Spraying Apparatus for Pest Control in Cotton for the Small Farmer

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ABSTRACT

It is expected that the small farmer will, in future, produce up to 30% of the seed cotton in South Africa. To achieve this, small producers will need to control insects cost-effectively with an apparatus that is affordable and acceptable to the farmer. An insecticide application apparatus for the small cotton farmer, based on a knapsack sprayer and mounted on wheels, has been developed. The pump action is driven by the wheels which, for ease of calibration, have a circumference of 2 m. The apparatus generates a pressure of 2.5 bar at a speed of 1 m/sec. If 6 TXVS-2 nozzles are used and 1 row is sprayed singly, a walking distance of 10 km is needed to spray 1 ha of cotton with a 100cm wide row spacing. Under these conditions, the apparatus delivers 103 l/ha. Two rows of cotton which is less than 400 mm high, can be sprayed simultaneously with 3 nozzles / row. This translates in to 51.5 l/ha and a walking distance of 5 km/ha. If one ha cotton is sprayed with a knapsack in the conventional manner, i.e. each row is sprayed from both sides, the walking distance is 20 km. This sprayer can either be pushed or drawn by one person, but under field conditions it is less taxing if one person pulls the sprayer and a second person steers it. It can also be pulled by a draught animal. In field trials insect control obtained by using this sprayer was comparable to that obtained with a knapsack sprayer.

Introduction

Pearson and Maxwell-Darling (1958) described all the cotton insect pests found in Africa, a number of which can seriously damage the yield. Broodryk *et al.* (1971) described the most important cotton insect pests found in South Africa and pointed out that cotton is eminently suitable for cultivation by small farmers. It is expected that small farmers will, in future, produce up to 30 % of the seed cotton in South Africa. Small farmers experience great difficulties in obtaining and applying pesticides and the costs involved in chemical insect control are prohibitive. Some insects with piercing and sucking mouth-parts can be controlled by means of seed dressing or soil-applied insecticides. Jassid-repellent cultivars can be planted. However, bollworms must still be chemically controlled.

Bollworms are the group of insects that determine cotton yields to a great extent. The America bollworm *Helicoverpa armigera* is the cotton pest that causes the most damage in the South Africa and Tanzania (Nyambo, 1989). Kabissa (1989) reported that six or more spray applications against *H. armigera* are the norm in Tanzania. The red bollworm, *Diparopsis castanea*, and the spiny bollworm (*Erias species*) can also reduce yields.

If a farmer uses a knapsack sprayer with a hand lance with a single nozzle and every cotton plant is sprayed from both sides, he will have to walk 20km/ha in order to spray 1 ha with between row spacing of 1.0m. Most knapsack sprayers have a capacity of ± 15l, which means that, in addition to the sprayer, the person who is spraying the insecticide will have to carry an average of at least 7.5kg (from 15 to 0kg) of the spray mixture for a distance of 20km. On average, a knapsack sprayer delivers ± 50ml every time it is pumped. If ± 100l of the mixture is sprayed per hectare, the knapsack sprayer will have to be pumped 2,000 times

Experimental Procedure

Since the objective of this project was to assist farmers who cannot afford automatic or tractor-mounted sprayers, it was assumed that the spraying would be done mainly by hand. The first objective was to determine whether a human being would have the necessary energy to sustain spraying over a long period. If the walking distance could be reduced and the carrying of the insecticide eliminated, spraying would be easier. The knapsack sprayer was used as aq basis in designing the new sprayer because most small farmers already have one.

A knapsack sprayer was mounted on two wheels and pumping was activated by a camshaft which was attached to one of the wheels. Wheels with a circumference of 2.0m were used to facilitate calibration. A CP15 knapsack sprayer with TXVS-2 nozzles was used in configuration as indicated in Figures 1 and 2. One row can be sprayed with six nozzles or two rows with three nozzles each.

To determine its effectiveness, the spraying apparatus, manually operated cotton spray, (MOCS) was

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compared with a knapsack sprayer and an unsprayed control. The treatments were replicated 10 times in a randomized block. After the appearance of the first flowers, the trial was sprayed with endosulfan once a week for six consecutive weeks. The plants in each plot were examined once a week and insect counts taken.

Results

Table 1 shows the average delivery of the nozzles at different spray pressures. The time required to cover 100m as well as the volume of insecticide applied per hectare is also given.

Table 2 shows the number of American bollworms, red bollworms and spiny bollworms that were found in the 10 replicates of each treatment. It also shows the damaged fruiting points, i.e. squares, flowers and bolls.

Discussion

It is possible to spray with six nozzles at a pressure of 2.5bar and at a walking speed of ± 1m/sec to give an application of ± 100l/ha (Table 1). This compares well with that used in commercial sprayings (Figure 2). At 2.5bar, TXVS-2 nozzles give noticeably good insecticide cover. This sprayer cannot be used to spray double rows with ten nozzles as it is impracticable to push the sprayer through a cotton field at a speed of ± 2m/sec. When the cotton plants are shorter than ± 400mm, two rows can be sprayed simultaneously, using three nozzles per row (Figure 1), reducing the walking distance to only 5km/ha. If the pump and hand lances are removed, this apparatus can be used as a multi-purpose conveyance for water, fertilizer, picked cotton, etc. Under field conditions, it is less taxing if one person pulls the sprayer and a second person steers it. Ideally, the sprayer should be drawn by a draught animal.

Spraying with this apparatus controls bollworms as effectively as knapsack spraying and better yields are definitely obtained in comparison with these obtained from the untreated control Table 2.

References

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Table 1. Volume spray mixture/ha at different spray tempos.

Spray pressure in bar	sec/100m	nozzles	ml/nozzle/100m	l/ha
2.5	94	6	172	103.0
4.0	60	6	159	95.5
2.5	49	10	90	53.8

Table 2. Number of bollworms found in the treatments during weekly scouting (100 lt. Endosulfan/ha/week).

Treatment	Pests and Damage	Week						Total
		1	2	3	4	5	6	
MOCS	American bollworm	1	0	1	0	0	0	2
	Red bollworm	19	21	34	29	24	39	166
	Spiny bollworm	1	1	0	0	2	0	4
	Damage	51	56	69	52	62	73	363
Knapsack sprayer	American bollworm	2	0	0	0	0	0	2
	Red bollworm	16	15	26	35	35	38	165
	Spiny bollworm	1	0	2	0	0	0	3
	Damage	39	51	71	76	90	72	399
Unsprayed control	American bollworm	9	6	6	1	0	0	22
	Red bollworm	14	21	47	32	47	44	205
	Spiny bollworm	3	0	2	3	3	6	17
	Damage	79	86	125	81	105	123	599

Figure 1. Spray nozzle configuration, plants less than 400 mm tall, spray 2 rows with 3 nozzles per row.

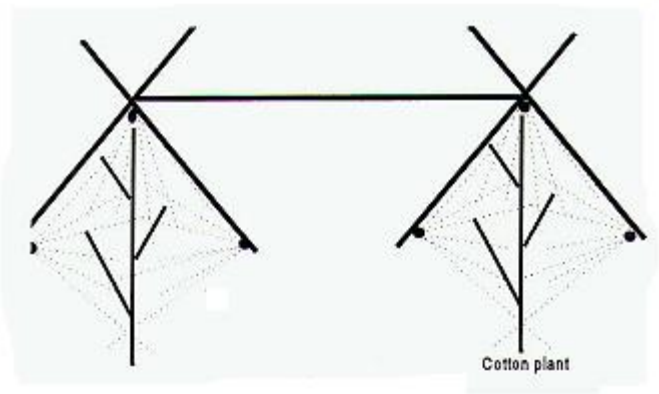

Figure 2. Spray nozzle configuration, plants more than 400 mm tall, spray two half rows simultaneously with 6 nozzles per row