.0	100.0
NL	NL21039	Other	41.7	95.8	100.0
NL	NL21054	Other	100.0	100.0	100.0
Belgium	21042	Other	100.0	100.0	100.0
Belgium	21085	Other	0.0	98.3	100.0
Belgium	21005	Other	100.0	100.0	100.0
UK	W11352A	Other	100.0	100.0	100.0
UK	W10602A	Other	79.0	100.0	100.0
UK	W11436B	Other	76.7	100.0	100.0
NL	NL21038	Other	100.0	100.0	100.0
NL	NL21048	Other	100.0	100.0	100.0

CONCLUSIONS

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- No isolates were found with a reduced sensitivity to benthiavalicarb.
  - EC_{50} around 0.3 ppm
  - MIC (Minimum Inhibitory Concentration) $\leq$ 3 ppm
- Only very small variations in sensitivity observed between genotypes and isolates.
- No relationship between genotype and sensitivity.

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