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Cost Economics of a Battery Operated Vehicle for Plant Protection Equipment

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ABSTRACT: Spraying and dusting are important operation to be performed by the farmer to protect the cultivated crops. Due to increase in production and less labour available farm mechanization has become a necessity. A battery operated vehicle for plant protection equipment was developed at College of Technology and Engineering (C.T.A.E.), MPUAT, Udaipur. Cost economics of developed battery operated vehicle for plant protection equipment was found and compared with ground wheel operated sprayer that saving on spraying cost by developed battery operated boom sprayer was 22.95 Rs/ha.

KEYWORDS: Spraying, battery operated vehicle for plant protection equipment.

I. INTRODUCTION

India is a huge nation; 60 to 70 per cent of its population lives in rural areas, and farming is the primary industry. One of India's most important economic sectors, agriculture employs 60 per cent of the nation's workforce, accounts for 54.6 per cent of the country's Gross Value Added (GVA) for the fiscal year 2017–18 (at current prices), and employs 54.6 per cent of the overall workforce (Anonymous, 2018). The area of India used for agriculture is around 43per cent of the total area. The average size of a farm is 1.16 hectares, and over 80per cent of farmers own tiny plots of land (Singh, 2016). India uses pesticides differently from the rest of the globe as a whole. In India, insecticides account for 76per cent of all pesticide use, compared to 44per cent globally (Mathur, 1999). As a result, less is used of fungicides and herbicides. Cotton crops account for 45per cent of India's total pesticide consumption, followed after by paddy and wheat. The majority of farmers in India are minor, marginal farmers with little land available for agriculture. In addition, labour is more affordable in India than it is in wealthy nations. Indian farmers use tiny manually driven equipment rather than self-propelled equipment for these two reasons. Small equipment was employed by farmers with ease, effectively, and affordably to meet their demands. Taking these scenarios in account the economic viability of developed battery operated vehicle for plant protection equipment was evaluated.

II. RELATED WORK

Singh (2016) developed and tested a ground wheel-operated boom sprayer for uniformity of application, discharge rate, field capacity, and field efficiency. The sprayer achieved an application rate of 281.3 l/ha with a coefficient of variation of 2.80 per cent among the nozzle discharge rate, an effective field capacity of 0.83 ha/hr, a theoretical field capacity of 1.04 ha/hr, and a field efficiency of 82.7 per cent vs the manually operated knapsack sprayer, which has a field capacity of 0.4 ha/day and a field efficiency of 56per cent.

Gururaj (2020) conducted an experiment on the development and performance evaluation of a cycle mounted battery operated boom sprayer, and discovered that the initial investment and operational costs of a cycle mounted battery operated boom sprayer were lower than those of existing power sprayers on the market. The designed boom sprayer has an area coverage of 0.61 ha/hr and a field efficiency of 83.56 per cent. The boom sprayer cost Rs 5,650.0 to manufacture and 92.0 Rs per hour to operate.

III. METHODOLOGY

The experimental investigation of the developed battery operated vehicle for plant protection equipment was done at the farm of C.T.A.E., MPUAT Udaipur. The test was conducted in maize crop for field computation of developed vehicle. Economic viability was checked calculating the following parameters.

1. fixed costs
2. variable cost



1. Fixed cost : This includes the following:

A) Depreciation – it is determined by the following formula :

$$D = \frac{(P - S)}{(L \times H)}$$

Where,

D = depreciation charge (Rs/hr)

P = Development charge (Rs)

S = Salvage value = 10 per cent of P

L = Life of the machine in year

H = Number of working hour per year

B) Interest -Annual interest is calculated on an average investment by using the following formula.

$$I = \frac{P + S}{2} \times \frac{i}{H}$$

Where,

I = Annual interest charge (Rs/h)

i = Interest rate (decimal)

C) Insurance -Taking insurance charge @ 1 per cent of the development charge per year.

$$\text{Insurance cost} = 1 \text{ per cent of } P = \frac{1 \text{ per cent of } P}{H}$$

D) Housing rate -Taking housing charge @ 1 per cent of development charge per year

$$\begin{aligned} \text{Housing rate} &= 1 \text{ per cent of } P = \frac{1 \text{ per cent of } P}{H} \\ &= \frac{0.01 \times 20000}{300} \\ &= 0.66 \text{ Rs/hr} \end{aligned}$$

E) Taxes - Taking taxes charge including GST @ 18 per cent of development charge for whole life

$$\text{Taxes charge} = \frac{0.18 \times P}{L \times H}$$

2. Variable cost: This includes the following:

A) Repair and maintenance - Repair and maintenance charge was taken 5 per cent of the development charge of the machine per year.

$$\text{Repair and maintenance} = \frac{5 \text{ per cent of } P}{H}$$

B) Labour charge - Labour charge was taken 400 per day for eight working hour.

3. Theoretical field capacity : It is calculated using the following formula:

$$\text{Theoretical field capacity} = \frac{W \times S}{10}$$

Where,

W = spraying width (m)

S = Forward speed (km/h)

$$4. \text{ Cost of spraying} = \frac{\text{Total operational cost} \left(\frac{\text{Rs}}{\text{hr}} \right)}{\text{Theoretical field capacity} \left(\frac{\text{ha}}{\text{hr}} \right)}$$

IV. EXPERIMENTAL RESULTS

Taking development cost for ground wheel operated sprayer and developed vehicle as 20000 and 30000 Rs respectively. Labour charge and life of machine 400 Rs/ day and 2400 hours respectively, the following results were obtained for one hectare of land:

1. Fixed cost –

A) Depreciation = 7.5 Rs/hr , for ground wheel operated sprayer
= 11.25 Rs/hr, for developed vehicle



- B) Interest = 3.6 Rs/hr, for ground wheel operated sprayer
= 5.5 Rs/hr, for developed vehicle
- C) Insurance = 0.66 Rs/hr, for ground wheel operated sprayer
= 1 Rs/hr, for developed vehicle
- D) Housing = 0.66 Rs/hr, for ground wheel operated sprayer
= 1 Rs/hr, for developed vehicle
- 2. Variable cost –
 - A) Repair and maintenance = 3.33Rs/hr, for ground wheel operated sprayer
= 5 Rs/hr, for developed vehicle
 - B) Labour charge = 50 Rs/hr, for ground wheel operated sprayer
= 50 Rs/hr, for developed vehicle
- 3. Theoretical field capacity = 0.281 ha/hr, for ground wheel operated sprayer
= 0.36 ha/hr, for developed vehicle

V. CONCLUSION

1. Total fixed cost of ground wheel operated sprayer is 13.22 Rs/hr.
2. Total fixed cost of battery-operated vehicle for plant protection equipment is 22 Rs/hr.
3. Total operating cost of ground wheel operated sprayer is 53.33 Rs/hr.
4. Total operating cost of battery-operated vehicle for plant protection equipment is 55 Rs/hr.
5. The operating costs for a ground-wheel sprayer and a battery-operated vehicle for plant protection equipment were 236.83 and 213.88 rupees per hectare, respectively.

REFERENCES

1. Anonymous, 2018. Annual report. *department of agricultural, cooperation and farmer's welfare, Ministry of Agriculture & Farmers Welfare Government of India KrishiBhawan, New Delhi* pp.1-2.
2. Gururaj, T.R., Mallesh, K.U., Basavaraj and Chaitanya, 2020. Development and performance evaluation of cycle mounted battery operated boom sprayer. *International Journal of Agriculture Sciences*. **12** pp.-10503-10505.
3. Mathur, S.C. 1999. Future of indian pesticides industry in next millennium. *Pesticide Information* **24**: 9-23.
4. Sharma, D.N. and Mukesh, S. 2013. Farm machinery design principle and problems. *Jain brothers, New Delhi*. pp: 215-220.
5. Singh, S. 2016. Farm tools and equipment for agriculture. *New India publishing Agency* pp. 571-572.
6. Wolman, M.G. and Fournier F. G. A. 1987. *Plant Protection and Land Transformation*. John Wiley and Sons, Inc., New York.



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