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Study of Wetting Pattern on Drip Irrigation

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Abstract: ***There is global consensus on food security challenge and increasing crop production to meet the demand across globe. Population growth, increasing water stress and climate variability, stresses on finding ways of getting more crop to meet our food needs, approach. One solution to this problem is the use of drip irrigation system which improves profitably by increasing crop yield and quality while reducing costs from water, energy, labour, chemical inputs and water runoff. The experiment was conducted in the Gangapada farm, Khordha, Odisha. The actual discharge of the dripper having theoretical capacity 8lph was measured and the result varied in the range of 6.8 - 8.15lph. The wetting pattern also measured by constructing three Bed having size 2.6 × 2 × 1 ft. The average wetting pattern was found of are 43.5, 36.3, 26, 12.0 cm at the depth of 0,10,20,30,40 cm respectively. The moisture content was also measured at different depth to study the variation at different depth using 8lph dripper.***

Keywords: Drip irrigation, Wetting pattern

I. INTRODUCTION

Drip irrigation is the most efficient water and nutrient delivery system for growing crops, delivering water and nutrients directly to the plant's root zone in the right amount, in the right time. It has higher consistency crop yields, water saving, no evaporation, no runoff, no wastage, and 100% of land utilization. It works on low pressure, does efficient use of fertilizer and crop protection with no leaching and less dependency on weather, leading to greater stability and lower risks. The main components of a drip irrigation system include the mainline, valve, sub-main, backflow preventer, pressure regulator, filter, tubing adapters and fittings, drip tubing, emitters, and end caps. The mainline is the pipe that runs from the water source to the valve, and the sub-main runs from the valve to the point where the drip tubing is connected. The combined length of the mainline and sub-main should not exceed 400 feet. Backflow preventers are necessary to ensure that irrigation water doesn't flow back into the pipes and contaminate the main water source. Pressure regulators are needed if the water pressure is over 40 pounds per square inch. Filters keep dissolved substances in the water from clogging the emitters over time. Tubing adapters and fittings are used to attach the drip tubing to the rest of the system. Drip tubing is a polyethylene tube with emitters placed along the plants, and the length of a single drip tube should not exceed 200 feet from the point where water enters the tube. Drip irrigation is an effective way to deliver water directly to soil, reducing soil erosion and runoff. It also allows fertilizers, nutrients, and other water-soluble substances to be used, leading to higher yields and improved production results.

II. METHODOLOGY

A. Study Area Location

This experiment was conducted on drip irrigation in a farm near coconut development board, Ganga pada, Bhubaneswar, Odisha. The total area is about 25 acers. Papaya, drumstick and lemon etc. Are grown there, Garlic are grown there using in the cropping and About 700 Guava plant are planted.



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B. Material Required

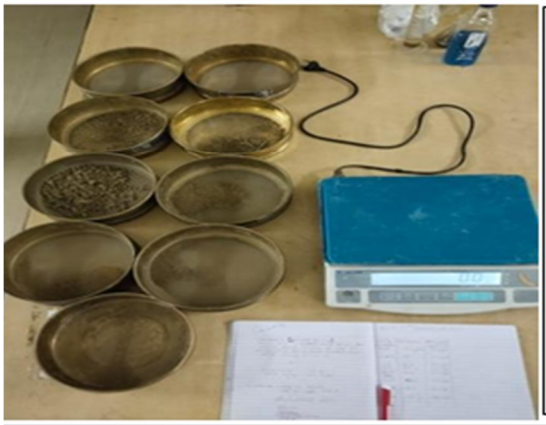
1) Measuring tape
2) Measuring Scale
3) Sieve
4) Stop watch
5) Auger
6) Rest instruments require for texture analysis
7) Hot air oven
8) Container
9) Sensor

C. Procedure

1) Methods For Measurement Of Soil Texture By Sieving Method

a) We took 1000gram of soil sample, from which grain size distribution was studied. Then we placed the soil on 100mm IS sieve.
b) Then transferred the soil retained into a container and weighed which is 259.49gram soil particles.
c) We kept that container in an oven for measuring the moisture content for 24 hour maintained 100°c temperature.
d) Then we weighed oven dried soils which is 227.5gram.
e) After that the weight of the fine-grained soil was taken for sieving test in different sieving size which is 4.75mm,2.36mm, 1.18mm, 600micron, 425micron, 212micron ,150micron,75micron,and the last one was pan.
f) Then we cleaned all the set completely to remove all the soil particles were struck in them then weighed one by one.
g) For sieving, we arranged the sieves, in order such that coarse sieve was kept at the top, the fine sieve was at the bottom and the pan was placed below the finest sieve.
h) Next we poured the oven dried soil took into the top sieve and placed the lid on the top of the coarse sieve.
i) Afterwards we separated the sieves and weighed the amount of soil retained on each sieve carefully and noted it down.
j) That was done by the sieve before sieving we weighed the empty sieve so we substitute the sieving soil to the empty sieve.
k) Subsequently we noted down the observation in the table provided.






2) *Methods For Study Of Performance Evaluation*

a) We took 15minute reading then we multiply it with 4 so that we could get the 1 hr reading.

b) We get 2 lph discharge in the drip system.

c) After getting the rate of discharge we measure the Then we noted the rate of discharge, for that we took three beakers, two beakers are 200mm and another one is 140mm.



Measuring the discharge rate

3) *Methods For Measuring The Vertical And Horizontal Wetting Depth Of Drip Irrigation*

a) We prepared a bed of three guava plant in a row for two days. The distance between plant to plant is 60cm.

b) We allowed water for 1hour.Exactly 1 hour we measured the vertical width of each plant.

c) For measuring the width of the plants we used the measuring tape and noted the values of each plants and concluded that the wetting width is varies from each other.

d) After it we left the bed for 24hour for measuring the depth.

e) We took a measuring scale and found the final wetting depth of the first day is 20 cm of each three plants.

f) Second day we got the same depth of each plant.





Measuring the wetting pattern of drip irrigation

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4) Methods For Measuring The Moisture Content

a) For measuring the soil moisture we have taken nine tins for collecting the soils from different vertical depth ie. 0cm,10cm and 20cm respectively.

b) Then weight those soil with tins before taking the tins to the field we weighted those tins and noted down it.

c) After weighting the soils we put it in the oven for 24hours with 105 degree celcius.

d) After the drying of soils again we weighted it and noted the values of dry soil.

e) For getting the moisture content of the soils we subtract the dry soil's values from moist soil and noted all the values.



III. RESULT AND DISCUSSION

A. Data Analysis

Sieve size	Weight of empty sieve (gm)	Weight of sieve + dry soil (gm)	Weight Retain (R)	Cumulative weight retains (gm)	% of retain (R)	% of finer (100 – R)
4.75mm	412.5	513.2	100.7	100.7	10.07	89.93
2.36mm	308.1	350.5	42.4	143.1	14.31	85.69
1.18mm	360	400.6	40.6	183.7	18.37	81.63
600micron	388.4	407.3	18.9	202.6	20.26	79.74
425micron	309.9	314.9	5	207.6	20.75	79.25
212micron	328.8	341.8	13	220.6	22.06	77.95
150 micron	281.3	281.4	0.1	220.7	22.06	77.94
75 micron	332.7	338	5.3	226	22.59	77.41
Pan			1.5	227.5	22.75	77.25

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From the analysis we found that the least soil was >75 micron. Therefore it is an coarse grained soil (sandy loam and gravel). We conducted this experiment and the result that we got from the experiment are below:

Table 2: Data collected for measuring actual discharge value

Sl no.	Days	Sample no.	Discharge (lph)
1	1	1	2.64
2		2	2.16
3		3	2.20
4	2	4	2.16
5		5	2.02
7		6	2.24

B. Measurement Of Vertical And Horizontal Wetting Pattern

Bed no.	**Vertical depth (cm)**	**Horizontal width (cm)**
1	0	36
	10	30
	20	26.9
2	0	30.48
	10	26.3
	20	21
3	0	38.1
	10	31.2
	20	28

Bed 1: In this day we measured the vertical wetting pattern of the water of the plant. The wetting pattern at the depth of 0,10,20 was found to be 36,30,26.9 cm respectively. It was observed that the horizontal wetting decreases as the vertical depth increases. The bed 2 and bed 3 are measure the reading as well as bed 1.

C. Measurement Of Moisture Content At Different Depth Of Drip Irrigation

Bed no.	Vertical depth(cm)	Moisture content (%)
1	0	29.3
	10	35.1
	20	26.8
2	0	34.9
	10	25
	20	42.3
3	0	27.6
	10	30.8
	20	28.8

Bed 1: In this day we took the sample from the different depth of the soil profile. The content at the depth of 0,10,20 was found to be 29.3,35.1,26.8% respectively.
Bed 2: In this day we did the same and took the sample from different depth of the soil profile. The moisture content of the depth of 0,10,20, was found to be 34.9,25,42.3% respectively.
Bed 3: The moisture content of the depth of 0,10,20, was found to be 27.6,30.8,28.8% respectively.

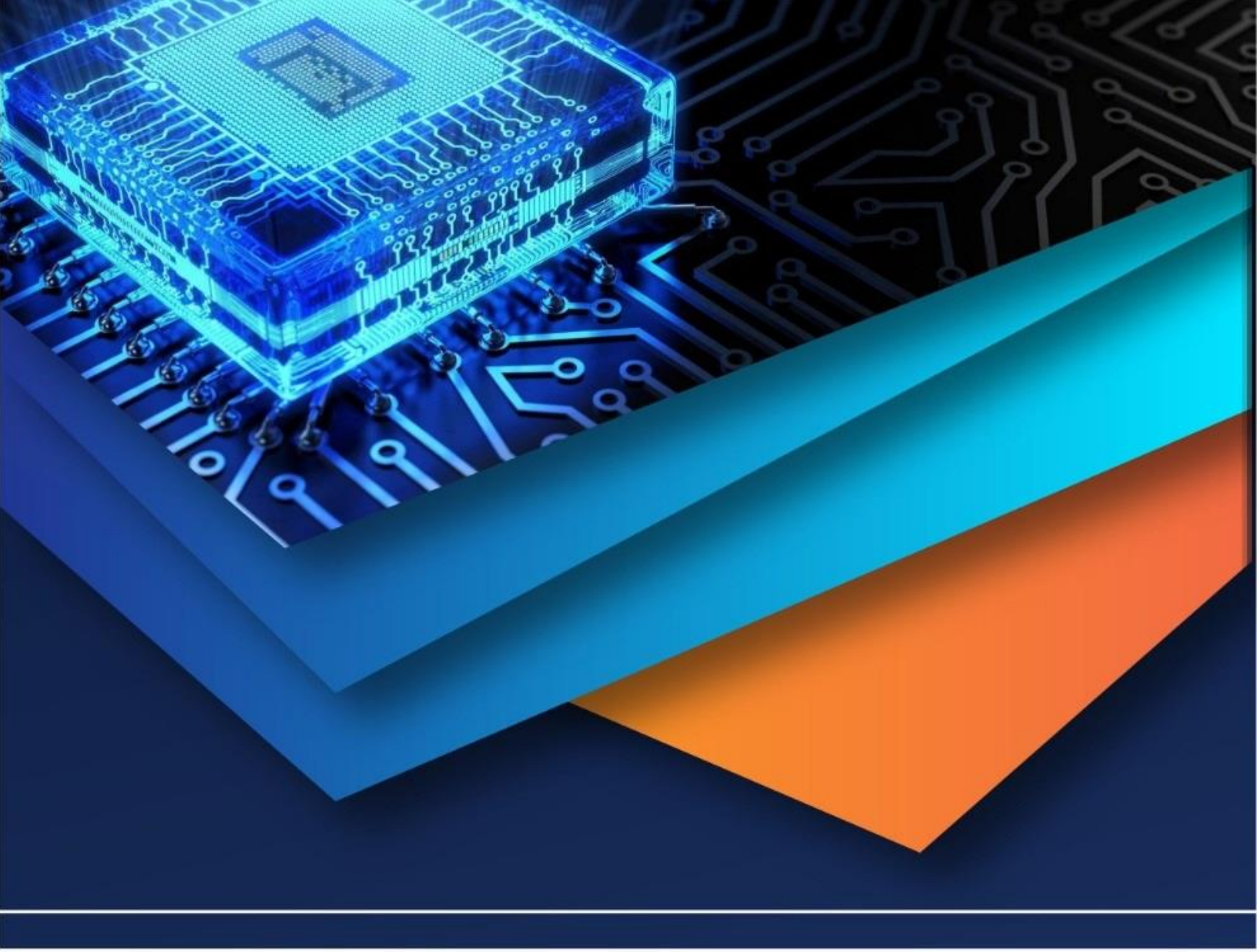
IV. CONCLUSION

Drip irrigation is a sub-surface method of irrigating water with higher water demands in arid regions. It can achieve water conservation by reducing evaporation and deep drainage, and it can also eliminate diseases spread through water contact with the foliage.
Drip irrigation is used in farms, commercial greenhouses, and residential gardeners, especially for crops and trees such as coconuts, containerized landscapetrees, grapes, bananas, pandey, eggplant, cittra, strawberries, sugarcane, cotton, maize, and potatoes. Drip kits are increasingly popular for the homeowner and consist of a timer, hose, and emitter.

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