A SHADEHOUSE METHOD FOR TESTING ACARICIDES
AGAINST THE EUROPEAN MITE,
PANONYCHUS ULMI (KOCH)

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Summary

A shadehouse testing method was devised to incorporate the convenience of a laboratory test with the desirable features of field tests which include exposure to U V light and weathering of spray deposits. This shadehouse method utilises unbudded Malling 9 apple rootstocks grown in pots and placed for the duration of each test in separate compartments or bins. These bins have the roof and floor area open so that the test plants are exposed to near normal outdoor conditions of humidity, rainfall and temperature. Results from tests conducted in the shadehouse using the methods described, indicate that this method offers a reliable means of assessing the probable field performance of mite control chemicals.

INTRODUCTION

ON fruit trees untreated with chemical pesticides, the European mite population is normally held at a low level by certain predatory insects and mites. Unfortunately, it is not yet practical in New Zealand to produce high yields of quality fruit without recourse to chemical pesticides and these pesticides, which destroy beneficial predator populations, must be used in the field.

Trial results obtained from leaf dip, slide dip and other laboratory methods are obtained under conditions very different from those existing in a commercial fruit orchard. Field testing following laboratory tests overcomes this objection but field testing has a number of disadvantages. These include uncertain availability of mite infested trees for test, need for destruction of fruit crop where no residue tolerance for the test chemical is approved, uncertainty of fine weather and lack of wind during spray application and the need to avoid application of all other pesticides with an acaricide effect for the duration of the test.

The purpose of this paper is to describe briefly the development of a shadehouse technique whereby up to 20 candidate acaricide chemicals, formulations or varying dosage rates, can be tested simultaneously for their effect on european mite. The system of shadehouse testing described includes facilities for producing host plants, mites for the tests and conducting the tests in the one basic structure.

EXPERIMENTAL METHODS

Shadehouse Requirements and Construction:

To allow for the effective breeding, maintenance and isolation of european mite populations the shadehouse structure must incorporate the following features: shelter from strong winds, sufficient shading and air movement to prevent shade temperatures rising above 29°C, no permanent overhead roofing so that mite populations are subjected to outdoor conditions of rainfall, sunlight, temperature and humidity. Adequate drainage for disposal of storm water and a fence or wall enclosing the shadehouse structure to prevent access by unauthorised persons are essential.

A suitable area utilising three existing walls of a disused truck loading bay was used by the author. In the absence of available facilities, three walls 3 m high built to form three sides of a rectangle with the open end facing north (southern hemisphere), would be necessary to form the shadehouse. Two sections each consisting of ten separate bench high compartments or bins must be placed permanently one against the inside face of each side wall. Each bin should measure 60 cm wide x 60 cm deep and 90 cm in height. The structure is open to the sky and the floor of each bin, which is at bench height, consists of expanded aluminium of mesh 25 x 10 mm. This allows for drainage and air circulation throughout the bin. The sides of each bin are of clear sheets of 24 oz glass and the back is formed by the 3 m high walls. A removable 'nova roof' clear plastic sheet forms the front wall of each bin. This 'nova roof' gives approximately 25% shading. A strip of 'kuralon' mesh grade 100, 60 cm wide is stretched over the open top of each section of 10 bins. This is rated to give 35% shading.

Host Plant:

Unbudded Malling 9 rootstocks potted singly in 15 cm plastic pots are very suitable for this work. Four pots are held in each bin for the duration of a test, being taken from the bin only for spray application and recording. Watering is by plastic tubing and a 'jet wet' plastic probe on the soil surface of each pot. The growth from each stock is confined to a single vertical shoot which is headed back when 38 cm above soil level. Typically this would then carry 18 to 20 leaves on a single stem. Additional potted Malling 9 rootstocks for subsequent tests are held on the floor area between the two rows of bins until required.

Mite Infestation:

To establish a mite population on the host plant a single 2.5 cm twig naturally infested with winter eggs of european mite is attached in contact with the lower leaves on the Malling 9 stock to be infested. The mite population is then allowed to build up to at least 10 motile mites on each one of 5 leaves reasonably spaced up the stem of each test plant. These 5 leaves are identified with a single stroke with a felt marker pen. These marked leaves are then observed and recorded at various times throughout the test. Each acaricide treatment is applied to 4 single pot replicates. This allows a total of 20 leaves per treatment for recording purposes.

Application of Acaricides:

Spray application is carried out indoors away from the shadehouse bin to avoid spray contamination of fittings within the shadehouse.

Orchard Pests

A Dronwal 'Master' No. 5/P pneumatic hand sprayer is used for spray application. To achieve even spray coverage each potted test plant is placed on a turntable revolving at 9.5 r.p.m. A standardised technique ensures similar spray application to each test plant which is then returned to the appropriate shadehouse bin. Both bins and pots are numbered. This ensures that pots are correctly identified with a treatment and a bin for the duration of the test.

Method of Recording:

Mortality of motile mites 24 hours after spraying is assessed by scanning the 5 marked leaves on each test plant with a 20x hand lens. Detailed counts are not required, each leaf being assessed as near complete control, some control or no apparent control. A similar assessment is repeated 5 days after spraying.

A detailed count of all live mite stages remaining on the 5 marked leaves on each test plant is carried out 12 to 14 days after spraying. The 4 plants comprising one treatment are removed from the shadehouse bin to the laboratory. The 5 marked leaves from each plant in turn are removed and placed between 2 sheets of 'armourfloat' toughened glass with leaf stems protruding. Both sides of each leaf are then scanned under a binocular microscope and motile mite stages counted before the leaf is withdrawn from between the glass sheets and discarded. The motile mite stages present on a leaf are recorded using the following scale (Slade 1966).

- 1 = No live mites
- 2 = 1 to 2 live mites
- 3 = 3 to 5 live mites
- 4 = 6 to 8 live mites
- 5 = over 8 live mites

The mean for the 5 leaves is referred to as the mite index.

Interpretation of Results:

The mite index figure arrived at 12 to 14 days after spray application must be considered in conjunction with the observations recorded 24 hours and 5 days after spraying.

A mite index below 1.5 indicates that the miticide at the dosage rate used definitely warrants further evaluation and development.

A mite index below 2.0 indicates further evaluation is certainly warranted perhaps at slightly higher dosage rates.

A mite index between 2.0 and the maximum of 5.0 can indicate one of two things.

- a. If the observations at 24 hours and 5 days both indicate poor control then no further evaluation is warranted at the dosage rate used. Further tests at considerably higher dosage rates may be necessary.
- b. If observation at either 24 hours only or at both 24 hours and 5 days indicates good control but the mite index at 12 to 14 days is between 2.0 and 5.0 then this indicates a material with good initial control of motile stages but inadequate persistence and no effect on eggs. This characteristic can be useful where a mite infestation must be controlled close to the time of harvest without leaving unacceptable spray residues in the crop. Further tests at varying dosage rates would therefore be warranted. If necessary in this situation the

detailed count can be carried out at 24 hours or 5 days from spraying instead of at the 12 to 14 day interval normally used, and the effect of a second spray to control mite hatching from eggs may be investigated.

CONCLUSIONS

Results obtained from approximately 170 separate tests carried out between 1970 and 1973 suggest that the shadehouse technique offers a reliable method for assessing the probable field performance of acaricides on apple trees. Subsequent field trials and commercial grower use of acaricides has confirmed the pattern of mite control obtained in shadehouse tests.

The information and advantages available from shadehouse testing include the following:

1. Comparisons of the performance of up to 20 different acaricides are possible under similar conditions.
2. An indication is obtained of speed of kill, persistence and ovicidal effect of the acaricide under test.
3. The effect of different dosage rates on the degree of mite control is obtained.
4. It appears probable that only acaricides which perform well in the shadehouse need be considered for further field evaluation and development.
5. Relatively uniform spray coverage eliminates a variable which occurs in even the best conducted hand sprayed field trials.
6. The method overcomes the major problem of locating sufficient numbers of naturally mite infested apple trees in an orchard suited to test work.
7. Tests can be conducted in weather conditions making field tests not possible.
8. The method could be adapted to test other aspects of acaricide use including the effects of rainfall (natural or simulated) at varying periods after spray application and the testing of mite populations for resistance to particular acaricides.

REFERENCES

- Slade, D. A., 1966. N.Z. Fruitgrowers' Federation Ltd. *Bulletin* No. 8