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# Optimization of length and diameter of laterals in rain hose irrigation system[1]

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## Abstract

**Introduction:** Meeting the food and fibre demands of a growing global population is a considerable challenge. To date, irrigated agriculture has been responsible for 40% of the total food and fibre production whilst using only 18% of world's arable land, Irrigation requirements, however, account for nearly 70% of the world's total freshwater withdrawals and have significantly altered hydrological and environmental conditions in both surface and subsurface water resources. This has generated criticism and debate about the (un) sustainability of irrigated agriculture. Irrigation managers must often justify the use, efficiency and productivity of water in competition and comparison with other uses and users. The challenge is to enhance water allocation decisions to reduce negative environmental impacts, whilst continuing to satisfy food and fibre demands. Research and investments have been oriented towards applying cost effective technology, precision agriculture, and environmentally friendly techniques to pursue sustainable water use in agricultural development. Rain Hose is affordable spray irrigation technology. Its replacement for Sprinkler Irrigation System. It's easy to install and maintain. Rain Hose is flexible hose with pattern of drip holes. These drip holes are made with nano punching technology to ensure uniform flow of water. Rain Hose is suitable for closely spaced crops, onion, vegetable crops, leafy vegetables, groundnut etc. Rain Hose is an affordable spray irrigation technology. It is a replacement for the sprinkler irrigation system. It is easy to install and maintain. Rain Hose is a flexible hose with a pattern of drip holes. These drip holes can be made with nano punching technology to ensure a uniform flow of water. The rain hose is suitable for closely spaced crops like onions, vegetable crops, leafy vegetables, groundnuts, etc. Rain hose is an emerging irrigation technique which is widely used for

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closed spaced crops. It is an alternative to the sprinkler irrigation but both are adopting the spraying technology. The spraying pattern in the rain hose irrigation will be linear on either sides up to the full stretch of the rain hose. Variation in the spray width and the discharge of water from the nozzles of rain hose under different flow rates are studied for various available diameters of rain hose. There is no standard available on the optimum combination of length and diameter of rain hose. A Catch-can method based field test was conducted to estimate the influence of length and diameter of rain hose for four flow rates and the pressure values through the main pipe viz., were noted down.

**Materials and Methods:** A rain hose of five diameters 20mm, 32mm, 40mm, 50mm, and 63mm were attached to the main pipe individually using proper setup and the spray width and discharge through the nozzles were measured for every 20m interval. The 2end coupler is connected with the main pipe and the other end is sealed shut, making sure that the water flows through the main hose in the desired pressure. The rain hose is attached laterally to a main PVC pipe of 63mm diameter, where the connection is made by the help of 4-way couples. The end of the rain hose is closed with an end cap. A 5HP open-well motor of type TMH4H is used, wherein the discharge capacity is 33, 120 litres per hour. Regulating valves and Reducers are used to control the flow of water in the system. The standard wall thickness of all the above used rain hoses are 350 microns. The field test conducted, is conducted at an interval of 20m from the main pipe where the total discharge of the water and the width of spraying in between the interval points are obtained for the rain hoses of the above mentioned diameters, as a result of which the effective laying length of the rain hose is evaluated by considering the reduction in water discharge and spraying width, in each types.

**Results**: For every 20m intervals, the corresponding spraying width and the water discharge in between the intervals for various diameter rain hose are graphically represented. The results of this study can be of great help to researchers in the purposeful application of precipitation-runoff and timely management of water resources.

**Conclusions:** These results are obtained in Coimbatore. There will be chances of slight deviation in the results based on other environmental condition. There will be a maximum possibilities of water leakage if joints are increased and it has to meet the pressure fluctuations throughout the length of the rain hose.

**Keywords:** Spray width, Rain hose, Discharge, Length of laterals.

## 1. Introduction

Farmers searching for imaginative, reasonable, simple to introduce and keep up water system arrangements presently have an alternative in rain hose pipes. Having spearheaded this technology, irrigation packs in Asia (Graham & et al., 2007; Munir & et al., 2018). Rain hose frameworks are another method of watering crops strongly under moderate tension utilizing a siphon (Rajesh, 2017; Rawal, 2017; Munir & et al., 2019; Sattar & et al., 2019).

Rain Hose is an affordable spray irrigation technology. It is a replacement for Sprinkler Irrigation System. It is easy to install and maintain. Rain Hose is flexible hose with pattern of drip holes (Cardenas-Lailhacar & et al., 2008; Xiao & et al., 2010; Munir, 2018; Sarwar & et al., 2019). These drip holes are made with nano punching technology to ensure uniform flow of water (Shiraz Pasha & Yogesha, 2014).

This water system framework can be utilized in yield nurseries for vegetables, organic products or ranger service. It can likewise be utilized in watering short vegetable yields knee-high and beneath, for example, cabbage, lettuce, broccoli, kales, spinach, collards, expansive beans, carrot, strawberry and others, or field, grass and vegetables. While picking the harvest to flood utilizing this strategy, consider its powerlessness to foliage contagious contaminations (Graham & et al., 2007; Parameswaran & Sivaprasath, 2016; Saab & et al., 2019). This is inclined by leaf surface wetness. Tomato, potato, peppers, peas, green beans and stew effectively surrender to foliage parasitic contaminations when overhead or a downpour hose framework is utilized for quite a while (Dukes, 2012; Sharma & et al., 2015; Saqib, 2020).

## 2. Materials and Methods

For the study, a quantity of 5 rain hoses of various diameters (20mm, 32mm, 40mm, 50mm, 63mm) of a standard length, 100m are taken. The 2end coupler is connected with the main pipe and the other end is sealed shut, making sure that the water flows through the main hose in the desired pressure.

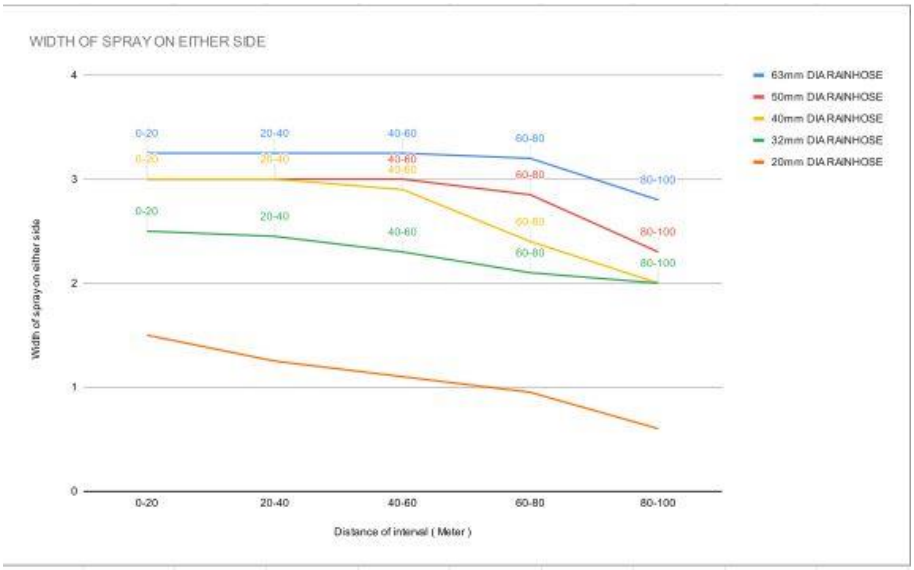
The rain hose is attached laterally to a main PVC pipe of 63mm diameter, where the connection is madeby the help of 4-way couples. The end of the rain hose is closed with an end cap. The operation pressure in the rain hose is maintained at 1 kg/cm$^2$. If the pressure exceeds this limit, the rain hose gets damaged (Naik & et al., 2016; Bzdok & et al., 2018).

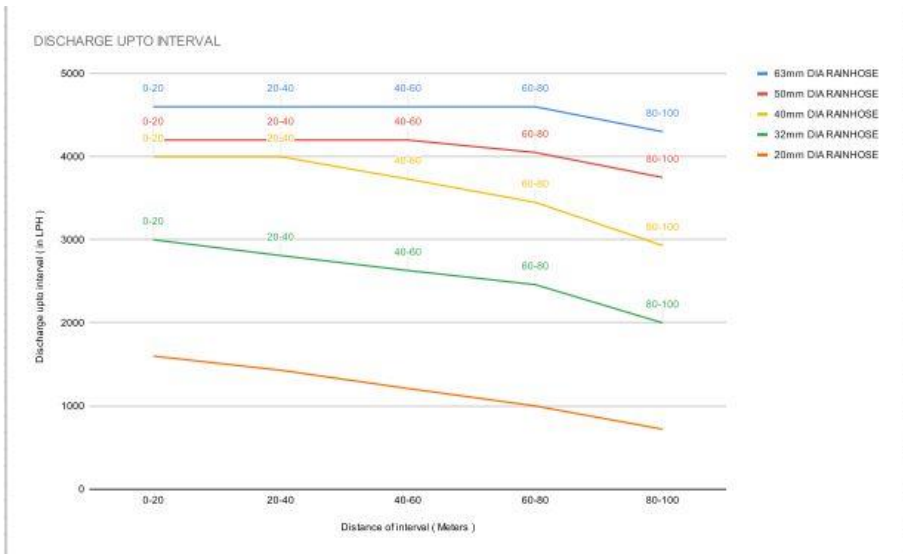
A 5HP open-well motor of type TMH4H is used, wherein the discharge capacity is 33, 120 litres per hour. Regulating valves and Reducers are used to control the flow of water in the system. The standard wall thickness of all the above used rain hoses are 350 microns.

The field test conducted, is conducted at an interval of 20m from the main pipe where the total discharge of the water and the width of spraying inbetween the interval points are obtained for the rain hoses of the above mentioned diameters, as a result of which the effective laying length of the rain hose is evaluated by considering the reduction in water discharge and spraying width, in each types.

## 3. Results

For every 20m intervals, the corresponding spraying width and the water discharge in between the intervals for various diameter rain hose are graphically represented.




It has been noted that for:

i) 63mm diameter rain hose, the discharge value tends to decrease after 80m

ii) 50mm diameter rain hose, the discharge value tends to decrease after 75m

iii) 40mm diameter rain hose, the discharge value tends to decrease after 40m

iv) 32mm diameter rain hose, the discharge value tends to decrease after 40m.

v) 20mm diameter rain hose, the discharge value tends to decrease after 15m.

These results are obtained in Coimbatore. There will be a chance of slight deviation in the results based on other environmental condition.

## 4. Conclusions

Rain hose irrigation is one of the modern irrigation techniques used for small spacing crops. However, there are only few manufacturers of rain hose with the same rolling length of 100m.There will be a maximum possibilities of water leakage if joints are increased and it has to meet the pressure fluctuations throughout the length of the rain hose. The effective laying length for all available diameters of rain hose has determined thereby the manufacturing length of the rain hose can be modified accordingly.

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