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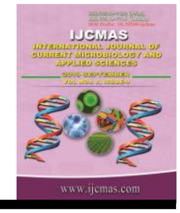

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Effect of Drip Fertigation with Different Fertilizer Levels and Traditional Method of Fertilizer Application on Growth and Yield of Brinjal

Mayur P. Adawadkar*, Mahendra M. Deshmukh and Sudhir B. Wadatkar

Department of Irrigation and Drainage Engineering, Dr. PDKV, Akola, India

**Corresponding author:*

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ABSTRACT

A field experiment was conducted to study the comparison of brinjal production under drip fertigation and traditional method of fertilizer application, at Dr. PDKV, Akola during November 2017 to May 2018. The experiment was laid out in randomized block design with five treatments which includes four drip fertigation levels (75, 100, 125, and 150 % of RDF) and control treatment of traditional fertilization at 100 % RDF and these all treatments are replicated four times. The study indicated higher plant growth, more number of branches, higher number of fruits per plant and enhancement in the yield under all drip fertigation levels. Yield of brinjal was maximum in treatment of drip fertigation at 150 % RDF (T_4) (557.10 q/ha) and found at par with treatment of drip fertigation at 125 % RDF (T_3) (554.88 q/ha). But the advantage in treatment T_3 was requirement of 25 % less amount of fertilizer. Considering requirement of less amount of fertilizer in treatment T_3 than treatment T_4; the treatment T_3 may be suggested as a best treatment. Minimum yield of brinjal was found in treatment of traditional fertilization at 100 % RDF. Highest irrigation water use efficiency i.e. 7.33 q/ha-cm, was found in treatment of drip fertigation at 150 % RDF (T_4) followed by treatment of drip fertigation at 125 % RDF (T_3).

Introduction

Brinjal or eggplant or aubergine (*Solanum melongena* L.) belongs to family Solanaceae and is one of the most common and popular vegetable crop grown in Ind ia and other parts of the world. Brinjal is a staple vegetable in our diet. It is liked both by poor and rich people. It is quite high in nutritive value and can be compared with tomato.

It contains 92.7 % water, 1.4 % protein, 4.0 % carbohydrates, 0.3 % fats, 0.3% minerals, 1.3 % fibre (Aykroyd, 1963). India is leading country next to China in the production of brinjal. Area and production of brinjal in India during 2015-16 was 662.54 thousand hectares and 12510 thousand MT, respectively; with the productivity of 17.07 MT/ha. Whereas, in Maharashtra the area and production of brinjal was 21.09 thousand hectares and 407.64 thousand MT, respectively; with the productivity of 19.33 MT/ha. (National Horticultural Board Database, 2017). Drip irrigation has proved its superiority over other methods of irrigation due to the direct application of water and nutrients in the vicinity of the root zone. Improper management of water and nutrient has contributed extensively to the current water scarcity and pollution problems in many parts of the world and is also a serious challenge to future food security and environmental sustainability. Bringing more area under irrigation would depend largely upon efficient use of water. In this context, micro-irrigation has a most significant role to achieve not only higher productivity and water use efficiency but also to have sustainability with economic use and productivity.

In conventional fertilization, there are high chances of leaching and volatization of nutrients, nonuniform and irregular supply, groundwater contamination and soil compaction. Moreover, in traditional method nutrient supply is not in tune with crop development phase and higher nutrient doses are adopted. This results in nutrient losses and low fertilizer use efficiency. Hence one must think about the fertigation when drip irrigation is used.

Fertigation is a process in which fertilizer is dissolved, diluted and distributed along with water in drip irrigation system. In order words, it is the process or application of water-soluble solid fertilizer or liquid fertilizers through drip irrigation system. Drip fertigation increases nutrient uptake by plants along with relatively uniform application and distribution of fertilizers in the effective root zone of the crop all over the field. It provides flexibility in timing of application and nutrient application can be controlled at the precise time and rate. Fertigation reduces leaching of fertilizer below the root zone and minimizes the nutrient loss, which in turn results into high fertilizer use efficiency. Drip fertigation not only save fertilizer but also labour and energy cost.

Materials and Methods

The experiment was carried out with an objective to assess the response of *Rabi* brinjal (*solanum melongena* L.) to different fertilizer levels and traditional method of fertilizer application in term of growth and yield. A suitable drip set was required for irrigating the crop through drip irrigation. The ridges were formed at 90 cm spacing with approximately height of 30 cm. The irrigation system mainly consists of mainline, sub mainline, inline lateral, screen filter, fertigation tank, accessories such as control valve, Tee, reducer, elbow, coupling, G.T.O etc. The experiment was arranged in a randomized block design with five treatments with four replications. Silver polyethylene mulch paper was used to save water and prevention of weed growth.

The five treatments are:

- $T_{1:}$ Drip fertigation with 75% of RDF + 80% ETc.
- $T_{2:}$ Drip fertigation with 100% of RDF + 80% ETc.
- $T_{3:}$ Drip fertigation with 125% of RDF + 80% Etc
- $T_{4:}$ Drip fertigation with 150% of RDF + 80% ETc.
- $T_{5:}$ Traditional application of fertilizer with 100% RDF (Soil application of basal dose of 50% N+ 100% P+ 100% K through solid fertilizer at the time of transplanting and remaining 50% N in two splits at 30 and 45 DAT) + 80% ETc. (control).

Irrigation water was aaplied at the rate of 80% crop evapotranspiration (ET_C), because of use of polyethylene mulch paper. The recommended fertilizer dose of 150:75:75 N:P:K Kg/ha was taken. In treatments T_1 to T_4, water soluble fertilizers (source- 19:19:19 WSF complex and urea) through drip fertigation was applied in 18 splits at an interval of 10 days. Out of which, during first 60 days after transplanting (DAT) i.e. in vegetative growth stage; $^{1}/_{4}$th of total fertilizer dose was applied in 6 equal splits at an interval of 10 days and remaining $^{3}/_{4}$th of total fertilizer dose was applied after 60 DAT in 12 equal splits at an interval of 10 days as per fertilizer level in respective treatment.

In control treatment T_5, soil application of basal dose of 50% N + 100% P + 100% K (sources – Urea, MOP, and SSP) were given as traditional fertilization through solid fertilizers at the time of transplanting and remaining 50% of N (source-Urea) was given in two splits at 30 and 45 DAT through drip fertigation.

Results and Discussion

Growth observations

Effect of different fertilizer levels on plant height (cm)

Plant height of brinjal crop was recorded at 30, 60, 90, 120 days after transplanting (DAT) and at harvest. The data obtained in respect to plant height was presented in Table 2.

It is seen from the observations that during initial growth stages (30 and 60 DAT) of brinjal crop, the maximum plant height was found in control treatment T_5 i.e. in traditional soil application of fertilizer with 100 % recommended dose of fertilizer (RDF). This high growth of plant in treatment T_5 may be due to that whole fertilizer dose was given during initial growth stage of crop i.e. before 60 DAT. However at 90, 120 DAT and at harvest highest plant height was observed in treatment T_4 (Drip fertigation at 150% RDF) and it was found to be at par with treatment T_3 (Drip fertigation at 125 % RDF) followed by treatment T_2 (Drip fertigation at 100 % RDF) and T_1 (Drip fertigation at 75 % RDF). Lowest plant height was observed in treatment T_5 (Traditional fertilization at 100 % RDF) and it was found at par with treatment T_1 (Drip fertigation at 75 % RDF) at 90, 120 DAT, and at harvest.

Effect of different fertilizer levels on number of branches per plant

Data pertaining to number of branches per plant as influenced by various treatments are presented in Table 3.

It is observed from the observations that during initial growth stages (30 and 60 DAT) highest number of branches per plant were observed in control treatment, T_5 may be due to that in treatment T_5 full dose of fertilization was applied within 60 DAT.

At 90 DAT, significantly highest number of branches per plant were observed in treatment T_4 (Drip fertigation at 150 % RDF) and it was found to be at par with treatments T_2 (Drip fertigation at 100 % RDF) and T_3 (Drip fertigation at 125 % RDF).

At 120 DAT and at harvest, treatment T_4 (Drip fertigation at 150% RDF) showed significantly highest number of branches per plant over other treatments. However, it was at par with treatment T_3. Whereas lowest number of branches per plant was observed in treatment T_5 (Traditional fertilization at 100% RDF) and was found at par with treatment T_1.

Effect of different fertilizer levels on canopy cover

It was observed from the observations that initially at 30 DAT of brinjal crop, the significantly highest canopy cover was found in treatment T_5 (Traditional fertilization at 100 % RDF). Whereas, other drip fertigation treatments were found at par. However at 60

DAT, canopy cover in treatment T_5 (Traditional fertilization at 100 % RDF) was found to be highest and at par with treatments T_2, T_3, and T_4. Thus higher canopy cover in treatment T_5 may be due to initial higher doses of fertilizers.

At 90 DAT, the highest canopy cover was observed in treatment T_4 (Drip fertigation at 150 % RDF) and it was found to be at par with treatment T_3 (Drip fertigation at 125 % RDF). Similarly treatment T_2 (Drip fertigation at 100 % RDF) was found to be at par with treatments T_3 and T_5 in respect of canopy cover. However the lowest canopy cover was observed in treatment T_5 (Traditional fertilization at 100 % RDF) and it was found at par with treatment T_1.

At harvest, significantly highest canopy cover was observed in treatment T_4 (Drip fertigation at 150 % RDF) and it was found to be at par with treatment T_3 (Drip fertigation at 125 % RDF). However lowest canopy cover was recorded in treatment T_5, which was found at par with treatment T_1 (Drip fertigation at 75 % RDF) and T_2 (Drip fertigation at 100 % RDF).

Yield contributing observations

Effect of different fertilizer levels on number of fruits per plant

The data of number of fruits harvested per plant as influenced by drip fertigation with different fertilizer levels and traditional method of fertilizer application is presented in Table 5.

The results revealed that there was increase in number of fruits per plant as the fertigation levels increased. Treatment T_4 (Drip fertigation at 100% RDF) showed significantly highest number of fruits per plant (98.60) over treatments T_1, T_2 and T_5. However, it was found at par with treatment T_3 (Drip fertigation at 125 % RDF). Lowest number of fruits per plant was recorded in treatment T_5 (Traditional fertilization at 100 % RDF, 70.78). The higher number of fruits were observed in drip fertigation treatments as compared to traditional method of fertilizer application with solid fertilizer may be due to frequent and required application of nutrients along with irrigation water within effective root zone of crop thereby, increasing the availability of nutrients in soil which has increased the number of fruits in fertigation treatments.

Effect of different fertilizer levels on Yield of fruit per plant

The data of yield of fruits harvested per plant as influenced by drip fertigation with different fertilizer levels and traditional method of fertilizer application is presented in Table 6

The results revealed that there was increase in yield of fruits per plant as the fertigation level increased. Significantly highest yield of fruit per plant was observed in treatment T_4 (Drip fertigation at 150 % RDF) over treatments T_1, T_2 and T_5. However, it was found to be at par with treatment T_3 (Drip fertigation at 125 % RDF). Lowest yield of fruit per plant was recorded in treatment T_5 (Traditional fertilization at 100 % RDF).

The highest yield of fruits per plant were observed in drip fertigation treatments as compared to traditional method of fertilizer application with solid fertilizers, may be due to frequent and required application of nutrients through drip system which may causes high uptake of nutrients by plants.

Effect of different fertilizer levels on Yield of brinjal

As the brinjal crop is vegetable crop, its harvesting was done from time to time by picking of fruits. The complete harvesting was obtained by 20 pickings. The data pertaining to average yield of brinjal as influenced by drip fertigation with different fertilizer levels and traditional method of fertilizer application is presented in Table 7. The yield of brinjal was influenced significantly due to different fertigation levels. Treatment T_4 (Drip fertigation at 150 % RDF) recorded significantly highest yield of brinjal (557.10 q/ha) and it was found at par with treatments T_3 (Drip fertigation at 125 % RDF), which is followed by treatments T_2 and T_1.

Table.1 Experimental details

Sr. No.	Particulars	Specifications
1	Crop	Brinjal
2	Scientific name	*Solanum melongena* L.
3	Variety	Phule Krishna Hy.
4	Experimental Design	Randomized Block Design
5	Number of treatments	5
6	Number of replications	4
7	Number of plots	20
8	Plot size	3.75 m × 5.4 m
9	Season	Rabi
10	Crop spacing	0.90 X 0.75 m
11	Crop period	180 days
12	Recommended fertilizer dose	150:75:75
13	Date of transplanting	16^{th} November, 2018
14	No of picking	20

Table.2 Effect of different fertilizer levels on plant height (cm) at successive crop growth stages in brinjal

Treatments	Plant height (cm)				
	30 DAT	**60 DAT**	**90 DAT**	**120 DAT**	**At Harvest**
T_1 (Drip fertigation at 75 % RDF)	10.83	32.49	68.65	71.77	73.06
T_2 (Drip fertigation at 100 % RDF)	11.35	35.00	79.57	80.65	82.48
T_3 (Drip fertigation at 125 % RDF)	12.43	39.10	88.11	89.64	91.64
T_4 (Drip fertigation at 150% RDF)	13.03	39.58	89.84	90.42	92.07
T_5 (Traditional fertilization at 100 % RDF)	13.75	41.34	68.21	71.17	72.60
F – Test	NS	Sig.	Sig.	Sig.	Sig
SE (m) ±	0.74	1.40	2.65	2.82	2.97
CD at 5%	-	4.31	8.17	8.68	9.15
CV%	12.06	7.46	8.13	8.48	7.21

Table.3 Effect of different fertilizer levels on number of branches per plant at successive crop growth stages in brinjal

Treatments	Number of branches per plant				
	30 DAT	60 DAT	90 DAT	120 DAT	At Harvest
T_1 (Drip fertigation at 75 % RDF)	4.45	10.60	13.25	15.05	15.90
T_2 (Drip fertigation at 100 % RDF)	4.47	11.90	15.65	17.43	18.25
T_3 (Drip fertigation at 125 % RDF)	5.00	12.25	17.05	20.33	21.10
T_4 (Drip fertigation at 150% RDF)	5.11	12.60	17.15	20.90	21.50
T_5 (Traditional fertilization at 100 % RDF)	5.50	12.90	13.10	14.23	14.95
F – Test	NS	NS	Sig.	Sig.	Sig.
SE (m) ±	0.30	0.73	0.72	0.74	0.72
CD at 5%	-	-	2.23	2.27	2.21
CV%	12.13	12.07	9.50	8.38	7.84

Table.4 Effect of different fertilizer levels on canopy cover (cm2) at successive crop growth stages in brinjal

Treatments	Canopy cover (cm^2)			
	30 DAT	60 DAT	90 DAT	At Harvest
T_1 (Drip fertigation at 75 % RDF)	519.03	2716.25	3715.29	4085.14
T_2 (Drip fertigation at 100 % RDF)	581.13	3085.96	4182.72	4594.32
T_3 (Drip fertigation at 125 % RDF)	625.39	3290.88	4636.11	5193.52
T_4 (Drip fertigation at 150% RDF)	639.90	3321.40	4679.25	5198.18
T_5 (Traditional fertilization at 100 % RDF)	867.57	3578.77	3710.56	4002.64
F – Test	Sig.	Sig.	Sig.	Sig.
SE (m) ±	41.42	175.97	151.92	190.41
CD at 5%	127.61	542.17	468.09	586.66
CV%	12.81	11.00	8.83	8.25

Table.5 Effect of different fertilizer levels on number of fruits

Treatments	Number of fruits per plant
T_1 (Drip fertigation at 75 % RDF)	71.85
T_2 (Drip fertigation at 100 % RDF)	85.15
T_3 (Drip fertigation at 125 % RDF)	98.35
T_4 (Drip fertigation at 150% RDF)	98.60
T_5 (Traditional fertilization at 100 % RDF)	70.78
F – Test	Sig.
SE (m) ±	4.27
CD at 5%	13.16
CV%	10.06

Lowest yield of brinjal was observed in treatment T_5 (Traditional fertilization at 100% RDF, 428.56 q/ha), which may be due to less availability of nutrients at flowering and fruiting stage of crop, as whole fertilizer dose was given in vegetative growth stage itself in this treatment.

It was seen that yield of brinjal in treatment T_4 was found to be higher than that of treatment T_3, which was statistically at par. But the advantage in treatment T_3 was requirement of 25 % less amount of fertilizer. Considering requirement of less amount of fertilizer in treatment T_3 than treatment T_4; the treatment T_3 may be suggested as a best treatment. The higher yields in drip fertigation treatments may be due to regular availability of nutrients to plants by frequent application of nutrients in 10 days interval; avoiding leaching of soluble fertilizers applied with measured and required amount irrigation water. Whereas, in traditional fertilization treatment, yield level may be low due to application of 50 % N, 100 % P and 100 % K nutrients at the time of transplanting and remaining 50 % N at 30 and 45 DAT; the result showed that lack of nutrients availability in later stages, which might affected the flowering and fruiting of crop.

In conclusion,

1. Though treatment of drip fertigation at 150 % RDF (T_4) recorded higher yield than treatment of drip fertigation at 125 % RDF (T_3) which was statistically at par; there is 25 % less requirement of amount of fertilizer in treatment of drip fertigation at 125 % RDF (T_3). Hence treatment of drip fertigation at 125 % RDF (T_3) may be considered as best treatment.

2. Drip fertigation with fertilizer level of 125 % RDF along with silver polyethylene mulch was found superior to obtain higher yield of brinjal.

References

Anonymous,(2017). National Horticultural Board Database 2015-16 – NHB.

Aykroyd, W.R, (1963). Composition of brinjal fruit. ICMR Special Rept.pp.42.

Antony E and Singandhupe R B, (2004). Impact of drip and surface irrigation on growth, yield and WUE of capsicum (*capsicum annum* L.). *Agricultural Water Management,* 65: 121–132.

Ndereyimana A., S. Praneetha, L.Pungalendhi, (2013), Earliness and yield parameter of eggplant (*Solanum melongena* L.) grafts under different spacing and fertigation levels. African Journal of Plant Science. Vol.7(11), pp. 543-547.

Patel, R.S., Patel, P.G., Patel, J.C. and Patel, M.M., (2006). Effect of fertigaton and nitrogen on growth and yield of brinjal under drip system. J. Maharashtra Agric. Univ. 31(2): 173-175.

Kharde R.P., S.A.Ranpise, M.N.Bhalekar and K.G.Shinde, (2016). Fertigation and irrigation scheduling in brinjal CV. Phule Arjun. Bioinfolet 13(1A): 56-58.

Shinde, P.P., More, V.G., Ramteke, J.R., Chavan, S.A., (2002). Studies on response of brinjal to fertigation. J. Maharashtra Agric. Univ. 27 (3): 260-262.

Ugade S.R., B.L. Ayare, T.N. Thorat, (2014). Effect of irrigation and fertigation levels on yield and nutrient uptake of brinjal (*Solanum melongena* L.), International Journal of Agricultural Engineering Vol.7 Issue 1, 74-80.

Ugade S.R., and U.V. Mahadkar, (2015). Effect of different planting density, irrigation and fertigation levels on growth and yield of brinjal (*Solanum melongena* L.), The Bioscan, The International Quarterly Journal of Life Sciences 10(3): 1205-1211,2015.

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