

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.907.463>

Performance Evaluation of VNMKV Developed Power Weeder

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ABSTRACT

Keywords

Power Weeder,
Energy requirement
in weeding,
performance
evaluation

Article Info

Accepted:
22 June 2020
Available Online:
10 July 2020

Weeding is tedious and labour consuming operation in Agriculture .More than 33 percent of the cost incurred in cultivation is diverted to weeding operations there by reducing the profit share of farmers. Power weeder was developed and its performance was at Department of farm Machinery and Power, college of Agricultural Engineering and Technology, VNMKV, Parbhani. The weeding efficiency was 83.60 and 84.48 percent for soyabean and turmeric respectively with plant damage percentage of 4.6 and 6.7 percent. The effective field capacity, field efficiency of developed weeder was 0.45, 0.47 ha per day and 84.28 percent and 81.42 percent respectively. The fuel consumption for weeding in both crop was 0.61 and 0.58 lph respectively for soyabean and turmeric crop. Operation cost by developed weeder is less than other two methods. It saves 35.50 percent and 20.00 percent over the manual weeding and weeding with the help of bullock hoe energy required foe weeding the one hectare by traditional human power with the help of kurpi is 328.52MJ/ha ,by traditional bullock hoe is 660.82MJ/ha and by developed weeder is 524.86MJ/ha.

Introduction

A weed is essentially any plant which grows where it is unwanted. Saving of labour requirement (man-h/day) is achieved with the use of improved long-handle mechanical weeders like wheel hoes, animal drawn weeders (two to three rows) and engine-operated power weeders. Typical work rate of hand tool (Khurpi), hand chopping hoe, push / pull type or push-pull weeder and animal drawn weeding implement varies between 300-500, 200-300, 100-125 and 6-20 man-h/ha respectively resulting in saving in cost of weeding approximately from Rs. 4000-5000 per ha (manual weeding) to Rs. 1500-2000

per ha in case of improved mechanical weeders (Singh *et al.*, 1999-2000, Alam and Singh 2003).

Mechanical weeding is one of the oldest, but the most common methods of weed control in upland crops. Although it has undergone a spectacular advancement, yet hand weeding with simple weeders is common. These simple weeders are cheap, more efficient and suitable for farmer's situation to reduce the cost of crop production and improve crop yield to a great extent. It is not only safe to the environment, but also safe to the user. The physiological demand in using weeders was relatively higher than in manual weeding.

However the efficiency of the work in terms of area covered was significantly better with the weeder than with manual weeding. The energy demand in manual weeding is only about 27 per cent where as for weeding with different weeders, the energy goes up to 56 per cent. The strain was relatively less in case of wheel hoe type weeder (Rajasekar, 2002).

Materials and Methods

The power weeder consists of following components or systems.

1) Engine 2) Main frame 3) Weeding assembly 4) Ground wheel 5) Front wheel 6) Control system 7) Power transmission system 8) Fuel tank 9) Light system 10) Cover.

i) A engine operated blade weeder had a adjustable operating width to. adopted row spacing. The depth of operation was adjustable to 2 cm to 7 cm.

ii) Power transmission system

Chain and sprocket system was used to transmit the power of engine to ground wheel. Sprocket used was made up of high carbon steel. Such sprockets has a maximum load transmission ability without breakage.

iii) Material of blade

Blade was the soil working tool for machine. Spring steel was used for blade after heat treatment.

The power operated weeder was operated in the field of AICRP on soyabean, and vegetable VNMKV, Parbhani. The field test was carried out as per RNAM test code procedure for weeder. The weeder was evaluated for the actual field capacity, theoretical field capacity, weeding efficiency, fuel consumption etc

Calculation of energy

Source-wise energy consumption was calculated for each source used for the operation. Energy equivalents were used as mentioned in the table.1.

Co-efficient for various sources of energy

Energy coefficient for various sources of energy taken into all forms of energy input to their production has been worked out, Mittal & Dhawan (1988). The energy equivalent used in the study is shown in table.2.

Results and Discussion

The developed weeder was evaluated for its performance in the field of AICRP on Vegetables and AICRP on soyabean.

The field condition at both the farms are given in table 3. Black cotton soil is present in the both fields and planting method in the fields was Ridges and furrows for vegetable field while in soyabaen field it was BBF planting

The results obtained in the field confirms with the results obtained for the field performance evaluation. The weeding efficiency was 83.60 and 84.48 percent for soyabean and turmeric respectively with plant damage percentage of 4.6 and 6.7 percent.

The effective field capacity, field efficiency of developed weeder was 0.45, 0.47 ha per day and 84.28 percent and 81.42 percent respectively. The fuel consumption for weeding in both crop was 0.61 and 0.58 lph respectively for soyabean and turmeric crop.

Energy requirement for Weeding

The energy used in weeding with different methods was calculated as discussed in the

materials and methods. For calculating the energy supplied from various sources like - human, bullock and mechanical and converted into energy by using the conversion factor the details of calculations are given in appendix and the energy requirement is shown in table 5

It shows that the energy required for weeding the one hectare by traditional human power with the help of kurpi is 328.52MJ/ha, by traditional bullock hoe is 660.82MJ/ha and by developed weeder is 524.86MJ/ha.

Cost economics of turmeric digger

Adaptability of any machine depends of its performance, cost economic. The cost of weeding for all three types of operation i.e. weeding by manually, bullock weeder and developed weeder was calculated. It is clear from the table that operation cost by developed weeder is less than other two methods. It saves 35.50 percent and 20.00 percent over the manual weeding and weeding with the help of bullock hoe.

Table.1 Specification of Engine Weeder

Sr. No.	Particular	Specification
1.	Name of machine	Engine Operated Weeder
2.	Make	MAU,Parbhani.
3.	Model	Prototype
4.	Type of machine	Blade type(straight)
5.	Overall length of machine (mm)	1820
6.	Overall height of machine (mm)	1020
7.	Overall width of machine (mm)	640
8.	Overall weight of machine (Kg)	45
9.	Ground clearance (mm)	180
10.	Width of blade (mm)	25 or 42.5 (as per requirement)
11.	Turning space diameter (mm)	2000

Table.2 Energy equivalent MJ/Unit

Sr.No	Items	Energy equivalent MJ/Unit
1	Human labour Male Female	1.96 MJ/male hr 1.57MJ/female hr
2	Bullock with a body weight (350-450 kg/bullock	10.10 MJ/pair
3	Diesel	56.31 MJ/lit
4	Machinery Prime mover other than electric motor including self Farm machinery other than propelled ones	54.8 MJ/kg 62.7 MJ/kg
5	Electric motor	11.93 MJ/kWh

Table.3 The field conditions at both the centres were as follows

Particulars	AICRP on vegetable	AICRP on soyabean
Type of soil	Black cotton soil	Black cotton soil
Moisture content of soil	16.5 percent	18.6 percent
Planting method	Ridges and furrows	BBF
Age of crop	45 days	30 days

Table.4 Performance evaluation of developed digger in the field

Sr.no.	Particulars	Soyabean	Turmeric
1	Working width (mm)	390	415
2	Depth of operation (mm)	39	42
3	Speed of operation (km/h)	1.8	1.90
4	Theoretical field capacity (ha/day)	0.54	0.58
5	Effective field capacity (ha/day)	0.45	0.47
6	Field efficiency (%)	84.28	81.42
7	Plant Damage %	6.7	4.6
8	Fuel consumption lph	0.61	0.58
9	Weeding efficiency (%)	83.60	84.48

Table.5 Comparative table for Energy requirement for weeding

Sr.No	Type of energy consumed	Traditional Hand Weeding	Traditional Bullock Hoe	Developed weeder
1	Human being E= Energy equivalent × man's hours	165*1.96=323.40	22.67*1.96 =44.96	1.96 * 18 = 35.28
2	Energy from machine	0.031*165=5.115	22.67*62.70*40/240=236.90	$\frac{64.8 \times 40 \times 18}{320}$ = 145.8
3	Energy from petrol /Bullock		14.07*22.67=318.96	0.396× 48.23× 18 = 343.78
	Total	328.51 MJ/ha	600.82 MJ/ha	524.86 MJ/ha

Table.6 Comparative table for cost of weeding with different methods

Sr.no	Particulars	Cost of operation
1	Weeding with traditional human (Kurpi)	Rs.3600/ha
2	Weeding with traditional Bullock Hoe	Rs.2900/ha
3	Weeding with developed weeder	Rs.2322/ha



It is clear from the table that operation cost by developed weeder is less than other two methods. It saves 35.50 percent and 20.00 percent over the manual weeding and weeding with the help of bullock hoe.

In conclusion the developed weeder was operated for row spacing 375 to 450 mm with 39 to 42 mm depth. The weeding efficiency was 83.60 and 84.48 percent for soyabean and turmeric respectively with plant damage percentage of 4.6 and 6.7 percent. The effective field capacity, field efficiency of developed weeder was 0.45, 0.47 ha per day and 84.28 percent and 81.42 percent respectively. The fuel consumption for weeding in both crop was 0.61 and 0.58 lph respectively for soyabean and turmeric crop. Energy requirement in developed weeder is less than that of the traditional operation carried out with bullock hoe. The effective field capacity of developed weeder is more than both the traditional methods. The time and cost required for the operation with developed weeder is less than other two methods.

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How to cite this article:

Munde, P. A., R. T. Ramteke and Solanki, S. N. 2020. Performance Evaluation of VNMKV Developed Power Weeder. *Int.J.Curr.Microbiol.App.Sci.* 9(07): 3943-3948.
doi: <https://doi.org/10.20546/ijcmas.2020.907.463>