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Assessment of irrigation performance: contribution to improve water management in a small catchment in the Brazilian savannas

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Irrigated agriculture is the major consumer of surface water in Brazil using over 70% of the total supply. Due to the growing competition for water among different sectors of the economy, sustainable water use can only be achieved by decreasing the portion of water used by the irrigated agriculture. Thus, in order to maintain yield, farmers need to irrigate more efficiently. There is little known on irrigation efficiency in Brazil. Therefore a study was carried out in the Buriti Vermelho basin to assess the irrigation performance of existing system. The experimental basin has a drainage area of 940 hectares and is located in the eastern part of the Federal District, in the Brazilian savanna region. Agriculture is the main activity. There is a dominance of red latosols. Several types of land use and crop cover are encountered in the basin. Conflicts among farmers for water are increasing. As water, in quality and quantity, is crucial to maintain the livelihood of the population in the basin, concern about risk of water lack due to climatic and land use change is in place. Once irrigation is the main water user in the basin, to increase water availability and reduce conflicts a water resource management plan has to be established. For this purpose, irrigation system performance has to be understood. The objective of this work was to assess the performance and the management of irrigation (small and big) that has been carried out by farmers in the Buriti Vermelho experimental watershed. A survey undertaken in 2007 was used to identify the irrigation systems in the basin. It was verified that irrigation is practiced by both small (area up to 6 hectare) and big farmers. Small farmers usually crop limes and vegetables and use micro-irrigation, drip, sprinkler, guns or furrow to irrigate them. Big farmers plant annual crops and use center pivot as irrigation system. In this first assessment 13 irrigation systems were evaluated: five conventional sprinklers, four drip systems, one microirrigation system and three center pivots schemes. Field evaluations used the method advocated by Keller and Bliesner and conducted during farmer scheduled irrigation. Soil samples were taken before irrigations to investigate adequacy of water applied. Since the irrigation water management and the uniformity of water distribution are the two major factors used to define the quality of irrigation, the following criteria for uniformity was used: i) Localized irrigations (distribution uniformity - UD) – excellent (90% < UD), acceptable (70% < UD < 90%), not acceptable (UD < 70); ii) Center pivots and conventional sprinkler irrigations (Christiansen coefficient - UC) - excellent (85% < UC), acceptable (85% < UC < 75%), not acceptable (UC < 75%). The water stored in the root zone after an irrigation event was compared with the real necessity. The results showed that: i) Localized irrigations – Three systems had UD < 70% and all systems presented deficit or excess of irrigation; ii) Conventional sprinkler system – Three system had UD smaller than 75% and all systems applied less water than the minimum necessary to keep an amount of water in the soil that don't cause plant stress; iii) Center pivot – In two system were observed UC < 75%. In one of the center pivots the depth applied was about 42% higher than the required and in the other two it was 39% and 47% lower. The study demonstrated the importance of adopting irrigation management criteria, in agricultural basins, once irrigation water becomes limiting and reduces basin water productivity.