Project Report No. 444

Abstract and Summary

November 2008

Appropriate Doses Network: up-to-date information on fungicide performance for wheat growers

by

David Lockley[1], Bill Clark[2], Simon Oxley[3], Marion Self[4], Anne Ainsley[5], Chris Dyer[6], Neil Paveley[7] and Brendan Dunne[8]

[1] ADAS, Staplake Mount, Starcross, Exeter, EX6 8PF.
[2] ADAS Boxworth, Cambridge, CB3 8NN (Now at Broom's Barn Research Centre, Higham, Bury St Edmunds, Suffolk IP28 6NP)
[3] SAC Edinburgh, West Mains Road, Edinburgh, EH9 3JG
[4] TAG, The Old Rectory, Morley St Botolph, Wymondham, Norfolk, NR18 9DB
[5] c/o ADAS High Mowthorpe, Duggleby, Malton, North Yorkshire, YO17 8BP
[6] c/o ADAS Rosemaund, Preston Wynne, Hereford, HR13PG
[7] ADAS High Mowthorpe (as above)
[8]Teagasc, Crops Research Centre, Oak Park, Carlow, Ireland

This is the final report of an HGCA project which started in September 2004 for 42 months and was funded by a contract of £304,505 (Project No. 3025).

ABSTRACT

Advances in fungicide chemistry play a key role in maximising economic returns from wheat production. With grain values stronger than for some time, but high crop establishment and nitrogen costs, it is crucial that the investment made in establishing and growing green crop canopy is protected through effective disease management. The development of fungicide resistance threatens disease control, making it more important that the industry uses new fungicide active substances and modes of action efficiently. The project reported here assessed the performance of a range of established and newly introduced fungicides against the major economic diseases of UK wheat. Dose-response curves were quantified to help establish the doses required to obtain effective control, even under high disease pressure. Each of the fungicides tested was applied as a single spray to the upper leaves, at quarter, half, full and double the label recommended dose, and untreated plots were included for comparison. Double dose treatments were applied for experimental purposes and must not be applied to farm crops. The conclusions from this work were widely reported during the life of the project, at HGCA events, Cereals 2005, 2006 and 2007, and in the farming press, so the practical messages may no longer seem 'new'. This report sets out the dose-response curves for all the diseases and products tested. In summary, the main conclusions were:

Septoria tritici: The decline in the performance of triazole fungicides seen over recent decades appears to have stabilised. Epoxiconazole and prothioconazole both continue to provide good control, provided the dose used is sufficiently robust for the disease susceptibility of the variety and disease pressure. The addition of chlorothalonil or boscalid is recommended. The addition of strobilurins to good triazoles adds little to septoria control, but is justified for rust control (see below).

Stagonospora (*Septoria*) *nodorum* (glume blotch): This disease remains a substantial risk in the south west. Products based on prothioconazole or epoxiconazole gave good glume blotch control, as did pyraclostrobin.

Brown rust: 2007 was a particular severe brown rust season across much of southern and eastern England, due to high spring temperatures and a breakdown of disease resistance in some major wheat varieties. Strobilurins and triazoles have maintained their effectiveness against brown rust. The most effective control was given by Fandango, Tracker and Vivid. Yield responses in the trials (as in farm crops) were related to control of rust and septoria, and the largest yield responses were given by Opus + Comet, Prosaro, Tracker and Fandango.

Yellow rust: Fungicides or fungicide mixtures containing epoxiconazole, prothioconazole or tebuconazole all gave excellent control, usually even at low doses. The strobilurins azoxystrobin and pyraclostrobin were also effective. Control by prothioconazole appeared to be improved by the addition of fluoxastrobin (as Fandango).

Powdery mildew: A range of new active substances have provided a substantial improvement in mildew control. Metrafenone (Flexity), proquinazid, (Talius) and the more recently introduced cyflufenamid (Cyflamid), gave excellent control even at low doses. Yield responses were modest (as mildew is less damaging to yield than septoria or rusts), but economic.

1.0 **SUMMARY**

The project assessed the performance of a range of established and newly introduced fungicides against the major economic diseases of the UK wheat crop. Dose-response curves were quantified to establish the doses required to obtain effective control, even under high disease pressure.

This report covers work conducted over three harvest years at sites selected to target the main foliar diseases of winter wheat – *Septoria tritici*, *Stagonospora (Septoria) nodorum*, yellow rust, brown rust and powdery mildew.

A randomised block design incorporating between 34 and 42 treatments with three replicates was used for all experiments. At sites targeting rusts or mildew, guard plots of a variety resistant to the target disease were drilled alternately with treatment plots wherever possible.

Fungicide treatments listed in the table below were applied as single sprays. The target stage for fungicide application was determined by pathogen development. At the *S. tritici* sites, the target timing was at the emergence of eventual leaf 2. This was usually at GS 33, but may have occurred at GS 32 in some crops. This growth stage was also the timing for the yellow rust and mildew sites, but at these sites, the timing was adjusted earlier if early epidemic development required. Brown rust and *S. nodorum* are characterised by rapid development late in the season, so the target timing for these sites was at GS 37-39 rather than GS 33 unless there was a risk of severe disease development at GS 33.

Each fungicide product was applied at quarter, half, full and double the label recommended dose. Double dose treatments were applied for specific experimental purposes and must not be applied by farmers to farm crops. Crop that received double dose treatments was disposed of safely at harvest.

Active ingredients and products tested

	Active ingredient	Product
Standards		
	Epoxiconazole	Opus
	Chlorothalonil	Bravo
	Tebuconazole	Folicur
Test actives		
	Pyraclostrobin	Vivid/Comet
	Prochloraz	Poraz
	Prothioconazole	Proline
	Prothioconazole + fluoxastrobin	Fandango
	Prothioconazole + tebuconazole	Prosaro
	Dimoxystrobin + epoxiconazole	Swing Gold
	Epoxiconazole + boscalid	Tracker
	Trifloxystrobin	Swift
	Pyraclostrobin + epoxiconazole	Vivid + Opus
	Azoxystrobin	Amistar
	Fenpropidin	Tern
	Fenpropimorph	Corbel
	Cyprodinil	Unix
	Spiroxamine	Neon
	Quinoxyfen	Fortress
	Metrafenone	Flexity
	Cyflufenamid	Cyflamid
	Proquinazid	Talius
	Untreated	

The main conclusions from the project in relation to each disease were:

Stagonospora (Septoria) nodorum

- Products based on epoxiconazole or prothioconazole gave good control of glume blotch.
- Chlorothalonil and prochloraz did not give effective control of glume blotch when applied to leaves.
- Pyraclostrobin continues to give reasonable control of glume blotch, even at low doses.
- Some large yield responses were recorded, up to 4 tonnes/ha, but it was not possible to determine how much of this was due to glume blotch control and how much was due to the control of *S. tritici.*
- Yield increases were reflected in increases in specific weight.

Septoria tritici

- The decline in activity of strobilurin fungicides against *S. tritici* appears to have stabilised and there is a suggestion that pyraclostrobin (Vivid or Comet) gave slightly better disease control in 2006 and 2007 than in 2005.
- However, there was no evidence that the addition of a strobilurin product to an effective azole fungicide enhanced *Septoria* control (Fandango v Proline or Opus + Comet v Opus).
- Tebuconazole (Folicur) was consistently less effective in controlling *S. tritici* than epoxiconazole (Opus) or prothioconazole (Proline).
- The activity of prochloraz (Poraz) against *S. tritici* remains weak and at the moment, there seems little, if any, benefit from its slightly different target site.
- Increases in specific weight were generally in line with yield increases.

Yellow Rust

- Fungicides or fungicide mixtures containing the azoles epoxiconazole, prothioconazole and tebuconazole all gave good control of yellow rust, usually even at low doses.
- The strobilurins azoxystrobin and pyraclostrobin were also effective, except when *S. tritici* compromised disease control.
- The control of yellow rust by prothioconazole (Proline) appeared to be improved by the addition of fluoxastrobin (as Fandango)
- Spiroxamine (Torch Extra) had some activity against yellow rust, but was inconsistent.
- Levels of yellow rust at the three sites were not high and yield responses from the control of the disease in the absence of significant *Septoria* were modest, but often achieved by low doses.
- Where *Septoria* infection was more severe, as in 2006, the shape of the dose-response curves for yield for the azole fungicides was different. These curves did not level off after quarter dose and full doses were needed to give maximum yield responses.
- Increases in specific weight were generally small.

Brown Rust

- The most effective control of brown rust was given by Fandango, Tracker and Vivid.
- The activity of Fandango was largely due to the strobilurin component of the fungicide mixture.
- Prothioconazole (Proline) consistently gave poorer control of brown rust than other azole products (Opus and Folicur)
- The inclusion of boscalid in Tracker improved brown rust control compared with Opus alone.
- Data for spiroxamine (Torch Extra) was limited to one year and no firm conclusions can be drawn concerning its activity against brown rust.
- Yield responses were generally modest except in 2007. Even in 2007, yield responses were not as great as might be expected considering the brown rust severity. However, treatments were applied when the crop was already at the beginning of ear emergence, and this was probably too late to achieve effective control due to the early development of the brown rust epidemic.
- Fandango, Tracker, Prosaro and Comet plus Opus gave the greatest yield responses.

Mildew

- The new generation of mildewicides - metrafenone (Flexity) and proquinazid (Talius) and more recently cyflufenamid (Cyflamid) gave very good control of mildew, often at quarter or half doses.
- Other recent introductions such as quinoxyfen (Fortress) and spiroxamine (Neon, Torch Extra) were not quite as effective.
- Fenpropimorph (Corbel) and Cyprodinil (Unix) generally gave poor control of mildew.
- Of the azole fungicides, prothioconazole gave slightly better mildew control than epoxiconazole.
- As usual, yield responses and any increase in specific weight from mildew control were small.
- Prothioconazole (Proline) consistently gave the greatest yield increase despite its poorer mildew control, probably due to the control of low levels of *Septoria*.