

Research Paper :

Hydraulic of broad bed furrow through volume balance approach in medium black soil

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ABSTRACT

The volume balance approach gives the reliable estimation of uniformity and efficiency by considering soil parameters. The present experiment was conducted at Junagadh Agricultural University on medium black soil in groundnut crop with six broad beds of 0.6 m wide each and five furrows of top width of 0.5 m each of 15 m long through volume balance approach with different discharge. The furrow geometry was measured by furrow profilometer and corresponding furrow parameters were calculated. The maximum average application efficiency (E_a), deep percolation ratio and tail water ratio were found to be 66.52 per cent, 1.12 and 32.41, respectively at 1.50 lps/m discharge. The study showed that the field irrigation system should be designed properly for getting the maximum efficiencies and to reduce deep percolation and tail water losses. The poorly designed system may lead to losses of water more than 50 per cent.

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In Saurashtra region of Gujarat state, only 16 per cent area is under irrigation. Groundnut (*Arachis hypogaea* L.) is main cash crop, which is cultivated in *Kharif* season. However, due to vagaries of the south - west monsoon, its yield fluctuates year by year. If the rainfall occurs more than 600 mm and distributed timely during the season as per its various critical growth stages, its yield would be about 2500 kg/ha. However, this yield level is possible in favourable monsoon years, which generally occurs in 3 years out of every 10 year cycle. Groundnut crop is being preferred and cultivated during summer season for better yield and less damages with insects/pests. As water is scarce in the region, there is need of an efficient irrigation system for summer irrigated groundnut crop. In fact, furrow irrigation system is a common practice followed by farmers of this region.

However, there is need of a proper designed irrigation system for replenishing the root zone with enough moisture to avoid stress to crop. Historical design practice based primarily on volume balance concepts is now replaced with hydrodynamic, zero-inertia and kinematic wave models (Walker and Scogerboe, 1987).

Volume analysis by Hall (1956), Philips and Farrell (1964), Wilke and Smerdon (1965) and Hart *et al.* (1968) solved the Lewis Milne equation without resorting to an assumption regarding the advance rate functional form.

Kiefur (1959) and Fok and Bishop (1965) considered alternative volume model with Kostiaikov infiltration function to derive analytic volume expression. Strelkoff and Katapodes (1977) proposed the zero inertia model. Clemmens (1979), Elliott *et al.* (1982) and Oweis (1983) applied this model to surface irrigated conditions including furrows. Wilke (1968) studied the hydrodynamic flow in furrow irrigations. However, the volume balance methodology is still used though the state of art technology has superseded the volume balance concept. This concept provides the procedures without cumbersome detail of advanced theory. The influence of variables such as field slopes and length, roughness of the field and infiltration characteristics of the soil are ascertained easily. This method also requires cross section, tail water volume (Elliott and Walker, 1982 and Walker and Scogerboe, 1987) Here effort has been made to determine the hydraulic performance of furrow irrigation for the soil of this region by using a volume balance approach described by Walker and Scogerboe (1987).

METHODOLOGY

The present experiment was conducted for the summer groundnut crop in the Mechanized Cultivation Farm of Junagadh Agricultural University, Junagadh.