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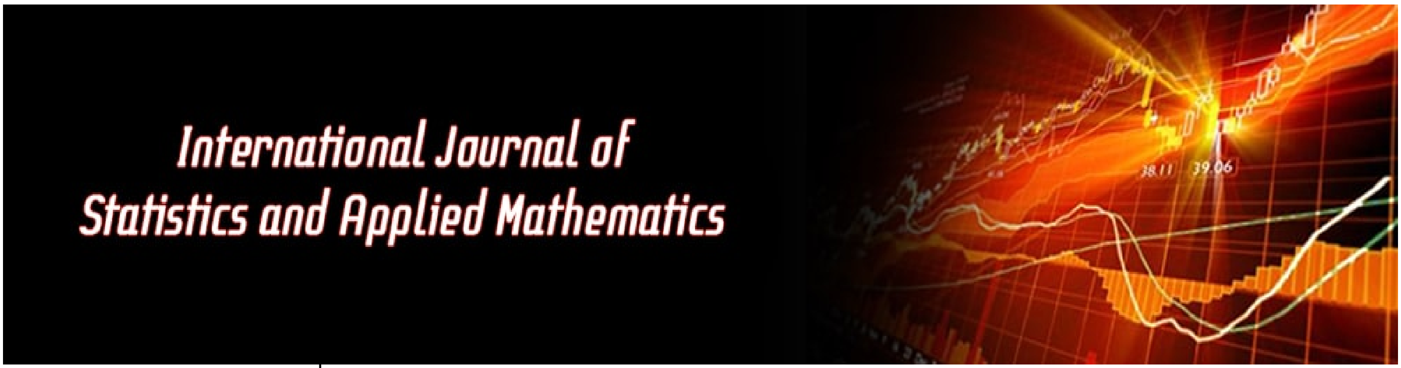

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Consequence of FYM and major nutrient on growth and yield of linseed (*Linum usitatissimum* L.)

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Abstract
The field experiment was carried out in Saikheda, Chhindwara (M.P.) in the rabi season of 2022 at the Agronomy Farm, Department of Agronomy, School of Agricultural Sciences, G.H. Raisoni University. to evaluate the growth performance of linseed to FYM and Major nutrients. Consist of Nine treatments and three replications made up the experiment's Randomized Block Design layout. The treatments were given on FYM and major nutrients are T_1- 0 TONS FYM +75% RDF, T_2- 2.5 TONS FYM +75% RDF, T_3- 5 TONS FYM +75% RDF, T_4- 0 TONS FYM +100% RDF, T_5- 2.5 TONS FYM +100% RDF, T_6- 5 TONS FYM +100% RDF, T_7- 0 TONS FYM +125% RDF, T_8- 2.5 TONS FYM +125% RDF and T_9- 5 TONS FYM +125% RDF used. The use of 5 TONS FYM +125% RDF among the organic sources and nutrient management studied recorded considerably higher growth parameters, while 5 TONS FYM +125% RDF (T_9) recorded significantly superior growth parameters *viz*., plant heights, numbers of branches per plant and numbers of leaves per plant followed by 5 TONS FYM +100% RDF (T_6) and lowest should be found in 0 TONS FYM +75% RDF (T_1).

Keywords: Linseed, nutrients, RDF, growth, yield, FYM

Introduction
Linseed (*Linum usitatissimum* L.) also known as flax is a member of genus Linum belonging to family Linaceae. It is a native to the region extending from the Eastern Mediterranean to India. It is known as Agasi/ Akshiin (Kannada), Jawas/ Javas or Alashi in (Marathi), Alsi in (Hindi) and Ousahalu in (Telugu).It has a high percentage of essential fatty acid which plays a role in cell membrane synthesis by making them flexible, and affects several biological processes such as blood clotting and blood vessel contraction (EL-Hariri *et al*., 1998) [3].
Oil seeds are rich in fat and in addition they contain a high level of protein, they contribute edible oil (fats) and vanaspati ghee to human diet. Edible oil is concentrated source of energy. The energy content of oil is much higher (39.80 mg kg^{-1}) than protein (23.88 mg kg^{-1}) or carbohydrate (16.76 mg kg^{-1}). They contain useful carbohydrates, vitamins and provide essential fatty acids. Edible oil cakes are fed to cattle, while non-edible cakes are used as organic manures and are also a major source of raw material in industries for manufacturing a wide range of products used in life. Oilseeds have also medicinal and therapeutic values.
India is the second largest producer of linseed, next to Canada in the world with an area of 2.0 lakh ha, total production of 1.21 lakh tones per annum and productivity of 605 kg ha^{-1}. India has 18.8 percent of worlds recorded linseed area but produces less than 10% of total world production
Farmyard manure seems to act directly for increasing the crop yields either by acceleration of respiratory process with increasing cell permeability and hormonal growth action or by combination of all these processes. It supplies nitrogen, phosphorus, potassium and micronutrients like Fe, S, Mo and Zn etc. in available form to the plants through biological decomposition and improves physical-chemical properties of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increase in cation exchange capacity, stimulation of soil flora and fauna etc. On an average it contains 0.50, 0.17 and 0.55 per cent of N, P and K, respectively.
Among different nutrients, nitrogen is the most important constituent of protein, enzymes and chlorophyll and involved in all processes associated with protoplasm, enzymatic reactions and photosynthesis.

Reported responses of linseed to N are diverse and conflicting. An adequate supply of nitrogen is associated with vigorous vegetative growth and dark green colour. It promotes cell division and cell enlargement, resulting in more leaf area and thus insuring better growth, development, plant vigour and yield (Patel *et al*. 2017) [7].

Very little information is available regarding the nutrient management in linseed through integrated nutrient management. Hence, the intent of present investigation was to study the consequence of FYM and major nutrient on growth and yield of linseed (*Linum usitatissimum* L.).

Material and Methods

The field experiment was conducted during *rabi* 2022-2023 at at the Agronomy Farm, Department of Agronomy, School of Agricultural sciences, G.H. Raisoni University, Saikheda, Chhindwara (M. P.). The experiment was laid out in Randomized Block Design (RBD) with 9 treatments and three replications. The treatment consists of T_1- 0 TONS FYM +75% RDF, T_2- 2.5 TONS FYM +75% RDF, T_3- 5 TONS FYM +75% RDF, T_4- 0 TONS FYM +100% RDF, T_5- 2.5 TONS FYM +100% RDF, T_6- 5 TONS FYM +100% RDF, T_7- 0 TONS FYM +125% RDF, T_8- 2.5 TONS FYM +125% RDF and T_9- 5 TONS FYM +125% RDF.

Result and Discussion

Growth attributes: Growth attributes like plant height, number of branches and number of leaves plant^{-1} recorded significantly higher at application of 5 TONS FYM +125% RDF (T_9). The data found on plant height recorded and analyzed is presented in Table 1. At harvest stage plant height showed that was significant. Application of 5 TONS FYM +125% RDF (T_9) recorded higher plant height (50.82 cm). It was at par with application of 5 TONS FYM +100% RDF (T_6). Growth components such as plant height was improved with increased doses of nitrogen and phosphorus fertilizers over no fertilization (Badiyala and Kumar, 2003) [1].

The data on number of branches per plant were recorded and presented in Table 1. At harvest, 5 TONS FYM +125% RDF (T_9) recorded significantly higher number of branches per plant (4.62). It was at par with application of 5 TONS FYM +100% RDF (T_6). This might be due to initial boost of nitrogen through 100% RDF that have stimulated cell division which resulted in better growth characters throughout the plant growth. Similar results have been reported by Pargi *et al.* (2018) [6].

Table 1: Growth attributes of linseed influenced by application of FYM and major nutrients

	Treatments	Plant height (cm)	No. of branches plant^{-1}	Number of leaves plant^{-1}
T_1	0 TONS FYM +75% RDF	36.38	3.05	123.40
T_2	2.5 TONS FYM +75% RDF	39.97	3.44	124.01
T_3	5 TONS FYM +75% RDF	44.12	3.91	139.10
T_4	0 TONS FYM +100% RDF	40.42	3.70	129.48
T_5	2.5 TONS FYM +100% RDF	44.16	4.06	102.61
T_6	5 TONS FYM +100% RDF	48.87	4.44	154.78
T_7	0 TONS FYM +125% RDF	41.87	3.73	139.43
T_8	2.5 TONS FYM +125% RDF	46.18	4.14	153.88
T_9	5 TONS FYM +125% RDF	50.82	4.62	157.96
	SE (m) ±	2.01	0.18	4.71
	CD at 5%	6.02	0.55	14.11
	GM	43.64	3.90	123.40

The data found on number of leaves plant^{-1} recorded and analyzed is presented in Table 1. At harvest, application of 5 TONS FYM +125% RDF (T_9) recorded significantly maximum (157.96). It was at par with application of 5 TONS FYM +100% RDF (T_6). This might be due to initial boost of nitrogen through 100% RDF that have stimulated cell division which resulted in better growth characters throughout the plant growth. Similar results have been reported by Pargi *et al.* (2018) [6].

Yield attributes

Yield attributes *viz*., number of capsules plant^{-1} and grain yield kg ha^{-1} and straw yield kg ha^{-1} was recorded significantly higher at foliar spray of 19:19:19 @ 1.5% at 40 and 60 DAS but at par with DAP @ 2% at 40 and 60 DAS (T_1) (Table 2).

The maximum number of capsules plant^{-1} were recorded with application of 5 TONS FYM +125% RDF (T_9) (70.43). It was at par with 5 TONS FYM +100% RDF (T_6) (Table 2). This may be due to sprays of WSF at reproductive stage might to be increased N availability to the plant due to the combination of organic fertilizers. The results are in consonance with Rensang *et al.* (2022) [9] and Penalosa *et al.* (1988) [8].

The data found on yield recorded and analyzed is presented in Table 2. The maximum grain yield was recorded significantly with application of 5 TONS FYM +125% RDF (T_9) (1551 kg ha^{-1}). It was at par with 5 TONS FYM +100% RDF (T_6) (Table 2). The increased yield attributes under these treatments might be due to availability of adequate major nutrients that helped in better harnessing of solar energy that resulted in better development of photosynthetic organs and good branching resulting in more pods per plant. These results are in conformity with result of Sharma *et al.* (2015) [10] and Joshi *et al*. (2018) [5].

Significantly highest straw yield kg ha^{-1} were recorded with application of 5 TONS FYM +125% RDF (T_9) (2221 kg ha^{-1}). It was at par with 5 TONS FYM +100% RDF (T_6) (Table 2). The increased yield attributes under these treatments might be due to availability of adequate major nutrients that helped in better harnessing of solar energy that resulted in better development of photosynthetic organs and good branching resulting in more pods per plant. These results are in conformity with result of Sharma *et al.* (2015) [10] and Joshi *et al*. (2018) [5].

Table 2: Yield attributes of linseed influenced by application of FYM and major nutrients

Treatments		No. of capsules plant^{-1}	Grain yield ha^{-1} (kg)	Straw yield ha^{-1} (kg)
T_1	0 TONS FYM +75% RDF	51.85	1145	1695
T_2	2.5 TONS FYM +75% RDF	55.27	1207	1730
T_3	5 TONS FYM +75% RDF	61.67	1320	1927
T_4	0 TONS FYM +100% RDF	56.67	1207	1774
T_5	2.5 TONS FYM +100% RDF	65.01	1439	2079
T_6	5 TONS FYM +100% RDF	70.24	1499	2158
T_7	0 TONS FYM +125% RDF	59.33	1292	1866
T_8	2.5 TONS FYM +125% RDF	68.33	1487	2128
T_9	5 TONS FYM +125% RDF	70.43	1551	2221
	S.E(m) ±	3.83	82	119
	CD at 5%	11.47	247	356
	GM	62.09	1350	1953

Conclusion

Application of 5 TONS FYM +125% RDF (T_9) recorded higher the growth attributes *viz.*, plant height, number of branches plant^{-1} and dry matter accumulation plant^{-1} of linseed and yield attributes of linseed *viz.*, number of capsules plant^{-1}, grain yield kg ha^{-1} and straw yield kg ha^{-1} over all other treatments but was at par with 5 TONS FYM +100% RDF (T_6).

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