Psa Product Testing – Summary of Greenhouse Results

21 December 2012

The following products significantly reduced Psa leaf spot development in the greenhouse on seedlings at at least one assessment time (based on statistical analyses). Products new to the list are highlighted in yellow.

Product name	Active ingredient	Testing methodology	Efficacy demonstrated on at least one occasion in one experiment				ACVM label claim for Psa	ZESPRI Crop Protection Standard status	Pre-Harvest Interval (days)	Comments
			Hort16A	Hayward	Bruno	Gold3				
Actigard	1, 2, 3 – benzothiadiazole 7 thiocarboxylic acid-S-methyl-ester	Elicitor	Yes	Yes	Yes	Yes	Limited	CPP	Pre-flower	
Alexin	Salicylate derivatives	Elicitor	No	Yes	Yes	NT	None	AOC	14	Generally increased leaf spotting in Hort16A
ARMOUR-Zen	Chitosan	Biological	Yes	NT	No	No	None	AOC	Pre-flower	
Champ DP	Copper hydroxide	Protectant	Yes	NT	Yes	NT	None	CPP	7	
Chinosol®W	8-hydroxyquinoline sulphate	Protectant	No	NT	Yes	NT	None	Not allowed	Not allowed	Product no longer in production
Citrox BioAlexin	Natural ingredients	Elicitor	Yes	Yes	Yes	NT	In progress	AOC	1	Some efficacy shown in field on Hort16A
Duraban	3-trihydroxysilyl propyloctadecyldimethyl ammonium chloride	Protectant	NT	NT	Yes	No	None	Not allowed	Not allowed	Tested 4 times on Bruno but only reduced leaf spotting once
BlightBan A506	*Pseudomonas fluorescens*	Protectant	NT	NT	Yes	NT	None	Not allowed	Not allowed	Tested several times but only reduced leaf spotting once
Blossom Bless	*Pantoea agglomerans*	Biological	No	Yes	No	NT	None	AOC	1	Tested several times but only reduced leaf spotting once
Kasumin	Kasugamycin	Protectant	Yes	Yes	Yes	NT	In progress	Not allowed	Not allowed	Registration unlikely to be completed this season
KeyStrepto	Streptomycin sulphate	Antibiotic	Yes	Yes	Yes	Yes	Limited period off-label use	CPP Restricted	Pre-flower	Consistently reduced leaf spotting

Product name	Active ingredient	Testing methodology	Efficacy demonstrated on at least one occasion in one experiment (NT = Not tested)				ACVM label claim for Psa	ZESPRI Crop Protection Standard status	Pre-Harvest Interval (days)	Comments
			Hort16A	Hayward	Bruno	Gold3				
Kocide Opti	Copper hydroxide	Protectant	No	NT	Yes	NT	None	CPP	7	Variable results – did not always reduce spotting.
Mantissa Choice	Copper hydroxide	Protectant	NT	NT	Yes	NT	None	Not allowed	Not allowed	
Moddus	Trinexapac-ethyl	Elicitor	Yes	Yes	No	NT	None	Not allowed	Not allowed	Variable results – did not always reduce spotting.
Nordox 75 WG	Copper oxide	Protectant	No	NT	Yes	NT	Limited	CPP	7	Variable results – did not always reduce spotting.
OMS 1	Oxolonic acid and elicitor based	Elicitor	No	Yes	No	NT	None	Not allowed	Not allowed	Experimental product from Omnia. Reductions in leaf spotting were small.
OMS 3	Elicitor and bactericide combination	Elicitor	No	Yes	NT	NT	None	Not allowed	Not allowed	Experimental product from Omnia. Reductions in leaf spotting were small.
Oryzemate	Probenazole	Elicitor	NT	Yes	No	NT	None	Not allowed	Not allowed	
Phyton 27	Copper sulphate pentahydrate	Protectant	Yes	Yes	Yes	NT	In progress	Not allowed	Not allowed	
Spotless	Benzalkonium ammonium chloride, Salicylic acid, Urea, Propiconazole	Protectant & elicitor	No	Yes	Yes	NT	Limited	CPP	Until the end of Flowering	Yet to be tested in the field.
TNL 2952, 2953, 2954, 2956, 2957	Confidential	Protectant	NT	Yes	NT	NT	None	Not allowed	Not allowed	Experimental products from ZELAM.
TNL 2958	Confidential	Protectant	NT	Yes	NT	NT	None	Not allowed	Not allowed	Experimental product from ZELAM.
TNL 2961	Confidential	Protectant	NT	NT	Yes	NT	None	Not allowed	Not allowed	Experimental product from ZELAM.
Vacciplant	Laminarine (seaweed extract)	Elicitor	Yes	Yes	Yes	NT	None	Not allowed	Not allowed	Variable results – did not always reduce spotting.
VerdeSpada-125	Quaternary ammonium chloride	Protectant	NT	NT	NT	Yes	None	Not allowed	Not allowed	

Key: CPP = Crop Protection Programme, AOC = Allowed Other Compounds (compounds which are exempt ACVM registration or have label claims not supported by efficacy data)

Greenhouse Testing Results

Below is a list of all products that have been tested in the greenhouse trials to date, for a reduction in disease symptoms following inoculation with Psa-V. The product tested, test methodology used and whether or not the product demonstrated efficacy and in which cultivars is summarised. Products new to the list are highlighted in yellow.

Product	Active ingredients	Test protocol*	Product demonstrated efficacy in at least one cultivar at at least one timing after inoculation**	Cultivar in which efficacy observed***
Acadian Seaweed	Seaweed extract	Elicitor	No	NA
Actara	Thiamethoxam	Elicitor	No	NA
Actigard™	acibenzolar-S-methyl	Protectant	Yes	BS
		Elicitor	Yes	GS, HS, BS
Agro Argentum Forte	Nitrogen, nanosilver, potassium	Protectant	No	NA
Alexin	Salicylate derivatives	Elicitor	Yes	HS, BS
Allicin	Garlic extract	Protectant	No	NA
Aliette® Super	Fosetyl-aluminium, thiabendazole & thiram	Elicitor	No	NA
ARMOUR-Zen	Chitosan	Biological	Yes	GS
Aussan Disinfectant 2%	Bioflavonoids and organic acids	Protectant	No	NA
BacStar	*Bacillus subtilis*	Protectant	No	NA
		Biological	No	NA
Bacterimycin	Bronopol (25% w/w)	Elicitor	No	NA
Bacteriophage	Bacteriophages collected from NZ water sources	Biological	No	NA
Benefit	Amino acids, nitrogen, vitamins	NA	NA	NA
Biomin Copper	Copper as amino acid chelates	Protectant	No	NA
BioSolute (C-Actin 12)	Organic acids and natural fruit extracted polyphenols	Protectant	No	NA
BioWish	Biocatalysts to break down organic molecules	Protectant	No	NA
BlightBan A506	*Pseudomonas fluorescens*	Protectant	Yes	BS
		Biological	No	NA
Blossom Bless	*Pantoea agglomerans*	Biological	Yes	HS
Blue Shield® DF	Copper hydroxide	Protectant	No	NA
Bronopol PC	2-bromo-2-nitropropane-1,3-diol	Biological	No	NA
Cabrio®	Pyraclostrobin	Elicitor	No	NA
Champ DP	Copper hydroxide	Protectant	Yes	GS, BS

Chelal® Kubig	Chelated copper	Protectant	No	NA
Chinosol® W	8-hydroxyquinoline sulphate	Protectant	Yes	BS
Chitosan (GroSafe)	Chitosan	Elicitor	No	NA
Citric Acid	Citric acid	Protectant	No	NA
Citrox BioAlexin	Natural ingredients (details not disclosed)	Elicitor	Yes	GS, HS, BS
Citrox BC	Citrus extracts	Protectant	No	NA
Citrox PNS SFF	rogCitrus extracts	Protectant	No	NA
Citrox PWT	Citrus extracts	Protectant	No	NA
Clarity	*Bacillus subtillis*	Protectant	No	NA
Colloidal Silver	Colloidal silver	Protectant	No	NA
Combat	Dodine	Protectant	No	NA
Copper Oxychloride	Copper oxychloride	Protectant	No	NA
CropBioLife	Bioflavonoids and organic acids derived from fruits and vegetables	Elicitor	No	NA
		Protectant	No	NA
CP-1	Natural plant extracts	Protectant	No	NA
CP1-D	Natural plant extracts	Protectant	No	NA
Cuprofix	Copper sulphate + hydrated lime	Protectant	No	NA
Cuproplex	Experimental copper formulation	Protectant	No	NA
Cusol	Copper ammonium acetate	Protectant	No	NA
Duraban	3-trihydroxysilyl propyloctadecyldimethyl ammonium chloride	Protectant	Yes	BS
Erger Mixture	Inorganic nitrogen	Protectant	No	NA
Flint	Trifloxystrobin	Protectant	No	NA
Foliacin	Fermentation extract and minerals	Elicitor	No	NA
Foli-R-Fos® 400	Phosphorous Acid Salts	Protectant	No	NA
Graphic® Biocide	Alkyl dimethyl benzyl ammonium chloride, copper sulphate	Protectant	No	NA
Gro-Plus	Polyphenolics extracted from kiwifruit	Protectant	No	NA
Harvestcide® Gel	Bromo-chloro-dimethyl hydantoin	Protectant	No	NA
Hortisan	Chlorine Dioxide	Protectant	No	NA
Iodine Mix	Iodine	Protectant	No	NA
Kasumin	Kasugamycin	Biological	Yes	GS, HS, BS
KeyStrepto™	Streptomycin sulphate	Protectant	Yes	GS, HS, BS

KiwiLustre	Lactic acid and phosphate	Protectant	No	NA
KiwiShield	Fulvic acid	Protectant	No	NA
Kocide Opti®	Cupric hydroxide	Protectant	Yes	BS
Kotek	Mancozeb	Protectant	No	NA
Kumulus® DF	Sulphur as water dispersible granules	Protectant	No	NA
Kytogen	Chitosan	Elicitor	No	NA
Lemon C	Saponified fatty acids with Terpene alcohols	Protectant	No	NA
Liquicop	Copper ammonium acetate	Protectant	No	NA
ManKocide®	Copper hydroxide, mancozeb, sodium hydroxide	Protectant	No	NA
Mantissa Choice	Copper hydroxide	Protectant	Yes	BS
Mirenat®-N	Hydrochloride of N-(1-oxododecyl)-L-ethyl arginate	Protectant	No	NA
Moddus	Trinexapac-ethyl	Elicitor	Yes	GS, HS
Mossoff	Natural plant extracts	Protectant	No	NA
Movento	Spirotetramat	NA	NA	NA
NeemAzal-TS	Azadirachtin (neem technical)	Protectant	No	NA
Nixall	hypochlorous acid (a naturally occurring molecule synthesized from an electrolyzed solution of water and salt)	Protectant	No	NA
Nordox 75 W	Copper oxide	Protectant	Yes	BS
Organic Tree Wash	Water, soybean oil, molasses, hop extract, kelp, yucca extract	Protectant	No	NA
Omniwett	Didecyl dimethyl ammonium chloride, nickel (III) sulphate, salicylic acid	Protectant	No	NA
		Elicitor	No	NA
OMS-1	Oxolonic acid and elicitor based	Protectant	No	BS
		Elicitor	Yes	HS
OMS-3	Elicitor and bactericide combination	Elicitor	Yes	HS
OMS-4	Combination of known plant elicitors in a proprietary blend	Elicitor	No	NA
Oryzemate	Probenazole	Elicitor	Yes	HW
Oxine	Stabilised chlorine dioxide	Protectant	No	NA
Oxyspray 3000 + Anngro™	Chlorine dioxide (Oxyspray), Fatty acids (Anngro)	Protectant	No	NA
Oxywash	Chlorine dioxide	Protectant	No	NA

Path-Away™	Plant bioflavonoids	Protectant	No	NA
Path-X	Didecyldimethyl-ammonium chloride	Protectant	No	NA
Phyton 27	Copper sulphate pentahydrate	Protectant	Yes	HS
		Biological	Yes	GS, BS
Pristine®	Pyraclostrobin + boscalid	Elicitor	No	NA
Protector hml®	Fatty acids	Protectant	No	NA
Proxitain	Hydrogen peroxide and peroxyacetic acid	Protectant	No	NA
PS Ban	Undisclosed	Protectant	No	NA
PSCH Tech	Chlorhexidine gloconate plus active octadecyldimethyl (3-trimethoxysilylpropyl) ammonium chloride	Protectant	No	NA
PSQ Tech	Didecyl dimethyl ammonium chloride, alkyl benzylkonium chloride, octadecyldimethyl (3-trimethoxysilypropyl) ammonium chloride	Protectant	No	NA
Quintec	quinoxyfen	Protectant	No	NA
Regalia Maxx	Giant knotweed plant extract	Elicitor	No	NA
Regalis	Prohexadione-calcium	Elicitor	No	NA
Selecta Disperss®	Hydroxycopper sulphate	Protectant	No	NA
Serenade® Max	*Bacillus subtilis* QST 713	Biological	No	NA
Scion Products	Confidential	Protectant	No	NA
SMS	Sodium metabisulphite	Protectant	No	NA
Southern Defence	Chlorine dioxide	Protectant	No	NA
Sporekill	Didecyldemethyl ammonium chloride	Protectant	No	NA
Spotless™	Benzalkonium ammonium chloride, Salicylic acid, Urea, Propiconazole	Protectant	Yes	BS
		Elicitor	Yes	HS, BS
Sudoshield	Pseudomonas fluorescens + carrier	Biological	No	NA
Sunny	uniconazole-P	Elicitor	No	NA
Teracep + Hydracep	Peracetic acid + hydrogen peroxide (Teracep), non-ionic surfactant (Hydracep)	Protectant	No	NA
TNL 2952, 2953, 2954, 2956 & 2957	Confidential	Protectant	Yes	HW
TNL 2958	Confidential	Protectant	Yes	HW

TNL 2959	Confidential	Protectant	No	NA
TNL 2697	Cis-Jasmone	Elicitor	No	NA
Treet	2-hydroxybenzoic acid	Elicitor	No	NA
Triplex	*Bacillus amyloliquefaciens* BS1b	Protectant	No	NA
Vacciplant	Laminarine (seaweed extract)	Protectant	No	NA
		Elicitor	Yes	GS, HS, BS
Verdespada-125	Quaternary ammonium chloride	Protectant	Yes	HS
WormTech	Vermicast	Protectant	No	NA
Zinc pyrithione	Zinc pyrithione	Protectant	No	NA
Zumsil	Silicic acid	Protectant	No	NA

* *Protectant* – the product is applied to the plant and allowed to dry prior to inoculation with Psa-V.
Biological – the product is applied to the plant two to three days prior to inoculation with Psa-V.
Elicitor – the product is applied to the plant seven to ten days prior to inoculation with Psa-V.

**A 'Yes' result indicates that the product reduced leaf spotting significantly (according to statistical analysis) in at least one cultivar and at least at one assessment time i.e. one, two and/or three weeks after inoculation with Psa-V. These results are from greenhouse screening trials on seedling plants. Failure to demonstrate efficacy in these trials does not mean the product would not work if tested under alternative conditions. Likewise, care must be taken when interpreting these results and applying to field situations.

***GS – Hort16A seedlings
HS – Hayward seedlings
BS – Bruno seedlings
Not all products have been tested in all three cultivars being used in the greenhouse screens.

Note: this document should be read in conjunction with the overview of the Psa-V product testing programme

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