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GOVERNMENT OF WESTERN AUSTRALIA

Department of Agriculture and Food

Liquid banding of fungicide increases yields of cereals in paddocks with rhizoctonia bare-patch

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KEY MESSAGES

- Patches and uneven growth in a crop can be caused by *Rhizoctonia solani* AG8 or root lesion nematodes or a combination of the two. Correct identification of the pathogen/pest is essential.
- DAFWA and SARDI (South Australian Research and Development Institute) field trial results show banding fungicides in-furrow below the seed alone or in combination with either banding at soil surface or with a seed treatment can significantly increase grain yield of barley and wheat in paddocks affected by *R. solani*.
- The APVMA is currently reviewing submissions from Bayer CropScience and Syngenta to enable banding of selected fungicides to improve control of *R. solani* in cereals; if approved, registration should be granted in 2015. Permits have been approved for large scale evaluation in 2014; watch out for local field days conducted by Syngenta and Bayer CropScience.
- Use of fungicides alone will not eliminate patches caused by *R. solani* and need to be used as part of an integrated management program.

BACKGROUND AND AIMS

Rhizoctonia bare-patch (*R. solani* AG8) is a major problem across WA's cereal growing regions and is estimated to reduce WA state-wide cereal yields by 1% to 5% annually at a cost of $27M in wheat and barley (Murray and Brennan, 2009, 2010). Current management practices recommended to minimise the impacts of rhizoctonia bare-patch in WA are combinations of, cultivation with a fungicide seed-dressing and adequate nutrition (Gupta *et al*., 2012). In 2013, new fungicide options became available for application on seed, including Vibrance® and EverGol Prime®. In DAFWA and SARDI field trials, these new seed treatments increased yield by 5% on average in wheat and barley (Hüberli *et al*., 2013).

Further to the research on seed treatments by DAFWA and SARDI, new fungicides and methods of application have been developed to reduce yield losses caused by *R. solani*. The first field trials to evaluate banding of liquid fungicides for *R. solani* control were conducted in WA in 2005 at Katanning and Northam (Syngenta funding) and in SA in 2010 at Geranium (SAGIT/Syngenta funding). In-furrow banding 2-3 cm below the seed is anticipated to provide protection to the seminal roots whereas surface banding of product behind the press wheel is anticipated to protect the crown roots.

This paper summarises the yield responses from most of the field trials conducted in WA and SA from 2011 to 2013 to evaluate liquid banding of fungicides to reduce yield losses caused by *R. solani* and generate efficacy data to support label registration by the APVMA. The APVMA is currently considering applications from Syngenta and Bayer CropScience for label recommendations to band fungicides, and if approved, registration should be granted in 2015. Only the results of a Syngenta coded product (SYNSIF1) are presented in this paper to avoid supporting off-label use of other products.

METHOD

Twenty-two fungicide efficacy trials, sown to either barley or wheat, were established in WA by DAFWA and in SA by SARDI during 2011 to 2013. All trial sites were selected based on rhizoctonia bare-patching in the previous

year's cereal crop and/or a medium to high disease risk determined using PreDicta B on soil samples collected in autumn; all trials utilised native *R. solani* inoculum present in the paddock. The trials had a randomised block design with six replicate plots (20 m x 1.8 m) for each of the six treatments. Treatments included liquid banding of fungicide (SYNSIF1) on the soil surface and in-furrow below the seed, in-furrow below the seed only or in-furrow below the seed combined with a seed treatment (Vibrance^{TM}) (Table 1 and 2). Different rates of SYNSIF1 were also tested. In WA, each treated plot was adjacent to an untreated plot, while in SA individual plots were split into treated and untreated halves. All treatments were compared with untreated controls plots.

WA plots were sown using knife points to the seed depth (3 cm) and were injected with Flexi-N +/- SYNSIF1 below the seed in 2012 and 2013, while a granular fertiliser was applied below the seed in 2011 and SYNSIF1 was applied in water. In SA, plots received liquid and granular + liquid UAN fertilisers in 2012 and 2013 respectively, and SYNSIF1 was applied separately in water at 75-80 L/ha. The surface application treatment applied behind the press wheel in SA was applied using a low volume narrow angle nozzle set to spray along its narrow side creating a narrow band approx. 2 cm wide. In WA, the surface band treatment was applied as a trickle in a separate pass following the first pass application of fungicide as a trickle below the seed using GPS controlled auto-steer.

RESULTS AND DISCUSSION

Yield responses for six main treatments are presented in Tables 1 and 2 for wheat and barley, respectively. Note that some treatments were evaluated in recent years only. The results are presented as net yield increases (t/ha) for each treatment, with the site untreated yields (t/ha) and pre-sowing *R. solani* levels included to characterise each site. *Rhizoctonia* field trials are inherently variable and it was difficult to detect statistically significant yield responses less than 10% and sometimes larger.

The treatments producing the most consistent yield responses had the "split" application of fungicide applied on the soil surface behind the press wheel and in-furrow 3.5 cm below the seed. In wheat, significant yield responses of 0.11 to 0.39 t/ha (6 of 7 trials) were found at the medium rate (rate 2) and 0.20 to 0.53 t/ha (4 of 4 trials) at the high rate (rate 3). In barley, significant responses of 0.25 to 0.69 t/ha (3 of 6 trials) were observed at the medium rate and 0.37 to 0.87 t/ha (2 of 3 trials) at the high rate.

Application of SYNSIF1 in-furrow only produced significant yield increases in wheat of 0.12 to 0.33 t/ha (7 of 11 trials) at the medium rate and 0.08 to 0.42 t/ha (5 of 7 trials) at the high rate. In barley, net yield responses of 0.25 to 0.69 t/ha (5 of 10 trials) at the medium rate and 0.26 to 0.53 t/ha (5 of 6 trials) at the high rate were found.

Banding below the seed at the low rate in combination with Vibrance^{TM} seed treatment increased yield significantly by 0.09 to 0.47 t/ha in wheat (6 of 11 trials) and 0.17 to 0.62 t/ha in barley (4 of 10 trials). Seed treatment alone increased yield significantly in 3 of 11 wheat trials and 1 of 10 barley trials.

Table 1. Summary of net wheat yield responses (t/ha) in *Rhizoctonia solani* fungicide application trials with SYNSIF1 and Vibrance™.

Site	Year	Pre-sow Rhizo DNA (pg/g soil)	Untreated yield (t/ha)	Vib.	Vib. + IF rate 1 (low)	IF rate 2 (medium)	IF rate 3 (high)	½ Sur + ½ IF rate 2 (medium)	½ Sur + ½ IF rate 3 (high)
Katanning(WA)	2013	6	4.28	0.04	0.00	-0.02	0.04	**0.15***	**0.23***
Weetulta (SA)	2013	205	0.88				**0.40****		**0.49****
Lameroo (SA)	2013	106	2.29	0.09	**0.18****	**0.13****	**0.19****	**0.24****	**0.20****
Wynarka (SA)	2013	257	1.79	0.03	**0.22****	**0.28****	**0.21****	**0.38****	**0.53****
Lake Grace (WA)	2012	65	0.71	**0.09***	0.05	0.02	**0.08***	**0.11***	
Karoonda (SA)	2012	138	1.36	**0.25****	**0.47****	**0.33****	**0.42****	**0.39****	
Port Julia (SA)	2012	102	2.88	0.02	**0.14***	**0.14***	0.09	0.11	
Corrigin (WA)	2011	62	2.84	0.00	0.09	**0.26****			
Ongerup (WA)	2011	161	1.82	0.12	-0.09	0.00			
Keith (SA)	2011	76	2.70	0.02	0.07	0.14			
Minnipa (SA)	2011	109	1.98	**0.08****	**0.09****	**0.12****			
Yumali (SA)	2011	219	1.33	0.06	**0.20****	**0.20****		**0.19****	

* Significant ($P < 0.05$) or ** Significant ($P < 0.001$), compared to untreated plots

Vib = Vibrance™ seed treatment applied at 360 ml/100 kg seed, IF = SYNSIF1 applied in-furrow (3-4 cm below seed), Sur = SYNSIF1 applied on furrow surface.

Table 2. Summary of net barley yield responses (t/ha) in *Rhizoctonia solani* fungicide application trials with SYNSIF1 and Vibrance™.

Site	Year	Pre-sow Rhizo DNA (pg/g soil)	Untreated yield (t/ha)	Vib.	Vib. + IF rate 1 (low)	IF rate 2 (medium)	IF rate 3 (high)	½ Sur + ½ IF rate 2 (medium)	½ Sur + ½ IF rate 3 (high)
Kojonup (WA)	2013	22	4.38	0.04	0.18	-0.21	**0.36***	**0.25***	0.13
Lameroo (SA)	2013	106	2.77	**0.21****	**0.17****	**0.30****	**0.31****	**0.40****	**0.37****
Wynarka (SA)	2013	257	1.93	0.09	**0.62****	**0.69****	**0.53****	**0.69****	**0.87****
Karoonda (SA)	2012	138	2.63	-0.12	0.18	**0.44***	**0.49***	0.24	
Port Julia (SA)	2012	102	2.99	-0.03	0.01	0.16	-0.15	0.15	
Calingiri (WA)	2012	13	1.20	0.05	**0.17****	**0.25****	**0.26****	-0.05	
Keith (SA)	2011	76	2.93	-0.03	0.18	0.09			
Minnipa (SA)	2011	109	2.61	0.09	0.12	**0.28****			
Yumali (SA)	2011	219	1.53	-0.07	**0.20***	0.12			
Salmon Gums (WA)	2011	136	0.46	0.01	0.0	-0.01			

* Significant ($P < 0.05$) or ** Significant ($P < 0.001$), compared to untreated plots

It is important to note that prior to commencing any management program that the pathogen, pest or issue is identified as management approaches for *R. Solani* and nematodes are different. Patches and unevenness in a paddock can be caused by *R. solani*, root lesion nematodes or a combination of the two, as well as other factors. Fungicides alone will not eliminate patches caused by *R. solani* and need to be used as part of an integrated management program. Factors that will reduce the disease risk of *R. solani* include:

- Vibrance™ and EverGol® Prime seed treatments which have been shown in DAFWA/SARDI field trials to increase yield by 5% on average relative to untreated seeds.
- Sowing a non-cereal break crop, especially canola, may provide a useful reduction in *Rhizoctonia* levels for the following crop.
- Frequent summer rainfall with summer/autumn weeds controlled.
- Early sowing and soil disturbance 10 cm below the seed using knife-points facilitates root growth down the soil profile and breaks up the hyphal network.
- Applying adequate nutrition to encourage rapid seedling vigour, in particular minimise N deficiency by banding N below the seed; do not incorporate stubble.
- Address in-crop nutrient/trace element deficiencies with foliar application.

CONCLUSION

- Liquid banding of fungicide can significantly improve the control of *R. solani*.
- Application method of fungicide does affect the capacity to control *R. solani*; liquid banding of fungicide either in-furrow only or “split” 50-50 in-furrow and at the soil-surface offer significantly better control than the seed treatments.

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KEY WORDS

Rhizoctonia solani, root disease, soilborne pathogen, banding fungicides, liquid injection.

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