Int.J.Curr.Microbiol.App.Sci (2024) *13*(11): 51-62

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 13 Number 11 (2024)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2024.1311.007

Enhancing the Yield of Lentils (*Lens culinaris*) in Greater Noida (U.P.) by Improving Irrigation Frequency, Nutrient Management Techniques, and Soil Conservation Techniques (Mulching) at Greater Noida (U.P.), India

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Keywords

Recommended Dose of Fertilizer, vermicompost, farm yard manure, lentil cultivation

Article Info

Received:
15 September 2024
Accepted:
24 October 2024
Available Online:
10 November 2024

A B S T R A C T

The study aimed to Optimizing Lentil (*Lens culinaris*) Yield Through Irrigation Frequency at the Experimental Fields of Sharda University, Greater Noida, Uttar Pradesh, during the *rabi* season of 2023-2024. A split-plot Design with nine Treatments and three replications was employed, which includes T_1: M_1S_1; T_2: M_1S_2; T_3: M_1S_3; T_4: M_2S_1; T_5: M_2S_2; T_6: M_2S_3; T_7: M_3S_1; T_8: M_3S_2; T_9: M_3S_3. Measurements were taken for plant parameters, yield analyses and soil analyses. Results indicated that integration of second irrigation and 50% Organic manure+ 50% R.D.F. (T_6) demonstrated significantly higher growth and productivity in lentil compared to other treatments. This combination led to increased plant height, dry matter accumulation and higher yields, including the number of pods and grains per plant. Moreover, soil analyses revealed improvements in soil pH, organic carbon, and nutrient levels with this integrated approach. Additionally, effective crop management practices, such as timely irrigation, weed management, and disease control, contributed to the overall success of lentil cultivation. These findings underscore the significance of optimizations in integrating fertilization strategies, incorporating both organic and inorganic amendments along with rhizobium culture, for maximizing lentil productivity while ensuring soil health and sustainability.

Introduction

Lentil (*Lens culinaris*) is a significant pulse crop in India, grown in 1.48 million hectares (M ha) with a total yield of 1.03 million tonnes (Mt). It is used as a high source of protein in a vegetarian diet. The significance of lentils as a type of crop has been well recorded for centuries because of its importance in India's food, animal feed, and agricultural systems. Incorporating it into your daily meals as dal (a popular thick soup) with rice offers a balanced diet for human nourishment. The seeds are packed with a lot of good protein and important vitamins and minerals. There is a lot of lysine in the seeds, which helps make up for the low lysine in cereal protein. The shorter cooking time of lentils has made them popular in countries like India, where there is a lack of fuel for cooking. It is usually cultivated for its vegetables, pods, seeds, and leaves for animal feed. Lentils can be

cultivated in dry and semi-dry areas with low rainfall. It is seen as a crucial part of the farming system that can be cultivated as a catch crop, mulch crop, intercrop, mixed crop, and green crop. As a type of plant that produces seeds in pods, it can capture nitrogen from the air, meeting the plant's need for nitrogen, and plays an important role in crop rotation (Wang *et al.,* 2012). It can help in the soil's ability to convert atmospheric nitrogen at a rate of 49.20 Kg/ha with the help of symbiotic bacteria under favorable conditions (Gan *et al.,* 2017). Lentil Variety L4717 was announced and made available in 2017. It is resistant to powdery mildew disease and somewhat resistant to fusarium wilt and Ascochyta blight. It is advised for central areas including Madhya Pradesh, sections of Uttar Pradesh, Rajasthan, and Chhattisgarh. Appropriate for planting at the right time without irrigation in the central areas during the *rabi* season. Lentil is a somewhat drought tolerant plant and is primarily cultivated for people to eat. Planting techniques and watering methods are crucial agricultural factors for achieving the highest yield of lentil crops. It is a popular winter crop in India and the second most crucial winter legume after chickpea (*Cicer arietinum L*) (Kumar *et al.,* 2016). Even though they are typically grown in arid areas, lentils can also be cultivated in fields with proper water control. Because lentil plants do not like wet soil, they cannot survive in soggy conditions and will die in floods. Excessive watering of lentil crops can lead to reduced yields, increased disease rates, and delayed maturation. During the plant's early growth, it needs a cool temperature, but it needs a warm temperature when it's fully grown. The best temperature for its growth is between 18-30ºC, according to Choudhury *et al.,* (2012). It is widely known that using chemical fertilizers without organic manure can harm the soil's biological and physio-chemical properties, as well as its overall health and environment. Farmyard manure is well-known for serving as a storage place for plant nutrients. Vermicompost appeared to be the top organic option for keeping soil fertility in a sustainable way for a eco-friendly environment. This is because it is filled with important nutrients, vitamins, plant growth regulators, and helpful microorganisms.

Using vermicompost on different field crops has been shown to reduce the reliance on synthetic fertilizers without decreasing crop yield. Similarly, agricultural waste manure (FYM) and compost, along with other substances, are known for serving as storage areas for plant nutrients, demonstrating varied nutrient makeup and patterns of nutrient release after decomposition. Manual removing of weeds, natural and synthetic covering such as wheat chaff and dark plastic are commonly utilized and have been proven to be successful for managing weeds in lentil crops (Rhioui *et al.,* 2023). A layer of substance distributed over the ground's surface is known as a mulch. Despite being cultivated by farmers for many years, this crop lacks adequate irrigation and nutrient management methods to increase its yield. This study aims to find the most affordable and environmentally friendly ways to water, fertilize, and protect the soil in order to increase the number of lentils that can be grown. The objectives of the study includes to assess the impact of different irrigation frequencies on lentil crop growth and yield. To evaluate the effect of different nutrient management strategies on lentil crop growth and yield. To determine the interactions between irrigation frequency and nutrient management and their combined effects on lentil crop performance. And also to identify the most cost-effective and sustainable irrigation and nutrient management practices for maximizing lentil crop yield.

Materials and Methods

The field experiment titled “Optimizing Lentil (*Lens culinaris*) Yield Through Irrigation Frequency and Nutrient Management Strategies and Soil Conservation Strategies (Mulching)” was conducted at Sharda University in Greater Noida, Uttar Pradesh to study the effect of different irrigation frequency, nutrient management and soil conservation techniques and their interaction for maximizing lentil crop yield.

Experimental site

The experiment was conducted at crop cafeteria in School of agricultural sciences, Sharda university, Greater Noida, Uttar Pradesh, India during 2023-24 growing season. The area receives average rainfall of 735 mm annually and has mean temperature of 24.6 ºC Soil characteristics

The three main seasons in Greater Noida's tropical savanna climate are summer, monsoon, and winter. With the exception of the monsoon season, the region is mostly dry. Summertime temperatures range from 45°C (maximum) to 23°C (minimum) from March to June. The region experiences 93.2 cm of rain on average during the monsoon season, which runs from mid-June to mid-September.

Maximum temperature recorded is 35°C, while minimum temperature is 20°C. The winter months of October through February see temperatures between 20°C (maximum) and 3–4°C (minimum). With a relative humidity of 78.14%, August has the highest relative humidity, while April has the lowest relative humidity (292%).

Soil Characteristics

On October 20, 2023, following the harvest of rice, soil samples were taken from the fixed plots using a core sampler, in preparation for the sowing of the lentil crop during the *rabi* season of 2023–2024. At a depth of 0 to 15 cm, soil samples were collected from different areas of the plot, and composite samples were created. At this depth, the sandy loam soil texture in the experimental field had the following characteristics:

Treatments and experiment details

The experiment was conducted in a split-plot design with three replications. The experimental field consists of 27 plots with plot size of 3.8m×3.1m= 11.72 m². it has three rows each containing 9 plots. There were 9 treatments. In these experiment, three levels of irrigation were given at different time intervals each for specific plots also organic mulch were applied on specific plots.

Experimental details

Details of the experiments are given below

Season : *Rabi* season
Crop and Variety : Lentil (Var. L4717)
Replications : 3
Total no of plots : 27
Experimental design : Split-plot design
Location : Experimental field, Sharda university
Gross plot size : 3.8m×3.1m= 11.72 m²
Total plot size : 12.5m×28.2m= 352.5 m²
Spacing : row to row: 25cm, plant to plant: 25cm
Sowing time : 25th November

Treatment Details

1) Main Plots: Different irrigation frequencies

M_1: 1 Irrigation, M_2: 2 Irrigation, M_3: 3 Irrigation
These are the larger treatments.

2) Subplots: Different nutrient source

S_1: Recommended Dose of Fertilizer (RDF)
S_2: Organic Manure (FYM + Vermicompost)
S_3: RDF + Organic Manure as the subplots.
These are the smaller treatment areas.

Description of materials used

Lentil Variety

Lentil Variety L4717 was notified and released in 2017 and is resistant to powdery mildew disease and moderately resistant to *Fusarium wilt* and *Ascochyta blight.*

It is recommended for central zones compromising state of Madhya Pradesh, parts of Uttar Pradesh, Rajasthan and Chhattisgarh. Suitable for timely planting under rainfed conditions in central zones for *rabi* season.

Nutrient management practices

Recommended dose of fertilizer (RDF)

A standard NPK (Nitrogen, Phosphorus, Potassium) ratio of 20:40:20 kg/ha was applied as the RDF. In this research study, the Recommended Dose of Fertilizer (RDF) was applied using a combination of urea, Di-ammonium phosphate (DAP) and Muriate of potash (MOP).

Urea, a source of nitrogen, and DAP, a source of phosphorus and nitrogen and MOP as potassium, were used in the ratio specified for the RDF. This balanced application of urea, DAP and MOP aimed to provide essential nutrients to the crops, ensuring optimal growth, development, and yield. This balanced fertilizer dose is commonly recommended for optimal crop nutrition and growth.

Organic manure (Farm yard manure + vermicompost)

The experimental plots received a combination of organic inputs, including Vermicompost at 1 t/ha and Farm Yard Manure at 5 t/ha. This organic supplementation aimed to improve soil fertility, enhance nutrient availability, and promote overall soil health.

Field Operations

The cultural operations for the cultivation of lentils, as outlined below, were undertaken during the experimental phase:

Land Preparation

Following the harvest of the previous crops, land preparation commenced utilizing a tractor. Primary tillage practices were carried out using a tractor-drawn disc plough, succeeded by levelling with a harrow to achieve a fine tilth in the soil. Subsequently, plots were delineated by constructing bunds around them.

Field Irrigation

Prior to sowing lentils, the fields were irrigated by flooding with water 1-2 days before sowing to prepare the soil for optimal seed germination and establishment. Three levels of irrigation were also given after sowing of lentils In different time intervals as M_1, M_2 And M_3

These cultural operations are specific to the cultivation of lentils and were conducted to ensure favorable conditions for the growth and development of the lentil crop during the experimentation period.

Fertilizer application

The treatments in this study involved varying doses of fertilizers and organic amendments to evaluate their impact on crop growth and yield. RDF was applied on the ratio of 20:40:20 and Farmyard manure and vermicompost were given as 5t/ha and 1t/ha respectively S_1(100 % RDF) contains 216g of Nitrogen, 432 g of phosphorus and 216 g of potassium. S_2(Organic manure) contains 6kg of FYM and1.2 kg of vermicompost. S_3(50% RDF + 50% Organic manure) contains 108g of nitrogen and potassium, 216g of phosphorus and 3kg and 0.6kg of FYM and vermicompost respectively.

Harvesting and Threshing

For the harvesting and threshing of lentil crops, a net plot area of 1m² was randomly chosen within each plot for manual harvesting. Subsequently, the rest of the crops were harvested collectively using a harvester. Threshing of the lentil crops was conducted manually by beating the crop against an object. Each crop with different treatments was threshed separately to maintain treatment integrity. Following threshing, the grains were cleaned, and the grain yield was recorded.

Additionally, the biomass weight was measured immediately after harvesting for wet biomass, and for dry biomass, measurements were taken a week after harvesting. These procedures were carried out systematically to accurately assess the yield and biomass characteristics of the lentil crops across various treatment conditions.

Measurements

A) Plant Parameters

Morphological Parameters

No. of branches/plant (30, 60 DAS, and harvest)
Plant height (30, 60 DAS, and harvest)
Dry matter/plant (30, 60 DAS, and harvest)
Effective nodules/plant (45 and 60 DAS)
Total number of nodules/plant (45 and 60 DAS)
Fresh and dry weight of nodules/plant (45 and 60 DAS)

B) Yield Analyses

No. of pods/plant
No. of grains/plant
Test weight
Grain yield, stover yield, and Harvest index

C) Soil Analyses

pH, Organic Carbon (OC), NPK (Initial and Harvest)

D) Crop Management

a) Water Management

First irrigation: Pre-flowering
Second irrigation: Pod formation

b) Weed Management

Post-emergence application of Pendimethalin @ 1.0 a.i./ha at 20-25 DAS

c) Pest and Diseases Management

Use of disease-free seed
Vigilance in the field

Observation

During the lentil crop growth stages, various parameters were observed and recorded to assess plant development, yield potential, and soil characteristics.

Plant Parameters
Yield attributes and Yields
Nutrient Analysis
Soil Analyses.
Statistical analysis

Results and Discussion

Effect on growth attributing characters

Plant height

The comprehensive analysis of the experimental data highlights T_6 (M_2S_3) as the most effective treatment across various parameters, including plant height, dry matter accumulation, number of pods, number of grains, grain yield, stover yield, biomass, harvest index, 1000 seed weight, and nutrient levels.

T_6 consistently showed significantly higher performance, indicating its superiority in promoting optimal growth and maximizing yield.

Table.1 Cropping history of experimentation field

Year	Cropping systems	Description
2022-2023	Rice	Rice was planted in fixed Layout of split-plot design with Treatments
2023-2024 (Current experiment)	Lentil	Following the harvesting of rice crop, lentil was sown in fixed layout using a split plot design.

Climate and weather conditions of the experimental site

Table.2 Initial soil properties of the experimental field (Before sowing of lentil)

Soil Properties	Result	Method/Tool
Texture	Sandy loam	USDA textural triangle.
pH	6.5	Glass electrode pH meter (Jackson, 1958).
E.C. (Ds/m)	6.2	EC meter
Organic carbon (%)	4.2	Walkely *et al.,* method (1934)
N(Kg/ha)	240	Alkaline $KMnO_4$ method (Subbiah and Asija, 1956).
P(Kg/ha)	14	Olsen's extraction method (Olsen *et al.,* 1954)
K(Kg/ha)	140	Neutral 1 N ammonium acetate extraction method (Hanway *et al*., 1952)

Table.3 Treatment symbol and Description

Symbol	Treatment Description
T_1	M_1S_1
T_2	M_1S_2
T_3	M_1S_3
T_4	M_2S_1
T_5	M_2S_2
T_6	M_2S_3
T_7	M_3S_1
T_8	M_3S_2
T_9	M_3S_3

Table.4 Field Layout

R_1	R_2	R_3
M_1S_1	M_3S_2	M_2S_3
M_1S_2	M_3S_1	M_2S_1
M_1S_3	M_3S_3	M_2S_2
M_3S_2	M_2S_1	M_1S_2
M_3S_1	M_2S_3	M_1S_1
M_3S_3	M_2S_2	M_1S_3
M_2S_1	M_1S_3	M_3S_1
M_2S_3	M_1S_1	M_3S_2
M_2S_2	M_1S_2	M_3S_3

Table.5 Plant height at "30 DAS, 60 DAS" & Harvest stage.

Treatment	30 DAS	60 DAS	At harvest
T_1: M_1S_1	9.25	17.54	22.48
T_2: M_1S_2	8.16	16.43	20.38
T_3: M_1S_3	10.23	16.94	20.98
T_4: M_2S_1	10.87	17.82	22.68
T_5: M_2S_2	11.79	19.02	21.28
T_6: M_2S_3	13.93	20.53	25.39
T_7: M_3S_1	9.39	15.73	19.38
T_8: M_3S_2	8.39	16.52	20.29
T_9: M_3S_3	10.38	17.02	21.93
CV	10.42	9.37	10.11
CD	2.05	2.95	3.83

Table.6 Dry matter (g/m^2) of Lentil at 30 DAS, 60 DAS and Harvest stage.

Treatment	30 DAS	60 DAS	At harvest
T_1: M_1S_1	97.93	148.39	103.47
T_2: M_1S_2	104.73	153.28	204.29
T_3: M_1S_3	97.82	142.29	187.39
T_4: M_2S_1	105.39	160.39	205.83
T_5: M_2S_2	117.28	178.29	235.92
T_6: M_2S_3	134.62	201.39	264.28
T_7: M_3S_1	123.29	184.38	246.72
T_8: M_3S_2	102.38	119 28	211.93
T_9: M_3S_3	110.39	132.29	193.57
CV	29.31	32.28	36.39
CD	11.72	11.27	10.47

Table.7 Number of pods per plant in lentil crop

Treatment	Pods / Plant
T_1: M_1S_1	31.17
T_2: M_1S_2	30.73
T_3: M_1S_3	31.39
T_4: M_2S_1	45.28
T_5: M_2S_2	45.82
T_6: M_2S_3	59.83
T_7: M_3S_1	38.29
T_8: M_3S_2	37.29
T_9: M_3S_3	34.92
CV	9.31
C.D.	5.72

Table.8 Number of grains per plant

Treatment	Grains / Plant
T_1: M_1S_1	53.45
T_2: M_1S_2	52.82
T_3: M_1S_3	55.83
T_4: M_2S_1	81.64
T_5: M_2S_2	74 93
T_6: M_2S_3	106.89
T_7: M_3S_1	66.39
T_8: M_3S_2	57.95
T_9: M_3S_3	67.29
CV	12.97
CD	13.21

Table.9 Grain yield stover yield and biomass of lentil crop.

Treatment	Grain	Stover	Biomass
T_1: M_1S_1	16.63	22.39	39.02
T_2: M_1S_2	16.42	22.04	38.46
T_3: M_1S_3	16.87	22.58	39.15
T_4: M_2S_1	17.92	23.84	41.76
T_5: M_2S_2	17.45	23.34	40.79
T_6: M_2S_3	18.39	23.58	41.97
T_7: M_3S_1	15.44	21.73	37.17
T_8: M_3S_2	15.13	21.27	36.4
T_9: M_3S_3	15.93	21.83	37.76
CV	12.73	12.43	10.62
CD	2.2	2.16	3.83

Table.10 Harvest Index and 1000 seed weight of lentil.

Treatment	Harvest Index	Test weight
T_1: M_1S_1	43.04	17.96
T_2: M_1S_2	42.76	17.32
T_3: M_1S_3	43.22	18.21
T_4: M_2S_1	44.56	19.25
T_5: M_2S_2	44.47	18.83
T_6: M_2S_3	44.73	20.59
T_7: M_3S_1	43.69	18.49
T_8: M_3S_2	43.46	18.38
T_9: M_3S_3	43.94	18.67
CV	11.68	9.83
CD	NS	3.14

Table.11 pH, organic carbon, and nutrient levels in soil samples of lentil crop.

Treatment	pH	OC (g/kg soil)
T_1: M_1S_1	6.74	4.14
T_2: M_1S_2	5.79	5.21
T_3: M_1S_3	6.54	4.85
T_4: M_2S_1	6.68	4.28
T_5: M_2S_2	5.86	5.32
T_6: M_2S_3	6.45	4.73
T_7: M_3S_1	6.62	4.51
T_8: M_3S_2	5.98	5.49
T_9: M_3S_3	6.38	4.65
CV	10.58	10.75
CD	NS	NS

Table.12 Nitrogen, Phosphorus and Potassium levels of lentil crop.

Treatment	Nitrogen	Phosphorus	Potassium
T_1: M_1S_1	269.53	19.72	159.29
T_2: M_1S_2	267.62	17.39	155.83
T_3: M_1S_3	271.21	19.96	165.73
T_4: M_2S_1	273.49	26.83	170.83
T_5: M_2S_2	271.92	25.42	168.92
T_6: M_2S_3	278.59	27.83	187.39
T_7: M_3S_1	269.71	20.32	167.32
T_8: M_3S_2	271.28	19.89	166.39
T_9: M_3S_3	271.73	20.53	167.29
CV	10.74	11.38	11.28
CD	44.38	7.28	31.17

Figure.1 Lentil (Var. L4717)

Figure.2 Plant height at "30 DAS, 60 DAS" & Harvest stage.

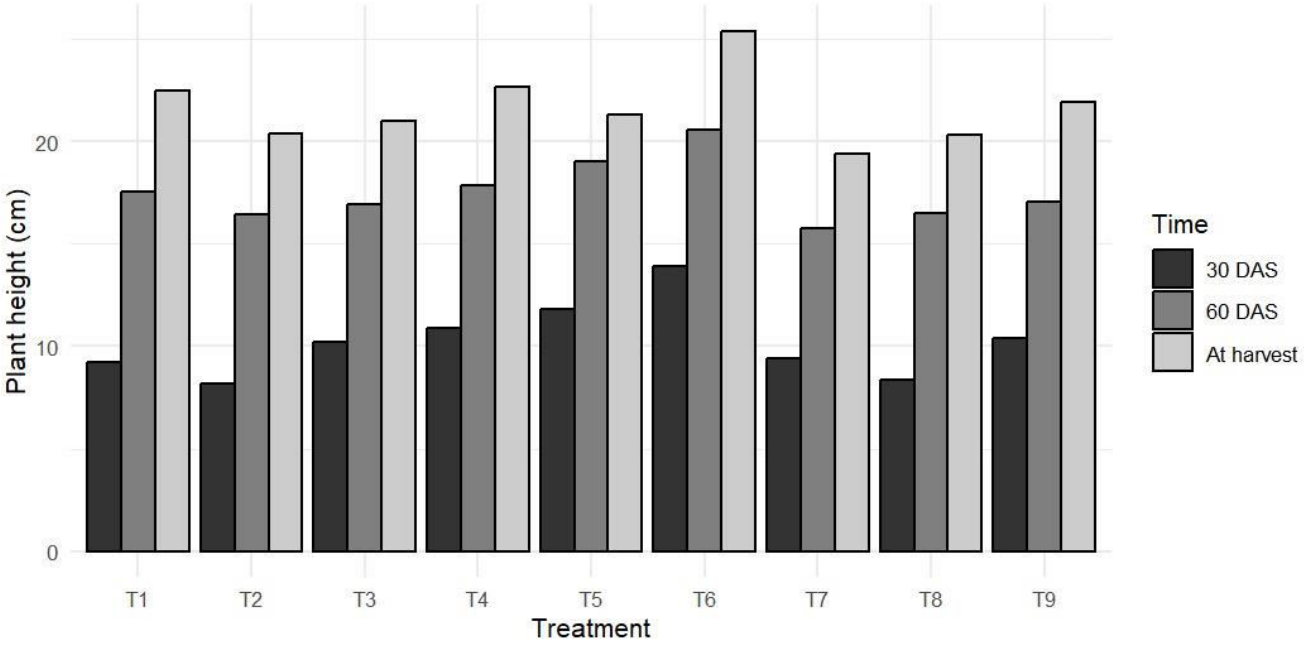
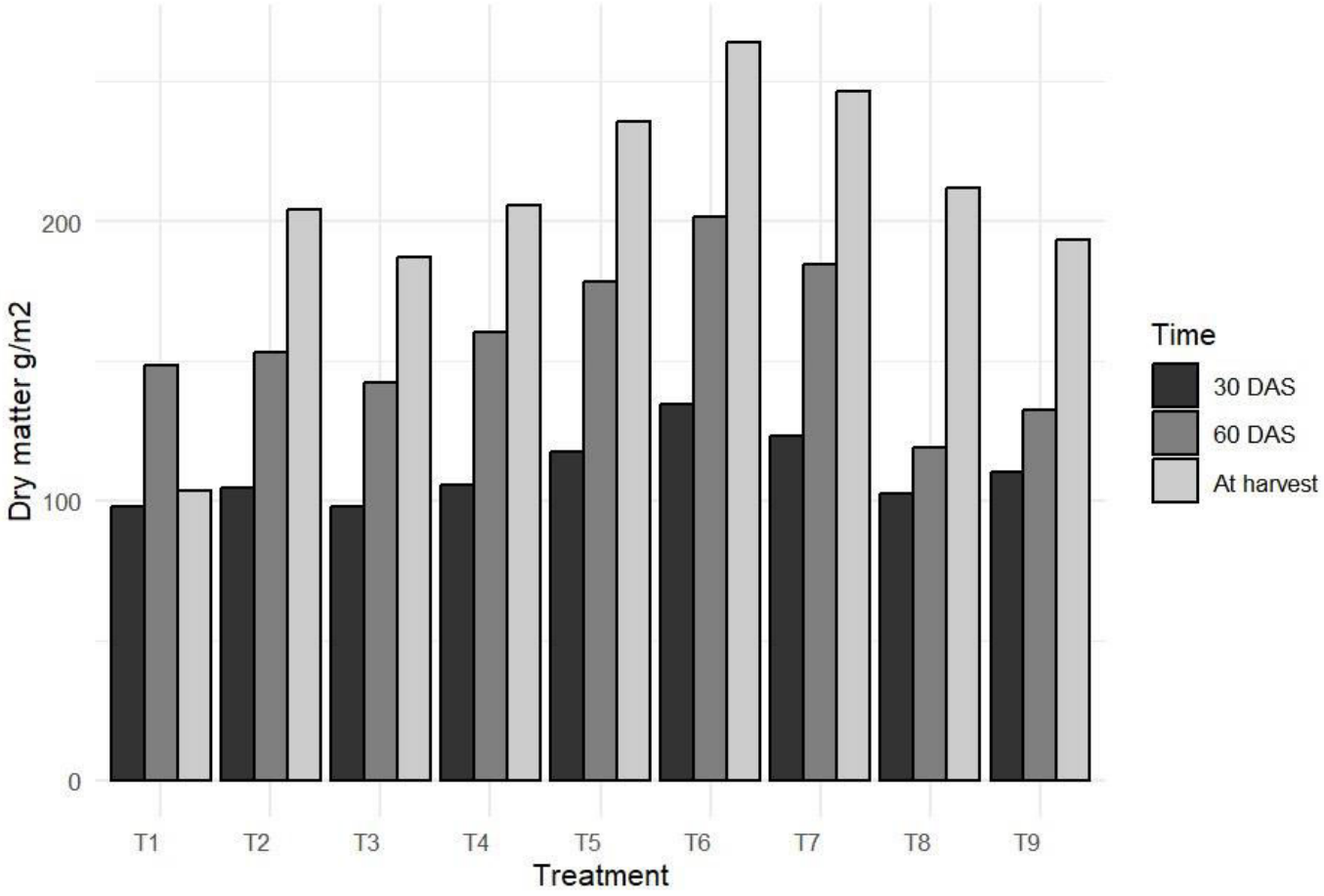


Figure.3 Graphical representation of dry matter (g/m^2) of Lentil at 30 DAS, 60 DAS and harvest stage.



Number of pods per plant

Conversely, treatments like T_2 (M_1S_2) and T_8 (M_3S_2) were generally at par or significantly lower in performance, indicating less favourable conditions for plant growth and nutrient utilization. These findings underscore the importance of selecting the right combination of treatments to achieve maximum productivity and soil health.

Author Contributions

Varun Tripathi: Investigation, formal analysis, writing—original draft. Nyaken Chisi: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.
Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Ali, J., Nawaz, M., Ilyas, M., Chattha, M. U., Khan, I., Chattha, M. B., Arshad, M., Akram, M., Kharal, M., Ullah, E., Aslam, M. T., Athar, F., Mustafa, A., & Hassan, M. U. (2022). Effect of Different Irrigation Intervals and Sowing Methods on Growth and Productivity of Lentil Crop Grown in Semi-Arid Conditions. Journal of Innovative Sciences, 8(1). https://doi.org/10.17582/journal.jis/2022/8.1.20.28

Ali, M. H., & Talukder, M. S. U. (2008). Increasing water productivity in crop production—A synthesis. Agricultural Water Management, 95(11), 1201–1213.

Choudhury, D. R., Tarafdar, S., Das, M., & Kundagrami, S. (2012). Screening lentil (*Lens culinaris* Medik.) germplasms for heat tolerance. Trends Biosci, 5(2), 143–146.

Erman, M., Demir, S., Ocak, E., Tüfenkçi, Ş., Oğuz, F., & Akköprü, A. (2011). Effects of Rhizobium, arbuscular mycorrhiza and whey applications on some properties in chickpea (*Cicer arietinum* L.) under irrigated and rainfed conditions 1—Yield, yield components, nodulation and AMF colonization. Field Crops Research, 122(1), 14–24.

Gan, Y., Hamel, C., Kutcher, H. R., & Poppy, L. (2017). Lentil enhances agroecosystem productivity with increased residual soil water and nitrogen. Renewable Agriculture and Food Systems, 32(4), 319–330.

Hanway, J. J and Hiedal, H. (1952). Soil analysis method used in Iowa State Soil Testing Laboratory. Iowa Agric. (c.f. methods of soil analysis, part 2 Ed. C.A. Black, Medison Wisconsin. American Soci. Of Agron. 57: 1025-1027.

Jackson, M. L. (1958): Soil chemical analysis. Prentice-Hall Inc. Englewood Cliffs. NJ. 180-192.

Kumar, J., Kant, R., Kumar, S., Basu, P. S., Sarker, A., & Singh, N. P. (2016). Heat tolerance in lentil under field conditions. Legume Genomics Genet, 7(1), 1–11. https://doi.org/10.5376/lgg.2016.07.0001

Olsen, S. R., Cole, V. C., Wantanable, F. S. and Dean, L. A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Circular of United State Department of Agriculture, pp. 939.

Rakesh, P. S., Ankita, P., Annie, M. C., AshutoshMasih, E. M., Geethu Rachel, G. S., Jayajiwan Simon, J. T. G., Schilling, P., Lombi, K. M., Alex, R., & Balraj, V. (2017). Chemical use in farming and its health and environmental implications in a rural setting in southern India. IOSR J Environ Sci, 11, 90–95.

Rhioui, W., Al Figuigui, J., Boutagayout, A., Zouhar, M., & Belmalha, S. (2023). Effects of organic and inorganic mulching, nettle extract, and manual weeding on weed management under direct-seeded lentil in Meknes region, Morocco. Crop Protection, 173, 106376. https://doi.org/10.1016/j.cropro.2023.106376

Sauer, T. J., Hatfield, J. L., & Prueger, J. H. (1996). Corn residue age and placement effects on evaporation and soil thermal regime. Soil Science Society of America Journal, 60(5), 1558–1564.

Shirisha, K., Ray, L. I. P., Parida, P. K., Singh, A. K., & Singh, N. J. (2023). 0000000. International Journal of Bio-Resource and Stress Management, 14(Aug, 8), 1099–1107. https://doi.org/10.23910/1.2023.3556c

Soltani, A., Khooie, F. R., Ghassemi-Golezani, K., & Moghaddam, M. (2001). A simulation study of chickpea crop response to limited irrigation in a semiarid environment. Agricultural Water Management, 49(3), 225–237.

Subbiah, B. V. and Asija, G. L. (1956). A rapid procedure for the determination of available nitrogen in soils. Curr. Sci., 25: 259-260.

Walkley, A. and Black. C. A. (1934). An examination of wet acid method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Sci., 37: 29-38. http://dx.doi.org/10.1097/00010694-193401000-00003

Wang, L., Gruber, S., & Claupein, W. (2012). Optimizing lentil-based mixed cropping with different companion crops and plant densities in terms of crop yield and weed control. Organic Agriculture, 2, 79–87. https://doi.org/10.1007/s13165-012-0028-5

How to cite this article:

Varun Tripathi and Nyaken Chisi. 2024. Enhancing the Yield of Lentils (*Lens culinaris*) in Greater Noida (U.P.) by Improving Irrigation Frequency, Nutrient Management Techniques, and Soil Conservation Techniques (Mulching) at Greater Noida (U.P.), India. *Int.J.Curr.Microbiol.App.Sci.* 13(11): 51-62.
doi: https://doi.org/10.20546/ijcmas.2024.1311.007