FINAL REPORT

GRDC
Grains Research & Development Corporation

Preliminary evaluation of fungicide efficacy for control of eyespot in wheat and extension of cost-effective management strategies

AAG00002

Project Details

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- **Project Title:** Preliminary evaluation of fungicide efficacy for control of eyespot in wheat and extension of cost-effective management strategies
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Summary

Eyespot is a localised severe disease of wheat in Australia. Most infection is due to the pathogen *Tapesia yallundae* which results in the formation of eye-shaped lesions towards the base of the stem of cereal plants. The disease is mostly pathogenic on wheat in Australia but barley, oats, rye and triticale are all susceptible to the disease. Overseas research would indicate it is more pathogenic on wheat and barley than rye.

Severe symptoms and yield losses are generally associated with growing wheat in the susceptible regions of Australia but losses have also been recorded in triticale and barley. Occasionally, sharp eyespot caused by *Rhizoctonia cerealis* has been detected. The lesions produced with sharp eyespot differ from eyespot in that they are generally smaller with very defined margins and are present on the leaf sheath as well as the stem.

Conclusions

The trial results indicate there is variation in fungicide activity to control eyespot.

In addition, field observations have indicated that the in-furrow applied fungicides triadimefon and fluquinconazole have very poor activity against eyespot yet the method of delivery should be very good at delivering fungicide to the susceptible plant parts at the appropriate growth stage. Using in-furrow fungicides to reduce initial infection and maintain fungicide activity at the crucial early stem elongation phase (GS30-32) would appear to provide high levels of eyespot control.
Fungicides with a higher level of activity on eyespot might give satisfactory control or suppression of eyespot if applied in-furrow. It is recommended that future research be conducted on this.

This trial has identified that foliar fungicides can provide good control of eyespot but there is variation in fungicide efficacy and that results are seasonally dependent.
A predictive tool to assist with the choice of timing of application could be developed to determine if applicators need to be at growth stage (GS)30, GS32, a combination of both or a supplementary later application as well. This tool would be largely driven by weather conditions and canopy development.

Fungicide programs that could be integrated to provide control for a range of diseases, including stripe, leaf and stem rust of wheat, while also controlling eyespot should be investigated. This trial indicates that the choice of fungicide to control other diseases present or anticipated might not give adequate eyespot control. A fungicide program based on tebuconazole for stripe rust control in wheat, for example, might give inadequate control of eyespot.

It is appropriate that further research is conducted into:

1. The activity of a range of fungicides when delivered at seeding as an in-furrow application.
2. Comparison of in-furrow and foliar applied fungicide treatments.
3. Identification of resistance in current wheat varieties and germplasm.
4. Investigation of other cereal crops as hosts of eyespot.
5. Comparison of foliar applied fungicides.

Achievement/Benefit

Introduction

Eyespot is a localised severe disease of wheat in Australia. Most infection is due to the pathogen *Tapesia yallundae* which results in the formation of eye-shaped lesions towards the base of the stem of cereal plants. The disease is mostly pathogenic on wheat in Australia but barley, oats, rye and triticale are all susceptible to the disease. Overseas research would indicate it is more pathogenic on wheat and barley than rye.

Severe symptoms and yield losses are generally associated with growing wheat in the susceptible regions of Australia but losses have also been recorded in triticale and barley. Occasionally, sharp eyespot caused by *Rhizoctonia cerealis* has been detected. The lesions produced with sharp eyespot differ from eyespot in that they are generally smaller with very defined margins and are present on the leaf sheath as well as the stem.

Eyespot is widespread in the Mid and Lower North, southern Eyre Peninsula and parts of the south east of South Australia (SA), Tasmania (TAS) and south eastern New South Wales There are reports of eyespot having been identified in western and north eastern Victoria.

Eyespot is a fungal disease that occurs in areas with prolonged cool and damp conditions and has potential to reduce wheat yields by up to 65%. The disease is more prevalent where wheat is grown in cool, wet winters. Humidity at the stem base, made worse by crop competition from weeds, can also be conducive to the disease.

Eyespot has been detected in south-eastern Australia for the past 30 years. However, infection has been on the rise recently because of increased areas of cereals grown, retention of stubble and larger, denser canopies through early sowing and higher nitrogen (N) usage.

If left untreated, eyespot can result in lodging with yield losses of 10 to 65%, and higher screenings at harvest because of shrivelled grain. The actual yield losses from eyespot as against the losses from the lodging it causes have not been evaluated in Australia. It is thought that an eyespot infection level of around 10% can result in lodging and yield losses somewhat higher than 10%. A yield loss of 65% was determined at Mintaro in 2005 where lesions were found on approximately 30% of stems. Eyespot tends to be more devastating in high production years, where there is more moisture and rainfall during vegetative growth in the lead-up to and around GS30. Yield losses are higher and smaller grains more common in high production years. In dry years, conditions are not as conducive to the disease and yield losses not as great, even where significant initial disease was present.

The likelihood of eyespot infection varies because of the environmental conditions conducive to its spread. While it affects relatively small areas of south-eastern Australia, its impacts can be devastating for individual growers.

Eyespot is a soil and stubble-borne disease with spores produced in autumn and winter. Spores can survive on infected stubbles for one to two years or in soil for up to five years.

Eyespot spores can be rain-splashed short distances. Infection can occur in coleoptiles and leaf sheaths during the early vegetative period and the disease is favoured by wet conditions around GS30. The early stages of infection are difficult to detect and it can take six to eight weeks to clearly identify the disease in crops. This will be too late to avoid yield losses. Pathology tests can detect the presence of disease during the vegetative stages before GS30.

The key risk factors for eyespot infection are:

1. If there has already been an infection in a paddock, it is likely to be reinfected in following years.
2. Growing wheat, the most susceptible crop, and particularly tall wheat varieties.
3. High N status and lush crops that keep the base of the plant in damp conditions and are more prone to lodging.
4. Soil texture - eyespot is a disease associated with heavy soils and has not been recorded on sandy soils.

Once infection exists, weather and local conditions play a crucial role in the development and severity of the disease. The conditions are:

1. Receiving rain or heavy dews that produce wet conditions around the base of the plant for several days during June, July or early August.
2. Environments that maintain the wet and/or high humidity levels at the base of the plant. This can include large stubble loads, high humidity, lush crops or the presence of weeds such as soursobs

Eyespot is a difficult disease to manage because infection is hard to identify for early treatment. Unlike rust, which can be widespread, eyespot is a paddock-by-paddock disease, where different rotations, farming practice and environmental conditions can be the difference between infection and healthy crops.

Management must focus on preventative measures. Grain growers need to anticipate how often conditions conducive to eyespot occur on their property. This means the frequency of at least some rain for several successive days in July and early August combined with days where humidity is high at the base of the plant.

There are no chemical options registered for treatment of eyespot in Australia, although the main control method has been to apply fungicides at GS 30-32. The effectiveness of control with fungicides depends on the activity of the fungicide itself against eyespot, the severity of the disease, weather conditions at susceptible stages, coverage of susceptible plant parts and timing of application.

Experience has shown that propiconazole[#] is widely used in South Australia and has provided good control whereas tebuconazole[#] and triadimefon[#] have provided poor control of eyespot. Epoxiconazole[#] and tebuconazole/prothioconazole[#] (Prosaro®#) have also been applied for eyespot.

Objectives

1. To compare the efficacy of a range of foliar applied fungicides for eyespot control.
2. To compare fungicide efficacy at two application timings.

Methodology

Refer to 'Report Disclaimer' page 1

A field site was selected at Merilden, in the Mid North of SA, where it was highly likely eyespot would occur. The trial site was selected based on previous history of eyespot infection in crops. The site was sown to Orion wheat on May 18 on a burnt wheat stubble where some lower stems and crowns were not completely burnt.

The main assessment for determining disease control with fungicides was to assess eyespot incidence. 150 to 200 individual plants were randomly selected from each plot and then one stem from each plant randomly removed for disease identification.

Each stem was examined in the laboratory for the presence or absence of eyespot lesions. The results were statistically analysed and compared as eyespot incidence and frequency.

Bayer Crop Science provided products and assisted with trial layout, application of treatments, disease assessment and statistical analysis. The experimental product DC-111 is a fungicide from the Succinate Dehydrogenase Inhibitor (SDHI) group of fungicides, an alternative to the triazole group.

The site consisted of randomised split plot design. Plot dimensions were 20m x 4m and plants were sampled from an area of 20m x 2m.

Table 1. Products applied in Eyespot trial, Merilden 2012

Treatment	**Application Rate**	**Application Timing**		
		GS 30	**GS 32**	**GS 30 & 32**
Untreated		Yes	Yes	Yes
Prosaro®#150	150 ml/ha	Yes	Yes	No
Prosaro®#300	300 ml/ha	Yes	Yes	Yes
DC-111#	400 ml/ha	Yes	Yes	No
Opus®#	500 ml/ha	Yes	Yes	No
Amistar®# Extra	400 ml/ha	Yes	Yes	No
Tilt®#	500 ml/ha	Yes	Yes	No
Switch®#	62.5 g/ha	Yes	Yes	No
Cabrio®#	500 ml/ha	Yes	Yes	No
Folicur®#	145 ml/ha	Yes	Yes	No

Table 2. Active ingredients

Product	**Active Constituents**
Prosaro®	210 g/l prothioconazole# + 210 g/l tebuconazole#
DC-111	Bayer experimental SDHI product
Opus®	125 g/l epoxiconazole#
Amistar® Xtra	200 g/l azoxystrobin# + 80 g/l cyproconazole#
Tilt®	500 g/l propiconazole#
Switch®	375 g/kg cyprodinil# + 250 g/l fludioxonil#
Cabrio®	250 g/l pyraclostrobin#
Folicur®	430 g/l tebuconazole

Results

Tables 3 and 4 summarise the results of the trial. Results are presented as a simple comparison of the number of lesions (incidence or frequency), a log function and a percentage control compared with the Untreated.
Figs 1 & 2 are the same results.

Table 3. Control of eyespot with fungicides

Treatment	**Time of application**	**Rate**	**Formulation**	**Lesions per 100 stems**
Untreated				5.4
Prosaro®	GS 30	150	mL/ha	1.3
Prosaro®	GS 32	150	mL/ha	1.6
Prosaro®	GS 30	300	mL/ha	1.4
Prosaro®	GS 32	300	mL/ha	0.1
Prosaro®	GS 30 + GS 32	300	mL/ha	0.2
DC-111	GS 30	400	mL/ha	0.1
DC-111	GS 32	400	mL/ha	0.2
Opus®	GS 30	500	mL/ha	1.5
Opus®	GS 32	500	mL/ha	0.7
Amistar® Xtra	GS 30	400	mL/ha	2.2
Amistar® Xtra	GS 32	400	mL/ha	1.4
Tilt®	GS 30	500	mL/ha	1.4
Tilt®	GS 32	500	mL/ha	0.4
Switch®	GS 30	700	g/ha	1.3
Swittch®	GS 32	700	g/ha	0.9
Cabrio®	GS 30	500	mL/ha	1.7
Cabrio®	GS 32	500	mL/ha	4.5
Folicur®	GS 30	145	mL/ha	1.3
Folicur®	GS 32	145	mL/ha	3.3
				LSD (P= 0.05) 0.31

Table 4. Percent eyespot control

Treatment	**Time of application**	**Rate**	**% control**
Untreated			0
Prosaro®	GS 30	150	70
Prosaro®	GS 32	150	56
Prosaro®	GS 30	300	74
Prosaro®	GS 32	300	98
Prosaro®	GS 30 + GS 32	300	96
DC-111	GS 30	400	98
DC-111	GS 32	400	96
Opus®	GS 30	500	75

Opus®	GS 32	500	86
Amistar® Xtra	GS 30	400	55
Amistar® Xtra	GS 32	400	77
Tilt®	GS 30	500	74
Tilt	GS 32	500	93
Switch®	GS 30	700	72
Switch®	GS 32	700	85
Cabrio®	GS 30	500	63
Cabrio®	GS 32	500	19
Folicur®	GS 30	145	73
Folicur®	GS 32	145	40

Fig 1. Percent eyespot control

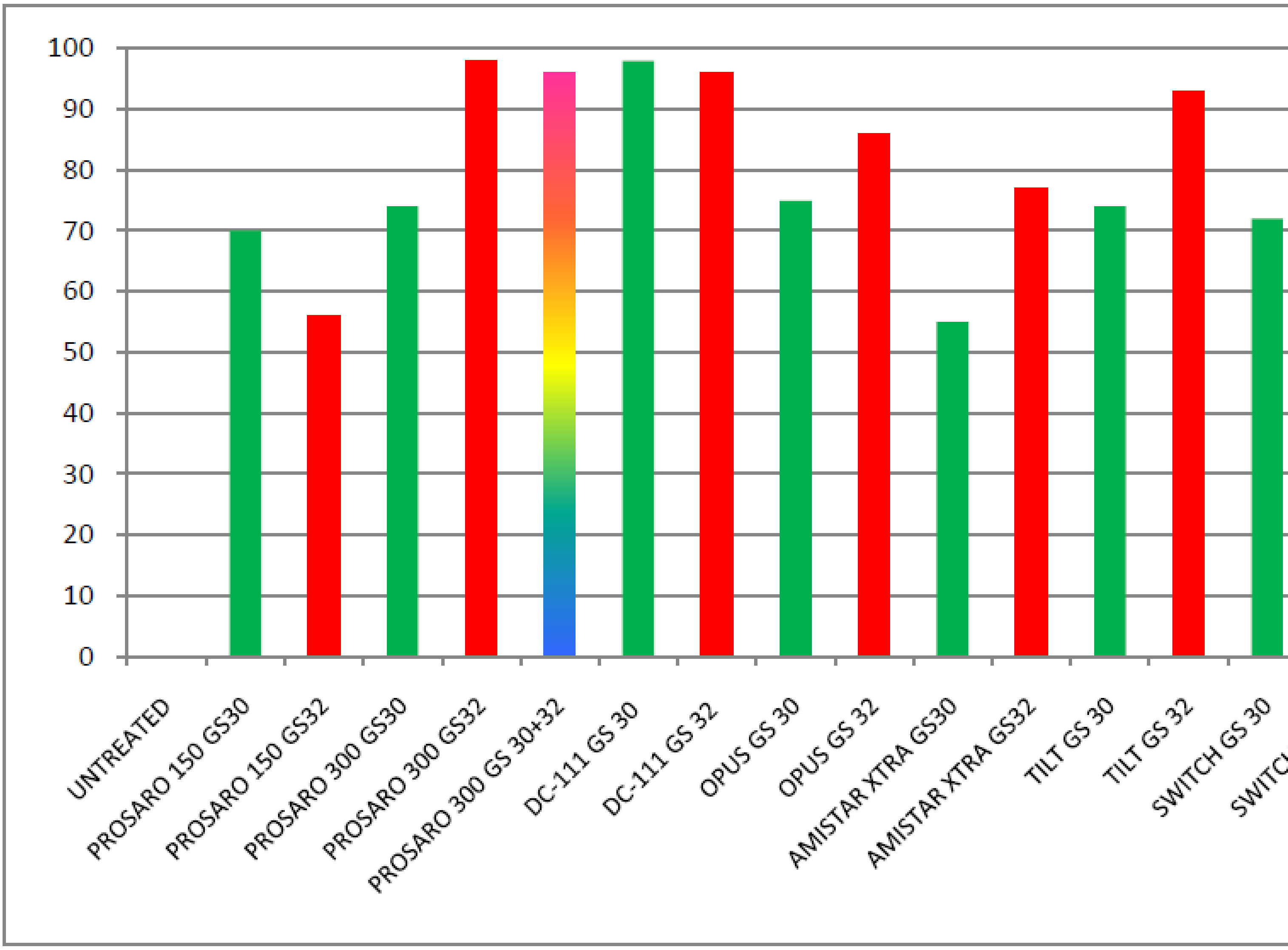
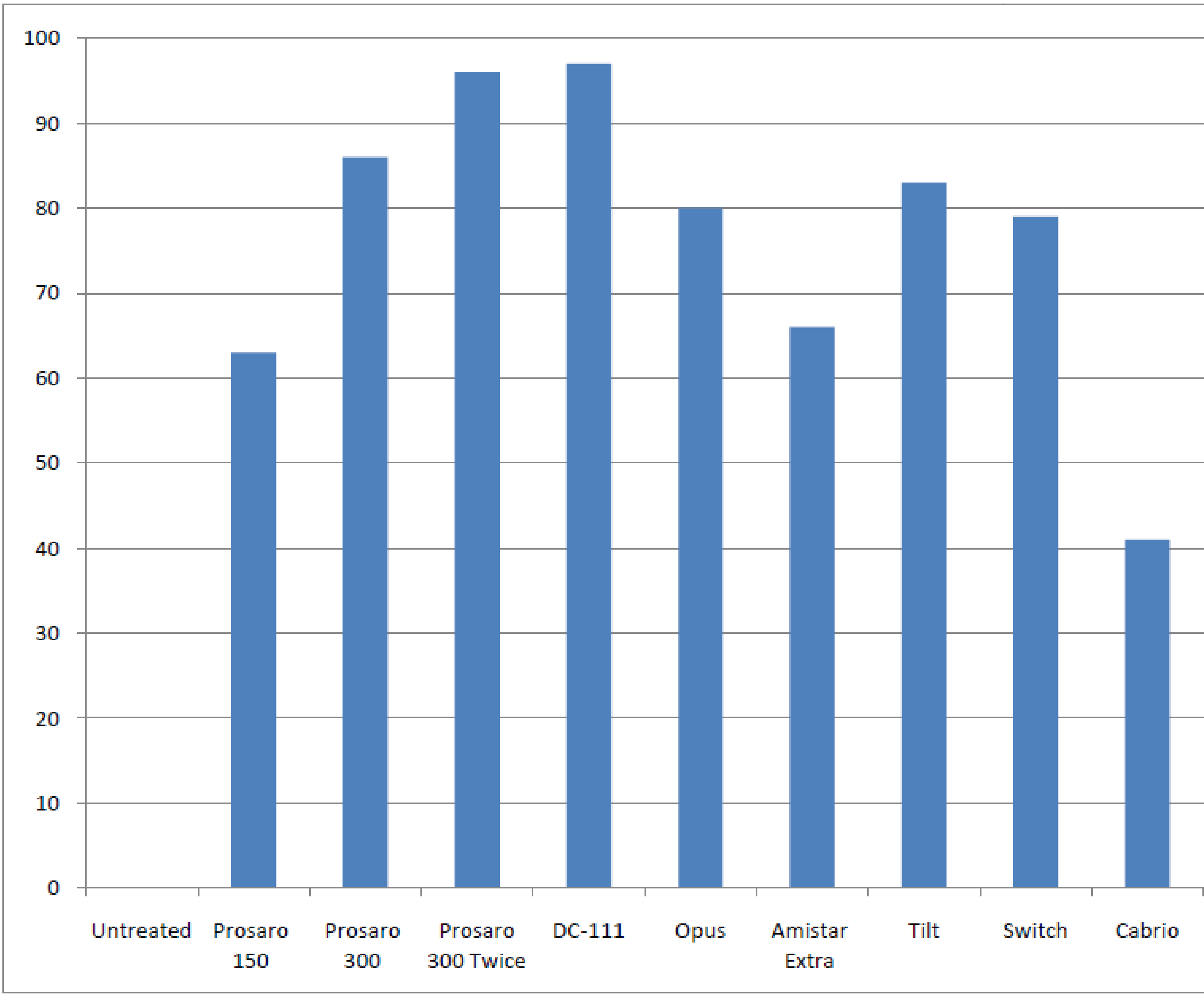


Fig 2. Percent eyespot control (average of application timings)



Discussion

Discussion

The results indicate good levels of control of eyespot even in a year when conditions did not suit the development or severity of the disease. All fungicides had some activity against eyespot but acceptable control is suggested as being greater than 80% reduction in the number of lesions, given the dry conditions.
It is unlikely that there would have been yield reductions due to eyespot in the trial as there was almost a total absence of lodging. There is no certainty that the efficacy of all products would have remained the same if conditions had been more conducive to disease incidence and severity.

Tebuconazole# is generally considered to have poor activity against eyespot so it is a reasonable expectation that any product that provides control similar to or less than tebuconazole in this trial is not going to provide adequate control in field conditions.
For products and rates that produced the greatest reduction in lesion numbers it appears as though application at GS32 was superior to GS30 in this trial. It is likely that because of dry conditions and reduced growth that coverage of lower stems with fungicide was still adequate at GS32 because of a more open canopy. This result may not be

repeated in wetter years when conditions are very conducive to disease development and spread at GS30-32 and crop canopy closes more quickly due to high N levels and ample soil water.

Currently no products are registered in Australia for controlling eyespot yet good control has been achieved with propiconazole# applied at GS30-32.

In this trial it also appears that there are products (Prosaro®# and DC-111#) that give very high levels of control and contain active ingredients from different fungicide groups. These would be useful if resistance develops to the triazole group.