TESTS WITH SOME ADDITIONAL NON-MERCURIAL FUNGICIDES FOR THE CONTROL OF PINEAPPLE DISEASE

By LETITIA E. MITCHELL-INNES and G. M. THOMSON
South African Sugar Association Experiment Station, Mount Edgecombe

ABSTRACT

The results of screening trials with non-mercurial fungicides for use in the pre-planting treatment of sugarcane setts are described. Laboratory and field trials have shown a number of these compounds to be promising as a means of preventing infection by *Ceratocystis paradoxa,* the causal agent of pineapple disease.

Introduction

Further screening trials have been carried out in attempts to find suitable replacements for mercurial fungicides when registration of the latter is withdrawn. At this stage only one such product, Benlate, has been registered for use in sugarcane, but in this latest batch of products there are a number which show considerable promise.

Methods and materials

Screening trials

The methods employed in the present series of screening trials were essentially the same as those described in an earlier report (Mitchell-Innes and Thomson[1]). Both laboratory and field trials were carried out to assess the performance of compounds supplied by various commercial companies as pre-plant fungicides for sugarcane. The methods of testing are summarized as follows:

Laboratory test No. 1

Wells were made in thick potato dextrose agar (PDA) plates by means of a sterilized cork borer (8 mm diameter). The agar plates were then inoculated with the pineapple disease pathogen *Ceratocystis paradoxa* either centrally, or at four separate points in plates prepared with single, central wells. On the following day the fungicide and control solutions were prepared and pipetted into the wells. Controls consisted of sterile water, a 6% organo-mercurial fungicide and Benlate. The test products were prepared at three or four concentrations. After seeding with the fungus and application of the fungicide the agar plates were incubated at 27°C for 2 to 3 days after which the degree of fungicidal and fungistatic activity was assessed.

Laboratory test No. 2

This test involved the use of sugarcane setts which were treated with fungicide solutions before being inoculated with the pineapple disease pathogen. Two-budded setts of the variety NCo 376 were cut and then immersed in the respective fungicide preparations for 5 minutes. A spore suspension of *Ceratocystis paradoxa* was prepared from PDA cultures using distilled water, and sprayed on to the cut and treated ends of each sett. The setts were sealed into plastic bags and incubated at 28°C for 10 days. In the untreated controls setts were dipped in water before being sprayed with the spore suspension. After the 10-day incubation the setts were removed for examination. Ratings were awarded for degree of infection by pineapple disease, and also for root and shoot development, since severe infections by *Ceratocystis paradoxa* inhibit the formation of roots and shoots.

Field test

Plot size was a single row, 4,0 m long, in which ten 3-budded setts of the variety NCo 376 were planted. The design was a randomized block with three replications. Freshly-cut setts were dipped in the prepared concentrations of the test products and allowed to drain before being sprayed with a heavy spore suspension of *Ceratocystis paradoxa.* The setts were then planted with the minimum of delay.

Regular germination counts were made from the fourth week after planting. After 15 weeks the plants were unearthed and the following observations made:

(i) number of buds germinated;
(ii) total number of shoots, i.e. primary shoots and tillers;
(iii) degree of sett-rotting caused by pineapple disease infection.

Controls for this experiment were as follows:

(i) setts treated with Aretan at the recommended concentration (3,0 g/l);
(ii) setts treated with Benlate at the recommended concentration (0,5 g/l);
(iii) freshly-cut setts inoculated with pineapple disease before planting;
(iv) freshly-cut setts planted without inoculation;
(v) setts hot water treated (50,5°C for 2 hours) and inoculated before planting;
(vi) setts hot water treated (50,5°C for 2 hours) and planted without inoculation.

Results

In this latest series of tests eight products were screened in laboratory and field trials. The majority of them showed considerable merit in relation to the mercurial fungicides now in use. The information set out in Table 1 refers to laboratory trials and indicates the relative effectiveness of the various compounds at the optimum concentration in each case. Assessments of the degree and quality of root and shoot development as observed in the plastic bag tests are also included.

TABLE 1

Summarized results of laboratory tests with fungicides

Product	Disease rating at optimum concentration	Root growth	Shoot growth
Acticide	3–4	fair	fair–poor
Bavistin	2	good	good
Dam	3	good	good
Dam + Dexon .	3	good	good
NF 48	3	good	good
Topsin 44 ..	2	good	good
RH 893	4–5	fair–poor	fair
Tecto 40	3	fair	fair
TBZ..	3	fair	fair
Aretan	4	good	fair–good
Benlate	2–3	good	good
Water	8–9	v. poor–nil	nil

Disease rating 0 = no infection
9 = severe infection

The field trial results are summarised in Table 2 and show a wide range of fungicidal activity among the various products, a number of which are apparently superior to the mercurial control. NCo 376 is affected badly by hot water treatment, and some of the results must be viewed in the light of this problem. However, it seems possible that hot water treated setts are more susceptible than untreated setts to infection by *Ceratocystis paradoxa.*

TABLE 2

Per cent germination and shoot production following fungicidal treatment and inoculation of cane setts with Ceratocystis paradoxa

Product/Concentration	% Germination	Mean No. shoots per plot
Topsin 44 .. 6,25 g/l	53	22
NF 48 .. .. 4,3 g/l	52	24
Bavistin.. .. 0,6 g/l (cold) ..	51	27
Acticide.. .. 25,0 ml/l	48	18
Dam .. .. 2,0 g/l	48	23
Dam .. .. 1,0 g/l	48	21
Acticide.. .. 33,0 ml/l	47	25
Tecto 40 .. 2,75 ml/l (cold)	43	17
Dam + Dexon 2,0 g/l	43	17
NF 48 .. .. 6,25 g/l	42	20
Bavistin.. .. 0,6 g/l (HW) ..	41	24
RH 893.. .. 2,0 ml/l	41	16
Topsin 44 .. 4,3 g/l	40	17
Dam + Dexon 1,0 g/l	38	17
RH 893.. .. 1,0 ml/l	36	15
Tecto 40 .. 2,20 ml/l (cold)	32	11
TBZ .. .. 2,20 ml/l (cold)	29	13
TBZ .. .. 2,75 ml/l (cold)	26	8
Tecto 40 .. 1,10 ml/l (HW)	24	12
Tecto 40 .. 1,375 ml/l (HW)	18	9
TBZ .. .. 1,375 ml/l (HW)	13	7
TBZ .. .. 1,10 ml/l (HW)	4	2
Aretan .. .. 3 g/l..	47	20
Benlate .. .. 0,5 g/l (cold) ..	48	21
Benlate .. .. 0,5 g/l (HW) ..	29	15
Control.. .. cold — not inoc.	42	17
Control.. .. cold — inoc. ..	19	7
Control.. .. HW — not inoc.	23	12
Control.. .. HW — inoc. ..	1	< 1

Discussion

The following assessments were made of the products screened in this series of tests.

Acticide

In agar plate tests all four concentrations used (50,0, 33,0, 25,0 and 20,0 ml/litre) produced wide zones of inhibition which after several days showed very little indication of mycelial regrowth. Both freshly-mixed and stored preparations behaved equally well and the product compares favourably with Benlate. In the field trial the two concentrations tested were 33,0 ml/litre and 25,0 ml/litre. Both gave results comparable with those of Benlate and better than those of Aretan. The final shoot population in the higher-concentration treatment was particularly good.

Bavistin

Bavistin shows very considerable promise at a concentration of 0,6 g/litre. The product was as effective as Aretan and Benlate and the results are similar to those in other countries, notably Hawaii, where Bavistin has been rated equal to, and in some cases better than Benlate. In the field trial Bavistin performed very well as a cold dip and when added to the hot water treatment bath showed superiority over hot Benlate. Root and shoot growth was very good in the plastic bag test and in the field trial.

Dam

This product was tested at concentrations of 2,0 g and 1,0 g/litre, both of which gave good results similar to those obtained with Aretan and Benlate. The pineapple disease pathogen was well controlled at both concentrations and the fungicide maintained its activity well after 10 days. Dam gave good results in the field, cane germination being fractionally better than that obtained with Aretan and equal to that obtained with Benlate. Root and shoot development was good in both the laboratory test and in the field trial. When used in combination with Dexon, another product from the same company, results were less promising than those obtained with Dam alone.

NF 48 and Topsin 44

These two products are closely related chemically but differ in the concentration of active ingredient. Both performed very well. Test concentrations used in the laboratory and field were 6,25 g and 4,3 g per litre. Both compared well with Aretan and Benlate in the laboratory tests with no mycelial regrowth over the inhibition zones in the agar plate trials. In the field trial Topsin 44 at 6,25 g/litre produced the best germination results (53%), followed closely by NF 48 (52%). Development of roots and shoots was also very good with both products.

RH 893

In laboratory trials RH 893 performed well but not as effectively as Aretan or Benlate. Of the four concentrations tested (4,0, 2,0, 1,0 and 0,5 ml/litre) the highest appeared to suppress root and shoot growth, while the 2,0 ml/litre concentration seemed to give adequate control of pineapple disease.

Tecto 40 and TBZ

These are liquid formulations which in agar plate tests seemed to be as effective as the Aretan and Benlate controls. In the laboratory tests making use of the plastic bag technique disease control was good with Tecto 40 being the superior product. In the field trial, however, neither of these standards was maintained although Tecto 40 at 2,75 ml/litre performed fairly well. Both products gave very poor results when used in the hot water bath.

Products still in the early stages of testing

A number of fungicides submitted for screening have received preliminary assessments based on laboratory tests only and may or may not be carried forward into field trials at a later date. This group includes the following:

DS 9073

In initial laboratory trials DS 9073 has performed well and although superior to Aretan does not appear to be as effective as Benlate. The concentrations tested were 35,0, 25,0 and 17,5 ml/litre. Stored preparations retain their effectiveness provided they are well mixed before re-use. In plastic bag tests good disease control was obtained and root and shoot growth was adequate. The manufacturers report the possibility of phytotoxicity with this product, especially to wound tissue.

Fongorene 80

Fongorene 80 appeared to be superior to Aretan and Benlate in agar plate tests at all three concentrations used (12,5, 6,25 and 3,125 g/litre). It appeared to suffer very little deterioration in storage. Root and shoot development of setts in plastic bags was not particularly good but this product will probably be considered for inclusion in a field screening trial.

Panoctine

Initially Panoctine at concentrations of 100 and 500 ppm a.i. compared favourably with Aretan and Benlate, but the pineapple disease fungus soon overcame any fungistatic effects on the agar plates.

Root and shoot development of treated cane in plastic bags was good at both concentrations.

SN 41703

This product has not proved very successful in pineapple disease control in laboratory tests and its inclusion in field tests does not seem to be warranted at this stage.

Conclusions

Although the registration of mercurial fungicides is likely to be withdrawn in mid 1974, the availability of tested products such as Benlate will ensure that cane growers can continue to combat pineapple disease economically and effectively. A number of more recently available products have now shown promise, and it seems likely that within a few years there will be a choice of at least three non-mercurial fungicides with which to treat seedcane for planting.

REFERENCE

1. Mitchell-Innes, L. E. and Thomson, G. M. (1973). A new fungicide for the pre-planting treatment of sugarcane setts. SASTA Proc. 47 : 181-184.