

Original Research Article

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Effect of Black Mulching on Growth and Yield of Chilli under Drip Fertigation

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ABSTRACT

A field experiment was conducted to study the effect of black mulch on growth and yield of chili under drip fertigation at Dr. P.D.K.V., Akola from August 2013 to February 2014. The experiment was laid out in a randomized block design with five treatments which included four irrigation levels (100 %, 80 %, 60 %, and 40 %) with plastic mulch and (100 % ET) without mulch considering four times replication. The study indicated higher plant growth, number of fruits, and enhancement in the yield under all drip irrigation with mulch. The yield of green chili was maximum in the treatment of drip irrigation at 80 % ET with mulch (335.16 q/ha) and found to be at par with the treatment of drip irrigation at 100 % ET with mulch (319.50 q/ha) directly reflects 17.01 percent water is saving with comparable yield. A minimum yield of chili was found in the treatment of drip irrigation at 100 % ET without mulching (201.95 q/ha). Irrigation water use efficiency of 9.58 q/ha-cm was found in the treatment of 80 % ET with mulch. Highest weed count and weed weight was observed in the control treatment of 100 % ET without mulch, and negligible weed growth was found in all mulching treatment. By benefit-cost ratio, it is economically viable for the farmers to adopt drip irrigation at 80 % ET with mulching for green chili which shows BC ratio of 2.71.

Keywords

Benefit-cost ratio,
Chili, Drip
irrigation, Mulch,
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efficiency

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Introduction

Chili is a vegetable crop grown throughout the world in a wide range of climatic conditions botanically known as *Capsicum annum* L. placed in Solanaceae family and classified as fruit vegetable crop. The popularity of chili for spice, vegetable, and other uses increases every year. It is grown almost throughout the country. The

outstanding chili growing states in India are Andhra Pradesh, Maharashtra, Karnataka, and Tamilnadu, which together constitute nearly 75 percent of the total area.

As the world becomes increasingly dependent on vegetable production, it is necessary to make efficient use of water and bring more area under irrigation through available water resources Drip irrigation under mulching

provides potential to achieving moderate crop yields through improved water use efficiency and control of the soil environment, including water conservation (Diaz-Perez *et al.*, 2010). Mulching is the process or practice of covering the soil to make more favorable conditions for plant growth, development, and efficient crop production. Enhancing the population of natural enemies to manage pests of chili can be efficiently and effectively supplemented with cultural methods such as mulching, but the suitable material like refractive silver/black plastic mulches help to repel aphids and other insect that damage plants and are vector of viral diseases.

Materials and Methods

The field experiments pertaining to the effects of different irrigation methods on the crop growth and yield of chilli conducted during kharif season of 2013-14 at Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The field experiment was laid out in randomized block design, with four replication and five treatments of drip irrigation at different level of ET with and without plastic mulching.

Before transplanting, common irrigation was applied on 12th August 2013 to bring the soil at the field capacity in each plot. Healthy seedlings of chilli were transplanted on 13th August 2013 with spacing of 60 cm (plant to plant) and 45 cm (row to row). The depth of water to be applied per plant was calculated by using Dick Krupp's formula given in equation.

$$Q = A \times B \times C \times D$$

Where,

Q = Water requirement per plant (lit/plant)

A = $E_{To} = E_{pan} \times K_p$

B = Crop coefficient (KC)

C = Canopy factor

D = Area allotted per plant (m²)

E_{pan} = Cumulative evaporation for two days

K_p = Pan coefficient (0.8)

Irrigation to chilli crop was scheduled on every alternate day considering the cumulative pan evaporation of previous two days. In case of precipitation, it was cumulated for the same previous two days and cumulative rainfall subtracted from cumulative evaporation. If cumulative evaporation was more than cumulative rainfall, then remaining evaporation was taken for calculating the water requirement. But if cumulative rainfall was more than cumulative evaporation, then irrigation was not applied on that scheduled day. Moreover, irrigation was not applied for next two days due to excess rainfall than evaporation and considering the two days (48 hrs) period for getting soil reach to its field capacity.

The biometric characters related to height of plant, number of branches canopy cover, length of fruit and yield of green chilli were studied. Cost analysis was worked out for each treatment.

Results and Discussion

This particular field study was conducted to evaluate the effects of drip irrigation and plastic mulch on chilli in terms of water saving, water use efficiency, crop yield, etc. The observations recorded and results obtained are discussed in this chapter.

It was revealed that the water saving under drip irrigation system at 40, 60 and 80 % ET levels with plastic mulching over 100 % ET with and without plastic mulching was found to be 51.03, 34.02 and 17.01 %, respectively. It was also indicated that by utilizing water equivalent to 100 % ET with and without

plastic mulching by adopting drip irrigation at 40, 60 and 80 % ET with plastic mulching, the per cent increase in irrigated area over 100 % would be 104, 52 and 20 %, respectively.

Height of plant, number of branches per plant and canopy cover was found to be superior in drip irrigation at 80 % ET with mulching treatment followed by drip irrigation at 100 % ET with mulching. These were found higher in all mulching treatment as compared to non-mulching treatment.

It revealed that under drip irrigation and plastic mulch the highest number of fruits were observed in the treatment T₃ and lowest number of fruits (371.50) recorded in control treatment T₅. The non-significant differences in the average weight of fruit were observed.

But numerically largest value of fruit weight was recorded in T₃ (2.10 gm) followed by T₄ (2.07 gm) and T₂ (2.04 gm). It was also observed that treatment T₃ recorded a significantly higher yield of green chili (335.16 q/ha) and found at par with the treatment T₄ and followed by treatment T₂, T₁. The lowest yield of chili recorded in treatment T₅ (201.95 q/ha).

The maximum B:C ratio was obtained in treatment T₃ (2.71) followed by 2.58, 2.28, 2.05 and 1.92 for the treatments T₄, T₂, T₅ and T₁, respectively. From the above results it can be concluded that treatment T₃ (80 % ET + PM) was found best among all the treatments. These results are in conformity with those obtained by Pradhan *et al.*, (2010) and Singh *et al.*, (2011).

Table.1 Treatments details

Treatments	Specification
T ₁	40 % ET with silver polyethylene mulch with drip fertigation
T ₂	60 % ET with silver polyethylene mulch with drip fertigation
T ₃	80 % ET with silver polyethylene mulch with drip fertigation
T ₄	100 % ET with silver polyethylene mulch with drip fertigation
T ₅	100 % ET without mulch with drip fertigation (Control).

Table.2 Comparative statement of water utilization

Treatments	Water applied (ha-cm)	Water saving (per cent)	Area would be irrigated by applying water equivalent to 100 % ET	Per cent increase in area over 100 % ET
T ₁ (40 % ET with PM)	20.64	51.03	2.04	104
T ₂ (60 % ET with PM)	27.81	34.02	1.52	52
T ₃ (80 % ET with PM)	34.98	17.01	1.20	20
T ₄ (100 % ET with PM)	42.15	-	-	-
T ₅ (100 % ET without PM)	42.15	-	-	-

Table.3 Growth parameters

Treatments	Growth parameters		
	Plant height (cm)	Number of branches	Canopy cover (cm ²)
T₁ (40 % ET with PM)	48.78	6.90	18.54
T₂ (60 %ET with PM)	50.36	8.60	21.33
T₃ (80 % ET with PM)	53.18	10.90	25.12
T₄ (100 % ET with PM)	50.74	10.30	26.83
T₅ (100 % ET without PM)	43.79	3.90	11.34
F – test	Sig.	Sig.	Sig.
SE (m) ±	1.67	0.285	1.178
CD at 5%	5.13	0.877	3.630
CV%	6.75	7.010	11.419

Table.4 Quality parameters

Treatments	Quality parameter		
	Number of fruits	Avg. weight of fruit (g)	Fruit length
T₁ (40 % ET with PM)	426.50	2.03	7.28
T₂ (60 %ET with PM)	501.50	2.04	7.50
T₃ (80 % ET with PM)	562.50	2.10	7.78
T₄ (100 % ET with PM)	553.75	2.07	7.68
T₅ (100 % ET without PM)	371.50	1.96	6.90
F – test	Sig.	NS	NS
SE (m) ±	24.319	0.062	0.20
CD at 5%	74.928	0.190	0.61
CV%	10.067	6.057	5.33

Table.5 Cost analysis of chilli production

Treatment	Yield of green chilli (q/ha)	Gross return (Rs/ha)	Total cost (Rs/ha)	Net return (Rs/ha)	BC ratio
T ₁ (40 % ET with PM)	237.50	237497	123685	113813	1.92
T ₂ (60 % ET with PM)	282.50	282500	123727	158773	2.28
T ₃ (80 % ET with PM)	335.16	335164	123769	211394	2.71
T ₄ (100 % ET with PM)	319.50	319500	123812	195688	2.58
T ₅ (100 % ET without PM)	201.95	201954	98594	103360	2.05

In conclusion, drip irrigation at 80 % of water requirement along with silver-black plastic mulch significantly increased green chili yield with a saving of water and was found to be most economical measure.

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