

SPRAYER FOR YOUNG PALM

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One of the three-prong strategies to overcome labour shortage introduced by the Malaysian Government is to mechanize operations that require a high number of workers (Khalid Ibrahim, 1996). Experience gained to date reveals that the adoption of mechanized operations can reduce the labour usage from 6 to 13 ha man-day⁻¹ (Teo Leng, 1990). However, not all operations in the plantation have been mechanized due to various restrictions as well as unavailability of technology.

Weed control is one of the major activities in the plantation that requires a high number of labour. The present methods of weed control include manual, mechanical and chemical eradication. However, the most popular and effective approach is by using chemical herbicides.

There is a range of sprayers available in the market. They are categorized into conventional knapsack sprayers (CKS), motorized knapsacks (MKS), mist blowers, controlled droplet applicators (CDA) and mini-tractor drawn tankers. The choice depends very much on the field conditions and the age of palms. On the technique of applying a solution, there are various spraying nozzles available in the market that are specifically aimed at different purposes such as high-volume (HV), low-volume

(LV), very-low-volume (VLV) and ultra-low-volume (ULV).

In young palm areas, spraying is only confined to the weeded circle. Blanket spraying is not practised due to the desire to maintain the cover crop as a source of nutrients. It has been noticed that the main restriction in spraying young palm areas is the position of fronds that are still low. Therefore, spraying using conventional knapsack sprayers, as practised at present, can be harmful to the palms. With such sprayers, an operator has to spray carefully to avoid spraying on the fronds.

It was reported that the productivity of the worker using a CKS was 0.8 ha day⁻¹ with the labour cost of RM 11 ha⁻¹. While the use of ultra-low-volume method (CDA sprayers) enables an operator to cover an average of 3.4 ha day⁻¹ with the labour cost at RM 4 ha⁻¹.



Figure 1. The sprayer in action.

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Figure 2. Spray cover eliminates the spray drift affecting the fronds.

It is recognized that the present methods of spraying may cause the fronds to be seriously injured by spray drift. Therefore, efforts have been directed towards developing a machine that gives minimum injury to the palms.

THE MACHINE

A one-man operated mechanized sprayer has been developed. The main components that have been designed and developed are the spray cover and telescopic arm. The focus was on the design of the spray cover, which must be able to confine the spray solution under the canopy circle without affecting the fronds. Two fan-type nozzles are placed under this spray cover. They are placed in such a way so that the spray drift does not spread out from the cover and affect the fronds. The cover is used to flip the fronds up so that the spraying can be confined under the fronds' canopy with ease. A telescopic arm that can be rotated 180° is used to position the spray cover at the best position before the spraying is performed. All the components are attached to an 18-hp 4WD prime mover.

The choice of nozzles depends very much on the application and user's needs. Any type of nozzle such as HV, LV, VLV and ULV can be used.

THE FIELD TRIAL

The prototype was fully tested at Koperasi Bukit Keramat Estate, Pahang. The topography was flat and the palms were about three years of age. The frond canopies were very low and this condition was very suitable for testing this machine. The normal method practised by the estate was the conventional knapsack sprayer. The field trial started in July 2000, and modifications and developments were extensively made along the way to ensure that the machine performed effectively in this area. In the trial, the nozzle flow rate was set at 1.6 litres min⁻¹ that is equivalent to 125 litres ha⁻¹. A paraquat-based chemical was used with the dilution rate of 150 ml chemical per 18 litres of water.

From the field trials, the following observations were recorded:

- Productivity;
- Fuel consumption; and
- Repair and maintenance cost.

On the average, the daily productivity of the machine was about 10 ha day⁻¹ (circle spraying) over 6 hr. The fuel, repair and maintenance costs were estimated at RM 0.65 and RM 3.30 per working hour respectively. A straight-line depreciation was used to estimate the average cost per hectare of spraying. The machine cost was RM 33 000 with an annual depreciation of RM 5940 and the economic life was five years with a scrap value of RM 3300 (10% of the purchase cost). Based on the data obtained from the field trials and the estimated value for repair and maintenance cost, the cost per hectare of the machine (over five years) was estimated to be RM 7.20.

THE BENEFIT

The developed sprayer enables spraying of weeds under the fronds' canopy to be done effectively without injuring the palms. The productivity is dramatically increased from 0.8 ha man-day⁻¹ to 10 ha man-day⁻¹, and decreased in cost from RM 11 day⁻¹ to RM 7.20 day⁻¹ for CKS and the developed unit, respectively. Other methods of spraying such as blanket as well as selective spraying can also be practised using this machine.

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