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INSECTICIDES TO CONTROL SORGHUM MIDGE CONTARINIA SORGHICOLA (COQ.)

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SUMMARY

To determine a suitable alternative insecticide to DDT for control of sorghum midge, *Contarinia sorghicola* (Coq.), trials were conducted on the Darling Downs in Queensland during 1969–71. Seven insecticides (including DDT) were applied as high volume sprays at 3- to 4-day intervals during the crop flowering period. Efficacy was assessed in terms of percentage seed set.

In a screening trial, monocrotophos, diazinon and carbaryl showed promise as suitable alternatives to DDT and were carried through to dosage level trials. Maldison, demeton-S-methyl and dimethoate were ineffective.

Monocrotophos at 280 g ha^{-1} active constituent (a.c.) was the most efficacious material but was not immediately recommended for general use following reports of phytotoxicity in other sorghum trials in Queensland. The next most efficacious material, diazinon, also used at 280 g ha^{-1} (a.c.) has become a general recommendation for midge control in Queensland.

I. INTRODUCTION

The sorghum midge, *Contarinia sorghicola* (Coq.), is the most serious pest of grain sorghum in Queensland. The adoption of cultural procedures as means of avoiding infestations has been suggested by Atherton (1941), Sloan (1945), Officers of the Department of Agriculture and Stock (1951) and Passlow (1955) who also recommended the use of DDT when infestations occurred. Although the control achieved with DDT remains satisfactory, its use is now actively discouraged because of the possibility of hydrocarbon residues in the grain and stubble of this valuable animal food crop (Waite and Passlow 1971).

A series of trials designed to determine a suitable alternative insecticide was conducted on the Darling Downs during 1969–71.

II. MATERIALS

The following insecticides were used—

DDT—an emulsion concentrate containing 25% w/v p.p' isomer (trials 1 and 3)
—an emulsifiable concentrate containing 25% w/v p.p' isomer (trial 2)

diazinon—an emulsifiable concentrate containing 80% w/v active constituent (trials 1 and 2) and 20% w/v (trial 3) monocrotophos—an emulsifiable concentrate containing 60% w/v active constituent

carbaryl—a dispersible powder containing 80% w/v active constituent

demeton-S-methyl—an emulsifiable concentrate containing 25% w/v active constituent

maldison—an emulsifiable concentrate containing 103% w/v active constituent

dimethoate—an emulsifiable concentrate containing 30% w/v active constituent

III. METHODS

Trial 1, a screening test conducted during 1969, was set out as an 8 x 3 randomized block with a plot size of one row 20 m long. Untreated guard rows alternated with plot rows.

Trials 2 and 3, dosage levels tests, were conducted during 1970 and 1971 respectively, each being set out as a 12 x 3 randomised block. The plot size and guards in trial 2 were as in trial 1. In trial 3, the plots were 3 rows of crop each 20 m long without guard areas, all data being taken from the middle row.

The plots were inspected at 3- to 4-day intervals throughout the susceptible period and midge populations assessed on five flowering heads per plot.

Sprays were applied when populations exceeded 5 midge per head in trials 1 and 3. In trial 2, high populations did not eventuate and sprays were applied at an infestation level of 2 to 3 midge per head. Spraying dates were:—

Trial 1—11, 14, 18 and 21 March, 1969

Trial 2—6, 9 and 23 March, 1970

Trial 3—1 March, 1971

The application rates were 730 1 ha^{-1} in trials 1 and 2 and 340 1 ha^{-1} in trial 3.

Results were assessed in terms of percentage seed set and grain yield.

The percentage seed set was calculated from counts of florets which had produced seed and which had been ruined by midge attack. All florets from four spikelets on each of 10 heads per plot in trials 1 and 2, and 12 heads in trial 3, were examined to obtain these data. The spikelets were selected to represent stages in flowering, from upper to lower head positions.

The number of florets per spikelet varied from 4 to 150 depending on head position, spikelets with the greater number of florets being found at the lowest head position and with the lesser number at the tip.

In trials 1 and 2, crop development was uniform, therefore the heads from which spikelets were taken were selected at random on the dates of sampling—13 May 1969 and 23 April 1970 respectively. Crop development in trial 3 was irregular. To achieve uniformity therefore, heads susceptible to midge attack were marked at the time of spray application and the spikelets sampled on 20 April 1971.

All heads in a central 16·5 m of datum row per plot were harvested on 20, 19 and 24 May in trials 1, 2 and 3 respectively. After threshing, grain yields were recorded.

IV. RESULTS

Midge populations in trial 1 consistently exceeded five per head and on some heads exceeded 50 at the dates shown for spray applications. In trial 2, sprays were applied to midge populations of 2 to 3 per head. During the remainder of the flowering period few midge were noted. A population level of six midge per head was recorded on the treatment date in trial 3 but no further infestation occurred.

The results from trial 1 are shown in table 1 and those from trials 2 and 3 in table 2.

Yields are given as the mean grain weights per plot and the seed set data for trials 1 and 3 were calculated as the mean percentage seed set of all spikelets. The data for trial 2 were calculated as percentages on a plot basis. Analysis of data from trial 2 was not warranted.

TABLE 1

TRIAL 1—PERCENTAGE SEED SET AND YIELD PER PLOT

Treatment	Dosage Rate g ha^{-1} (a.c.)	Seed Set %	Yield kg $plot^{-1}$
monocrotophos	560	69·82	5·23
DDT	1 120	67·75	6·02
carbaryl	1 120	58·19	4·85
diazinon	280	58·09	4·48
demeton-S-methyl	280	29·52	2·60
dimethoate	210	28·44	2·37
maldison	560	26·06	2·32
Check	..	18·67	1·51
Necessary differences for significance 5%	..	10·86	1·29
Necessary differences for significance 1%	..	15·07	1·80

TABLE 2

TRIALS 2 AND 3—PERCENTAGE SEED SET AND YIELD PER PLOT

Treatment	Dosage Rate g ha^{-1} (a.c.)	Trial 2		Trial 3	
		Seed Set %	Yield g $plot^{-1}$	Seed Set %	Yield g $plot^{-1}$
carbaryl	1 120	68·1	2 046	36·82	1 264
	560	70·7	2 567	38·47	1 000
	280	67·1	2 199	35·57	915
diazinon	280	78·1	2 046	43·60	1 047
	140	60·2	1 876	37·99	1 009
	70	71·1	2 547	33·97	1 075
monocrotophos	280	75·9	1 670	58·73	1 094
	140	73·5	3 178	37·52	868
	70	68·5	2 773	34·56	849
DDT	560	81·1	3 339	54·64	1 198
Check (Mean of 2)	..	71·4	2 754	33·93	840
Necessary differences for significance					
Among treatments 5%	..	..	..	14·17	450
1%	..	..	..	19·23	611
Treatments V check 5%	..	..	..	12·27	390
1%	..	..	..	16·66	529

V. DISCUSSION

The results of the screening trial indicated the potential of monocrotophos, diazinon and carbaryl as alternatives to DDT for the control of sorghum midge. At the dosage rates employed, the remaining insecticides tested were shown to be unsuitable.

The infestation during flowering in trial 2 was light. On three occasions, populations of two to three midge per head were noted and sprays applied. However, relatively little grain loss occurred and any differences among plots were not related to treatments. The results confirm the statement (Passlow 1960) that a population of two females per head does not warrant spraying.

In trial 3, the seed set data show that midge control following applications of monocrotophos 280 g ha^{-1} or diazinon 280 g ha^{-1} was not significantly different from that following DDT 560 g ha^{-1} application although the monocrotophos result was statistically better than the diazinon. The yield data show that carbaryl at 1 120 g ha^{-1} treated plots yielded significantly better than check plots although not significantly different from other plots. As the variabilities of plant density and crop development were not taken into account, this result is not regarded as a reliable indicator of midge control.

Although monocrotophos was shown to be the more efficacious insecticide, it has recently been implicated in phytotoxic effects (T. Passlow, personal communication). Therefore, its general use cannot be recommended until varietal relationships to phytotoxicity in sorghum are examined. No phytotoxic effects were recorded in the trials on the Darling Downs.

The commercial use of both monocrotophos and diazinon has confirmed the validity of the conclusions drawn from these trials.

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