

monitoring of *Phytophthora infestans* strains for sensitivity against bentiavalicarb

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Monitoring programme

- Since market introduction of Valbon (2004), Certis and Kumiai have conducted a monitoring programme for late blight strains for sensitivity towards bentiavalicarb
- Research is part of the FRAC – CAA monitoring programme
 - Results are shared between companies involved in CAA fungicides
 - Advice is developed on usage of CAA fungicides against various downy mildew diseases



FRAC – CAA advise

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



Monitoring programme 2016

- Isolates collected
 - 20 from UK (David Cooke, James Hutton Institute)
 - 33 from NL and 4 from Germany (Trudy v.d. Bosch/ Geert Kessel, WUR)
- Genotyping of all isolates was conducted by David Cooke, James Hutton institute
- Testing is conducted on potato leaves by JAS, Nimes
 - JAS = Japan Agro Services. Field research station jointly owned by Mitsui (Certis), Nisso, Kumiai and Mitsui Chemical.



Leaf disc assay sensitivity testing



Untreated.

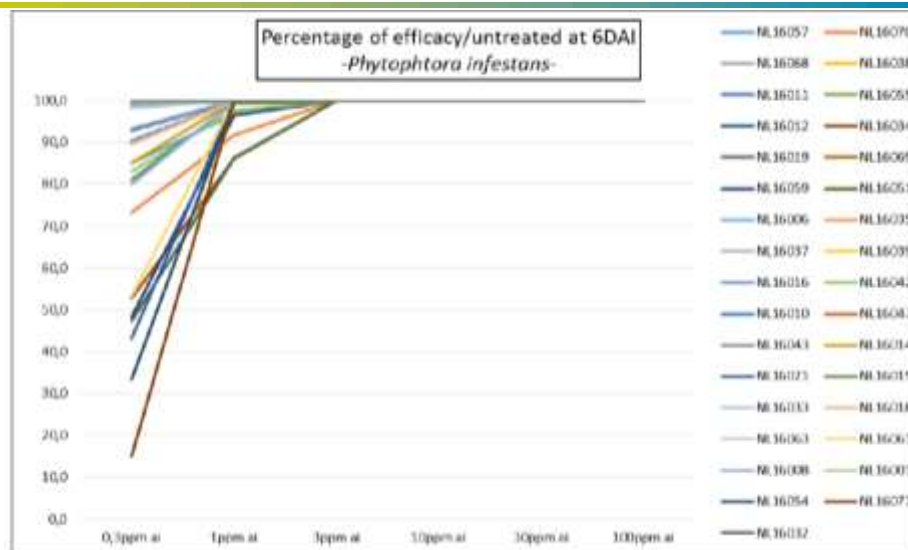


Treated with spray solution of 3 ppm benthiavalicarb

- 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 6 days.

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Sensitivity of strains from Netherlands



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Sample No	Gtype	Rate ppm benthiavaliarb and efficacy (%)					
		0.3	1	3	10	30	100
NL16039	EU_13_A2	33.3	99.2	100.0	100.0	100.0	100.0
NL16059 field trial benthiavaliarb	EU_13_A2	48.2	96.5	100.0	100.0	100.0	100.0
NL16081 field trial benthiavaliarb	EU_13_A2	63.4	100.0	100.0	100.0	100.0	100.0
UK13154B	EU_13_A2	55.0	95.0	100.0	100.0	100.0	100.0
UK13156C	EU_13_A2	63.3	98.3	100.0	100.0	100.0	100.0
NL16077 field trial benthiavaliarb	EU_13_A2	85.0	96.7	100.0	100.0	100.0	100.0
NL16069 field trial benthiavaliarb	EU_13_A2	89.8	100.0	100.0	100.0	100.0	100.0
DE16004 Field trial benthiavaliarb	EU_13_A2	98.1	99.3	100.0	100.0	100.0	100.0
NL16043 Field trial benthiavaliarb	EU_13_A2	98.7	100.0	100.0	100.0	100.0	100.0
NL16051	EU_13_A2	99.3	100.0	100.0	100.0	100.0	100.0
UK13102A	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16010	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16011	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16037	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16047 field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16055 field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16063 field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16068 field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
DE16001 field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
DE16002 Field trial benthiavaliarb	EU_13_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16056 field trial benthiavaliarb	EU_36_A2	23.3	100.0	100.0	100.0	100.0	100.0
NL16034	EU_36_A2	52.8	95.1	100.0	100.0	100.0	100.0
NL16015	EU_36_A2	81.0	99.3	100.0	100.0	100.0	100.0
NL16042	EU_36_A2	83.0	97.6	100.0	100.0	100.0	100.0
NL16014	EU_36_A2	85.5	100.0	100.0	100.0	100.0	100.0
NL16006	EU_36_A2	90.0	100.0	100.0	100.0	100.0	100.0
NL16032	EU_36_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16035	EU_36_A2	100.0	100.0	100.0	100.0	100.0	100.0
NL16038	EU_36_A2	100.0	100.0	100.0	100.0	100.0	100.0
UK16077 field trial benthiavaliarb	EU_17_A2	100.0	100.0	100.0	100.0	100.0	100.0
UK12598B	EU_6_A1	0.0	83.3	100.0	100.0	100.0	100.0
UK12606A	EU_6_A1	0.0	83.3	100.0	100.0	100.0	100.0
UK13154B	EU_6_A1	0.7	88.7	100.0	100.0	100.0	100.0
UK12842C	EU_6_A1	14.0	100.0	100.0	100.0	100.0	100.0
UK12828B	EU_6_A1	39.1	98.6	100.0	100.0	100.0	100.0
NL16021	EU_6_A1	43.2	100.0	100.0	100.0	100.0	100.0
UK12646A	EU_6_A1	60.8	100.0	100.0	100.0	100.0	100.0
UK13310C	EU_6_A1	63.3	97.7	100.0	100.0	100.0	100.0
UK12894C	EU_6_A1	69.0	95.0	100.0	100.0	100.0	100.0
UK16079 untreated ref field trial	EU_6_A1	73.3	97.7	100.0	100.0	100.0	100.0
UK13002A	EU_6_A1	76.0	100.0	100.0	100.0	100.0	100.0
UK12758C	EU_6_A1	80.0	100.0	100.0	100.0	100.0	100.0
UK12614A	EU_6_A1	84.9	100.0	100.0	100.0	100.0	100.0
UK12614A	EU_6_A1	86.0	100.0	100.0	100.0	100.0	100.0
NL16051 field trial benthiavaliarb	misc	87.4	86.4	100.0	100.0	100.0	100.0
UK13134B	misc	90.0	100.0	100.0	100.0	100.0	100.0
UK13210D	misc	94.7	100.0	100.0	100.0	100.0	100.0
DE16008 field trial benthiavaliarb	misc	95.8	99.3	100.0	100.0	100.0	100.0
NL16018	misc	89.6	100.0	100.0	100.0	100.0	100.0
NL16012	misc	90.3	100.0	100.0	100.0	100.0	100.0
NL16019	misc	92.9	100.0	100.0	100.0	100.0	100.0
UK12628B	misc	95.3	100.0	100.0	100.0	100.0	100.0
NL16016	misc	95.3	100.0	100.0	100.0	100.0	100.0
UK13214D	misc	100.0	100.0	100.0	100.0	100.0	100.0
UK13224C	na	23.8	85.0	100.0	100.0	100.0	100.0
NL16008	na	80.0	100.0	100.0	100.0	100.0	100.0
NL16033	na	98.3	100.0	100.0	100.0	100.0	100.0

Benthiavaliarb sensitivity monitoring 2016

- **No** reduced sensitivity of Phytophthora infestans towards benthiavaliarb
- Similar results to other CAA fungicides (FRAC – CAA report)
- No relationship between sensitivity and genotype of Phytophthora infestans.

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Conclusions

- No isolates were found that have a reduced sensitivity to benthiavaliarb.
 - MIC (Minimum Inhibitory Concentration) < 3 ppm
 - At 1 ppm, > 85 % inhibition for all populations.
 - EC₅₀ < 0.3 ppm for populations from NL and Germany
 - EC₅₀ = 0.84 for the UK populations
- Only very small variations on sensitivity observed between strains.
- No relationship between genotype and sensitivity.

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Monitoring programme 2017

- Isolates from commercial fields
 - 20 from UK (James Hutton Institute, David Cooke)
 - 10 from Belgium (CRA Wallonie, Vincent Cesar)
 - 20 from Netherlands (WUR, Trudy v.d. Bosch/Geert Kessel)
- Isolates from field trials which received frequent applications with bentiavalicarb containing products.
- Lab Testing is ongoing

