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Conversion from Irrigated Deficit Crop Production to Dry land Crop Production in Arid Zones

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Editorial

Rain fed farming and dry land farming is often used interchangeably, but this is a serious error. They both exclude irrigation, but beyond that, they can differ significantly. Dry land farming is a special case of rainfed agriculture practiced in arid and semiarid regions in which annual precipitation is about 20–35% of potential evapotranspiration. Conditions of moderate-to-severe moisture stress occur during a substantial part of the year, greatly limiting yield potential, and in which farming emphasizes water conservation in all practices throughout the year. Rainfed systems, although they include dryland systems, can also include systems which emphasize disposal of excess water, maximum crop yields, and high inputs of fertilizer. There are three components of a successful dry land farming system: (1) retaining the precipitation on the land, (2) reducing evaporation from the soil surface to increase the portion of evapotranspiration used for transpiration, and (3) utilizing crops that have drought tolerance and that fit the precipitation patterns. Although these components have been known for centuries, new technologies continue to be developed that increase crop production in water-short areas.

Worldwide agricultural production in semiarid climates is a high-risk endeavour given the uncertainty of rainfall distribution and amount. For example, the semiarid region of the Texas High Plains has an average rainfall where the monthly coefficient of variation is greater than 70% and the introduction of irrigation in the 1950's provided year-to-year stability in crop yields. The source of the irrigation water is an underground aquifer, Ogallala that extends from Texas north to the Dakota's. In the Texas High Plains, the aquifer has diminished, reaching water levels that in certain areas can only supply a limited amount of water that is well below the crop's water requirements, i.e., deficit-irrigation. Current irrigation technology, such as sub-surface drip and overhead sprinkler has improved the efficiency of applying water while minimizing losses and has extended the application of water from a declining water table. As a result, there is a transition being experienced from deficit-irrigation to dry land crop production. The rate of this transition is unknown and varies across the region and is a function of crop grown, irrigation system used and other agronomic management factors.

Dry land production relies on stored soil water and thus agronomic management practices must maximize the amount of rain that infiltrates, i.e., effective rain, into the soil and minimize losses due to runoff and evaporation from the soil. Previous field studies in dry land production indicate that traditional experimental designs do not always capture the inherent spatial variability in soil properties that is required to develop relations that can predict crop yield as a function of effective rainfall and stored soil water. The alternative are experiments in large plots and over long-time scales, i.e., landscape scale (≥ 20 ha) with multiple years, to quantify agronomic management effects on production. Further, experimental results combined with simulation models can be used to evaluate multiple scenarios. While the problems associated with dry land production are general, the solutions are site-specific and require a systems approach.

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