

## NEWS AND NOTES

### **Krishak Bandhu – An Agricultural Pump that Pedalled Rural Economy to Prosperity in Bangladesh – Subhajyoti Das**

*“Majhi, a farmer in Orissa, was in utter despair and illusion, facing a tremendous monetary pressure, the farm, a family of five and the diesel pump and always in debt trap. After he purchased a ‘treadle pump’ his life changed like a miracle. The pump could draw water with ease from wells and without recurring cost. The harvest was bountiful. He was able to draw a regular income selling vegetables in nearby market. Within two years he earned a profit of \$1500. He enrolled his son in nearby school. He also fulfilled his long cherished dream of owning cattle which, too, fetched an income” (IDEI<sup>1</sup> 2007).*

This is not a story of an individual, but of countless subsistence farmers of Bangladesh and India. ‘*Krishak Bandhu*’ or treadle pumps have transformed their lives from one of poverty and despair to a life of affluence. They have helped them to come out of the trap of endemic debts. By use of this small and simple device the farmers of Bangladesh irrigated their dry fields in non-monsoon months, revolutionized agriculture and revived sagging economy of the country, shattered in the wake of the historic partition of 1947 and freedom struggle decades later. This ‘mystery’ pump first conceived, designed and developed in Bangladesh and technically known as Treadle pump or *Krishak Bandhu* (farmer’s friend), has two bamboo treadles and is peddled to extract groundwater and irrigate fields with no electricity or diesel needed for its operation, generating employment especially to the women in villages. It is in use in its standard or modified forms in several parts of India, Nepal, African and South Asian countries apart from Bangladesh. It is the only human engineered pump which has received such a wide acceptance in the third world countries. It defined two to three decades of Bangladesh’s agriculture and rural economy.

#### **Design and Operations**

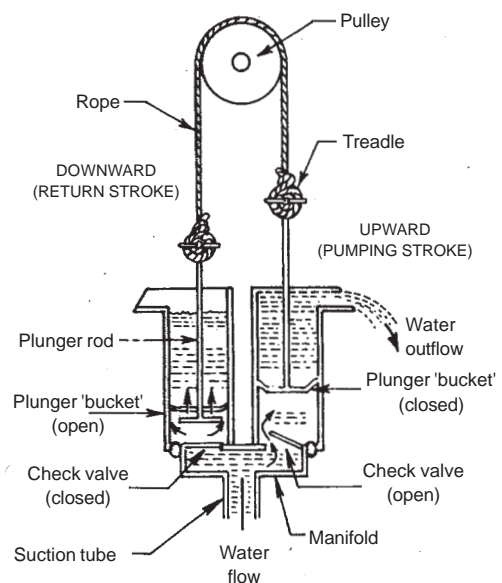
The treadle pump owes its origin to the

ingenious conceptualization of a mechanical genius of Bangladesh, Narendra Nath Deb that multiple cylinders may be attached to a single tubewell, the down stroke to one would energizes upstroke (suction stroke) to the other. This realization contributed to the development of the treadle pump. However, the treadle pumps would not have been a reality but for another talented Norwegian mechanical engineer, Gunner Barnes, who working with Rangpur Dinajpur Rural Service, designed, tested and developed the treadle pump based on the operating principle evolved by Deb (IDEI<sup>2</sup>) It can do most of the work done by a motorized pump, but costs much less to purchase and operate, as the pump is driven by the operator’s body weight and leg muscles without use of fossil fuel or electricity.

Briefly, Treadle pump is a foot-operated water lifting device, – single acting double cylinder piston pump used for irrigating small plots of farmland by pumping groundwater from a shallow depth (Fig.1). It uses a bamboo or PVC tubewell. The components of the pump comprise a metal pump head, two treadles and a frame, a bamboo or PVC pipe and strainer. Holding on to a horizontal arm on the bamboo frame the user balances his body weight and operates a rope and pulley with two plungers by pedaling up and down on the two long poles or treadles. The plungers are placed in metal cylinders, one in each of the twin cylinders welded together at the bottom by a suction inlet. Groundwater is sucked up into the cylinders by upward pumping stroke, while water from the earlier stroke is let into a field channel. The volume of water pumped depends on the depth of water table, diameter of the pump cylinder and also the energy expended by the operator of the pump. The pump operates

efficiently with the suction head within 4.5 m below land surface. The discharge of the pump is generally in the range of 0.8-1.5 liters per second. It is operated usually for 2-8 hours a day. This brings additional land under irrigated agriculture enabling the farmers to grow a variety of crops in the dry season like garlic, onion, spices, potatoes and special mixed vegetables. This ensures food security, and substantially increases family income.

There are several models of the treadle pump now in use in India, Bangladesh and elsewhere, such as 3.5 inch pump (metal barrels) with bamboo metal treadles, 5 inch pump (metal barrels) with metal treadles and 5 inch concrete pump (PVC) with wooden treadles. The cost of the different types in different regions of India vary from INR 600 to 1800 without suction pipe. Power pumps are widely used in East Africa based on modified version of the Treadle pump. These Treadle pumps can operate sprinklers. It has a suction head of 8-10 m with a reported discharge of 2000 liters per hour. The pump can lift water from a pond or river to a height of 20 m (source: IDEI<sup>3</sup>).



**Fig.1.** Treadle pump (from Orr et al. 1991).

### Story of Bangladesh

Floods wreak havoc in the plains of Bangladesh every monsoon, but soon after, the fields turn dry and lie fallow, suffering due to lack of soil moisture. The use of Treadle pump lifting groundwater from shallow depths helped the farmers in doubling crop yields. It is reported that the pumps have contributed to nearly 136% rise in irrigated area in Bangladesh during the period 1975-1995, as against 36% rise of global irrigated area. Each pump cost \$35 including its installation while the annual net average return was \$100. *"The pumps gave them (poor farmers) independence from local water lords, a more reliable supply of water, and precise control over when and how much they irrigated"* (Sandra Postal<sup>5</sup>).

However, presently irrigation from treadle pumps has been confined more or less to Rangpur –Dinajpur areas, and in some pockets outside, replaced by heavy duty tubewell irrigation in a bid to raise multiple crops and agricultural production manifold. The latter has depressed the water table beyond the suction level of treadle pumps. Further, with alternate employment potentials generated, the use of treadle pumps in Bangladesh has sharply declined.

### Potentials in the Developing Countries

According to Paul Polak, President of International Development Enterprises (IDE), the total market of treadle pumps in the developing world may be 10 million including 3 million in Bangladesh, 6 million in India, and the remaining in the other Asian and African countries. In major parts of the Indo-Ganga-Brahmaputra plains of Northern and Eastern India outside the canal

command usually a single crop, such as wheat and maize, is grown in the kharif or monsoon season. The unsustainable income from a single crop compels the farmers to migrate to cities in search of work, dislocating their normal life. While the affluent farmers buy and operate diesel pumps for irrigation, raising crops all the year round, the poor can only hire diesel pumps, but at a high cost, and that, too, will be available as per convenience of the pump owner and not at the time the crops need irrigation for growth. Thus manual irrigation device like Treadle pump has large potential in India as in Bangladesh, where land holding is very small, density of population is high and employment potential poor.

In India the marketing and use of treadle pumps has been at a low key compared to neighbouring Bangladesh, one of the reasons being lack of proper marketing strategies. Secondly, groundwater irrigation reaching a high pitch in the country, groundwater level has got depressed through overexploitation by rich farmers owning large extent of land. With the globalisation of economy opening up many new opportunities, people are getting attracted towards alternate remunerative employment, and migrating to cities neglecting agriculture. Even so, there are large tracts in Orissa, parts of eastern Uttar Pradesh, West Bengal, Jharkhand, Bihar and North Eastern States (specially Assam and Tripura) where, there is large scope for food production using treadle pump. Currently International Development Enterprises (IDE, India) is engaged in promoting use of the treadle pumps in the country.

These low-cost foot-operated suction

pumps for small scale irrigation can be the answer for increasing food production in the poor, under-developed or developing countries. It is technically simple, light and portable, easy to install, operate and maintain. But what is needed is an aggressive marketing strategy. It is reported that in Africa and Nepal treadle pumps are widely in use and highly popular. Summing up, the treadle pumps have made significant impact on the life and economy of the developing countries

This is the story of 'Treadle Pump', a wonder machine, – a manually operated irrigation device. The two talented mechanical engineers, – Narendra Nath Deb and Gunner Barnes, are deserving recognition for their services to the State. Rural India should give a fair trial to this simple device and promote development.

### References

- <sup>1</sup>IDEI (2007) The Force Behind Million Smiles. Success Stories. International Development Enterprises India, New Delhi (<http://www.ide-india.org/ide/cs2-majhi.shtml>).
- <sup>2</sup>IDEI (Not mentioned) The Treadle Pump: Economic Power to the Landless. International Development Enterprises India, New Delhi, pp1-26).
- <sup>3</sup>IDEI(Not mentioned) Making Sustainable Development Work. International Development Enterprises India, New Delhi, p 4-5).
- <sup>4</sup>ORR, A., NAZRUL ISLAM, A.S.M. and BARNES, G. (1991) The Treadle Pump. RANGPUR Dinajpur Rural Service, Dhaka, Bangladesh.
- <sup>5</sup>SANDRA POSTAL (1999) Pillars of Sand. W.W.Norton & Company, New York and London, p.206, 209).