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Estimation of the cost economics of developed ground wheel operated sprayer

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Abstract

The agriculture sector is facing problems with capacity issues, shrinking revenues, and labour shortages and increasing consumer demands. Present study results revealed that total cost of operation for one hectare by hand operated and developed sprayer were found 725₹/ha and 236.83₹/ha respectively. Which was about 50 per cent less as compare to hand operated sprayer available in the market.

Keywords: Estimation, cost economics, shrinking revenues

Introduction

Farming is the backbone of Indian economy. In this agriculture sector there is a lot of field work, such as weeding, reaping, sowing etc. Apart from these operations, spraying is also an important operation to be performed by the farmer to protect the cultivated crops from insects, pests, funguses and diseases for which various insecticides, pesticides, fungicides and nutrients are sprayed on crops for protection. Farming has undergone a great evolution in last 50 years. Out of the various reasons involved for this evolution is control of various diseases on crops (Sivanainthaperumal, 2018) [3]. India is a land of agriculture which comprises of small, marginal and large farmers. Small scale farmers are interested in manually lever operated knapsack sprayer because of its versatility, cost and design. The prevalence of traditional agriculture equipment intensifies these issues. In addition, most farmers are desperately seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer in an agriculture field. Farmers are facing enormous problem while spraying the pesticide like tank capacity is very small, high cost and spaying time taken more. In order to reduce these problems many different type of sprayers has been introduced in the market, but these devices do not meet the above problems or demands of the farmers (Bhumannavar *et al.* 2015) [1]. To solve these difficulties there is need of new equipment that will be manually operated and wheel driven mechanism with low cost or cost effective.

Material and Methods

Location of experiment

A manual operated sprayer was designed and fabricated in the Departmental Workshop of Farm Machinery and Power and evaluated at field of College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur.

Economic evaluation of developed sprayer

The cost of spraying operation consists of fabrication cost, rental cost, and insurances cost, repair and maintenance and labor wages. The cost of operation of ground wheel operated boom sprayer is divided in two parts first is fixed cost and second is variable cost. The fixed cost is independent of the operational work while variable cost varies according to use of spraying machine. Cost of the machine and its operation was calculate in Rs/ha using straight line method of depreciation and economic evaluation of machine were calculated.

Total fixed cost

Depreciation cost: The annual depreciation cost can be determine by following formula.

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

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Where, D = depreciation cost (₹/h), P = purchase price (₹), S = salvage value, L = life of the machine in year and H = number of working hours per year.

Interest (I): Annual interest is calculated on an average investment by using the following formula.

$$I = \frac{(P+S)}{2} \times \frac{i}{H} \dots\dots\dots(ii)$$

Where, I = annual interest charge (₹/h) and i = interest rate (decimal)

Insurance: Taking insurance charge @ 1% of the purchase price per year.

$$\text{Insurance cost} = 1\% \text{ of } P = \frac{1\% \text{ of } P}{H} \dots\dots\dots(iii)$$

Housing rate: Taking Housing charge @ 1% of purchase price per year

$$\text{Housing cost} = 1\% \text{ of } P = \frac{1\% \text{ of } P}{H} \dots\dots\dots(iv)$$

Taxes rate: Taking taxes charge including GST @ 18% of purchase price for whole life.

$$\text{Taxes cost} = \frac{0.18 \times P}{L \times H} \dots\dots\dots(v)$$

Repair and maintenance cost: Repair and maintenance cost was taken 5% of purchase price of the machine per year.

Labour cost: Labour cost was taken 400Rs per day for eight working hour.

Results and Discussion

A ground wheel operated sprayer was developed to cover more area and perform spraying without using fuel (petrol, diesel) and electricity. It increases swath width, theoretical field capacity, and effective field capacity and also increases field efficiency. The mechanical device to operate the pump was designed named as scotch yoke. The scotch yoke was powered by ground wheel. Two different types of stoke was used. The length of first stoke was 4 cm and the other was 4.5 cm. Following parts were selected for the developed boom section.

Cost economics

The cost of spraying the fenugreek with ground wheel operated sprayer was assessed and compared with hand operated knapsack sprayer. The total cost of developed ground wheel operated sprayer was ₹20000. The assessed value has been shown in the table 1.

Table 1: Economics of spraying by developed sprayer for one hectare.

Development cost of spraying machine (includes material charge and labour charge for fabrication	: ₹ 20000
Cost of pesticides	: ₹/kg
Labour charge	: ₹400/day
Life of spraying machine	: 8 year, 2400hrs
Working hours per year	: 300
Salvage value	: 10% of development cost
Interest rate(per year)	: 10% of development cost
Insurance(per year)	: 2% of development cost
Taxes of dusting machine for whole life	: 18% of development cost
Housing (per year)	: 1% of development cost
Repair and maintenance costs (per year)	: 5% of development cost
Depreciation	: Straight line method

The capacity of hand operated knapsack sprayer and developed ground wheel operated sprayer was found 0.072 ha/hr (Kumar, 2015) [2] and 0.281 ha/hr respectively. The cost of spraying of hand operated and developed sprayer was calculated 52.22 ₹/hr and 66.55 ₹ /hr respectively. Total cost of operation for one hectare by hand operated and developed sprayer were assessed 725 ₹/ha and 236.83 ₹ /ha respectively. The cost of spraying per hectare in hand operated was much higher than the developed sprayer.

Conclusion

Spraying is one of the most important operations in crop production. Spraying operation is a complex process and can be influenced by many variables. The agriculture sector is facing problems with capacity issues, shrinking revenues, and labour shortages and increasing consumer demands. The prevalence of traditional agriculture equipment intensifies these issues. In addition, most farmers are desperately seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer in an agriculture field. A pesticide sprayer has to be portable and with an increased tank capacity as well as should result in cost reduction, labour and spraying

time. Total cost of operation for one hectare by hand operated and developed sprayer were assessed 725 ₹/ha and 236.83 ₹ /ha respectively.

References

1. Bhumannavar GP, Srinivasa, Lohit HS. Design and development of a low cost mobile spray pump for indian middle class farmer. Msruas sastech Journal. 2015; 15:25-28.
2. Kumar CS. Development and performance evaluation of single wheel driven boom sprayer. International Journal of Agricultural Science and Research. 2015; 5:277-285.
3. Sivanainthaperumal T, Selvam M, Pandiyaraj R, Arunraj S. Design and development of wheel spray pump. International Journal of emerging technology in computer science and electronics 2018; 15:590-594.