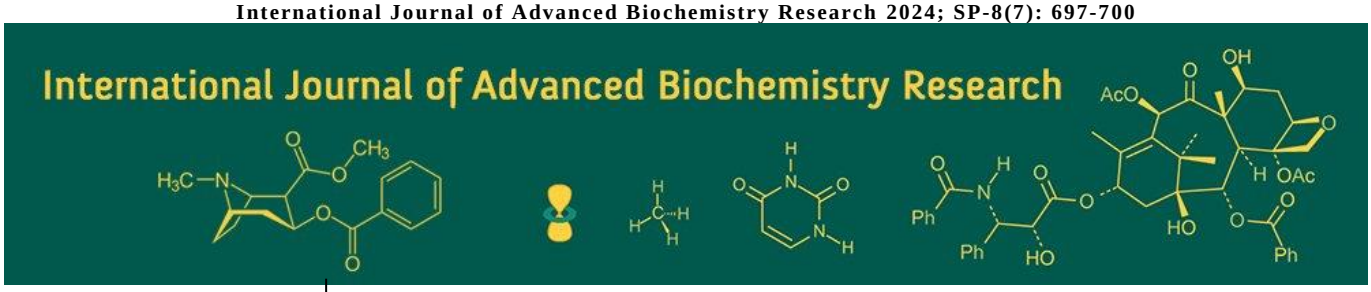

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(7): 697-700
www.biochemjournal.com
Received: 25-05-2024
Accepted: 30-06-2024

Mirza IAB
Associate Professor, Department of Agronomy, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

GL Kadam
Assistant Professor, Department of Agronomy, College of Agriculture, AAU, Anand, Gujarat, India.

AD Pawar
Ph.D. Scholar, Department of Agronomy, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

SS Halge
Ph.D. Scholar, Department of Agronomy, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Mirza IAB
Associate Professor, Department of Agronomy, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Response of nutrient levels on yield and economics of linseed (*Linum usitatissimum* L.)

Mirza IAB, GL Kadam, AD Pawar and SS Halge

DOI: https://doi.org/10.33545/26174693.2024.v8.i7Si.1620

Abstract
The experiment was carried out at Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *rabi* season 2020-21. To Study on nutrient management under different fertilizer doses in linseed (*Linum usitatissimum* L.) The experiment was laid out in randomized block design with three replication and nine treatments of fertilizer doses such as T_1: 25:25:00 NPK kg ha^{-1} (RDF), T_2: 30:30:00 NPK kg ha^{-1}, T_3: 35:35: 00 NPK kg ha^{-1}, T_4: 25:25:25 NPK kg ha^{-1}, T_5: 30:30:00 NPK kg ha^{-1}, T_6: 35:35: 35 NPK kg ha^{-1}, T_7: 40:20:20 NPK kg ha^{-1}, T_8: 50:25:25 NPK kg ha^{-1}, T_9: control. The result of the experiment revealed that among the treatments among the different treatments application of 50:25:25 NPK kg ha^{-1} (T_8) recorded the higher yield and yield attributes such as seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), harvest index (%), higher gross monetary returns (₹57911 ha^{-1}) and net monetary returns (₹35693 ha^{-1}) but it was comparable with the treatments 40:20:20 NPK kg ha^{-1} (T_7). The higher benefit: cost ratio (2.61) was recorded by treatment 50:25:25 NPK kg ha^{-1} (T 8). Lowest gross monetary returns (25809 ha^{-1}), net monetary returns (6059 ha^{-1}) and benefit: cost ratio (1.31) was obtained by control (T_9).

Keywords: Linseed, GMR, B:C ratio, NMR, yield

1. Introduction
Linseed or flax (*Linum usitatissimum* L.) belongs to family Linaceae is one of important *rabi* oilseed crop. It contains 35 to 45% oil. The oil cake left, after extraction of oil is a most valuable cake, perhaps the most favorite cattle feed. The oil cake is a good feed for milch cattle and poultry and hence priced higher than mustard cake. Linseed crop is cultivated over an area of 22.70 lakh ha with a production of 22.39 lakh tonnes and productivity is 986 kg ha^{-1} at world level. In India, it occupies an area of 2.70 lakh ha with a production of 1.25 lakh tonnes and a productivity is 477 kg ha^{-1}. India ranks third in area after Canada and Kazakhstan. India contributes about 14.88% and 6.57% of world's area and production respectively. The major part of linseed growing area lies in the states of Madhya Pradesh, Himachal Pradesh, Chhattisgarh, Uttar Pradesh, Maharashtra, Bihar, Odisha, Jharkhand, Karanataka and Assam accounting for more than 97% of total area (Anonymous, 2016) [3]. The area under linseed in Maharashtra is 10.2 thousand ha, with an annual production of 2.5 thousand tonnes and averages productivity is 243 kg ha^{-1} (Anonymous, 2017) [4].
Nitrogen, phosphorus and potassium play important role in increasing the yield and quality of linseed crop. Nitrogen is a structural component of chlorophyll and protein therefore, adequate supply of nitrogen is beneficial for both carbohydrates and protein metabolism as it promotes cell division and cell enlargement, resulting in more leaf area and thus ensuring better growth and development of plant producing higher seed and dry matter yield. Phosphorus is essential for cell division and meristematic growth of tissue. It helps in stimulating flowering as well as seed and fruit development. It plays important role in growth, development and maturity. It helps in flowering and fruiting. Phosphorus is a constituent of nucleic acid, phytine, phospholipids and many enzymes, which are involved in carbohydrate and fat metabolism. It hastens maturity and improves quality of grain. It is an essential part of skeleton of plasma membrane, nucleic acid, many co-enzymes and phosphorylated compound. It also plays an important role in energy transfer in plant body and formation of reproductive organ of plant. Hence good supply of phosphorus is usually associated with increased root density and proliferation, which aid in extensive exploration and supply of nutrient and water to the growing plant parts, resulting in increased growth and

yield, thereby ensuring more seed and dry matter yield (Maiti and Jana, 1985) [9]. The application of phosphorus play a vital role in the formation and translocation of carbohydrates, root development, crop maturation and resistant to disease pathogen.

2. Materials and Methods

The experiment was laid out in field at Experimental Farm (Plot No. A-5) Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *rabi* season 2020-21. The experiment was laid out in Randomized block design with Treatment details: T_1: 25:25:00 NPK kg ha^{-1} (RDF), T_2: 30:30:00 NPK kg ha^{-1}, T_3: 35:35: 00 NPK kg ha^{-1}, T_4: 25:25:25 NPK kg ha^{-1}, T_5: 30:30:00 NPK kg ha^{-1}, T_6: 35:35: 00 NPK kg ha^{-1}, T_7: 40:20:20 NPK kg ha^{-1}, T_8: 50:25:25 NPK kg ha^{-1}, T_9: control. For treatment T_7 and T_8 nitrogen applied in two splits of 50% as basal dose and remaining at 30 DAS. For all the remaining treatments entire dose of RDF was applied at the time of Sowing. The Net plot size was 4.8 m x 4.2 m. Sowing was done on 2nd November, 2020. The spacing of 30cm x 15cm was maintained. The recommended cultural practices and plant protection measures were taken.

3. Results and Discussion

Table 1: Mean seed yield (kg ha-1), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest Index (%) of linseed as influenced by different treatments.

Trt. No.	Treatment details	Seed Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})	Biological Yield (kg ha^{-1})	Harvest index (%)
T_1	25:25:00 kg NPK/ha (RDF)	645	1470	2115	30.69
T_2	30:30:00 kg NPK/ha	781	1785	2566	30.54
T_3	35:35: 00 kg NPK/ha	835	1800	2636	31.70
T_4	25:25:25 kg NPK/ha	695	1510	2206	31.67
T_5	30:30:00 kg NPK/ha	839	1830	2670	31.45
T_6	35:35:35 kg NPK/ha	862	1873	2736	31.53
T_7	40:20:20 kg NPK/ha	1050	2165	3215	32.76
T_8	50:25:25 kg NPK/ha	1113	2225	3339	33.36
T_9	Control	496	1125	1621	30.63
SE (m)±		43.16	112.8	136.78	--
C.D. at 5%		129.94	339.48	411.75	--
General mean		813.37	1754	2567	31.59

3.1 Effect of different fertilizer doses on yield of linseed as influenced parameters.

The data on Mean seed yield (kg ha-1), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest Index (%) of linseed as influenced by different treatments.

3.1.1 Seed yield (kg ha^{-1})

The treatments differences of seed yield of linseed crop due to different treatments were found significant. The mean seed yield of linseed crop was recorded 813kg ha^{-1}. Data from Table 1. revealed that application of 50:25:25 kg NPK/ha (T_8) which was significantly seed yield (1113 kg ha^{-1}) higher than other treatment except for application of 40:20:20 NPK kg ha^{-1} (T_7) (1050 kg ha^{-1}). It was observed 35:35:35 NPK kg ha^{-1} (T_6) (862 kg ha^{-1}), 30:30:30 NPK kg ha^{-1} (T_5) (kg ha^{-1}), 35:35:00 NPK kg ha^{-1} (T_3) (839 kg ha^{-1}), and 30:30:00 NPK kg ha^{-1} (T_2) (781 kg ha^{-1}), were at par with each other. The lowest seed yield of linseed obtained with control treatment (T_9) (496 kg ha^{-1}). Higher seed yield recorded in higher fertilizer dose treatment is due to higher leaf area promoted by availability of nutrients which in turn helps in photosynthesis and dry matter accumulation which increases the weight of capsule in plants which in turn resulted in higher seed yield. Similar results were reported by Khajani *et al.*, (2012) [13]

3.1.2 Straw yield (kg ha^{-1})

The data on mean straw yield kg ha^{-1} was influenced significantly by various treatments. The mean straw yield kg ha^{-1} was 1754 kg ha^{-1}. The straw yield was differed significantly due to different treatments. The highest straw yield (2225 kg ha^{-1}) recorded with application of 50:25:25 NPK kg ha^{-1} (T_8) which was at par with 40:20:20 NPK kg ha^{-1} (T_7) (2165 kg ha^{-1}) and significantly superior over all other treatment. This might be due to the higher growth and photosynthesis which resulted in more dry matter accumulation in treatment receiving higher fertilizer doses. Similar trend of observation was also reported by Delesa and Choferie (2016) [7]. The lowest straw yield (1125 kg ha^{-1}) was observed with treatment T_9 (Control). This treatment was found significantly inferior over rest of the treatments.

3.1.3 Biological yield (kg ha^{-1})

The treatments differences of biological yield of linseed due to different treatments were found significant. Data from table 1 revealed that application of 50:25:25 kg NPK/ha (T_8) which was significantly higher biological index (3339 kg ha^{-1}) higher than other treatment except for application of 40:20:20 NPK kg ha^{-1} (T_7) (3215 kg ha^{-1}). Among remaining treatment i.e., 35:35:35 NPK kg ha^{-1} (T_6) (1873 kg ha^{-1}), 30:30:00 NPK kg ha^{-1} (T_5) (1830 kg ha^{-1}), 35:35: 00 NPK kg ha^{-1} (T_3) (1800 kg ha^{-1}) and 30:30:00 NPK kg ha^{-1}(T_2) (1785 kg ha^{-1}), which was found at par with each other. The lowest biological yield (1661 kg ha^{-1}) recorded with control (T_9). Lower biological yield in control treatment might be due to the less availability of nutrient. Similar kind of observation was recorded by El-Nagdy *et al.*, (2010) [8].

3.1.4 Harvest index (%)

Data on harvest index presented in Table 1 revealed that the highest harvest index was observed in treatment when application of 50:25:25 NPK kg ha^{-1} (T_8) (33.36%) and lowest harvest index observed was (30.63%) due to treatment T_9 (Control).

3.2 Economics

The data on GMR (₹ ha^{-1}), NMR (₹ ha^{-1}), COC (₹ ha^{-1}), and B:C ratio of linseed as influenced by various treatment are presented in table 2.

Table 2: GMR (₹ ha^{-1}), NMR (₹ ha^{-1}), COC (₹ ha^{-1}), and B:C ratio of linseed as influenced by various treatments.

Trt. No.	Treatment details	Gross monetary returns (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net monetary returns (₹ ha^{-1})	B:C ratio
T_1	25:25:00 NPK kg ha^{-1} (RDF)	33547	21170	12377	1.58
T_2	30:30:00 NPK kg ha^{-1}	40636	21450	19186	1.89
T_3	35:35: 00 NPK kg ha^{-1}	43452	21739	21713	2.00
T_4	25:25:25 NPK kg ha^{-1}	36175	21929	14246	1.65
T_5	30:30:00NPK kg ha^{-1}	43654	22360	21294	1.95
T_6	35:35: 35 NPK kg ha^{-1}	44856	22800	22056	1.97
T_7	40:20:20 NPK kg ha^{-1}	54617	21724	32893	2.51
T_8	50:25:25 NPK kg ha^{-1}	57911	22218	35693	2.61
T_9	Control	25809	19750	6059	1.31
SE(m)+		2720	-	1369.24	-
C.D. at 5%		8188	-	4121.81	-
General mean		42295	21682	20613	1.94

3.2.1 Gross monetary returns (₹ ha^{-1})

The gross monetary returns as influenced by different treatments are presented in Table 2. The mean gross monetary returns recorded were (₹ 42295 ha^{-1}). The differences in gross monetary returns were significantly influenced due to different treatments. The data in Table.2 showed that the significantly higher gross monetary returns (₹ 57911 ha^{-1}) were recorded by 50:25:25 NPK kg ha^{-1} (T_8) treatment over rest of treatments and found statistically at par with 40:20:20 NPK kg ha^{-1} (T_7) (₹ 54617 ha^{-1}). Among remaining treatment i.e., 35:35:00 NPK kg ha^{-1} (T_6) (₹ 44856 ha^{-1}), 30:30:00 NPK kg ha^{-1} (T_5) (₹43654 ha^{-1}), 35:35: 00 NPK kg ha^{-1} (T_3) (₹ 43452 ha^{-1}) and 30:30:00 NPK kg ha^{-1} (T_2) (₹ 40636 ha^{-1}) which was found at par with each other. Lower Gross monetary returns (₹ 25809 ha^{-1}) was recorded by treatment of control (T_9). Higher gross monetary returns in treatment receiving the higher fertilizer dose might be due to the higher yield recorded in those treatment compared to control. Similar kind of results were reported by Suryavanshi *et al.*, (2012) [12], Kumar *et al.*, (2014) [10] and Nathan *et al.* (2018) [11].

3.2.2 Net monetary returns (₹ ha^{-1})

The net monetary returns (₹ ha^{-1}) as influenced by different treatments is presented in Table. 2 The mean net monetary returns recorded was (₹ 20613 ha^{-1}) The differences in net monetary returns were significantly influenced due to different treatments.

The significantly higher net monetary returns (₹ 35693 ha^{-1}) were obtained by 50:25:25 NPK kg ha^{-1} (T_8) treatment over rest of treatments and found statistically at par with 40:20:20 NPK kg ha^{-1} (T_7) (₹ 32893 ha^{-1}). Among remaining treatment i.e., 35:35:35 NPK kg ha^{-1} (T_6) (₹ 22056 ha^{-1}), 30:30:00 kg NPK/ha (T_5) (₹ 21294 ha^{-1}), 35:35:00 NPK kg ha^{-1} (T_3) (₹ 21713 ha^{-1}) and 30:30:00 NPK kg ha^{-1} (T_2) (₹ 19186 ha^{-1}) which was found at par with each other. Least net monetary returns (₹ 6059 ha^{-1}) were recorded by control (T_9).

3.2.3 Benefit: cost ratio

Data pertaining to benefit: cost ratio as influenced by various treatments is presented in Table 2 The mean benefit: cost ratio recorded was (1.94).

The higher benefit: cost ratio (2.61) was recorded by the treatment 50:25:25 NPK kg ha^{-1} (T_8) over rest of treatments followed by 40:20:20 NPK kg ha^{-1} (T_7) (2.51). Among remaining treatment i.e. 35:35:00 NPK kg ha^{-1} (T_6) (1.97), 30:30:00 NPK kg ha^{-1} (T_5) (1.95), 35:35: 00 NPK kg ha^{-1} (T_3) (2.00) and 30:30:00 NPK kg ha^{-1} (T_2) (1.89) which was found at par with each other. The lower B: C ratio was recorded by Control (T_9) (1.31).

4. Conclusions

Among the different treatments 50:25:25 NPK kg ha^{-1} (T_8) recorded the higher seed yield (1113 kg ha^{-1}), gross monetary returns (₹ 57911 ha^{-1}) and net monetary returns (₹ 35693 ha^{-1}) but it was comparable with the treatments 40:20:20 NPK kg ha^{-1} (T_7). The higher benefit: cost ratio (2.61) was recorded by treatment 50:25:25 NPK kg ha^{-1} (T_8). Lowest seed yield (496 kg ha^{-1}), gross monetary returns (₹ 25809 ha^{-1}), net monetary returns (₹ 6059 ha^{-1}) and benefit: cost ratio (1.31) was obtained by control (T_9).

5. References

1. Ahemed MK, Saad AO, Thaloot AT, Kabesh MO. Response of sesame to inorganic, organic and Biofertilizer. Ann Agric Sci Ain Sham Univ. 1997;42(2):365-375.
2. Ali A, Hussain M, Tanveer A, Nadeem AM, Haq. Effect of different levels of phosphorus on seed and oil yield of two genotypes of linseed (*Linum usitatissimum* L.). Pak J Agri Sci. 2002;39(4):281-282.
3. Anonymous. All India area, production and yield of linseed (*Linum usitatissimum* L.); c2016.
4. Anonymous. All India area, production and yield of linseed (*Linum usitatissimum* L.); c2017.
5. Awasthi UD, Dubey SD, Shripal. Effect of nitrogen and moisture conservation practices on yield, uptake, water-use efficiency and quality of linseed (*Linum usitatissimum* L.). Ind J Agril Sci. 2011;81(4):383-385.
6. Choubey NK, Shrivastava GK, Lakpale R, Tripathi RS. Effect of different cropping sequence and fertilizer levels on seed yield and economics of linseed under rainfed condition. ISOR Natl Sem Stress Management in Oilseed. 2003;28(30):309-310.
7. Delesa A, Choferie A. Response of linseed (*Linum usitatissimum* L.) to fertilizer application and weeds control in South-Eastern Highlands of Ethiopia. J Cereals Oilseeds. 2016;7(5):44-54.
8. El-Nagdy GA, Nassar DM, El-Kady EA, El-Yamanee GS. Response of flax plant (*Linum usitatissimum* L.) to treatments with mineral and bio-fertilizers from nitrogen and phosphorus. J Ameri Sc. 2010;6(10):207-217.
9. Maiti DD, Jana PK. Effect of different levels of nitrogen and phosphorus on yield and yield attributes of sesame. Ind J Oilseeds Res. 1985;45(2):252-259.

10. Kumar M, Ram Tirth, Uttam SK, Kaushal Kumar, Parihar GS. Production potential of linseed (*Linum usitatissimum* L.) under different crop sequences and nitrogen application in rainfed condition. Int J Agril Inno Res. 2014;3(4):2319-1473.
11. Nathan JK, Lata AM, Joseph B, Madhavi A. Influence of nitrogen and sulphur on growth yield and economics of spineless safflower under irrigated condition. Int J Pure App Biosci. 2018;6(3):77-81.
12. Suryavanshi VP, Suryawanshi SB, Ghodke MK. Studies on yield and economics of sunflower hybrid and varieties as influenced by different fertilizer levels. J Oilseeds Res. 2012;30.
13. Khajani FP, Irannezhad H, Majidian M, Oraki H. Influence of different levels of nitrogen, phosphorus and potassium on yield and yield components of flax seed oil (*Linum usitatissimum* L.) variety Lirina; c2012.