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OPERATION CHARACTERISTICS OF PULSATING SPRINKLER 60-505 AT DIFFERENT WIND SPEED
(Karakteristik Operasi Sprinkler Pulsating 60-505 pada Perbedaan Kecepatan Angin)

Sitti Nur Faridah, Mahmud Achmad and Aryuni
Department Agricultural Technology - Hasanuddin University, Makassar
Perumahan Dosen UNHAS. Jl. Al Kharismi Blok G1 No. 4, Makassar
idajamal@yahoo.com

Abstract

The research about sprinkler irrigation was done in the experimental field and Fluid Mechanical Laboratory of Agricultural Engineering Department, Hasanuddin University. Sprinkler irrigation is a high efficiency irrigation system due to its capability to distribute water uniformly in the exact time. This irrigation system has many types and operation characteristics which different between one to the other. The aim of this research was to study the characteristic of sprinkler pulsating 60-505 and its performance in the field with different wind speed. The research was done by obtaining primary data in the field and measured the wind speed during the operation of the irrigation system on the pressure of 103.44 kPa to 206.88 kPa. It was obtained from the research that the average wind speed was 3 m/second. In this condition, the shape factor of the irrigation system was 0.55 to 0.62 m. The pressure of 103.44 kPa to 206.88 kPa produced spray radius between 3 to 6 m, with application diameter was 6 and 12 m. The research showed that, the performance of the irrigation system was fairly good in the operation with wind speed from 0 to 3 m/second and the pressure of 206.88 kPa. However, in the lower pressure with wind speed over 3 m/second, the irrigation system was less effective.

Keyword: The wind speed, Sprinkler, Pressure, Irrigation system

INTRODUCTION

Wind speed could influence water distribution to the plants. The high wind speed over 4 m/second in the sprinkler irrigation system will disturb the water distribution to the field. The placement
and the choice of sprinkler will influence the uniform distribution of water to the field. With a good design and widely spray distance from the irrigation system to the field, the irrigation system can be designed to distribute water with Uniformity Coefficient more than 90%.

The low yearly rainfall and relatively short rain period are the constraint of pattern and planting time. Thus, it is needed to distribute water maximally to the land, although the water will not distribute 100% to the field due to the influence of wind and evaporation.

There are many types of sprinkler, such as roll-move, center pivot, and big-gun. The roll-move and center pivot have moving sprinklers, whereas the big-gun is operated steadily. One type of single nozzle sprinkler which produced commercially is pulsating sprinkler 60-505, with the nozzle diameter is 2 mm. This type usually used in vegetable seeding irrigation.

AIMS OF RESEARCH

The research aims were to find out the characteristic of pulsating sprinkler 60-505 and to find out the relationship between wind speed and shape factor.

METHODOLOGY

The research was done in the experimental field and Fluid Mechanical Laboratory of Agricultural Engineering Department, Hasanuddin University Makassar.

Instruments and Materials

Research instruments consisted of a sprinkler (pulsating sprinkler 60-505), a water pump, an anemometer, pipes (PVC ½ and 1 inch), a stopwatch, catch-cans, a gauge pressure, measure glasses (50, 500, 3000 ml), plastic hose, buckets, hose connections (T, L, and straight connections), hose caps, saws, a measuring tape, and valves. The materials were water, cable, pipe glue, and ropes.

Research Procedures

The research was done by collecting primary data through these steps:

Preparation steps

Deciding field to be used in the irrigation sprinkler, then the field was plot using ropes. Installation the irrigation system by construct the pipes and connect the pipe into the pump, and also placed the gauge pressure and sprinkler. Placing the catch-cans based on grid pattern (1 m distance between catch-cans) in the sprinkler area. Operating the irrigation system with the selected spray time (15, 30, 45, and 60 minutes).

Sprinkler Test

Pulsating Sprinkler 60-505 Test

Measuring the discharge (Q) and time (t) every 2 minutes. Measuring sprinkler discharge (Q) of pressure gauge in 5 Psi, 10 Psi, 12 Psi, 15 Psi, and 18 Psi. Calculating sprinkler rpm on pressure of 5 Psi, 10 Psi, 12 Psi, 15 Psi, and 18 Psi. Repeated the procedures 3 times.

Field Test to analyze the effect of wind speed to the shape factors

Measuring wind speed by using an anemometer. Calculating sprinkler rpm in the pressure of 15, 20, 25, and 30 Psi. Measuring pressure height (P) and sprinkler spray radius (the diameters). Measuring the shape factors. Measuring the application water volume (water catch-can results) on each can every 15 minutes.

Data Calculation

Calculating empirical coefficient (Kd)
if it was operated under 0 – 3 m/second
wind speed, and 206.88 kPa pressure. 
Wind speed below 3 m/second produced
shape factor higher than wind speed
above 3 m/second.

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