BROWN RUST OF BARLEY

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Summary

Brown rust of barley *(Hordeum vulgare)*, is described, caused by *Puccinia hordei.* A field trial has shown that this disease can cause considerable yield losses in late sown barley during a dry spring followed by a wet summer.

INTRODUCTION

During recent years changes in crop rotations and the introduction of new barley *(Hordeum vulgare)* varieties appear to have increased the severity of brown rust *(Puccinia hordei)*. The disease is easily recognised by the reddish-brown spots (pustules) which develop on the leaves of infected plants. When severe the leaf may become a mass of pustules resulting in a decrease in the manufacture of products essential for grain production. In South Island cropping regions barley stubble remaining throughout autumn and winter is common. In most of these paddocks volunteer barley plants provide an ideal site for the fungus to overwinter. Although the development of rust is slow at this time, the warmer weather in the spring and early summer leads to increased production of rust spores, which are readily spread by the wind from the overwintering plants to the newly emerging crops. The disease is generally favoured by the warm conditions which occur later in summer. The crops most severely affected are those sown late in the season such as barley following early peas. These crops are exposed to rust attack by the time tillering commences. Rust epidemics in earlier sown crops usually do not occur until the growth is more advanced. The effect on the plant however may still be serious.

METHOD

During 1974/75 two trials at the DSIR, Lincoln assessed the effect of brown rust on the yield of barley. The first used late sown 'Zephyr' barley (sown 12 November), and was divided into 24 plots, each 20 x 5 m. Twelve randomised plots were sprayed with a systemic fungicide benodanil (at the recommended rate of 2 kg/ha). Fungicide application was by means of a motorised 2.5 m boom sprayer delivering 300 litres/ha at 345 kPa. Two applications of fungicide were made, at the earliest sign of disease at the beginning of tillering (G.S. 4), while a second was applied at the jointing stage (G.S. 7). Disease was assessed 3 weeks after each spray application by scoring the top four leaves of 20 plants from each plot using the assessment diagrams developed by James (1971). The amount of disease was recorded as a percentage of leaf area infected. Prior to harvest samples of four 1 m lengths from each plot were collected, measured, and individually threshed. The plots were then harvested by auto-header of 1.75 m cut.

The second trial had no fungicide treatments but compared the rust susceptible variety 'Zephyr' with the slow rusting 'Manapou', with and without irrigation.

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RESULTS AND DISCUSSION

Results from the first trial are summarised in Table 1 and 2. At the first assessment the development of rust up the plants was clearly evident, the bottom leaves being most heavily infected. There was a light infection of rust on the lower leaves of plants in the treated plots indicating that the effect of the fungicide was possibly beginning to decline. The second assessment 3 weeks after the second spraying showed the rust epidemic to be severe, up to 93 % of leaf area infected in untreated plots while less than 1% leaf area was infected in treated plots.

TABLE 1: EFFECT OF TREATMENT ON INCIDENCE OF BROWN RUST ON 'ZEPHYR' BARLEY

		Percentage leaf area infected (Plot mean; 20 plants/plot)			
		Leaf			
		1	*2*	*3*	*4*
First assessment	treated	0	0	0.4	2.2
(3.1.75; G.S. 8)	untreated	0.1	3.6	9.6	16.7
Second assessment	treated	0.2	0.7	leaves too dry	
(25.1.75; G.S. 10.1)	untreated	64.2	92.7	to measure	

TABLE 2: EFFECT OF TREATMENT ON YIELD OF 'ZEPHYR' BARLEY

	Hand harvest			*Header harvest*
	Tiller No./ plant	*Grains/ head*	*1000 grain wt (g)*	*Mean plot yields (kg)*
treated	3.4	15.5	45.7	7.5 (3.7 t/ha)
untreated	3.1	14.0	40.5	4.3 (2.1 t/ha)
CV %	12.7	12.0	3.3	30.5
Significance levels	N.S.	5%	0.1%	1%

In the untreated plots each yield component was definitely reduced, the final yield reduction being 42% (Table 2). Plants in the treated plots were almost completely protected from brown rust while a severe epidemic occurred in the untreated plots, thus the reduction of 42% is a good indication of the severity of brown rust damage.

The general vigour of plants in the untreated areas was affected by brown rust attack. On visual assessment, leaves were smaller, stems weaker, and plants matured earlier. Wet weather prior to harvest caused considerable stem break in unsprayed plots resulting in the mature heads falling to the ground before they could be harvested. Yields in this trial were not heavy due to poor cultivation and severe drought conditions during the early spring.

In the second trial barley was sown in September and half the plots received irrigation during November and December. Under irrigation 'Zephyr' and 'Manapou' yielded 21.1% less and 16.7% more respectively than the same varieties under dry land conditions (Table 3). Visual assessments showed high levels of rust in the 'Zephyr' plots especially where irrigated. In a normal season and in the absence of rust it could be assumed that 'Zephyr' yields should increase under irrigation although no data is available regarding this.

TABLE 3: EFFECT OF IRRIGATION ON YIELD OF 'ZEPHYR' AND 'MANAPOU' BARLEY

Variety	*Total plot yields (kg/ha)*	
	Irrigation	*No Irrigation*
'Zephyr'	3213	4074
'Manapou'	5191	4449

The evidence of the first trial makes it possible to assume that yield depressions in trial 2 may be a direct result of increased rust levels under irrigation.

As many farmers are irrigating barley and 'Zephyr' is the variety most commonly grown a closer study of the problem is warranted.

This research demonstrates that brown rust of barley is potentially a serious disease of this crop in New Zealand. Although fungicidal control of the disease is possible its application on a commercial scale must be investigated further. Long term control of this disease may result from the release of rust-resistant varieties being developed by the Crop Research Division of DSIR and used in trial 2.

REFERENCE

James, W. C., 1971. An illustrated series of assessment keys for plant diseases, their preparation and usage. *Can. Plt. Dis. Survey 51:* 39-65.