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INFILTRATION OPPORTUNITY TIME IN LEVEL OR NEARLY LEVEL BORDERS

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Kerala is a land blessed with bountiful rains and extensive waterways. But experience has shown that agriculture in this region even today is dependent to a great extent on the rain. More than 70 per cent of the double cropped rice fields lie fallow during summer for want of irrigation facilities. Many large scale river-valley projects are to be commissioned in the near future. Large areas which are now lying fallow can be brought under cultivation after these river-valley projects are commissioned.

Rice cannot begrown during summer because of the limited availability of water and the very low water use efficiency that can be attained during this season. The development of a technology for efficient use of the limited water available during summer is necessary to make use of these rice fallows for cultivating crops other than rice. As most of the area is under paddy during first and second crop seasons, the levels of the land cannot be disturbed. But now, there is no satisfactory method of irrigation suitable for irrigating level or nearly level rice fallows.

The objective of this project was to study the infiltration opportunity time in level or nearly level border strips and to recommend suitable specifications of borders.

Materials and Methods

The experiment was done at the Agronomic Research Station, Chalakudy, Kerala during 1981-82. It consisted of five replications of four treatments. The treatments were two widths of 4 m and 6 m combined with two discharge rates of 2 l/s/m and 4 l/s/m the length of strip in all cases being 45 m. The surface gradient was 0.04 per cent in the direction of natural slope.

The texture of the soil is loamy sand with 74-84 per cent sand, 4-12 per cent silt and 7–11 per cent clay. The soil properties such as the bulk density, infiltration rate, field capacity and wilting percentage were determined by standard methods (Michael, 1978).

The irrigation water was measured by a 90° V-notch weir installed at the exist of the supply channel. The head corresponding to each discharge rate was maintained by making a temporary by-pass, 5-6 m behind the weir pond.

Altogether seven irrigations were given at an interval of seven days. The depth of irrigation was limited to 5 cm. Blackgram seeds were dibbled in the field after the first irrigation and the cultural practices as recommended by the Kerala Agricultural University were followed.

The time of advance was noted for every 5 m distance from the head of the border; after diverting the inflow into the border. Similarly, the time of recession of water at every 5 m distance was noted after the termination of inflow. The inflow was terminated when the water front advance reached 77 per cent of the total length of the field in all cases. The advance and recession time relationships were plotted and the opportunity time for every 5 m length along the border was obtained from the ordinates between the advance and recession curves. The hydraulic gradient, hydraulic resistance and velocity of flow for each irrigation were also determined.

Results and Discussion

The initial soil characteristics were estimated. The bulk density and infiltration rate were 1.3 g/cc and 2.4 cm/ha respectively. The field capacity was estimated as 14.46 per cent and the wilting percentage as 8.06.

The average advance and recession curves for discharges of 2 l/s/m and 4 l/s/m in 4 m width strips ate given in Fig 1 and 2.

The recession curve was found to be almost parellel to the advance curve upto the first 30 m length for the discharge of 2 l/s/m. That is from 0 to 30 m length, the infiltration opportunity time was almost the same. The mean opportunity time was 33 minutes 47 seconds. From 30 to 35 m, the opportunity time gradually increased. That is, from 30 m onwards, there was excess infiltration opportunity time, which contributed to wastage of water at the down stream end. Petrasovits (1971) also observed excess water of 5-10 per cent at the downstream end during his experiments on borders of 1.2 per cent slope.

For the discharge of 4 l/s/m for the first 5 m, the opportunity time was about 18 minutes. For 5-15 m the opportunity time was less than 32 minutes. Then from 15 to 30 m, the curve obtained was almost parallel to the advance curve in that range That is, the time of ponding was almost the same in that range, which was about 32 minutes. From 30 m onwards, the tail water receded more slowly, giving more opportunity time. The opportunity time varied from 39 minutes at 35 m to 51.9 minutes at 45 m. This resulted in deep percolation losses at the downstream end. In other words, with this discharge rate, the opportunity time varied from 18 minutes at the upstream end to 51.9 minutes at the down stream end which resulted in very low water distribution efficiency.

From these observations, the discharge of 2 l/s/m was found to be the best. This treatment gave the same time of ponding upto 66 per cent of the advance length.

Petrasovits (1971) observed that erosion was caused when the velocity exceeded 8 m/min. The maximum velocity attained even with a discharge rate of 4 l/s/m was only 3.6 m/min. Hence the velocity of flow was very much within the

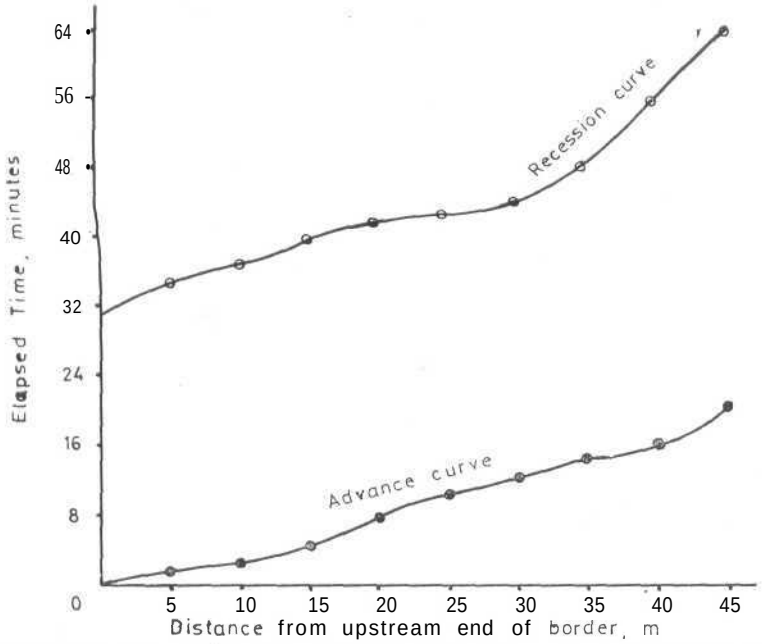

Fig.1 ADVANCE AND RECESSION CURVES FOR THE DISCHARGE RATE OF 2l/s/m

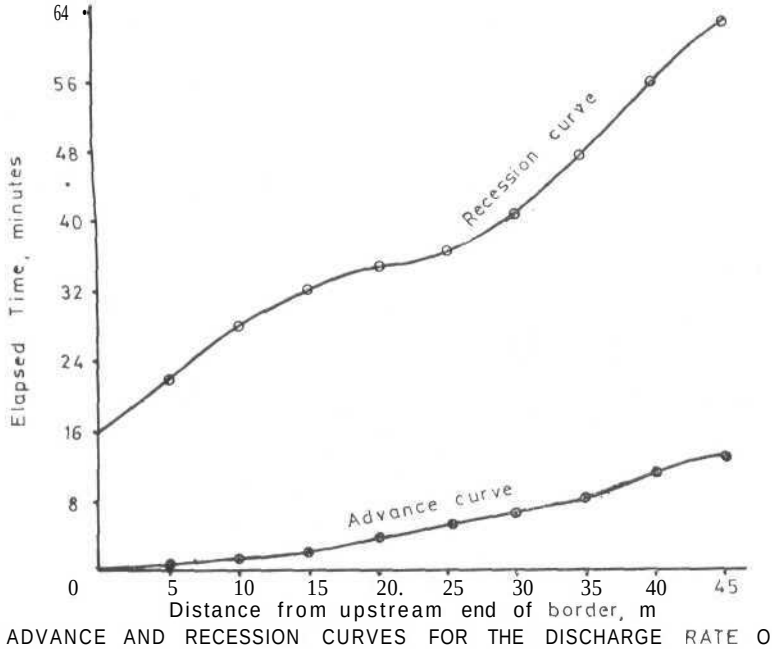

Fig. 2 ADVANCE AND RECESSION CURVES FOR THE DISCHARGE RATE OF 4l/s/m

safe limit in both the cases. The hydraulic gradient ranged between 0.00011 and 0.00165. The hydraulic resistance was found to be higher in treatments with 2 l/s/m and the 'n' values ranged between 0.02 and 0.185.

Summary

The study was conducted in 1982 with an objective of finding out the infiltration opportunity time in nearly level border strips. The results revealed that a discharge rate of 2 l/s/m is the best for irrigating nearly level borders of 4-6 m width. This discharge rate gives almost equal opportunity time throughout the entire length of the strip excepting at the downstream end, thus giving better distribution efficiency. The recommended length of strip is upto 45 m and these can be laid in the direction of natural slope.

Acknowledgement

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