Evaluation of stream-driven spiral pumps under field conditions

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In many countries, there is potential for using stream-driven devices to lift irrigation water. These pumps use no fossil energy and can be constructed by local craftsmen using available materials.

The concept of utilizing the energy of water flow to drive rotating direct-lift water pumps is not new. But conventional low-speed rotating pumps cannot raise water much higher than the pump structures themselves. Low-speed, rotating, positive displacement pumps, such as spiral pumps, can deliver irrigation water to a much higher total head (Fig. 1).

Parameters for a spiral pump were evaluated in the laboratory. We evaluated the performance of spiral pumps in cooperation with the Abra River Irrigation Project.

Diversion canals there feed several thousand hectares of agricultural fields. However, fields situated above the irrigation canals cannot benefit. The spiral pumps could supply water to these fields.

Three spiral pumps were installed into a 3.00-m-wide main diversion canal. Water depth fluctuates from 1.20 to 1.60 m. At a velocity of about 1.59 m/s, approximately 7.5 m³ of water per second passes through the canal.

Spiral pumps with 2.5, 4.0, and 5.0 m outer diameter, matching conditions of the dike, were constructed and tube diameters and the influence of the size of the water intake spouts tested.

The tube diameter, the height of the water delivery, and the water volume scooped into the tube resulted in varying speeds of rotation of the wheel, and different volumes of water delivered. The results agreed with data from laboratory tests (Fig. 2).

Given the kinetic energy of a stream and the drag coefficient designed into the paddles of the pump, it is possible to design a spiral pump with all factors adapted to existing natural conditions and the needs of a farmer.}

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