

# Managing wheat production systems through better agronomy and fungicide applications

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## Key messages

- In a wheat-on-wheat system; variety choice, disease severity and nitrogen application all impact on grain yield.
- Fungicide application significantly reduced severity of yellow spot / septoria nodorum. Yield was correlated with disease severity at anthesis.
- Nitrogen application of 30 kg N/ha increased wheat yield by 6.5% (3.1 to 3.3 t/ha) across all varieties and fungicide treatments.

## Aims

A profitable wheat-on-wheat system includes managing disease and nutrition for improved production of quality grains. Agronomy through better variety selection and management may reduce risks of diseases and improve profitability in wheat-on-wheat systems. The aim of this work was to determine the value of nitrogen and fungicide on the profitability of new wheat varieties with different disease resistances in wheat-on-wheat system.

## Method

The trial was conducted at Wickpin as a split plot design with fungicide as main plots and varieties x N rate as subplots. There were 36 treatments with three replications. The trial was sown on 16 May into wheat stubbles. The varieties Cobra (MRMS, MS for Septoria nodorum blotch and yellow spot respectively), Corack (MSS, MR), Emu Rock (VS, MS), Justica CL plus (MS, S), Mace (MS, MRMS) and Magenta (MRMS, MR) were sown with three nitrogen rates in fungicide treated (plus) and untreated (nil) blocks. A basal fertiliser 100 kg Super Phosphate was drilled in the whole trial at seeding. Three nitrogen treatments were N0 (Nil N), N30 (30 Kg N/ha) and N60 (60 Kg N/ha). The nitrogen was applied in split treatments of 23 kg/N in N30 and N60 plots at seeding followed by 7 Kg N/ha and 37 kg N/ha top dressed after 6 weeks. The foliar fungicide Prosaro 0.15 Lt/ha was applied on 14 August (Z32/33) in fungicide plus blocks.

The trial was closely monitored for foliar diseases. The disease data were collected during spring (at Z32, 49, 65 & 75).

## Results

The trial was sown into adequate soil moisture with good crop establishment followed by a dry June, however good spring rainfall resulted in above average wheat yield.

## Fungal leaf disease assessments

Assessments for fungal leaf disease infection were made at four times during the season (Z32, 49, 65, 75). Dry conditions post emergence did not favour disease development and at the time of fungicide application leaf area affected on leaf 3 of the susceptible variety Justica was less than 5%, both yellow spot (YS) and septoria nodorum (SNB) were present (65% YS : 35% SNB) (Table 1). With subsequent increasing rainfall, disease severity increased to moderate levels, particularly in the more susceptible varieties.

Disease severity was greatest in Justica CL plus, however significant levels of disease were also evident in the untreated Mace and Corack. Fungicide application at Z32/33 significantly reduced disease severity across all varieties. However, disease severity in fungicide treated Justica CL plus was still significantly greater than other fungicide treated.

Disease severity was marginally greater (10-15%) in the absence of nitrogen.

**Table 1 Leaf area affected by Yellow Spot / Septoria Nodorum at anthesis (~Z65) (average % leaf area of top 3 leaves) for six wheat varieties at three nitrogen rates with and without fungicide application at Wickepin in 2013**

Variety	Nil Fungicide			Plus Fungicide			Ave for variety						
	NO	N30	N60	NO	N30	N60							
Cobra	7.4	3.9	2.7	1.7	2.0	1.3	3.2						
Corack	10.3	7.9	6.5	1.3	1.9	1.5	4.9						
Emu Rock	3.5	4.2	3.6	1.3	1.4	2.5	2.7						
Justica CL plus	17.9	16.4	21.3	7.9	3.0	3.3	11.6						
Mace	16.0	8.7	10.5	2.4	1.7	2.6	7.0						
Magenta	5.0	4.2	3.0	0.7	1.1	1.1	2.5						
Average for N rate	10.0	7.6	8.0	2.5	1.9	2.0							
N main effect (LSD 0.65)													
	F pr	Lsd (p=0.05)		<table><tr><td>NO</td><td>N30</td><td>N60</td></tr><tr><td>6.3</td><td>4.7</td><td>5.0</td></tr></table>			NO	N30	N60	6.3	4.7	5.0	
NO	N30	N60											
6.3	4.7	5.0											
Variety	<0.001	0.91											
Fungicide main effect (LSD 1.71)													
Fungicide	0.027	1.71		<table><tr><td>Nil</td><td>Plus</td></tr><tr><td>8.5</td><td>2.1</td></tr></table>			Nil	Plus	8.5	2.1			
Nil	Plus												
8.5	2.1												
N rate	<0.001	0.65											
All interactions	<0.001	4.16											

## Grain yield

Variety, nitrogen rate and fungicide application all impacted on grain yield. Across all treatments, varieties yielded between 2.75 t/ha (Justica CL plus) to 3.6 t/ha (Corack). Mace (3.55 t/ha) and Corack (3.61 t/ha) significantly out yielded all other varieties (Table 2). Application of 30kg/ha nitrogen (averaged across all varieties and fungicide treatments) produced a significant yield response of 0.17 t/ha. In plots without fungicide treatment, both variety and nitrogen rate determine yield response (Lsd=0.48), Corack more responsive to additional nitrogen than Mace. However with fungicide application, response to nitrogen is less evident.

Across all treatments yield was significantly correlated with disease severity at anthesis ( $r=0.66$ ,  $p<0.001$ ). Across all varieties, fungicide increased yield from 3.05 t/ha to 3.40 t/ha...

Grain quality results are not yet available at reporting

**Table 2 Grain yield (t/ha) for six wheat varieties at three nitrogen rates with and without fungicide application at Wickepin in 2013**

Variety	Nil Fungicide			Plus Fungicide			Ave						
	N0	N30	N60	N0	N30	N60							
Cobra	2.99	3.19	3.31	3.47	3.51	3.75	3.37						
Corack	3.09	3.43	3.91	3.72	3.74	3.75	3.61						
Emu Rock	2.54	2.90	2.96	2.98	3.12	2.84	2.89						
Justica CL plus	2.40	2.45	2.59	2.75	3.15	3.13	2.74						
Mace	3.23	3.43	3.46	3.72	3.80	3.65	3.55						
Magenta	3.14	3.05	2.87	3.44	3.57	2.95	3.17						
Average for N rate	2.90	3.07	3.18	3.35	3.48	3.34	3.22						
N main effect													
	F pr	Lsd (p=0.05)		<table><tr><td>N0</td><td>N30</td><td>N60</td></tr><tr><td>3.11</td><td>3.28</td><td>3.28</td></tr></table>				N0	N30	N60	3.11	3.28	3.28
N0	N30	N60											
3.11	3.28	3.28											
Variety	<0.001	0.17											
Fungicide	ns	0.51		Fungicide main effect									
N rate	0.013	0.12		<table><tr><td>Nil</td><td>Plus</td></tr><tr><td>3.05</td><td>3.40</td></tr></table>				Nil	Plus	3.05	3.40		
Nil	Plus												
3.05	3.40												
All interactions		n.s.											

## Discussion

Mace and Corack were highest yielding at ~3.6 t/ha followed by Cobra and Magenta (3.2 t/ha). These varieties are consistent in producing higher yield over the last few years in Western Australia. Emu Rock and Justica CL plus yielded significantly lower (2.8 t/ha) than Mace. Emu Rock has been considered competitive with Mace at lower yield potential (around 2.0 t/ha particularly in low rainfall regions), but not in higher yielding scenarios. While yield of Emu Rock was higher than expected it was not competitive with Mace at this site this season. Similarly Justica CL plus was not as high yielding and its disease profile is not suited for sowing into wheat stubble, however it does provide an additional option for weed control.

All varieties were responsive to addition of nitrogen in 2013. Grain yield was increased by 6.5 % averaged across all varieties and fungicide treatments by increasing nitrogen from nil to 30 kg N/ha. Yield response to an additional 30 kg/ha nitrogen (60 kg/ha total) was not consistent and averaged across treatments did not provide a significant or economic return.

Where lack of nitrogen was yield limiting, a small but significant increase in disease severity was evident. This result reflects responses in previous trials in the northern agricultural region where sub-optimal levels of nitrogen nutrition resulted in small increases in disease severity; however the primary benefit from optimum nitrogen application is reflected in plant growth rather than disease management.

Due to the presence of wheat stubble, there was low-moderate level of yellow spot and septoria nodorum infection in the trial, however dry early season conditions limited disease development prior to flag leaf emergence. Fungicide was applied at Z32/33 and significantly reduced disease severity, resulting in 0.35 t/ha yield response averaged across all varieties. The susceptible variety Justica CL plus had greatest levels of disease and lowest yield and it may have benefited from an additional fungicide application. Despite having greater levels of disease than might be expected for their resistance rankings, Mace and Corack were highest yielding in both the Nil and Plus fungicide treatments.

This trial has shown that both nitrogen nutrition and disease severity can impact on yield of wheat varieties sown onto wheat stubble. To attain optimum yield and maximum economic benefit in wheat-on-wheat situations, it is essential to provide adequate, but not excess, nitrogen and to manage foliar disease to maintain green leaf area during anthesis and grainfill.

### **Key words**

Cultivars, wheat agronomy, nitrogen

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