

The Control of Cotton White Mealybug Using Sanitary, Chemical and Biological Techniques in Zimbabwe

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ABSTRACT

The mealybug is a polyphagous sucking pest which causes vast cotton destruction resulting in 100% yield loss. Trial work on the evaluation of sanitary, biological and chemical control techniques for the white mealybug in cotton was initiated in 2016/17 to 2019/20. Trials laid out in a Randomised Complete Block Design (RCBD) with six treatments replicated four times, were set up at Chizvirizvi, Masakadza, Dande, Muzarabani, Tokwane and Matikwa in 2016/17 to 2019/20. The treatments used in the study were: (1) No control of mealybugs only weeding to keep cotton weed free from planting to harvest, (2) Larvin 375SC at 1.250 litres/ha, (3) Cabaryl 85WP at 1.470kg/ha, (4) Cartap hydrochloride 50SP at 1 kg/ha, (5) Marshal 25EC at 0.250 litres/ha with 1ml Cooking oil, (6) Biological control with locally found predators (*Coccinellid* beetles, larva and wasps). Measurements were mealybug counts. The square root transformation of count + 3/8 was used on all data not following a normal distribution curve. Significant treatment means ($p < 0.05$) were separated using Fisher's Protected LSD test. Larvin 375 SC, Carbaryl 85 WP, and Cartap hydrochloride 50 SP gave good control of the mealybug. The three insecticides were recommended for mealybug control at the rates: Larvin 375 SC 1.250 l/ha (468.75g ai/ha), Carbaryl 85wp 1.470kg/ha (1250g ai/ha) and Cartap hydrochloride 50sp at 1kg/ha (500g ai/ha).

Keywords: Mealybug, Sanitary control, Biological control, Chemical control, RCBD.

INTRODUCTION

The mealy bug is a major pest of cotton which boasts of over 2000 species and 290 genera. The destructive nature of this pest causes enormous quality and productivity decline, (1). Mealybugs are a significant threat to agricultural systems worldwide due to their polyphagous feeding nature, wide host range, quick reproduction, ability to induce damage through sap sucking, honeydew excretion as well as transmitting pathogens during feeding, (2). The pest has an ability to turn all cropping dreams into a nightmare, (3). The most damaging stages of the pest are the immature nymphs and larvae (4). The pest attacks a wide range of plants including vegetables, field crops, ornamental plants and fodder crops. Due to the pest's invasiveness, rapid spread, and morphological and biological variations, there is a need for establishing an effective strategy for its control (5). studies by Desai *et-al* indicated that weather conditions like morning and evening humidity as well as rainfall pose a negative effect/decline on mealybug populations, (6). Mealybugs can be effectively managed on farms using

insecticides, but where some of the critical insecticides get banned for use, thereby creating need to find alternatives, (7). Around the globe, the following pesticide groups were recommended for control of the pest under severe infestations: Carbamates (Carbaryl 50WP @ 2500g/ha, Larvin (Thiodicarb 75FWP @625g/ha), organophosphates (Profenofos 50EC @1250ml/ha, Quinalphos 25EC @ 2000ml/ha, Acephate 75SP @2000g/ha, Chlorpyrifos 25EC @ 5000ml/ha, 1-3 times as per need in rotation, (8). In Pakistan biological control for mealybug was employed after having failed to get satisfactory results using chemicals. A predator known as the mealy bug destroyer (*Cryptolaemus montrouzeiri*) was introduced from California for mealy bug control, (9). Important predators such as *Coccinellids* spp and wasps have been observed to effectively reduce mealy bug nymphs population. Entomopathogenic fungi *Verticillium lecanii*, has been observed to reduce mealybug populations when sprayed during high humid days. Fish Oil Rosin Soap (FORS) applied at 20g/L of water at an interval of 15-20 days, depending on pest incidence, helps to keep the populations of mealybugs low (8).

The objectives of this work were to assess the effect of Larvin 37.5 FW (375 SC), Carbaryl 85 WP, Cartap hydrochloride 50 SP, Marshal 25 EC and biological control using locally found *Coccinellids* and wasps on the control of mealybug in cotton.

MATERIALS AND METHODS

Work on the evaluation of mealybug insecticides was initiated in 2016/17 to 2019/20 at Chizvirizvi, Masakadza, Dande, Muzarabani, Tokwane and Matikwa in Zimbabwe. The treatments were: (1) No chemical control of mealybugs weeding only to Keep treatment weed free from planting to harvest, (2) Larvin 375 SC at 1.250 litres/ha, (3) Cabaryl 85WP at 1.470 kg/ha, (4) Cartap hydrochloride 50SP 1 kg /ha, (5) Marshal 25EC 0.250 litres/ha with 1ml Cooking oil, (6) Biological control with locally found *Coccinellid* beetles or larva and wasps

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(predators of mealy bug). The trial had six treatments laid out in a randomised complete block design replicated four times. The gross plots were 8 rows x 14 metres (112m²), sprayed areas of 6 rows x 10 metres (60 m²) and sampling areas of 4 rows x 8 metres (32 m²) at all sites. Information on planting dates, emergence, commencement and end of scouting, commencement of treatment applications and end of application, as well as seed cotton, was taken as part of crop agronomy records. Scouting was done twice a week for mealybug counts as well as counts and scores of other pests. On the first scouting day of the week, mealybug counts as well as counts and scores of other pests were recorded. Treatment sprays for the control of mealybugs were applied upon first seeing the mealybugs; then aim to keep mealybug populations below 100 on 24 scouted plants per treatment. A second scouting during the same week was done whenever mealybug treatment sprays were applied. Sprays for control of other pests were applied based on the pests' threshold levels as indicated in the cotton handbook (10).

Table 1: Effect of treatments on mean mealybug populations

Treatments	Chizvirizvi	Masakadza	Dande		Tokwane	Muzarabani		Matikwa
	2016/17	2017/18	2017/18	2018/19	2019/20	2018/19	2019/20	2019/20
1.No control of mealybug	152.9b	47.4c	49.94c	2.50c	1981c	17.5b	18.50d	33.47c
2.Larvin 375SC at 1.250L/ha	93.8a	37.0ab	7.97a	1.30b	205a	9.3a	2.20a	8.06a
3.Cabaryl 85WP at 1.470kg/ha	108.7a	42.1bc	21.83b	0.42a	133a	17.9b	6.45b	14.44a
4.Cartap hydrochloride 50SP at 1kg/ha	111.7a	35.5a	21.56b	0.2a	195a	18.6b	7.00b	19.25b
5.Marshall 25EC at 0.250L/ha with 1ml Cooking oil	113.2a	56.3d	21.22b	0.0a	491a	16.8b	5.15b	29.94c
6.Coccinellid Larva, adults and wasps	171.8b	54.8d	47.86c	0.0a	1254b	16.2b	13.95c	34.53c
Mean	125.4	45.5	28.4	0.80	709.51	16.0	8.88	23.28
P - Value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
LSD (0.05)	23.04	6.52	12.51	0.51	519.205	3.12	2.184	7.580
CV, %	12.2	9.5	15.6	16.1	25.4	12.9	16.3	21.6

Means followed by the same letter are not significantly different at 5% Fischer's protected LSD
Figures in brackets were transformed using the square root of count + 3/8

CONCLUSION

Larvin 375 SC, Carbaryl 85 WP, and Cartap hydrochloride 50sp gave good control of mealybug.

RECOMMENDATIONS

Larvin 375sc at 1.250 L/ha (468.75g ai/ha), Carbaryl 85wp at 1.470kg/ha (1250g ai/ha) and Cartap hydrochloride 50sp at 1kg/ha (500g ai/ha) were recommended for mealybug control in Zimbabwe. Larvin 375 SC and Carbaryl 85 WP belong to the Carbamate group of insecticides, while Cartap 50sp is a hydrochloride. Evaluation of more chemicals that belong to different chemical groups than Larvin 375 SC, Carbaryl 85 WP and Cartap hydrochloride 50 SP is critical for rotational purposes. Further evaluation of Marshal 25ec with reviewed upward application rates needs to be considered. More work on biological control options for mealy needs to be initiated.

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Only sites where significant differences occurred between treatments on mealybug populations have been indicated in the tables of results.

RESULTS AND DISCUSSION

Effect of Treatment on Mealybugs

Larvin 375sc gave exclusively high performance on the control of mealybugs at Chizvirizvi, Masakadza, Dande, Tokwane, Muzarabani and Matikwa. Carbaryl 85wp exhibited good mealybug control at Chizvirizvi, Dande, Tokwane and Matikwa. Cartap hydrochloride 50sp controlled mealybugs at Chizvirizvi, Masakadza, Dande, and Tokwane. Marshal 25ec had good mealybug control at only three sites (Chizvirizvi, Dande and Tokwane). However, there may be a need to revise the application rate of Marshal 25ec from 250ml/ha upwards for more positive results. Biological control treatment and the no control of mealybugs' treatments had the highest mealybug populations on all sites (Table 1.)

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