DEVELOPMENT OF SOLAR-POWERED WATER PUMP FOR CONTINUOUS IRRIGATION PUMPING OPERATIONS

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ABSTRACT

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For supplemental irrigation, farmers rely on electric and fuel-powered pumps. However, small farmers are burdened by growing fuel and energy prices and water pump machine upkeep. The main objective of this study is to develop a solar-powered pump for surface water pumping in agricultural production. The study aims to help farmers, particularly those who reside in flat-land areas where agricultural land is far from the grid but still requires irrigation that needs expensive fuel. The discharge capacity and total dynamic head of the fabricated pump have been evaluated in different factor combinations. Two different combinations of the length of stroke and the speed of rotations (RPM) were evaluated in terms of their effects on the discharge and total dynamic head of the pump. Two-way analysis of variance showed both the length of stroke and flywheel's speed of rotation, as well as their interaction, affect significantly the discharge of the pump. On the other hand, the total dynamic head was found to be affected by the length of stroke and the flywheel's speed of rotation but not the interaction of the two.

By adjusting either the flywheel's rotational speed or the piston's length of stroke, the reciprocating pump's overall pumping rates could be changed. A speed of rotation of 280 rpm and a 25 cm length of stroke resulted in a discharge capacity of up to 0.371 m^3/h

with a total dynamic head of 3.610 meters and 64.30% efficiency. The lowest discharge was observed to be 0.140 m^3/h with a total dynamic head of 3.40 meters and 58.09% efficiency using a 23 cm length of stroke and 130 rpm of the flywheel.

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