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Feasibility Testing of Aeroblast Sprayer

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Abstract

The spraying of insecticides is the very important timely operation. High capacity with precision spraying is the requirement for enhancing the crop yield. The aero blast sprayer has got the special features of air blasting which makes the droplets into the mist and hence quick & immediate spraying of insecticide could be possible. Hence, aero blast sprayer was evaluated for its performance. The field performance of aeroblast sprayer was carried out for the pigeon pea crop field. The average effective field capacity of the aeroblast sprayer were found to be 2.5 ha/h. The fuel consumption of the tractor for the aeroblast sprayer was found to be 2.5 l/h. The cost of operation of the machine were calculated and found to be 250 Rs/h and 125 Rs/ha.

Keywords: Aeroblast Sprayer, Pigeon Pea Crop, Evaluation, Cost of Operation.

Introduction

Crop yield is reduced by mainly due to attack of pests, diseases and weed. Chemical control is the popular method adopted for controlling most insects, weed and diseases. The chemicals are applied either by spraying or dusting. Spraying is one of the most effective and efficient techniques for applying small volume of spray liquid to protect crops. In conventional methods, manually operated low and high volume hydraulic sprayer and power operated hydraulic sprayer with long boom, long lances or spray gun are used to carry fluid at different targets. In this method, the time and labour required is more. It is difficult to spray the pesticide uniformly and effectively throughout the tree by conventional method of spraying. Though this method gives good pest control, it consumes large volume of liquid per plant, great amount of time and labour are required. Also drip losses are more. Owing to concern towards protecting environment from pollution by excessive use of pesticide and to economies the spraying method suitable alternative should be identified. In India, diverse farm mechanization scenario in country due to varied size of the farm holdings and socio-economic disparities.

To solve this problem the aeroblast sprayer was introduced. The blast of the air of the sprayer deflects the canopy and hence the spray material in the form of fine particles have easily deposited on the leaves and the pest could control effectively. To assess the feasibility of the aeroblast sprayer this investigation were under taken objectives to testing of Aero-blast sprayer for spraying on various crops and to ascertain the feasibility for its adoptability

Review of Literature

This chapter deals with past works aimed out on mechanical spraying especially aspect of power operated sprayer has been outlined. Sprayer has been a subject of interest for many scientists since the last few decades. The related review regarding evaluation & cost of spraying are given below.

Mathew V. J. *et al*. (1992), studied test of power tiller operated boom sprayer. In this study the experiment was conducted for varying pressure on the power tiller operated boom sprayer provided with hollow cone nozzle. Also they reported that illustrated the relationship between pressure and cone angle, where cone angle is the angle subtended at the orifice by the edge of spray pattern. The result observed that at higher pressure of 3 kg/cm^2 it shows more even distribution than that of 2 kg/cm^2 pressure. It was also observed that the cost of operating the boom sprayer reduced 29% in compared with the hand compression knapsack sprayer.

Padmananthan P. K. and Kathirvel K. (2007), evaluated the power tiller operated rear mounted boom sprayer for cotton crop. The performance of power tiller operated boom sprayer was satisfactory at a pressure of 3 kg/cm^2 and could be adopted by the farmers for spraying

cotton crop and other row crops. It saves the cost and time of operation per ha by 51% power operated knapsack sprayer.

Veerangouda M. *et al*. (2010), evaluated the performance of bullock drawn sprayers for cotton crop. They reported that the bullock drawn traction sprayer was capable to cover 6 rows at a stretch with an average field capacity of 0.66 ha/h with a power output of 0.68 kW. Also in this study average quantity of chemical solution sprayed per ha was 441.80 l/ha. The field capacity of bullock drawn engine sprayer was 1.19 ha/h with a power output of 0.60 kW.

Gimenes M. et al. (2012) evaluated the performance of air-assistance in spray booms which have different spray volumes and nozzle types. Two spray nozzles (flat fan nozzle and hollow cone nozzle) were tested, combined with two air assistance levels in the spray boom (with and without air assistance) and a treatment control. They showed that hollow cone nozzle increased the spray deposit level on the corn plants compared with the flat fan nozzle, at growth stage V4.

Material and Methods

Methodology adopted for testing of aero blast sprayer. The sprayer was evaluated in actual field condition. Present study has been carried out at Department of Farm Power & Machinery, CAET, Dr. PDKV, Akola. As the aeroblast sprayer is most suitable for dense crop; hence crop like pigeon pea, seasamum, sunflower and the other crops were sown with a strip of 25 m. So as to move the tractor easily on the space left after 25 m. The expected swath was 12 to 15 m. The tractor along with sprayer was moved with the strip of open space in the crops as to cover the entire crop. The operational working of the aeroblast sprayer in different crop is given in plate 1 to 3.

Test were conducted in different crop like pigeon pea, Seasamum crop and Sunflower crop for evaluating the performance of aeroblast sprayers was maintained at the rate to prevent fatigue. RNAM test code followed for field testing.

Following different parameters were noted at the time of testing in the field.

Travelling Speed

For calculating travelling speed, two poles 30 meters apart were placed. On the opposite side also two poles were placed to form the corner of the rectangle, parallel to at least one long side of the test plot. The speed was calculated from the time required to machine to travel the distance (30 m) between the assumed connecting two poles on sides. The average of such 5 readings was taken to calculate the travelling speed of machine in km/hr.

Width of Operation

Width of spraying operation was taken randomly in the field at the different location.

Actual Field Capacity

For calculating actual field capacity the time consumed for real work and that lost for other activities such as turning, filling of tank were taken into consideration. The time required for actual operation and time lost measured by stopwatch. The time lost for refueling was deleted because usually filling up before starting test can make refueling unnecessary for specially large field, also time for rectifying machine trouble and nozzle was nor taken onto consideration as it varies widely to varies factors and its inclusion in time factor sometime unreasonably lower the actual field capacity.

$$\text{Actual field capacity was given by } = \frac{Actual\ area\ covered\ (ha.)}{Total\ time\ required\ to\ covered\ area\ (hr.)}$$

Theoretical Field Capacity

Theoretical field capacity was calculated by following formula (J. Sahay 2008)

$$\text{Theoretical field capacity } = \frac{Theoretical\ width\ (m) \times\ Speed, (km/h)}{10}$$

Field Efficiency

Field efficiency is the ratio of actual field capacity to the theoretical field capacity; field efficiency is expressed in %, (J Sahay 2008)

$$\text{Field efficiency } = \frac{Actual\ Field\ Capacity}{Theoretical\ field\ capacity} \times 100$$

Fuel Consumption

The method was used for measuring of fuel consumption as follows. The tank was filled to full capacity before the operation with petrol. Amount of refuelling after the test was the fuel consumption for the test. When filling of the tank, care was taken to keep the tank horizontal and did not to leave empty space in the tank.

Economics of Spraying Operation by Using Aeroblast Sprayers

The operational cost of aeroblast sprayers was determined as per specification of BIS. The cost of operation of aeroblast sprayers was calculated by using standard procedure.

Results and Discussion

The tractor operated aeroblast sprayer was tested in university field area as per the land suitability for the tractor operations. The labour requirements were observed to be 0.5 man-h per hectare for selected crops. The effective working width of sprayer was observed to be 13 m. The effective field capacity of the sprayer was found to be 2 ha/h. The average fuel was found 2.5 litre/h. The detail of various test and their result are shown in Table 3.1.

Table 1
Test Results of Tractor Mounted Aeroblast Sprayer in Pigean Pea Crops

S.N.	Parameters	Average
1	Actual area covered, ha	5
2	Labour requirement, Man-h/ha	0.5
3	Effective working width, m	13
4	Soil moisture, % db	12
5	Chemical used, name % concentration tec	EC @35
6	Dosage given, total quantity used	2 l/tank
7	Effective field capacity, ha/h	2.5
8	Fuel consumption, l/h	2.5
9	Cost of operation, Rs/h	250
10	Cost of operation, Rs/ha	125

Economic of Spraying Operation

The cost of aeroblast sprayer was determined as per specification of the (BIS). As for as cost operation is concerned, the aeroblast sprayer

required reasonable cost. The cost economics of aeroblast sprayer was observed 250 Rs/h and 125 Rs/ha.

Conclusion

The aeroblast sprayer was evaluated at the University field. From the field test result following conclusions could be drawn.

1. The operator has to monitor the working of spraying width while in field.
2. It saves the time, energy and money with operation performance was drudgery free as compared to traditional operation.
3. The field capacity was very high and it was 2.5 ha/hr.
4. The saving in time was found to be 115 per cent over the traditional sprayer.
5. The aero blast sprayer was found reliable ease in operation on field.

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