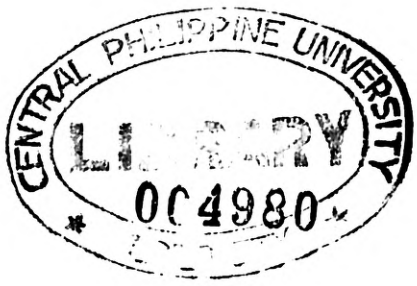
DESIGN AND EVALUATION OF A DEEP-WATER-PUMPING WINDPUMP FOR DRIP IRRIGATION AT MINDANAO STATE UNIVERSITY, GENERAL SANTOS CITY

Alexis T. Belonio
Appropriate Technology Center
Department of Agricultural Engineering
College of Agriculture
Central Philippine University
Iloilo City

and

Hayde P. Bustamante
Department of Agricultural Engineering
College of Agriculture
Mindanao State University
Fatima, General Santos City



A Project Report Submitted to the
UNIVERSITY RESEARCH CENTER
Central Philippine University
Iloilo City

SEPTEMBER 2002

DESIGN AND EVALUATION OF A DEEP-WATER-PUMPING WINDPUMP FOR DRIP IRRIGATION AT MSU, GENERAL SANTOS CITY

by

Alexis T. Belonio and Hayde P. Bustamante

ABSTRACT

A deep water pumping windpump was designed and evaluated for drip irrigation at the Demonstration Area of the College of Agriculture, Mindanao State University, Fatima General Santos City (MSU-GSC). The design development of the windpump was done at the Appropriate Technology Center, Department of Agricultural Engineering, Central Philippine University (ATC-DAE-CPU), Iloilo City during the month of February 2001. Fabrication of the head assembly was done at Dennis Metal Craft, Jaro, Iloilo City during the month of March 2001. Construction and installation of various components of the windpump including the drip irrigation system was carried out at the MSU-GSC from April 1, 2001 to January 31, 2002.

The windpump has a rotor diameter of 4.39 m with 24 arch steel blades and a four-legged truss-type tower with a height of 9.14 m. The rotational motion of the rotor is converted by a crank-type transmission system to a reciprocating motion of a 1-1/4-in diameter deep well pump installed 40.24 m below the ground surface. The length of stroke was 0.20 m with an average stroke obtained during the test of 36.72 strokes per min. The water source was at a depth of 59.45 m using a 6-in. diameter steel pipe casing.

Performance testing and evaluation employing 16 runs, revealed that at the average wind speed of 3.88 m/s, a flow of 256.37 mL/s and hydraulic power of 43.16 W were obtained. It was observed that the wind flow and the hydraulic power continue to increase to 380.00 mL/s and 113 W at a wind velocity of 12.73 m/s. However, it started to decrease to 323.63 mL/s and 96.65 W at a wind speed of 12.84 m/s.

Wind velocity was observed to effect on wind power. At a wind velocity of 3.88 m/s, the wind power was 442.05 W. It increased to 16,032.91 W at the highest wind speed of 12.8 m/s.

It was also noted that the overall system efficiency decreased as the wind velocity increased. Its value ranged from 0.60% to 12.91%.

During the months of November 2001, December 2001, and January 2002 the mean depth of rainfall, evaporation rate, and wind velocity at the area where windpump and drip irrigation system were installed were 6.82, 1.74, and 1.80 mm per day, 3.49, 3.67, and 4.62 mm/day, and 2.44, 2.22, and 3.30 m/s, respectively.

Of the three different kinds of drip lines used for windpump, the pressure compensating dripper was observed to perform well. This can be attributed to its very low pressure operating characteristics.

The cost of operating the system, both for the windpump as well as the drip irrigation system, is relatively high due to low pumping output as a result of low wind stream in the area.