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Effect of Different Levels of Drip Irrigation over Furrow Irrigation and Fertilizer Levels on Biometric Parameters of Brinjal Crop

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Abstract

The response of biometric parameters to drip irrigation was better than that for furrow irrigation. The height of plant, stem diameter and number of branches per plant was highest in 100% crop ET treatment. The reproductive stage of the crop was achieved earlier in drip irrigation treatments than that for furrow irrigation treatments. Among fertilizer levels, 100% RDF recorded highest for all biometric parameters compared to 75 and 50% RDF.

Key words : Drip irrigation, Furrow irrigation, Plant height, Stem Diameter, Number of branches.

Brinjal or egg plant (*Solanum melongena* L.) belonging to the family Solanaceae is one of the common vegetable crops grown in almost all parts of India. Besides, its use as a fresh vegetable, it has a good medicinal value, contrary to the common belief, it is high in nutritive value which compares well with other vegetables like tomato. It is a rich source of vitamin A, thiamin, riboflavin, nicotinic acid, vitamin C and mineral elements like iron, calcium and phosphorus. It is a well adopted crop to a wide range of climatic and soil conditions and cultivated in one or the other season. The plants may continue to yield fruits for a year or more. The data on the biometric performance of brinjal under different levels of drip irrigation are not available. Hence an attempt was made to study the effect of different levels of drip irrigation over furrow irrigation on biometric parameters of brinjal crop.

Methods

The experiment was laid out using split plot statistical design with a total of eight treatments comprising five main treatments (irrigation levels) and three sub-treatments (fertilizer levels) and the treatments were replicated thrice to reduce diversity in observation and errors in readings. The treatment details are given as follows. Main treatments : I_1—Drip irrigation at 60 per cent crop ET, I_2—Drip irrigation at 80 per cent crop ET, I_3—Drip irrigation at 100 per cent crop ET, I_4—Drip irrigation at 120 per cent crop ET, I_5—Control treatment (furrow method). Sub-treatments : F_1—50 % of the recommended dose of fertilizer (RDF), F_2—75% of the recommended dose of fertilizer (RDF), F_3—100% of the recommended dose of fertilizer (RDF).

The experiment was laid out on an area of 32 × 25 m, with more uniformity in topography and physical properties. Each treatment was laid out on 0.9 × 10 m consisting of 44 plants per plot. The buffer of 1 m along treatments and 1.0 m along replication was left to avoid the border effect of treatment and or replications over each other.

Observations were recorded on following characters from five randomly tagged plants in each treatment per replication. The number of days after transplantation to the date at which 50% of the total number of plants flowered in each treatment was recorded. Height of the plant from base to tip was recorded in centimeters at an interval 15 days till final harvest of the crop from 5 tagged plants and average was worked out. The total numbers of branches per plant were recorded from tagged plants in each treatment at an interval of 15 days and the average number of branches per plant was computed. The stem diameter was measured using vernier callipers at a height of

Table 1. Effects of irrigation and fertilizer application on height of brinjal.

Treatments	Plant height (cm) 15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT
Irrigation						
I_1	16.033	23.100	30.044	35.056	38.733	44.233
I_2	16.389	26.467	33.978	38.322	42.956	50.189
I_3	16.533	29.989	35.511	40.444	45.200	51.580
I_4	16.211	24.989	31.278	37.156	40.600	46.422
I_5	15.000	22.689	28.144	32.000	36.356	40.356
SE ±	0.269	0.190	0.322	0.287	0.492	0.283
CD at 5%	0.879	0.619	1.049	0.935	1.605	0.924
Fertilizer						
F_1	15.867	24.847	31.033	35.840	40.107	45.693
F_2	16.000	25.253	31.813	36.733	40.700	46.653
F_3	16.233	26.240	32.527	37.213	41.500	47.327
SE ±	0.152	0.200	0.192	0.201	0.335	0.149
CD at 5%	NS	0.589	0.565	0.592	0.987	0.438

3—5 cm above the shade surface.

The data were analyzed using the analysis of variance procedure. Test of significance was carried out at 5% level of significance.

Results and Discussion

The plants receiving water at 100% crop ET (I_3) recorded higher plant height at 15, 30, 45, 60 and at 90 DAT. Similar results with increasing trend were observed for 80% crop ET (I_2), 120% crop ET (I_4) and 60% crop ET (I_1) at all the growth stages. Significantly least plant height was observed in plants receiving water through furrow irrigation at 15, 30, 45, 60 and at 90 DAT (Table 1).

Among the fertilizer levels plant height did not

Table 2. Effect of irrigation and fertilizer applications on stem diameter of brinjal (cm).

Treatments	15 DAT F_1	F_2	F_3	Mean	30 DAT F_1	F_2	F_3	Mean	45 DAT F_1	F_2	F_3	Mean
I_1	0.387	0.450	0.617	0.484	1.300	1.293	1.300	1.297	1.853	2.203	2.280	2.112
I_2	0.567	0.723	0.880	0.723	1.857	2.197	2.113	2.05	2.530	2.373	2.433	2.445
I_3	0.820	0.933	0.680	0.811	2.167	2.310	2.623	2.36	2.553	2.627	2.730	2.636
I_4	0.577	0.773	0.763	0.704	1.443	1.690	1.837	1.656	2.23	2.297	2.437	2.321
I_5	0.313	0.347	0.447	0.369	0.853	0.883	1.033	0.923	1.747	1.643	1.830	1.740
Mean	0.533	0.645	0.677	0.618	1.864	1.674	1.781	1.657	2.185	2.229	2.342	2.252

	15 DAT SE ±	CD at 5%	30 DAT SE ±	CD at 5%	45 DAT SE ±	CD at 5%
Between two irrigation means	0.023	0.076	NS	–	0.037	0.120
Between two fertilizer means	0.012	0.035	NS	–	0.027	0.079
Between two fertilizer-means at the same irrigation	0.027	0.079	NS	–	0.060	0.176
Between two irrigation means at the same or different	0.032	0.094	0.073	–	0.061	0.180

Table 2. Continued.

Treatments	60 DAT				75 DAT				90 DAT			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
I_1	2.143	2.347	2.373	2.287	2.833	2.933	2.917	2.894	3.550	3.757	4.107	3.804
I_2	2.477	2.463	2.75	2.563	2.233	3.313	3.340	2.962	4.250	4.267	4.223	4.246
I_3	2.670	2.847	2.870	2.795	3.443	3.323	3.513	3.426	4.427	4.320	4.513	4.420
I_4	2.440	2.567	2.537	2.514	3.250	3.267	3.223	3.246	4.040	4.090	4.057	4.062
I_5	1.660	1.842	2.270	1.924	1.857	2.240	2.437	2.178	2.767	3.133	3.00	2.966
Mean	2.278	2.413	2.560	2.417	2.921	3.015	3.086	3.007	3.807	3.913	4.060	3.926
		SE ±	CD at 5%			SE ±	CD at 5%			SE ±	CD at 5%	
Between two irrigation means		0.024	0.079			0.047	0.152			0.132	0.430	
Between two fertilizer means		0.014	0.040			0.020	0.060			0.028	0.082	
Between two fertilizer means at the same irrigation		0.031	0.090			0.046	0.135			0.062	0.183	
Between two irrigation means at the same or different		0.035	0.103			0.060	0.176			0.141	0.416	

differ significantly at 15 DAT. The 100% recommended dose of fertilizer (F_3) recorded significantly maximum plant height at 30, 45, 60 and at 90 DAT over other levels of fertilizers. Interaction effects were found to be non-significant for all the growth stages.

The effect of irrigation and fertilizer application on stem diameter is presented in Table 2. At 15 DAT, stem diameter differed significantly due to irrigation levels. Among different levels of irrigation 100% crop ET (I_3) recorded highest stem diameter (0.81 cm) compared to rest of other irrigation levels. The lowest stem diameter was observed in furrow irrigation for all DAT.

Among the fertilizer levels plants receiving 100% RDF (F_3) recorded significantly higher stem diameter (0.67 cm, 2.34 cm, 2.56 cm, 3.08 cm and 4.06 cm respectively) at all the stages of growth over 50 % RDF (F_1). The interaction effects were found to be significant for all the stages of crop growth except 30 DAT.

At 15 DAT, combined application of 100% crop

Table 3. Effects of irrigation and fertilizer applications on number of branches per plant of brinjal.

Treatments	Number of branches 30 DAT
Irrigation	
I_1	2.493
I_2	4.667
I_3	4.796
I_4	3.573
I_5	2.268
SE ±	0.003
CD at 5%	0.010
Fertilizer	
F_1	2.912
F_2	3.798
F_3	3.962
SE ±	0.002
CD at 5%	0.006

Table 4. Effects of irrigation and fertilizer application on days to 50% flowering on brinjal.

Treatments	F_1	F_2	F_3	Mean
I_1	31.333	32.000	34.333	32.556
I_2	32.000	31.333	32.000	31.778
I_3	29.667	31.000	32.000	30.889
I_4	32.667	34.333	34.333	33.778
I_5	36.667	37.667	36.333	36.889
Mean	32.467	33.267	33.800	33.178
SE ±	CD at 5%			
0.272	0.888	Between two irrigation means		
0.185	0.544	Between two fertilizer means		
0.413	1.217	Between two fertilizer means at the same irrigation		
0.433	1.278	Between two irrigation means at the same or different		

ET (I_3) and 75% RDF (F_2) recorded significantly higher stem diameter (0.93 cm). Significantly lower stem diameter was recorded in control (I_5F_1).

The data pertaining to number of branches per plant at various stages of growth is presented in Table 3. Among irrigation levels 100% crop ET (I_3) recorded significantly higher number of branches (1.51) over control (1.39) followed by 80% crop ET (1.37) which was found to be at per with 120 (%) crop ET (1.36). The lowest numbers of branches per plant were observed in furrow irrigation at all the stages of crop growth

Among fertilizer application 100% RDF (1.39) recorded significantly higher number of branches over 50% RDF (1.34). Same trend was observed at 45, 60, 75 and 90 RDF. The interaction effects were found to be significant for all the stages of crop growth except 30 DAT.

It is seen that response of biometric parameters to drip irrigation was better than that for furrow irrigation. The reproductive stage of the crop is achieved earlier in drip irrigation treatments than that for furrow irrigation treatments.

Among fertilizer levels, 100% RDF recorded highest for all biometric parameters compared to 75 and 50% RDF. The results of height, stem diameter and number of branches and other biometric parameters are in conformity with the earlier findings of Sivanappan et al. (1) in tomato and Deolanker and Firke (2) in chilli.

The decrease in the vegetative growth in furrow irrigation method may be due to the reason that the net carbondioxide assimilation and transpiration decrease within 24 hours of flooding and remains at reduced levels as flooding persists (3). Moreover, due to flooding, stomatal conductance also decreases the hydraulic conductivity of roots and thus uptake is reduced (4). This survival mechanism however reduces the net carbondioxide assimilation which eventually translates into decreased growth and yield. The better growth in case of drip irrigation is due to the fact that the frequent application of water in the vicinity of the root zone produces a continuously high soil water content around the roots which helps in better growth of plants. These results are in agreement with the findings of Roth (5).

Data on days to 50% flowering as influenced by application of irrigation and fertilizer levels are presented in Table 4. Among drip irrigation levels 120% crop ET took significantly more number of days to 50% flowering (33.78) compared to other irrigation level. On the contrary, furrow irrigation took more number of days for (36.89) 50% flowering which is significantly higher than other drip irrigation treatments.

For earlier flower initiation the values of these parameters at 60 and 80% crop ET treatments were at par with each other than that for 100 and 80% crop ET treatment and hence we can adopt 60% crop ET for water application to brinjal crop.

Among fertilizer levels application of 100% RDF took significantly higher number of days to 50% flowering (33.8) than 50% RDF (32.46). However, 75% RDF was found to be on par with 100% RDF (33.26). Interaction effects were found to be significant for days to 50% flowering.

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