International Journal of Agricultural Engineering, Vol. 4 No. 2 (October, 2011) : 130 -132

Research Paper :

Effect of nozzle size on evaporation and drift losses from mini-sprinkler

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Received : March, 2011; Revised : May, 2011; Accepted : July, 2011

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ABSTRACT

Evaporation and wind drift losses from the mini-sprinkler under different combinations of climatic and operating conditions were determined. The evaporation and drift losses increased with small nozzles and decreased with large nozzle size. This may be due to the fact that small nozzles produce large quantities of small droplets which are susceptible to hot, dry and windy conditions. The losses ranged from 11.95 to 23.41%, 6.22 to 29.93% and 5.49 to 14.90 % at 1.5, 2.0 and 2.5 kg/cm^2 operating pressure for 1.94, 2.10 and 2.50 mm nozzle sizes.

Kadam, S.A. and Deshmukh, V.V. (2011). Effect of nozzle size on evaporation and drift losses from mini-sprinkler. *Internat. J. Agric. Engg.*, **4**(2) : 130-132.

Key words : Nozzle size, Evaporation and drift losses, Mini-sprinkler

Evaporation and wind drift losses in sprinkler irrigation have been the subject of numerous field, laboratory and analytical studies. A wide range of losses have been reported in the literature due to the many design, climatic and operation parameters involved in evaporation and wind drift losses. These losses are taken as the difference between the amount of water leaving the nozzle and that measured with a grid network of catch cans. The losses were approximately proportional to wind velocity and operating pressure and inversely proportional to nozzle size and relative humidity of the air (Frost and Schwalen, 1955). Strong (1961) found that evaporation and wind drift losses increased as the riser height of sprinkler increased. Kraus (1966) found that evaporation and wind drift losses ranged from 3.4 to 17%, and 36% of these losses was due to wind drift. Sternberg (1967) reported that wind drift losses were 60% of the total loses. Hermsmeier (1973) found that evaporation and wind drift losses can range from 0 to 50%, and these losses are more closely related to air temperature and application rate than to wind velocity or relative humidity. Abo-Ghobar (1993) reported that average evaporation and drift losses ranged from7.5 % for single nozzle of 2.29 mm diameter to 22.6 % for double nozzle sprinkler of diameter 6.1 x 3.0 mm. The evaporation and wind drift losses are highest when sprinklers that produce large quantities of small droplets are operated in hot, dry windy conditions (Frost and Schwalen, 1955). The application efficiency of sprinkler irrigation system can be significantly influenced by the amount of evaporation and wind drift losses. The magnitude of these losses depends upon the climatic and operating conditions. To obtain and insight into the magnitude of these losses, it is necessary to determine the factors affecting evaporation and drift losses from mini-sprinklers under local conditions. There is very little information available on evaporation and wind drift losses at different operating conditions such as riser height and nozzle size. Therefore, the experiment was conducted to study the evaporation and drift losses from mini-sprinkler irrigation system under different operating conditions.

METHODOLOGY

The experiment was conducted to study the effect of nozzle size on evaporation and drift losses from mini-sprinkler irrigation system at the Instructional Farm of Department of Irrigation and Drainage Engineering, Dr. A. S. College of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri. Three commercially available mini-sprinklers of nozzle size 1.94 mm, 2.10 mm and 2.50 mm were used for the study. The mini-sprinklers were tested at 1.5, 2.0 and 2.5 kg/cm^2 pressure to find the effect of nozzle size on evaporation and drift losses in mini-sprinklers. The observations on flow rate, gross depth of application, depth reaching the catch can were recorded