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EFFECT OF CRACKS ON WATER REQUIREMENT FOR LAND SOAKING IN LOWLAND PADDY CULTIVATION

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Rice production is known to be less water-efficient than that of other crops. About 5 m^3 of water is used to produce 1 kg of irrigated rice. Out of the total water supplied, the water requirement for land preparation accounts for 30 - 40%. It was reported that the amount of water used for land soaking in the Mahaweli System C was 100 - 400% higher than that of the theoretical amount required to saturate the first 30 cm of soil. Crack formation, a common feature in the rice field, could be a reason for the large quantity of water loss in the rice field. Therefore, an understanding on soil cracking and its influence on water flow processes are important to improve the water use efficiency in paddy cultivation.

This study was conducted in a paddy field at Maha-iluppallama. Two plots each of 5 x 1.5 m were plowed, puddled and allowed to dry for two weeks. One plot was mulched with straw. Cracks formed in 60 x 60 cm grid in both plot were quantified using digital camera. Locally fabricated wetting front sensors were installed at three depths of soil profile, at five distances from the water supply end. Water was spread across the width of the plot at the rate of 1.5 L s^{-1} and surface and subsurface waterfront were observed. Infiltration and percolation rates in cracked soil were measured in two 60 cm diameter cylindrical lysimeters. Perforated pipes were placed at the bottom of the lysimeter and covered by gravel layer to collect drain water. Soil collected from paddy field was filled up to 45 cm and puddled down to 30 cm. One of the lysimeters was mulched with straw. After formation of cracks, water was applied at the rate of 0.2 L s^{-1} for 12 min. Ponded water and drainage water were measured with time.

The soil used for this study was clay loam in texture. In clay soils, drying results in soil shrinkage and cracking. Less cracks was observed in the mulched plot since the rate of removal of moisture is low compare to non-mulched plot. The crack area intensities of plots with and without mulch were 633 and 1641cm^2 m^{-2}, respectively. A clear difference was found in waterfront advance, between the two plots. With the increase of soil cracking, water penetrates the subsurface through cracks and advances at a faster rate than the surface water. In less cracked plot, waterfront on the surface was ahead of more cracked plot. The water reached the farthest point (30 cm depth at the tail end) in 85 seconds in the more cracked plot and in 195 seconds in less cracked plot. These figures may change with water supply rates. However, the comparison indicates that water moves rapidly through crack networks ahead of the surface waterfront. In lysimeter with more cracks, the drainage started after 128 seconds of water supply and the amount drained in 15 minutes was 53 L. In contrast, in lysimeter with less cracks, the time of starting of drainage was 139 second and the amount drained in 15 minutes was only 37 L. It could be inferred from the study that the level of crack formation has strong influence on surface and subsurface water movement, which determines the land soaking requirement. A better understanding on flow processes in cracked field will help to improve on farm water management through the development of techniques which reduce crack formation in lowland paddy cultivation.

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