The Feasibility of Photovoltaic Pumping System For Apple Orchards Irrigation in Loess Plateau

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Rainwater collection and utilization is a common method to relieve soil water pressure in dry dryland orchards. Due to relatively low levels of economic development and population distribution, these areas are unable to develop electricity or import large amounts of energy, resulting in rainwater harvesting often not being fully utilized. Photovoltaic (PV) pumping system is an effective way to ensure the sustainable utilization of soil water in apple orchards. In order to explore the application potential of PV pumping system in the apple suitable area of the loess plateau, this study simulates the rainwater collection amount and the orchard water demand change process in typical hydrological years and conducts a feasibility analysis of the PV pumping system from both technical and economic perspectives. The results found that the precipitation from June to October could not meet the water requirement of the growth of apple tree in the demonstration orchard and the total annual water demand reaches 170 m³. Fortunately, the local solar energy resources can basically meet the demand for solar energy in the PV pumping irrigation system, which ensures sufficiently irrigation water for the apple trees grow. After the completion of the PV pumping irrigation system, the income from the increase in fresh grass production in the demonstration area will reach 8019 CNY/year. The ratio of investment to income is 1:3.0. The investment recovery period is 4 years and it has good economic feasibility. Finally, using spatial geographic information technology, the apple-adapted area is systematically matched with the most suitable planting area for solar irrigation. The land area suitable for solar technology irrigation accounts for 47.6% of the total area, showing promising prospects to be popularized in Western China at large scale.

KEY WORDS: photovoltaic pumping system; loess plateau; economic benefit; application potential; apple orchards