



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(8): 1216-1218
Received: 19-06-2026
Accepted: 23-07-2026

Sipra Sudipta
M.Sc. Scholar, Department of
Agronomy, N. M. College of
Agriculture, Navsari Agricultural
University, Navsari, Gujarat, India

VR Naik
Associate Director of Research,
Navsari Agricultural University,
Navsari, Gujarat, India

Rakhi Singh Gandhar
M.Sc. Scholar, Department of
Agronomy, N. M. College of
Agriculture, Navsari Agricultural
University, Navsari, Gujarat, India

MN Muchhadiya
M.Sc. Scholar, Department of
Agronomy, N. M. College of
Agriculture, Navsari Agricultural
University, Navsari, Gujarat, India

Corresponding Author:
Sipra Sudipta
M.Sc. Scholar, Department of
Agronomy, N. M. College of
Agriculture, Navsari Agricultural
University, Navsari, Gujarat, India

Effect of land configuration, drip lateral placement and scheduling of irrigation on growth and yield of *Rabi* Garlic (*Allium sativum* L.)

Sipra Sudipta, VR Naik, Rakhi Singh Gandhar and MN Muchhadiya

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i8o.6408>

Abstract

A field experiment was conducted during the *rabi* season of 2024-25 at Soil and Water Management Research Unit Farm, Navsari Agricultural University, Navsari, Gujarat to study the effect of land configuration, drip lateral placement and scheduling of irrigation on growth and yield of garlic under South Gujarat conditions. The experiment was arranged in a factorial randomized block design with four replications consisting of two land configurations [flatbed (L_1) and raised bed (L_2)], two drip lateral placements [one lateral per eight rows (S_1) and two laterals per eight rows (S_2)] and three irrigation scheduling levels [0.6 PEF (I_1), 0.8 PEF (I_2) and 1.0 PEF (I_3)]. Raised bed planting recorded significantly higher bulb yield (75.78 q ha^{-1}) in comparison to flatbed planting with significant improvement in growth attributes. The Placement of two drip laterals per eight rows improved the plant growth and bulb yield (69.71 q ha^{-1}) significantly over one lateral per eight rows. Irrigation at 1.0 PEF recorded significantly higher growth and bulb yield (71.78 q ha^{-1}), but it was remained at par with 0.8 PEF for most of the growth characters and bulb yield. The study revealed that raised bed planting with two drip laterals per eight rows and scheduling of irrigation at 1.0 PEF is an effective production practice for improving growth and bulb yield of garlic under the clay soils of South Gujarat.

Keywords: Garlic, bulb yield, drip lateral placement, irrigation scheduling, land configuration, raised bed

Introduction

Garlic (*Allium sativum* L.) belongs to the family *Alliaceae* and is the second most consumed bulb crop after onion. It has a strong sulfurous smell and flavour due to the presence of allicin, an antibacterial oil. Garlic has numerous medicinal properties, primarily attributed to its active compound allicin, which has antibacterial and antifungal effects. As a shallow rooted crop, garlic is particularly vulnerable to moisture stress, especially during the bulb development stage, which requires effective irrigation scheduling to enhance yield, bulb quality and water use efficiency. Drip irrigation plays an alternative to traditional flood irrigation by delivering water directly to the root zone. This method minimizes water loss and improves nutrient availability and crop productivity. However, the primary expense associated with drip irrigation arises from the cost of drip laterals. In heavy black soils, increased lateral water movement may allow for wider spacing of drip laterals through appropriate plant geometry, which reduce the system costs. Additionally, planting techniques affect soil aeration, drainage, root development and bulb growth, with raised beds typically offering superior conditions compared to flatbed planting. The limited information on the combined impact of planting methods, drip lateral spacing and scheduling of irrigation for garlic in South Gujarat, this study was initiated to assess their effects on growth and yield of garlic cultivation.

Materials and Methods

A field experiment was conducted during the *rabi* season of 2024-25 at soil and water management research farm, Navsari Agricultural University, Navsari. The soil used in the experiment was clay, exhibiting a pH of 7.49, an electrical conductivity (EC) of 0.29 dS m^{-1} and an organic carbon content of 0.84%. The soil was characterized by low levels of available nitrogen ($206.72 \text{ kg ha}^{-1}$), medium levels of available phosphorus (29.22 kg ha^{-1}) and high levels of available potassium

(488.01 kg ha⁻¹). The experiment included twelve treatment combinations, which consisted of two land configurations (L₁: Flatbed and L₂: Raised bed), two placements of drip laterals (S₁: One lateral per 8 rows and S₂: Two laterals per 8 rows) and three levels of irrigation scheduling (I₁: 0.6 PEF, I₂: 0.8 PEF and I₃: 1.0 PEF). This was organized in a Factorial Randomized Block Design with four replications. Raised beds were prepared by top width of 80 cm, furrow width of 40 cm and depth was 30 cm. The recommended fertilizer dose for the crop was 100:50:50 kg ha⁻¹ of NPK. Out of the total nitrogen (N) and potassium (K₂O), 10% each was applied as a basal dose at the time of sowing, along with 100% of the recommended phosphorus (P₂O₅). The remaining 90% of nitrogen and potassium was applied in ten equal splits at intervals of 10-12 days, commencing from 15 days after planting. The mean maximum temperature fluctuated between 29.6°C to 37.3°C, whereas the minimum temperature varied from 12.9°C to 20.6°C throughout the experimental period. The maximum and minimum relative humidity levels were recorded between 63% to 92% and 17% to 49% at morning and evening respectively. One common surface irrigation of 60 mm depth was given at the time of sowing for proper planting and establishment of crop, then the system was operated as per treatment on an alternate day basis. Irrigation was ceased two weeks prior to the crop harvest. Five plants were randomly selected from the net plot area for recording growth observations. Bulb yield was recorded from net plot area. The data obtained were subjected to statistical analysis as suggested by Panse and Sukhatme (1985) [7].

Results and Discussion

Effect of land configuration

Raised bed planting (L₂) achieved significantly superior growth parameters, including plant height, number of leaves, neck thickness, dry weight of leaves, dry bulb weight and total dry plant weight, as compared to those from flatbed planting (Table 1). Treatment L₂ also showed significantly greater bulb width, bulb diameter, bulb weight and bulb yield (Table 2). The superior yield observed in raised bed planting can be attributed to enhanced soil aeration, effective drainage, improved root development, moisture and nutrient availability in the root zone. Furthermore, raised beds assist in reducing temporary water

stagnation and establishing favourable soil physical conditions for bulb development. As garlic is a shallow-rooted crop, it responds favourably to well-aerated soil conditions, resulting in enhanced vegetative growth and bulb formation. The results corroborate the earlier findings of Dodake (2005) [2], Kadari *et al.* (2019) [3] and Kaur *et al.* (2022) [4], who recorded markedly higher yield of garlic when planted on raised bed.

Effect of drip lateral placement

Between the two treatments for drip lateral placement, the installation of two laterals for every 8 rows (S₂) demonstrated a significantly higher values of all the growth parameters, yield attributes and yield of garlic as compared to one lateral per 8 rows (S₁) (Table 1 and 2). The increase in growth and yield associated with double lateral placement is likely due to the uniform distribution of water in the crop root zone and the maintenance of optimal soil moisture levels throughout the growing period. The superior wetting pattern under double lateral placement promotes nutrient uptake, photosynthesis and the movement of assimilates towards bulb development. Similar results were obtained by Patel *et al.* (2014) [8] and Mehla *et al.* (2022) [6].

Effect of irrigation scheduling

The results presented in Table 1 and 2 showed that increasing the drip irrigation schedules from 0.6 PEF to 1.0 PEF caused significant increase in growth and yield attributing characters. However, in most of the cases, including bulb yield treatment 0.8 PEF and 1.0 PEF remained at par with each other. In the present study, the higher growth and yield of garlic recorded under the 1.0 PEF and 0.8 PEF irrigation scheduling were mainly attributed to the favourable maintenance of soil moisture and the uniform application of irrigation water throughout the crop growth period. Another possible reason is that the continuous availability of moisture under this treatment improved nutrient availability and uptake during the entire growing season, which promoted better vegetative growth, enhanced bulb development and ultimately resulted in higher garlic yield. Increased yield with drip irrigation was also reported by Sankar *et al.* (2008) [10], Mathukia *et al.* (2014) [5], Der *et al.* (2018) [1] and Sahu *et al.* (2023) [9].

Table 1: Effect of land configuration, drip lateral placement and scheduling of irrigation on growth parameters of garlic

Treatments	Plant height (cm)			Number of leaves			Neck thickness (cm)	Dry weight of leaves (g plant ⁻¹)	Dry weight of bulb (g plant ⁻¹)	Dry weight of whole plant (g plant ⁻¹)
	45 DAS	60 DAS	90 DAS	45 DAS	60 DAS	90 DAS				
Land configuration										
Flatbed	44.20	51.65	55.48	5.43	6.07	10.07	1.49	1.64	4.23	5.88
Raised bed	47.97	55.86	60.42	5.91	6.62	10.99	1.92	2.10	5.36	7.46
S. Em±	0.50	0.54	0.65	0.06	0.07	0.13	0.03	0.03	0.08	0.08
CD at 5%	1.45	1.56	1.86	0.17	0.20	0.37	0.08	0.08	0.22	0.22
Drip lateral placement										
One lateral per 8 rows	45.36	52.96	57.01	5.58	6.23	10.34	1.63	1.80	4.64	6.44
Two laterals per 8 rows	46.81	54.54	58.88	5.77	6.47	10.72	1.78	1.94	4.95	6.89
S. Em±	0.50	0.54	0.65	0.06	0.07	0.13	0.03	0.03	0.08	0.08
CD at 5%	1.45	1.56	1.86	0.17	0.20	0.37	0.08	0.08	0.22	0.22
Irrigation scheduling										
0.6 PEF	44.73	52.28	55.85	5.46	6.08	10.15	1.56	1.70	4.39	6.08
0.8 PEF	46.32	54.12	58.45	5.74	6.45	10.58	1.74	1.90	4.87	6.77
1.0 PEF	47.21	54.86	59.54	5.81	6.51	10.86	1.81	2.01	5.13	7.14
S. Em±	0.62	0.66	0.79	0.07	0.09	0.16	0.03	0.03	0.09	0.09
CD at 5%	1.77	1.91	2.28	0.21	0.24	0.46	0.10	0.09	0.27	0.27

Table 2: Effect of land configuration, drip lateral placement and scheduling of irrigation on yield attributes and yield of garlic

Treatments	Bulb width (cm)	Bulb diameter (cm)	Bulb weight (g)	Bulb yield (q ha ⁻¹)
Land configuration				
Flatbed	2.83	3.79	17.34	60.34
Raised bed	3.36	4.42	20.40	75.78
S. Em±	0.05	0.04	0.20	0.82
CD at 5%	0.13	0.12	0.58	2.36
Drip lateral placement				
One lateral per 8 rows	3.01	4.02	18.45	66.41
Two laterals per 8 rows	3.17	4.19	19.29	69.71
S. Em±	0.05	0.04	0.20	0.82
CD at 5%	0.13	0.12	0.58	2.36
Irrigation scheduling				
0.6 PEF	2.91	3.87	17.69	62.89
0.8 PEF	3.11	4.17	19.26	69.51
1.0 PEF	3.26	4.28	19.66	71.78
S. Em±	0.06	0.05	0.25	1.00
CD at 5%	0.16	0.15	0.71	2.89

Conclusion

Based on the findings of the field experiment conducted during the *rabi* season of 2024-25, raised bed planting proved superior to flatbed planting for achieving higher bulb yield in garlic cultivation. Further the use of two drip laterals per eight rows improved bulb yield as compared to one lateral per eight rows. Irrigation scheduling at 1.0 PEF and 0.8 PEF recorded higher growth, yield attributes and bulb yield than 0.6 PEF.

irrigation practices on growth and yield of garlic (*Allium sativum* L.) var. G 41. Journal of Spices and Aromatic Crops. 2008;17(3):230-234.

References

- Der HN, Dabhi AB, Barad BB, Gohil PJ. Scheduling of drip irrigation and fertigation in rabi garlic (*Allium sativum* L.). International Journal of Chemical Studies. 2018;6(3):1002-1005.
- Dodake SB. Management of clay soils of South Gujarat for improving yield and quality of onion (*Allium cepa* L.). Navsari: Navsari Agricultural University; 2005.
- Kadari IA, Shinde SJ, Maske SN. Effect of land configuration with different levels of spacing and fertilizers on yield and economic studies of onion (*Allium cepa* L.) cultivation. Journal of Pharmacognosy and Phytochemistry. 2019;8(1):2452-2455.
- Kaur K, Kaur A, Singh M. Effect of planting time and planting methods on the performance of garlic (*Allium sativum* L.) under Punjab conditions. The Pharma Innovation Journal. 2022;11:2431-2435.
- Mathukia RK, Asodaria KB, Patel KC, Davaria RL. Evaluation of micro-irrigation in garlic (*Allium sativum* L.). Journal of Agriculture Science and Technology. 2014;3(2):1-3.
- Mehla MK, Jhorar RK, Sanjay K, Ashish K. Effect of drip irrigation frequency and lateral spacing on kharif onion crop. International Journal of Agriculture, Environment and Biotechnology. 2022;15(2):205-212.
- Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: Indian Council of Agricultural Research; 1985. p. 199-200.
- Patel JM, Naik VR, Patel RB. Study on drip layout with different dripper discharge rates in onion grown on clay soil. The Bioscan. 2014;9(4):1367-1370.
- Sahu KK, Sharma JC, Sanadya SK. Optimizing garlic (*Allium sativum* L.) yield through irrigation scheduling and nitrogen management. International Journal of Plant and Soil Science. 2023;35(20):1137-1144.
- Sankar V, Lawande KE, Tripathi PC. Effect of micro