

Animal Drawn TENDUA IRON PLOUGH

SUCCESS STORY



ALL INDIA COORDINATED RESEARCH PROJECT ON
**INCREASED UTILIZATION OF ANIMAL ENERGY
WITH ENHANCED SYSTEM EFFICIENCY**

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- Year : 2011
- Published by : Coordinating Cell AICRP on Increased Utilization of Animal Energy with Enhanced System Efficiency Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal – 462 038, India
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TENDUA IRON PLOUGH

INTRODUCTION

Primary tillage implements displace and shatter soil to reduce soil strength and to bury or mix plant materials and fertilizers in the upper layer of soil. In Chhattisgarh state of India, the traditional practice of primary tillage followed by the farmers is ploughing with indigenous wooden plough (Fig. 1). This plough is operated by draught animals like bullocks and he – buffaloes. This is the simplest tool used by the farmers and is designed to break the top soil. Farmers also carry out secondary tillage with this implement. Multiple operations with this implement are required in order to prepare a good seedbed. This practice is prevailing since centuries and shape and size of the implement has not been changed. This practice is time consuming as the field capacity of the traditional plough is very low. Further the plough is made of wood which is becoming scarce and expensive day by day. The life of this plough is also short. An iron plough could be a good substitute for existing indigenous wooden plough since life of implement would increase. A steel plough was therefore developed which was having increased life keeping the design features similar to the indigenous plough. This plough was named as the Tendua Iron Plough

Evolution of Tendua Plough

The Tendua iron plough originated at village 'Tendua' of Kawardha district of Chhattisgarh. This was modified at the College of Agricultural Engineering, IGKV, Raipur. The performance evaluation of the implement was carried out. Data on field capacity, depth of operation, power utilized and cost of operation was obtained. In addition, physiological responses of animal during operation were also recorded. Modifications were carried out based on field evaluation studies.

After successful development of implement, this was taken up for popularization among farmers under Village Saturation Programme. After obtaining satisfactory response from farmers this was taken up under Prototype manufacturing at University workshop. Subsidy was obtained from State Government on sale of implements. Subsequently manufacturers were trained to take up the manufacture of this plough.

Salient features of the Tendua Plough

The implement consists of a steel body similar to the shape and size of the indigenous plough used in the region. A steel shovel is fixed at the lower end of the plough which can be replaced on wearing. The weight of the plough is only 1 kg higher than indigenous plough. The indigenous wooden plough and Tendua iron plough is shown in Fig 1. The specifications of the above ploughs are presented in Table 1. The width of Tendua plough is higher as compared to indigenous plough which results in increased width of cut. The cost of the plough is however 2.5 times that of traditional indigenous plough.



Indigenous Plough



Tendua Iron Plough

Fig. 1 Indigenous Wooden Plough and Tendua Iron Plough

Table 1. Specifications of Tendua Iron Plough and Indigenous Wooden Plough

S.No.	Particulars	Tendua Plough	Indigenous Plough
1	Material	Mild Steel	Wood
2	Length of share, mm	23	21
3	Width of share, mm	7.5	6.4
3.	Height, mm	620	880
4.	Size of cut mm	120	100
5.	Weight with beam, kg	22.5	21.5
6.	Cost, Rs.	1680	650

Performance Evaluation of Tendua Iron Plough

The Tendua iron plough was tested in the experimental field at Faculty of Agricultural Engineering, IGKV, Raipur and a comparative evaluation was also carried out with traditional plough. The results obtained are presented in Table 2. Effect of ploughing with Tendua plough on physiological responses of bullocks is presented in Table 3.

Table 2. Field Performance of Tendua Iron Plough

S.No.	Particulars	Tendua Plough	Indigenous Plough
1	Draught (kg)	63.39	64.51
2	Speed (kmph)	2.17	2.15
3	Average width of cut (cm)	11.25	9.70
4	Average depth of cut (cm)	8.08	8.28
5	Theoretical field capacity (ha/h)	0.026	0.021
6	Effective field capacity (ha/h)	0.015	0.012
7	Field Efficiency (%)	60.98	60.00
8	Power (kW)	0.38	0.60
9	Weeding Efficiency (%)	70.45	71.70
10	Operational energy per ha (MJ)	1501.55	1781.21
11	Cost of operation per ha (Rs.)	3040.75	3658.99

It was observed that field capacity of Tendua iron plough (0.015 ha/h) was higher as compared to indigenous plough (0.012 ha/h) because of higher width of cut of Tendua plough. The draught requirement was 63.39 kg which was well within the capacity of local bullocks. The estimated power required for indigenous plough (0.60 kW) was considerably higher as compared to Tendua plough (0.38 kW). The energy consumption for ploughing operation was higher when ploughing was done with indigenous plough as compared to Tendua iron plough. Use of Tendua plough for ploughing operation saves 15.70 per cent energy as compared to indigenous plough. This may be due to the fact that Tendua plough has higher coverage capacity and there by requires less numbers of hours to complete the ploughing operation. The cost of operation for indigenous plough was found highest as its effective field capacity was less as compared to Tendua plough.



Fig. 1 Ploughing with Tendua Iron Plough



Fig 2. Tendua iron plough during operation



Fig 3. Indigenous plough during operation

Effect on Physiological Response of Bullocks during Ploughing by Tendua plough

The data on effect of physiological response of bullocks during ploughing by Tendua plough is presented in Table 4. The data revealed that, pulse rate, respiration rate and body temperature increased with duration of time. It also increased with increase in draught load. The average initial pulse rate (beats/min) of bullocks was 36 at rest and increased to 64, 71, 78 and 83 after each hour of operation up to four hours. The average initial respiration rate (blows/min) of bullocks was 36 at rest and increased to 60, 65, 68 and 71 after 1st, 2nd, 3rd and 4th hour of operation. Similarly the initial body temperature of local bullocks was 37.2^o C at rest and increased to 39.3^o C at the end of four hours of operation. The average draught load was recorded as 63.39 kg which was within the capacity of the bullocks.

Table 3. Effect on physiological responses

Hours	Ploughing Operation by Tendua Iron Plough		
	PR (beats/min)	RR (blows/min.)	BT (^o C)
Initial	36	36	37.2
1	64	60	37.7
2	71	65	38.2
3	78	68	38.8
4	80	71	39.3

(PR = Pulse Rate, RR = Respiration Rate, BT = Body Temperature)

Popularization of Tendua plough under Village Saturation Programme

The AICRP on UAE, Raipur centre initiated the Village Saturation Programme during 2004-05 by adopting 16 farmers each from three villages. The farmers of the adopted villages were using indigenous plough for field preparation (primary tillage) and following paddy-chickpea and paddy-wheat crop rotation. Initially for ploughing operation, Tendua plough was distributed amongst the group of farmers. Due to encouraging response of the farmers from these villages and to promote the implement in new villages, two more villages were adopted and implement was distributed to each of the adopted farmers in the year 2005-06 and one village in 2007-08. Details of FLD carried out are presented in Table 4. The response and

feedback collected from the farmers were good and a good demand was created. Considering the demand, State Government was approached for subsidy which was granted by State Government. Prototypes were manufactured at Prototype Production Centre of University and sold to farmers under subsidy. Considering the encouraging response manufactures and village artisans were trained in fabrication of the implement.

Table 4: FLD's on Tendua plough at farmers' fields under VSP programme

Villages	No. of farmers benefited	No. of FLD's	Area covered under FLD (ha)	% increase in area coverage as compared to existing practice	No. of farmers aware	No. of farmers responded
Kapasda	16	16	6.4	10.7	258	70
Belar	16	12	6	9.6	185	33
Kopedih	16	16	16	10.3	170	41
Parsada	2	2	2	10.9	474	78
Pirda	2	2	2	10.7	350	84
Tulsi	2	2	3	9.4	309	81
Korba KVK	2	2	2	9.5	-	-

Commercialization

The Farm Implement Manufacturing unit of IGKV, Raipur and State Govt. Agril. Engg. Dept. are the major manufacturers of this implement. In addition four private manufacturers are also engaged in manufacturing this implement. The above manufacturers have sold 2697 units of Tendua plough till 2008 – 09 and 800 units in the year 2009 – 10. In order to increase the adoption of animal drawn implements, 50% subsidy has been granted by the Government which include 25% share of the State Government and 25% share of the Central government. The 'Tendua' plough has gained popularity in Raipur, Bilaspur, Korba, Raigarh, Dantewada, Janjgir and Narayanpur districts.

Manufacturers

1. Farm Implement and Manufacturing, Revolving fund scheme, IGKV, Raipur (CG).
 2. Office of Agriculture Engineer (Govt. of CG), Telebandha, Raipur
 3. Office of Agriculture Engineer (Govt. of CG), Nutan Colony, Sarkanda, Raipur
 4. Chhattisgarh State Seed and Farm Development Corporation, Raipur (CG)
 5. Batala Engineering, Hirapur, Tatibandh, Raipur.
 6. Asian trading company, Telebandha, Raipur.
 7. KD enterprises, Mahadevghat Road, Raipur (CG)
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