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Development and Performance Evaluation of Manually Operated Multipurpose Farm Tool

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ABSTRACT

Agricultural practices require various implements. The implements are manually operated as well as tractor operated. Many of these implements are inconvenient for small farmers (upto 1-2 ha) to use in their filed. The manual methods are also time consuming, labour consuming. So there is need to develop a tool which will be useful for the small formers and one can perform the various operations. So a tool was developed to overcome these problems named "Manually operated multipurpose farm tool". As the name it is operated manually, and perform various operations. Manual method of seed planting, results in low seed placement, spacing, efficiencies and serious drudgeries for the farmer. The weeding operations when done by traditional methods it causes non-uniformity, time consuming and drudgeries to human body. Peasant farmers can do much to increase food production especially grains, if drudgery can be reduced or totally removed from their farming operations. To achieve the best performance, the above limits needs to be optimized by developing proper designed tool which can perform several operations and selection of the components required on the machine to suit the need of operations.

Keywords: *Main frame, Wheel, Handle, seed covering device, V-Blade, specifications, Performance.*

INTRODUCTION

A developing country like India is expected to continue to rely more on hand tools for the various operations which are performed on the field, time to time depending upon the crop and field conditions. These operations are generally performed by the traditional methods by using various traditional tools by small farmers. It causes less accuracy in operation, time consuming and drudgeries to human body. As the population continues to increase, it is necessary to produce more food, but this can only be achieved through some level of mechanization. After land preparation sowing is done. The marginal farmers in rural areas performs it with broadcasting method.

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Manual method of seed planting, results in low seed placement, spacing, efficiencies and serious drudgery for the farmer which limits the size of field that can be planted. However, planting machine or planter that is normally required to produce more food is beyond the purchase capacity of small farmers. These small farmers still continue to plant manually and the result of which is low productivity of the crops. The use of hand tools for land cultivation is still predominant in India because draft animals and tractors require resources that many Indian farmers do not have easy access. The need for agricultural mechanization in India must therefore be assessed with a deeper understanding of the small h farmer's activities and what values farm power generated for them. When the field is too big for performing operations with hands and too small for a tractor, the farm tool to use which should be convenient to use under such field efficiently and economically. Thus the "Manually operated multipurpose farm tool" is developed. It is the easiest way of sowing, cultivating and weeding.

A) Development of manually operated multipurpose farm tool

a) Main frame

The main frame is the skeletal structure of the multipurpose tool on which all other components are mounted. In this work mild steel rectangular pipe of 25 mm x 25 mm x 2 mm was used to give the required rigidity. The main frame is rectangular in shape. The frame has provided the axel for attaching the transport wheel. The wheels are then attached to this axel from the both sides.

Fig. 1: Main frame

b) Handle

The adjustable handles consist of two mild steel square pipe each of 900 mm long and of 25 × 25 × 2 mm are fastened to the frame at two ends of the flat bar. One square pipe of 25 × 25 × 2 mm dimensions and 450 mm length is attached at the end of mild steel square pipe perpendicular to them. The two pipes of 20 mm external diameter and of 140 mm length are joined on the both the ends of the perpendicular bar.

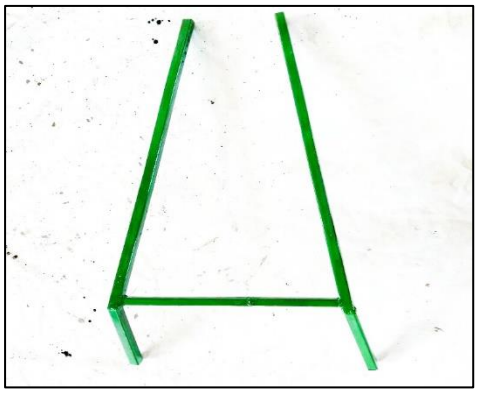

Fig. 2: Handle

c) Transport wheels

Two transport wheels are made of mild steel flat plate of 20 × 4 mm. These wheels are attached on the front side of the main frame. The diameter of the each of the wheel is 400mm. The wheel containing periphery width of 30 mm which reduce side thrust and 10 mm rod which serves as spokes. There are 6 such spokes.

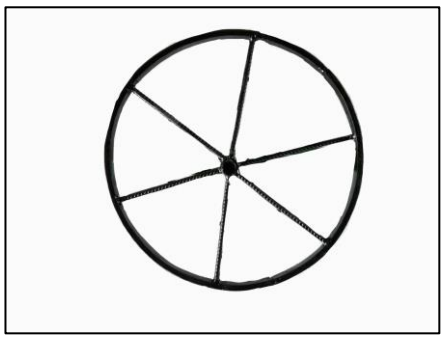

Fig. 3: Transport Wheel

d) Furrow opener

The type used for this work is the shoe type. These types of furrow openers are used for forming narrow slit under heavy soils for placement of seeds at medium depths up to 3 to 4 cm. The furrow openers have length 180 mm and that of the furrow opener shank is 80

mm. The piece of square pipe is attached behind the shank. The spacing between the rows can be adjusted as 30 cm.

Fig. 4: Furrow opener

e) Seed covering plate

The Furrow covering device is made of two mild steel flat plates of dimension 30 mm × 5 mm. These plates have clearance between them of 15 mm. The plates are welded to the two square pipes of 20 × 5 × 2 mm and 180 mm length. It was fastened with the four nut-bolts to the frame through a hole drilled on the frame.

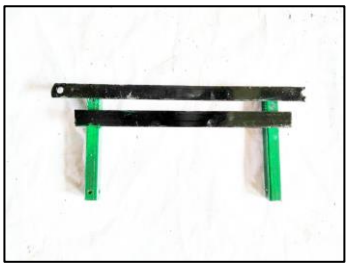

Fig. 5: Seed covering device

f) V-blade

The V-blade is made from the mild steel flat of 5 mm thickness and 30 mm wide. The overall length of the V-blade is 300 mm, total cutting length 300 mm and the rake angle is 150. The V-blade has a welded to the two square pipes of 25 mm and 200 mm length.

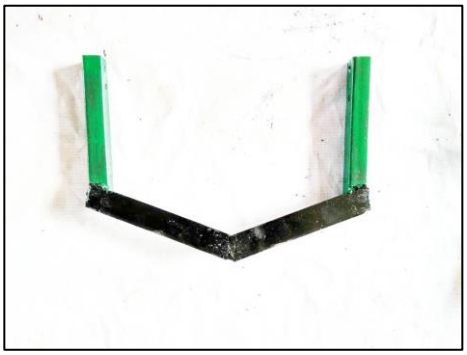

Fig. 5: V-blade

g) Hoe blades

The hoe blades are provided for working under the different crops. The first is 350 mm long these blades are made from the mild steel flats of 30 mm width and 5 mm thickness. In both cases the blades are welded to the square pipes of 20 mm length. rake angle of the blade is 15^0.

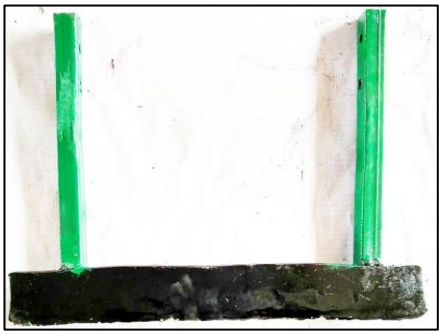

Fig. 6 Hoe blade

h) Three tine cultivator

The three tine cultivators as the name indicates consist of the three tines. Each consist of the shank of length 80 mm. The overall working width of the cultivator is 300 mm. The square rod of 300 mm length is bent to attach the shank to its one end. The another end is welded to the square pipe of 25 mm and 250 mm length.

Fig. 7:Three tine cultivator

B) Detail specifications of developed manually operated multipurpose farm tool.

Sr. No.	Components	Specification	Material
1	Main frame	Total length : 500 mm	MS pipe 25 × 25 × 2 mm
2	Adjustable Handle	Maximum length : 900 mm Minimum length : 760 mm	MS square pipe 25 × 25 × 2mm
3	Transport wheels	Rim diameter : 400 mm Rim width : 20 mm	MS flat plate 20 × 4 mm
4	furrow openers	row spacing : 30 cm, Depth : 20 to 30 mm Length of openers : 00 mm Length of shank : 80 mm	Angle bar iron
5	Seed covering plate	Length of plate : 370 mm Clearance between plates : 15 mm	MS flat plate 30 mm × 5mm MS square pipe 25 × 25 × 2mm
6	V-blade	Overall length : 290 mm Cutting length : 300 mm Rake angle : 15^0	MS flat plate 30 mm × 5mm MS square pipe 25 × 25 × 2mm
7	Hoe blades	Length of larger blade : 370 mm Rake angle : 15^0	MS flat plate 30 mm × 5mm MS square pipe 25 × 25 × 2mm
8	Three tine cultivator	Length of shank : 50 mm Working width : 330 mm	MS square rod 10 × 10 mm MS square pipe 25 × 25 × 2mm

C) Performance evaluation of developed manually operated multipurpose farm tool

The developed "Manually operated multipurpose farm tool" was tested in field for its performance evaluation. It was tested on the field of College of Agricultural Engineering and Technology, jalgaon (ja). affiliated to Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to obtain the observations and the result.

a) Furrow openers

	Sr. No	Time (s)	Speed (km/hr)	T.F.C. (ha/hr)	E.F.C. (ha/hr)	Field efficiency (%)	Avg. Result (%)
Furrow Opener	1	22	0.98	0.0244	0.0184	75	74.72
	2	21	0.97	0.0232	0.0178	73.1	
	3	20	0.98	0.0253	0.0178	73.5	
	4	18	0.97	0.0249	0.0171	71	
	5	19	0.95	0.0251	0.0179	72	

Seed covering device

Seed	Sr. No	Time (s)	Speed (km/hr)	T.F.C. (ha/hr)	E.F.C. (ha/hr)	Field efficiency (%)	Avg. Result (%)
Covering Plate	1	12	0.98	0.0243	0.0169	71.2	72.86
	2	16	0.95	0.0232	0.0171	73	
	3	15	0.98	0.0251	0.0179	72.54	
	4	12	0.95	0.0243	0.0169	71	
	5	14	0.97	0.0249	0.0173	72.1	

b) V-blade

	Sr. No	Time (s)	Speed (km/hr)	T.F.C. (ha/hr)	E.F.C. (ha/hr)	Field efficiency (%)	Avg. Result (%)
V-blade	1	21	0.97	0.0249	0.0179	73	73.1
	2	22	0.98	0.0243	0.0183	73.3	
	3	23	0.97	0.0245	0.0181	74	
	4	20	0.96	0.0251	0.0179	72	
	5	21	0.97	0.0243	0.0175	72.9	

Hoe blade

	Sr. No	Time (s)	Speed (km/hr)	T.F.C. (ha/hr)	E.F.C. (ha/hr)	Field efficiency (%)	Avg. Result (%)
Hoe blade	1	21	0.95	0.0239	0.0173	73.1	73.6
	2	20	0.97	0.0251	0.0179	72	
	3	22	0.98	0.0243	0.0178	73.5	
	4	23	0.95	0.0235	0.0181	74	
	5	21	0.97	0.0243	0.0175	73	

Three tine cultivator

	Sr. No	Time (s)	Speed (km/hr)	T.F.C. (ha/hr)	E.F.C. (ha/hr)	Field efficiency (%)	Avg. Result (%)
Three Tine Cultivator	1	15	0.98	0.0243	0.0168	71.2	72.2
	2	17	0.96	0.0248	0.0173	72.1	
	3	15	0.95	0.0243	0.0163	71.3	
	4	14	0.98	0.0243	0.0175	73	
	5	12	0.97	0.0249	0.0173	72	

SUMMERY AND CONCLUSION

1. The average operating speed for the V-blade was 0.9875 km/h with theoretical field capacity 0.0243 ha/h, effective field capacity 0.0183 ha/h, field efficiency 73.1 per cent and weeding efficiency 75.07 percent.
2. The average speed for the hoe blade (37cm) was 0.95km/h, theoretical field capacity 0.0235ha/h, effective field capacity 0.0181 ha/h, field efficiency 73.6 per cent and weeding efficiency 77 per cent..
3. The average operating speed for the three tine cultivator was 0.97 km/h with theoretical field capacity 0.0249 ha/h, effective field capacity 0.0173 ha/h and field efficiency 72.21 percent.
4. The time requirement to change one tool with another tool is generally 2 to 3 min depending on the tools and the operator. The overall weight of the implement with two wheels, handle and individual tool is up to 12 kg. The weight of the entire parts of the multipurpose tool is 15kg.

REFERENCES

Agarwal, K. N., Tiwari, P. S., Gite, L. P., & Bhushanababu, V. (2010). Isometric push/pull strength of agricultural workers of central India. Agricultural Engineering international: the CIGR *Journal manuscript 12*(1),115－124.

Brain, G. S. (2000). Elements of design and evaluation of animal drawn weeders. A resource book of Animal traction network for eastern and southern Africa. Silsoe research institute, technical center for agricultural and rural cooperation Wageningen.

Cloutier, D. C., Weide, V. D., Peruzzi, A., & Leblanc, M. L. (2007). Mechanical

weed management. CAB International. ed.111-134.

Gianessi, L. P., & Reigner, N. P. (2007). The value of herbicides in U.S. crop production. *Weed Technology 21*(2), (April): 559-566.doi:10.1614/WT- 06-130.1.

Gianessi, L. P., & Sankula, S. (2003). The value of herbicides in U.S. crop production. Washington D.C. National Centre of Food and Agricultural Policy.

Parida, B. C. (2002). Development and evaluation of star-cum cono weeder for rice. Agricultural Mechanization in Asia, Africa and Latin America. *33*(3), 21-22.

Senthilkumar, L. (2003). Effect of weed control methods on rice cultivars in Indian rice field. *Journal Biological Science 3*, 119-123.

Slaughter, D. Giles, D., & Downey, D. (2008). Autonomous robotic weed control systems: A review. Computers and Electronics in Agriculture *61*(1), (April): 63-78.

Walz, E. (2004). Fourth national organic farmers' survey: Sustaining organic farms in a changing organic marketplace. Santa Cruz, Ca.: Organic Farming Research Foundation.