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BACK PACK CONTROLLED DROPLET APPLICATOR (CDA) FOR BETTER PESTICIDE APPLICATION

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ABSTRACT

This paper describes the construction of the Back-pack Controlled Droplet Applicator (CDA) and highlights its advantages over the hand-held CDA and other pesticide applicators. It also lists the instructions to be followed by the operator.

INTRODUCTION

Ultra Low Volume (ULV) Controlled Droplet Application (CDA), is a fine spray of pesticide in a concentrated form. It gives better coverage of the crop and better pest control (Pawar, 1986) compared with medium or high volume application. CDA is commonly practiced by using a hand-held spinning disc sprayer which distributes 3 to 15 l/ha of spray liquid. However, this sprayer exposes the operator to considerable risk of contamination from spray drift unless he strictly observes the following precautions when spraying the crop (Pawar, 1988).

- spraying must only be undertaken when the wind is at an angle greater than 25° to the line of walking of the operator, and at a velocity between 3-10 km/h.
- the sprayer must always be held downwind, with its spinning disc as far away as possible from the body, and
- spraying must begin from the downwind edge of the field and finish at the upwind edge, and the operator should always be walking through the untreated area of the crop.

Further, an oil-based formulation which is ideal for CDA application, is not commonly available for most pesticides, thus limiting the use of spinning disc sprayer to emulsifiable concentrate (EC) formulation of the pesticide. The spray liquid prepared from the wettable powder (WP) does not flow freely through the minute passage from the spray liquid tank to the spinning disc. The spray liquid container, which has a maximum capacity of only one litre, also needs to be filled frequently. Moreover, the flow of spray liquid to the spinning disc, which is by gravity, decreases with the receding spray liquid in the container. These problems were also evident in our earlier adaptive developments on the use of spinning disc sprayers (Pawar 1985, 1987; Awadhwal and Takenaga 1987). However, we have finally succeeded in mitigating these problems by developing a Back-pack CDA sprayer.

BACK-PACK CDA

The Back-pack CDA unit consists of two metallic frames of galvanised iron pipe - a fixed main frame and a sliding-swinging frame. The main frame (Fig.1a) is 1.2 m tall. It is shaped and padded so that it fits comfortably on the back of the operator. It is looped to the front at the top, and developed as a stand (for the whole unit) at its base. The top loop supports one or two batteries and the base supports the spray-liquid tank of 5 litre capacity. A small motor pump is fixed at the bottom of the tank to pump spray

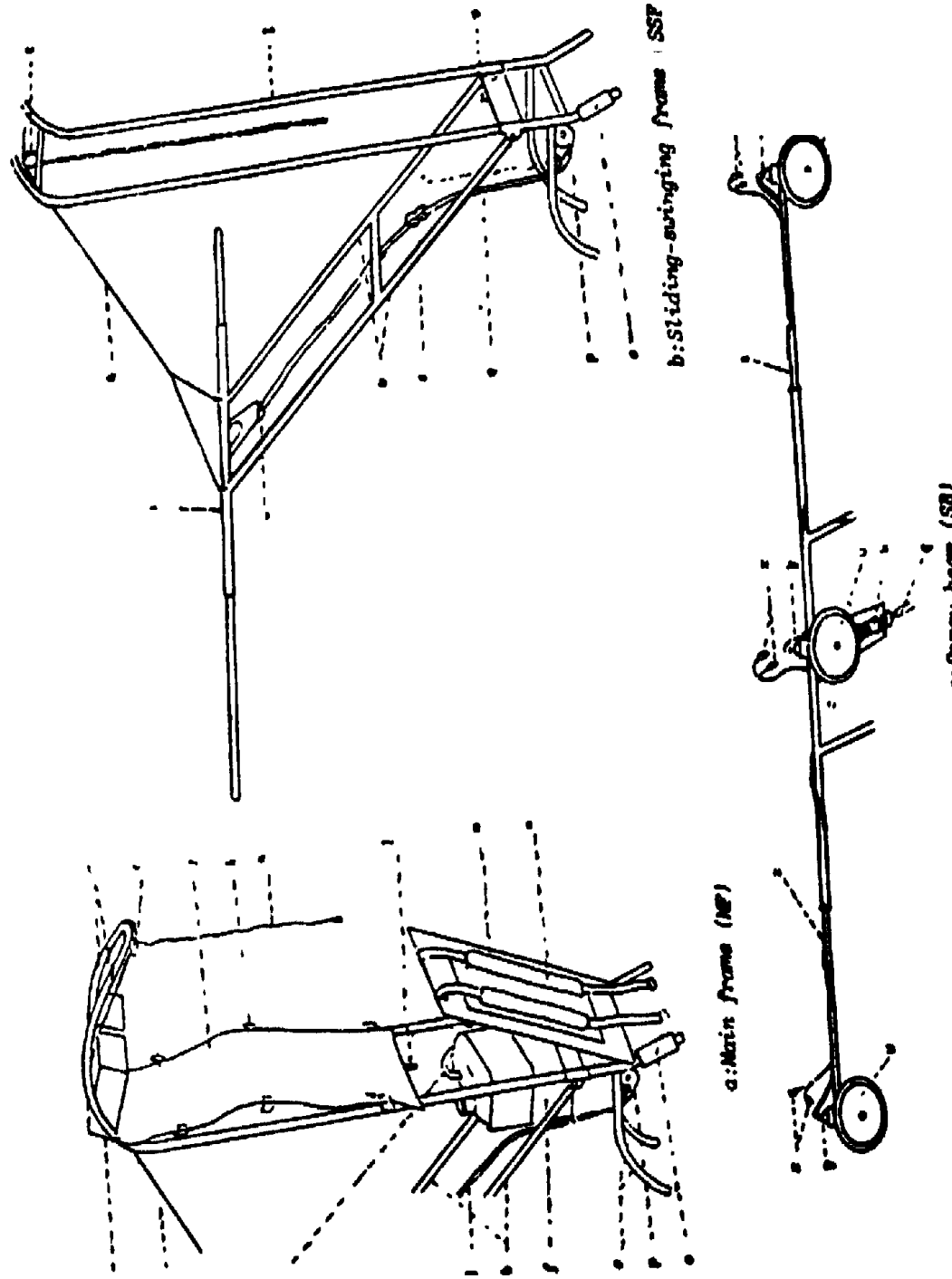

Fig: Back pack CDA

liquid to the sprayer heads. There is a flexible coir curtain hanging half-way from the top of the main frame to protect the operator from spray drift.

The sliding-swinging frame (Fig. 1b) is 1 m long. It is fixed to the required height by hooking its base to a chain hanging from the top of the main frame. It supports a spray-beam distally, the height of which can be adjusted by a nylon string running over a pulley fixed on the top of the main frame.

The spray-beam (Fig. 1c) consists of two aluminium pipes (1 m long) which slide in-and-out of the GI horizontal pipe (1 m long) of the sliding-swinging frame. Its length can be adjusted from 2 to 2.5m. This beam supports three CDA sprayer heads which are adjustable for distance between them and for the spray angle.

The flow of spray liquid is adjusted by a flow regulator on the rubber tubing which connects the motor pump with the distributor to the sprayer heads. A side tube from the main tube before the regulator diverts about half of the flow of the sptray liquid back to the tank. This agitates the spray liquid continuously. All the motors are driven by the same battery/ batteries.

Major components

1. *CDA sprayer heads* : Spinning disc sprayer heads with good capacity motors (6-12 Volts) of 4000-6000 rpm are ideal.

2. *Motor pump* : A motor pump (6-12 Volts) with 1500-1800 rpm is ideal.

3. *Battery* : Rechargeable wet or dry batteries of 6 Volts and 6-10 amp are ideal.

Important features

i) Weight of the empty sprayer —11.5Kg

ii) Weight of the filled sprayer—16.5 Kg

iii) Spray boom height—0.3-2.5 m (adjustable)

iv) Spray swath—3.0-3.6m (adjustable)

v) Droplet size - 150-250 μ (as per flow)

vi) Spray liquid required l/ha—15-80 l (adjustable)

vii) Time required h/ha—1hr. 30 minutes

viii) Pesticide formulation required-EC or WP

Safety

The back-pack CDA offers greater safety to the operator than the hand-held CDA in the following ways :

a) It provides for direct mixing of the spray liquid in the tank. This reduces the chances of contamination of the operator during mixing. One needs to only put in the required amount of pesticide and water in the spray liquid tank and operate the side flow in the tank for a few minutes by closing the main tubing with the regulator. During spraying the spray liquid in the tank is agitated by the side-flow.

b) It produces less drift than the hand-held CDA. This is because it emits bigger droplets (150-250μ) than the hand-held CDA (100-165μ). The back-pack CDA uses 15-80 l/ha of spray liquid compared with 5-12.5 l/ha by the hand-held CDA (Indian make). Most of the droplets that are released 15-30 cm above the crop canopy fall into the crop before they have drifted a metre or more, and so do not contaminate the operator (Table 1).

TABLE 1 Average number of spray droplets per cm obtained on photographic bromide papers placed on different parts of the body of the operator during 2 minute of spraying of 1.8 m tall sole pigeonpea with Hand-held (HH) and Back-pack (BP) CDAs at an average wind velocity 8 6 km ha, ICRISAT Center, 1987

Part of the body of the operator	The angle of the wind direction to the line of walking of the operator					
	15–20		45–50		75–80	
	HH-CDA	BP-CDA	HH-CDA	BP-CDA	HH-CDA	BP-CDA
Front of the body						
Forehead	30 2	0 6	4 0	0 0	1 0	0 0
Mouth & nose	25 0	0 9	2 0	0 0	0 0	0 0
Chest	15 0	0 0	1 8	0 0	0 6	0 0
Abdomen	2 0	0 3	1 7	0 1	0 3	0 0
Back of the body						
Head	0 6	0 0	0 3	0 0	0 1	0 0
Back of the chest	3 0	0 0	1 0	0 0	0 1	0 0
Hips	1 6	0 0	0 6	0 0	0 1	0 0
Right arm	20 0	1 0	12 0	2 1	2 1	1 6
Left arm	28 6	1 6	7 6	2 0	1 8	0 9
Mean	14 0	0 5	3 4	0 5	0 7	0 2
S Em ± staff	2 82		0 73		0 09	

Instructions for using the Back-Pack CDA.

1 Wear protective clothing including a face mask, goggles and gloves before starting to spray the crop

2 Ensure that the battery is fully charged In case it is only partially chaged, put two batteries in a series to obtain the required voltage

3 Before spraying, standardise the sprayer for the rate of release of spray liquid by adjusting the flow-regulator Operate the sprayer using water only for 5 minutes, then estimate the quantity of spray liquid required for the area and the amount of pesticide formulation per filling of the tank

4 Set the sprayer heads on the spray-boom so that they are at 30-45° angle to the horizontal plane, and set the boom so that it is 15-30 cm above the crop canopy

5 Depending upon the pesticide and its formulation, set the flow-regulator to obtain the recommended release per hectare

Type of pesticide	Formulation	Recommended rate of application l/ha
Insecticide	EC	15-30
	WP	30-45
Fungicide	EC	30-45
	WP	45-60
Weedicide	EC/WP	60-80

6 To prepare the spray liquid within the tank of the sprayer, first put the quantity of pesticide formulation required for 5 litres into the tank and fill it up to the mark with water Close the main tubing completely by pressing it between fingers and operate the motor In a minute or two spray liquid will be mixed uniformly

7 Lift the sprayer onto the back of the operator and set the spray-boom 15-30 cm above the crop canopy

8 Switch on the sprayer head and pump motors as you enter the crop Switch them off as you come out of the field, even during turning

9 Walk at a normal speed With a sprayer on the back, the operator should cover 100 m in 2 5 min

10 Spray the crop only when the wind is gentle, 3-10 km/h Morning before 1030 h, and late afternoons after 1600 h are the best times for spraying

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