THE HISTORY OF PEST AND DISEASE CONTROL IN KIWIFRUIT

P.R. SALE

Ministry of Agriculture and Fisheries, Tauranga

Summary

Kiwifruit (*Actinidia chinensis*) has risen in a comparatively short time from being a backyard curiosity to one of the most important horticultural crops in New Zealand with the potential to make a major contribution to the economy. As the importance of the crop has grown to that of a major export, pest and disease incidence has increased. The requirement is to achieve control that is up to the standard of international plant quarantine and keep chemical residues below the acceptable tolerances in all the major export markets.

INTRODUCTION

In the early days of growing kiwifruit in New Zealand it was considered a crop that didn't need spraying. The very small amount of fruit produced was sold on the New Zealand market without any major problems due to pests or diseases. Although the area planted in kiwifruit increased slightly through the 1950s, and the first exports were made in the middle of that decade, it was not until exports started to develop in the mid 1960s that the planting rate increased dramatically. This expansion of the kiwifruit industry is still continuing (Sale 1979). Predictably as the area planted increased, and more fruit was submitted to the scrutiny of export inspection, more pest and disease problems were encountered and more sophisticated methods of control were required.

PEST CONTROL

Historically pest control in kiwifruit can be divided into four eras:

1. No spraying

In the very early days when it was only a very minor fruit crop supplying the New Zealand market, no sprays were applied. There are still a few small growers who do not spray at all, but their fruit is seriously damaged by leaf roller caterpillars, and there is no chance of such growers being able to export kiwifruit as fresh fruit.

2. Simple spray programmes to control leaf roller caterpillars (*Ctenopseustis obliquana*, *Planotortrix excessana*, *Epiphyas postvittana*)

Kiwifruit are readily attacked by leaf roller caterpillars, and as plantings developed it became apparent control measures were necessary, especially for export fruit. Initially, old fashioned materials such as arsenate of lead and TDE were used. No trial work was done but the basis of their use was experience on other crops notably apples or citrus. As time progressed TDE came under disrepute, along with all other organo-chlorines, and its place was taken by azinphos-methyl again on the basis of its use in apples.

3. More comprehensive spray programmes to control greedy scale (*Hemiberlesia rapax*) as well as leaf roller

As exports developed in the late 1960s greedy scale was noticed in significant numbers on the fruit and became a problem in meeting international quarantine standards. Greedy scale was not a debilitating pest to the crop, nor was it a problem to local market fruit, but for export fruit it had to be controlled along with the ever present leaf roller.

4. A severe restriction on the materials that could be utilised due to the problems of residue tolerances

In 1978 when the question of the setting of tolerances for spray residues became a

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problem in the international trading of fruit and vegetables, kiwifruit was disadvantaged by its uniqueness. At that time New Zealand was the only significant producer of kiwifruit, and although there were tolerances set for the New Zealand market there were no overseas tolerances specifically for kiwifruit anywhere else in the world.

After a lot of behind the scenes work by the Agricultural Chemicals Section of the Ministry of Agriculture and Fisheries, an acceptable tolerance was set for phosmet in all our major markets for the 1979 season, diazinon had almost as wide an acceptance, but one major market would not accept levels of azinphos-methyl which limited its use to the early part of the season only. There were also problems with tolerances for carbaryl, which had recently become the standard close to harvest insecticide for both leaf roller and greedy scale and, consequently, carbaryl had to be dropped from the export spray programme.

Trials and experimentation with insecticides on kiwifruit

It was not until greedy scale became a quarantine problem at the end of the 1960s that any insecticide trial work was carried out on kiwifruit. The growers were then faced with a field problem and as kiwifruit, at that time, was of such minor importance, no research agency was prepared to become involved, so the Department of Agriculture Horticultural Advisory Officers in Tauranga tackled it, and this became phase one of a ten phase development of research into pest control in kiwifruit.

1. Mass screening of insecticides + oil.

The following materials were initially tested:

carbaryl	ethion	dichlorvos
maldison	methidathion	diazinon
dimethoate	carbophenothion	endosulphan
methyl-parathion	menazon	fenitrothion
azinphos-methyl	mevinphos	phosmet
formothion	demeton-S-methyl	

As a result of this initial screening ethion + oil was used for control of greedy scale in the March, April period (Ford 1971).

2. Shortly after this it became apparent that oil applied in the late season was damaging to kiwifruit, causing a softening at the stem end which gave off an unpleasant odour and caused fruit to fall from the vines. The next phase was in checking on the phytotoxicity of oil on kiwifruit in late season, and it proved to be an unacceptable spray at that time (Sale 1972). In the same season several large growers had damage as a result of using oil in the late dormant season.

3. Phase three was the re-checking of a wide range of insecticides without oil, as the ethion originally recommended with oil had not proved very effective in controlling greedy scale on its own.

The following materials were tested at this stage:

diazinon	phosmet	aminocarb
omethoate	maldison	methidathion
azinphos-methyl	ethion	dichlorvos

As a result of this work diazinon replaced ethion + oil as the recommended late season insecticide.

4. The life cycle of greedy scale was investigated which enabled the pest and its control to be approached more comprehensively (Ferguson 1974). Further information on a severe outbreak of greedy scale in 1977 has also been valuable in helping to pinpoint weaknesses in pest control programmes (Sale 1977).

5. The effect of wetting agent as a controlling factor of greedy scale was studied when Entomology Division of DSIR joined the Horticultural Advisory Officers in joint projects. It was shown that wetting agent could enhance the effect of insecticides against greedy scale, and in fact was superior to the addition of 0.5% oil (Sale and Ferguson 1974).

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6. Testing of selected materials continued, as full seasons programmes taking into account leaf roller as well as greedy scale control. As a result phosmet was selected to replace diazinon for the late season sprays due to its superior leaf roller control (Sale and Ferguson 1974). The testing continues and a laboratory method of screening materials against greedy scale has been of value (Ferguson and Wallace 1979).
7. With the knowledge gained on the life cycle of greedy scale and the moth trapping programme being undertaken on leaf roller, it appeared feasible to reduce the number of insecticide applications if they were timed correctly. The results in this on-going programme of research appear encouraging (Wearing 1979).
8. With increased knowledge of the life cycle an approach to control greedy scale in the dormant season was undertaken, and it was shown that 7% lime sulphur gave a high level of control, as well as clearing up lichen growth on the vines. Control of greedy scale was further enhanced when followed 10 days later by a suitable insecticide (Sale 1979).
9. The growth of the kiwifruit industry, and its rise as a major horticultural crop in New Zealand has encouraged agricultural chemical firms to engage in testing programmes of their own products, thus increasing the input into the investigation of pest and disease problems.
10. Residue trials have been undertaken to obtain data which can be used for making application for residue tolerances on kiwifruit in overseas markets. At present there are a number of materials that have given satisfactory control of both leaf roller and greedy scale, but their introduction as alternative choices in the spray programme is delayed until residue data are obtained, and residue tolerances are set in overseas markets.

Although pest control in kiwifruit in New Zealand has been dominated by two pests there are several minor pests which occasionally have to be contended with. These minor pests include the passion vine hopper (*Scolypopa australis*); *Stathmopoda skelloni*; various mites of which the six spotted mite (*Eotetranychus sexmaculatus*) is the most significant and root knot eelworm (*Meloidogyne hapla*).

DISEASE CONTROL

Until recently fungal and bacterial diseases have had far less effect on the production and marketing of kiwifruit than have the insect pests. Consequently, the wide use of fungicides by growers is a new development.

In the past a fungicide such as captan was applied at petal fall as a protective measure against botrytis (*Botrytis cinerea*) which caused fruit rot in the orchard. Where this was more of a problem in high rainfall areas with vines trained on pergolas a short programme of a captan + benomyl mixture from petal fall to mid January was very effective.

Some blocks have had a problem with leaf spot and premature leaf fall caused by a range of fungi (*Glomerella* sp, *Alternaria* sp, *Colletotrichum* sp, *Phoma* sp, *Phomopsis* sp). However, these diseases were well contained by applications of captan and were not a major problem. A bacterial blossom rot (*Pseudomonas viridiflava*) had also been found in a number of orchards but specific control measures were not generally undertaken (Wilkie *et al* 1973). However, work is in progress on bacterial blossom rot and indications suggest that summer or autumn are the likely periods of bud infection.

Recently botrytis has become a problem as a rot of fruit in store, or in transit to export markets and has become one of the largest problems facing the industry, having a profound effect in the marketing sphere. A massive input of research effort by Plant Diseases Division, DSIR, and commercial firms will hopefully provide the answers needed for controlling this serious disease (Beever 1979). It has been shown that sclerotinia (*Sclerotinia sclerotiorum*) is present with botrytis in the orchard, and this fact must be taken into account for future control measures.

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There is very little data on the use of fungicides from the efficacy or residue angle. Some basic fungicide residue data are, however, being collected on trials laid down in 1979 (Sale 1979) and more will be available from the large scale botrytis trials in 1980.

CONCLUSION

It can be seen that the kiwifruit industry is having the predictable problems of an increase in pests and diseases of economic importance as the area of the crop increases. This is accentuated by the fact that it is a highly export orientated industry and the product must meet the stringent standards demanded by importing countries.

In the area of pest and disease control, the New Zealand kiwifruit industry is having to walk the very fine line between achieving adequate pest control for export and not exceeding the tolerances set for spray residues imposed by importing countries - a problem that is compounded by the different tolerances in the various markets.

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