Agronomy and disease management to improve profitability in wheat on wheat systems

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AIM

To determine the value of nitrogen and fungicide on the profitability of new wheat varieties with different disease resistances in wheat on wheat system.

TRIAL DETAILS

Property:	Shane Hill
Plot size & replication:	1.54m x 20m (3 replications)
Soil type:	Sandy
Crop Variety:	9 varieties
Application Date:	Pre-emergent (@ seeding) – 17/05/2012 Post Emergent – 18/07/2012 & 20/08/2012
Sowing Date:	17/05/2012
Seeding Rate:	150 plants/m2 (ie. Mace @ 80kg/ha)
Fertiliser (kg/ha):	Agras NO 1 @ 110kgha; 50kg/ha Urea
Paddock rotation:	2011 – Wheat (continuous)
Herbicides:	Pre-emergent – 0.025kg/ha Chlorsulfuron, 1.5L/ha Trifluralin 480, 4L/ha Sprayseed 250 Post Emergent – 1.4L/ha Bromicide, 0.3L/ha Axial Post Emergent – 0.5L/ha Crusader + 0.3L/ha Prosaro

BACKGROUND

Profitable wheat on wheat systems 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.

METHODOLOGY

36 treatments:

9 Varieties – Mace, Yitpi, Wyalkatchem, Emu Rock, Cobra, Corack, Magenta, Calingiri, Envoy

2 Nitrogen rate – Low and High rates - 60 kg N- high (target 11%protein) and 30 kg N - low (target 10% protein) based on soil N

2 Fungicide applications – 1: Z32, 2: nil.

3 replications

RESULTS & DISCUSSION

There was patchy and uneven growth within and between plots during the growing season. The trial was affected by foliar fungal disease (yellow spot), viruses (WSMV/HPV), weeds (ryegrass), root disease (Rhizoctonia) and drought. Despite early infection by yellow spot, the primary factors influencing crop growth were virus infection, grass weed competition and poor seasonal rainfall. The trial was assessed for incidence and severity of virus (WSMV/HPV) infection (Table 1) and fungal (YS&SNB) leaf diseases (Table 2).

Wheat streak Mosaic and High Plains Virus

The trial was sown into a paddock with heavy cover of volunteer wheat regrowth that had been sprayed with knockdown herbicide 3 weeks prior to sowing. Seedlings emerged as the volunteer cereals were dying, providing a fresh host for virus infected Wheat Curl Mites. The surrounding paddock was sown 10 days later than the trial; crop emergence occurred after volunteer cereals had browned off and died.

At the time of the first fungal leaf disease assessment (14 Aug) it was evident that significant leaf yellowing and plant stunting was occurring across the trial that was unrelated to yellow spot susceptibility or infection. On 4th September, 20 leaves were collected at random from 4 replicate plots of each variety for virus testing. All plots (4 reps) and surrounding crop were tested by ELISA and PCR for *Wheat streak mosaic virus* (WSMV) and a single plot of each variety tested for *High Plains Virus* (HPV). Visual scoring of severity of leaf symptoms was carried out on all varieties. In the crop surrounding the trial, 100 leaves were randomly collected from each of the 4 directions (north, south, east and west) to a distance of 50m from the trial for WSMV testing. Samples collected from the west side were also tested for HPV. Annual ryegrass from within the plots was sampled (60) and tested for WSMV and HPV.

WSMV and HPV were detected in all varieties by ELISA and PCR tests. WSMV incidence ranged from 78% in Magenta to 99% in Calingiri and Emu Rock (Table 1). There were no significant differences in WSMV incidence between the 9 varieties. HPV incidences ranged from 5% in Yitpi to 55% in Cobra (one replicate). Infected plants from all varieties were easily identified with typical yellow streaking in leaves, and plants were stunted, however the symptom severity varied between varieties. Emu Rock had the most severe symptoms (rating 5), while Calingiri and Envoy were less severe (rating 1.5), for all other varieties symptom ratings ranged from 2-3.5. In the crop surrounding the trial WSMV incidence ranged from 4-11%. HPV incidence in the 'west' crop area was 1%. Annual ryegrass from within the trial was infected with WSMV (3.5%), but HPV was not detected.

Harvested seed will be tested for seed transmission of WSMV and HPV (results not currently available).

Variety	WSMV (%) 4 reps	HPV (%) 1 rep	Symptom severity rating (1=mild, 5=severe)
Calingiri	99	22	1.5
Emu Rock	99	16	5
Envoy	87	22	1.5
Cobra	91	55	2.5
Wyalkatchem	89	16	3
Mace	87	16	3
Yitpi	82	5	2
Corack	81	22	3.5
Magenta	78	22	3
P 0.05	n.s.		
Crop			
North	8	NT#	
South	4	NT#	
East	10	NT#	
West	11	1	

Table 1: Incidence and symptom severity of *Wheat streak mosaic virus* (WSMV) and *High Plains virus* (HPV) in the agronomy wheat trial and surrounding crop at Corrigin (2012).
NT#: Not tested

Fungal leaf disease assessments

Assessments for fungal leaf disease infection were made at three times during the season, however only the assessment made at seedling / early tillering (4th July – Z14/22) were not seriously compromised by the presence of WSMV. At this time significant yellowing and necrosis resulting from yellow spot infection was present on lower leaves, particularly in the susceptible variety Yitpi (Table 2). Laboratory assessment showed that pathogens were present at very low level, in proportion of 85% yellow spot: 15% septoria nodorum blotch.

By mid stem extension (Z32) very few symptoms of fungal leaf disease were evident and leaf yellowing was due primarily to WSMV/HPV infection. At grain-fill, again there was very little evidence of fungal leaf disease infection and loss of green leaf area appeared to be mostly related to moisture stress.

Variety	Leaf area necrotic (%)		
	L1#	L2	Average
Calingiri	9.1	7.2	8.2
Cobra	4.6	5.1	4.9
Corack	5.6	12.7	9.1
Emu Rock	14.7	20.1	17.4
Envoy	12.3	10.7	11.5
Mace	6.1	9.7	7.9
Magenta	6.5	10.4	8.4
Wyalkatchem	14.9	9.4	12.2
Yitpi	47	17.5	32.3
p	<.001	0.133	<.001
LSD	11.7	10.4	9.8

Table 2: Leaf area affected by Yellow Spot in a range of varieties, (Z14-16/21-22)

L1 = bottom leaf (seedling leaf)

* YFEL = Youngest fully expanded leaf

Grain yield

Yield across all plots was variable, factors including the dry spring, virus infection, weed competition and root disease reduced the site average grain yield to 0.5 t/ha (Fig 1).

As overall yield was low (0.5 t/ha) and that variability across the trial area make further comparisons difficult.

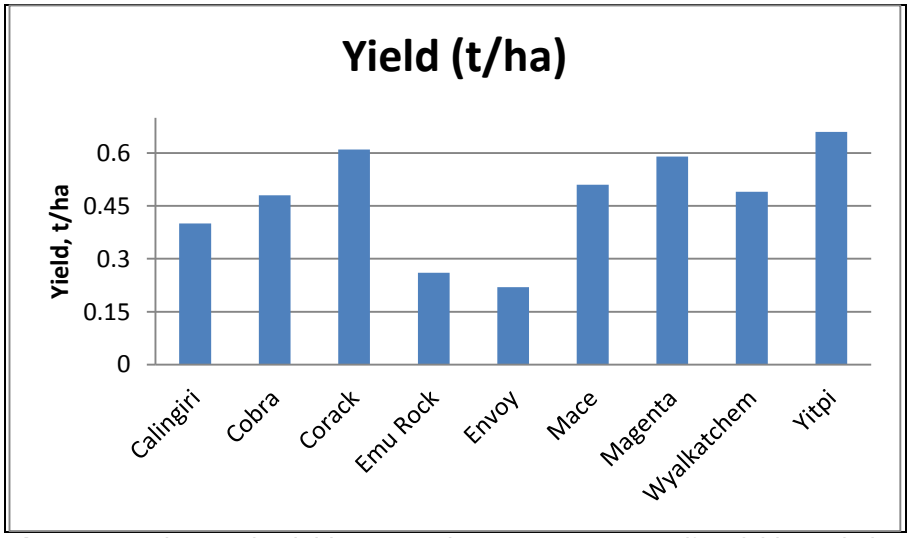

Figure 1: Variety grain yield averaged across treatments (fungicide and nitrogen), LSD (0.171).

CONCLUSION

- Early differences in YS infection were evident at seedling/tillering stage, infection was greatest in the susceptible variety Yitpi, however seasonal weather conditions and WSMV infection reduced any further impact from fungal leaf disease.
- *Wheat streak mosaic virus* (WSMV) and *High Plains Virus* (HPV) caused yellowing and stunting of plants across the trial with >75% WSMV infection evident in all plots, differences between varieties in incidence of infection were not significant. However, yield was greatest in varieties with lowest incidence of WSMV infection.
- WSMV and drought stresses severely reduced yield and as such results are not conclusive for nitrogen and fungicide applications in wheat on wheat systems.
- Similar DAFWA research in Northern Region (having no WSMV) reported that wheat with sub-optimal nitrogen and no fungicide application is more vulnerable to fungal leaf spot diseases, particularly in a susceptible variety, and may suffer yield losses (compared to optimal N and fungicide) in wheat on wheat systems.
- Further collaborative work will be planned in 2013 to determine the value of nitrogen and fungicide on the profitability of new wheat varieties with different disease resistances in wheat on wheat system.

IMPACT AND MANAGEMENT OF WSMV / HPV

- *WMSV* and *HPV* can cause significant crop damage and are another constraint to be considered in a wheat on wheat cropping system.
- *WSMV* can directly influence yield through stunting of plants, leaf yellowing and shrivelled grain and indirectly through reducing competitiveness of crop to weeds.
- *WSMV* and *HPV* are seed borne in wheat and green-bridge diseases. While WSMV occurrence has been sporadic over the last 5 years, the infection in this trial indicates that it is present in the wheatbelt and can cause significant damage if simple management approaches are not followed.
- Greatest risk of infection occurs when crops are sown into cereal regrowth, facilitating transfer of virus infected Wheat Curl Mite from dying regrowth to newly emerging crops.
- In wheat on wheat systems, do not sow seed from infected crops and ensure all volunteer cereal plants are sprayed out at least 4 weeks prior to sowing.

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