CropInfo Confidential Report No. 586

Survey of downy mildew of lettuce

A report prepared for

New Zealand Vegetable and Potato Growers' Federation Inc.

L-H Cheah

May 1999

New Zealand Institute for Crop & Food Research Limited
Private Bag 11 600, Palmerston North, New Zealand

CROP & FOOD RESEARCH
Mana Kai Rangahau

CropInfo Confidential Report No. 586
Survey of downy mildew of lettuce
L-H Cheah

CONTENTS

1 EXECUTIVE SUMMARY

Field surveys and laboratory tests were carried out to investigate the cause of loss of control of downy mildew on lettuce (caused by *Bremia lactucae*); 35 outdoor and 5 indoor growers in six major growing regions were surveyed. On outdoor crops we found that downy mildew attacked late autumn to spring crops but was seldom found in summer crops. All winter cutting lettuce varieties were susceptible to the disease. Generally, growers in the North Island do not consider the disease to be a major problem in the summer, but can cause damage to winter crops. In the South Island however, growers recognise that it can cause economic losses at any time. We did not find any strains of *B. lactucae* that were insensitive to metalaxyl (Ridomil) in samples of the pathogen population taken from lettuces throughout New Zealand. The loss of disease control during the last two seasons (1996/97 and 1997/98) in the South Island was most probably the result of unusually wet, mild and humid weather conditions, which are conducive to infection and epidemic development. None of the indoor crops surveyed had downy mildew problems.

Research is required to develop downy mildew resistant lettuce varieties and to determine if there is a new strain of *B. lactucae* in New Zealand. It is recommended that growers become better informed about the disease which will help them to improve their control strategies.

2 INTRODUCTION

Downy mildew of lettuce, caused by the fungus *Bremia lactucae*, is a widespread and important disease in glasshouses and field-grown crops. It is often more troublesome during periods of prolonged high humidity and leaf wetness.

Symptoms of the disease are initially inconspicuous and difficult to detect, particularly at the seedling stage of host growth. Affected seedlings may show slight chlorosis of affected leaves and downward rolling of the leaf margins. On close examination the pathogen can be seen sporulating on upper and lower leaf surface of seedlings. On older plants, the symptoms are easy to see and appear as bright yellow or necrotic patches on upper leaf surfaces with white downy growth of the pathogen (conidia) on leaf undersurfaces below these patches (Figures 1 and 2).

Preliminary surveys of some lettuce growers indicate that control of downy mildew is becoming much more difficult than previously, especially on spring-grown lettuce crops. In nurseries, the disease is estimated to cause economic losses of about 10% annually. Losses in field crops can also be high. We do not know the actual cause of loss of control of downy mildew on lettuce. Difficulties in disease control in spring-grown crops are likely because of unpredictable weather conditions (wet periods and high humidity). In Australia and Europe strains of downy mildew resistant to metalaxyl have been found in *B. lactucae* populations (Crute et al. 1987).

Because the status of downy mildew of lettuce in New Zealand is poorly understood, in the initial stages of this project we have gathered relevant information on the disease both from within New Zealand and from overseas. We then propose to progress toward specific research that is relevant to New Zealand lettuce growers.

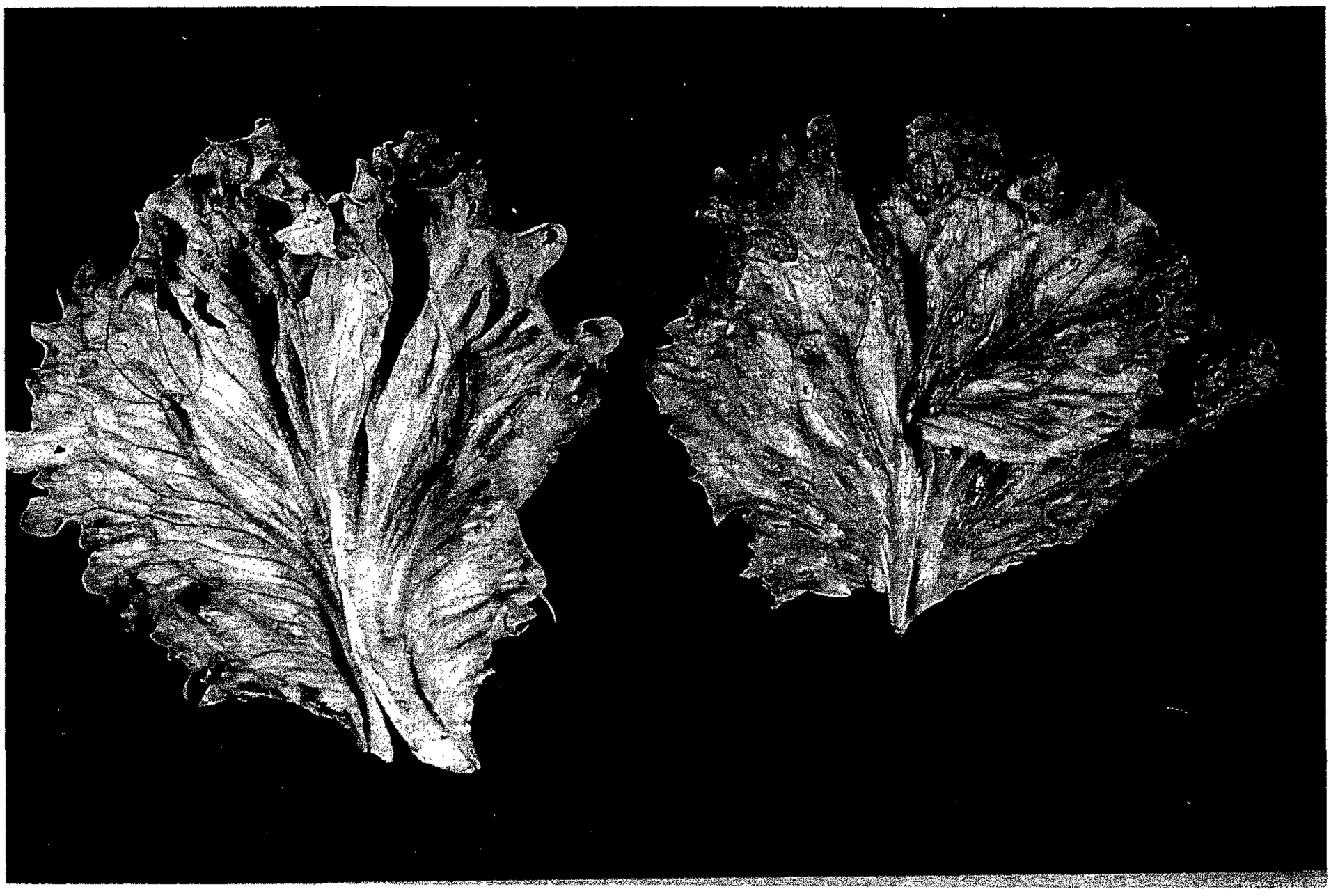

Figure 1: Downy mildew symptoms on lettuce.
Left: the fungus is sporulating on the underside of the leaf.
Right: Yellow necrotic patches on the upper leaf surface.

Figure 2: Downy mildew symptoms on field lettuces. White downy growth of the fungus (conidia) on leaf undersurface (bottom) and yellow necrotic patches on upper leaf surface (top).

3 OBJECTIVES

- Survey New Zealand lettuce growers to determine the current status of downy mildew of lettuce and current practices used to control the disease in indoor and outdoor crops.
- Determine the susceptibility of New Zealand strains of *B. lactucae* to fungicides.

4 MATERIALS AND METHODS

4.1 Grower survey

A nationwide survey of indoor and outdoor lettuce growers was carried out. A package consisted of questionnaire form (Appendix 1), plastic bag and a return addressed envelope were prepared and sent to growers for questionnaire completion and returning diseased specimens for diagnosis. The survey recorded information on cultivars being grown, growing conditions, cultural practices, chemical use and postharvest practices.

4.2 Fungicide resistance survey

Field samples of *B. lactucae* were collected from diseased plants from different growing areas. The baseline sensitivity to fungicides (metalaxyl) was determined (Cheah et al. 1993). As *B. lectucae* is an obligate pathogen, fungicide sensitivity was tested using the leaf disc bioassay method of Crute et al. (1987).

5 RESULTS

5.1 Grower survey

Thirty five outdoor lettuce growers in six major growing regions (Auckland, Gisborne, Hawke's Bay, Horowhenua, Canterbury and Otago) were surveyed. Our results showed that downy mildew attacked the late autumn to spring cutting lettuces and occasionally caused damage on summer crops. Generally, growers in the North Island do not consider downy mildew to be a major problem in the summer, but can cause damage to winter crops. In the South Island, however, growers recognise that it can cause economic losses at any time. In the North Island, growers can grow several varieties of lettuces for winter/spring cutting (e.g. 'Wintergreen' and 'Triumph', etc), while in the South Island only one variety ('Triumph') is grown. All lettuce varieties were susceptible to downy mildew. Many growers in the South Island do not grow winter/spring cutting lettuces because of severe infection by the disease.

The disease outbreaks during the 1996/1997 and 1997/1998 seasons in the South Island was most probably the result of unusually wet, mild and humid weather conditions, which are conducive to infection and epidemic development, and the growers' inability to apply control chemicals under such conditions. The problem was compounded by lack of knowledge about the disease. The main chemicals used are copper (cupric hydroxide), mancozeb (Dithan M45), phosphorous acid (Foli-R-Fos) and metalaxyl (Ridomil). The latter two chemicals are not registered for use on lettuces.

Five indoor lettuce growers surveyed said downy mildew was not a problem on their crops.

5.2 Fungicide resistance survey

Thirty isolates of *B. lactucae* that were suspected of metalaxyl resistance were collected from six regions and tested in the laboratory. We found that the baseline sensitivity was 10 ppm (i.e. spores of sensitive isolates were killed at 10 ppm of metalaxyl). We also found that all 30 suspected isolates stopped growing at this concentration. These results indicate that there is no insensitivity to metalaxyl among the *B. lactucae* population in New Zealand.

No tests were carried out with other chemicals (copper, mancozeb and phosphorous acid) as insensitivity to these chemicals is unlikely to occur (Crute et al. 1987).

6 DISCUSSION

Our survey results showed that downy mildew on lettuces is a more serious problem in the South Island than the North Island. This could be due to the weather conditions during winter and spring periods. For example, during our survey (September 1998), we observed a severe infection by the disease on 'Triumph' in Oamaru areas while the same variety grown in Gisborne areas was completely free of the disease. We noted that while cultural practices were the same in both areas, the weather conditions were much different. The weather conditions in Oamaru areas were much cooler (8° - 15°C) and had prolong leaf wetness periods (due to morning dew) as compared to that of Gisborne areas (dry, warm and low humidity). Cool weather and high humidity are essential for *B. lactucae* conidium germination and development of the disease (Brien et al. 1957).

To date, there are only four chemicals registered for use to control downy mildew on lettuces (i.e. Acrobat, copper, Euparen and mancozeb). All these are protectant fungicides and have to be applied before infection occurs in order to achieve effective control. Unfortunately, these fungicides did not give full protection under wet weather as usually experienced in the South Island. As a result, growers have to use 'off-label' fungicides (e.g. Foli-R-Fos and Ridomil) which are not registered for use on lettuces. The efficiency of these fungicides should be experimentally confirmed before they are allowed for use commercially.

In this survey, we screened for insensitivity to metalaxyl in *Bremia* populations because there is evidence that the strains of *Bremia* have become insensitive to this fungicide (Crute et al. 1987) and there is no evidence of insensitivity to other fungicides mentioned above (Dr Dan Trimboli, Yates Vegetable Seeds Ltd, Research Station at NSW Australia, Pers. comm.).

Since all commercial lettuce varieties appear to be susceptible to downy mildew and so far only a few chemicals are available for use, the main control measures against this disease should involve cultural practices, e.g. crop rotation and good hygiene. It is important to detect the disease early so that chemicals can be applied before further infection takes place.

7 RECOMMENDATIONS

- Research is required to develop downy mildew resistant varieties of lettuce.

- Since all commercial lettuce varieties used in New Zealand appear to be susceptible to downy mildew and only a few chemicals are available for control of the disease, the main control measures should involve cultural practices of crop rotation and good hygiene. It is important to detect the disease early so that chemicals can be applied for effective control.

- It is recommended that growers become better informed and understand the disease which will help them to improve their control strategies.

8 ACKNOWLEDGEMENTS

This research was financed by the New Zealand Vegetables & Potato Growers' Federation Inc. Thanks also to Drs Dan Trimboli, Martyn Callaghan and Patricia Pijnaker of Yates Vegetable Seeds Ltd, Research Station, NSW, Australia for valuable discussion on fungicide insensitivity testing techniques.

9 REFERENCES

Brien, R.M.; Dye, D.W.; Fry, P.R.; Harrison, R.A.; Jacks, H.; Newhook, F.J. 1957: Diseases and Pests of lettuce in New Zealand and their Control. *New Zealand Department of Scientific and Industrial Research. Information series No. 14*: 37pp.

Cheah, L-H.; Tate, K.G.; Hunt, A.W.; De Silva, N. 1993: Decreased sensitivity of *Taphrina deformans* (peach leaf curl) to copper fungicides in Hawkes Bay. *Proceedings of the 46th New Zealand Plant Protection Conference*: 15-17.

Crute, I.R.; Norwood J.M.; Gordon P.L. 1987: The occurrence, characteristics and distribution in the United Kingdom of resistance to phenlamide fungicides in *Bremia lactucae* (lettuce downy mildew). *Plant Pathology* 36: 297-315.

10 APPENDIX

SURVEY OF DOWNY MILDEW ON LETTUCES

Grower

Name:

Address:

Contact: Tel: Fax:

Crop & Practices

What variety:

When planted:

What fungicides used:

How many sprays were applied:

When was 1st spray applied:

Any disease before spray:

Disease presence or absence on previous crops:

Any control, with what:

Sprayer type and volume:

In your opinion, the loss of disease control is due to:

1) fungicide resistance
2) incomplete spray coverage due to the weather conditions
3) neither.