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Impact of Different Levels of Nitrogen on Growth and Yield of Linseed (*Linum usitatissimum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. Author KLS collected the data for the experimental field. Author AMP designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors AT and DK managed the analyses of the study and also provide assistance for manuscript preparation. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The current investigation was carried out to analyze the effects of distinct levels of nitrogen on growth and yield for the linseed cultivar Jawahar-7.
Study Design: The experiment consists of randomize block design.
Plan and Duration of Study: The experiment was having three replications which was conducted in Sanjeev Agrawal Global Educational (SAGE) University experimental field which is under the supervision of School of Agriculture; during *rabi* season 2022-23.

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Methodology: In this experiment, 7 treatment combinations including four levels of nitrogen as N1- 0 kg/ha, N2- 60 kg/ha, N3- 10 kg/ha, N4-20 kg/ha, N5-30 kg/ha, N6-40 kg/ha, and N57- 50 kg/ha, respectively. These treatments were treated on the popular variety; Jawahar-7.
Results: Results revealed that the highest plant height (79.21 cm), number of branches per plant (7.78), number of capsules per plant (36.24), test weight (9.96 g), seed yield (17.65q/ha) and stover yield (28.67 q/ha), highest gross return (104541.00 Rs/ha, net returns (81425.00 Rs/ha) and benefit cost ratio (3.87) at maximum crop growth stage was recorded in plots treated with application of nitrogen @ 60 kg/ha followed by the 40 kg/ha, and 50 kg/ha nitrogen application rate. The sequential increase in fertilizer levels of nitrogen gives the higher growth and yield attributes.
Conclusion: Nitrogen supply, N @ 60 kg/ha should be more profitable for the improved growth and development of the crop resulting in enhancement of yield and yield attributing traits which can be economically more beneficial to the farmers.

Keywords: Linseed; nitrogen level; growth yield; B:C ratio.

1. INTRODUCTION

"Oilseeds have occupied very important place in human life. Among these, linseed is being one of the most important as per its multiple uses. Linseed (*Linum usitatissimum* L.) is one of the oldest crop plants cultivated for the purpose of fibre and seed oil. It is one of the important oilseed crops in India next to rapeseed-mustard, commonly recognized as flax. India holds fifth position, in area while ranks sixth in production after Kazakhstan, Canada, Russian Federation, China and USA" [1]. It contains 33-34% oil and 24% of protein. Linseed has many inherent characteristics like tolerance to abiotic and biotic stresses, high iodine value which is being used as an industrial applicant as well as its oil is rich in Omega-3. Likewise, the stem yields good quality of fibre than cotton [2]. Almost each and every part of the linseed plant can be utilized for marketable purpose. One of them is linseed cake which can also be also be utilized as an organic manure.

"The average yield of 544 kg/ha in India was observed to be very low while comparing to the world average yield of 927 kg/ha and highest average yield of 1497 kg/ha in Canada" [3]. "Low crop yields also results due to poor fertility, traditional crop management practices and inadequate use of fertilizers. Among these, the imbalance of nutrients appears to be the most serious one. Research proved that crop yield can be increased by choosing high yielding linseed varieties with considerable supply of nutrients via fertilizers" [4].

Among the major and essential elements, nitrogen is one of the prime nutrients required by plants for their improved growth and development therefore suitable supply of nitrogen is advantageous. It promotes cell division and cell enlargement, resulting in more leaf area thus insuring better growth, plant vigour and yield [5]. Considering this, an experiment was conducted to estimate the effects of different levels of nitrogen on growth and yield for the linseed cultivar Jawahar-7.

2. MATERIALS AND METHODS

The experiment was demonstrated in Sanjeev Agrawal Global Educational (SAGE) University experimental field which is under the supervision of School of Agriculture; during *rabi* 2022-23. The field is located on an altitude of 500 m above mean sea level with 23°5'N latitude and 77°10'E longitude in the Vindhya plateau region of Bhopal, Madhya Pradesh, India. The soil was sandy loam in texture having available N (180.25 kg/ha) P (14.25 kg/ha), potassium (157.68 kg/ha) and organic carbon of soil was of 0.32 % with 6.5 pH. The design used for this experiment was Randomized Complete Block Design (RCBD) with three replications having gross and net plot size was 2.5 m x 3.5 m and 2.0 m x 3.0 m, respectively and 7 treatments. The 7 treatment combinations including T1- Control, T2- RDF (100%) + Nitrogen 0 kg/ha, T3- RDF (P, K100%) + Nitrogen 10 kg/ha, T4- RDF (P, K100%) + Nitrogen 20 kg/ha, T5- RDF (P, K100%) + Nitrogen 30 kg/ha, T6- RDF (P, K100%) + Nitrogen 40 kg/ha and T7- RDF (P, K100%) + Nitrogen 50 kg/ha, respectively. The recommended dose of fertilizer was 60:30:40 kg/ha NPK. Nutrients, nitrogen (N2O) was applied as per the treatments. Half dose of nitrogen and full dose of phosphorus and potassium was applied as basal dose and remaining half dose of nitrogen was applied in two equal splits during first and second irrigation. All the other agronomic practices were applied

uniformly to all the treatments. The crop variety used for this experiment was 'Jawahar-7'.

"All the significant observations like growth, yield attributes, yield etc. were recorded. For recording the growth and yield attributes, five randomly selected plants of respective treatments were tagged. The collected data was statistically examined with the help of analysis of variance (ANOVA)" [6]. The critical difference (C.D.) was worked out at 5 per cent level of significance for treatment comparison where the 'F' test revealed the significant effect [7].

3. RESULTS AND DISCUSSION

The result shows that plant height, number of branches per plant, number of capsules per plant, test weight, seed yield and stover yield was influenced knowingly due to different concentrations of nitrogen. [4] and [5] also observed the similar status seeing the increasing levels of nitrogen on various yield attributes.

Table 1 shows the observations regarding these various traits as given above. Statistical analysis of the data revealed that maximum plant height, number of branches and capsules per plant at maximum crop growth stage (79.21 cm, 7.78 and 36.24 respectively) were recorded in the plot (N2) treated with the application of nitrogen @ 60 kg/ha while, lowest value was observed in plot that received no nitrogen (N1).

It was seen that plant development expanded steadily with the ideal nitrogen portion. This may be because of higher accessibility of nitrogen that dynamically improved the vegetative development of the plant [8]. "The quick expansion in plant level in the beginning phase of plant development might be credited to the larger number of leaves creating higher food material for development of the plant. As a matter of fact, more and large size leaves were liable for planning more food photosynthates which expanded cell division and brought about fast growth and expansion of the plants" [9]. Comparable results were reported by [10], [11] and [12]. Results about the number of capsules were also confined by [13].

Being a viable extractor of soil nitrogen, it is thought that nitrogen is additionally a significant supplement in linseed crop. The expansion in development boundaries is credited to the more grounded job of N in cell division, cell extension and broadening which at last influence the vegetative development of yield and powerful usage of supplements through the broad root foundation created by crop plants under coordinated N application.

The critical variation in plant level might be because of the way that nitrogen application further developed the underground root growth through speeding up inner physiological processes. The expansion in plant level and number of branches per plant was likewise revealed by [14] and [15].

Data regarding test weight, seed yield, stover yield and harvest index is reported in (Table 2). Statistical analysis revealed that test weight, seed yield, stover yield and harvest index (9.96 g, 17.65q/ha, 28.67 q/ha and 38.51 respectively) was recorded highest in plots treated with the application of nitrogen @ 60 kg/ha followed by the application nitrogen @ 50 kg/ha, while lowest values were observed in plot that received no nitrogen.

Utilization of nitrogen was seen as altogether unrivaled for endlessly yield credits as well as oil content. The plant treated with ideal nitrogen dosages, coming about expanded the root through better root advancement and more supplement accessibility, bringing about enthusiastic plant development and dry matter collection prompting blossoming, fruiting and case arrangement. The most extreme number of containers per plant with ideal nitrogen rates was owing to more readily establish development which thus prompted expansion in seed yield. These discoveries matched the results of [16] and [17]. This might be due to nitrogen application which results in the root foundation through speeding up different metabolic cycles like cell division, cell advancement and cell expansion in roots.

The upgraded seed and stover yield because of nitrogen application might be ascribed to the actuation of metabolic cycles. The excitement impacts of N on development and yield credits and upgraded nitrogen movement in plant which thus thought about emphatically financial yield of the harvest. The better ripeness status of the plots, which got higher measure of nitrogen in linseed, could have further developed the plant development and yield ascribes. Higher take-up of supplements improved the photosynthetic proficiency as well as movement of photosynthates from source to sink which

resulted in higher yield. The outcomes are in close similarity with the work [18].

Harvest index was calculated based on the economic and biological yield of individual treatments and subjected to analysis. The application of N @ 60 kg/ha recorded the highest harvest index (38.51). The difference in harvest index may be the impact of better yield, yield attributes and better relationship of the source and sink [4] and [19]. Also, the highest benefit cost ratio (3.87: 1) was observed among the application of N @ 60 kg/ha by calculating gross monetary as well as net monitory returns on various treatments (Table 3). Adding levels of nitrogen significantly increased the net returns and benefit cost ratio [20]. This might be due to maximum retrieval from application of nitrogen with less disbursement. Similar outcomes were recorded by [5], [19] [21] and [22].

Table 1. Effect of nitrogen levels on growth parameters of linseed

Treatments	Plant height (cm)	Number of branches/Plant	Number of capsules per plant	Number of leaves / plants
Effect of nitrogen				
T1	65.42	4.14	18.68	41.03
T2	79.21	7.78	36.24	49.21
T3	68.55	4.56	23.05	42.47
T4	71.12	5.11	24.25	43.17
T5	73.61	5.46	26.79	44.54
T6	75.19	6.32	29.46	45.87
T7	77.32	6.89	33.24	47.62
S. Em±	1.44	0.49	2.29	1.10
C.D. (*P*=0.05)	2.45	2.21	3.79	2.10

Table 2. Effect of nitrogen levels on yield attributes of linseed

Treatments	Dry weight (g)	Test weight (g)	Seed yield (q/ha)	Straw yield per hectare (q/ha)	Biological yield per hectare (q/ha)	Harvest index (%)
Effect of nitrogen						
T1	2.15g	7.79	11.35	24.27	35.96	34.12
T2	3.77g	9.96	17.65	28.67	47.39	38.51
T3	2.27g	8.03	12.85	24.89	36.61	34.78
T4	2.35g	8.34	13.36	25.45	37.39	35.45
T5	2.46g	8.69	14.07	26.12	39.47	36.21
T6	2.78g	8.92	15.81	26.96	41.34	37.33
T7	3.59g	9.45	16.33	27.65	43.87	38.14
S. Em±	0.24	0.29	0.83	0.59	1.46	0.63
C.D. (*P*=0.05)	0.62	1.74	1.39	1.32	2.54	1.82

Table 3. Effect of nitrogen levels on economics of linseed

Treatments	Gross Return (Rs/ha)	Net Return (Rs/ha)	Benefit - Cost Ratio
Effect of nitrogen			
T1	74230.00	58725.00	2.42
T2	104541.00	81425.00	3.87
T3	78780.00	60818.00	2.47
T4	83408.00	64273.00	2.64
T5	86737.00	68731.00	2.87
T6	88387.00	71521.00	3.14
T7	97505.00	75826.00	3.44
S. Em±	3965.84	3093.25	0.20
C.D. (P=0.05)	9356.71	7074.98	0.54

4. CONCLUSION

In conclusion it is observed that the Nitrogen supply, N @ 60 kg/ha should be more profitable for the improved growth and development of the crop resulting in enhancement of yield and yield attributing traits which can directly affect money-making more economically. Hence the above concentration of the nitrogen (60Kg/ ha)can be utilized by the farmers to get higher yield of linseed crop.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFRENCES

1. FAOSTAT. Area, production and productivity of linseed in the world. Statistics Division, Food and Agricultural Organization of United nations. www.faostat.fao.org. 2019. 22 June, 2022.
2. Solo V, Singh PL, Singh AP. Effect of Nitrogen and Sulphur levels on growth and yield of linseed (*Linum usitatissimum* L.) under rainfed condition of Nagaland. Agricul Sci Digest: A Research Journal of Agriculture, Animal and Veterinary Science. 2021;41(4):590 594.
3. FAOSTAT. Area, production and productivity of linseed in the world. Statistics Division, Food and Agricultural Organization of United nations. www.faostat.fao.org. 2018.15 June, 2020.
4. Pawar AV, Misal AM, Thombre PR, Rathod MR. Studies on effect of nitrogen and sulphur on growth and yield parameters in linseed (*Linum usitatissimum* L.) varieties. The Pharma Innov Journal. 2023;12(1):206-209.
5. Sameer S, Singh V, Tiwari D, George SG. Effect of nitrogen and phosphorus levels on growth and yield of Linseed (*Linum usitatissimum* L.). The Pharma Innov Journal. 2021;10(10):1833-1836.
6. Panse VG, Sukhatme PV. Statistical method for agricultural research workers. 2nd ed. ICAR Publication, New Delhi; 1967.
7. Aditya Bunkar and DP Chaturvedi. Effect of phosphorus levels and varieties on growth, yield and quality of linseed (*Linum usitatissimum* L.). The Pharma Innovation Journal. 2022;11(8): 1716-1720.
8. Razaq M, Zhang P, Shen HI, Salahuddin. Influence of nitrogen and phosphorous on the growth and root morphology of Acer mono. Plus One. 2017;12 (2):1-13.
9. Liu W, Hou Y, Jin Y, Wang Y, Xu X, Ha J. 2020. Research progress on liposomes: Application in food, digestion behavior and absorption mechanism. Trends in Food Sci & Tech. 2022;104: 177-189.
10. Chopra P, Badiyal D. Influence of nitrogen fertilization on performance of linseed (*Linum usitatissimum* L.) under Utera system. Himachal J Agril Res. 2016;42(1):108 110.
11. Singh DN, Bohra JS, Singh JK. Influence of NPK and variety on growth, yield and quality of irrigated linseed (*Linum usitatissimum*). Indian J Agril Sci. 2013;83(4):456- 45.
12. Khajani FP, Hamid I, Majid M, Hussein O. Influence of different levels of nitrogen, phosphorus and potassium on yield and yield components of flax seed oil (*Linum usitatissimum* L.) variety Lirina. J Med Plnts Res. 2012;6(6):1050-1054.
13. Pohare VB, Raundal PU, Bhondave TS. Effect of NPK levels on linseed under plain zone of Maharashtra. J Agril Res and Tech. 2015;40:528-532.
14. Kumar A, Mahapatra BS, Singh VP, Shukla, Negi MS, Yadav A, Singh SP, Gupta, G, Singh M. Effect of nutrient levels on yield, nutrient uptake and economics of Indian mustard (*Brassica juncea*) in Tarai region of Uttarakhand. Indian J Agron. 2017;62 (3):116-119.
15. Vyas VV, Singh R, Singh E. Effect of different levels of Phosphorus and Sulphur

on Growth and Yield of Linseed (*Linum usitatissimum* L.). Int J Current Microb and Applied Sci. 2020; 9(12):1692-1696.

16. Singh AK, Singh H, Rai OP, Singh G, Singh VP, Singh NP, Singh R. Effect of sowing dates and varieties for higher productivity of Indian mustard (*Brassica juncea* L.). J Appl and Nat Sci. 2017;9 (2):883 – 887.
17. Parmar SK, Thanki JD, Tandel B B, Pankhnaiya R M. Effect of nitrogen phosphorus and sulphur application on yield, quality, uptake and economics of linseed (*Linum usitatissimum* L.). Int J of Chem Studies. 2020; 8 (5):1956-1960.
18. Biswas S, Mukherjee B, Munshi A, Chongre S, Ray M. Evaluation of Mustard Hybrid varieties in Gangetic Plains of West Bengal, India. Int J Current Microb and Applied Sci. 2019;8(10):585-590.
19. Gaikwad SR, Suryavanshi VP, Bhusari SA and Misal AM. 2020. Effect of fertilizers on growth and yield of Linseed (*Linum usitatissimum* L.) varieties. The Pharma Innov J. 2020;9(10):127-131.
20. Kumar R, Deka BC. Response of fertility levels and seeding rates on production potential and moisture use efficiency of linseed under foot hill condition of Nagaland. Indian J Hill Farming, 2016;29:1-5.
21. Awasthi UD, Dubey SD and Shripal. Effect of nitrogen and moisture conservation practices on yield, uptake, water-use efficiency and quality of linseed (*Linum usitatissimum*). Indian J Agricultural Sciences. 2011;81(4):383–5.
22. Tanwar SPS, Rokadia P and Singh AK. Effect of row ratio and fertility levels on chickpea (*Cicer arietinum*) and linseed (*Linum usitatissimum*) intercropping system. Indian J Agronomy, 2011; 56 (3): 217–22.

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