EFFECT OF SOME ENGINEERING FACTORS OF SPRINKLER IRRIGATION ON SPRINKLER PERFORMANCE

By

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B.Sc. Agric. Eng., Faculty of Agric., Ain Shams University, 2009

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ABSTRACT

Doaa Mamdouh said: Effect of some engineering factors of sprinkler irrigation on sprinkler performance. Unpublished M.Sc. Thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2016.

The Laboratory experiments were carried out at the National Irrigation Laboratory of Agricultural Engineering Research Institute **(AEnRI)**, Dokki, Giza, Egypt to study the effect of two engineering factors (riser length – riser diameter), two hydraulic parameters (pressure – velocity) under four operating pressure (175 - 200 - 225 - 250) kPa. and four percentage of overlap (70 – 80 - 90 – 100) % on two impact sprinkler (1/2" and 3/4" inlet diameter) performance (flow rate – precipitation rate – emission uniformity).

The study included an evaluate two impact sprinklers (1/2" and 3/4") inlet diameter, at two riser heights (0.75 m and 1.0 m) with two different diameters for each riser (1/2" and 3/4").

Results of this study were:

1- Impact sprinkler (1/2'') with riser 0.75 m:

At using impact sprinkler (1/2") inlet diameter with riser height 0.75 m, a diameter (1/2") without header (R1): Cu values increased from 48.1 to 83.3 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%. At using impact sprinkler (1/2") inlet diameter with riser height 0.5 m, a diameter (1/2") + height 0.25 m, a diameter (3/4") with header (R2): Cu values increased from 48.2 to 81.8 % under operating pressure 250 kPa. with increasing overlap from 70 to 100 %.

2- Impact sprinkler (3/4'') with riser 0.75 m:

At using impact sprinkler (3/4") inlet diameter with riser height 0.75 m, a diameter (3/4") without header (R3): Cu values increased from 56.1 to 78.6 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%. At using impact sprinkler (3/4") inlet diameter with riser height 0.5 m, a diameter (3/4") + height 0.25 m, a diameter (1/2") with header 1 (R4): Cu values increased from 52.1 to 79.2 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%. At using impact sprinkler (3/4") inlet diameter with riser height 0.5 m, a diameter (1/2") + height 0.25 m, a diameter (3/4") with header 2 (R5): Cu values increased from 59 to 82.2 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%.

3- Impact sprinkler (3/4'') with riser 1.0 m:

At using impact sprinkler (3/4") inlet diameter with riser height 1.0 m, a diameter (3/4") without header (R6): Cu values increased from 50.2 to 79.3 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%. At using impact sprinkler (3/4") inlet diameter with riser height 0.5 m, a diameter (3/4") + height 0.5 m, a diameter (1/2") with header 1 (R7): Cu values increased from 58.9 to 81.8 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%. At using impact sprinkler (3/4") inlet diameter with riser height 0.5 m, a diameter (1/2") + height 0.5 m, a diameter (3/4") with header 2 (R8): Cu values increased from 56.5 to 80.1 % under operating pressure 250 kPa. with increasing overlap from 70 to 100%.

- At pressure 250 kPa. with overlap 90 %, (Cu) value was 80.9 % for (R1) and 80.5 % for (R2).
- At pressure 250 kPa. with overlap 90 %, R5 and R4 had (Cu) value 75.3 and 71.6 % respectively, higher than R3 (Cu) value 70.9 %.
- At pressure 250 kPa. with overlap 90 %, R8 and R7 had (Cu) value 73.4 and 75.1 % respectively, higher than R6 (Cu) value 70.4 %.

Key words:

Sprinkler irrigation – Nozzle diameter – Distribution uniformity – Riser height.

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INTRODUCTION

In the sprinkler method of irrigation, water is sprayed into the air and allowed to fall on the ground surface somewhat resembling rainfall. The spray is developed by the flow of water under pressure through small orifices or nozzles. The pressure is usually obtained by pumping. With careful selection of nozzle sizes, operating pressure and sprinkler spacing the amount of irrigation water required to refill the crop root zone can be applied nearly uniform at the rate to suit the infiltration rate of soil.

Scherer et al., (1999) summarized that the number of surface-irrigated area has declined by more than 1 million hectares, while the number of sprinkler-irrigated areas has increased from less than 1.5 million hectares to about 6 million hectares.

The trials conducted in different parts of the country revealed that water saving due to sprinkler system varies from 16 to 70 % over the traditional method with yield increase from 3 to 57 % in different crops and agro climatic conditions.

The uniformity of water application in a field under sprinkler irrigation is primarily a function of design, operational and climatic factors. Effects of soil characteristics on the distribution are considered negligible. Irrigation quality is function of water application uniformity. Insight into the performance of an irrigation system can be obtained of the pattern (distribution) of water application can be established for a specific set of conditions.