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SHORT COMMUNICATION

WATER REQUIREMENT FOR WETLAND PREPARATION DURING *YALA* SEASON IN DIFFERENT DRAINAGE CLASSES OF NON CALCIC BROWN SOILS

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INTRODUCTION

Inappropriate on-farm water management has resulted in wastage of irrigation water in paddy cultivation. Generally, people closer to the reservoirs utilize excess water and tail-enders experience shortages of water. The irrigation efficiency is estimated to average less than 40 % indicating that nearly 60 % of the water diverted to agriculture never benefits the crop (Ramulu, 1998).

The Non Calcic Brown (NCB) soils and Reddish Brown Earth (RBE) are the major soil groups found in Mahawali system B (Panabokke, 1996). Depending on drainage, the NCB soils has three drainage classes namely, well-drained, moderately well-drained, and poorly-drained soils (Panabokke, 1996). The NCB soil is a course textured soil which comprises 90 % sand (Rajapaksha and Mapa, 1993). Drainage differences also occur due to the position in land catena and the seepage from the adjacent water bodies.

The water requirement for land preparation for paddy is varying with the drainage conditions of the soil. However, water utilization and allocation is carried out without thinking of these differences thus leading to waste of considerable amounts of irrigation water, which is a scarcs resource especially in the *yala* season of the region. Therefore, the information on water requirement for different drainage classes is important for water management authorities to achieve efficient and more productive water management systems. The objective of this study was to determine the water requirement for land preparation in two different drainage classes of NCB soils during *yala* season.

MATERIALS AND METHODS

Field experiments were conducted at the Regional Agricultural Research and Development Centre, Aralaganwila, located in low country dry zone (DL_{2b}). An area comprising of Non Calcic Brown (NCB) soil was selected for the study in the *yala* season of 2008. The experiment was carried out in a RCBD with three replicates. The treatments were; T_1: moderately well-drained soil and T_2: poorly-drained soil, which were selected based on the land catena. The parameters measured to determine the water requirement for land preparation were field capacity, initial moisture content, soil bulk density, infiltration rate, weed density and water conveyance losses.

Field capacity of the soil was measured by taking four undisturbed soil core samples, and the moisture contents of samples were measured gravimetrically (Singh, 1980). The initial moisture content was also measured gravimetrically and converted to depth of water. Undisturbed core samples were taken from three places of a replicate (27 samples per treatment), each at 15 cm depth, the dry weight of soils were measured, and the soil bulk density was calculated.

The infiltrations of the two drainage classes were estimated using a concentric cylinder infiltrometer (Ghildyal and Tripathi, 1987), where the two rings were penitrated to a 10 cm depth; the outer ring was 50 cm diameter and inner ring was 30 cm diameter. The receeding water levels against time at suitable time intervals in the central ring were recorded and the infiltration rate was calculated in mm hr^{-1}. The conveyance loses of the field canals were measured by establising two long throat flumes in the upper stream and the down stream sides of the canals.

According to the field capacity and water availabiltiy, the volume of water required to soak the upper 30 cm of soil was estimated and supplied through the long throat flumes to the experimental sites. The respective flow rates (m^3s^{-1}) were measured by changing the deapth of the water flow in the flume and ploting a rating curve using the height against discharge.

RESULTS AND DISCUSSION

Bulk density of the soil

The mean bulk density for moderately well-drained soil and poorly-drained soil were 1.47 gcm^{-3} and 1.56 gcm^{-3}, respectively. The bulk density of poorly-drained soil was high, probably due to accumilation of clay and humus as located in low line of land catena.

Infiltration rate

The vertical infiltration is the water moving downward from the soil surface (Jury *et al.*, 1991). In this experiment infiltration rates of the moderately well-drained soil (Figure 1) were 8 to 4.2 cm hr^{-1} withing the five hr period of measurement.

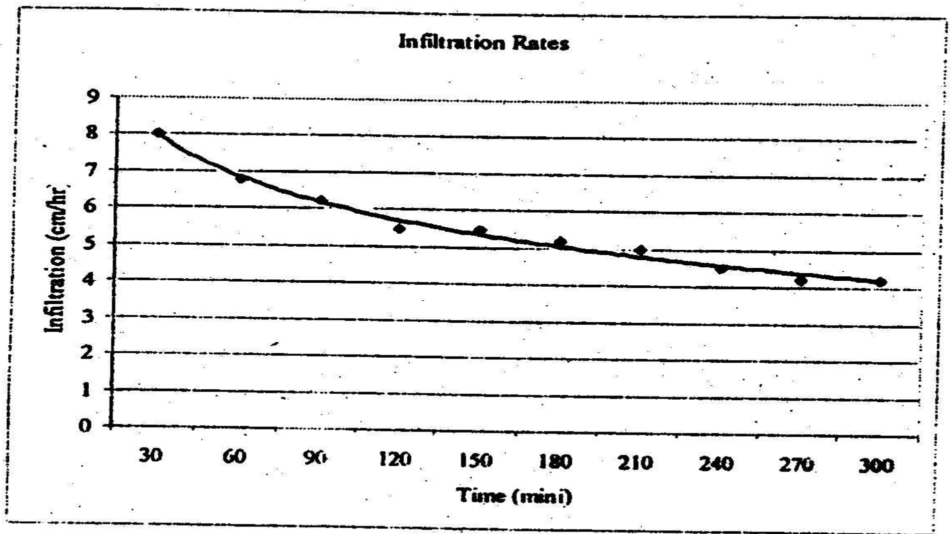

Figure 1. Infiltration rate of the moderately well-drained soil

Water convey loses

The conveyance losses were observed in moderately well-drained soils, while in poorly-drained soil there were no accountable conveyance loses. The canal of poorly-drained soil was always wet with high moisture contents and water did not lose through the canals. The rate of convayance loss was 0.117 m^3 hr^{-1} for the moderately well-drained soil. Hence, the water convayence count was 2.29 x 10^{-3} $m^3hr^{-1}m^{-1}$ and was used to estimating the water use for land preperation. The convayence efficiency of the canals in the moderately well-drained soil was 99.25 %. The convayence efficeincy of canal in the poorly-drained soils was negligeable and could not be monitored due to submergence.

Water loses in land preparation

The total water losses are usually accounted by evapotranspiration, infiltration, percolation and seepage. The evapotranspiration of the experiment site was 5.92 mm day^{-1}, which ranged from 8.98 to 2.8 mm day^{-1}. In the moderately well-drained soil the average water loses was high as 79.3 cm and in poorly-drained soil the average water loss was 30.9 cm (Table 1) for the total period. These variation in the water losses was due to the infiltration, deep percolation and the seepage differences among the two drainage classes. This indicate the water requirement to supliment of water loses during land preparation was different with draingae diferences of the land.

Water application efficiency

Water application efficiency is the percentage of water stored in the root zone in relation to the delivered water to the fields (Hansen, 1980). Water application efficiency was high in poorly-drained soil when compared to the moderately well-drained soil (Table 2). The average water application efficiency changed with tillage. According to the results, water application efficiency increased during secondary tillage, in both drainage classes of the soil indicating that tillage has a possitive impact on water application efficiency due to the accumulation of clay below the surface of the soil. This suggests the importance of correct land preperation for water conservation.

Table 1. Total water losses in experment

*Treatments**	*Total Water losses (mm)*
T_1	79.3
T_2	30.9

*Refer to the section on Materials and Methods for details of the treatments

Table 2. Average water application efficiency

Treatments	*Stage*	*Average water application efficiency (%)*
T_1	1st Tillage	85.88
	2nd Tillage	90.25
T_2	1st Tillage	92.7
	2nd Tillage	95.22

*Refer to the section on Materials and Methods for details of the treatments

Total water requirement for land preparation

The amount of water required for soaking to leveling of land is the total water requirement for the land preperation. In the present study, the moderately well-drained soil required 61.61 mm of water to soak the land prior to land preparation while the poorly-drained soil did not require supplementary irrigation as it was in waterlogged condition. Primary and secondary tillage also showed a significant difference ($p<0.05$; Table 3) in water requirement with respect to different drainage conditions of the land. For primary and secondary tillage, the moderately well-drained soil utilized 311.14 mm and 242.99 mm of water, respectively, whereas the poorly-drained soils utilized 212.05 mm and 164.69 mm of water, respectively. This indicates the importance of water management with respect to different drainage classes of soil.

Table: 3 Average water requirement for land preparation

Treatments	*Soaking (mm)*	*Primary tillage (mm)*	*Secondary tillage (mm)*	*Leveling (mm)*	*Total water reguirment (mm)*
T_1	61.61	311.14	242.99	3.55	619.30
T_2	0.00	212.05	164.69	0.00	376.74

*Refer to the section on Materials and Methods for details of the treatments; CV 5.6% p=0.008

The total water requirement for land preparation was 619.30 mm for the moderately-drained soil and 376.74 for the poorly-drained soil. These result revealed that the water requirement for wetland preparation was significantly different with respect to the drainage classes excisting in the catena. This result would assist the water management authorities of the Mahawali system B for saving the fresh water resources and increase the irrigable area to a considerable extent with proper water management.

CONCLUSIONS

Water requirements for wetland preparation was different with different drainage classes of Non Calcic Brown (NCB) soils. Allocation of water according to the drainage classes could lead to more efficeient water management in the Mahawali system B irrigation scheme.

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