3b. Eyespot Management

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KEY MESSAGES

- This is the first quantitative information we have for the effects of varietal resistance and fungicide application and timing on eyespot expression and crop yield in the South East. These preliminary recommendations will become more robust as we gather more information.
- No fungicides are registered at present for eyespot management, but it is anticipated at least one registered product will be available for use in the 2017 season. Applying fungicides for eyespot management reduced eyespot expression and increased yields in the trials at Kangaroo Inn.
- Select more resistant varieties – untreated they will perform better and they may also be more responsive to fungicide application, particularly where disease pressure is high.
- Delays in fungicide application until after early stem elongation (recommended timing, as the canopy is still open enough to allow good coverage of the stem bases) may reduce eyespot incidence and severity but may not give a yield response.

Background

Eyespot is an increasing problem in the higher rainfall grain growing areas of SA such as lower Eyre Peninsula, the Cleve Hills, the mid North, the Adelaide Plains and the South East. This increase is mainly due to farming systems moving to stubble retention, direct drill and more cereals in rotations as well as to the trend to sowing cereals earlier. In Australia, eyespot in cereals is caused by the fungus *Oculimacula yallundae* (previously known as *Pseudocercosporella herpotrichoides*) which infects stem bases causing the eye-like lesions which gives eyespot its name.

Yield losses from this disease occur as a direct result of the stem lesions and, secondarily, from plants lodging due to weakened stem bases which can make it difficult or impossible to harvest affected plants. Overseas, eyespot control includes fungicide application and the use of partial resistance in varieties but as eyespot has a restricted distribution in Australia no fungicides are currently registered for eyespot management.

GRDC funded research in 2014 and 2015 to acquire data to support submission of fungicide products for registration/label extensions for eyespot management in bread wheat in Australia. As a direct result of this research, submissions for registration of 5 fungicides are currently being prepared by commercial companies. It is important to understand how to make best use of those fungicides in an integrated eyespot management system designed to maximise fungicide efficacy and to minimize potential resistance problems (in leaf diseases as well as eyespot).

This research was initiated to provide preliminary data to improve our understanding of:

- The effectiveness of timing of fungicide application for eyespot management in the South East.
- Interactions between MS and S varieties and fungicide efficacy.
- Impact of fungicides, varieties and combinations on eyespot inoculum carryover.

Figure 1. Eyespot lesions on the stem of a plant
Photo courtesy Marg Evans, SARDI

Activities

The Kangaroo Inn site was located on Richard Kirkland's property in a paddock that has had a history of eyespot problems. High levels of eyespot inoculum (162,000 copies – very high compared with other paddocks having eyespot problems) were present at the site at the start of 2016.

Plots (6 rows x 10 m) were defined in the commercial crop of SQP Revenue (sown on May 15th) adjacent to the eyespot variety screening trial. Treatments were selected in collaboration with local growers and advisors to provide information about fungicide efficacy for eyespot management if wet soil prevents timely fungicide application. Fungicide was applied at one or a combination of the following times: July 18th - early tillering (at the time of herbicide application); September 6th - early stem elongation (GS30-31 – recommended timing); September 19th - (later than recommended timing to simulate delays due to waterlogging or poor weather).

In addition, within the variety screening trial (sown on May 18th) at Kangaroo Inn, paired plots of Mace and of Trojan were sown to examine fungicide x variety interactions. Fungicide was applied to one of the paired plots of each variety on August 5th at GS31 (one node present) while the canopy was still open. The same fungicide & variety treatments were also undertaken within the Tarlee variety screening trial.

Stem samples were collected on 5th December, when plants were at late grain fill. Thirty to 40 stems were assessed in each plot, with stems being taken from each of the 6 inner rows of the plot. The percentage of the circumference of each stem occupied by eyespot symptoms was recorded as an indicator of eyespot expression. This scoring method also allowed calculation of eyespot incidence (% stems with lesions).

Results & Discussion

The trial established well and weeds and insect pests were adequately controlled. Leaf diseases (e.g. septoria, stripe rust) were not present at significant levels and should not have influenced yield responses to fungicide applications for eyespot management.

Eyespot infection in the commercial Revenue crop was high (93% of stems infected) and in the variety trial infection rates were medium (56% of Mace stems infected). The largest yield improvement due to fungicide application in Revenue was 0.46 t/ha (Table 1), in Mace 0.20 t/ha and in Trojan 0.31 t/ha (Table 2). These yield improvements are less than seen in trials at other sites 2014-2016 for Mace (0.63-1.38 t/ha) and Trojan (0.43 t/ha). This might be characteristic for the South East, but it is more likely that good rainfall and mild conditions during grain filling allowed affected stems to produce reasonable grain yields. Trials planned for this year will provide more data on yield improvements to be gained using fungicides for eyespot management in the South East and the economics of those applications.

The 2016 season was exceptionally wet, with many periods during May, June, July, August and September where eyespot infection would have occurred. This resulted in 93% of untreated SQP Revenue stems becoming infected with eyespot (Table 1), with fungicide application only affecting eyespot severity (% of the stem circumference affected). All timings and numbers of fungicide applications reduced incidence and severity of eyespot when compared with the untreated control (Table 1). Relative improvements in yield from fungicide application were consistent with the reduction in eyespot incidence and severity (Table 1). Early application alone or in combination with a late application was most effective at improving yield, but an early application in combination with an application at the recommended timing had no effect on yield, which is inconsistent with the other results and is unlikely to truly represent the treatment effect (Table 1). Late application of fungicide did not improve yield, despite reducing eyespot incidence and severity – perhaps because eyespot had more time to damage plant tissue within the stem prior to fungicide application.

Expression of eyespot in the moderately susceptible Trojan was lower than that for the susceptible variety Mace (Table 2) and for both varieties, fungicide application reduced eyespot incidence and expression (Table 2). For Trojan, fungicide application decreased eyespot incidence by 89% and for Mace by 63% with decreases in eyespot severity of 96% for Trojan and 85% for Mace. This suggests that fungicides might have greater efficacy when applied to varieties with more eyespot resistance.

Soil samples (including plant residues) have been taken from all plots to explore the effects of variety and of fungicide application on carryover of eyespot inoculum (via the SARDI root disease testing service). When results become available, findings will be extended through the MFMG newsletter and field days in 2017.

Table 1. Effect of timing and number of fungicide applications on eyespot incidence, severity and yield improvement in SQP Revenue at Kangaroo Inn, 2016. Fungicide application times – Early (July 18th at early tillering when applying herbicides); Recommended (September 6th at early stem elongation, GS31 – canopy partly closed); Late (September 19th to simulate delays due to waterlogging/ poor weather – canopy mostly closed).

Treatment	Incidence (%)	% of stem affected	Yield (t/ha)	Yield increase
Untreated	93	72	5.23	
Early	76	47	5.68	0.45
Recommended	74	44	5.36	0.13
Late	68	46	5.24	0.01
Early + recommended	66	36	5.30	*0.07**
Early + late	37	9	5.69	0.46
l.s.d	**18**	**23**	**ns**	

* This yield result is inconsistent with the other results and is unlikely to truly represent the treatment effect.

Table 2. Effect of fungicide application at early stem elongation (GS31; August 5th - canopy partly closed) on eyespot incidence, severity and yield of Mace (S) and Trojan (MS) at Kangaroo Inn, 2016.

	Incidence (%)	% of stem affected	Yield (t/ha)	Yield increase
Mace	56	40	4.23	
Mace + fungicide	21	6	4.43	0.20
Trojan	44	26	4.92	
Trojan + fungicide	5	1	5.23	0.31
l.s.d	**23**	**20**	**ns**	

Conclusions

Variety susceptibility rating and timing of fungicide application affect both eyespot expression and yield. This is the first time data has been collected in the South East to quantify yield improvements due to fungicide application and the interaction of variety susceptibility and fungicide. The 2016 season was exceptionally wet, with many periods during May-September where eyespot infection would have occurred and results might be different in a drier season. This means more data will be needed before firm recommendations can be made.

Findings from 2016 suggest that, where eyespot inoculum is high, yield improvements are likely to result from:

- Selecting more resistant varieties.
- Applying registered fungicides (no fungicides are registered for eyespot management at present, but it is anticipated at least one registered product will be available in the 2017 season).

They also suggest that fungicide applied later than early stem elongation (recommended timing, with the canopy still open to allow good coverage of the stem bases) may reduce eyespot incidence and severity but may not give a yield response.

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