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Effect of Conservation Practices on Early Growth of Brinjal

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ABSTRACT

This study investigated the combined effects of drip irrigation and mulches on early vegetative growth of brinjal (egg plant). The treatments of the study comprised different combinations of two drip irrigation levels (100 and 80% of crop water requirement, ETc) and two mulches (black polyethylene sheet and paddy straw). The early vegetative growth characters in the mulched treatments for both levels of irrigation were significantly higher compared to those in the un-mulched treatments. The early vegetative growth of brinjal increased with the increasing amount of irrigation water in un-mulched treatment. The trend was reversed when drip irrigation was coupled with mulches. The highest shoot and root length, number of primary branches, number of leaves, fresh and dry weight of shoot and root, root shoot ratio, root length, diameter and volume of root were obtained when 80% of water requirement was applied. The highest leaf chlorophyll content was observed with polyethylene mulch at both irrigation levels compared to paddy straw mulch and un-mulched plots. The study thus reveals that drip irrigation with mulch has an explicit role in increasing the early vegetative growth in brinjal, which further promotes more vigorous growth and heavy yields.

Key words: *Brinjal, Shoot, Root, Mulch, Irrigation.*

INTRODUCTION

Mulches are well known for modifying the energy and water balance at surface of soils and creating more favourable conditions for plant growth. This may include temperature moderation (facilitates more retention of soil moisture and helps in control of temperature fluctuations) and weed control, soil conservation (reduces the deterioration of soil by way of preventing the runoff and soil loss) and after decomposition of organic mulch improves physical, chemical and biological properties of soil, adds nutrients to the soil and ultimately enhances the growth and yield of crops[8,10,13,14]. Mulching is also applicable to most field crops. However, it is preferred in fruit orchard, flower and vegetable production and nurseries. Black polythene mulch is most commonly used in agriculture and clear plastic mulch is used in some areas due to its increased soil warming characteristics. There are different mulches available for crop production starting with plant derivative mulches (organic) to inorganic mulches. The pros and corns of the different mulches are varied.

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Nowadays using inorganic mulches became more popular due to their efficiency in weed control[3,12,19] less pest and disease problem[9], moisture conservation and increase water use efficiency[5]; easy availability in market, durability, easy in mechanized agriculture [4], early growth and increased in potential yield of crops[6,7,11]. Research has shown that white or Aluminium reflective mulch also repels aphids[4] which spread some virus diseases. Among different colour mulches black polythene mulches are more efficient in weed control, conserving soil moisture and yield[1]. Mulching effect on the micro climate of the soil, preserve the moisture in area of root zone; there by helping the optimum uptake of the water and available nutrients for better growth and efficient crop yield[2].

Drip irrigation is the slow and frequent application of small amounts of water through emitters or tiny holes spaced along polyethylene tubing or tape. Drip irrigation is gaining importance over surface irrigation methods like flooding, ring method, ridge and furrow method, etc. due to the shortage of irrigation water with uncertain rain fall, long dry spells and increased global temperatures. The advantages of drip (micro) irrigation include improved water and nutrient management, potential for improved yields and crop quality[17,18], less weed growth, pest and disease infestation, greater control on applied water resulting in less water and nutrient loss through deep percolation, and reduced total water requirements.

Roots are the lifeline of a plant, taking up air, water, and nutrients from the soil and moving them up into the leaves, where they can interact with sunlight to produce sugars, flavors, and energy for the plant. Important root functions include shoot anchorage, water uptake, nutrient uptake, and hormone production. The size, morphology or architecture of a root system may control the relative size and growth rate of the shoot. Optimum root systems throughout the plant life cycle can ensure optimum shoot growth; shoot development, and subsequent yields. Root dry-weight accumulation, number, diameter, length, surface area, and distribution in a soil profile can differ within crop species. Taproot, basal root, and adventitious root variables differ between genotypes and which are having the strong root system produce optimum shoot growth and help in producing high yields.

MATERIAL AND METHODS

The experiment was carried out at CRIDA, Hyderabad during the months of June to August 2016. There were six treatments viz. T1, Drip irrigation with 100% ETc with no mulch; T2 Drip irrigation with 100% ETc with paddy straw mulch (SM); T3, Drip irrigation with 100% ETc with black poly mulch (PM); T4 Drip irrigation with 80% ETc with no mulch; T5 Drip irrigation with 80% ETc with paddy straw mulch (SM); T6 Drip irrigation with 80% ETc with black poly mulch (PM). It was laid out with Randomized Block Design (RBD) with four replications. Organic mulches were applied @ 7 tonnes/ha after planting and polythene mulch was placed in the inter-row spaces. The soil was sandy loam, of medium fertility, having organic carbon 0.52% and soil pH 6.8. Seedlings of 24 days old are selected and transplanted in the experimental field with drip irrigation with the spacing of 60 x 60 cm in the first week of May. The above ground below ground observations are taken from seedling stage, 30 DAT (days after transplanting) and 60 DAT.

The height of plant, number of primary branches, number of leaves, leaf chlorophyll content were measured before uprooting the plant, leaf chlorophyll content was measured with SPAD 502 Plus Chlorophyll Meter. The fresh weight, dry weight of shoot and root observations were recorded by destructive sampling method. Root parameters were measured with WinRhizo (Regular 2009c Version by Regent Instrument, Canada). After separation of roots from the plant fresh weight of roots was measured, the roots were scanned using flat bed scanner of STD 4800. After scanning the root scans were stored in “tiff” format and data were generated in text file, later converted into

Excel files for further analysis for root length, root diameter, root surface area and root volume. After scanning, the roots were dried at 40°C for four days for root dry weights. The actual crop evapotranspiration was (ETc) computed by multiplying the reference evapotranspiration (ETo) with crop coefficient (Kc) and area of application with the following formula.

ETa (m^3) = Kc × ETo (m) × projected area (0.6 × 0.6 m^2).

RESULTS AND DISCUSSION

Effect of different levels of irrigation

The effect of different levels of irrigation on above and below ground parameters such as plant height, number of leaves per plant, fresh and dry weight of shoot, leaf chlorophyll content, root length, root diameter, root volume, root surface area, root fresh and dry weights were analyzed statistically. The experimental results of these biometric observations are presented in Table 1, 2. The results of analysis of variance showed that variations among four replications for all the treatments were found to be statistically significant. The analysis of observations showed that different levels of drip irrigation responded differently to biometric parameters of crop.

The plant height, number of leaves, fresh weight, dry weigh of shoot, chlorophyll content of leaves, root length, root volume, root surface are, root fresh and dry weights at 30 and 60 DAP varied significantly with different levels of irrigation and were maximum with 100% ETc and minimum with 80% ETc without mulch. The results were reverse when drip irrigation was provided with mulches. Irrigation with 100% and 80% ETc with PM produced slightly higher vegetative growth than the same irrigation regimes with SM. There was a decrease in vegetative growth with the increase in irrigation regime except for leaf chlorophyll content and root diameter. This result complies with that of Shrivastava *et al*[15].

Effect of different mulches

The vegetative growth of above and below ground components of brinjal was significantly greater at both levels of irrigation in mulched treatments as compared to un-mulched treatments. Mulches had a significant positive effect on all vegetative growth components and the effect was more pronounced in lower water regime treatment than higher water regime treatments.

The PM treatments recorded higher growth of above and below ground parameters and high root to shoot ratio at 30 and 60 DAT when compared to SM. Both mulches treatments given irrigation with 80% ETc produced more growth compared to 100% ETc for almost all characters except leaf chlorophyll content and root diameter. The reason might be the rate of water loss from soil surface through evaporation was much lower in case of PM than SM. This resulted in poor aeration with high moisture regime beneath the PM, which might not be good for active vegetative growth. Beneficial responses of vegetable crops to mulch in terms of growth and yield have been reported by many investigators[3,15,17,16,4,5].

Table 1: Early growth of brinjal as influenced by different levels of drip irrigation and mulches at 30 DAT

Treatments	Above ground parameters						Below ground parameters						Root shoot ratio
	Plant height (cm)	No of Primary branches	No. of leaves	Fresh weight (g)	Dry weight (g)	Leaf chlorophyll content	Root length (mm)	Root diameter (mm)	Root volume (cm^3)	Root surface area (cm^2)	Root fresh weight (g)	Root dry weight (g)	
T_1	38.10	6.4	13.2	60	9.83	47.96	280.50	3.95	2.45	113.35	9.86	2.25	0.229
T_2	39.55	7.0	16.3	101.25	14	51.05	281.25	4.02	2.65	115.65	11.65	3.31	0.236
T_3	40.80	8.6	19.5	110.65	15.5	55.37	294.45	4.25	2.80	123.35	12.91	3.93	0.254
T_4	37.00	6.1	13.0	54	9.71	46.44	272.35	3.91	2.40	110.33	9.55	2.09	0.215
T_5	41.50	7.6	16.8	109.67	14.8	49.53	293.35	3.99	2.83	120.25	12.11	3.63	0.245
T_6	42.25	9.0	21.4	120.2	16.45	49.68	305.65	4.13	2.96	131.50	13.73	4.43	0.269
CD at 5%	0.57	NS	0.90	0.99	0.63	0.93	2.98	NS	NS	1.06	0.51	0.38	-

(DAT- days after transplanting; NS-non significant)

Table 2: Early growth of brinjal as influenced by different levels of drip irrigation and mulches at 60 DAT

Treatments	Above ground parameters						Below ground parameters						Root shoot ratio
	Plant height (cm)	No of Primary branches	No. of leaves	Fresh weight (g)	Dry weight (g)	Leaf chlorophyll content	Root length (mm)	Root diameter (mm)	Root volume (cm^3)	Root surface area (cm^2)	Root fresh weight (g)	Root dry weight (g)	
T_1	57.15	9.09	33.00	189.00	30.96	49.62	561.00	5.65	4.57	196.10	19.72	5.09	0.164
T_2	60.51	9.31	41.57	268.31	37.10	51.05	573.75	5.87	5.05	203.54	23.77	7.47	0.201
T_3	65.08	12.00	50.60	291.01	40.77	55.37	616.87	6.35	5.69	221.41	27.05	9.32	0.229
T_4	54.76	7.93	31.59	170.10	30.59	46.48	532.44	5.43	4.16	197.49	18.67	4.65	0.152
T_5	64.33	10.26	44.18	290.63	39.22	50.34	613.10	5.79	5.59	210.44	25.31	8.35	0.213
T_6	66.33	12.96	55.00	312.52	42.77	53.68	637.28	6.22	6.13	249.85	28.63	10.10	0.236
CD at 5%	0.92	0.23	1.17	7.88	1.33	0.68	12.92	0.20	0.19	2.95	0.27	0.28	-

(DAT- days after transplanting)

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