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Real-Time Optimisation and Minimal Energy Use for Water and Environment Efficient Irrigation

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Abstract : The viability and sustainability of crop production is currently threatened by increasing water scarcity. Water scarcity problems can be addressed through improved water productivity and the options usually presumed in this context are efficient water use and conversion of surface irrigation to pressurized systems. By replacing furrow irrigation with drip or centre pivot systems, the water efficiency can be improved by up to 30 to 45%. However, the installation and application of pumps and pipes, and the associated fuels needed for these alternatives increase energy consumption and cause significant greenhouse gas emissions. Hence, a balance between the improvement in water use and the potential increase in energy consumption is required keeping in view adverse impact of increased carbon emissions on the environment. When surface water is used, pressurized systems increase energy consumption substantially, by between 65% to 75%, and produce greenhouse gas emissions around 1.75 times higher than that of gravity based irrigation. With gravity based surface irrigation methods the energy consumption is assumed to be negligible. This study has shown that a novel real-time infiltration model REIP has enabled implementation of real-time optimization and control of surface irrigation and surface irrigation with real-time optimization has potential to bring significant improvements in irrigation performance along with substantial water savings of 2.92 ML/ha which is almost equivalent to that given by pressurized systems. Thus real-time optimization and control offers a modern, environment friendly and water efficient system with close to zero increase in energy consumption and minimal greenhouse gas emissions.

Keywords : pressurised irrigation, carbon emissions, real-time, environmentally-friendly, REIP
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