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Effect of irrigation and fertigation levels on yield and nutrient uptake of brinjal (*Solanum melongena* L.)

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ABSTRACT : A field experiment was under taken in *Rabi* season of the year 2009-2010 at Agronomy Farm, Dapoli to study the effect of irrigation and fertigation levels on the yield and nutrient uptake of brinjal under drip irrigation. The soil of the experiment field was sandy clay loam in texture, moderately high in available nitrogen and phosphorus while very high in available potassium. The experiment was laid out in split plot design with main plot treatments as three plant spacing *i.e.* S_1-75 cm x 75 cm, S_2 – 75 x 50 cm x 90 cm, S_3-175 cm x 50 cm x 50cm, and three irrigation levels *i.e.* I_1 – 0.6 PE with drip, I_2-0.4 PE with drip, I_3 – 0.2 PE with drip irrigation, while sub plot treatments comprised of two fertigation levels *i.e.* F-100% of recommended dose of fertilizer (RDF-150:50:50 kg ha^{-1}) through water soluble fertilizer (WSF), F-80% of (RDF) through WSF. The treatment F_1 (100%) RDF through WSF recorded significantly superior yield (36.74 t ha^{-1}) over fertilizer level F_2 *i.e.* 80% RDF through WSF (32.31 t ha^{-1}). The total nutrient uptake of nitrogen (144.4 kg ha^{-1}), phosphorus (44.13 kg ha^{-1}) and potassium (203.6 kg ha^{-1}) was noticed significantly higher under the fertigation level F_1 *i.e.* 100% RDF through WSF. The maximum fertilizer use efficiency of NPK was 71.81, 62.52, 153.7 per cent, respectively under the treatment F_2 *i.e.* 80% RDF through WSF.

KEY WORDS : Brinjal, Irrigation levels, Fertilizer levels, Yield, Fertilizer use efficiency, Drip irrigation

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Drip irrigation is the major component in adoption of precision agriculture. Maharashtra has largest area under drip irrigation. The drip irrigation system keeps the soil moisture near to field capacity and this system also increases fertilizer use efficiency after avoiding losses through leaching, volatilization and fixing of nutrient in the soil (Nakayama and Bucks, 1986). The research carried out by Padmakumari and Sivanappan (1978) reported that brinjal with drip irrigation required only 24 cm of water as against 69 cm of water in conventional method. Application of fertilizers through irrigation systems is called as fertigation which has become the state art in brinjal vegetable production because the nutrients can be applied in correct doses and at appropriate stage of plant growth. In addition it improves fertilizer use efficiency, hastens the maturity of crop and improves the quality of produce. The fertigation has number of advantages like improvement in nutrient use efficiency, placement of nutrients in the vicinity of crop root zone and saving of nutrients. Fertigation reduces the ammonia volatiztion, leaching losses, phosphate fixation etc. as much more in band placement. The best known method for maximization of yield and for improvement in quality is the application of balanced and judicious doses of fertilizers by means of fertigation. Dalvi (1984) carried out a field experiment at Dapoli and reported that close spacing (30cmx30cm) recorded significantly higher values of nitrogen uptake by maize stover over the wide spacing (60cmx30cm) and (45cmx30cm). Tumbare *et al.* (2004) carried out an experiment on *Kharif* brinjal at Mahatma Phule Krishi Vidyapeeth, Rahuri to study the effect of planting technique and fertigation interval on brinjal and revealed that, the maximum nutrient uptake by crop was observed under triangular planting (45cm-135cm x 60cm) *i.e.* 145.70 kg N, 39.42 kg P and 224.29 kg K ha^{-1}. However, least uptake was observed under normal planting (90cm x60 cm) *i.e.* 98.28 kg N, 21.88 kg P and 146.33 kg K ha^{-1}). Kadam *et al.* (2007) conducted an experiment on brinjal at M.P.K.V., Rahuri, on sandy clay loam

Table A : Details of plot size, plant population of brinjal and per cent saving in dripper and lateral

Plant spacing	Plot size (m)	Plant population per ha	% saving as compared to spacing S_1	
			Dripper	Lateral
S_1=75cm x 75cm	8.25m x7m	17778 per ha	-	-
S_2=75cm- 50cm x 90cm	8.75m x7m	17760 per ha	50	41
S_3=175cm-50cm x 50cm	10.75m x7m	17600 per ha	49	67

soil and observed that significantly superior individual weight of fruit (g), fruit yield (t ha^{-1}) registered under treatment 100 per cent of RDF followed by 75 and 50 per cent RDF, respectively.

Brinjal is one of the most common, popular and principal vegetable crops grown throughout the country except higher altitudes. It is a good source of minerals, vitamins and is rich in total water soluble sugars, free reducing sugars, amide proteins among other nutrients. Brinjal has been cultivated in India for the last 4,000 years. Brinjal is also exported in the fresh or frozen form. It also fetches good income to the farmer. Keeping this in mind, the present investigation was undertaken to study effect of irrigation and fertigation levels on yield and nutrient uptake of Brinjal (*Solanum melongena* L.).

METHODOLOGY

A field experiment was carried at All India Co-ordinated Research Project on Water Management, Dapoli centre, in lateritic soils of Konkan region of Maharashtra during *Rabi* season. The soil was sandy clay loam with pH 5.5, very high in organic carbon content (18.45 g kg^{-1}), low in available nitrogen content (232 kg ha^{-1}), very low in available phosphorus content (6.11 kg ha^{-1}) and very high in available potassium content (369.6 kg ha^{-1}). The experiment was laid in split plot design. The numbers of treatments were eighteen and numbers of replications were three. The main plot treatments were three plant spacing's *viz*., S_1(75cm x 75cm), S_2(75cm- 50cm x 90cm) and S_3(175cm-50cm x 50cm). The irrigation levels were 0.6 PE, 0.4 PE and 0.2 PE *i.e.* I_1, I_2 and I_3, respectively and in sub plot treatments fertigation levels were two, *viz.*,100 per cent, 80 per cent *i.e.* F_1, F_2, respectively, of recommended dose (150:50:50, N:P:K).There were two controls (check basin) with manual application of recommended dose of fertilizer(C_2) and without fertilizer(C_1) in combination of surface irrigation at 1.0 IW/CPE ratio, respectively which kept separated beside main and sub-main treatments. The details of plot size, plant population and per cent saving of laterals and drippers are given in the Table A.

FYM @20 t ha^{-1} was applied uniformly after preparing the spots of required size before transplanting. The brinjal seedlings of variety CHES – 309 (Suwarna Pratibha) were transplanted in fourth week of December. The discharge of dripper was 4 LPH with different spacing between two drippers. The pre-transplantation irrigation of 6 cm depth was applied to all plots irrespective of the treatments.

For all treatments of drip irrigation NPK dose was applied fortnightly through water soluble fertilizers namely 19:19:19 grade and remaining quantity of N was given through urea as per the treatment. Fertigation was given through the venturi provided in system of 0.75 inches. For the control treatment (C_2), fertilizer was given in three splits. For control treatment C_2 *i.e.*100 per cent RDF through soil application, 1/3rd quantity of N and 100 per cent P, K was applied as a basal dose and remaining 2/3rd quantity of N was applied at 30, 60 and 90 DAT through manual application of solid fertilizers *viz*., urea, SSP and MOP. For control C_1 no fertilizer was given, which kept as absolute control. The recommended plant protection measures were taken during the crop growth.

RESULTS AND DISCUSSION

The result of the present study as well as relevant discussion have been presented under following heads.

Yield :

The yield of brinjal per plot was recorded and yield per hectare was calculated in each treatment as reported in Table 1.The brinjal planted at S_2 and S_3 spacing produced significantly higher yield as over the plant spacing S_1 and the treatments S_1 and S_3 were at par with each other in producing brinjal yield. Irrigation level did not vary significantly in producing brinjal, whereas the fertilizer applied at F_1 produced maximum and significant yield over F_2 level. From the yield data it is revealed that, maximum yield of 44.04 t ha^{-1} was observed in $S_3I_1F_1$ treatment followed by $S_3I_2F_1$ treatment, 40.07 t ha^{-1}.

Water requirement and water use efficiency:

The total depth of water applied in different irrigation level over control is given in Table 1. The total water applied using drip irrigation system with irrigation levels of I_1, I_2 and I_3 were 36.96, 23.31 and 11.65 ha-cm, respectively, whereas in control treatment it was 65 ha-cm.

The maximum water use efficiency (WUE) of 3230.5kg ha-cm^{-1} was observed in $S_3I_3F_1$ treatment followed by 3131.7 q ha-cm^{-1} in $S_2I_3F_1$ treatment (Table 1).

Nutrient uptake and fertilizer use efficiency :

The soil analysis was carried out for available N, P_2O_5

and K_2O before initiating the experiment and after harvest of the crop. Plant samples after harvesting were analyzed for N, P, K content and their uptake for fruit, leaves and stem. The per cent N, P, K was multiplied by corresponding dry matter yield of the different constituents.

Nitrogen content and uptake:

Data pertaining to mean nitrogen content in fruit, leaf and stem (%), nitrogen uptake by fruit, leaves, stem and total nitrogen uptake (kg ha^{-1}) as influenced by various treatments are presented in Table 2. The plant spacing S_3 (175cm-50cm x 50cm) recorded significantly higher value in respect of mean nitrogen content in fruit, leaf and stem, mean uptake of nitrogen by fruit, leaf, stem and total nitrogen uptake over the rest of plant spacing. Similarly, the planting density S_2 (75cm-50cm x 90cm) observed statistically superior to plant spacing S_1 (75cm x75cm) under study. The irrigation level I_1 showed significantly higher value of nitrogen content in fruit, leaf and stem over the rest of irrigation levels under study. Similarly, the irrigation level I_2 was statistically superior to irrigation level I_3. The fertigation level F_1 (100 per cent RDF through drip irrigation (WSF)) was found significantly superior in respect of nitrogen content in fruit, leaf and stem from the fertigation level F_2 (80 per cent RDF through drip irrigation (WSF)) under study.

While the treatment C_2 (100% RDF through soil application) in combination of surface irrigation with 1.0 IW/CPE ratio showed reduced average values of nitrogen content in fruit, leaf and stem, mean nitrogen uptake by fruit, leaves, stem and total nitrogen uptake as compared to all irrigation and fertigation treatments. However, the lowest average values were recorded in treatment C_1 (absolute control). Effect of interaction was found to be non significant with respect to nitrogen content in fruit, leaf and stem, mean nitrogen uptake by fruit, leaves, stem and total nitrogen uptake.

Phosphorus content and uptake studies:

The data pertaining to phosphorus content in fruit, leaves and stem (%), mean phosphorus uptake by fruit, leaves, stem and total phosphorus uptake (kg ha^{-1}) as influenced by various treatments are presented in Table 3. It was observed that, in case of phosphorus content in fruit the plant spacing S_3 (175cm-50cm x 50cm) showed significantly higher values over the plant spacing S_1 (75cm x75cm). The plant spacing S_3 and S_2 (75cm-50cm x 90cm) were at par with each other. Similarly, plant spacing S_1 was at par with plant spacing S_2.

In case of value of phosphorus content in leaf and stem, the plant spacing S_3 shown significantly higher variation over the rest of plant spacing under study. Similarly, the plant spacing S_2 noticed statistically superior to planting density S_1. In case of phosphorus uptake by fruit, leaves, stem and total phosphorus uptake the plant spacing S_3 recorded significantly higher phosphorus uptake over the rest of the planting densities. Similarly, the plant spacing S_2 was observed to be

Table 1 : Mean yield of brinjal (t ha^{-1}) as affected by different irrigation treatments and water use efficiency

Sr. No.	Treatments	Yield (t ha^{-1})	Water applied (ha-cm)	W.U.E. (kg $ha\text{-}cm^{-1}$)
1.	$S_1I_1F_1$	34.25	34.96	979.7
2.	$S_1I_1F_2$	31.49	34.96	900.9
3.	$S_1I_2F_1$	34.99	23.31	1500.7
4.	$S_1I_2F_2$	30.30	23.31	1299.9
5.	$S_1I_3F_1$	33.85	11.65	2905.3
6.	$S_1I_3F_2$	30.54	11.65	2621.2
7.	$S_2I_1F_1$	34.36	34.96	982.9
8.	$S_2I_1F_2$	31.92	34.96	913.1
9.	$S_2I_2F_1$	35.73	23.31	1532.8
10.	$S_2I_2F_2$	34.12	23.31	1463.7
11.	$S_2I_3F_1$	36.48	11.65	3131.7
12.	$S_2I_3F_2$	34.42	11.65	2954.5
13.	$S_3I_1F_1$	44.04	34.96	1259.7
14.	$S_3I_1F_2$	32.04	34.96	916.6
15.	$S_3I_2F_1$	40.07	23.31	1719.1
16.	$S_3I_2F_2$	31.65	23.31	1357.8
17.	$S_3I_3F_1$	37.63	11.65	3230.5
18.	$S_3I_3F_2$	33.64	11.65	2887.8
19.	C_1(ab. Control)	11.88	65	182.7
20.	C_2	36.57	65	562.6

statistically superior to plant spacing S_1. With respect to value of phosphorus content in fruit, the irrigation level I_1 (0.6PE) and I_2 (0.4PE) both were found at par with each other and found significantly superior over the irrigation level I_3 (0.2PE) under study. In case of value of phosphorus content in leaf, the irrigation level I_1 (0.6PE) recorded significantly superior value over the I_3 level but at par with I_2. Also the similar trend observed in irrigation level I_2 (0.4PE) over I_3 (0.2PE).

With respect to value of phosphorus content in stem, the irrigation level I_1 (0.6PE) was found significantly superior over the rest of irrigation level. The irrigation level I_2 (0.4PE) was at par with irrigation level I_3 (0.2PE) under study. In case of phosphorus uptake by fruit, the irrigation level I_1 (0.6PE) and I_2 (0.4PE) both were found at par with each other and significantly superior over I_3 level. In case of phosphorus uptake by leaf and stem, the irrigation level I_1 (0.6PE) showed significantly superior value over the rest of treatments. Similarly, the treatment I_2 (0.4PE) was significantly superior to treatment I_3 (0.2PE). In case of total phosphorus uptake irrigation level I_1 recorded significantly superior value over the rest of irrigation levels. Also the similar trend was observed in irrigation level I_2 over I_3. The fertigation level F_1 [100 % RDF through drip irrigation (WSF)] recorded significantly superior value of phosphorus content in fruit, leaf and stem over the fertigation level F_2 (80 per cent RDF through drip irrigation (WSF)) under study. In case of phosphorus uptake by fruit, leaves, stem and total phosphorus uptake the fertigation level F_1 [100 % RDF through drip irrigation (WSF)] noticed significantly superior value over the fertigation level F_2 [80 % RDF through drip irrigation (WSF)] under study.

Table 2 : Mean nitrogen content (%), nitrogen uptake by fruit, leaf, stem and total nitrogen uptake (kg ha^{-1}) as influenced by different treatments

Treatments	Content N (%)			N uptake (kg ha^{-1})			Total N uptake (kg ha^{-1})
	Fruit	Leaf	Stem	Fruit	Leaf	Stem	
Plant spacing							
S_1 – 75cm x 75 cm	1.45	2.40	1.74	82.25	20.07	28.91	131.2
S_2 – 75cm – 50 x 90 cm	1.54	2.50	1.83	88.89	21.17	31.69	141.7
S_3 – 175cm - 50 x 50 cm	1.63	2.59	1.92	95.28	22.17	34.37	151.8
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0008	0.0016	0.0013	0.0469	0.0179	0.0515	0.1059
C.D. (P=0.05)	0.0025	0.0048	0.0040	0.1407	0.0538	0.1544	0.3177
Irrigation levels							
I_1 – 0.6 PE	1.57	2.53	1.86	90.94	21.50	32.59	145.0
I_2 – 0.4 PE	1.54	2.50	1.83	88.76	21.13	31.66	141.5
I_3 – 0.2 PE	1.51	2.47	1.80	86.72	20.79	30.72	138.2
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0008	0.0016	0.0013	0.0469	0.0179	0.0515	0.1059
C.D. (P=0.05)	0.0025	0.0048	0.0040	0.1407	0.0538	0.1544	0.3177
Fertilizer levels							
F_1 – 100% RDF through drip	1.57	2.52	1.86	90.59	21.43	32.39	144.4
F_2 – 80% RDF through drip	1.52	2.47	1.80	87.02	20.85	30.93	138.8
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0030	0.0026	0.0026	0.134	0.0288	0.0943	0.0841
C.D. (P=0.05)	0.0091	0.0078	0.0078	0.402	0.0865	0.2828	0.2523
Control treatments							
C_1 – Absolute control	1.22	2.15	1.50	29.69	9.040	13.87	52.62
C_2 –100% RDF as soil appli.	1.38	2.35	1.67	66.29	15.98	23.54	105.8
Interaction effects							
Sp. x Irr.	0.0012	0.0022	0.0019	0.0663	0.0254	0.0728	0.1498
Sp. x Fert.	0.0052	0.0045	0.0045	0.2322	0.0500	0.1634	0.1457
Irr. x Fert.	0.0052	0.0045	0.0045	0.2322	0.0500	0.1634	0.1457
Sp. x Irr. x Fert.	0.0091	0.0078	0.0078	0.4023	0.0866	0.2830	0.2524
'F' test	NS	NS	NS	NS	NS	NS	NS

NS=Non-significant

While the treatment C_2 (100% RDF through soil application) in combination of surface irrigation with 1.0 IW/ CPE ratio showed reduced average values of phosphorus content in fruit, leaf and stem, phosphorus uptake by fruit, leaves, stem and total phosphorus uptake as compared to all irrigation and fertigation levels. However, the lowest average values were recorded in treatment C_1 (absolute control). Effect of interaction was found to be non significant in case of phosphorus content and total uptake by brinjal plant.

Potassium uptake studies:

The data pertaining to potassium content in fruit, leaves and stem (%), mean potassium uptake by fruit, leaves, stem and total potassium uptake (kg ha^{-1}) as influenced by various treatments are presented in Table 4. It was observed that the plant spacing S_3 (175cm-50cm x 50cm) showed significantly higher value of potassium content in fruit, leaf and stem over the rest of plant spacing under study. Similarly, the spacing S_2 (50cm x 90cmx75cm) noticed statistically superior to spacing S_1 (75cm x75cm).

In case of total potassium uptake plant spacing S_3 (175cm-50x50cm) recorded significantly higher value over the rest of spacing's. Similarly, the spacing S_2 (75-50x90cm) shown statistically higher value to spacing S_1 (*i.e.*75cmx75cm). With respect to value of potassium content in fruit, the irrigation level I_1 (0.6PE) was found significantly superior over the irrigation level I_3 (0.2PE). The irrigation level I_1 (0.6PE) was at par with the irrigation level I_2 (0.4PE). Similarly, the irrigation level I_2 (0.4PE) and I_3 (0.2PE) both were at par with each other in respect of potassium content in

Table 3 : Mean phosphorous content (%), phosphorus uptake by fruit, leaf, stem and total phosphorus uptake (kg ha^{-1}) as influenced by different treatments

Treatments	Content P (%)			P uptake (kg ha^{-1})			Total P uptake (kg ha^{-1})
	Fruit	Leaf	Stem	Fruit	Leaf	Stem	
Plant spacing							
S_1 – 75cm x 75 cm	0.30	1.17	0.76	16.96	9.788	12.77	39.52
S_2 – 75cm – 50 x 90 cm	0.31	1.25	0.79	17.91	10.59	13.63	42.14
S_3 – 175cm - 50 x 50 cm	0.32	1.33	0.82	18.65	11.38	14.66	44.70
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.±	0.0041	0.0017	0.0024	0.2344	0.0164	0.0413	0.2384
C.D. (P=0.05)	0.0124	0.0052	0.0072	0.7028	0.0493	0.1238	0.7147
Irrigation levels							
I_1 – 0.6 PE	0.32	1.28	0.80	18.47	10.86	13.97	43.31
I_2 – 0.4 PE	0.31	1.25	0.79	18.09	10.57	13.68	42.35
I_3 – 0.2 PE	0.29	1.22	0.78	16.96	10.33	13.41	40.71
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.±	0.0041	0.0017	0.0024	0.2344	0.0164	0.0413	0.2384
C.D. (P=0.05)	0.0124	0.0052	0.0072	0.7028	0.0493	0.1238	0.7147
Fertilizer levels							
F_1–100% RDF through drip	0.32	1.27	0.85	18.52	10.81	14.80	44.13
F_2 – 80% RDF through drip	0.30	1.23	0.73	17.16	10.36	12.58	40.11
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.±	0.0029	0.0033	0.0024	0.1637	0.0319	0.0469	0.1743
C.D. (P=0.05)	0.0088	0.0101	0.0072	0.4909	0.0959	0.1408	0.5226
Control treatments							
C_1 – Absolute control	0.20	0.96	0.65	5.030	4.030	6.030	15.10
C_2–100% RDF as soil appli.	0.27	1.10	0.71	13.28	5.220	10.10	28.61
Interaction effects							
Sp. x Irr.	0.0058	0.0024	0.0033	0.3315	0.0232	0.0584	0.3371
Sp. x Fert.	0.0051	0.0058	0.0041	0.2836	0.0554	0.0813	0.3019
Irr. x Fert.	0.0051	0.0058	0.0041	0.2836	0.0554	0.0813	0.3019
Sp. x Irr. x Fert.	0.0088	0.0100	0.0078	0.4912	0.0959	0.1409	0.5230
'F' test	NS	NS	NS	NS	NS	NS	NS

NS=Non-significant

fruit. In case of potassium content in leaf, the irrigation level I_1 (0.6PE) recorded significantly superior value over the rest of irrigation levels followed by the irrigation level I_2 (0.4PE).

In case of potassium content in stem, the irrigation level I_1 (0.6PE) was found significantly superior over the rest of irrigation levels under study. Similarly, the irrigation level I_2 (0.4PE) was statistically superior to irrigation level I_3 (0.2PE). In case of potassium uptake by fruit and stem, the irrigation level I_1 (0.6PE) was found significantly superior over the rest of the irrigation levels. Also the similar trend was observed in irrigation level I_2 (0.4PE) over I_3 (0.2PE). With respect to values of potassium uptake by leaves the irrigation level I_1 (0.6PE) was found significantly superior over the rest of the irrigation levels. However, irrigation level I_2 (0.4PE) was at par with the irrigation level I_3 (0.2PE) under study.

In case of total potassium uptake irrigation level I_1 (0.6PE)

Table 4 : Mean potassium content (%), potassium uptake by fruit, leaf and stem, total potassium uptake (kg ha^{-1}) as influenced by different treatments

Treatments	Content K (%)			K uptake (kg ha^{-1})			Total K uptake (kg ha^{-1})
	Fruit	Leaf	Stem	Fruit	Leaf	Stem	
Plant spacing							
S_1 – 75cm x 75 cm	2.80	1.52	1.22	158.8	12.72	20.31	191.9
S_2 – 75cm – 50 x 90 cm	2.83	1.55	1.31	163.1	13.12	22.71	199.0
S_3 – 175cm - 50 x 50 cm	2.87	1.59	1.40	167.5	13.58	25.08	206.2
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0033	0.0026	0.0014	0.1863	0.0344	0.0447	0.1990
C.D. (P=0.05)	0.0100	0.0080	0.0042	0.5587	0.1033	0.1340	0.5966
Irrigation levels							
I_1 – 0.6 PE	2.85	1.56	1.34	164.4	13.25	23.50	201.1
I_2 – 0.4 PE	2.84	1.55	1.31	163.0	13.11	22.72	198.9
I_3 – 0.2 PE	2.83	1.54	1.28	162.1	13.05	21.88	197.0
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0033	0.0026	0.0014	0.1863	0.0344	0.0447	0.1990
C.D. (P=0.05)	0.0100	0.0080	0.0042	0.5587	0.1033	0.1340	0.5966
Fertilizer levels							
F_1 – 100% RDF through drip	2.89	1.61	1.34	166.6	13.59	23.35	203.6
F_2 – 80% RDF through drip	2.79	1.49	1.28	159.7	12.69	22.05	194.4
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.0029	0.0029	0.003	0.1664	0.0330	0.0444	0.1749
C.D. (P=0.05)	0.0087	0.0086	0.010	0.4991	0.0991	0.1332	0.5245
Control treatments							
C_1 – Absolute control	2.52	1.23	0.92	116.75	6.39	10.19	133.3
C_2 –100% RDF as soil appli.	2.72	1.42	1.16	150.05	9.70	16.35	176.1
Interaction effect							
Sp. x Irr.	0.0047	0.0038	0.0019	0.2635	0.0487	0.0632	0.2814
Sp. x Fert.	0.0050	0.0050	0.0060	0.2883	0.0572	0.0769	0.3030
Irr. x Fert.	0.0050	0.0050	0.0060	0.2883	0.0572	0.0769	0.3030
Sp. x Irr. x Fert.	0.0080	0.0087	0.0104	0.4994	0.0992	0.1332	0.5248
'F' test	NS	NS	NS	NS	NS	NS	NS

NS=Non-significant

Table 5 : Fertilizer use efficiency (%) as influenced by different fertilizer treatments

Treatments	N	P	K
C_1 – Absolute control	-	-	-
C_2-100 per cent RDF through soil application	35.45	27.02	85.6
F_1-100 per cent RDF through drip	61.18	58.06	140.6
F_2-80 per cent RDF through drip	71.81	62.52	153.7

recorded significantly higher value over the rest of irrigation levels. Similarly, the irrigation level I_2 (0.4PE) observed to be statistically superior to irrigation level I_3 (0.2PE). The fertigation level F_1 [100 % RDF through drip irrigation (WSF)] was found significantly superior in respect of value of potassium content in fruit, leaf and stem over the fertigation level F_2 [80 % RDF through drip irrigation (WSF)]. In case of potassium uptake by fruit, leaves and stem the fertigation level F_1 [100 % RDF through drip irrigation (WSF)] recorded significantly more uptake of potassium by fruit, leaves and stem over the fertigation level F_2 [80 per cent RDF through drip irrigation (WSF)].In case of total potassium uptake treatment F_1 [100 % RDF through drip irrigation (WSF)] recorded significantly superior value over the treatment F_2 [80 % RDF through drip irrigation (WSF)]. While the treatment C_2 (100% RDF through soil application) in combination of surface irrigation with 1.0 IW/CPE ratio showed reduced average values of potassium content in fruit, leaf and stem, mean potassium uptake by fruit, leaves, stem and total potassium uptake as compared to all irrigation and fertigation treatments. However, the lowest average values were recorded in treatment C_1 (absolute control).

Effect of interaction:

The interaction effect was found to be non significant in case of values of potassium content in fruit, leaf and stem, mean potassium uptake by fruit, leaves, stem and total potassium uptake by brinjal crop.

Fertilizer use efficiency(FUE):

The fertilizer use efficiency was worked out from the value obtained by nutrient uptake using the formula :

$$\text{FUE} = \frac{\text{Uptake intreated plot – uptake in control plot}}{\text{Amount of nutrient applied}} \text{ x } 100$$

The data presented in Table 5 show that, the maximum fertilizer use efficiency *i.e.* 71.81, 62.52 and 153.7 per cent of N, P and K, respectively was recorded with treatment F_2 (80 per cent RDF through fertigation) whereas in case of treatment F_1 fertilizer use efficiency of N, P and K was 61.18, 58.06 and 140.6 per cent, respectively which was comparatively less as compared to treatment F_2. However, minimum fertilizer use efficiency of N, P and K to the tune of 35.45, 27.02 and 85.6 per cent, respectively was observed in treatment C_1 (100 % RDF through soil application).

Conclusions:

Total water requirement for growing brinjal in Konkan region of Maharashtra was found to be 37 ha-cm (3900 m^3 ha^{-1}) using drip irrigation system. The highest yield of brinjal (44.0 t ha^{-1}) was found in $S_3I_1F_1$ treatment.

The plant spacing S_3 (175cm- 50cm x 50cm) recorded significantly higher value of total nitrogen, phosphorus, potassium uptake over rest of the plant spacing.

The maximum fertilizer use efficiency of NPK was recorded with fertilizer level F_2.

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