



Research Article

EFFECTS OF DRIP FERTIGATION AND MULCHES ON GROWTH AND YIELD ATTRIBUTES OF CHILLI (*Capsicum annuum* L.)

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Abstract: A field experiment was conducted in *kharif* season at farmers field of village Khatla in district Burhanpur to study the effect of drip fertigation and mulches on growth and yield of chilli. The experiment was laid out in randomized block design with three fertigation level 75, 100 and 125 percent recommended dose of fertilizer (RDF) and three mulching treatments 25, 50 micron black plastic mulch and no mulch with three replication. Total nine treatments and three replications were taken. Among the various treatment, black plastic mulch 25-micron thickness and drip fertigation with 125 % RDF recorded maximum plant height and number of primary branches i.e., 85.11cm and 8.10 respectively. Maximum yield of 465.12 q.ha⁻¹ was observed for the treatment T₃ followed by T₆ (440.44 q.ha⁻¹). Black plastic mulch with drip fertigation showed positive response on moisture conservation, high yield, maximum water & fertilizer use efficiency and higher weed control.

Keywords: On Farm Trial, Hybrid F₁, Drip Fertigation, Plastic Mulch, Yield Q.Ha⁻¹ and Green Chilli

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Introduction

Chilli (*Capsicum annuum* L.), the most widely used and universal spice of India, belong to the family solanaceae. Chilli occupies an important place in Indian diet and it is an indispensable item in the kitchen. India is the largest producer and exporter of chillies in the world. The fruits are good source of vitamin A and (292 IU) and ascorbic acid (111mg/ 100 gm of edible matter). This has high medicinal value especially anti cancerous and instant pain and relief. In daily life chilli are integral and the most important ingredient in many different cuisines around the world it adds pungency, taste, flavor and colour. The present area under chilli cultivation is about (0.79 million ha) with a production of (1.2 million tonnes) and productivity of about 1.5 t/ha [1]. Among chilli producing states in the country, Andhra Pradesh stands first and also constitutes the maximum acreage for chilli cultivation in the country. In Madhya Pradesh, Chilli is grown in an area of 54.4 (7.02 percent) thousand hectare with a total production 93.6 (6.27 percent) thousand tonnes and the productivity was 1.72 tonnes per hectare followed by Odisha and Gujarat. The use of organic and inorganic mulch as a soil cover is effective in improving growth and yield of chilli (*Capsicum annuum* L.). Mulching reduces weed competition, soil compaction, soil erosion. It also maintains a uniform root environment and conserves soil moisture. It stimulates the microbial activity in soil through improvement of soil properties, it minimizes the requirement of nitrogen fertilizer, warms the soil and suppresses weed growth and therefore increases yield. Chilli, being a long duration crop, requires proper manuring and balanced fertilizers along with sufficient moisture level for higher yield and quality produce [8]. Generally, application of fertilizers through fertigation has enhanced the fertilizer use efficiency [12]. Fertigation is a new concept recently practiced in several parts of the world in horticultural crops. It offers a right mixture of water and nutrients to the crop through drip system, and thus meeting plants water and nutrient requirements in most efficient possible manner [7]. It also provides essential elements directly to active root zone thus minimize losses of expensive fertilizer which ensures higher and quality yield along with saving in time and labour [7]. Experiments have already indicated that through fertigation 40 to 50

percent of nutrients could be saved. Therefore, the present study was carried to ascertain the effects of fertigation involving the rate of fertilizers along with black polyethylene mulching for commercial production of chilli.

Materials and Methods

A field experiment was conducted to evaluate the effects of drip fertigation and mulches on growth and yield attributes of chilli at farmers field in the village of Khatla district Burhanpur. The soil was neutral in reaction with low in organic carbon, available nitrogen and phosphorus and medium in available potassium. Normal weather conditions prevailed during the crop growth period. The experimental plot was throughout ploughed with disc plough and tilled twice with cultivator to bring optimum soil tilth. The length and width of the field is 15 m X 15 m respectively. The total area is divided into various strips of 4.5m X 1.2m according to the treatments. The spacing of 60X60 cm, recommended for chilli package and practice. The experiment was laid out in randomized block design with nine treatments, combinations consists of three fertigation treatments and three mulching treatments. Different chilli varieties such as F₁ hybrids, Syngenta No.12, Sitara, Nandita were cultivated by the farmers. The treatments are consisting of 3 mulching levels of Black plastic mulch of 50 microns thickness, 25 microns thickness and No mulch, and 3 fertilizer levels of 75 %, 100 % and 125 % of Recommended Dose of Fertilizers (RDF). The details are shown in [Table-1].

Table-1 Treatment Details

T1	Black plastic mulch of 25 microns thickness and fertigation with 75% RDF
T2	Black plastic mulch of 25 microns thickness and fertigation with 100% RDF
T3	Black plastic mulch of 25 microns thickness and fertigation with 125% RDF
T4	Black plastic mulch of 50 microns thickness and fertigation with 75% RDF
T5	Black plastic mulch of 50 microns thickness and fertigation with 100% RDF
T6	Black plastic mulch of 50 microns thickness and fertigation with 125% RDF
T7	No mulch with 75% RDF
T8	No mulch with 100% RDF
T9	No mulch with 125% RDF

Other management practices like gap filling, weeding and plant protection measure were carried out according to the recommended package and practices. The various growth, yield and quality parameters were recorded at appropriate stage by selecting ten plants randomly in the net plot area of individual treatments and green chilli yield was observed from the net plot area and its mean yield was multiplied to one hectare area.

Results and Discussion

The data were taken on plant height, number of primary branches, fruit length, fruit weight, no of fruits per plant and green chilli yield at 45,60,90 days after transplanting as influenced by mulching and fertigation levels.

Table-2 Effect of drip fertigation and mulch on growth parameters of chilli

Treatment	Plant Height			No. of Primary Branches/ Plant		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₁	50.23	70.22	75.11	4.50	5.71	6.78
T ₂	55.29	74.21	79.22	4.67	5.90	7.21
T ₃	58.61	79.70	85.11	4.82	6.20	8.10
T ₄	49.21	69.22	74.22	4.45	5.70	6.70
T ₅	53.70	73.22	77.69	4.65	5.82	6.90
T ₆	56.03	76.28	81.22	4.80	6.01	7.50
T ₇	43.22	62.20	65.22	4.29	5.55	6.55
T ₈	49.10	67.22	72.12	4.44	5.69	6.39
T ₉	52.22	71.11	77.65	4.66	5.89	6.85

Plant Height

Among the various treatments, black plastic mulch of 25-micron thickness and drip fertigation with 125% RDF (144:96:96 kgNPK/ha) recorded maximum plant height (85.11 cm). The lowest plant height of 65.22 cm was recorded for the treatment T₇ (No mulch with 75% RDF). Similar results were reported [4] that plant height was maximum in plant grown on drip fertigation and black plastic mulch than control. The increase in plant height is attributed to moisture conservation and weed suppression due to application of mulches [13].

Number of Branches

The maximum number of branches per plant was observed in T₃ (8.10), followed by T₆ (7.50), T₂ (7.21) while, the treatment T₈ (6.39) showed the minimum number of branches per plant. Control always showed the least number of branches per plant. Favourable weather conditions and moisture of the soil are important parameters affecting the branches per plant.

Table-3 Effects of drip fertigation and mulching on yield and yield traits of chilli

Treatment	Length of Fruit (cm)	Fruit Weight (gm)	No. of Fruit/ Plant	Yield (q/ha)
T ₁	9.88	390	251	387.24
T ₂	10.64	405	269	425.34
T ₃	11.69	412	281	465.12
T ₄	9.82	385	240	367.7
T ₅	10.58	400	260	410.55
T ₆	10.79	408	270	440.44
T ₇	9.7	355	230	322.1
T ₈	9.74	375	238	350.17
T ₉	10.5	395	245	398.13

Length of fruit (cm)

The maximum green chilli length of 11.69 cm was recorded in treatment T₃ of 25-micron thickness plastic mulching with 125 percent RDF level of fertigation followed by treatment T₆(10.79cm) and the lowest fruit length of 9.70 cm is observed in treatment T₇ of no mulch with 75 percent RDF level of fertigation. The above results are in close agreement with the finding [12].

Fruit Weight (gm)

Treatment T₃ resulted in higher fruit weight than in control, indicating that mulch had positive effect in generating increased fruit weight. Black plastic mulch with 125 percent RDF level of fertigation T₃ produced highest fruit weight of 412 gm followed by T₆ (408gm). The lowest fruit weight of 375gm was recorded for the treatment T₇ (No mulch with 75% RDF). This may be due to induced favourable conditions conducive to attainment of fruits with higher weight. The results are in

accordance with who reported maximum fruit weight in case of drip fertigation and black plastic mulch in chilli [2].

No of fruits per plant

Drip fertigation and mulching produced a greater number of fruits per plant as compared to control [Table-3]. It means that mulching had positive influence of fruit setting in chilli. The treatment viz black plastic mulch of 25 micron thickness and drip fertigation with 125% RDF recorded higher no of fruit per plant T₃ (281) followed by T₆ (270) and minimum with control T₇ (230). The results are in accordance with the earlier report, who reported that drip fertigation and mulching significantly improved the number of fruits per plant and reduced the percentage fruit abortion compared to control [9,10]. The increase in the number of fruits per plant associated with drip fertigation and plastic mulching can probably be attributed to conservation of moisture, improved microclimate and less competition from weed growth. The suitable conditions enhanced the plant growth and development and produced increased fruit bearing nodes compared to the control [5,6].

Yield (q.ha⁻¹)

Black plastic mulch produced maximum yield attributes compared to control with no mulching treatment. This increase in the yield attributes was probably associated with the conservation of moisture and improved microclimatic both beneath and above the soil surface. The maximum total green chilli yield of 465.12 q.ha⁻¹ were recorded for T₃ and T₆ respectively, and the lowest total green chilli yield of 322.10 q.ha⁻¹ was recorded for the treatment T₇ (No mulch with 75% RDF). Similarly, recorded a yield increase of 9 percent with the adoption of drip irrigation over furrow method [14]. The increased yield in fertigation treatment might be due to better availability of plant nutrients and irrigation water throughout the crop grown period under drip fertigation system. This is accordance with the findings [3]. Hence the 25 microns thickness black plastic mulch produced higher soil temperature than 25 microns thickness mulch. The difference of 2 to 5°C was observed between mulch and non-mulch treatments.

Conclusion

Based on the experimental results, it could be concluded that drip fertigation and plastic mulches can prove as a boon to enhance productivity in the district. The plant growth parameters, yield attributes and green chilli yield were enhanced by the combined effect of drip fertigation at 125% RDF along with 25 microns thickness black plastic mulching. Treatment T₃ of 25 microns thickness and drip fertigation with 125% RDF was economically viable and the control plot (T₇), with 75% RDF, which is less than the other treatment.

Application of research: When compared to control treatment 30.74 percent of chillies yield increases in both drip fertigation and plastic mulching. Hence, farmers should therefore be encouraged to use mulch as a crop husbandry practice for moisture conservation and fertigation for effective utilization of water and nutrients.

Research Category: Drip fertigation

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Study area / Sample Collection: Khatla in district Burhanpur

Cultivar / Variety name: Chilli (*Capsicum annuum* L.)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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