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## Comparative Study on Water Use Efficiency of Cotton in Sole and Relay Intercropping Wheat-Cotton Production Systems

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### Abstract

Climate change induced water scarcity is one of the most important challenges for agricultural production. Therefore, agricultural lands are expected to be limited especially in arid and semi-arid areas due to restricted water resources. Furthermore, land-use competition between staple crops such as wheat and cash crops such as cotton will inevitably rise. In the present study, we aimed to evaluate water use efficiency (WUE) in relay-intercropping system which increases land-use efficiency and allows to cultivate wheat and cotton in a sam. land and growing season. A field experiment during 2017/18 was carried out with two different water regimes (deficit-watered and well-watered) and two different cropping systems (sole and relay strip intercropping of wheat-cotton). Irrigation amount in well-watered treatment was adjusted according to local farmer practices in the experimental site (480 mm) while 13% reduced water applied in deficit watered treatment to simulate moderate water limited conditions. Our results indicated that WUE of cotton and wheat were affected significantly by cropping systems ( $p < 0.05$ ). Sole cropping of cotton had higher WUE ( $0.209 \text{ kg ton}^{-1}$ ) than relay strip intercropping with wheat ( $0.142 \text{ kg ton}^{-1}$ ). Similarly, sole cropping of wheat had higher WUE ( $0.554 \text{ kg ton}^{-1}$ ) than relay strip intercropping with cotton ( $0.388$ ). These results were found by evaluated of each individual crops separately in cropping systems. However, it is possible to revealing synergistic effect of relay strip intercropping by calculating monetary water use efficiency (WUEM). According to monetary comparison based on cropping systems, sole cotton ( $0.170 \text{ ton}^{-1}$ ) and relay strip intercrop ( $0.165 \text{ ton}^{-1}$ ) had almost same WUEM and also higher than WUEM of sole wheat ( $0.146 \text{ ton}^{-1}$ ). Consequently, while well watering conditions lead to increase (17%) in WUEM of sole cotton, the increase was more pronounced (45%) in relay strip intercropping system. According to our first findings, wheat-cotton production by relay strip intercropping system could be suggested as alternative system to sole cotton in terms of water use efficiency.

**Keywords:** Cotton, relay strip intercropping, water scarcity, water use efficiency, wheat