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## Promotion of mini power tiller among marginal and small farmers

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**Abstract**

The present study has been conducted at Sakra and Muraul block of Muzaffarpur district of Bihar with objective to incorporate mini power tiller equipped with cultivator, ridge maker and potato digger among marginal and small land holding farmers. Use of mini power tiller reduced the cost and time of operations as compare to human and bullock pair involvement in farm activities. In compare to human, total cost saving for ploughing, ridge making and potato digging by mini power tiller was observed 97.76%, 93.59% and 97.44% respectively whereas, it was 24% (ploughing), 56.38% (ridge making) and 51.19% (potato digging) as compare to bullock pair. So, it can be suggested that low cost mini power tiller is a great alternative of high cost tractor and high time-consuming human and bullock drawn farm activities for small and marginal farmers.

**Keywords:** Mini power tiller, cultivator, ridge maker and potato digger

**Introduction**

Bihar is second largest populated state of India. The population density of Bihar is 1106 per square kilometre (Census of India, 2011) <sup>[1]</sup>. Whereas, the population density of Muzaffarpur district is 1506 per square kilometre (Census of India, 2011) <sup>[1]</sup>. Agriculture is the key source to overall development of the state economy. Agriculture is the backbone of Bihar's economy, since it comprises 77% of workforce and generating nearly 24.84% of the state domestic product. The percentage of population employed in agriculture production system in Bihar is estimated to 77% which is much higher than national average (Department of Agriculture, Govt. of Bihar, 2011-12). Agriculture is the vital source of wealth in the state. The cropping intensity of the state is 138%. About 78% of the farmers possess an area less than 2 hectare with poor resources at their command, especially in the dry land regions (Vatsa, 2013) <sup>[16]</sup>. Annually three seasons of cropping requires efficient farm mechanization but high cost of bigger implements limited to only large farmers. Power tillers occasionally termed as walking tractors have been conceived as an equipment to prepare seedbeds with rotary tillers and for transportation. They have limitations in their use for traction work due to the low drawbar power per brake horsepower of the engine. At present, most of the power tiller manufactured in the country are in the range of 8-10 hp and weigh about 400 kg. The power tillers are not potentially used in hilly areas due to the lack of its manoeuvrability on sloppy lands. This is primarily due to its heavy weight, which needs to be optimized (Mandal and Maity, 2013) <sup>[14]</sup>. It is also known as hand or walking type tractor (BIS, 2002). The initial introduction of power tillers was without a complete range of matching equipment (Kathirvel *et al.*, 2000) <sup>[11]</sup>. The structure of small tractors is simple and this makes the operation, maintenance and repair easy (Ademiluyi *et al.*, 2008) <sup>[1]</sup>. Light weight power tillers can be used for seedbed preparation and inter culture operation in wide spaced row crops like cotton and sugarcane. Some pull type light weight power tillers are also available in the country to pull ploughs, harrows and cultivators (Narang and Tiwari, 2005) <sup>[15]</sup>. Therefore, it is felt necessary to develop a lightweight power tiller fitted with 2-4 hp engines. Considering all these factors, and as a small effort towards mechanizing agriculture and helping the 60% Indian population who depend on agriculture for their livelihood and to encourage their share in developing our economy (Kadu *et al.*, 2015) <sup>[9]</sup>. The average field efficiency and average fuel consumption of lightweight power tillers was found as 93.77% and 0.85 l/hr (Mandal *et al.*, 2016) <sup>[14]</sup>. The light weight of power tiller is a favourable factor for working in wet and dry land conditions (Kumar and Kumar 2018) <sup>[12]</sup>. As increasing the traction and torque for tilling process achieving by depth of 4-7 inch in Mini cultivator and tiller. (Karjatwala *et al.*, 2018) <sup>[10]</sup>. The trials were conducted to test a 7.46 kW light weight power tiller to evaluate parameters like drawbar pull, fuel consumption and wheel slip (Anonymous, 2001a) <sup>[5]</sup>.

The testing of a 4.10 kW power tiller for drawbar performance with three-bottom mould board plough and 5-tine cultivator revealed that use of 60 kg ballast weight could develop a maximum pull of 1333.75 N with cage wheels under field conditions (Anonymous, 1975) [3]. Several farmers of this block are very innovative and very much eager to learn and adopt new technologies in their field. A study revealed that farmers have adopted an innovative strategy for nutrient and disease management in *Solanum tuberosum* cultivation through organic farming (Kumari, *et al.*, 2019) [13]. Keeping these above facts, the present study is focussed on mini power tiller which can be used for primary and secondary tillage implements by cultivator and rotavator respectively, furrow making by ridger, levelling by leveller that reflect the benefit cost effectiveness in compare to manual and bullock drawn farm activities.

## Materials and Methods

The present case study has been carried out during the

cropping season 2019-20. The study area was located at Sakra and Muraul block of Muzaffarpur district as shown in Fig.1. The geographical locality lies between latitude 25°51'10" to 26°01'30"N and longitude 85°23'10" to 85°39'00"E. The area falls under Northern West Agro-climatic Zone I prevalent with sandy loam soil with the total average annual rainfall of 1250 mm. The soil is mainly young loam rejuvenated every year by constant deposition of silt, clay and sand brought by different streams. This soil is deficient in phosphoric acid, nitrogen and humus, but potash and lime are usually present in sufficient quantity. The cold weather season, hot weather season and Southwest monsoon is observed in December to February, March to May and June to September respectively. As per Agricultural Census (2010-11) [2], 91.06% and 5.85% are Marginal farmer (land holding 0-1ha) and small farmer (land holding 1-2 ha) respectively. The area adopted three cropping seasons *viz.* Kharif, Rabi and Zaid.

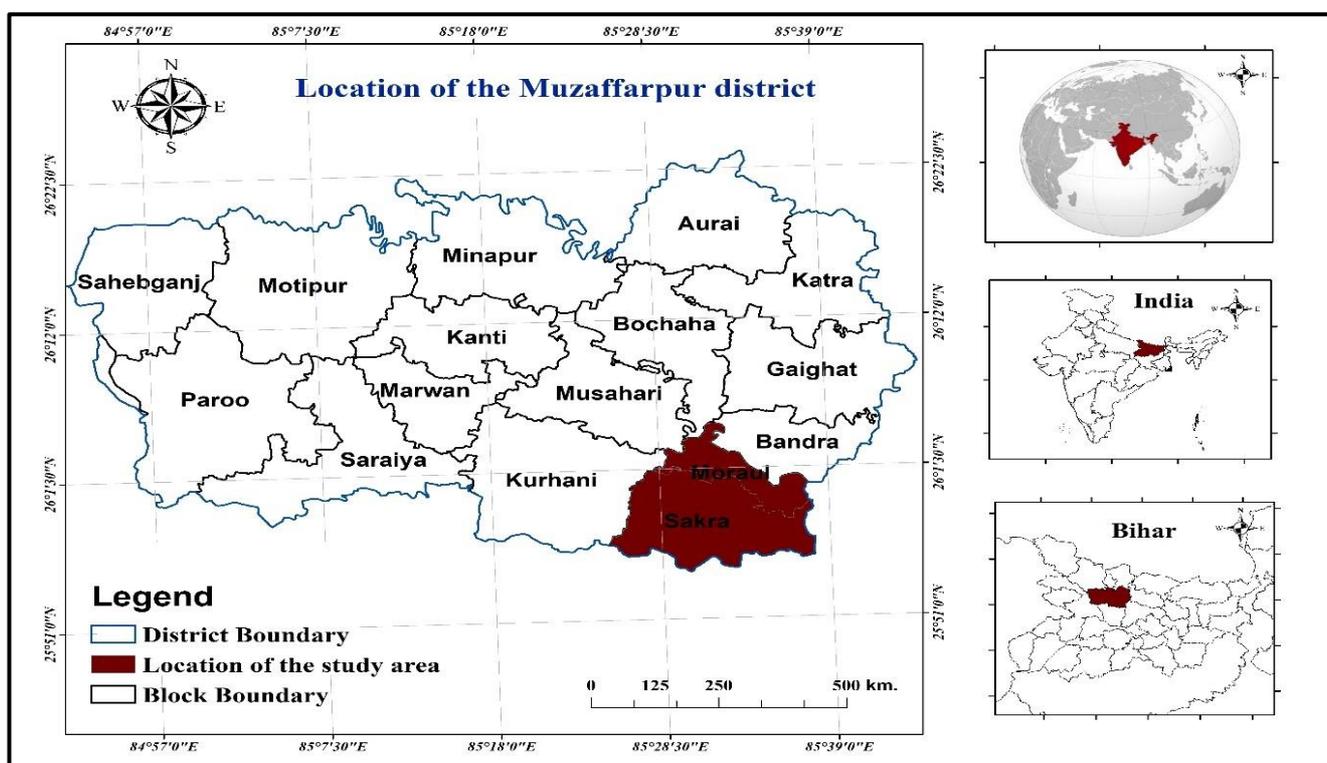


Fig 1: Study area location map of Sakra and Muraul block of Muzaffarpur, Bihar

Majority of farmers are having fragmented land holdings, so small implements have been suggested for agricultural activities. KVK advised farmers to adopt 7 hp mini power tiller or light weight power tiller operated with petrol engine which is attached with cultivator, rotavator and ridger. Further trailer, reaper, potato digger, weeder etc. can also be attached which adds some more price, so the farmers are suggested to use the primary attachments like cultivator, rotavator and ridger. Mini power tiller of 7hp petrol engine works in diverse soil type. In the present study, farmers of these two blocks used mini power tiller of 7 hp which has been brought from Raja enterprise, Ludhiana, Punjab having cost of INR 46,000 after subsidy with attachments like 3 tyne cultivator, 32 blades rotavator and ridger (Fig. 2). Speed of the implement can be maintained by two gears which helps in different operation according to soil conditions. The fuel consumption of this mini power tiller is 900 ml/hr. The weight of this implement is 70 kg without attachment.



Fig 2: Mini power tiller different attachments with rear and front view

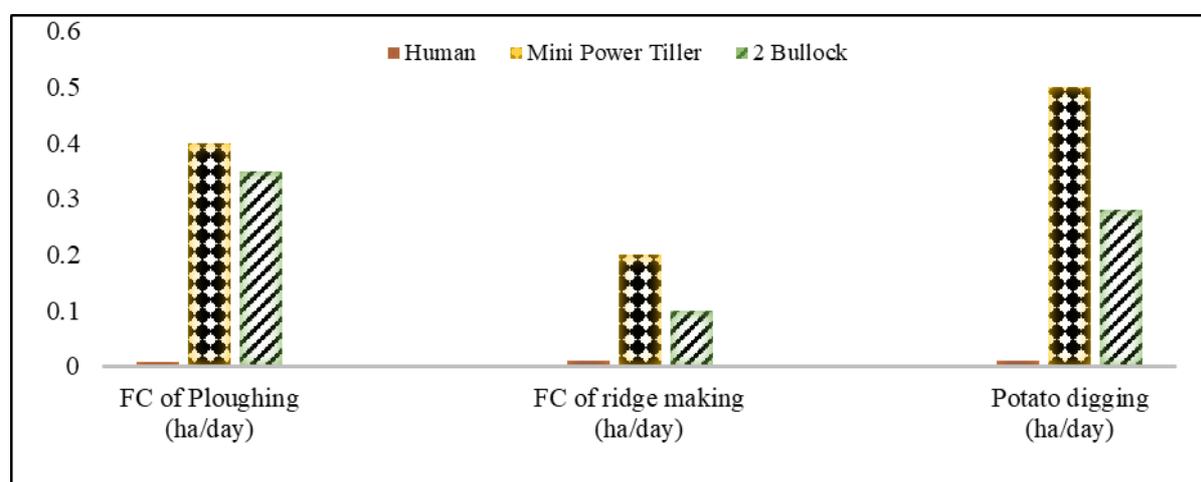
## Results and Discussion

The field capacity of mini power tiller in ploughing operation was observed higher as 0.4 ha/day in compare to human (0.007 ha/day) and one bullock pair (0.35 ha/day). The performance evaluation of human, mini power tiller and bullock pair farming operation is given in Table 1. The field capacity of potato digging and ridge making by mini tiller is also found higher in comparison of another two methods (Fig.3). However, in mini tiller average cost of operation and maintenance per day is higher but in respect of time consumption per hectare it was highly economic as compare

with human and bullock which results in lower down the overall farm operation cost. The ploughing activity done through mini tiller took 98.25% less time in compare to human and 16.67% in compare to pair of bullocks is presented in Table 2. The total cost saving in ploughing activity by mini tiller is 97.76% in compare to human and 24% in compare to bullock pair. The ridge making activity done through mini tiller took 95% less time in compare to human and 50% in compare to pair of bullocks. The total cost saving in ridge making activity by mini tiller is 93.59% in compare to human and 56.38% in compare to bullock pair.

**Table 1:** Performance evaluation of Human, Mini Power Tiller and Bullock Pair farming operation

Sl. No	Power Source	Human	Mini Power Tiller	2 Bullock
1.	Power comparison (hp)	0.06	7	1
2.	Field capacity of Ploughing (ha/day)	0.007	0.4	0.35 (3 tyne)
3.	Field capacity of ridge making (ha/day), one bund at a time	0.01	0.20	0.10
4.	Potato digging (ha/day)	0.01	0.5	0.28
5.	Average operation & maintenance cost (Rs. /day)	320	410	470



**Fig 3:** A comparative graphical representation of Field capacity (FC) of Ploughing, ridge making and potato digging by human.

The potato digging done through mini tiller took 98% less time in compare to human and 44.44% in compare to pair of bullocks. The total cost saving in potato digging by mini tiller is 97.44% in compare to human and 51.19% in compare to bullock pair. Small farmers are entirely dependent on daily wage labours for their farming operations, which increase

input cost of cultivation. Use of bullocks for agricultural work is limited to tillage, threshing and transportation. The total annual use of bullock amounts to less than 300 hours. Cost of utilization is, therefore, very high as the bullocks are to be fed throughout the year irrespective of their use (Anonymous, 2001b) [5].

**Table 2.:** Economic feasibility of Mini power tiller over manual and bullock farm activity

Operation	Resources	Cost Rs. /ha	Operational time (Days)	Time saving with respect to human (%)	Time saving with respect to bullock (%)	Cost saving with respect to human (%)	Cost saving with respect to bullock (%)
Ploughing	Human	45760	143	-	-	-	-
	Bullock	1350	3.0	97.90	-	97.05	-
	Mini power tiller	1025	2.5	98.25	16.67	97.76	24.07
Ridge making	Human	32000	100	-	-	-	-
	Bullock	4700	10	90.00	-	85.31	-
	Mini power tiller	2050	5.0	95.00	50.00	93.59	56.38
Potato digging	Human	32000	100	-	-	-	-
	Bullock	1680	3.6	96.40	-	94.75	-
	Mini power tiller	820	2.0	98.00	44.44	97.44	51.19

## Conclusion

This implement is very much helpful for small and marginal farmers and works very efficiently in sandy loam or loamy soil. Less cost of this implement can enhance the productivity with reduced labour charges, time and cost of operation of any farm activities in compare to manual operations. This is found in the study farmers are hiring implements on rent basis

and facilitate their farm activities but due to demand of the implements at a time results in delayed cropping, which decrease the productivity. Low cost mini power tiller is a great alternative of high cost tractor for small and marginal farmers. Further after getting advantages of this mini power tiller they are interested to buy additional attachments like trailer, reaper, potato digger, weeder etc. Fuel consumption is

maximum one litre per hour. It can be also used for potato digging, harvesting by reaper, carrying farm residues if attached with trailer.

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