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Assessment of Water Requirement of Sugarcane, Banana and Paddy in Sevanagala

L.M.J.R Wijayawardhana, A.L.C De Silva and W.R.G Witharama

Abstract

Conversion of irrigable sugarcane lands to paddy and banana has been a major threat to Sevanagala sugar industry. This has not only reduced availability of land for sugarcane cultivation, but also has created an additional irrigation water demand within the project. The objective of this study was to make a comparative assessment of water requirement of sugarcane, paddy and banana in Sevanagala to pinpoint the problem.

Relevant meteorological data were obtained from Sevanagala Sugar Industries. Water requirement for sugarcane and banana was calculated using the class A pan evaporation method. The total water requirement for paddy was taken from the data published by the Department of Agriculture, Sri Lanka. Monthly reference evapo-transpiration (ET_o) was calculated by multiplying class A pan evaporation with pan coefficient (kp).

The total water requirement estimated for sugarcane, banana and paddy was 1294, 1356 and 2891 mm per annum respectively. Thus, paddy and banana need nearly 123% and 5% more water than sugarcane respectively.

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Introduction

Sevanagala sugar project was established in 1986 under Uda Walawe irrigation scheme. The project has planned to provide irrigation water from left bank channel of the Uda Walawe reservoir at the rate of 149,000 m^3/day (Maaike, 2002). The total extent of sugarcane under this scheme is 1832 ha under irrigation and 2387 ha under rain-fed.

Sifting farmers to banana and paddy had been a major threat to the project. According to Kodithuwakku and Keerthipala (2010), nearly 50% of sugarcane lands in Sevanagala had been converted into paddy and banana. With the increase of sugarcane price in 2012, this problem reversed temporally, but the threat is still there unless cane price is adjested to compensate the increasing market price of other competitive crops. The conversion of sugarcane lands to paddy and banana was more in high productive and irrigable lands. Furthermore, additional demand of irrigation water within the sector for paddy and banana has further reduced availability of irrigation water for remaining sugarcane lands in addition to the reduction of land availability for sugarcane.

The annual water requirement for sugarcane under tropical conditions is about 1200-1500 mm per annum (Glyn, 2004), but paddy and banana consumed more water than sugarcane (pers.com. Agronomist Sevanagala). However, scientific assessments have not been carried out to prove this. Therefore, the objective of this study is to make a comparative assessment of the annual water requirement for sugarcane, paddy and banana in Sevanagala.

Method

The water requirement for sugarcane and banana was estimated according to the class A pan evaporation method (Doorenbos, 1984). Since, a substantial amount of water is needed for land preparation for paddy, apart from its physiological crop water requirement, the total water requirement for paddy was taken from the data published by the Department of Agriculture (DOA) of Sri Lanka (www.agridept.gov.lk). Monthly reference evapo-transpiration data (ET_o) were derived by multiplying class A pan evaporation with pan coefficient (kp) as follows:

ETo = kp x Class A pan evaporation; Where, ETo – reference evapo transpiration;
kp- pan co efficient

The pan coefficient values (kp) varied from 0.65-0.85 according to the local climatic conditions, i.e., relative humidity and wind velocity. Therefore, these kp values were

adjusted for average relative humidity and mean wind velocity values of each months (Doorenbos,1984). Accordingly, monthly crop evapo-transpiration (ET_{crop}) was calculated for each crop by multiplying ETo with relevant crop factor (kc) of each crop.

ET crop = kc x ETo ; Where kc = crop factor;

For this analysis, kc values of peak water-demanding stage of each crop were used. These crop factors were adjusted for monthly mean wind velocity, average relative humidity as per the procedure given by the Doorenbos (1984). Monthly soil moisture deficit for each crop was calculated by field water balance method. For this, mean monthly rainfall and pan evaporation data collected at Sevanagala Sugar Industries during the last 10 years from 2003 to 2012 were used. Mean monthly rainfall data were converted to monthly effective rainfall values according to the procedure given by Doorenbos (1984). This monthly effective rainfall values were further adjusted with effective storage factors of soil for each crop (Doorenbos, 1984). By this effective rainfall method, fraction of possible runoff losses is omitted and deep drainage beyond the root zone is assumed as zero. Monthly water surplus or deficit for each crop was determined by subtracting this average evapo-transpiration data from effective rainfall values in each month.

Results and discussion

The ten-year (2003–2012) average annual rainfall and class A pan evaporations in Sevanagala area were 1616.8 mm ± 42.2 and 1521.1mm ± 22.1 respectively. Nearly 48% of annual rainfall was received in the months of October, November and December; during Maha cropping season. There was a minor peak of receiving rainfall during March, April and May, which represent Yala cropping season. As such, most of the paddy cultivation activities in area are carried out with the onset of Yala and Maha rains. The mean monthly rainfall and 0.75 probability rainfall (dependable rainfall) in Sevanagala showed significant seasonal variation with clear bimodal distribution pattern (Figure 1). There was an increase of monthly average pan evaporation during dry periods and decrease during rainy months.

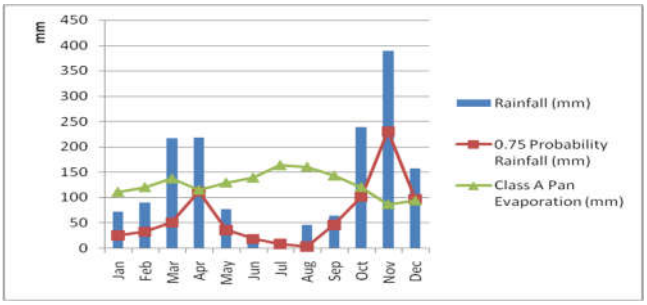

Figure 1: Mean monthly rainfall, 0.75 probability rainfall (dependable rainfall) and monthly average pan evaporation in Sevanagala

The estimated total water requirement for optimum growth of sugarcane was 1293.9 mm per annum. . For banana, the estimated water requirement was 1355.5mm per year. The average water requirement for 3- and 4-month-old paddy varieties grown in Reddish Brown Earths soil (the major soil type available in Sevanagala area) was 1144.5 mm/season (Table 1). Moreover, paddy requires extra water, as about 300mm/season for land preparation (www.agridept.gov.lk). Therefore, total water requirement for paddy would like 1444.5 per season. If cultivated during two seasons, both Yala and Maha, paddy requires 2891.0 mm water per year. For sugarcane, a single light irrigation of about 30 mm is enough for land preparations in RBE soil (SRI, 1989). In sugarcane, more than 5 ratoon crops are raised in Sevanagala, and hence the water requirement for land preparation is comparatively low.

Cultivation practices of banana in Sevanagala do not require irrigation water for land preparation. Therefore, the respective annual water requirement for paddy and banana cultivations in Sevanagala are 123.4 % and 4.6% more. Thus, paddy is the highest water-demanding crop and sugarcane is the least water needing crop among these three crops.

Annual water balance in the area showed that sugarcane and banana cultivations experience a water deficit of 522.8 and 560.7mm respectively. Thus, irrigation water requirement for banana is 37.9 mm more and it is a 7.1% more than that for sugarcane. In paddy cultivation, rainfall during March- June (Yala) and October–January (Maha) supplied 872.8 mm water , thus additional 2018.2 mm water has to be supplied by irrigation. This amount is 286% and 260% higher than the irrigation requirement of sugarcane and banana respectively.

Table 1: Water requirement for paddy : data at Mahailukpallama

Soil type	Age of the crop	
	3 month	4 month
Reddish brown earths (RBE)	1057	1232
Low humic glay soils (LHG)	948	1128

Conclusion

The study revealed that sugarcane was the lowest water required crop compared with other two competitive crops of banana and paddy. Thus conversion of sugarcane lands to banana and paddy, which requires more irrigation water reduces the productivity of irrigated sugarcane lands by limiting water. Therefore, action should be taken to stop conversion of lands allocated for sugarcane in Sevanagala to more water demanding crops like paddy and banana.

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