A SURVEY OF BARLEY DISEASES IN NEW ZEALAND

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Summary

The incidence of disease was assessed in 152 barley crops throughout New Zealand. Disease incidence varied with location although in each region the most prominent pathogens were *Puccinia hordei* and *Pyrenophora gramineae*. Attempts were made to estimate yield losses due to the pathogens encountered.

INTRODUCTION

INFORMATION regarding diseases of barley crops in New Zealand is limited. Several pathogens have been recorded from individual crops, but a nation-wide survey has not previously been carried out, although Neill (1928) carried out a disease survey of barley crops in the South Island.

To obtain information on the relative importance of barley diseases in New Zealand a survey of barley crops was conducted during the 1972/73 season, throughout the major barley growing regions.

The incidence of leaf diseases were compared with overseas reports in an attempt to estimate crop losses due to the pathogens involved.

METHODS

Areas for inspection were selected within each barley growing district with the assistance of local Ministry of Agriculture officers. As many crops as possible within these areas were then inspected. As the intentions of this survey were to establish the range and intensity of pathogens present in the crops a detailed survey of individual crops was not necessary.

Each crop was inspected by at least two persons and incidence of disease recorded as near as possible to that system used by James (1971). Each crop was inspected for approximately 5 to 10 minutes so as a satisfactory number of plants were compared with disease "key" diagrams and disease incidence recorded.

Most crops were inspected at Feekes Growth Stage 11.1 (Large 1954), as a correlation between disease incidence and crop losses has been reported at this stage, (James *et al* 1968; Melville and Lanham 1972).

Recordings of loose smut, (*Ustilago nuda* [Jens.] Rostr.), were made by noting the number of smutted heads seen per man during the inspection.

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RESULTS

Four leaf diseases and one head disease were found to be common in all regions. These were: powdery mildew (*Erysiphe graminis* DC), brown rust (*Puccinia hordei* Otth.), leaf stripe (*Pyrenophora gramineae* Ito & Kuribay), scald (*Rhynchosporium secalis* [Oudem] J. J. Davis), and loose smut (*Ustilago nuda*).

Five other pathogens were recorded but seldom seen; net blotch (*Pyrenophora teres* Drechsl.) in Canterbury and Marlborough, stem rust (*Puccinia graminis* Pers.) in Canterbury and Hawke's Bay, covered smut (*Ustilago hordei* [Pers.] Logerh.) in Hawke's Bay, culm rot (*Fusarium culmorum* [W. G. Smith] Sacc.) in Gisborne, and take all (*Gaeumannomyces graminis*) in several areas.

Actual disease recordings are summarised in Tables 1 and 2.

TABLE 1: NORTH ISLAND

Pathogen	Manawatu/Wanganui			Hawke's Bay			Gisborne		
	I	R	L	I	R	L	I	R	L
<i>P. hordei</i>	55	3.5		70	11.7		75	13.4	
<i>E. graminis</i>	55	3.7	4.8	40	3.2	4.5	38	5.3	5.7
<i>R. secalis</i>	36	2.0	1.0	30	1.0	0.5	25	1.0	0.5
<i>P. gramineae</i>	100	4.5	2.3	90	6.0	3.0	75	1.2	0.6
<i>U. nuda</i>	45	7.4		30	2.0		50	1.5	
Crops inspected	22			10			7		

I = percentage of crops infected.

R = mean disease rating (percentage).

L = estimated yield loss (percentage).

TABLE 2: SOUTH ISLAND

Pathogen	Otago/Southland			Canterbury			Marlborough		
	I	R	L	I	R	L	I	R	L
<i>P. hordei</i>	100	4.08		100	4.0		55	8.6	
<i>E. graminis</i>	0			31	2.5	3.9	52	4.5	5.3
<i>R. secalis</i>	0			65	1.7	0.8	21	2.0	1.0
<i>P. gramineae</i>	8	10.0	5.0	35	1.8	0.9	79	6.4	3.2
<i>U. nuda</i>	0			15	13.6*		83	2.0	
Crops inspected	12			72			29		

* This recording is abnormally high due to one crop having a rating of 90.

Estimates of anticipated yield loss for three pathogens were attempted. Yield losses for *E. graminis* were based on the formula derived by Large and Doling (1962), where percentage mildew infection (M) is recorded at Feekes Growth Stage 11.1.

Estimated yield loss = 2.5 square root M

Estimates of yield loss for *P. gramineae* and *R. secalis* were based on the method of James et al (1968), who found that predicted loss in barley crops infected with *R. secalis* was the average of half the percentage of leaf area infected on the top 2 leaves. This method was used for *P. gramineae* also as leaf damage was of a similar nature.

The small number of crops inspected in the Hawke's Bay area was due to drought conditions resulting in the early ripening of many crops.

DISCUSSION

The results of this survey indicate several important factors. Comparing incidence of disease over the whole survey area, the percentage of crops infected with each disease is as follows: *P. hordei* 76%, *P. gramineae* 65%, *U. nuda* 37%, *E. graminis* 36%, and *R. secalis* 30%. Thus brown rust and leaf stripe were the two most prominent barley pathogens present in the survey. According to Dingley (1969) leaf stripe has occurred only occasionally and is of minor importance. This survey indicates that the disease has increased in recent years. Estimates of yield loss due to this pathogen amount to 3%. This is a relatively low figure, however, information from Europe shows that weather conditions throughout the season of the survey would not have encouraged the pathogen to develop. An increase in rainfall during the summer months would cause rapid development of the pathogen. Some confusion may have occurred in distinguishing between *P. gramineae* and *P. teres* in the field, but at no stage was *P. teres* isolated into culture whereas *P. gramineae* was readily obtained.

Incidence of *E. graminis* was unexpectedly low but may have also been due to, the dry conditions.

The low incidence of *R. secalis* can be attributed to the fact that barley seed crops are sown in spring, while development of this pathogen is favoured by cold wet conditions experienced only in autumn sown crops.

A culm rot was discovered in 2 crops in the Gisborne area. The disease was caused by *F. culmorum* and is a new record on barley in New Zealand, although a root rot due to this pathogen has been recorded. *F. culmorum* is also found on maize crops and in this area maize and barley are grown in close association, thus the maize forms a possible source of inoculum. Twelve per cent of plants were infected and this would seriously affect yield of the crop.

The incidence of loose smut varied throughout each area and was indicative of several paddocks being sown with the same seed line. The seed had obviously not been treated for the disease.

CONCLUSIONS

The incidence of disease in barley crops cannot be estimated accurately in one survey. Estimates of disease incidence and yield loss should be based on a series of surveys over a period of years. This type of survey is to be continued in an effort to evaluate the effect of barley diseases on grain production in New Zealand.

Survey results indicate that control measures are not necessary for these diseases. Individual crops however, were often heavily infected with either *P. hordei* or *P. gramineae* and crop losses could be assumed to be

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much higher in these cases. Several control measures are available for these pathogens but they have not been investigated under New Zealand conditions.

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