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Studies on Water Losses in Irrigation for Rice

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ABSTRACT

Seepage studies show that 12—18 per cent of water is lost through conveyance of water to the rice fields. Masonry and pre-fabricated cement concrete were found to be effective in minimising the losses whereas the latter was more economical. Percolation loss in the rice field has been observed to be of the order of 23.6 to 53.8 per cent. More attention is required to minimise this loss by changing the seed bed conditions.

INTRODUCTION

In India nearly 50 per cent of the total quantity of irrigation water is utilised for growing rice crops alone. Hence it is possible to increase the area under irrigation without any additional increase in the quantity of irrigation water by reducing the different losses of irrigation water in the rice fields to the least possible extent. As a first step to achieve the goal, the quantitative analysis of the different losses of water is essential. In this paper, the two important losses in the rice cultivation viz. conveyance and percolation losses are evaluated and the control measures are discussed.

Water is lost by percolation or seepage while in storage or conveying it to the farm. Estimates by the United States Department of Agriculture on irrigation water requirements in major river basins indicate that on the average nearly 50 per cent of the water drawn from the primary source never reaches the farm where it could be used (Anon, 1961). It is also reported by Krastz, (1971), that the percentage of seepage losses in small canals and farm ditches is normally greater than the large conveyance canals and in carrying 30 to 150 litres of water per second to a distance of 1 60 kilometer length the water loss through seepage can be as high as 20 per cent.

The percolation rate is governed not only by soil texture but also by soil structure. specifically cracks and holes created by plant roots or small worms. Percolation loss in the rice field is varying from 200–1200 mm. The loss will be very much if the soil is sandy and sandy loam. It is estimated that the actual loss from horizontal percolation average two to five times

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those of vertical percolation (Hitushi Fukuda and Hikaru Tasutsui, 1968).

MATERIALS AND METHODS

The estimation of conveyance loss has been done by adopting a) Inflow and outflow method and b) Still pool water level method. In the first method the length of the channels selected was 60 metres. The unlined earthern channels were formed both in sandy loam and clay loam soil. The gradient of different channels selected were 0.2 per cent and the water allowed was about 6 litres per second. In all cases, the loss of water was calculated as percentage of total water allowed in the channel. To confirm the results obtained from this method another experiment was carried out by 'still pool water level method' under earthern channel condition in which the size of the pit selected was 1 × 1 m with a depth of 7 cm in the same field. The experiments were conducted at the Tamil Nadu Agricultural University Coimbatore during 1966 – 68. The conveyance losses for other channels were calculated by the inflow and outflow method only by constructing the channels to a length of 60 metres in the same field. The cost of construction of various channels with reference to earthern channel were calculated.

'Modified drum culture' technique was adopted for the estimation of percolation loss. An area of 500 sq. m. rectangular plot was chosen. The boundaries of this field was surrounded by masonry core well. The depth of the wall below the ground was 1 metre and its height above the ground level was 15 cm A G. I. Tank of size 1 × 1 m. with closed bottom was embedded in the soil about one metre away from the side wall (Fig. 1). High yielding varieties of rice viz. IR. 22, IR. 24, Kanchi and Bhavani were grown in the field and as well as inside the tank. The spacing of the crop and density of population both in the field and in the tank were identical. During each irrigation, care was taken to see that the level of the water in the field and inside the tank was same. The daily loss of water in the tank was recorded which was only due to evapo-transpiration as the bottom of the tank was sealed. The water loss in the field was subjected to deep percolation and evapotranspiration. The difference of the above two readings show the loss of water due to percolation.

RESULTS AND DISCUSSION

The observations on the seepage losses through different types of channels have been analysed and the results are given in table 1. It can be seen that the seepage losses vary from 0 to 18 per cent, maximum being under unlined earthern channel in sandy loam soil and minimum being under masonry structures including free fabricated cement concrete channels. Taking into account the prevailing cost of materials and labour, the cost structures was analysed assuming the cost per unit measure for eerthern channel as one. Between brick masonry and prefabricated cement concrete channel, the latter proves to be economical and more effective. Considering the durability aspects, prefabricated soil cement channel comes next to the masonry and

TABLE 1. Seepage losses in various channel types.

Type of channel	Loss through 60 m. run in litre/sec	Seepage loss in percentage	Cost structure in units.
Open channel in sandy loam soil	0.51 to 0.91	12 to 18	1 0
Open channel in clay loam soil	0.34 to 0.51	8 to 10	1.0
Brick with lime mortar 1 : 2 plastered with cement mortar 1 : 4	Nil	Nil	10.0
Brick with mud plastered with cement mortar 1 : 4	Nil	Nil	8.5
Clay cement and sand 10 : 1 : 1	0.54 to 0.74	10 to 16	2.4
Soil cement (8 : 1)	0.20	5	2.9
Polythene film	0.057 to 0.51	2 to 15	1.7
Prefabricated soil cement 8 : 1	0.028 to 0.057	1 to 2	4.3
Pre-fabricated cement concrete (1 : 2:4)	Nil	Nil	6.5

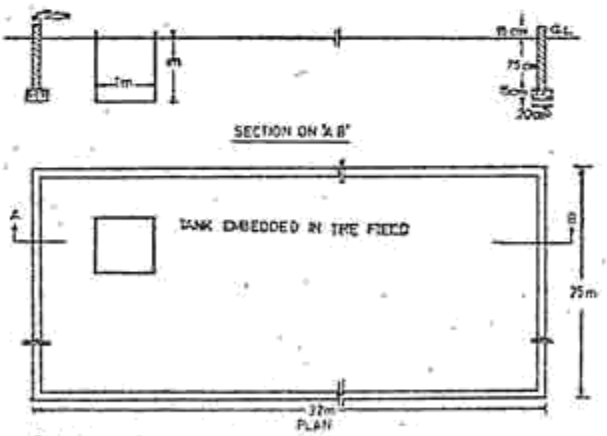

Fig.1 Experimental set up for estimating percolation

TABLE 2. Percolation losses in the rice field.

Rice variety	Total water requirement (mm.)	Percolation loss (mm)	Percolation loss (percentage)
IR 22	1042	245	23.8
IR. 24	1115	395	35.4
Kanchi	1320	684	51.8
Bhavani	963	248	25.6

prefabricated cement concrete channel, though it is economical.

The study conducted for percolation loss under different varieties of rice has been analysed and the percolation magnitudes have been illustrated in table 2. From the table it is seen that out of the total requirements of water, 23.8 to 53.8 is lost by way percolation in the field. This needs to be minimised in order to improve water use efficiency. Experiments are in progress to manipulate the soil through 'Sheep foot roller' an implement developed at this University. Pilot studies indicate that this implement has potential use in minimising the percolation loss.

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