

DEVELOPMENT AND POPULARIZATION OF MULTIPURPOSE PIPE FRAME IMPLEMENT FOR ADIVASI FARMERS OF GUJARAT

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ABSTRACT

An improved multipurpose pipe framed implement was fabricated to suite the local requirements and the bullocks of adivasi area. The improved new device, thus, serves as an efficient and rugged primary ploughing implement over and above providing two parallel furrows, which is presently not obtainable with the local implement. However, qualitative observations indicated that the plough could be easily pulled by a pair of bullocks and operated smoothly any unbalance. the total cost of improved implements including all the attachments (two plough bottoms, different size of blades for harrow, four tines, bund former set, five furrow openers with complete sowing devices comes to Rs. 18000/-whereas the total cost of local implements set as Rs. 26000/-. Therefore, the new improved multipurpose implement cost Rs. 8000/- less as compared to the conventional wooden set presently used in this area. Its cost of operation per hour is Rs.5.44 as compared to Rs. 9.66 per hour for the local set. The comparative field performance data indicated that the improved implement provides increased work output 25 % in ploughing, 68 % in sowing of pigeon pea / cotton, 22 % of sowing of maize/sorghum, 48 % in inter-culturing of pigeon pea /cotton. Its use will result in 24, 43, 22 and 36 % reduction in cost of doing these operations, respectively.

KEY WORDS: Adivasi Farmers, Multipurpose pipe framed implement

INTRODUCTION

Tribes live in undeveloped isolated areas, which are not connected to other parts of the country through roads, lights and telephones. They are illiterate and their migration from rural to urban areas is also negligible. Any new development is not easily adopted by adivasi because of its unsuitability for the area. Adivasi people are poor and mostly dependent on farming and allied business. Adivasi live in

confined area which have several location specific problems. Their average land holding is very small and their purchase capacity is also less. Therefore, specific attention is required for developing or transferring any technology in these conditions. Many farmers of Adivasi belt of Gujarat state having a pair of bullocks, whether with dry farming or irrigated farming, whether growing only one crop or variety of crops, whether taking one

crop per year or two to more crops per year, whether small or big have at least the following local wooden implements, found during the survey work.

- (i) Local indigenous plough
- (ii) Single straight blade harrows (Karab, Dhundhiya, Dodhiya, Omiya, Ekliya, etc.) seed covering, harvesting of root crops, etc. for various crop row spacing
- (iii) Twin straight blade harrows (Karabadi, Double Karab, Beli, etc.) for inter-culturing in row crops
- (iv) Wooden plank (Rapat) for leveling, clod crushing, and seed covering.
- (v) Two to five tyne cultivators cum seed drills (Tarfen, Vavania, etc.) with different row spacing for seed bed preparation, furrow opening, seed and fertilizer sowing using seed bowl and seed tubes. and
- (vi) Bund former and Ridger for irrigation purpose.

The number of each of the above implement may be one, two or more depending upon the size of blade, size of farm, cropping pattern, investment capacity, number of bullock, etc. of the farmers. All above these implements mostly made from local wood and made by the local artisan. Therefore, the farmers reported frequent breakdowns in these implements during the different field operation. Adivasi farmers are using old agricultural implements made of wood which was easily available in those days but nowadays wood has become costly input and on the other hand its strength and life is less. A maintaining several implements for individual farm operation is difficult, time and money lost during the transporting as well as storage.

Considering above fact and requirements, there is a need of one multipurpose implement substitute of several local wooden implements. The farmers are having numbers of separate implements for various farm operations in different crops which add to the cost. Therefore, it is very well required to develop and popularize such implement which is multipurpose, efficient, and cheap and be able to reduce the human drudgery. Therefore, a project was undertaken for the Adivasi areas of Gujarat with objectives to study the existing agricultural implements used by the farmers for various farm operations, to develop the set of Agricultural implements suitable for Adivasi areas based on the preliminary study, to test the developed implements and compare with the existing implements, and to popularize the developed package of implements through demonstration among the farmers and local manufacturers.

Especially a project was undertaken for development of bullock drawn implements for Adivasi farmers of Chota Udepur and Sankheda Talukas of Gujarat. Under which bullock drawn multipurpose pipe frame implement was designed, developed, tested and released for those farmers by Junagadh Agricultural University.

These implements are operated by a pair of bullocks using wooden yoke of different lengths depending upon the crop row spacing. The local implements were tested under actual field condition to find out the draw backs and problems faced by the farmers in using. Depending upon type of operation, row spacing and implement about 1-2 hectare area can be covered in a day of 8 hours. None of the implements is multipurpose; therefore, frequently adjustment and

replacement are required. The working with the existing implements is not ergonomically suitable.

It was decided to develop a multipurpose implement such that it reduces the initial investment and cost of operation with general design considerations as described below.

General design considerations:

1. Design should make use of available standard parts and material.
2. Design should be kept simple without sacrificing workability and efficiency.
3. It should be low cost without sacrificing performance, durability and safety.
4. It should be easily manufactured and repairable by local artisan.
5. Reasonable draft and power requirement of a pair of bullocks.

6. Reasonable space and weight requirement.

7. It should replace all the local traditional implement

MATERIALS AND METHODS

During the survey work at Adivasi farmer's field, the following information was obtained from the farmers. (i) All the farmers used a local deshi plough for primary tillage and some of them also used as a one row sowing implement. (ii) Secondary tillage operation farmers were used implements like, Karab (30 cm & 40 cm), Dodhiya (60 cm), Omiya (90 cm), Karabadi (22 cm x 2), Wooden plank (Rapat) for seed covering and some of also used three rows sowing tarfen (seed drill) & wooden funnel for sowing implement as shown in Figure 1.



Fig.1: Implements used by the Adivasi farmers of Gujarat

A multipurpose implement most popular in Saurashtra region was taken to the village of Adivasi farmers' field. This implement was operated after harvesting of *Kharif* crops on selected farmers field at different locations, showing the operation of ploughing, harrowing, sowing, inter-culturing and bund forming etc. by comparing the same operation with the local implements already owned by the

farmers. The field capacity, Draft, Power requirement and quality of work were studied and reported in Table 1.

The multipurpose pipe frame implement has the following main components / attachments with their constructional details as shown in Figure 2. Keeping the all above facts in mind and all the requirements by the local farmers an improved multipurpose pipe framed implement

was fabricated to suite the local requirements and the bullocks of adivasi area. The improved implement was tested in different farmers' field.

This implement has all the attachments as required for primary and secondary tillage, inter-culturing, sowing, bund forming etc.

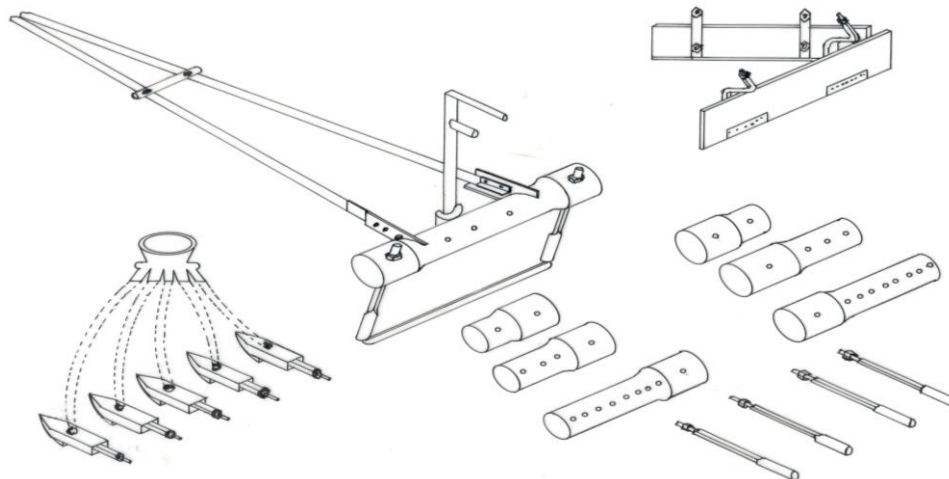


Fig. 2: Assembly drawing of the improved multipurpose implement.

Construction Details:

The improved pipe frame multipurpose implement has the following main components / attachments as shown in Figure 3.

(1) Head piece or frame:

It is fabricated from 75 mm (2.5") G.I. pipe; it consists of total 7 pieces (one central piece & 3 pairs of extension pieces), which can be fitted with each other by bolts and nuts. There are round/square holes are provided in the pieces of the pipes at

required distance to facilitate rigidly fitting of prongs (tines) for plough, harrow, cultivator, bund former and furrow opener for sowing attachment. A central piece is welded with the channel on both the sides so that the beams can be fitted to it. There is a provision to fit the beams at the desired angle so as to adjust the depth of working. Two holes are also provided in the central pieces so that the handle can be fixed on it.

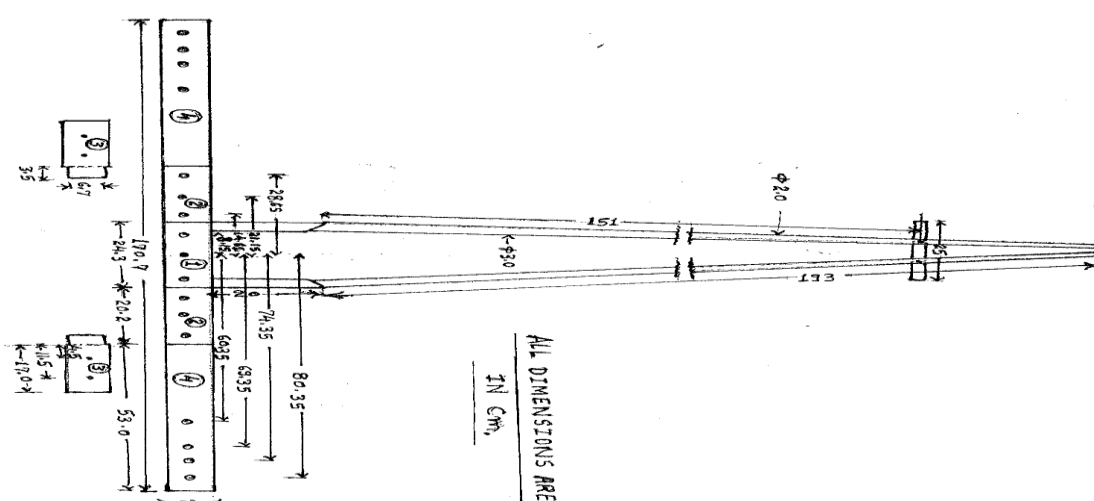


Fig. 3: Multipurpose pipe implement with all attachments

Legend

Sr. No.	Parts	Uses
(1)	Central Piece	Ploughing, Interculturing
(2)	First Pair of Extension Pieces	Interculturing,
(3)	Second Pair of Extension Pieces	Harrowing, Bund forming
(4)	Third Pair of Extension Pieces	Sowing, Land levelling

The central piece is provided for land preparation (ploughing) and inter- culturing operation. The first pairs of extension pieces are provided for inter culturing operation. The second pairs of extension pieces are provided for harrowing and bund forming operations. The third pairs of extension pieces are provided for parallel furrows forming, sowing and land leveling operations. The extension pieces can be conveniently fitted / removed to carryout particular operation.

(2) Beam:

It is prepared from 31.8 mm (1.25") and 25.4 mm (1") G.I. pipe and is fitted on the front side of beams provision of fitting it on the beams at any desired distance is made so that the implement can be used with bullocks of different breeds having different height and to adjust the depth of working.

(3) Prongs:

Prongs are prepared from 25.4 mm (1") square bar of mild steel. Their one end is hollow so that the straight blades can be fitted in them. Another

end is threaded so that they can be rigidly fitted in the hole of the headpiece with the help of nut. Single straight blade harrows are used for (i) Secondary tillage after ploughing (ii) Inter culturing wide spaced crops during later stage of crops like cotton, pigeon pea, bajara, castor, banana etc.(iii) Harvesting of groundnut crop and (iv) Covering seeds immediately after sowing (rapat). Twin straight blade harrows are used only for inter culturing during early stage of crops like groundnut, wheat, bajara, cotton, castor, pigeon pea, maize etc.

(4) Handle:

It is prepared from mild steel flat and conduit pipe and fitted on center of headpiece for controlling the implement during operation.

(5) Sowing attachments:

These attachments consist of three/five furrow openers, three/five seed tube and seed funnel. The furrow openers prepared from angle iron of 25.4 mm (1") square bar of mild steel. The seed tube made from conduit pipe and seed dropping funnel made from iron of 2, 3, 4 and 5 holes (Figure 4).

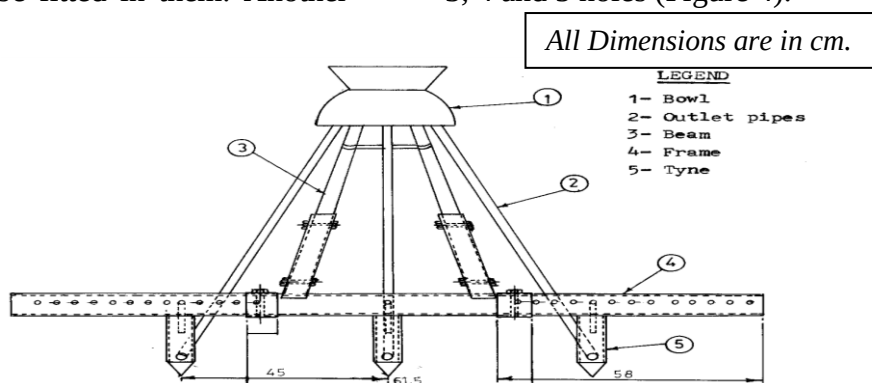


Fig. 4: Seeding attachment on multipurpose frame

(6) Bund forming attachments:

This attachment consists of four bend prongs and two wooden plates and angle iron (Figure 3).

Different operations by improved implement:

This implement was operated after harvesting of Kharif crops on selected farmers field at five different locations, showing the operation of ploughing, harrowing, sowing, inter-culturing and bund forming, which was compared with the same operation using local implements already owned by the farmers. The field capacity, Draft, Power requirement and quality of work were studied and reported in Table 1.

(1) Ploughing :

The farmers in these areas make significant use of plough for land preparation before harrowing. As per the desired of the farmers in view of the economic constraints it was considered proper to have an attachable design of plough as shown in Figure 6. To replace the local wooden plough and provide for its functioning as primary tillage & opening of furrow (chass) before sowing operation, appropriate plough bottom shown in Figure 5 has been design, fabricated, tried and tested at the above two locations. By attaching two such plough bottoms in the improved multipurpose implement, trial, testing and demonstration have been held for opening two parallel furrows at desired row spacing.

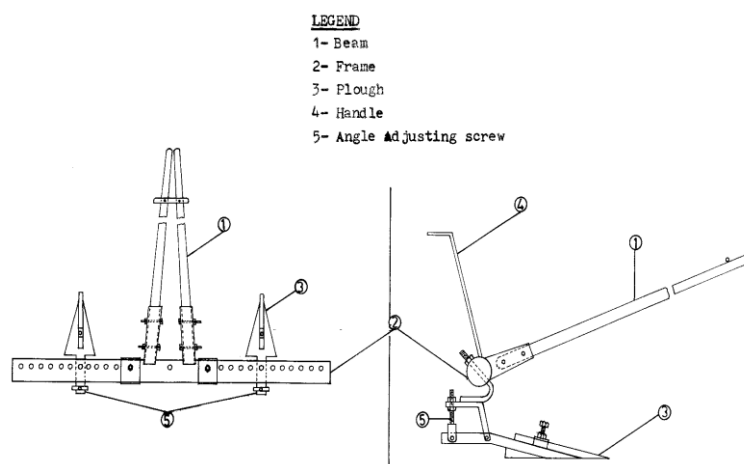


Fig. 5: Two plough bottoms attached for opening "furrow"

Fig. 6 : Plough attached to frame

(2) Sowing :

The farmers of the above areas mostly use a single hole funnel for sowing of various crops. As the length of frame of the new implement is 2.75 times longer than that of the local wooden-sowing implement, therefore

sowing 2, 3, 4 or 5 rows at a time by attaching appropriate funnel and distribution arrangement as show in Figure 4. This implement is also useful for sowing of seed or fertilizer by attaching the improved automatic seed drill as shown in photographs below:



(3) Bund forming :

Some of the farmers of the above areas use a separate bund former, which was made from iron. Therefore one bund forming attachment fabricated and provided with this implement. These consists of four band prongs made from 25 mm (1") MS square bar and two wooden plates with angle iron. These are especially useful for making bunds and furrow for irrigation and for earthening up of plant as shown in Figure 3.

The completely developed implement was given to few progressive farmers at above locations. The farmers were encouraged to use this implement to their full extent as per their farming need. This improved implement with all attachment tried & tested in different operation and same operation made by local wooden implements. Basic design field data and comparative field performance data of local and improved multipurpose implement are presented in Table 2.

Assumptions:

Following assumptions were made for cost analysis.

1. Salvage value of the implement= 10% of initial cost,
2. Useful life of local implement= 8 years,
3. Useful life of improved implement = 15 years.

4. Total hours of use of the implement in a year = 750,
5. Interest rate = 12 % ,
6. Repair and maintenance = 10 % of initial cost in local in and 5 % in improved implement

RESULTS AND DISCUSSION

The improved new device, thus, serves as an efficient and rugged primary ploughing implement over and above providing two parallel furrows, which is presently not obtainable with the local implement. However, qualitative observations indicated that the plough could be easily pulled by a pair of bullocks and operated smoothly any unbalance. For making any implements from this multipurpose implement like plough, ridger, harrow, cultivator, seed drill, digger, leveler, bund former etc. are made as per the requirement for different crops.

As indicated in the Table 1, the total cost of improved implements including all the attachments (two plough bottoms, different size of blades for harrow, four tines, bund former set, five furrow openers with complete sowing devices comes to Rs. 18000/-whereas the total cost of local implements set as Rs. 26000/-. Therefore, the new improved multipurpose implement cost Rs. 8000/- less as compared to the conventional wooden set presently used in this area. Its cost of operation

per hour is Rs.5.44 as compared to Rs. 9.66 per hour for the local set.

The comparative field performance data indicated that the improved implement provides increased work output 25 % in ploughing, 68 % in sowing of pigeon pea / cotton, 22 % of sowing of maize/sorghum, 48 % in inter-culturing of pigeon pea /cotton. Its use will result in 24, 43, 22 and 36 % reduction in cost of doing these operations, respectively.

It replaces more than seven local implements and two to three

improved implements. As it is manufactured from iron instead of wood, life will be longer and repair charges will be less in comparison to the local implements. Thus, the running cost of using the implements will be less. The implement can also be used for bunding and earthening up operation. In view of encouraging response of the farmers, functional utility and economics, the farmers of Adivasi belt of Gujarat state are advised to use this improved multipurpose implement in place of several local wooden implements.

Table 1: Design and functional comparison of local and improved multipurpose Implement

Sr. No.	Particulars	Implement	
		Local	Improved
1	2	3	4
1.	Field operation	Ploughing sowing single row & up to three rows, Inter culturing	Ploughing, sowing & inter culturing.
2	Special field operation.	____Nil____	Opening of parallel "furrows", sowing of more than three rows. Bund forming, inter culturing closer to the plants & two strips in between rows at a time.
3	Draft (kg), average of three locations		
a)	Ploughing	52.0	61.6
b)	Two parallel furrow opening.	Not Possible	98.0
c)	Inter culturing (Blades size 60cm.)	47.9	44.16
d)	Sowing	38.0(Single row)	46.2 (Three rows)
4	Average unit draft (ploughing, kg/cm ²)	0.86	0.52
5	Weight (kg) (Bukhar blade- 76 cm.)	25	30+Attachments
6	Initial cost (Rs. / Set)	26000/-	11000/-
	Special attachments cost (Rs.)	Nil	7000/-
	Net cost (Rs.)	*26000/-	**18000/-
7	Cost of operation (Rs. / hr.)	9.66	5.44
8	Farmers opinion	--	Farmers appreciated the special features of the implement.

* *Indigenous plough, Harrows (90cm.- Omiya, 60 cm.- Dodhiya, 40 cm.- Karab & 22 cm.-Two Karabadies) Turfen and wooden plank.*

** *Multipurpose pipe frame implement with two plough bottoms, different size of harrow blades, four tines, bund forming attachments, five furrow openers with complete sowing device.*

Table 2: Comparative field performance data

Sr. No.	Field operation	Effective field capacity (ha./day)		Percentage increase in work out/put.		Cost of Operation (Rs./ha.)		Percentage reduction in cost.	
		Local	Improved	Local	Improved	Local	Improved	Local	Improved
1	2	3	4	5	6	7	8	9	10
1	Plothing	0.176	0.22	--	25	4416	3380	--	24
2	Sowing (pigeon pea - Cotton) (Spacing:148cm.)	2.116	3.55	--	68	367	210	--	43
3	Sowing (Maize-Sorghum) (Spacing =45 cm.)	1.97	2.4	--	22	395	310	--	22
4	Inter culturing of pigeon pea-Cotton	0.716	1.058	--	48	1086	703	--	36

Note : a) Cost of operation of local implements 9.66 Rs./h.
b) Cost of improved implement is 5.44 Rs./h.
c) Hire charges of a pair of bullock with operator is Rs. 700/- per day of 8hrs.