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Review Article

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Incorrect Use of a Knapsack Sprayer Caused Many Farmers to Die When Applying a Very Toxic Insecticide

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In India it was reported, back in 2017, that many farmers using a knapsack sprayer to had died after spraying monocrotophos, a highly toxic insecticide late in the season to control pink bollworm on cotton crops. The spray operator had carried the lance so that the nozzle was close to the upper area of the cotton plants, but the spray droplets were in front of the operator's face, so some of the spray was inhaled by the operator.

Figure 1: Farmer walking towards the droplets of insecticide being applied in front of their face (Photo: Indian Express)

There should have been a ban on using an insecticide considered to have been too toxic for farmers to use with a sprayer as shown in Figure 1.

In Africa in 1960, instead of using a lance in front of the operator, a vertical boom was attached to back of the sprayer tank, so the operator could use more nozzles as the height of the pants increased and direct the spray laterally to the crop. It was referred to as a "Tailboom".

Using a sprayer with a tailboom significantly reduced operator exposure to the spray. Another problem is that the cone type of hydraulic nozzles produces droplets which vary considerably in size, so their deposition on the crop will vary although by directing the nozzles at an angle it can improve deposition on the underside of leaves.

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Figure 2: Tailboom on back of knapsack sprayer.

An advantage of the tailboom was that the number of nozzles could be increased to spray different areas of the plants as they increased in height.

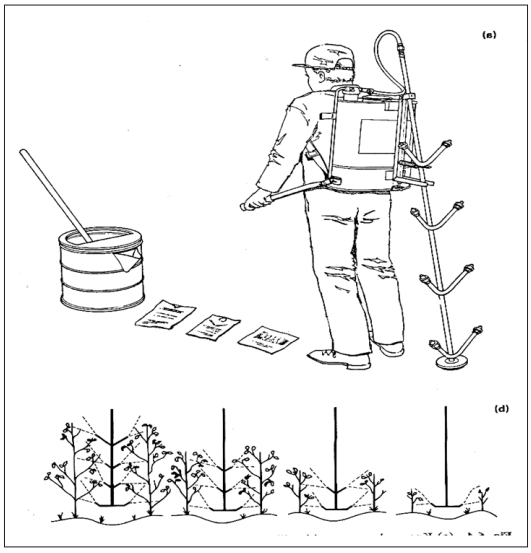

Figure 3: Diagram of Knapsack sprayer with "Tailboom" fitted with multiple nozzles as the plants increase in height.

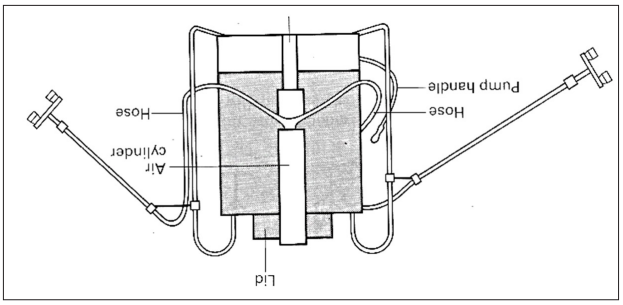

Figure 4: Simply two nozzles mounted behind the operator, who can walk away from the spray. This might be suitable for a spraying small plant if the lance on the back of the sprayer can be adjusted to spray latterly to a line of plant on each side of the pathway between rows.

Another problem has been the formulation of pesticides has resulted in most pesticides mixed in water to apply a spray. However, water supplies are not always easy for farmers so ideally the pesticide should be formulated in an oil and applied at ultra-low volume (ULV) as the droplets in an oil are more likely to stick on plants when it Rains. Some new types of sprayers using an electrostatic charge on the spray droplets improves the deposition of the droplets on foliage. More important if the formulation is mixed in oil rather than water, the loss of deposited droplets when it rains is avoided. Any spray washed off plants enters the soil and ultimately pollutes rivers [1].

Figure 5 Effect of rain on Spray droplets deposited on leaves

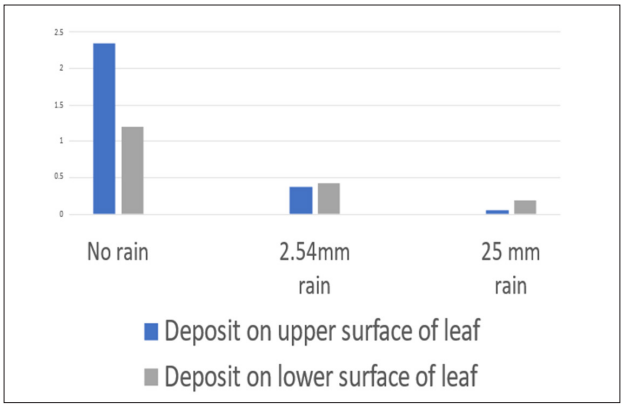

Figure 5: Farmer using a hand-carried sprayer with a rotary atomiser directed downwind has been used for ULV sprays not using water. and used an oil. As they said it was difficult get sufficient water to spray their crops of cotton (Matthews (1973).

The same techniques were also used in some countries in West Africa to spray their cotton crops between 1975 and 1995, and then changed to use water to spray cotton fields, but continued to use a sprayer as shown in Figure 5, but using c 10litres of water per hectare.

In Japan c.1990, Farmers growing rice did not like using a knapsack sprayer, so a company developed an Unmanned Helicopter to spray with a single rotor to spray the rice crop.

Later In China a different design of a Drone was developed using several rotors which in addition to keeping the drone moving above the crop, it created a downward air flow to increase penetration of spray into the crop (Figure 6).

The substantial proportion of Unintentional acute pesticide (UAPP) incidents were associated with a few highly hazardous pesticides (HHPs), particularly lambda-cyhalothrin, acetamiprid, and profenofos in Jamaica, and alpha-cypermethrin, paraquat and lambda-cyhalothrin in Trinidad.

Figure 6: On large farms, it is now recommended that sprays are applied using a drone.

Since 2010, more countries have introduced the use of drones to spray crops.

A more detailed account of unintentional acute pesticide poisoning among smallholder Vegetable farmers [2]. Their surveys addressed the crops grown, the occurrence of major pest organisms, pesticides use and knowledge, incidence of acute pesticide poisoning and the use of PPE. The questionnaire had three sections. The second section was incidents of UAPP experienced within the previous 12months, and the name, formulation and concentration of the pesticide that caused symptoms. In this study, UAPP was defined as a symptom or health effect resulting from exposure to a pesticide within 24h of pesticide exposure.

Most farmers used a manually operated backpack sprayer although some had a backpack mist blower or a hand-held ultra-low volume (ULV) sprayer with very few having a tractor-mounted sprayer. Relatively few used Chemical-resistant coveralls while applying pesticides some used a respirator and chemical resistant boots, and chemical resistant gloves. Non-protective clothing used while spraying pesticides were 'ordinary clothes with long sleeves or trousers used only for pesticide spraying', Only a small proportion of growers received training in the use of PPE.

Clearly the use of any pesticide that is highly toxic should not be registered for use in any country. This has now increased the need for biopesticides. In Somalia from 2019 to 2022, a biopesticide based on Metarizium acridum was registered and used to control locusts as they wanted to avoid using any chemical that might kill bees or other beneficial insects. The fungus used in an oil as ULV sprays (1 litre/hectare) [3]. This resulted in sprayed locusts dying in 4 days during which an unsprayed locust could touch the fungus and also die.

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