International Journal of Agricultural Engineering, Vol. 2 No. 1 : 9-13 (April to September 2009)

Distribution pattern of pop-up sprinkler under different operating conditions

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Accepted : *December, 2008*

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ABSTRACT

An experiment was conducted to study the distribution profile of pop-up sprinkler with three nozzle sizes 1.0, 3.0 and 8.0 mm manufactured by Netafim Irrigation Limited. Pop-up sprinkler with different nozzles was tested at different operating pressure to study pressure discharge and pressure throw radius relationships. Tests were conducted to determine uniformity coefficient (UC) and distribution uniformity (DU) at different operating pressures to study effect of pressure on UC and DU. Pressure-discharge relationship for pop-up sprinkler with different nozzles was very well established by power type equation of the form $Q= aH^b$. Pressure –radius of throw relationship for pop up sprinkler with different nozzles was very well established by power type equation of the form $R=aH^b$. Coefficient of uniformity of all three pop-up sprinkler nozzles was in the range of 80.33 to 89.10 %. It was also observed that the values of uniformity coefficient increased with increase in pressure. The minimum value of distribution uniformity *i.e.* 71.53 % was observed for nozzle 1.0 at 1.4 kg/cm^2 pressure and the maximum value of distribution uniformity *i.e.* 84.92% was noticed for nozzle 8.0 at 2.0 kg/cm^2 pressure. Average application depth was found to be increased with increase in operating pressure. The distribution profile of pop-up sprinkler was observed to be flat at different operating pressures indicating the uniform average depth.

Key words : Pop-up, Uniformity coefficient

Water is the greatest resource of humanity. It not only helps in survival but also helps in making life comfortable and luxurious. Advanced micro-sprinkler methods are floppy sprinkler, pop-up etc. The pop up is operated by using pressure from the water pump. The pop up sprinkler is laid under lawn surface to prevent damage from the lawn mower. Pop-up is overhead sprinkler method in which water is piped to one or more central location within the field and distributed with high pressure. Pop-up sprinkler have many advantages over traditional method of irrigation for landscaping (Singh *et al.*, 1995; Muley, 2004).

The performance of pop-up sprinkler irrigation is judged by its uniformity of distribution of water which depends on the proper, efficient and economic design of the system. This affect distribution pattern and the economy to the great extent.

Hence, systematic study was conducted to establish pressure-discharge, pressure-throw radius relationships, the effect of pressure on uniformity coefficient of pop-up sprinkler, distribution pattern of pop-up sprinkler.

METHODOLOGY

The experiment was carried out in College of Agricultural Engineering and Technology, Marathwada Agricultural University, Parbhani. Three nozzles of pop-up sprinklers were evaluated in this study. The specifications of these three nozzles are reported in the Table 1.

Table 1 : Details of pop-up sprinklers

Nozzle	Operating pressure (kg/cm^2)	Discharge (lph)
1.0	2.8 to 4.1	180 - 230
3.0	2.8 to 4.1	510 - 640
8.0	2.8 to 4.1	1430 - 1850

Pressure measurement:

The pressure was measured with the help of pressure gauge.

Discharge measurement technique:

The observations of discharges of pop-up sprinklers were recorded for different operating conditions ranging from 1.4 to 2 kg/cm^2 with an increment of 0.3 kg/cm^2.

Throw radius measurement technique:

The radius of throw for each pop-up sprinkler was measured at different pressures by gradually increasing the pressure and measuring the radius of throw *i.e.* jet length with the help of measuring tape.

Precipitation pattern:

Pop-up sprinkler of all the three nozzles were studied for precipitation parameters in terms of distribution profile and average application depth.

Distribution profile:

To determine the distribution profile, area around pop-