

ECONOMICS OF BRINJAL (*Solanum melongena* L.) AS AFFECT BY IRRIGATION LEVELS AND FERTIGATION SCHEDULES¹Dnyaneshwar S. Ravankar* ²Abhay P. Wagh, ³Arvind M. Sonkamble, ⁴Prakash K. Nagre, ⁵Mahendra M. Deshmukh, ⁶Sandip S. Hadole

1. (Ph.D. Scholar, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India dsrpdkv@gmail.com,
2. Professor, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.)
3. Associate Dean, College of Horticulture, Akola)
4. Retired Professor and Associate Dean, College of Agriculture, Akola.)
5. Head, Department of Irrigation and Drainage Engineering, Faculty of Agricultural Engineering and Technology, Akola)
6. Associate Professor, Soil Science and Agricultural chemistry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India.

MS Received: 27.06.2025; MS Revised: 28.07.2025; MS Accepted: 29.07.2025)



MS 3417

(RESEARCH PAPER IN VEGETABLE SCIENCE)

Abstract

A field experiment was carried out to study the economic analysis of brinjal at Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2019-20 and 2020-21. The experiment was laid out in Strip Plot Design with nine treatment combinations and each treatment replicated thrice. The treatments comprised of three irrigation levels (I) viz., I₁ (60% of irrigation water requirement), I₂ (80% of irrigation water requirement) and I₃ (100% of irrigation water requirement) and three fertigation schedules (S) viz., S₁ (RDF at 3 days interval upto 130 DAT), S₂ (RDF at 6 days interval upto 130 DAT) and S₃ (RDF at 9 days interval upto 130 DAT). The results of the experiment revealed that, highest B:C ratio (1.78, 1.99 and 1.89) of brinjal recorded under application of 100% irrigation level along with fertigation schedule at 6 days interval. At the same time, highest cost of cultivation and net return also were higher in same treatment. The economic analysis stated that the yield and income of farmers can be increased with help of irrigation and fertigation technology in brinjal cultivation.

Key word: Brinjal, Irrigation, fertigation, Economics of brinjal, Schedule.

Introduction

Brinjal (*Solanum melongena* L.) belongs to the solanaceae family is a popular vegetable crop grown in the subtropics and tropics and referred by various names viz., eggplant and aubergine etc. India is regarded as centre of origin and diversity of brinjal. It is a typical day neutral plant. Brinjal is quite diverse and more versatile, both in the garden and in the kitchen. The brinjal responds well under slightly acidic soils, having pH in the range of 5.5 – 6.5. However, pH upto 7.5 is also suitable.

Water plays vital role in improving plant growth and crop production. It is the most limiting factor in Indian agricultural scenario. Water saving from drip irrigation system varied from 50 to 75% for different crops besides increasing the production of crops. Due to limiting factor, efficient use of available irrigation water is essential for increasing agricultural production for the alarming Indian population. Water availability for irrigation is going to be a major constraint for agriculture in near future. Hence, judicious use of the available water resources through more efficient methods of water application like drip irrigation under precision farming or cultivation becomes necessary to enhance yield and water use efficiency (Dunage *et al.*, 2010).

Besides water the most critical input which seriously affects the growth and yield of crop is nutrients or fertilizers. Fertilizer being costly input, every effort needs to be made to enhance fertilizer use efficiency by the crop. Drip fertigation is an important irrigation-cum-nutrient application method in crop production; particularly in arid and semi-arid regions where there is a high competition for available water resources.

Fertigation combines two main inputs required for plant growth and development i.e. water and nutrients. The right combination of water and nutrients is the key for high yield and quality of any crop. Fertigation is the application of water soluble fertilizer or liquid fertilizer through drip irrigation system. Fertigation allows application of right amounts of plant nutrients uniformly to the wetted root volume zone where most of the active roots are concentrated and this helps enhance nutrient use efficiency. Application of nutrients can be controlled at the precise time and rate necessary. It minimized risk of the roots contracting soil borne diseases through the contaminated.

Plant nutrients can be applied in the correct dosage and at the required time appropriate for each specific growth stage. Fertilizers applied under conventional methods of irrigation are generally not efficiently used by the crop. Hence reduction in fertilizer rate is possible without compromising on the yield of crop in fertigation (Hebbbar *et al.*, 2004). Fertigation also enables the productive use of saline and marginal soils,

sand dunes and mountain slopes bringing them into agriculturally productive soil, it also enables efficient use of nutrients, saving of labor, reduction of weed growth and herbicide usage as well as the use of low quality water which makes fertigation economically profitable. Proper fertigation management requires the knowledge of soil fertility status and nutrient uptake pattern of the crop. Monitoring of soil and plant nutrient status is an essential safeguard to ensure maximum crop productivity. Fertilizer management or fertilizer scheduling is the most important agro-technique to maximizing the productivity of crop. Thus, a precise scheduling of fertilizer applications is essential for sustainable vegetable production.

Methodology

The field experiment was conducted at Instructional Farm, Department of Vegetable Science, College of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *summer* season 2019-2020 and 2020-21. Experiment was set out in strip plot design with three different irrigation levels i.e. Irrigation (I₁): 60 % of irrigation water requirement Irrigation (I₂) 80 % of irrigation water requirement and Irrigation (I₃): 100 % of irrigation water requirement and three fertigation schedule viz., schedule (S₁) 3 days interval, schedule (S₂) 6 days interval and Schedule (S₃) 9 days interval. Krishna variety seedlings 30-35 days old, they were transplanted in the main field in 120*60 cm in broad bed furrow with 50-micron silver-black polythene mulch. The recommended fertilizer dose of 150:75:75 N:P:K kg/ha was taken. In all treatments water soluble fertilizers 19:19:19 and urea are used through drip fertigation which was applied in 3 days interval (44 splits), 6 days interval (22 splits) and 9 days interval (15 splits) upto 130 days after transplanting (DAT). The micronutrients were applied through foliar sprays as per requirement.

The amount of water applied under drip irrigation was computed on the basis of crop coefficient, canopy factor, pan coefficient, area and pan evaporation and replenished at every alternate day considering the cumulative pan evaporation of two days. Irrigation to brinjal crop was scheduled on every alternate day considering the cumulative pan evaporation of previous two days. In case of precipitation, it was cumulated for the same previous two days and cumulative rainfall subtracted from cumulative evaporation. If cumulative evaporation was more than cumulative rainfall, then remaining evaporation was taken for calculating the water requirement. The depth of water to be applied per plant was calculated by using Dick Krupp's formula

$$Q = A \times B \times C \times D$$

Where,

- Q = Water requirement per plant (lit/plant)
 A = $ET_o = E_{pan} \times K_p$ (mm)
 B = Crop coefficient (K_c)
 C = Canopy factor
 D = Canopy area allotted per plant (m^2)
 E_{pan} = Cumulative evaporation for two days
 K_p = Pan coefficient (0.8)

Economics (B:C ratio)

Economics of brinjal production by using different irrigation levels and fertigation schedules was worked out by considering the price of inputs and produce, net returns and benefit cost ratios were worked out for each treatment by adopting the following formulae.

Net return ($Rs. ha^{-1}$) = Gross returns ($Rs. ha^{-1}$) – Cost of cultivation ($Rs. ha^{-1}$)

$$\text{Benefit: Cost ratio} = \frac{\text{Gross returns (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

Statistical analysis

The data was assembled from the studied field was statistically examined by ANOVA for strip plot design. Critical difference was figured out at five per cent probability level when the treatment differences were discovered significant and the values were well suited.

Results and Discussion

Yield parameter:

In irrigation level, It is cleared that the maximum fruit yield of brinjal (346.12, 382.27 and 364.19 q/ha) was obtained from 100% irrigation level where as minimum fruit yield of brinjal (291.84, 323.33 and 307.59) was obtained in the treatment 60% irrigation level during both the year and pooled. This might have resulted due to higher irrigation level i.e. 100% maintained the soil moisture at field capacity throughout the crop growth period resulting maximum absorption of moisture and nutrients, which enhanced all the growth attributes resulted in maximum absorbed PAR accompanied with higher rate of photosynthesis and dry matter accumulation towards reproductive parts helped to increased in fruit yield. The results are in conformity with Antony and Singandhupe (2004) in capsicum, Bahadur *et al.* (2006) in tomato, Patil (2006) in brinjal, Aujla *et al.* (2007) in eggplant, Bhogi *et al.* (2010) in brinjal, Khot *et al.* (2013) in chilli, Kharde (2016) in brinjal.

In fertigation schedule, maximum fruit yield (347.90, 383.14, 365.52 q/ha) is obtained in fertigation schedule at 6 days interval and minimum fruit yield (294.04, 328.66 and 311.35 q/ha) was obtained in fertigation schedule at 9 days interval. uniform application of required quantity of nutrients directly in vicinity of the root zone throughout crop growth period increased the nutrient use efficiency which leads to enhance all the growth and yield attributes of crop coupled with increase in physiological processes and efficient translocation of photosynthates towards reproductive growth in terms of yield. Similar results were found by Kadale and Shrikrishna (2002), Al-Ghawas and Al-Mazidi (2004) in tomato, Badr and El-Yazied (2007), Yasser *et al.* (2009), Akanda *et al.* (2012) and Amala and Syriac (2016) in tomato. The treatment combination 100% irrigation requirement with RDF in 22 equal splits at every 6 days interval up to 130 days after transplanting registered maximum fruit yield per plant (367.49, 406.55 and 387.02) This might be due brinjal crop experienced non stress condition owing to its luxurious growth and frequent fertigation in smaller quantity results in enhanced nutrient use efficiency resulted increase fruit yield per plant and fruit yield per hectare. The results are in conformity with Gupta *et al.* (2009) in capsicum, Vijaykumar (2010) in brinjal, Danawale (2013) in tomato, Der *et al.* (2018) in garlic, Maind *et al.* (2018) in chilli, Dahiphale (2021) in cauliflower, in tomato, Thange (2023) in watermelon and Singh *et al.* (2024) in tomato.

Economics of brinjal:

The result data of benefit cost ratio as influenced by interaction effect due to irrigation levels and fertigation schedules presented in Table 2.

Highest benefit cost ratio (2.16, 2.36 and 2.26) was obtained from the treatment I_3S_2 (100% irrigation water requirement + 6 days interval) which was followed by treatment I_2S_2 (80% irrigation level + 6 days interval) and least benefit cost ratio (1.78, 1.99 and 1.89) was obtained by the treatment I_1S_3 (60% irrigation water requirement + 9 days interval). In pooled results, among the treatments highest cost of cultivation was obtained in the treatment combination I_3S_2 i.e., (256629 Rs.), gross income (580529 Rs.) and net income (323900 Rs.).

Any technology tested on the basis of economic viability from the growers point for adoption. Irrigation and fertigation in vegetable particularly in brinjal crops required higher capital investment when water soluble fertilizers are used along with fertigation system. Hence, the economic viability of drip fertigation system was calculated considering the longer life span of the drip system, increased productivity and net extra income over conventional fertilization. However, due to higher uptake of nutrients and nutrient use efficiency the water soluble fertilizers registered higher gross income through significantly higher yields. This resulted in the production of higher yield per hectare with higher cost benefit ratio. The similar results are agreement with

the findings by Singh *et al.* (2009), Dunage *et al.* (2010), Danawale *et al.* (2013) and Amala and Syriac (2016) in tomato and Gireesh *et al.* (2020) in chilli.

Conclusion: The result's of data revealed that, in terms of monetary returns the treatment combination I_3S_2 (100% irrigation water requirement along with fertigation schedule at 6 days interval) proved to be highly remunerative with maximum net returns and benefit cost ratio.

References:

1. Amala, J. and Syriac, E. K. 2016. Standardization of fertigation schedule for tomato (*Solanum lycopersicum* L.) under open precision farming. *Journal of Crop and Weed*, 12(2): 82-85.
2. Antony, E. and Singandhupe, R.B. 2004. Impact of drip and surface irrigation on growth, yield and WUE of capsicum (*Capsicum annuum* L.). *Agriculture Water Management*, 6(5): 121-132.
3. Aujla, M.S., Thind, H.S. and Buttar, G.S. 2007. Fruit yield and water use efficiency of eggplant (*Solanum melongena* L.) as influenced by different quantities of nitrogen and water applied through drip and furrow irrigation. *Scientia Horticulture*, 112: 142-148.
4. Bahadur, A., Singh, K. P. and Rai, M. 2006. Effect of fertigation on growth, yield and water use efficiency of tomato. *Vegetable Science*, 33(1): 26-28.
5. Bhogi, B.H., Polisgowdar, B.S. and Patil, M.G. 2010. Study on the water requirement of brinjal (*Solanum melongena* L.). *Karnataka Journal of Agriculture Science*, 23(4): 666-667.
6. Danawale, N. J. 2013. Response of tomato to different irrigation regimes and fertigation schedule through drip during rabi season. Mahatma Phule Krishi Vidyapeeth, Rahuri (Ph.D. Thesis, Unpublished). 1-301.
7. Dunage, V. S., Balakrishnan P. and Patil M. G. 2010. Water use efficiency and economics of tomato using drip irrigation under net house conditions. *Karnataka Journal of Agricultural Sciences*, 22(1): 133-136.
8. Gireesh, B., Agrwal N. Tamrakar S. and Sinha J. 2020. Irrigation and fertigation management for chilli (*Capsicum annuum*) under drip irrigation system. *Journal of Agricultural Engineering*, 57(2): 182-194.
9. Gupta, A.J., Chattoo M.A. and Bhat F.N. 2009. Techno-economic evaluation of drip irrigation and fertigation practices in capsicum under kashmir conditions. *Vegetable Science*, 36(3): 309-314.
10. Hebbar, S.S., Ramachandrappa, B.K., Nanjappa, H.V. and Prabhakar, M. 2004. Studies on NPK drip fertigation in

- field grown tomato (*Lycopersicon esculentum* Mill.). Euro. J. Agron. **21**(1): 117-127.
11. **Kharde, Ram Pandurang 2016.** Fertigation and irrigation scheduling studies in brinjal (*Solanum melongena* L.) cv. Phule arjun. Mahatma Phule Krishi Vidyapeeth, Rahuri. (Ph.D. Thesis, Unpublished).
 12. **Khot, A. B., Ashoka P. and Neelakanth J. K. 2013.** Response of chilli (*Capsicum annum* L.) to drip irrigation and fertigation in vertisols. *Journal of Environment and Ecology*, **31**(2A): 642-646.
 13. **Patil, S.B. 2006.** Response of brinjal (*Solanum melongena* L.) to surface, subsurface and drip methods of irrigation. Mahatma Phule Krishi Vidyapeeth, Rahuri (M.Tech. Agril. Engg. Thesis, Unpublished).
 14. **Singh, J., Sandal S. K., Yousuf A. and Bhat M. A. 2024.** Effect of drip irrigation and NPK fertigation on growth, yield, quality and economics of tomatoes (*Lycopersicum esculentum*) under protected environment. *Journal of Soil and Water Conservation*, **23**(2): 168-176.
 15. **Thange, Anil Namdev 2023.** Effect of different irrigation regimes and fertigation schedules on watermelon, Mahatma Phule Krishi Vidyapeeth, Rahuri. (M.Sc. Thesis, Unpublished). 1-142.
 16. **Vijayakumar, G., Tamilmani D. and Selvaraj P.K. 2010.** Irrigation and fertigation scheduling under drip irrigation in brinjal (*Solanum melongena* L.) crop. *International Journal of Bio-resource and Stress Management*, **1**(2): 72-76.

Table 1. Effect of irrigation levels and fertigation schedules on fruit yield per hectare

Yield (q/ha)												
First year					Second year				Pooled			
Treatment	Fertigation schedules (S)				Fertigation schedules (S)				Fertigation schedules (S)			
Irrigation levels (I)	S1 3 Days	S2 6 Day	S3 9 Days	Mean	S1 3 Days	S2 6 Day	S3 9 Days	Mean	S1 3 Days	S2 6 Day	S3 9 Days	Mean
I1 60%	293.42	314.72	267.40	291.84	324.37	344.41	301.19	323.33	308.90	329.57	284.29	307.59
I2 80%	323.21	361.50	292.60	325.77	345.08	398.46	327.25	356.93	334.15	379.98	309.92	341.35
I3 100%	348.74	367.49	322.12	346.12	382.72	406.55	357.53	382.27	365.73	387.02	339.83	364.19
Mean	321.79	347.90	294.04		350.72	383.14	328.66		336.26	365.52	311.35	
	I	S	IXS		I	S	IXS		I	S	IXS	
F'test	Sig	Sig	Sig		Sig	Sig	Sig		Sig	Sig	Sig	
SE(m)±	2.19	2.00	3.39		4.2	2.9	4.8		2.78	2.31	3.87	
CD at 5%	8.59	7.86	11.05		16.6	11.4	15.5		10.90	9.08	12.61	

Table 2. Effect of irrigation levels and fertigation schedules on B:C ratio

2019-20					2020-21				Pooled			
Treatments	Cost of cultivation (Rs ha-1)	Gross income (Rs ha-1)	Net income (Rs ha-1)	B:C Ratio	Cost of cultivation (Rs ha-1)	Gross income (Rs ha-1)	Net income (Rs ha-1)	B:C Ratio	Cost of cultivation (Rs ha-1)	Gross income (Rs ha-1)	Net income (Rs ha-1)	B:C Ratio
I ₁ S ₁	232843	440132	207289	1.89	235175	486554	251379	2.07	234009	463343	229334	1.98
I ₁ S ₂	238906	472077	233171	1.98	241471	516622	275151	2.14	240189	494350	254161	2.06
I ₁ S ₃	225126	401093	175966	1.78	227172	401093	175966	1.99	226149	401093	175966	1.89
I ₂ S ₁	247301	484814	237513	1.96	250100	517626	267526	2.07	248701	501220	252519	2.02
I ₂ S ₂	255230	542253	287022	2.12	258262	597686	339424	2.31	256746	569969	313223	2.22
I ₂ S ₃	236574	438899	202325	1.86	238906	490872	251966	2.05	237740	464886	227145	1.95
I ₃ S ₁	257096	523105	266009	2.03	259661	574078	314417	2.21	258378	548591	290213	2.12
I ₃ S ₂	255230	551233	296003	2.16	258029	609825	351796	2.36	256629	580529	323900	2.26
I ₃ S ₃	243570	483183	239612	1.98	246135	536302	290167	2.18	244853	509742	264890	2.08

