RESEARCH REPORTS

Assessment of prochloraz fungicide as a sett treatment for the control of pineapple disease of sugar cane

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Summary

A 45% EC formulation of prochloraz was examined as a sett treatment to control pineapple disease of sugar-cane cuttings at planting. In field trials, a range of concentrations were examined and compared with several commercial treatments. Although several concentrations were found to be effective sett treatments, prochloraz at 0.0126% a.c. is recommended as a commercial treatment.

Introduction

Pineapple disease, caused by *Ceratocystis paradoxa* (Dade) C. Moreau, is a major fungal disease of newly planted sugar-cane cuttings in most sugar-producing countries of the world (Wismer 1961). The fungus penetrates the cuttings (setts) through the ends or damaged rind and a diagnostic odour similar to over-ripe pineapples is usually obvious during the early stages of rotting. Setts attacked by *C. paradoxa* either fail to germinate or produce weakened shoots and roots. Severe outbreaks result in poor crop establishment and necessitate costly replanting (Wismer 1961).

Under commercial conditions the disease has been controlled by treating setts with fungicides at planting and, for many years, organomercurial fungicides have been used in Queensland (Hughes and Christie 1949). Benomyl and carbendazim are also registered for use as sett treatments in Queensland but are not widely used. The possibility that organomercurial fungicides might be withdrawn from sale prompted investigations to find alternative chemical treatments. From these investigations, triadimefon and propiconazole have been found to be satisfactory alternatives, and have now been registered (Ricaud 1972; Ryan *et al.* 1983; Taylor and Ryan 1984).

During field-screening trials at the Bureau of Sugar Experiment Stations' Pathology Farm, Brisbane, the fungicide prochloraz [N-propyl-N-(2-(2,4,6-trichlorophenoxy)ethyl)-imidazole-1-carboxamide] sold under the trade name Sportak by Schering Pty Ltd, produced results for the control of pineapple disease similar to the organomercurials. This paper details the results obtained from these screening trials and from a trial on Bundaberg Sugar Experiment Station to assess the performance of prochloraz under conditions similar to commercial practice.

Materials and methods

Field-screening trials were carried out in 1982, 1983 and 1984 at the Bureau of Sugar Experiment Station's Pathology Farm, Brisbane. The efficacy of prochloraz as a sett treatment was compared with fungicides proven to control pineapple disease under commercial conditions. The fungicides were organomercurials (Aretan 6, ICI Australia Pty Ltd and Shirtan 120®, CFL Australia Pty Ltd), benomyl (Benlate, Du Pont Australia Ltd) and triadimefon (Bayleton, Bayer Australia Ltd). The formulation and concentration of each fungicide used in the trials are shown in Table 1. In these trials the organomercurials and benomyl and triademefon were used at the recommended rate. Two formulations of organomercurial fungicides, which have the same active ingredient (methoxy ethyl mercuric chloride), were used in these trials. Previous experiments have shown that the effectiveness of the active ingredient was not influenced by formulation (Ryan, unpublished data). The objective of the 1984 dose response trial was to determine the minimum concentration of prochloraz that was as effective as the commercial treatment.

In the field-screening trials, setts were immersed in a solution of fungicide or water for 30 sec, air-dried, and the cut ends of the setts inoculated with a spore suspension of *C. paradoxa*. Cultures of the fungus were initiated from a range of isolates from various cane-growing areas of Queensland. Inoculum was obtained by growing cultures on potato dextrose agar in glass Petri dishes at 28°C in the dark for approximately 4 weeks. A spore suspension of approximately 10^6 spores ml^{-1} was obtained by adding a small amount of distilled water to each plate and scraping the colony with a scalpel. The fungal suspension was then filtered through terylene before being applied by a hand atomizer to the cut ends of setts.

Each treatment was replicated five times and arranged in a completely randomized block design. Each experimental unit contained 15 two-eye setts of the cultivar Pindar. Setts were planted manually with the buds horizontal under 10 cm of soil. All trials were planted in the first 2 weeks of June in each year, this being a cooler part of the year which is unfavourable for rapid bud germination but favours the development of pineapple disease (Wismer 1961).

The number of shoots to emerge was recorded at weekly intervals until tillering prevented differentiation of primary shoots and tillers. Analysis of variance was performed on the log transformation of the areas under the shoot emergence curves. The area under the shoot emergence curves is a function of the number of shoots emerged and the time from planting to emergence. For each trial, two inspection dates were selected and the area under the shoot emergence curves up to those dates was used to compare treatments.

Additionally, a field trial was conducted in 1984 at the Bundaberg Sugar Experiment Station to assess the efficacy of prochloraz under simulated commercial conditions using two different planting systems, viz. a billet planter and a trash planter. Experience has shown that there is a tendency for more damage to occur to cuttings in

Table 1 Effect of benomyl, two formulations of organomercurial fungicide, triadimefon, and various concentrations of prochloraz on shoot emergence from sugar-cane setts which were inoculated with *Ceratocystis paradoxa*

Means followed by a common letter for each column are not significantly different ($P \leqslant 0.05$)

Treatment	Area under shoot emergence curve[A]					
	1982		1983		1984	
	91 days	133 days	92 days	127 days	86 days	124 days
Benomyl, 50% WP, 0.03% a.c.	3.30a	5.68a	4.58a	6.06a	3.72b	5.81bcd
Organomercurial (Aretan), 6% soluble; 0.015% a.c.	2.84a	5.03a	4.28a	5.76a	NI[B]	NI
Organomercurial (Shirtan), 12% liquid; 0.015% a.c.	NI	NI	NI	NI	4.82a	6.23a
Triadimefon, 10% EC; 0.0125% a.c.	3.26a	5.45a	NI	NI	NI	NI
Triadimefon, 12.5% EC; 0.0125% a.c.	NI	NI	4.90a	6.18a	NI	NI
Prochloraz, 45% EC; 0.075% a.c.	NI	NI	4.87a	6.12a	NI	NI
Prochloraz, 45% EC; 0.050% a.c.	2.47a	5.16a	5.08a	6.32a	NI	NI
Prochloraz, 45% EC; 0.025% a.c.	NI	NI	4.83a	6.19a	NI	NI
Prochloraz, 45% EC; 0.0126% a.c.	NI	NI	4.27a	5.85a	3.50b	5.79bcd
Prochloraz, 45% EC; 0.0063% a.c.	NI	NI	NI	NI	3.95ab	6.09ab
Prochloraz, 45% EC; 0.0032% a.c.	NI	NI	NI	NI	2.50cd	5.37e
Prochloraz, 45% EC; 0.0016% a.c.	NI	NI	NI	NI	3.56b	5.91abc
Prochloraz, 45% EC; 0.0008% a.c.	NI	NI	NI	NI	3.40bc	5.53de
Prochloraz, 45% EC; 0.0004% a.c.	NI	NI	NI	NI	3.08bc	5.59cde
Control (water)	0.79b	2.31b	1.04b	4.13b	1.97d	4.79f

[A] Function of number of shoots emerged and time from planting to emergence.
[B] NI, treatment not included in trial.

Table 2 Effect of an organomercurial fungicide and two concentrations of prochloraz on bud germination from sugar-cane setts treated by billet- and trash-planting systems

Treatment	% bud germination at 103 days	
	Billet planter	Trash planter
Organomercurial, (G. F. Tan), 6% soluble; 0.015% a.c.	54.4b	67.8a
Prochloraz, 45% EC; 0.0126% a.c.	52.8b	62.5a
Prochloraz, 45% EC; 0.0063% a.c.	42.2c	63.7a
Control (water)	3.8e	31.1d

Means followed by a common letter for both planting systems are not significantly different ($P \leqslant 0.05$).

the billet-planting system. In this trial, two rates of prochloraz (0.0126 and 0.0063% a.c.) and an organomercurial (methoxy ethyl mercuric chloride; G. F. Tan, General Fertilizers Ltd) at the recommended rate were applied to setts at planting (Table 2). The basis for selecting these rates was that the highest concentration of prochloraz was found to be as effective as commercial treatments in controlling pineapple disease in the 1983 screening trial and half this rate was included to test whether it was effective. Setts were not artificially inoculated because soils in this area are known to be naturally infested with *C. paradoxa*.

There were five replications of each treatment arranged in a randomized split plot design for both the billet- and trash-planted sections of the trial. Each experimental unit consisted of a row, 40 m in length of the cultivar Q111 of which the central 30 m was sampled. Setts were planted in May 1984 at a time likely to favour disease development. At tillering, the setts were recovered and the total number of buds on the setts was recorded. The number of buds per plot was used to calculate the percentage bud germination. A bud was regarded as germinated when it was 2 cm long. Weekly shoot counts (Taylor, unpublished data) indicated that, at tillering, some shoots were still emerging. A sample of some of the setts from all treatments which had not germinated were examined visually to see whether they were infected with the pathogen. In every instance, characteristic symptoms of the disease were observed in non-germinated setts. An analysis of variance was performed on the percentage of germinated buds.

Results and discussion

Results from the field-screening trials are presented in Table 1. In the screening trials in 1982 and 1983, prochloraz at concentrations of 0.075%, 0.05%, 0.025%, and 0.0126% a.c. was as effective as a sett treatment as was benomyl, the organomercurial fungicide (Aretan) and triadmefon. In the 1984 trial, very low concentrations of prochloraz (0.0126%, 0.0063%, 0.0032%, 0.0016%, 0.0008% and 0.0004% a.c.) produced a result comparable to benomyl, and prochloraz treatments at 0.0063% and 0.0016% a.c. were not significantly different from the organomercurial fungicide (Shirtan). This indicates that the treatments were in the plateau region of the dose response relationship. The cause of the relatively low shoot emergence obtained in the 0.0032% a.c. prochloraz treatment at 86 days is not known. In the field trial at Bundaberg in 1984 (Table 2), prochloraz at 0.0126% was as effective in sett treatment as the recommended organomercurial fungicide treatment in either the billet- or trash-planting systems.

From the studies reported in this paper, prochloraz at 0.0126% a.c. is recommended as a commercial canesett treatment as this concentration provides a satisfactory safety margin. The unexpected result from very low rates of prochloraz indicates that similar studies are required with other recommended sett treatments.

Acknowledgments

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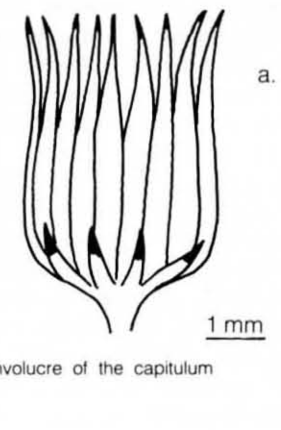
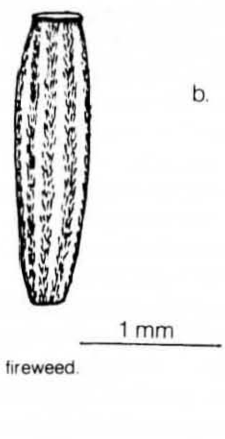
Erratum

On page 166 of *Plant Protection Quarterly* Volume 1(4), scale lines were accidentally omitted from Figure 4 of the paper 'The ecology and control of fireweed (*Senecio madagascariensis* Poir.)' by B. M. Sindel. The correct diagram is shown here.



(*a*) Involucre of the capitulum



(*b*) achene of fireweed.