Yield response to fungicide control of barley spot type net blotch in Western Australia

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Key messages

- Grain yield response to fungicide application occurred in more than half (58%) of trials analysed. Grain yield gain from STNB control ranged from 0.19 to 2.18t/ha (5 – 59%) of the untreated yield. Grain screenings reduced by a third and there were also improvements in grain weight, hectolitre, brightness and protein levels.
- Double applications of fungicide, with the first made at stem extension, gained the greatest yield responses in the medium and high rainfall areas.
- Variety yield response reflects the disease rating – the highest gains are with SVS varieties.
- Spring rainfall, particularly rainfall and number of rainy days in September, determines the likelihood of a yield response to fungicide application. Growers in the medium and low rainfall areas need to take the spring rainfall outlook into account when deciding if a second fungicide application is necessary – in a dry spring there is no additional benefit from a second application.
- Propiconazole and Prosaro® performed comparably in nearly all situations where they were head to head.

Aims

Just over 98% of the area sown to barley in Western Australia in 2015 was to a variety that is rated susceptible or worse for spot type net blotch (STNB). While nearly all the barley varieties grown in WA are susceptible to STNB, the dominance of Hindmarsh⒟, rated SVS, has exacerbated the problem. Barley on barley rotations have increased in prevalence, raising the disease pressure further and leading to situations where high levels of early infections occur.

This study brought together the results of many different small plot trials from WA across 17 years. Its aims were to:

1. Determine what the yield and grain quality benefits are from controlling STNB.
2. What is the most effective fungicide strategy to control STNB?
3. Of the commonly used fungicides, is any option better than another?

Method

This study used results from 24 small plot trials (1998–2015) where STNB was the primary disease present (Table 1). Most trials were located in the medium and high rainfall zones. Three trials were opportunistically set up in farmer established paddocks after disease appeared. Trial designs were randomised blocks or split plots with either three or four replicates (apart from two with six). Trials were sown into barley stubble, adjacent to barley stubble or had barley stubble spread after sowing while others followed canola (one), wheat (one) or pasture (one). Some trials contained a single variety while others had more. Fungicides and their times of application varied between trials.

Trials were selected on the basis that STNB was the only disease recorded or it was by far the dominant disease at a site. Disease assessments scored the percentage of disease present on the top leaves of ten randomly selected plants per plot (one trial assessed five plants/plot) with the disease levels at grain filling stage or the assessment nearest to this shown (Table 1). The leaves assessed always included flag-1 (F-1) and flag-2 (F-2) but some assessments included flag (F) leaf and others flag-3 (F-3) so that the Top 3 leaves is either F to F-2 or F-1 to F-3.

Grain yield was taken using small plot harvesters. Plot widths and lengths varied with widths of approximately 1.75m and lengths of 10-20m. The Genstat (VSNI, 2014) statistical package was used to analyse site data (apart from two sites) using the 95% level of confidence unless specified. Rainfall information is from the site, BOM, DAFWA and patch point data sets.

Grain quality data was not available for all trials or only some characteristics were measured. Grain size (2.5mm screenings) and hectolitre weight were usually reported (17 sites) and others also had grain weight (13 sites), grain brightness (12 sites) and grain protein (14 sites).

Results refer to treatment responses – results of full control applications (three or more fungicides) were excluded.

Table 1. Trial details for 24 sites. Barley variety abbreviations are Bass (Bs), Baudin (Ba), Buloke (Bu), Compass (Cs), Dash (D), Fathom (F), Gairdner (Ga), Granger (Gr), Hamelin (Ha), Hindmarsh (Hi), La Trobe (LaT), SY Rattler (R), Scope (Sc), Stirling (St), Vlamingh (V) and Wimmera (W).

Trial	Owner	Location	Rainfall zone	Sowing date	Barley variety	Rotation
15WE03	Bayer	Cunderdin	M	1/6/2015	LaT	diseased stubble spread
15WE01	Bayer	Dandaragan	H	25/5/2015	Bs	diseased stubble spread
15CAg-Stubble	ConsultAg	Corrigin	M	14/5/2015	Sc	barley
15CAg-Burnt	ConsultAg	Corrigin	M	14/5/2015	Sc	stubble burnt
15ES13	DAFWA	Wittenoom Hills	M	12/5/2015	Hi, LaT, Sc, Cs, R, F, Gr, D	barley
15ES11	DAFWA	Gibson	H	8/5/2015	Hi, LaT	barley
15ES39^	DAFWA	Coomalbidgup	H	26/4/2015	Sc	barley
15Farm&Gen^	Farm&General	Coomalbidgup	H	17/5/2015	LaT	pasture
15KA34	DAFWA	Arthur River	H	25/5/2015	Hi, Bs	barley
15ME11	DAFWA	Nungarin	L	11/5/2015	Sc, Hi	barley
15ME24	DAFWA	Nungarin	L	11/5/2015	Hi, LaT, Sc, Cs, R, F, Gr, D	barley
10AV03	DAFWA	Meckering	M	29/5/2009	Ba, Bs	barley
09AV03	DAFWA	Meckering	M	26/5/2010	Ba, Bs	barley
09WC39	Bayer	Meenar	M	?/6/2009	Hi	barley
06GE07	DAFWA	Mingenew	M	1/06/2006	Ha	barley
05ES05 TOS1	DAFWA	Salmon Gums	L	30/5/2005	Ba, Bu, V, St, Ha + 15 lines	barley
05ES05 TOS2	DAFWA	Salmon Gums	L	14/6/2005	Ba, Bu, V, St, Ha + 15 lines	barley
05ES06	DAFWA	Gairdner	H	25/5/2005	Ba, V	canola
03GE06^	DAFWA	Yuna	M	na	St	wheat
01AL03	DAFWA	South Stirling	H	26/5/2001	Ga	barley
00ES29	DAFWA	Gibson	H	8/5/2000	Ga	barley
99AL5	DAFWA	Wellstead	H	8/6/1999	Ga	barley stubble adjacent
99ES1	DAFWA	Scaddan	M	24/5/1999	Ga	barley stubble adjacent
98AL7	DAFWA	Wellstead	H	3/6/1998	Ga	diseased stubble spread

^Established opportunistically in a grower's crop.

Results

There was a reasonable range of disease levels represented in the study; of 24 trials, seven had an average untreated disease level of less than 10% of leaf area diseased (LAD of the top three leaves), seven trials had low to moderate levels (10 – 25% LAD), seven trials had moderate to high levels (25 – 50% LAD) and three trials had very high levels of disease (greater than 50% of LAD) (Table 2). In all trials, the leaf disease severity significantly decreased with fungicide application, including four sites where STNB occupied less than four per cent of leaf area (Table 2).

Table 2. In season trial details including rainfall totals for the months shown, zadoks growth stage of disease assessment, yield response (%) to fungicide application (best treatment response excluding full control), grain yield (kg/ha of untreated barley), STNB % of disease present on top 3 leaves of untreated barley, screenings (%<2.5mm of untreated barley). ns = not significant, na = not available.

		Rainfall (mm)				Untreated (Nil fungicide)		
Trial	Location	May-Oct	Aug-Sept	Growth stage	Yield response (%)	Grain yield (kg/ha)	STNB (% Top 3)	Screenings %<2.5mm
15WE01	Dandaragan	227	64	Z75	ns	2 670	6	na
15WE03	Cunderdin	167	53	Z75	ns	2 810	3	na
15ES11	Gibson	320	126	Z80	24	4 166	11	14
15ES13	Wittenoom Hills	301	105	Z76	27	4 100	18	35
15ME11	Nungarin	183	52	Z75	ns	2 800	40	12
15ES39	Coomalbidgup	305	119	Z73	11	4 017	10	24
15ME24	Nungarin	183	52	Z75	ns	3 118	40	32
15KA34	Arthur River	160	67	Z65	ns	2 460	10	na
15CAg-Stubble	Corrigin	160	70	Z38	10^	2 240	20	45

Trial	Location	Rainfall (mm) May-Oct	Aug-Sept	Growth stage	Yield response (%)	Untreated (Nil fungicide) Grain yield (kg/ha)	STNB (% Top 3)	Screenings %<2.5mm
15CAg-Burnt	Corrigin	160	70	Z38	ns	2 791	29	36
15Farm&Gen	Coomalbidgup	323	114	Z85	14	5 600	28	na
10AV03	Meckering	125	30	Z76	ns	1 564	6	38
09AV03	Meckering	251	72	Z75	ns	3 173	58	12
09WC39	Meenar	260	79	Z65	43	2 530	48	na
06GE07	Mingenew	151	84	Z83	ns	1 230	54	18
05ES06	Scaddan	278	91	Z73	11	3 993	13	4
05ES05 TOS1	Salmon Gums	227	74	Z84	5	3 782	2	3
05ES05 TOS2	Salmon Gums	227	74	Z64	6	3 728	1	4
03GE06	Yuna	273	126	Z49	23^	2 600	15	23
01AL03	South Stirling	247	103	Z73	59	2 940	54	16
00ES29	Gibson	201	82	Z77	32	3 900	99	42
99ES1	Scaddan	195	60	Z71	20	2 630	9	30
99AL5	Wellstead	221	58	Z71	24	3 000	3	14
98AL7	Wellstead	279	105	Z75	ns	1 900	46	na

^Significant at p=0.08;

Grain yield

Fifty eight per cent of sites (14/24) had a grain yield response to treatment applications of fungicides. The average grain yield of responsive sites was 3.58 t/ha while the average yield of non-responsive sites was 2.36 t/ha. Across all sites the average untreated yield was 3.07 t/ha which reflects the tendency of these trials to be in the medium to high rainfall areas (20/24 sites). Yield responses from controlling STNB ranged from five to 59% (0.19 – 2.18 t/ha) of the untreated yield with an average of 0.44 t/ha or 22% (Tables 2, 3). Yield responses to fungicides were higher (0.66 t/ha) and occurred more frequently (in 70% of trials) in the high rainfall zone than in the medium (0.35 t/ha, 50% of sites) or low rainfall zones (0.10 t/ha, 50% sites) (Table 3).

Table 3. Grain yield response (%) to STNB control of trial sites grouped by annual rainfall where high is >450mm, medium 350 – 450mm and low < 350mm. The average yield responses to two scenarios are shown; over all sites and at those that showed a significant yield response. Also shown are the number of sites in each rainfall zone, the number that had a significant yield increase and the range of the yield responses (% untreated).

Rainfall zone	No. sites	No. sites responsive	Responsive sites (%)	Response range (%)	Yield (t/ha) All sites	Responsive only
High	10	7	70%	11 - 59	0.66	0.94
Medium	10	5	50%	10 - 43	0.35	0.71
Low	4	2	50%	5 - 6	0.10	0.20
Overall	24	14	58%	5 - 59	0.44	0.70

Just over half of the sites (14/24) in this study experienced relatively low rainfall in the spring period (August – September), which was defined as less than 80mm in total. Sites that did not have a yield response to STNB control all had low spring rainfall. While it was possible to get a yield response in a dry spring (Table 4), it was less likely (43% chance or 6/14 sites) than where rainfall exceeded 80mm (80% chance or 8/10 sites). The magnitude of the yield response also increased substantially when sites received more than 80mm over spring (Table 4).

Table 4. Grain yield response (t/ha) to the application of fungicides based on the amount of spring rainfall where low is <80mm; adequate is >80 mm during August - September.

Trials	Spring rainfall Low	Adequate
All sites	0.21 t/ha	0.76 t/ha
Responsive only	0.49 t/ha	0.95 t/ha

Regression analysis showed that yield response (kg/ha) to control of STNB was driven by a combination of September rainfall, disease levels and the potential yield of the crop, particularly when the yield potential is very high ($p<0.001$, R^2=60.2%, n=24). However, even low levels of disease at head emergence can produce a significant increase in grain yield.

Grain quality

Spot type net blotch affected grain size (2.5mm screenings) more than other grain characteristics in both likelihood of occurrence and in the magnitude (Table 5). At seventy one per cent of sites (12/17) fungicide application decreased screenings. With fungicide use the median response was to reduce screenings by just over a third, although even higher reductions occur - narrow shaped varieties such as Scope tended to respond more than other varieties (Figure 1). In seven of the 12 responsive sites the reduction in screenings would have allowed the grain to become eligible for a malting/food grade (Figure 1). Sites where spring rainfall was below 80mm were less likely to have a yield or screenings response to STNB control, however in a small number of trials where there had been a dry spring there was a screenings response in the absence of a yield response to fungicide but the likelihood of this was low (18%).

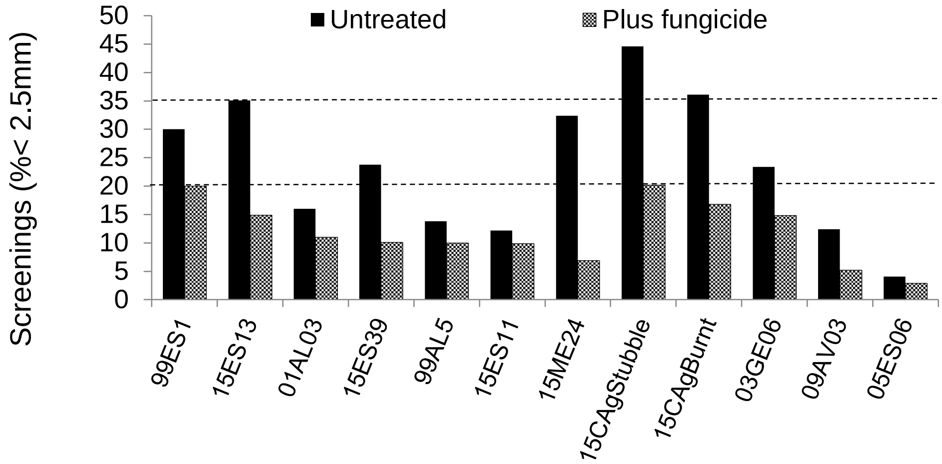

Figure 1. Screenings (%<2.5mm) for untreated and treated (plus fungicide) at sites with available data. The 20% and 35% limits for delivery into Malt1/BFOD1 (20%) and Malt2/BFOD2 (35%) are shown as dotted lines.

Grain weight was significantly improved with fungicide use in 53% of trials, sometimes in the absence of a grain yield response (16%). Hectolitre increased with fungicide use in 35% of trials (Table 5) but a grain yield response was required before this could occur. Grain brightness and protein levels were improved with fungicide use (Table 5). A significant grain yield response was required before an effect on brightness and protein occurred. Hence protein levels decreased with a fungicide use as they were diluted by an increase in grain yield.

Table 5. Grain quality changes with fungicide use shown as averages (n = number of sites with data available). Screenings are %<2.5mm, grain weight (mg, db), hectolitre weight (kg/hL), brightness (NIR L* score), protein (NIR %) shown as values so that screenings is the average reduction in screenings produced.

Quality parameter	Responsive sites (%)	Average response (%)	Average change^	n
Screenings	74%	-49	-14	17
Grain weight	46%	3.4	2.7	13
Hectolitre weight	35%	1	2.1	17
Brightness	42%	0.8	0.9	12
Protein	36%	-3.1	-0.1	14

^

Effect of fungicide timing

Trials that showed a significant yield response to fungicide applications were mainly from the medium and high rainfall zones. Four of these trials had a single fungicide application (most at stem elongation), four had two (double) applications at stem extension and half head emerged and five compared both single and double fungicide applications, including seed dressing. Table 6 can be used to compare the effectiveness of different fungicide timings within a trial by using the trial %Lsd to determine if the differences between treatments are significant. As an example, at the bottom of the table, the trial at Gibson showed that a seed dressing (fluxapyroxad) provided a 15% yield benefit over the untreated barley but a double foliar fungicide spray at Z31 + Z39 had a 24% yield response which was significantly better than the seed dressing treatments when the 5% lsd for the site is applied.

All of the single stem extension and flag leaf emergence fungicide treatments significantly increased yield compared to untreated barley with responses ranging from 5 – 59% (0.19 – 1.73 t/ha) of the untreated yield.

Table 6. Significant yield responses (% above nil) to fungicides applied to control STNB at various times as a seed dressing (SD), single or double foliar fungicide at the growth stages shown. Fungicide timings are grouped as prior to stem extension (pre Z30), stem extension (Z30-36) or flag emerging (Z37-39). ns=no yield response. Shaded section highlights single versus double fungicide comparisons.

					Yield response (% untreated)					
Trial	**Location name**	**Nil t/ha**	**Lsd %**	**Timing (single fung)**	**SD**	**Pre-Z30**	**Pre-flag Z30-36**	**Flag emerg Z37-39**	**Double**	**Timing (double spray)**
99ES1	Scaddan	2.63	9	Z33			17			-
99AL5	Wellstead	3.0	10	Z35			24			-
01AL03	South Stirlings	2.94	15	Z37				59		-
00ES29	Gibson	3.9	13	Z39				32		-
15ES13	Wittenoom Hills	4.22	2	-					23	Z31 + Z44/54^
05ES05 TOS1	Salmon Gums	3.73	4	-					5	Z31 + Z55
05ES05 TOS2	Salmon Gums	3.78	3	-					6	Z31 + Z55
05ES06	Scaddan	3.99	5	-					11	Z31 + Z55
15Farm&Gen	Coomalbidgup	5.60	5	Z31			5		12	Z31 + Z50
15CAgStubble	Corrigin	2.24	6[#]	Z31, Z38			9	10	10	Z31 + Z38
09WC39	Meenar	2.53	28	Z32			37		43	Z32 + Z51
03GE06	Yuna	2.6	11	Z39				12	23	Z39 + Z62
15ES39	Coomalbidgup	4.10	8	Z22		ns			9	Z22 + Z31
15ES11	Gibson	4.97	5	SD	15				15 24	SD+Z55; Z31+ Z39

^Z44/54 indicates the spread of variety growth stages at this site. [#]Significance level at this site was $p<0.08$.

Double fungicide applications, with the first made at stem extension, consistently returned a higher yield than single applications (Table 6, Figure 2). Exceptions to the yield response of double sprays occur when there is a dry spring, as occurred at Corrigin and Meenar (15CAgStubble, 15WC39), where a single application was as effective at improving grain yield as a double fungicide application (Figure 2). There was no data to compare the effect of a single versus double fungicide application on screenings changes.

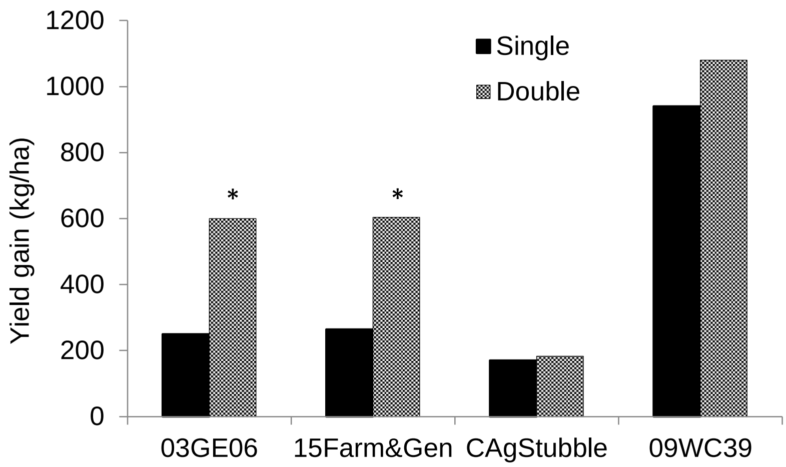

Figure 2. Yield gain (kg/ha) from making a single or double application of fungicide at three sites. * indicates that the difference is significant ($p<0.08$ in 03GE06).

On the basis of limited trial results, very early applications of fungicide appear unnecessary. Two of the sites where very early tillering applications were made experienced dry springs and had no yield responses to any fungicide treatment. However, if we consider leaf disease levels, a tillering fungicide at Mingenew in 2006 had no effect on disease levels at head emergence while a fungicide at stem extension had a significantly less disease (data not shown). At Merredin in 2012, a late tillering fungicide lead to slight reductions in STNB levels but didn’t change green leaf area by Z39. At the Coomalbidgup site of 15ES39 (Table 6) a single Z22 fungicide did not increase yield while a Z22 + Z31 double application did.

Fungicide comparisons

Propiconazole was the most widely applied fungicide, then Prosaro. Figure 3 shows how at single and double applications of each, the performance of propiconazole and Prosaro were comparable apart from one site (15CAgStubble Z31+Z38) which is indicated with an asterisk, where Prosaro was significantly better.

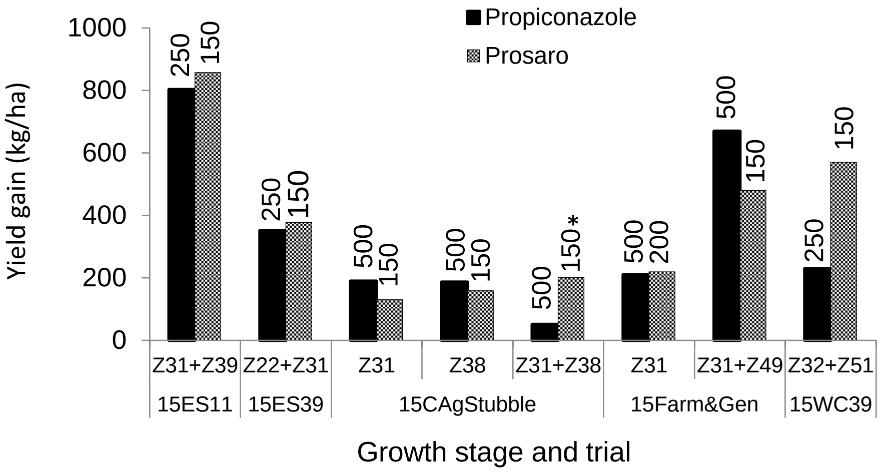

Figure 3. Comparison of the yield gain (kg/ha above untreated) achieved using single or double applications of propiconazole or Prosaro to control STNB at four sites at a range of growth stages. Propiconazole and Prosaro rates as shown; propiconazole rate is equivalent to 125 g/ha active ingredient (500 ml/ha in many formulations).* indicates that the difference is significant (p<0.08).

In two product comparison trials, single and double fungicides were applied. A basic return/cost analysis was done to compare products in two trials, CAgStubble (Table 8) and 15Farm&Gen (Table 9). Grain prices used were Malt1 $260/t, Malt2 $240/t, Feed $230/t with EPR of Scope $3.50, La Trobe $4.00. Various product costs for the rates applied are shown below in Table 7 with an application cost of $10/ha. These tables show that there are a broad range of profitable fungicide options available for growers to consider.

Table 7. Fungicides, their active ingredients and costs ($/ha) for the rates shown.

Product	Rate mL/ha	Price $/ha	Active ingredients
Amistar Xtra®	600	23.00	azoxystrobin + cyproconazole
Amistar Xtra	400	15.00	azoxystrobin + cyproconazole
Opera®	500	7.00	pryraclostrobin + epoxiconazole
Opus®	500	10.25	epoxiconazole
Propiconazole	500^	6.50	propiconazole
Prosaro	150	10.50	prothioconazole + tebuconazole
Radial®	420	14.00	azoxystrobin + epoxiconazole

^125 g active ingredient

Table 8. Returns ($/ha) and net gain over untreated ($/ha) for a range of registered products in a 2015 ConsultAg trial at Corrigin (Scope on barley stubble). Letters indicate significant yield differences (p<0.08). Prop = propiconazole.

Fungicides: Z31 rate + Z38 rate	Yield (t/ha)		Screenings (%<2.5mm)	Grade	Return ($/ha)	Net gain ($/ha)
Amistar Xtra 400 + Nil	2.43	a	27	Malt2	$565	58
Prosaro 150 x 2	2.44	a	35	Malt2	$557	50
Prosaro150 + Prop 500	2.47	a	43	Feed	$539	32
Amistar Xtra 600 + Prop 500	2.45	a	43	Feed	$535	28
Prop 500 + Nil	2.43	a	42	Feed	$540	33
Nil + Prop 500	2.43	a	39	Feed	$540	32
Nil + Prosaro150	2.4	ab	45	Feed	$533	26
Nil + Radial 420	2.37	ab	44	Feed	$528	20
Prosaro 150 + Nil	2.37	ab	40	Feed	$527	20
Prop 500 x 2	2.29	bc	48	Feed	$499	-8
Nil	2.24	c	45	Feed	$507	

Table 9. Returns ($/ha) and net gain over untreated ($/ha) for a range of registered products in a 2015 Farm and General trial at Coomalbidgup (La Trobe following pasture). Letters indicate significant yield differences (p<0.05); pricing based on yield only – all were assumed to be Malt2. Prop = propiconazole.

Fungicides Z31 rate + Z38 rate	Yield (t/ha)		Return ($/ha)	Net gain ($/ha)
Prop 500 + Opus 500	6.41	abc	$1,475	$154
Prop 500 + Opera 500	6.31	bcd	$1,456	$135
Prop 500 x 2	6.27	bcd	$1,453	$132
Amistar Xtra 400 x 2	6.34	abcd	$1,446	$124
Opera 500 x 2	6.26	bcd	$1,443	$121
Prop 500 + Amistar Xtra 400	6.14	cde	$1,407	$85
Prop 500 + Prosaro150	6.11	def	$1,401	$80
Prosaro 150 x 2	6.08	defg	$1,386	$65
Opus 500 + Nil	5.95	efg	$1,372	$50
Opus 500 x 2	5.92	efg	$1,358	$36
Amistar Xtra 400 + Nil	5.92	efg	$1,371	$49
Opera 500 + Nil	5.83	fg	$1,360	$38
Prosaro 200 + Nil	5.82	gh	$1,349	$28
Prop 500 + Nil	5.81	gh	$1,353	$32
Nil	5.6	h	$1,322	

An alternative strategy to foliar fungicides, particularly those applied at tillering, are systemic seed dressings such as fluxapyroxad which reduced severity of STNB in field trials for periods ranging up to head emergence (Figure 4).

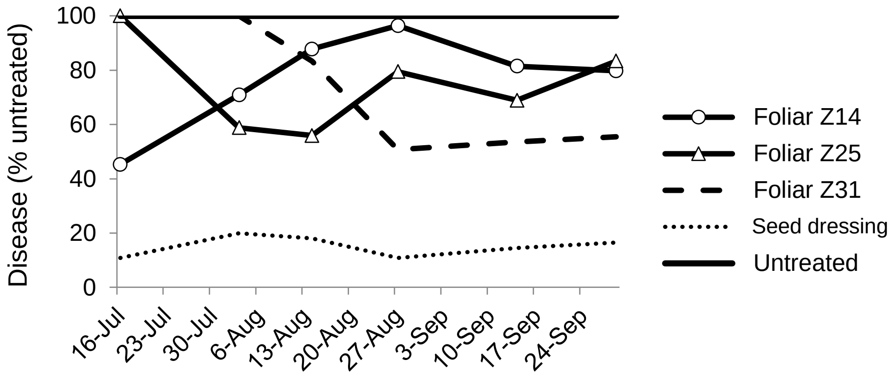

Figure 4. STNB disease progress (% top three leaves) in a disease nursery trial of Hindmarsh comparing the persistence of fluxapryroxad seed dressing against a registered foliar fungicide.

Variety comparisons

Trials confirm that variety yield response to the control of STNB is inverse to their resistance rating for STNB. That is, susceptible to very susceptible (SVS) varieties such as Hindmarsh will have a larger response to fungicide than a susceptible (S) variety such as Scope (Figure 5). The variety currently most resistant to STNB, Fathom (feed) showed the least yield loss at a trial in Wittenoom Hills in 2015 (Figure 5).

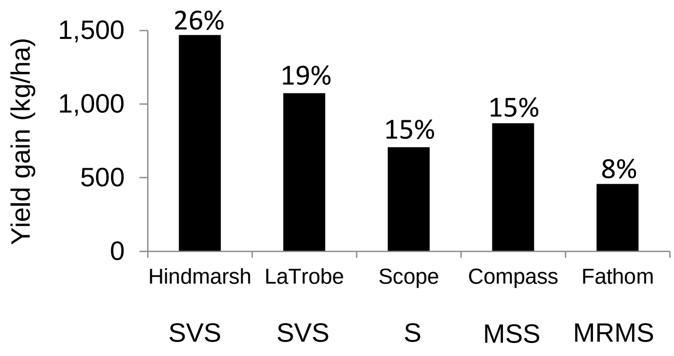

Figure 5. Yield gain (kg/ha) of a range of varieties to two applications of fungicide (Z31 + Z49) at Wittenoom Hills (barley on barley) in 2015 with the % response shown relative to the untreated. The rating for STNB is below each variety name.

Conclusions

The likelihood of a yield response and improved returns from controlling even low levels of STNB is very good unless there is a dry spring, when it halves. Low spring rainfall increases the risk of having no yield response and reduces the size of the yield response to fungicide applications. This is because low spring rainfall tends to lower the risk of STNB proliferating as well as decreasing crop yield potential. Overall, the crop yield response from fungicide applications tended to increase with growing season rainfall.

Grain quality was improved with fungicide use, particularly grain size (screenings); there were significant screenings responses when spring rainfall was low and occasionally even without significant yield increases. Grain weight, hectolitre and brightness increased while protein decreased as yields rose with fungicide application, which is consistent with other observations (McLean and Hollaway, 2015; Hills and Paynter 2008). In malting varieties improving grain quality is a significant contribution to the profitability of fungicide applications as it increases the chances of meeting malting specifications, primarily through reduced screenings.

Controlling spot type net blotch in medium and high rainfall areas was most profitable with a double spray at stem extension and then again from flag emergence (Z37) to half head emerged (Z55). Exceptions to this were in a dry spring when a single spray from stem extension or later was the most cost effective; growers need to take the spring rainfall outlook into consideration when deciding if a second fungicide is needed after spraying at stem extension. There were few trials in the low rainfall areas that compared fungicide applications and showed a significant yield change; in itself this indicates the caution needed if more than a single fungicide application is being considered in these environments although a low cost choice fungicide could be used instead of a premium product depending upon other diseases present.

Very early STNB control during tillering has few benefits as the disease usually increases back to untreated levels by flag emergence. However any rotation that avoids sowing barley onto barley will prevent an early build-up of disease as side by side trials at Corrigin (barley on barley versus barley on burnt stubble) showed. Where tillering applications are used, to accrue a yield benefit they will almost certainly need a follow-up application, or multiple, to manage later disease development.

There are a very limited variety number of barley varieties with effective STNB resistance; these are reputed to be coming in the next three to five years (Dave Moody, pers comm) but currently the feed variety Fathom (rated MRMS) is the only one. Fathom was competitive with Hindmarsh (yielding the same or better) in 43% of trials over 2010-2014 (Paynter et al, 2015) and may be a profitable alternative for some growers.

The choice of fungicide to control STNB will depend in part upon what other diseases may be present; this study and others have shown that a range of registered active ingredients are effective against STNB (e.g. Jayasena et al, 2002). In comparisons of the two most commonly applied fungicides, propiconazole and Prosaro, their relative yield gain in crops that are dominated by STNB was comparable in seven out of eight cases. Differences in disease control have been seen between products in higher rainfall environments with wet springs and other disease challenges, such as leaf rust, scald, powdery mildew, where there may be a benefit through the use of a product with best efficacy across a range of diseases. Information on registered foliar fungicides is available from the DAFWA website https://www.agric.wa.gov.au/barley/registered-foliar-fungicides-cereals-western-australia-wa

The seed dressing fluxapyroxad offers an alternative strategy to control a number of diseases, including STNB and may have a role in continuous barley rotations or in other situations where early sustained control is required. Fluxapryroxad has the additional benefit of being a SDHI type fungicide rather than the common DMI (triazole) or a QoL (strobilurin); STNB is considered at medium risk of developing fungicide resistance (FRAC, 2014) and diversifying fungicide group use will help prevent its development. If barley is sown at 70kg/ha, the current cost of fluxapyroxad is approximately $24/ha.

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