WATER BALANCE STUDY FOR IMPROVING IRRIGATION EFFICIENCY IN MINOR TANKS A STUDY IN ANURADHAPURA DISTRICT

By

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Thesis

Submitted in partial fulfilment of the requirements

for the degree of

MASTER OF PHILOSOPHY

in the

POSTGRADUATE INSTITUTE OF AGRICULTURE

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

April 1998

ABSTRACT

About 2280 minor tanks with irrigation potential of 40,000 ha are located in the Anuradhapura District. Most of these tanks have been rehabilitated under various projects but not received the designed water inflow to cultivate the targeted area. The observed reasons are, inaccurate assessment of water inflow (rainfall and water yield) or outflow (tank water losses, irrigation issues) components in the tank.

This research study was carriedout with the objective of making a correct assessment of the above components based on the following activities.

- Collected rainfall data in 12 meteorological stations for 40 years (1956 - 1995) and analyzed to assess the spatial variations of rainfall within the district. For further analysis, nearly 100 years rainfall data were used from three weather stations in three regions.
- Measured hydrological parameters such as rainfall, tank water height, and evaporation and irrigation issues daily in two minor tanks selected for the study for a period of 4 years (1989 to 1993 Sept).
- From the measured data, tank water balance components were computed and analyzed. The results were compared with the design values and monthly tank water balance (operation study) was assessed in both tanks.

The observations and results are:

- The rainfall pattern in the Anuradhapura district varies widely. The Western Region stations have low rainfall, the Middle Region medium and Eastern Region high (Annual Averages 1136 mm, 1331 mm and 1498 mm respectively). Hence, taking an average rainfall value for the entire district for irrigation designs is inappropriate. It is proposed that the district be divided into three regions on the pattern of rainfall distribution. The 75% probability values of about 100 years rainfall was computed for each region. The annual design rainfall is 787 mm and the computed values are: Western Region 616 mm, Middle Region 698 mm and Eastern Region 736 mm.
- The average design water yield computed by using Iso - yield curves varies between 25% and 35% in Maha and 7.5% and 15% in Yala season. But the observed values are much lower than that (18% and 9% in Maha and Yala, respectively) but varies much on climatological and physical factors in the area. On an average 15% - 25% and 6% - 10% catchment yield can be expected in Maha and Yala respectively.

In general, the evaporation is about 25% and 40% from the seasonal yield in Maha and Yala seasons respectively. But the seepage and percolation losses are very high (20% and 50%) compared to the design value (1% and 5%) in Maha and Yala seasons respectively. The dry weather condition and consequently low soil moisture content and low ground water table are the contributory factors for high S & P losses during Yala season. The irrigation

issues are limited to 10% to 25% from the seasonal water yield but depend on the cultivation calendar and practices. The tank water losses are proportionate to the water spread area.

From the model water balance, it was observed that if the tank water is maintained at a optimum level (between half and two third of the maximum water height) the potential for irrigation efficiency can be maximized. To increase the tank water capacity at the optimum height intervals, two methods have been proposed.

The low rainfall and the catchment water yield and high unavoidable tank losses observed during the study indicate that the irrigation potential under small tanks is marginal. The results deviate much from the design values. Hence the relevant design criteria should be updated after making a more detailed study. But under the prevailing situation, a proper System Development and Management could improve the performance to a considerable extent.