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DEFICIT IRRIGATION AS AN AGRICULTURAL WATER MANAGEMENT SYSTEM FOR CORN: A REVIEW

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ABSTRACT Traditional irrigation practices in many areas of the world are designed to maximize yields by avoiding crop water stress. This fundamental precept of irrigation management will probably be forsaken. Maximizing total benefits rather than yields will be the new strategy that replaces this precept. Deficit irrigation can be defined as an agricultural water management system in which less than 100% of the potential evapotranspiration can be provided by a combination of stored soil water, rainfall, and irrigation during the growing season. Deficit irrigation is not only strategy to save water or to increase water use efficiency, but is becoming the pattern in water scarce areas. The stakeholders need guidance from the scientific, economic or engineering communities. This article is a widely literature review to present a broad guidelines to the stakeholders including deficit irrigation definitions and concepts, practices, economics, management, and with the focus on deficit irrigation as a water management system for corn (maize) based on crop water use, yield and yield components, water-yield relations, and water productivity. The optimization models and the tools for implementing the scenarios, strategies, and polices of deficit irrigation management also presented. The potential benefits of deficit irrigation derive from three factors: reduced costs to production, greater irrigation water use efficiency, and the opportunity costs of water. Optimum water use implies deficit irrigation. Crop yield is usually linearly related to crop evapotranspiration from the yield threshold up to the point of maximum yield. Crop yield can be reduced by plant water stress that is caused by limited soil water availability. Yield reduction due to applying proper deficit irrigation lower than those due to plant diseases and pests, improper fertilization of fields, and losses during harvest and storage. The yield reduction will depend on the severity and the timing of the water stress (crop stage of growth). Reduction in water applications may have a favorable effect on yields by reducing the incidence of disease, improving the storage and handling properties of a crop, minimizing the leaching of fertilizers from the root zone, and improving aeration of the soil. Applying deficit irrigation strategies in a given region when irrigation water sources are limited or expensive ensures optimum and sustainable agricultural production as well as maximizes the income of the growers. Deficit irrigation saves irrigation water but requires better irrigation management in order to enhance crop water use efficiency and minimize the impact on crop growth and final yield. Irrigation water can be conserved and yields maintained by using irrigation timing at critical growth stages of corn. Short-season hybrids of corn reduce the income; the lost income could be offset by higher grain prices from the early hybrid and the opportunity for grazing a winter wheat double crop.

Keywords: Corn yield and yield components, deficit irrigation, ET deficit irrigation, irrigation optimization, optimum water use, limited irrigation, partial irrigation, regulated deficit irrigation, water productivity, water stress, yield response to water