DISEASES OF MAIZE IN NEW ZEALAND

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Summary

The major fungous diseases of maize in New Zealand are described and their importance discussed.

INTRODUCTION

PRIOR to 1960, maize production in New Zealand was traditionally an industry of the Gisborne district. Acreages in the country remained relatively static at around 3 000 to 4 000 ha until the mid- to late-1960s when there was a dramatic expansion of the industry. Acreages in the East Coast areas doubled and there were extensive plantings in the Waikato. By 1971-72, the areas planted to maize had reached approximately 18 600 ha. Plantings in the past season were slightly less at around 16 200 ha.

With larger areas of maize now being grown and the substantial investment of capital in the industry, the incidence and effects of diseases have assumed greater importance. Extensive field surveys have been conducted during the past two seasons, and this paper presents a brief outline of the main diseases that affect maize in this country.

NORTHERN LEAF BLIGHT

This disease is found in all the maize growing areas of New Zealand. It is recognised by long elliptical greyish green to tan lesions on the leaves, the fully-developed lesions often being up to 15 cm long and 3 cm wide. Older lesions often have a blackish tinge especially on the lower surface due to sporulation of the fungus. The disease usually appears first on the lower leaves of the plant and works upwards, extensive areas of leaf being killed. Crop losses depend on the extent of leaf damage and the stage of growth of the crop. It has been shown (Ullstrup *et al.*, 1957) that yields may be reduced by up to 50% if the disease is well established about the time of silking, but the later the disease appears, the less will be the loss. Severe infections 6 to 8 weeks after silking caused insignificant losses in yield. However, severe infections of leaf blight also weaken the stems and predispose plants to stalk rots and lodging and in case of late infection this effect may be more serious than direct reductions in yield.

Recent surveys indicate that the disease is present to some extent in most maize crops throughout the country. From time to time there are serious outbreaks, the most recent occurring in the Waikato during the 1970-71 season. Some areas were similarly affected the following year. Apart from a few crops with moderate infection, most crops were unaffected during the past season.

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The disease is caused by the fungus *Helminthosporium turcicum* Pass., conidial state of *Trichometasphaeria turcica* Luttrell. Spores can survive in the soil on debris from the previous crop and spores are carried to their infection sites in the whorls of seedlings by wind or rain-splash. The fungus sporulates profusely on older lesions during damp weather and the spores can be redistributed by wind or water to leaves higher on the plant. The fact that spores can be carried for miles by wind accounts for infection appearing in areas apparently well isolated from infected crops. For effective increase of the disease periods of rain are required; low daytime relative humidities tend to retard the disease in spite of high relative humidities at night (Cox and Harrison, 1958). Because of its ubiquitous distribution and ability to build up and spread rapidly under suitable weather conditions, northern leaf blight is potentially the most serious disease of maize in New Zealand.

The most economic means of control lies in the use of resistant hybrids. All the hybrids grown in New Zealand are susceptible. Many commercial hybrids in U.S.A. have a high level of resistance and efforts are being made by both DSIR and local seed companies to develop suitable resistant varieties for this country. Control has been attempted on a number of properties in the Waikato in past seasons, using the chemicals maneb and mancozeb. The future of chemical control is governed by economic considerations. It is effective but costly for, if conditions favour disease development, applications have to be made at 7 to 10 day intervals to afford continuous protection. Research is currently being conducted at Plant Diseases Division, Auckland, to determine the effectiveness of a limited number of applications of fungicides.

EYESPOT

Eyespot is a relatively "new" disease of maize. Originally described in Japan in 1959 (Narita and Hiratsuka, 1959), it was first reported from U.S.A. and Canada in 1969 (Worf and Ahrens 1959; Gates and Mortimer, 1969). It was identified in Europe in 1971 (Schneider and Kruger 1972) and in the same year was detected in both North and South Islands of New Zealand (Dingley, pers. com.).

The disease affects the leaves, producing large numbers of small circular spots 1 to 2 mm dia. Each spot has a tan to cream centre with a fine brown margin and is surrounded by a translucent yellow halo which imparts the characteristic "eyespot" appearance. In heavy infections the lesions coalesce to produce localised areas of scorching. Cob husks and leaf sheaths may also be affected. There the lesions are usually larger with a diffuse, often purple margin.

The disease is caused by the fungus *Kabatiella zeae* Narita and Hiratsuka. Like the northern leaf blight fungus, it can survive in debris and cause primary infections in the whorls of seedlings the following season. Plants can be infected at any stage of growth but seem to most susceptible when older. The disease can spread rapidly during periods of wet humid weather, and under these conditions can be aggressive and destructive, killing considerable areas of leaf and resulting in weakened stems. The overall effect on yield is not known.

Present to a minor degree in most maize crops in New Zealand, eyespot has reached epidemic proportions in some crops in the Waikato in the past two seasons. No suitable control is yet available. Repeated applications of mancozeb offer some protection to older crops but seem to be

less effective when plants are still in the whorl stage. Sources of resistance have been found both in New Zealand and in U.S.A. but the hybrids presently grown in New Zealand are susceptible.

HEAD SMUT

Caused by the fungus *Sphacelotheca reiliana* Kuhn., head smut has been endemic to the Gisborne area for over 30 years. It was officially reported from Hawke's Bay for the first time in 1972 and surveys during the 1972-73 season have shown it to be widespread in that district. Its origin and the length of time it has been present in the area are unknown. The disease is recognisable as a conspicuous black mass of spores in either the cob or the tassel, frequently both. Marketable cobs are seldom produced on infected plants and recent experimental work has confirmed that potential yields are reduced by a proportion equivalent to the proportion of smutted plants in the population (Fullerton, Scott, Graham, unpublished data). Infection percentages vary greatly between fields but there is commonly 5 to 7% infection in field rows with infection in the headland rows usually heavier, at 10 to 15%. Infection levels up to 20% in field rows and 28 to 30% in headland rows have been observed at Gisborne.

Infection occurs in the soil during and soon after seed germination. The fungus grows systemically within the developing plant and sporulates in the tassels and cobs when they are produced. Infection can only occur at germination; the disease does not spread from plant to plant during the season. Infected plants are usually indistinguishable from healthy plants until sporulation occurs but in some varieties there are other symptoms including chlorotic mottling of midribs and adjacent leaf tissues, water-soaked or brown speckling of the stem and, internally, browning of vascular tissue.

At present there is no satisfactory control of head smut. The standard seed dressing fungicide captan, is effective against seed-borne spores but not against spores in the soil. In experiments at Gisborne during the past season the systemic fungicides benomyl and carboxin have given promising results (Fullerton, Scott, Graham, unpublished data). The length of time spores can remain viable in the soil is not known but because of the ease with which spores are spread by wind and equipment, it is unlikely the disease can be eliminated by crop rotation. To avoid further spread of this disease in New Zealand it is important that only treated seed be planted in those areas in which the disease does not occur.

STALK ROTS

While stalk rots are regarded as one of the major diseases of maize on a world scale, little information is available on their incidence in New Zealand. Stalk rots are characteristically diseases of the mature plant and tend to become progressively worse with age of the crop. A number of organisms can cause stalk rot, the most common ones in New Zealand being *Gibberella zea* (Schw.) Petch and *Fusarium moniliforme* var. *subglutinans* Wr. & Reink. *Diploidia zea* Lev. a common cause of stalk rot in many countries is present in New Zealand but is more often a cause of cob rots than stalk rots. The general symptoms of stalk rot are a sudden wilting and collapse of individual plants throughout the crop. Initially these plants appear to have matured early but

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closer inspection will reveal a carmine discoloration and rotting of the stem often 2 or 3 nodes above the ground. The diseased part of the stem is easily broken in wind or rain. Losses occur from incomplete filling of cobs (if infection occurs early) and loss of cobs from lodged plants due to their rotting on the ground or being dropped during harvest.

The severity of stalk rot depends on a number of factors including the variety grown, previous land use, physical state of the plant and weather conditions. Resistant locally adapted hybrids offer the best means of control and the hybrids currently grown in New Zealand have a good tolerance of stalk rot. Extensive defoliation, either as a result of foliage diseases (northern leaf blight, eyespot) or heavy infestations of army worm leads to weakened stems and the premature collapse of many plants. Under these circumstances lodging may occur in the absence of stalk rotting organisms but the weakened stems are soon colonised by fungi thereby accentuating the problem. Many cases of severe stalk rot in New Zealand may be traced to prior heavy infection by leaf blight. In addition high plant populations result in plants with thinner, weaker stems which break easily if infected. It is essential to keep a watch on crops as they mature and crops with the greatest incidence of stalk rot should be harvested first.

COB ROTS

Maize is susceptible to a variety of cob rots. They probably occur to some extent in every field but, with combine harvesting, their presence goes unnoticed. They are more of a problem in wet years and accentuated by insect or bird damage. Crops left standing for long periods before harvest will suffer most and as indicated above, many cobs on lodged plants are destroyed by cob rots.

The organisms responsible are usually those associated with stalk rots mainly *Gibberella zeae*, *Fusarium moniliforme* var. *subglutinans*, and *Diplodia zeae*. In addition *Nigrospora oryzae* (Berk. & Br.) Petch. often causes considerable loss in crib-dried maize. The rots reduce yield and quality of the grain but are generally thought to be of less economic importance than stalk rots. The only feasible control measures lie in the use of suitable varieties, reducing as far as possible damage from insects, and harvesting as soon as possible after maturity.

RUST

Corn rust (*Puccinia sorghi* Schw.) is widespread in New Zealand but seldom exceeds more than trace amounts in an infected crop. It is recognised by numerous oval to elongate pustules, commonly 2 to 5 mm long, scattered over both surfaces of the leaf. The pustules are at first cinnamon-brown in colour later becoming brownish-black. In cases of light infection the pustules may occur on only a few leaves of any one plant and often tend to be grouped together. The cinnamon-brown spores (uredospores) are dispersed by wind and rain splash and under suitable conditions of temperature and moisture, germinate and infect. Only rarely has rust been observed to cause damage in New Zealand and at present control measures are unnecessary.

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