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Benefits and Drawbacks of Irrigation Scheduling in Semi-Arid Plants

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Perspective

Recent improvements are highlighted, particularly in the use of infrared thermometry and thermography to analyse stomata conductance variations. The relative applicability of different techniques for distinct crop and climatic settings is explored, with the goal of highlighting their strengths and weaknesses, as well as their suitability over various spatial and temporal dimensions. The use of various scheduling strategies to automate irrigation control using soil and plant-based systems is also covered. This research compares classic water-balance and soil moisture-based irrigation scheduling algorithms with those based on sensing plant responses to water deficiencies. The primary plant-based irrigation scheduling approaches are presented and appraised, including those based on direct or indirect detection of plant water status and those based on plant physiological responses to drought. Dendrometry, fruit gauges, and other tissue water content sensors are among the plant-based methods described, as are measurements of growth, sap flow, and stomata conductance.

Traditionally, irrigation scheduling has tried to produce an optimal water supply for production, with soil water content kept near field capacity. Irrigation scheduling can be thought of as a mature study topic that has progressed from cutting-edge science to the realms of application, or at the very least refining, of current practical applications. Water scarcity and irrigation expenses are increasing over the world, prompting a focus on creating irrigation technologies that utilise as little water as possible. Precision irrigation methods such as trickle irrigation have helped to reduce the amount of water used in agricultural and horticultural crops, but they have also emphasised the need for improved irrigation scheduling and control methods. The irrigation schedule strategy chosen is mostly determined by the irrigator's goals and the irrigation system available. Even less complicated systems, such as flood irrigation scheduling, can benefit from advances in irrigation scheduling as indicated here. A sensor system that assesses irrigation demand in real time or at least at frequent intervals is also required for effective operation of such systems; this rules out large-scale human monitoring programmes for such reasons and underlines the necessity for automated monitoring systems. A sensing system that determines irrigation needs in real time or at frequent intervals is also required for effective operation of such systems; this rules out large-scale human monitoring programmes for such reasons and underlines the necessity for automated monitoring systems.The current state of the art and future opportunities for using plant-based stress sensing as the basis for irrigation scheduling and control have been briefly discussed in this review. Plant-based sensing provides a number of potential benefits, including a stronger relevance to plant functioning than soil-based metrics, but these have been outweighed by a number of practical implementation challenges that have hampered the development of commercially successful systems thus far. Pressures for increased water efficiency and precision in irrigation systems, on the other hand, are likely to provide a real impetus for the development of new precision irrigation scheduling systems that take into account the irrigation needs of individual plants, and may well involve greater use of plant-based sensing systems.

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