Examining Advance Time of Furrow Irrigation at Koga Irrigation Scheme, Ethiopia

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Introduction

Furrow irrigation is the recommended method for the distribution of water to the fields at Koga irrigation scheme, found in Western Gojam, Mecha wereda. However, most surface irrigation systems have inherent inefficiencies due to deep percolation on the upper end and runoff at the lower end of the field. A properly managed surface system can attain efficiencies of 60% or better. In a study conducted by Kassa (2003) at Melka Werer, with a furrow length of 200 m and different inflow rates, the maximum attainable application efficiency is 62 to 64%.

The strategies to improve furrow irrigation efficiencies is by reducing runoff and deep percolation losses. These losses depend on furrow length, furrow gradient, discharge, and cutoff time which need to be optimized by irrigators to improve efficiency. This paper presents the advance time of furrow irrigation based on field data from Koga under different discharge rates and furrow gradients.

Methods

• The advance time of irrigation was recorded at different furrow gradients and discharge rates. Four furrow gradients (0.5%, 1%, 2%, and 2.5%) were chosen at different sites. The furrow discharge was measured using a stopwatch, and the advance time of the irrigation was recorded.

• Three adjacent furrows of length 90-110 m were measured. The central furrow was used as an experimental furrow while the two adjacent furrows receiving equal discharge with the center furrow were used as buffers.

• Two measuring RBC flumes were placed at the beginning and end of each center furrow. The application was terminated when the stream flow through the furrow outlet remains at steady flow.

• The travel time of water advancing through the furrow (advance time) was recorded at 10 m intervals for the whole furrow length using stopwatch. The advance time was examined in two irrigation cycles, first irrigation period (February) and second irrigation period (April).

Results

Effect of discharge on advance time

• The advance time of water to cover 90-110 m furrow length was 0.5, 0.9, and 2.5% field slopes was 213, 173, 150, and 369 min at 1st irrigation, and 134, 182, 221, and 97 min at 2nd irrigation respectively (Fig. 3).

• The effect of slope results in great variation of advance time at any point along the furrow length.

• The inconsistency of advance time against field slope was due to the irregularity of the field and surface roughness, for instance, at 2.5% field slope, the advance time is extremely slow at 1st irrigation.

• Comparing the 1st and 2nd irrigation cycles, the advance time become shorter when the field gets smoother as a result of further tillage operation in the 2nd irrigation cycle.

Effect of furrow gradient on advance time

• The advance time of water to cover 90-110 m furrow length at 0.5, 1.0, 2.0, and 2.5% field slopes was 213, 173, 150, and 369 min at 1st irrigation, and 134, 182, 221, and 97 min at 2nd irrigation respectively (Fig. 3).

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Conclusion and Recommendation

• The existing operational furrow length at Koga is extremely long which lead to very low application efficiency.

• With the given furrow length, irrigation application time per furrow is long and under such design it is difficult to establish appropriate irrigation operation rules among users for the whole scheme.

• The advance time by furrow length graphs revealed that optimum furrow length at different sites can only be possible at short advance or application time.

• In order to maximize application efficiency and minimize the loss, examining and determining an optimum furrow length before the operation of the whole scheme is essential.

• Irregular surfaces significantly affect the furrow length, optimum discharge, the application time and then application efficiency. It implies that land leveling work needs due attention so as to improve the overall efficiency of the irrigation scheme.

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References