DISEASES AND PESTS OF CEREALS IN THE WAIRARAPA — A SIX YEAR STUDY

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Summary

Diseases and pests of cereal crops in the Wairarapa have been studied over the last 6 years. Following the banning of organo-mercury seed treatments in 1973 seed-borne diseases rapidly built up culminating in an epiphytotic of net blotch (*Drechslera teres*) of barley in 1976-77. With the introduction of the new systemic seed treatments, yield losses fell from 25% to 1% in the first season of use and net blotch became of minor importance. Regular surveys brought to light a new disease and pest in the Wairarapa and trends in disease and pest levels. The current situation is a very satisfactory one but vigilance must be maintained to avert a recurrence of disease problems.

INTRODUCTION

The first disease survey of cereals by the Victoria University team was undertaken in 1974-75 and revealed a very confused and alarming situation where net blotch was a major problem with no effective seed treatment material available within New Zealand (Sheridan 1975, 1976; Spencer 1975). Trials set up in 1974 in the Wairarapa were continued each year, together with surveys of commercial crops, until the present. A considerable volume of information has accumulated and the current situation is a very satisfactory one where disease incidence and levels are low in cereal crops in the North Island.

A summary of the results is presented here illustrating trends over the past 6 years. Where outbreaks of diseases have occurred attempts have been made to elucidate the cause with a view to preventing a recurrence.

METHOD

Surveys of cereal crops growing in the Wairarapa were carried out each season between November and March and full records kept. Initially, pests were not included because this was considered to be outside our field of expertise, but they could not be ignored particularly when the major diseases were brought under control, so they were subsequently included. Cereal crop areas and locations were obtained from the local MAF and as many growers crops visited, at the seedling stage and then at heading, as possible. Data on previous cropping, seed lines and cultivars, seed treatment and fertilizer were recorded. Incidence was assessed by counting diseased plants in four groups of 25 plants randomly selected along a diagonal of the field. Diseases and pests were looked for along the whole diagonal and if none were found, a search made over a greater area of the field. Severity was assessed after ear emergence (Feekes Growth Stage 10.1 which is equivalent to Zadoks decimal scale 50-51: Zadoks *et al* 1974) by selecting 50 plants (single tillers) along a diagonal and recording disease on leaf 1 (flag leaf), leaf 2 and leaf 3. Reference was made to disease assessment keys (Anon 1972, 1976). In assessing the effectiveness of new seed treatment materials tests were carried out in the laboratory, glasshouse and field (for details see Sheridan *et al* 1980). The survey site was generally at Ahiahu near Carterton.

Because barley comprised 70 - 80% of the cereal area emphasis was placed on this crop. In calculating yield losses due to disease the formula of James *et al* (1968) was used.

Proc. 33rd N.Z. Weed and Pest Control Conf.

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The terms used in this paper are defined as follows (see James 1977):

$$\text{Disease incidence} = \frac{\text{Number of infected plan units}}{\text{Total number (healthy and infected) of units assessed}} \times 100$$

$$\text{Disease severity} = \frac{\text{Area of plant tissue affected by disease}}{\text{Total area}} \times 100$$

Disease prevalence = disease incidence within the context of a geographical area. For example if 100 fields in the Wairarapa were inspected for disease and 25 were found to be infected, the disease prevalence is 25%

RESULTS

The total area in cereals in the Wairarapa declined from 4695 ha in 1974-75 to 2300 ha in 1979-80. Barley fell from 3952 to 1550 ha respectively. The area of the major cereal crops and the proportion surveyed are shown in Table 1.

TABLE 1: Area of major cereal crops grown and area surveyed 1974-75 and 1979-80

Crop	Area grown (ha)		Area surveyed (%)	
	1974-75	1979-80	1974-75	1979-80
Barley	3952	1550	18	49
Wheat	469	350	17	17
Oats	274	280	26	49
Maize	-	120	-	7

In the early surveys the major disease was the seed borne net blotch of barley followed by leaf scald (*Rhynchosporium secalis*). These and loose and covered smut (*U. nuda* and *U. hordei*) continued to increase reaching a peak in 1976-77 when all crops were infected with net blotch, over 90% with leaf scald, over 50% with loose smut and almost 25% with covered smut. Severity of net blotch reached 24.5% in 1976-77 with calculated losses in yield of 25% (Table 2).

TABLE 2: Prevalence and severity of net blotch 1974-75 to 1979-80

	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Prevalence	83	96	100	93	47	55
Severity *	0.3	3.6	24.5	1.0	1.0	1.1

* mean for leaf 1 and 2

In 1977-78 captan was replaced by new seed treatments consisting of the mixture of 20% carboxin + 20% thiram and the mixture of 15% carbendazim + 60% mancozeb. Ninety-seven percent of the barley crops were treated and this was responsible for the dramatic reduction in net blotch, loose smut and covered smut (Table 3).

TABLE 3: Prevalence of loose and covered smut of barley 1974-75 to 1979-80

	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Loose smut	27	10	56	15	1	21
Covered smut	0	5	23	2	0	0

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The upsurge of loose smut in 1979-80 appears to be due to the increase in area of the newer susceptible cultivar Hassan. Covered smut has been eradicated from the Wairarapa.

Crown rust was present in all seasons and was severe in many oat crops in 1979-80. Grain heads were infected in some fields and the teleutospore stage appeared at G.S. 10.1 being widespread at G.S. 11.1. Loose smut prevalence increased in 1979-80 and disease incidence reached 12% in some fields of cvs Mapua and Black oats. These crops were either grown from untreated or captan-treated seed. In field trials the mixture 20% carboxin + 20% thiram, 15% carbendazim + 60% mancozeb and 15% triadimenol + 2% fuberidazole effectively controlled loose and covered smuts of oats.

Forty per cent of wheat crops were infected with loose smut, but incidence was less than 1%. No major disease of maize was seen this season.

Over the period of the survey barley yellow dwarf virus has increased and was present in all crops of barley, wheat and oats in the past two seasons. Brown rust, stem rust and powdery mildew are insignificant in the Wairarapa.

The major pests are stem weevil and leaf miner. The cereal root knot nematode, first found in 1977, is still present but its effects have not been assessed.

The prevalence of diseases and pests identified in the 1979-80 survey is given in Table 4.

During the past 4 years spotting of barley leaves, distinct from any known fungus disease, was present and increasing. The casual organism appears to be a *Pseudomonas* species which is seed-borne. The currently used seed treatments do not control it.

TABLE 4: Prevalence of diseases and pests in cereal crops in the Wairarapa 1979-80

Diseases and pests	Barley	Wheat	Oats
Foliar and Stem Diseases			
Net blotch (<i>Drechslera teres</i>)	55	-	-
Leaf stripe (<i>D. graminea</i>)	0	-	-
Spot blotch (<i>D. sorokiniana</i>)	5	-	-
Leaf scald (<i>Rhynchosporium secalis</i>)	56	-	-
Brown rust (<i>Puccinia hordei</i>)	25	-	-
Brown rust (<i>P. recondita</i>)	-	30	-
Crown rust (<i>P. coronata</i>)	-	-	100
Stem rust (<i>P. graminis</i>)	+	+	+
Mildew (<i>Erysiphe graminis</i>)	5	5	0
Barley Yellow Dwarf Virus	100	100	100
Bacterial spot (<i>Pseudomonas</i> sp.)	90	40	89
Grain Diseases			
Loose smut (<i>Ustilago nuda</i>)	21	40	-
Loose smut (<i>U. avenae</i>)	-	-	21
Covered smut (<i>U. hordei</i>)	0	-	-
Ergot (<i>Claviceps purpurea</i>)	2	0	0
Pests			
Argentine stem weevil (<i>Hyperodes bonariensis</i>)	100	100	100
Cereal root knot nematode (<i>Meloidogyne naasi</i>)	5	+	0
Leaf miner	100	+	0
Cosmopolitan armyworm (<i>Leucania separata</i>)	+	0	0
Grass grub (<i>Costelytra zealandica</i>)	+	0	0
Whitefringed weevil (<i>Graphognathus leucoma</i>)	+	0	0

+ = present; - = not applicable; 0 = nil

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DISCUSSION

Six years of disease and pest surveys in the Wairarapa showed a build up of an epiphytotic of net blotch in barley and its subsequent control by the new systemic seed treatments. Seed borne diseases are of little significance at the present time except possibly a bacterial disease about which little is known. Net blotch and leaf scald continue to be present because of the practice of growing barley crops for winter feed and leaving bales of infected straw in proximity to barley crops. Leaf stripe and covered smut of barley are apparently eradicated from the Wairarapa. Barley Yellow Dwarf Virus is now the major disease.

There is still a tendency to use captan-containing seed treatments on oats resulting in outbreaks of smuts. This should not be done. Any one of the three materials currently registered for use on barley is effective.

Pests are a problem and there may be a need to include an insecticide with the seed treatment. The cereal root knot nematode has not been reported elsewhere in New Zealand and there is a need to assess its significance.

ACKNOWLEDGEMENTS

We are grateful for help and co-operation of MAF staff, grain and chemical firms and growers without which this work could not have been done.

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