Technical Brief No. 35/Low-lift irrigation pumps

Small-scale irrigation is a key factor in the development of many rural communities in developing countries. A variety of water-lifting devices have been used in the past and this Technical Brief describes some of the most practical and efficient pumps in use today.

An irrigation pump needs to be able to deliver a large volume of water over a long period of time, and in order to achieve this the available human power needs to be used efficiently. Arms and shoulders are normally used to operate machinery, but higher power outputs can be achieved by using the whole body. A pedalling action gives the most power, as it uses the leg muscles, the largest in the body.

The water being pumped can come from a variety of sources – wells, boreholes, streams, rivers, and ponds.

The rower pump

- Stainless steel shaft
- Plastic tube
- Surge chamber improves efficiency
- Foot valve with rubber diaphragm
- Plastic riser
- Water source (well, stream, or pond)
- Maximum lift 7m
- Rowing action - a better use of energy
The rope-and-washer pump

Based on a principle developed in ancient China, the current design is a VLOM pump that can be built from materials that are available in most communities.

The main pulley is an old car tyre rim and this is used to turn a rope knotted to hold a series of rubber washers, made from car tyres. The use of wooden washers instead of rubber is not proving to be satisfactory. The riser pipe can be either plastic or bored-out bamboo.

Water can be lifted from up to 20m below the pump and delivered 5m above it, with output rates of up to 50 litres per minute depending on lift.

Sources can be wells, large diameter boreholes, ponds, and streams.

**Alternative arrangements**

- Traditional arrangement
- Overhead pumping
The treadle pump

Because the treadle pump is operated by the most powerful muscles of the human body, it can be operated for longer than other human-powered pumps.

The pump was developed in Bangladesh but has since been modified so that the discharge is pressurized. In this form it is capable of lifting water up to 20m above the pump, but because it works on a suction principle it can only be a maximum of 6m above the source. Water can be pumped from wells, boreholes, streams, and ponds, and discharge rates of 50 litres per minute can be achieved. This is a VLOM pump but welding facilities are required for its manufacture.
Suction pumps

Suction pumps exist in a great variety of designs. They can be used for low-lift irrigation purposes, but they have several disadvantages:

- lower discharge rates
- need to be fixed in a stable position over a well or borehole
- less efficient for prolonged use as arm and shoulder muscles used.
- more sophisticated manufacture required.

Alternative methods

There are other ways of lifting water for irrigation that have been in use for many generations. These include the Egyptian shadoof, the dhole and various water wheels and devices such as the mohete, which use animal power. Wind power can also be used to power irrigation devices.

For further information:

World Bank/UNDP, Community water supply - the handpump option, World Bank, 1996.

Prepared by Bob Elson and Rod Shaw

Water, Engineering and Development Centre (WEDC),

The Worth of Water: Technical briefs on health, water, and sanitation (ISBN 1 85339 071 2) is available at £9.95 plus £2.50 P&P from IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK.