# INSECTICIDAL CONTROL OF SORGHUM MIDGE, *CONTARINIA SORGHICOLA* (Coq.)

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## SUMMARY

**On the Darling Downs and in the Callide Valley during 1951-1956, 8 field trials were carried out using insecticides against sorghum midge,** *Contarinia sorghicola* (Coq.).

**Trial results, and consequent commercial practice, demonstrate that spraying at flowering with DDT (1 lb/ac in not less than 15 gal) in well-grown crops is economically sound when midge populations exceed 6 females per head. When swarm populations are present the save is 50–60 per cent.**


## I. INTRODUCTION

*Contarinia sorghicola* (Coq.), although first recorded in Queensland in 1894 (Tryon), was not of economic importance until the introduction of dwarf sorghum varieties resulted in a considerable expansion in the acreage sown for grain production. Cultural controls were discussed by Atherton (1941), Sloan (1945) and Officers of the Department of Agriculture and Stock (1951), and by Passlow (1955), who stated that the use of DDT in a well-grown crop when pest populations are high may result in a 50–60 per cent. save. The trials on which this recommendation was based, and later trials, are recorded in this paper.

## II. MATERIALS

The following insecticides were used:—

*BHC.*—A dispersible china clay powder containing 6·5 per cent. gamma isomer.

An emulsifiable preparation containing 6·5 per cent. gamma isomer.

*Chlordane.*—A kaolin dust containing 2 per cent. active ingredient.

*DDD.*—An emulsion concentrate containing 20 per cent. w/v $\rho.\rho'$ isomer (30 per cent. w/v technical).

*DDT.*—A kaolin dust containing 2 per cent. $\rho.\rho'$ isomer.

An emulsion concentrate containing 25 per cent. w/v $\rho.\rho'$ isomer.

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*Dieldrin.*—An emulsifiable preparation containing 15 per cent. w/v active ingredient.

*Endrin.*—An emulsifiable preparation containing 20 per cent. w/v active ingredient.

*Parathion.*—An emulsifiable preparation containing 25 per cent. w/v active ingredient.

*Toxaphene.*—A kaolin dust containing 2 per cent. active ingredient.

## III. METHODS

Trial 1 was set out as 9 × 3 randomized block with plot size of 11 ft × 4 ft; Trials 2–5 were 5 × 5 latin squares with plots of 1/80 ac; and Trials 6–8 were randomized blocks of 1/100 ac. Pest populations were assessed by counting the females in random samples of at least 10 heads per plot. Degrees of flowering were estimated from counts of not less than 50 stems per plot (except Trial 1).

In Trial 1, insecticides were applied with a hand atomizer and a duster to give thorough coverage of the heads and of "throats" from which heads had not yet emerged. In the other trials a knapsack was used: application rates per acre were 40 gal in Trials 2–5, 100 gal in Trials 6 and 7, and 50 gal in Trial 8.

Trials 2–5 were designed to investigate efficacies of DDT treatments when used as one or two applications either early or late in the flowering period. In Trials 6–8 spraying was carried out as indicated by pest population assessments. Further relevant details, including insecticide strengths expressed as active ingredients, are given with the results.

Harvests were complete except in Trial 2, where every fifth head only was taken. Stand counts were made in all plots, and in those trials where the regression of yield on number of heads was positive adjusted yields based on an equal number of heads per plot were calculated. Yields are expressed in the economic unit of bushels per acre.

## IV. RESULTS

### (a) Trial 1—Screening, 1951

Insecticides were applied to a crop of the variety Martin at Mt. Tyson, Darling Downs, on March 3, when 75 per cent. of stems had produced heads and 60 per cent. of the crop was at or past anthesis. A midge population of 50–60 females per head was present. The trial was harvested on May 7, and results are given in Table 1.

**TABLE 1**

TRIAL 1: HEADS PER PLOT AND YIELDS

| Treatment | Mean Number of Heads per Plot | Yield (bus./ac) | |
|---|---|---|---|
| | | Observed | Adjusted |
| BHC 0·1% emulsifiable spray .. .. .. | 47·0 | 27·9 | 28·3 |
| DDT 2·0% dust .. .. | 57·7 | 19·3 | 16·3 |
| Chlordane 2·0% dust .. | 53·0 | 18·1 | 16·6 |
| Toxaphene 2·0% dust .. | 50·0 | 17·7 | 17·1 |
| DDT 0·1% spray .. | 41·3 | 16·3 | 18·6 |
| Parathion 0·015% spray | 48·3 | 13·5 | 13·5 |
| Checks—mean of three .. | (45·7) | (11·8) | (12·7) |
| Necessary differences for significance .. 5% | 20·3 | 9·8 | 7·7 |
| Necessary differences for significance .. 1% | 27·6 | 13·5 | 10·5 |

The excessive BHC application resulted in practically complete control, and provides a base for estimating percentage save.

## (b) Trials 2 to 5—DDT Levels, 1951

Immediately prior to sprayings flowering was assessed, and relevant data are given in Table 2.

**TABLE 2**

TRIALS 2–5: FLOWERING

| Trial | Stems with Heads Emerged (%) | | Stems with Heads At or Past Anthesis (%) | |
|---|---|---|---|---|
| | At 1st Applic. | At 2nd Applic. | At 1st Applic. | At 2nd Applic. |
| 2 .. .. | 44·75 | 67·75 | 18·0 | 45·5 |
| 3 .. .. | 75·5 | 86·0 | 48·5 | 76·5 |
| 4 .. .. | 91·0 | 95·5 | 62·0 | 91·5 |
| 5 .. .. | 61·5 | 100·0 | 24·5 | 87·0 |

Trials 2 and 3 were adjacent in a field of Martin at Mt. Tyson and sprays were applied on February 24 and 27 in Trial 2, and on February 28 and March 5 in Trial 3. Few midges were noted on February 21 but on February 24 an average of 6 females per head was recorded. The population increased steadily to a peak of more than 50 per head (a swarming population) on March 5, and decreased rapidly to 6 females per head on March 8.

Trial 4 was in a field of Alpha at Mt. Tyson and insecticide was applied on March 2 and 8. Pest population was low prior to March 1, when very high numbers were recorded: this high population was present until the bulk of flowering had occurred.

Treatments were applied in Trial 5, in Plainsman at Biddeston, Darling Downs, on March 8 and 15. Pest numbers were 2 females per head during the application period.

Trials 2 and 3 were harvested on May 8–10, Trial 4 on May 14, and Trial 5 on May 21: results are set out in Tables 3 and 4.

**TABLE 3**

TRIALS 2 AND 3 : YIELDS

| Treatment | Trial 2 | | Trial 3 | |
|---|---|---|---|---|
| | Mean Yield (oz/100 heads) | Yield (bus./ac) | No. of Heads per Plot | Yield (bus./ac) |
| DDT emulsion 1 lb/ac in two applications | 51·2 | 22·6 | 557 | 23·20 |
| DDT emulsion 1 lb/ac in one application | 50·7 | 22·4 | 573 | 19·80 |
| DDT emulsion ½ lb/ac in two applications | 49·4 | 21·8 | 525 | 19·38 |
| DDT emulsion ½ lb/ac in one application | 45·6 | 20·1 | 593 | 20·55 |
| Check .. .. .. .. .. | 24·2 | 10·7 | 565 | 12·08 |
| Necessary differences for significance (1%) | 20·2 | | No significant differences | 5·68 |

**TABLE 4**

TRIALS 4 AND 5 : YIELDS

| Treatment | Trial 4 | | | Trial 5 | | |
|---|---|---|---|---|---|---|
| | No. of Heads per Plot | Yield (bus./ac) | | No. of Heads per Plot | Yield (bus./ac) | |
| | | Observed | Adjusted | | Observed | Adjusted |
| DDT emulsion 1 lb/ac in two applications | 623 | 25·4 | 27·1 | 363 | 19·5 | 18·4 |
| DDT emulsion 1 lb/ac in one application | 641 | 24·7 | 25·6 | 332 | 20·4 | 21·0 |
| DDT emulsion ½ lb/ac in two applications | 673 | 23·6 | 23·0 | 332 | 19·7 | 20·3 |
| DDT emulsion ½ lb/ac in one application | 695 | 24·3 | 22·7 | 341 | 17·9 | 17·9 |
| Check .. .. .. .. .. | 669 | 15·0 | 14·6 | 343 | 19·7 | 19·7 |
| Necessary differences for significance 5% | 60 | 3·1 | 1·5 | No significant differences | | |
| Necessary differences for significance 1% | 84 | 4·4 | 2·1 | | | |

These results indicate that when pest populations are high, DDT application may double yields. In these trials, however, the best yields obtained were not more than 50–60 per cent. of those which would have been obtained in the absence of midges. One application was efficacious and within limits, as in Table 2, percentage flowering was not critical so far as timing was concerned during the period of high pest population.

A population of 2 females per head does not warrant spraying (Trial 5).

### (c) Trials 6 to 8

Trial 6 was established at Bongeen, Darling Downs, in Martin which carried a population of 0–6 females per head on the treatment date; at no stage was the pest population severe. All insecticides were applied on March 22–23, 1954, when the bulk of the crop was flowering. A large number of plants, however, produced late tillers which did not flower until much later than the application date.

Trial 7 at Thangool, Callide Valley, was in a field of Caprock which carried a population of 6–20 females per head on treatment date, April 14, 1955. The bulk of the crop was at mid- to full-flowering when the insecticides were applied, but as in Trial 6 many later tillers were produced.

In Trial 8, situated in Alpha at Biloela, Callide Valley, sprays were applied on March 14, 1956, when most heads had completed flowering. Six to 8 females per head, however, were still active in the crop.

White oil was used as a wetting agent in Trials 7 and 8 at the rate of 1 gal per ac.

Trial 6 was harvested on May 12, Trial 7 on June 27, and Trial 8 on May 2: results are given in Tables 5–7.

**TABLE 5**

TRIAL 6 : YIELDS

| Treatment | Yield (oz/100 heads) | Adjusted Yield (bus./ac) |
|---|---|---|
| DDT emulsion 1 lb/ac .. .. .. | 116·8 | 31·22 |
| BHC disp. powder 0·33 lb/ac .. .. | 113·8 | 30·33 |
| Endrin 0·5 lb/ac .. .. .. .. | 112·2 | 29·11 |
| BHC disp. powder 0·1 lb/ac .. .. | 108·8 | 28·56 |
| Endrin 0·25 lb/ac .. .. .. | 107·8 | 29·00 |
| Dieldrin 0·5 lb/ac .. .. .. | 105·8 | 28·12 |
| Dieldrin 0·25 lb/ac .. .. .. | 104·7 | 27·62 |
| BHC disp. powder 0·25 lb/ac .. .. | 104·0 | 27·28 |
| BHC emulsion 0·25 lb/ac .. .. | 99·2 | 26·74 |
| Checks—mean of three .. .. .. | 97·3 | 25·93 |
| Necessary differences for significance 5% | 10·6 | 2·86 |
| Necessary differences for significance 1% | 14·1 | 3·81 |

**TABLE 6**

TRIAL 7 : YIELDS

| Treatment | Yield | | No. of Heads per Plot |
|---|---|---|---|
| | lb/plot | bus./ac | |
| BHC disp. powder 1 lb/ac | 10·37 | 17·3 | 316·7 |
| BHC disp. powder 0·7 lb/ac | 9·96 | 16·6 | 345·0 |
| BHC disp. powder 1 lb/ac plus White oil | 9·83 | 16·4 | 312·3 |
| DDT emulsion 1 lb/ac | 9·21 | 15·4 | 309·0 |
| BHC disp. powder 0·7 lb/ac plus White oil | 8·54 | 14·2 | 325·3 |
| DDT emulsion 1 lb/ac plus White oil | 8·44 | 14·1 | 305·0 |
| DDT emulsion ½ lb/ac plus White oil | 8·23 | 13·7 | 315·3 |
| BHC disp. powder 0·3 lb/ac plus White oil | 7·48 | 12·5 | 325·7 |
| DDT emulsion ½ lb/ac | 7·14 | 11·9 | 314·7 |
| BHC disp. powder 0·3 lb/ac | 6·02 | 10·0 | 313·7 |
| Checks—mean of three | 4·33 | 7·2 | 306·6 |
| Necessary differences for significance among treatments 5% | 2·56 | 4·27 | No significant differences |
| Necessary differences for significance among treatments 1% | 3·46 | 5·77 | |
| Necessary differences for significance between checks and treatments 5% | 2·09 | 3·48 | |
| Necessary differences for significance between checks and treatments 1% | 2·83 | 4·72 | |

**TABLE 7**

TRIAL 8 : YIELDS

| Treatment | Yield (bus./ac) | |
|---|---|---|
| | Observed | Adjusted |
| DDT emulsion 1 lb/ac plus White oil | 32·7 | 29·2 |
| DDD emulsion 1 lb/ac | 30·6 | 28·8 |
| BHC disp. powder 0·3 lb/ac | 30·4 | 28·4 |
| BHC disp. powder 1 lb/ac plus White oil | 27·9 | 29·9 |
| DDT emulsion 1 lb/ac | 26·3 | 26·2 |
| BHC disp. powder 0·7 lb/ac | 26·1 | 28·9 |
| BHC disp. powder 1 lb/ac | 25·2 | 24·3 |
| BHC disp. powder 0·3 lb/ac plus White oil | 25·2 | 26·1 |
| DDD emulsion ½ lb/ac plus White oil | 24·7 | 23·0 |
| DDT emulsion ½ lb/ac plus White oil | 23·7 | 22·5 |
| DDD emulsion 1 lb/ac plus White oil | 22·5 | 25·1 |
| DDT emulsion ½ lb/ac | 19·6 | 19·0 |
| BHC disp. powder 0·7 lb/ac plus White oil | 18·2 | 21·5 |
| DDD emulsion ½ lb/ac | 18·1 | 19·3 |
| Checks—mean of three | 22·5 | 22·2 |
| No significant differences | | |

## V. DISCUSSION

Results from Trials 6–8 give further information on pest populations which warrant treatment and demonstrate that, as expected, the use of insecticides results in greater percentage saves when pest populations are high (compare Trials 2 and 3 with 6).

Spraying is of no economic value when and after major flowering is complete (Trial 8).

Commercial practice using not less than 15 gal per ac confirms trial results: spraying with DDT at 1 lb per ac is economically sound in well grown crops when midge populations exceed 6 females per head at flowering. Usually boom sprays mounted on single-wheel trucks of standard clearance are employed in field spraying; damage caused by the passage of such a vehicle carrying a 40 ft boom is estimated as not exceeding 2 per cent. of the crop, this loss being caused almost entirely by the wheels.

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