

Assessment of Farmers Adaptability of a Pedal Pump

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ABSTRACT

Manual pumps are now a days very popular among small and marginal farmers of Bangladesh. Among the manual pumps the farmers predominantly use treadle pumps. It was found from study that the present structural design, the operation of the pump is tedious and at the same time very ineffective, which needs necessary modifications. An improved version of treadle pump called pedal pump was designed and fabricated at Agricultural Engineering Division, Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna, which is by-cycle operated, comfortable to operate, capable of lifting surface and ground water having discharge range from 60-100 litres per minute at different suction heads (up to 7 meters). The objective of the study was to assess the socio-economic profile of the pedal pump users and to determine the adaptability of the pedal pump by the farmers as perceived by them. For demonstration of pedal pump 12 demonstrated and 120 non-demonstrated farmers were selected at Pabna, Thakurgaon and Chuadanga district of Bangladesh. Demonstration farmers have smaller land holding (0.47 ha) and higher number of family size (8 Nos.) compared to non-demonstration farmers. Pedal pump has a potentiality to use as a small-scale irrigation device opined by 92% demonstration and 88% non-demonstration farmers. Sixty seven percent demonstrated and 80% of non-demonstrated farmers expressed that the price of pedal pump were satisfactory and 67% demonstrated and 64% non-demonstrated farmers expressed their willingness to buy pedal pump. Operation of the pedal pump, as perceived by the farmers is much easier and comfortable than treadle pump.

Key words: Marginal farmers, assessment, farmer's adaptability, pedal pump.

INTRODUCTION

In Bangladesh out of 3693.92 thousand hectare irrigated area 363.15 thousand hectare has been brought under traditional irrigation appliances (BBS, 2003). On average, 0.035 million hectares is irrigated by manual irrigation pumps. Most of the manual pump lifts water from the underground source. Where the static water level allows the use of manual pump, there is large potentiality to use the manual pumps (Aslam *et al.* 1991). Small and marginal farmers using manual pumps allocate the available resources like capital, labour, water and land to irrigate crops based on experience and intuition (Islam *et al.* 1993). In crop diversification, manual pumps can play a vital role in irrigating non-rice upland crops. Studies reveal that treadle and rower pumps can be used for small-scale irrigation with viable economic returns (Islam *et al.*, 1991). Optimal allocation of the available resources like land, labour, water and capital can make the pump users more profitable. Treadle pump is a miracle in the context of Bangladesh's problems. Hence, the treadle pump, in an

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area of abundant labour and fragmented land, is a perfect irrigation medium for rich and poor farmer's alike (Alastair *et. al.* 1989), as well as, various types of small-scale irrigation equipment developed by the scientists of Bangladesh Rice Research Institute. Among them BRR diaphragm pump is the best in respect of cost, capacities, ergonomic characteristics and command area as compared to No.6 Hand pump and Rower pump. They also showed that capacities of BRR diaphragm pump, No.6 Hand pump and Rower pump were 105, 33 and 41 litre min^{-1} respectively, at a lift of 4.6m (Taufiqul *et. al.* 2001). Considering the above facts, assessment of farmers adaptability of the developed pedal pump will enable the farmers to obtain better irrigation facilities as compared to other manually operated pumps.

Almost all the manual pumps especially treadle pump now operating in Bangladesh is used to lift ground water. The deep and shallow tube wells now used in Bangladesh are becoming expensive and difficult to use due to high price of spare parts and mechanical problems. The irrigation efficiency also has reported to be below 30% of their total capacity (Baqui, 1980). With the existing structural design the operation of the treadle pump is tedious and at the same time less effective which need to be modified (Taher *et al.* 1987).

Considering the problems of treadle pump such as timeliness of operation, lower capacity, operators foot frequently slipped out of the bamboo rods and causing muscle stiffness of the operators foot, human drudgery etc. an attempt was taken to design and fabricate the improved version of treadle pump named as pedal pump at Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna. The study was aimed at achieving the following objectives:

- i) To assess the socio-economic profile of the pedal pump users; and
- ii) To determine the adaptability of the pedal pump by the farmers as perceived by themselves.

MATERIALS AND METHODS

Pedal pump is a bicycle operated, lightweight, cheaper irrigation device. Two pistons of an ordinary two-cylinder pump were connected with a crankshaft, which has a flywheel on one end and a chain sprocket on the other end. The crankshaft is powered through a chain sprocket from the pedal of the bicycle, which is rotated by foot of the operator seating on the seat just like driving a bicycle. To reduce pressure of operator, fly wheel was used in consideration with moment of inertia. In addition, water was lifted through suction and compression process (Figure 1).



Figure 1. Photographic View of the Pedal pump

Twelve (12) pedal pumps were manufactured at BSRI and distributed among 12 demonstration farmers in 3 locations: 4 in Ishurdi site, 4 in Thakurgaon site and 4 in Chuadanga site. Following

points were considered in selecting demonstration sites:

- i) Sites located near the main station, sub-station and regional station of BSRI where there are sufficient scientific manpower to support the study during and beyond the project period.
- ii) Demonstration farmers were selected from areas where treadle pumps were in operation so that farmer can compare the workmanship of treadle and pedal pump very closely.
- iii) Demonstration sites were selected where ground water fluctuation remains within 7 meter round the year.
- iv) Sites where local facilities were available to repair the pedal pumps as and when required.

RESULTS AND DISCUSSION

Capacity and feasibility of the pedal pump

It can lift water up to 7 meter below the surface and also can lift water from surface water storage such as ponds, rivers and canals when the water level is within 7 meter. The discharge is between 60 to 100 litres per minute. Though the price of the pedal pump is higher than the treadle pump, but the small and marginal farmers due to its various advantages may accept the former. This can be manufactured locally from low-cost spare parts of bicycle and other materials available at any place of Bangladesh. This irrigation device can be operated by using family labour (both male and female) and can be taken home every day after irrigating land to prevent stealing. Considering the problems of treadle pump it was felt that the technological aspects of such pumps are to be evaluated before the farmers are exploited by the propaganda of the inventors. It was found from observation that the designed machine is much easier, efficient and durable than the treadle pump.

Socio-economic profile of the study farmers

Socio-economic information regarding average farm size, family size and number of agricultural workers of each study farm families are given in Table -1.

Table1. Socio-economic information of the study farmers

Type of farmer	No.	Average farm size (ha)	Average family size (no.)				No of agril. Worker
			Adult Male	Adult Female	Infant	Total	
1. Demonstration farmer	12	0.47	2.40	2.40	3.60	8.40	2.20
2. Non-Demonstration farmer	120	0.63	3.33	2.13	2.50	7.13	1.87

The average farm size for demonstration farmer was 0.47 ha, for non-demonstration farmers it is 0.63 ha. Average family size for demonstration farmer was 8.40 of which 2.40 was adult male and 3.60 for infants. On the other hand, average family size for non-demonstration farmer was 7.13 of which 3.33 was adult male, 2.13 is adult female and 2.50 was infant. Average number of family agricultural labour is 2.20 for demonstration farmer and 1.87 for non-demonstration farmers. It was observed that the demonstration farmers had smaller land holding and higher number of family size compared to non-demonstration farmer.

Ownership of irrigation appliances

Information on ownership pattern of irrigation implements of the demonstration and non-demonstration study farmers are given in Table-2.

Table 2. Information regarding irrigation appliances

Type of farmer	No.	Practice irrigation		Type of irrigation appliances used		
		Yes.	No.	Shallow tube well	Treadle pump	Hand tube well
1. Demonstration farmer	12	8	4	0	4	4
2. Non-Demonstration farmer	120	72	48	15	15	42

Of twelve demonstration farmers, eight had irrigation devices of which four had treadle pumps and four had hand tube wells. Among the non-demonstration farmers, only 72 had irrigation appliances of which 15 had shallow tube wells (own or rented), 15 had treadle pumps and 42 have had tube wells.

Crops under irrigation by the demonstration farmers

The crops under irrigation by the pedal pump demonstration farmers are mentioned in Table-3.

Table 3. Crops irrigated by the demonstration farmers using pedal pump

Demonstration Farmer	Land being Irrigated (ha)	Crops being irrigated
1	0.40	Arum (Oal), Lady's finger and paddy.
2	0.27	Sugarcane and turmeric
3	0.27	Arum(Oal), vegetables, paddy
4	0.02	Lal sak, Cucumber and Lady's finger
5	0.20	Lal sak, Cucumber, Lady's finger, Pui sak.
6	0.16	Lal sak and Lady's finger
7	0.12	Lal sak and Cucumber
8	0.24	Sugarcane
9	0.20	Sugarcane
10	0.14	Sugarcane and paddy
11	0.20	Lal sak and Lady's finger
12	0.20	Lal sak and Lady's finger

From Table 3 it revealed that the present area under irrigation by each pedal pump ranges from 0.20 ha to 0.40 ha. Crops being irrigated are mostly summer vegetables such as Arum (oal), lady's finger, lal sak, and cucumber and pui sak. Beside summer vegetables, few demonstration farmers are also irrigating their sugarcane and paddy fields.

Response of the farmers towards pedal pumps

i. Farmer's perception in operation of the pump

Almost 100% demonstration and non-demonstration farmers reported that pedal pumps are easy to operate for longer period, much easier, efficient and durable than the Treadle pump.

ii. Farmer's opinion to procure pedal pump

Farmer's response towards readiness to buy the pedal pumps under existing price (Tk.2000/-pedal pump) is mentioned in Table -4.

Table 4. Farmer's response towards procuring the pedal pumps at existing price of Tk. 2000/unit

Type of farmer	No.	Eagerness to procure	
		Yes (%)	No (%)
1. Demonstration farmer	12	8 (67)	4 (33)
2. Non-demonstration farmer	120	77 (64)	43 (36)

Out of 12 demonstration farmers 8 (67%) expressed their willingness to buy the pedal pumps under existing price, whereas remaining 4 (33%) expressed their willingness to procure the same. On the other hand, out of 120 non-demonstration study farmers, 77 (64%) expressed their willingness to procure the pedal pumps under existing price structure, remaining 43 (36%) did not show any interest.

iii. Farmers response for price of pedal pump

Farmer's responses regarding existing price of pedal pumps are indicated in Table- 5.

Table 5. Farmers response on existing price of pedal pumps

Type of farmer	No.	Response		
		Satisfactory price (No.)	Low price (no.)	High price (no.)
1. Demonstration farmer	12	8 (67%)	0	4 (33%)
2. Non-demonstration farmer	120	96 (80%)	0	24 (20%)

Figures in the parenthesis are percentages

Both demonstration and non-demonstration study farmers were asked to express their responses on price of pedal pumps on a 3-point scale. About 67% demonstration farmers expressed that the prices of pedal pump are satisfactory to them whereas 33% expressed that the price is higher. None told that the price is lower. About 80% of the non-demonstration farmers told that the price is satisfactory, 20% told that the price is higher, none told that the price is lower.

iv. Popularity of pedal pump as irrigation appliances

How farmers see the potentiality of pedal pumps as popular irrigation appliances are indicated in Table 6.

Table 6. Potentiality of pedal pumps

Type of farmer	Nos.	Potentiality of pedal pump	
		Yes (%)	No (%)
1. Demonstration farmer.	12	11 (92)	1 (8)
2. Non-demonstration farmer	120	106 (88)	14 (12)

Figures in the parenthesis are percentages

Of the demonstration farmer's, 92% opined that the pedal pump has a potentiality to become a popular small-scale irrigation device for the small and marginal farmers. Of the non-demonstration farmers, 88% have expressed similar opinions.

v. Farmers Interest Generated

Huge numbers of farmers visited the demonstration pumps. On an average, 500 farmers visited each demonstration pump of 4 locations, which indicates that the demonstration pedal pumps have created enthusiasm among the farmers.

vi. Suggestions for popularisation of pedal pump

Both demonstration and non-demonstration study farmer put forward a number of suggestions to popularise the pedal pump as indicated in Table-7.

Table 7. Farmer's suggestions to popularise the Pedal Pumps

Suggestion	Nos.	No of farmers suggested	%*
Selling price should be within Tk.1000/pedal pump instead of Tk. 2000/unit	12	10	83
Large-scale demonstration of pedal pumps and reducing the price by 50%	12	8	67
Large-scale demonstration and supplying among the small & marginal farmers through credit.	12	8	67

Farmers have multiple responses.

Most of the demonstration farmers (83%) suggested that the existing per unit of price of Tk.2000/pedal pump should be reduced to Tk.1000/-. About 67% of the demonstration farmers opined that the price should be reduced by 50%, and large scale-demonstration should be undertaken to popularise the pump among the farmers particularly the small and marginal farmers. They also suggested that to popularise the pedal pumps, it should be supplied among the farmers on credit basis in-addition with large-scale demonstration of the same.

CONCLUSIONS AND RECOMMENDATION

The following conclusions and recommendation can be derived from the study:

- (i) The pedal pump may be advantageous for small and marginal farmers in meeting their irrigation need if the price is reduced by 50%.
- (ii) Operation of the pedal pump, as perceived by the farmers is much easier and comfortable as compared to treadle pump.
- (iii) Performance and efficiency of the demonstration pedal pumps should be mentioned and evaluated during winter season against cultivation of winter vegetables.
- (iv) Further research should be undertaken to redesign the pump so that the present per unit price is reduced substantially.
- (v) Large-scale demonstration and supply of pedal pumps through credit should be undertaken by NGO's and Extension worker's (DAE) for rapid adoption of the pedal pump by the farmers.

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