POTATO BLIGHT

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Summary

In New Zealand late blight (*Phytophthora infestans* de Bary) is to be found wherever potatoes are grown but the disease is troublesome only in the higher rainfall areas where, frequently, foliage is liable to be wet with rain or dew for 8 hours or more. In the drier districts, late blight may not develop until the end of the growing season, and while not usually causing reduction in yield, the disease is liable to spread on to the tubers at harvest and cause tuber rot in storage. In these circumstances protective spraying is not warranted although haulm destruction before lifting is worth while. In the damper warmer districts, severe blight attack must always be anticipated. Here frequent, regular, protective spraying with copper oxychloride or maneb is essential with the object of preventing blight becoming established in the field. Between these extremes the need for spraying is more difficult to decide, for it depends upon the type of weather likely to pertain in the future. In the absence of satisfactory eradicator sprays and long-range weather forecasting, growers must either take the risk of not spraying soon enough to maintain control, or of spraying when it may not in fact have been necessary.

LATE BLIGHT of potatoes, *Phytophthora infestans* de Bary, is one of the classical diseases with which plant pathology had its beginnings. The fungus, which attacks potatoes, tomatoes and a number of *Solanum* weed plants, is now found wherever potatoes are grown.

In New Zealand potatoes are grown from one end of the country to the other with the chief production areas in Canterbury, Rangitiki, and Pukekohe. In most seasons, late blight is insignificant in Canterbury, patchy and sporadic in Rangitiki but troublesome in Pukekohe, particularly in the more important early crop, although often in the summer-grown "seed" crop also.

As a result of studies in Europe, it is now generally accepted that *P. infestans* survives the winter as living mycelium in potato tubers. When these, as seed or ground-keepers, shoot in the spring, the fungus succeeds in invading a few of the shoots—a very few of them—and comes above the ground within their tissues. If the temperature and humidity are favourable, the fungus in these isolated infected shoots produces sporangia which drift in the wind to spread the disease to healthy foliage if it remains wet from dew or rain for sufficient time. Once a few foci of infection have become established—a few plants with blight lesions scattered in a field or even a district—the disease can spread rapidly and over long distances during periods of favourable weather.

Where host plants grow the year around, as in Pukekohe, this survival mechanism may play a part in carrying the fungus through prolonged periods of summer drought, but generally blight-infected leaves are to be found the year round.

Sporangia from infected foliage, washed into the soil, can infect tubers near the surface, but a greater risk is to dig potatoes when blighted foliage is present. The tubers become contaminated with the spores and considerable losses from blight in stored tubers can result.

The disease may be controlled in four ways:

- (1) By growing potatoes in drier areas where blight is seldom able to become troublesome.
- (2) By the use of resistant varieties — *e.g.*, Rua and Tahi — recently released by Crop Research Division.
- (3) By the use of chemical and mechanical haulm destruction methods to avoid infecting tubers when dug.
- (4) By protective spraying with fungicides.

SPRAYING

Much attention has been given in England recently to the economics of spraying for blight control and the consensus of opinion seems to be that, while particular growers may gain an advantage at times, the general use of spraying is not worth while.

It is argued that seasons favourable to blight are also favourable to the potato, with the result that yields tend to be higher than average. Protective spraying increases the yield still further, accentuating the risk of glut. Also, when blight is not severe, the damage done by spraying machines and chemicals to the haulm and by soil compaction may be greater than the saving from blight protection. The significance of the arguments depends on the severity and frequency of blight attacks in any district.

In England, where these arguments have been advanced, blight tends to develop late. It has been shown that, provided blight damage had not gone beyond 75%-leaf-area-destroyed stage, yields are not affected and the object of protective spraying appears to be to delay the onset of this arbitrary 75% destruction level for a week or two and so maintain yields at maximum level.

The situation does not pertain in Pukekohe where, unless effective spray programmes are used, plants are completely destroyed early and crops fail. In England one or two judiciously placed sprays suffice, whereas at Pukekohe sprays are applied once and sometimes twice a week. Thus the English findings on the economics of spraying do not apply in Pukekohe but they probably do apply in Canterbury and perhaps in some parts of the Rangitiki-Marton areas.

In Canterbury it is seldom worth while spraying the main crop potato for blight control, although some growers, particularly those producing certified seed, might find it useful to be equipped to spray in the occasional blight year to delay onset of severe defoliation. Many more might find the use of haulm destruction chemicals worth while to reduce the risk of tuber infection.

In Rangitiki, protective spraying would pay in years of blight epidemics but without long-range, weather forecasting there is no way of picking blight years in advance. A grower has either to take the risk of spraying when it may not be required, thus wasting money, or of not starting spraying soon enough in blight years to prevent serious damage, for it is much more difficult to control blight after it has become established in a field than to keep it out by routine protective spraying.

Some fungicides are sometimes thought to be able to kill out existing infection. There are those who consider Bordeaux mixture can "burn out" blight lesions and so prevent the disease from

spreading. Certainly, if the weather improves, the blighted leaves dry up to give the impression that sprays have been successful. Of course, the same thing happens without Bordeaux spray.

Some growers have been persuaded to apply PMC (phenylmercury chloride) sprays on the understanding that PMC has eradicated properties against late blight.

PMC is undoubtedly a very potent but perhaps short-lived protective fungicide but it would be a mistake to rely on eradicated action. This can be easily demonstrated by taking a few blight-infected leaves from a field which has been sprayed with PMC and placing them in a moist chamber (or a polythene bag). If the fungus has been killed or checked by the spray new sporangia should not be produced, but in the writer's experience, after about 16 hours in the bag, sporangia production from PMC-sprayed lesions is just as great as from unsprayed lesions.

The eradicated properties of PMC were tested in the laboratory by applying the chemical just prior to and at intervals after potato plants were inoculated with *P. infestans*.

No lesions developed when the fungicide was present before inoculation; applied just after plants were removed from the moist inoculation chamber, where they had been for 24 hours, PMC showed some eradicated action—17% of foliage being attacked; when sprays were applied one day later, 68% were infected; after another day when blight lesions could still hardly be detected 85% of leaves developed blight. These figures are relative to the disease level in unsprayed foliage which was graded 100% infected. Mercury sprays should not be considered to eradicate the disease.

The standard protective fungicide for late blight control is copper oxychloride used at the rate of 5 lb per 100 gal per ac., applied sufficiently frequently to protect new growth, or, if the grower is a weather prophet, applied before the onset of damp, warm blight weather.

Copper oxychloride tends to depress yields a little if intensive spray programmes are used and this has led to increasing interest in the organic fungicides, especially the dithio-carbamates zineb and maneb. Zineb is perhaps not as reliable as copper against late blight but maneb, now that earlier formulation problems have been overcome, is being increasingly used with general satisfaction. Not only has maneb given excellent control of blight but, unlike copper sprays in the absence of blight, yields are sometimes increased by its use.