SOME ASPECTS OF STRIPE RUST CONTROL IN SOUTHLAND

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ABSTRACT

The control of stripe rust (*Puccinia striiformis*) in wheat by foliar spraying with the fungicide triadimefon was studied in spring-sown trials in Southland.

In a trial at Gore, infection first developed in early December but developed at different rates in three cultivars. In unsprayed plots the cultivar Tiritea was severely affected, Kopara slightly affected and Karamu affected very little. Spraying either once (G.S. 5), twice (G.S. 10.5 and 11.1) or three times (G.S. 5, 10.5 and 11.1) increased yield significantly in Tiritea but not in Kopara or Karamu.

Thousand grain weight and grains per head were both improved in Tiritea by spraying.

The effect of late spraying (post flowering) on the susceptible cultivars Takahe and Tiritea gave variable results. A significant response in Tiritea up to late milk (G.S. 11.2) was recorded under high infection conditions (>50% leaf infected). In other trials at lower rust levels, no yield responses were recorded even though the incidence of stripe rust on leaves and on heads was reduced.

Additional Key Words: foliar spraying, triadimefon, timing, cultivars, yield components

INTRODUCTION

The development of stripe rust (*Puccinia striiformis*) in Southland during the 1980/81 season posed a serious threat to the region's wheat industry as the main cultivar grown, Takahe, was found to be very susceptible. The likely effect of the disease over a full season can be judged from overseas where yields in susceptible crops can be reduced in epidemics by up to 50 percent. (Doodson *et al.*, 1964; King, 1976).

With the availability of foliar fungicides which control the disease, it is important that practical strategies are developed which could be used on commercial farms. The trials reported here were aimed at measuring the effect of foliar spraying at different times on the yield of the wheat crop under Southland conditions.

MATERIALS AND METHODS

Trials were established at Gore, Winton and Thornbury to assess the effects of foliar spray applied before and after ear emergence on the yield of three cultivars.

The Gore trial was sown with a cone seeder on 4 November 1981 with details in Table 1. Plots were 10 x 2 m. Sowing rate was 180 kg/ha for all treatments. A four replicate randomised block design with 12 treatments was used. Treatments were three cultivars, Tiritea (highly susceptible), Kopara (moderately susceptible) and Karamu (highly resistant) by four times of foliar spraying. Spraying was with triadimefon in an emulsifiable concentrate formulation at a rate of 125 ml/ha. The chemical was applied in 400 *l* water/ha with hydraulic cone nozzles at 345 kPa pressure. During the development of the crop, 20 tillers/plot were collected on four occasions and rated for percent leaf area infected with stripe rust using standard leaf area diagrams (MAFF, 1976). Plots were harvested on 20 April 1982 by direct heading.

The Winton and Thornbury trials were laid down to assess the effects of sprays applied during the ripening period from late January. Both had been sprayed six weeks previously with triadimefon but were becoming reinfected. Plots were 15 x 2 m and were laid down across existing drill rows. Spraying was with 25% triadimefon in an emulsifiable concentrate formulation at a rate of 125 ml/ha. Times of spray application are given in Table 1. Spray treatments were applied in 300 *l* water/ha with a propane gas powered knapsack sprayer at an operating pressure of 200 kPa using cone nozzles. Regular crop inspections were made at approximately weekly intervals when leaf infection was assessed according to the procedure described for the Gore trial. The Winton trial was on a Tiritea crop and the Thornbury trial on a Takahe crop. Strips 1.35 m wide by the plot length were harvested by direct heading.

TABLE 1: Treatment details of trials at Gore, Winton and Thornbury.

Spray treatment	Spraying dates	Spraying growth stages
Gore:		
A No spray	—	—
B Early spray	15/12/81	5
C Late spray	20/1/82	10.5
	11/2/82	11.1
D Regular spray	15/12/81	5
	20/1/82	10.5
	11/2/81	11.1
Winton and Thornbury:		
A	—	—
B	20/1/81	10.5.3
C	29/1/82	10.5.4.
D	3/2/82	11.1
E	11/2/82	11.2

RESULTS AND DISCUSSION

In the Gore trial, initial infections could be found on all cultivars in early December but this developed at very different rates (Fig. 1). On untreated Tiritea plants, severe infection developed rapidly after mid December (G.S. 5) (Large, 1954) and by late January (G.S. 10.5) had caused almost complete leaf death. A later and slower build-up occurred on Kopara with only 15% of the leaf area showing infection in late January, while Karamu exhibited only minor symptoms of the disease.

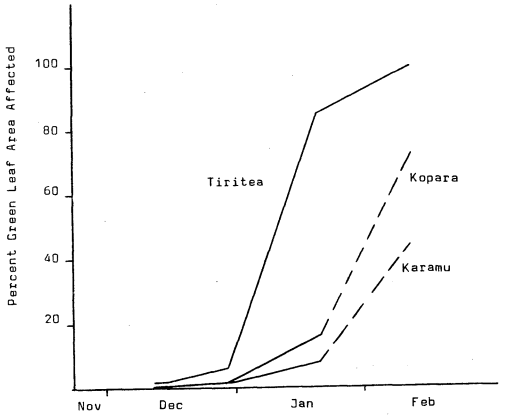

Figure 1: Percent green leaf area affected by stripe rust in unsprayed plots at Gore. — Loss of green leaf area attributed to stripe rust. -- Loss of green leaf area partially due to natural senescence.

The foliar spray treatments significantly increased the yield of Tiritea (Table 2) with one early spray (G.S. 5) or two late sprays (G.S. 10.5 and 11.1) giving a similar yield improvement. Three sprays applied over the season (G.S. 5, 10.5 and 11.1) gave a significantly better yield. However, the delay in treatment between the first and second sprays (G.S. 5 and 10.5) allowed some reinfection, which may have reduced potential production. Kopara and Karamu did not respond to foliar spray treatment (Table 2), indicating that the low levels of infection had no effect on yield. With Tiritea, the components of yield affected by stripe rust were the number of grains per head and grain weight (Table 2). Early spraying, which gave protection over the spikelet formation period, increased the numbers of grain per head while late spraying improved gain weight. These effects have also been recorded in other Southland trials with Takahe (Risk and Beresford, 1982). They also reported a grain size increase with Kopara, a cultivar moderately resistant to stripe rust. This did not occur in this trial presumably because Kopara was only lightly infected. In mid February over 80% of Tiritea heads were infected with no difference due to foliar spraying observed. The effect of this infection on yield could not be determined in this trial.

TABLE 2: Grains per head, thousand grain weights and grain yields at Gore.

	Grains per head	Thousand grain weight (g)	Yield (t/ha)
Tiritea			
A	24.0 a	26.0 a	1.88 A
B	27.0 bc	27.5 a	3.02 b
C	24.7 ab	29.8 b	2.84 b
D	29.4 c	34.2 c	3.57 c
CV%	6.5	4.1	8.9
Kopara			
A	27.2	40.3	3.40
B	27.3	39.5	3.81
C	28.9	40.2	3.53
D	28.9	41.6	3.55
	NS	NS	NS
CV%	6.5	4.1	8.9
Karamu			
A	28.2	44.6	5.50
B	30.8	43.1 ab	5.59
C	29.4	41.3 b	5.80
D	28.8	43.8 a	5.39
	NS	NS	NS
CV%	6.5	4.1	8.9

Late Spray Trials

In both trials, stripe rust had reinfected the crop after previous treatment and was increasing in severity over the flowering period. At Winton on Tiritea, the effect of spraying at intervals after late flowering was to delay

senescence of the flag leaf and reduce the amount of head infection. This was greatest with spraying at late flowering and was less with later applications.

Yield responses were recorded due to spraying over late flowering G.S. 10.5.3 and nine days later (G.S. 10.5.4). Spraying after this (G.S. 11.1 and G.S. 11.2) had no effect on yield (Table 3).

TABLE 3: Grain yields from trials at Winton and Thornbury.

Spray treatment	Yield t/ha Winton (Tiritea)	Thornbury (Takahe)
A	3.94 b	3.92 a
B	4.55 a	3.95 a
C	4.36 a	4.06 a
D	4.05 b	4.03 a
E	3.87 b	4.08 a
CV%	4.5	4.7

At Thornbury on Takahe, no yield responses due to spraying at or after late flowering were recorded (Table 3). Stripe rust did not become severe at this site with portions of the flag leaf on all treatments remaining green for two weeks longer than at Winton. Treatment B reduced the amount of leaf senescence after treatment but this did not affect yield. Very low levels of head infection occurred.

The reason for stripe rust not developing is unknown, but could be due to unsuitable climatic factors or possibly some varietal resistance when this cultivar, Takahe, nears maturity. This latter factor has been observed with the cultivar Kopara which is more susceptible to infection during the juvenile (pre head emergence) growth stage.

The main yield component that stripe rust infection at or after flowering can influence is grain size. If premature flag leaf death occurs, the plant may be unable to fill grains fully as this leaf is very important for photosynthesis. These trial results suggest that, at Winton where rapid senescence of the flag leaf occurred after flowering, grain filling was affected. At Thornbury where rust was less severe and the flag leaf remained partly photosynthetic for longer, any debilitating effect of the rust was able to be compensated for by the plant.

Yields in these trials were relatively low (Table 3). If the yield potential had been higher with more grains in each head, the effect of stripe rust is likely to have been more severe because of the greater stress on the plant.

CONCLUSIONS

Results of these trials show:—

1. Cultivars differ in susceptibility to stripe rust ranging from very susceptible to resistant.
2. Susceptible cultivars such as Tiritea are protected from infection by applying fungicides such as triadimefon with big yield responses occurring. Such cultivars may need to be sprayed more than once to prevent reinfection.
3. Late spraying of susceptible cultivars up to the watery, ripe growth stage (G.S. 10.5.4) can give significant yield increases if high levels of rust occur.
4. Early spraying is the most effective and economical treatment (Gore trial).

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