



IRRIGATION RESEARCH & EXTENSION COMMITTEE

2005



FOR IRRIGATION CROPPERS

Diseases in irrigated wheat systems, Stripe Rust and Septoria Tritici Blotch

Paper prepared by

ANDREW MILGATE

NSW Department of Primary Industries

Tel: 02 6938 1990

Email: andrew.milgate@agric.nsw.gov.au

IREC

C/- CSIRO Land and Water, Griffith

Private mail bag 3 Griffith NSW 2680

Tel: 02 69601550 **Fax:** 02 69601562 **Email:** irec@irec.org.au

Introduction

Varietal selection is the key platform on which foliar disease management strategies are based in any cropping system. Knowing the potential risks associated with a particular variety will help determine the appropriate response to any disease.

Irrigated wheat systems are high disease risk environments, they contains several ingredients which increase greatly the risk of epidemic development. These are high plant densities, high humidity and high inputs of fertilisers.

Stripe Rust

There are a number of publications available from NSW DPI and on the GRDC website that have clear messages about the management of stripe rust. All these publications present essentially the same message.

“Delay the epidemic onset”

How?

- *Control the green bridge.* Stripe rust requires living wheat plants to survive. So by eradicating volunteer wheat plants over summer this reduces the risk of early infection in fields.
- *Varietal choice.* The choice of sowing varieties of disease ratings of 5 or better has a three fold effect on the management of the disease. Firstly there is a reduction in the required fungicide management of the disease because of the ability of the plant resist infection. Secondly, volunteers' of more resistant varieties reduce the potential of stripe rust surviving over summer in high numbers. Thirdly, growing moderately resistant to resistant varieties reduces the risks of the pathogen rapidly mutating and new strains forming that are capable of overcoming other resistance genes.
- *Fungicide management.* Three factors should be considered when deciding on your fungicide management. Firstly, the strategy should be tailored to the resistance rating of the variety. For example varieties with resistance ratings of 1–3 a seed or fertiliser treatment in addition to one or more foliar applications depending on the epidemic development should be considered. Second, monitoring the crop in order to make the decision on whether there is an economic threat from disease. Third, timing of the application is critical for it to be cost effective.

Varietal choice for irrigation

Breeding programs around Australia in response to the new strain of stripe rust are moving quickly to release more resistant alternatives to the currently available varieties. When the available varieties in Southern NSW are compared on the basis of gross return after the cost of stripe rust control on dry land systems the highly resistant varieties are clear winners. However on irrigation there is greater variation of yield potential in the available varieties and the achievement of maximum quality grades less likely for the APH and AH varieties. So calculating the gross return of any variety is driven by the yield and price. Table 1 gives an example of the type of comparison that could be considered when making varietal choices. Of the currently available varieties for sowing in 2005 and looking forward to 2006 Table 1 shows that when yield and price differences are small the benefit of increased rust resistance is significant. The exception to this is Chara with a 6% (Winter crop variety experiments, 2004. pp 212) yield advantage. However the difference is only \$8.16/ha to Ventura which has a stripe rust rating of 8. The varieties with resistance ratings of 6 or above have the added benefit to control of the disease over summer and protecting the industry long term.

Table 1: Example of an economic comparison of wheat varieties with expected stripe rust management to achieve maximum yield. Several assumptions have been made to produce calculations. Maximum yield is achieved. No allowance for fertiliser input has been made to achieve specific quality grades. On irrigation APH varieties will achieve AH prices. Prices based on pool prices at Grong Grong on the 9/6/05.

Economic comparison of wheat varieties with expected stripe rust management necessary to achieve maximum yield						
Variety	Chara	Ventura	Janz	Drysdale	H45	Rosella
Stripe rust management	Fert+fol	Nil	Seed+fol	Seed+fol	Fert+fol	Seed+fol
Across sites 1998-2004 (Irrigation)	110	104	103	103	104	100
Across sites yield t/ha	6.42	6.07	6.02	6.02	6.07	5.84
Stripe rust rating	3	8	5	4	1	5
Wheat price \$/t	\$142.14	\$142.14	\$142.14	\$142.14	\$142.14	\$129.70
Gross return \$/ha	\$912.54	\$862.79	\$855.68	\$855.68	\$862.79	\$757.45
Seed/in-furrow fungicide	\$21.60	\$0.00	\$6.20	\$6.20	\$21.60	\$6.20
Smut/bunt seed treatment	\$2.60	\$2.60			\$2.60	
Foliar fungicide	\$7.00	\$0.00	\$7.00	\$7.00	\$7.00	\$7.00
Aerial application	\$12.00	\$0.00	\$12.00	\$12.00	\$12.00	\$12.00
End Point Royalty (EPR)	\$7.06	\$6.07	\$0.00	\$6.62	\$6.07	\$0.00
AWB bonus	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Gross return less stripe rust mgt costs and EPRs (\$/ha)	\$862.28	\$854.12	\$830.48	\$823.86	\$813.52	\$732.25
Diff b/n rank1 and other varieties (\$/ha)	\$0.00	-\$8.16	-\$31.79	-\$38.42	-\$48.76	-\$130.03
Ranking on return	1	2	3	4	5	6

*Calculation table courtesy of Mr. John Francis NSW DPI, District Agronomist Albury.

Septoria tritici blotch

Septoria tritici blotch (STB) is a social disease and is caused by *Mycosphaerella graminicola* (anamorph: *Septoria tritici*) it is an important fungal disease of wheat worldwide. The disease can cause yield losses of up to 60% in susceptible cultivars in severe epidemics. In Australia, it is estimated that the disease costs the wheat industry \$28.3 million annually with these losses concentrated in the southern and western cropping regions.

Genetic resistance

This is the best tool for ongoing control of this pathogen. During the 1970's and 1980's there was a shift away from highly susceptible cultivars to wide spread growing of moderately susceptible to moderately resistant varieties. This has contributed to the disease not being encountered in SNSW frequently at levels capable of causing economic injury to crops.

The pathogen is genetically diverse due to its heterothallic (sexual) mating system. This can lead to the evolution of new pathotypes emerging and spreading rapidly. The most recent information on the pathogen population in SNSW is that it is genetically distinct from the rest of the world and indeed distinct from the population in WA. What implications this has for the usefulness of overseas sources of resistance is under investigation.

There are currently 12 Stb resistance genes which have had their chromosomal location identified in separate projects around the world. These genes are scattered throughout the whole genome of wheat on different chromosomes. NSW DPI and the VAWCRC are about to commence a GRDC funded project that will focus on bringing together many of these genes into several cultivars that have proven adaptation to Australian conditions. It is intended that this germplasm will help provide ongoing protection to the industry from this disease.

Management

The same basic principals apply to STB control that do for stripe rust.

These are;

- *Control over summer survival of inoculum.* STB does not require live wheat plants to survive summer. Instead the fungus produces sexual spores which are capable of remaining viable during summer and autumn. These spores are found in the stubble of the previous susceptible wheat crops and are capable of travelling long distances in the wind. Thus an important part of management of STB is the removal of stubble prior to sowing the next season's crop.
- *Varietal choice.* Genetic resistance has been very effective against this pathogen. It is important to avoid sowing susceptible and highly susceptible cultivars. This is particularly important in irrigated areas where high humidity levels are very conducive to epidemic development.
- *Timing of sowing.* Early establishment of disease in a crop will lead to greater losses. This is very important for STB management as the spores which survive summer on the stubble are released early in autumn. Thus early sown crops experience greater disease pressure than those sown in the main season sowing window.
- *Fungicide management.* Both fluquinconazole and triadimefon are registered for the control of STB. Foliar applications for the control of STB should only be considered in susceptible and highly susceptible varieties. Ensure the disease has been correctly identified prior to commencing spraying because the symptoms are easily confused with other physiological damage or other pathogens.

Variety ratings for STB are available in the Winter Crop Variety Sowing Guide 2005.

Maintaining resistance to social diseases

Breeding programs through the release of resistant cultivars save the agriculture industry millions of dollars every year across the spectrum of diseases. For example in stripe rust prior to the most recent pathotype arrival, resistance breeding was estimated to be saving the industry \$161 million per annum (Brennan and Murray, 1998). The speed at which social diseases such as rusts or STB can overcome individual resistance genes and the devastating resulting costs have been clearly illustrated with the recent stripe rust incursion and subsequent epidemics.

To achieve greater durability of these genes the industry, breeding programs and growers, need to respond quickly to remove and replace susceptible varieties. This will help ensure that other effective genes are not placed under increasing pressure by rapid increases of the pathogen population. By working together in this fashion the industry can sustain effective genetic resistance and have minimal requirements of fungicides.

References

- Brennan, J. P. and Murray, G. M. (1998) *Economic importance of wheat diseases in Australia*, NSW Agriculture, Wagga Wagga.
- McRae, F.J., McCaffery, D.W. and Matthews, P. W. (2005) *Winter crop sowing guide 2005*, NSW Department of Primary Industries, Orange.