

## Impact of drip irrigation scheduling on growth, yield and water use efficiency in chilli crop under western region of Uttar Pradesh

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ARTICLE INFO	ABSTRACT
<p><b>Original Research article</b> Received on April 10, 2017 Accepted on May 17, 2017</p> <p><b>Article Authors</b> Ram Kumar, Joginder Singh</p> <p><b>Corresponding Author Email</b> <a href="mailto:ram_kumar@iftmuniversity.ac.in">ram_kumar@iftmuniversity.ac.in</a></p>	<p>Drip irrigation is basically precise and slow application of water in the form of discrete continuous drops, sprayed through mechanical devices, called emitters into the root zone of the plant. The field experiment on Impact of fertigation and drip system layout were conducted at Research farm at IFTM University Moradabad (UP). The experiment was laid out in factorial randomized block design with treatments. In chilli maximum yield of 812 g/plant which is worked out as 0.006 t/ha was observed for the treatment T<sub>2</sub>. Even though the yield for the treatment T<sub>2</sub> was high and was due to the reduction in the quantity of material for drip irrigation system. At harvesting time, samples of green pepper fruits were randomly harvested from each plot to measure fruit length, fruit diameter. In addition, total weight of fruits in each treatment were recorded by harvesting pepper fruits twice weekly and then the total yield as Kg/fed., was calculated. The maximum yield of crop 900 gm/plant and minimum of yield 600 gm/plant and total yield 52270 gm (52.270 kg).</p>
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<p>International Journal of Agricultural Invention (IJAI) RNI: UPENG/2016/70091 ISSN: 2456-1797 (P) Vol.: 2, Issue: 1, Pages: 72-77 Journal Homepage URL <a href="http://agriinventionjournal.com/">http://agriinventionjournal.com/</a> DOI: 10.46492/IJAI/2017.2.1.16</p>	<p>Typical Drip Irrigation Systems, Water Use Efficiency, Chilli, Yield</p>

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Drip irrigation technique permits the efficient use of water and can help maximize the use of semi arid lands for agricultural use. Drip irrigation system is extremely profitable as it saves 40-70 percent water as compared to surface irrigation method *i.e.* flood, sprinkler, furrow. The drip method also reduces labour cost and protects the plants from diseases by minimizing humidity in atmosphere. Besides, soluble fertilizers can also be applied with irrigation water. The modern technique of drip irrigation is successfully practiced in many countries for orchards, vegetables, ornamental crops and as well as high value field crops. Though India has the largest irrigation network, the irrigation efficiency does not exceed 40-60%. The average rainfall in Uttar Pradesh is 650 mm as against the average rainfall of 1190 mm in the country. Due to water scarcity, the available water resources should be very effectively utilized through water saving irrigation technologies. The need of the hour is, therefore, to maximize the production per unit of water. Improper management of water and nutrient has contributed extensively to the current water scarcity and pollution problems in many parts of the world, and is also a serious challenge to future food security and environmental sustainability. Micro-irrigation (MI) is proved an efficient method in saving water and

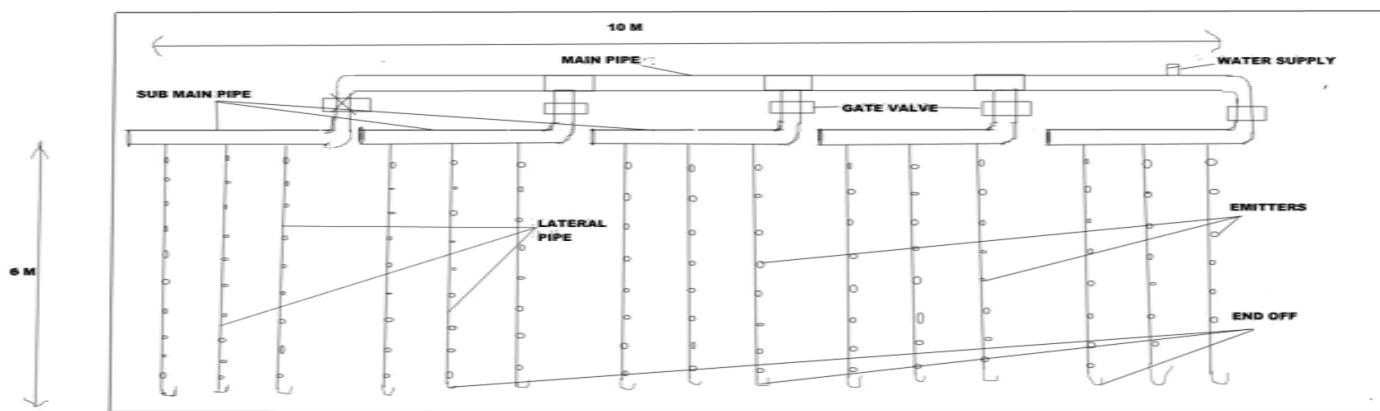
increasing water use efficiency as compared to the conventional surface method of irrigation, where water use efficiency is only about 35-40 percent. This system also allows precise application of water-soluble fertilizers and other agricultural chemicals. It helps to achieve yield gains of up to 100%, water savings of up to 40-80%, and associated fertilizer, pesticide, and labor savings over conventional irrigation systems. Apart from reducing water consumption, drip irrigation also helps in reducing cost of cultivation and improving productivity of crops as compared to the same crops cultivated under flood method of irrigation. Use of drip irrigation methods are becoming popular since water requirement in these methods is about half and water use efficiency is high. Various minor irrigation systems were tested and modified in different parts of the world by number of researchers. Some of them are (Kumar *et al.*, 2010, Fawzy, Z. F. *et al.*, 2012, Hakkim, 2014, Bhuriya, R. *et al.*, 2015, Gupta *et al.*, 2015, Ughade *et al.*, 2015) they suggested that continuous drip irrigation method could provide better yield and water use efficiency.

### MATERIALS AND METHODS

The study was conducted in the research

**Table 1. Soil physical characteristics of experiment**

Soil Depth (cm.)	Partical size distribution of soil			Texture Class	Saturated Point (%)	F. C. (%)	W.P. (%)	E. C. (dSm <sup>-1</sup> )
	Coarse Sand	Fine Sand	Clay Silt					
0-20	43.72	42.76	2.55	Sandy	24.0	10.5	4.4	0.30
20-40	52.73	39.55	3.40	Sandy	22.0	11.4	5.2	0.32
40-60	35.62	56.42	3.60	Sandy	20.0	10.8	4.2	0.42



**Fig. 1. Layout of typical drip irrigation system**



**Fig. 2. Wetted area covered by plant**

**Table 2. Experimental details of chilli crop**

S. N.	Description	Unit	Details
1.	Crop	Chilli	Crop
2.	Net irrigation Area	Ha.	0.006
3.	Row ot Row Spacing	Mtr.	50 cm
4.	Plant ot Plant Spacing	Mtr.	70 cm
5.	Row Diraction	-	East-West
6.	Total No. of Plants	No.	192
7.	Type of irrigation System	-	Typical Drip Irrigation System
8.	Emitter Type	-	online Emitter
9.	Emitter per Plant	No.	1 Emitter

farm located at IFTM University Moradabad western region. The farm is geographically situated at Field 280 50' 33.826" N latitude, 780 46' 48.535" E longitudes at an altitude of 193.23 m above mean sea level. The experimental plot was laid out in a completely randomized design with three treatments. Soil samples were collected from the experimental sites one month before planting. The trial was conducted for the year 2015-2016 from October to April, in the Moradabad region. This experiment has been conducted under field trial to improve irrigation scheduling.

### Soil Type

Estimate the soil samples were collected from the field by physical properties was judged as sandy soil with detailed are given in Table 1.

### Layout and Treatments of Designed Drip Irrigation System

Drip system consisting of main, sub-main and laterals was laid out in the experimental plot. Laterals of 12 mm diameter have been laid with spacing of 70x50 cm row to row and plant to plant and one seed was transplanted at a depth of 3 to 4 cm within recommended spacing of 50x70 cm where 70 cm is row to row and 50 cm plant to plant. The emitter discharge was 1.46 ltr/ hr and the end plugs were fixed to all control taps on laterals to facilitate in controlling the system shown in fig.1& 2. The design Data of the drip irrigation system and the experimental details for the test plots are given in Table 2.

### Design of Drip Irrigation System for Chilli Crop

The layout of drip irrigation system design is given in table 3

### Design and Treatments

The experiment was laid out with five treatments, combination consisting of three irrigation levels shown in Table 4. The experiment was laid out in Randomised Block Design having seven treatment combinations and was replicated thrice. The treatment detail is shown in Table.1

Main plots: Irrigation levels I1: 65% of the daily irrigation requirement. I2: 75% of the daily irrigation requirement. I3: 85% of the daily irrigation requirement. Sub plots Drip system layout.

**Table 3. Crop specification of chilli crop**

Crop Particular	Specification
Row to Row distance	70 cm
Plant to plant distance	50 cm
Plantation time	January
Duration of crop	150-200 days
Temperature	25-30°c
E <sub>pan</sub> Maximum	14.5 mm/day
K <sub>pan</sub>	<b>0.09</b>

**Table 4. The treatment details is shown in Table**

Treatments	Irrigation Scheduling
T1	50% drip irrigation level
T2	65% drip irrigation level
T3	75% drip irrigation level
T4	90% drip irrigation level
T5	100% drip irrigation level

**Table 5. Observation value of drip irrigation system**

Observations	Values
Area covered by each plant	0.35 m <sup>2</sup>
No. of plant/ha	2857
Maximum crop evapotranspiration (ET)	15 mm/day
Number of drippers in the field in actual conditions	192 drippers in
Total wetted area of the drippers	(0.006) hectare

### Water Use Efficiency

Having conveyed water to the point of use and having applied it, the next efficiency concept of concern is the efficiency of water use. It is expressed in kg/ha cm. The proportion of water delivered and beneficially used on the project can be calculated using the following formula:

$$WUE = \frac{W_u}{W_d} \times 100$$

where, WUE = water use efficiency per cent,  
 Wu =water beneficially used,  
 Wd = water delivered.

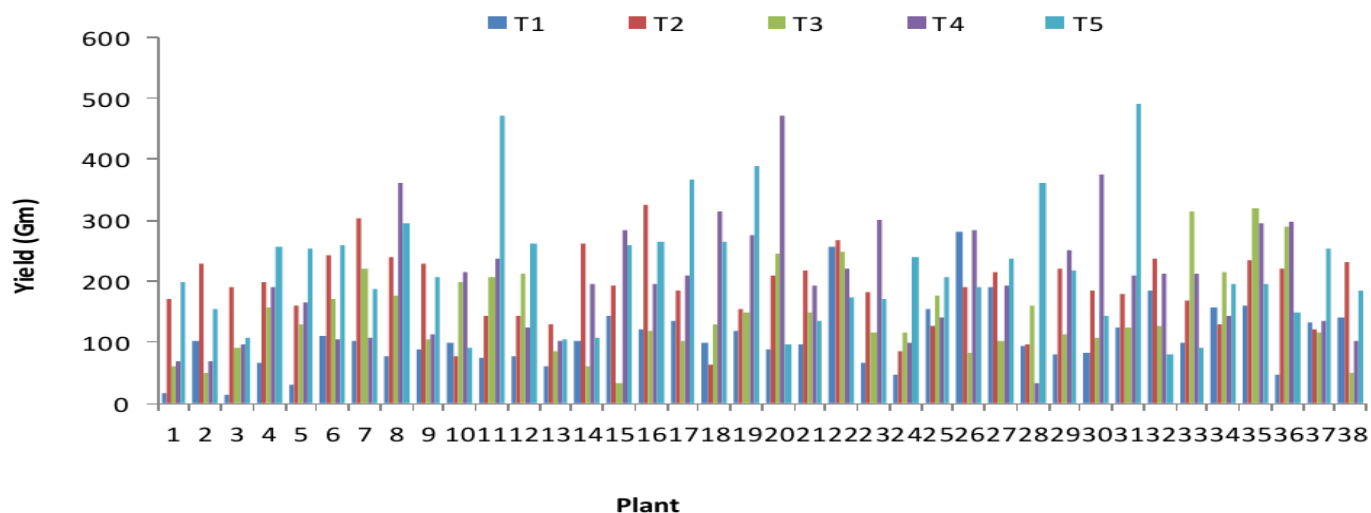


Fig. 3. Effect of drip irrigation levels on yield of per plants

Table 6. Field water use efficiency of chilli as influenced by drip irrigation levels

Irrigation schedule		Yield (kg ha <sup>-1</sup> )	Water used (cm)	Water saving (%)	Water use efficiency (kg ha <sup>-1</sup> )
T <sub>1</sub> : 50% drip irrigation	level	4.26	5.2	50	0.720
T <sub>2</sub> : 65% drip irrigation	level	6.95	6.5	35	1.072
T <sub>3</sub> : 75% drip irrigation	level	5.75	8.0	25	0.605
T <sub>4</sub> : .90% drip irrigation	level	7.29	8.5	10	0.825
T <sub>5</sub> : 100% drip irrigation	level	8.22	9.5	0	0.802

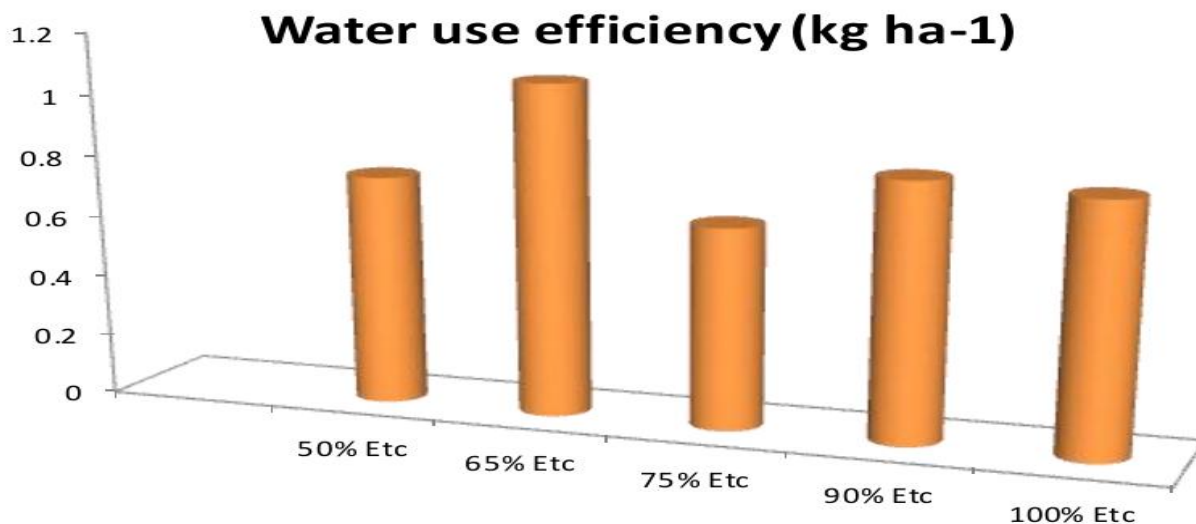


Fig. 4. Effect of drip irrigation levels on WUE

**Table 7. Effect of fertigation yield parameters of chilli for low fertility area**

Treatment	Fruit length (cm)	Fruit weight (g)	Fruit yield (g/plant)	Fruit yield (Kg)
T1	5.5	5.5	490.5	4.126
T2	5	4.5	320.5	6.995
T3	4.4	5.2	420.5	5.575
T4	5.2	5	410.6	7.529
T5	4.5	4.5	420.6	8.122
Mean	4.92	4.94	412.54	6.469
S. E. D.	0.080	0.070	2.450	0.080
CD (0.01)	0.04**	0.03**	0.09**	0.02**
CD (0.05)	0.02	0.02	0.04	0.02

\* - significant at 5 % level, \*\* - significant at 1 % level, NS – not

## RESULTS AND DISCUSSION

Drip systems available in the study area and used in the design the result of the investigation into the emitters available in the study area gave the following Table 5.

### Effect of Drip Irrigation Levels on Growth and Yield

The fruit characteristics recorded after every picking and the average values are expressed under various treatments are shown in Fig. 3 and table 5. Fruit yield and quality: At harvesting time, samples of green pepper fruits were randomly harvested from each plot to measure fruit length, fruit diameter. In addition, total weight of fruits in each treatment were recorded by harvesting pepper fruits twice weekly and then the total yield as Kg/fed were calculated. The maximum yield of crop 490 gm/plant and minimum of yield 32 gm/plant and total yield 33123 gm.

### Water Use Efficiency (WUE)

The increase in water use efficiency for drip irrigation the highest field water use efficiency (6148.31kg ha<sup>-1</sup> system, Among the drip irrigation levels, cm<sup>-1</sup>) was found at 65% irrigation level, indicating comparatively more efficient use of irrigation water (Table 6) with a possibility of water saving of 35% water by adopting chilli plot (1.46 litre plant<sup>-1</sup>day<sup>-1</sup>). The graph represents the effect of drip irrigation levels on water use efficiency of chilli crop (Fig. 4).

## Statistical Analysis

The Data on various parameters studied during the course of investigation were statistically analyzed, applying the technique of analysis of variance suggested by Panse and Sukhatme (1978). Wherever the treatment differences were found significant, (“F” test) critical difference was worked out at five per cent probability level in table 7. The treatment differences that were not significant were denoted by “NS”. Firstly, The water use efficiency of the crops has to be increased in order to reduce the water loss from the field, secondly, Drip irrigation system is considered as the most effective micro irrigation method, as water is applied directly into soil at the crop root zone and thirdly, is Hence it can be concluded that drip irrigation level of 65% (1.46 litre plant<sup>-1</sup> day<sup>-1</sup>) is the best irrigation level recommendation for salad cucumber grown under naturally ventilated poly house in order to get higher economical cucumber yield.

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