Surge flow irrigation: field experiments under short field conditions in Egypt.

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Abstract:

Surge flow irrigation is a surface irrigation method that can be used to improve the efficiency of water applied by furrows. Several studies have shown that surge flow irrigation offers the potential of increasing the distribution uniformity, thereby increasing the efficiency of surface irrigation. Most of these studies were conducted in fields with long furrows, but the effects of surge flow in short fields, like in Egypt, are still not well known. In order to investigate the effect of surge flow irrigation in short fields a series of experiments have been carried-out in two different locations in Egypt. The first location with a clay soil was situated at the Agriculture Experimental Station, Assiut University, Assiut. The second location with a sandy soil was situated at the Assiut University Experimental Station for Desert Land, El-Wadi El-Assuity, Assiut. The furrow length was 70 m and the furrow width was 0.70 m for both locations. The furrows had a blocked end. Three discharges were selected for each soil type, namely 0.46, 0.74 and 0.90 l/s for clay soil and 0.73, 1.0 and 1.4 l/s for sandy soil. The water was conveyed via siphons to the furrows. For each discharge two cycle times were investigated, namely 16 and 24 minute. For each cycle time three cycle ratios were chosen, i.e. 1/4, 1/2 and 3/4 for 16 minute and 1/3, 1/2, and 2/3 for 24 minute cycle time. The different cycle ratios were applied to study the effects of off-time on the water distribution along the furrow. The water content was recorded by a Profile-probe at three locations, namely at the beginning, middle and end of the furrow. In each location three points were measured in a vertical at a depth from 0 - 0.1, 0.1 - 0.3 and 0.3 - 0.7 m-surface. The results show that surge flow irrigation leads to a decrease in advance time compared to continuous flow. The reduction in advance time is more pronounced for high than for low discharges and also more in coarse than in fine textured soils. For both cycle times the advance time reduces compared to continuous flow in both soil types, except for 0.46 l/s in clay soils; this discharge leads to an increased advance time. For the other cases the reduction was more pronounced for a cycle time of 24 minute than for 16 minute. This reduction was due to the effect of off-time. When the off-time is long enough to infiltrate all the water before the second surge starts, the mechanism of surge flow works effective. The water content along the furrow is also more uniformly distributed than for continuous flow. In conclusion surge flow irrigation under the prevailing conditions in Egypt decreases the advance time, increases the efficiency and uniformity, and hence, it saves water.

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