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Effect of nutrient management on yield and economics of linseed

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Abstract

A field experiment entitled “Integrated nutrient management in linseed (*Linum usitatissimum* L.)” was conducted during *rabi* season of 2022-2023 at Agronomy Farm, College of Agriculture, Nagpur. The experiment was laid out in randomized block design with seven treatments replicated thrice. The treatments consisted of T₁ - 100% RDN (control), T₂ - 75% RDN + 25% RDN through Vermicompost, T₃ - 75% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹, T₄ - 75% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia, T₅ - 100% RDN + 25% RDN through Vermicompost, T₆ - 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ and T₇ - 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia. Result revealed that yield attributing character *viz.*, number of capsules plant⁻¹, number of seeds capsule⁻¹, seed and straw yield plant⁻¹ & seed and straw yield kg ha⁻¹ of linseed were significantly higher with T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) over rest of the treatments but was at par with T₆ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹). Gross monetary returns was found significantly highest with 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia (T₇) over rest of the treatments. Net monetary returns was found significantly highest with 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia (T₇) over all the treatments except 100% RDN control, where it was at par and B: C ratio was highest with 100% RDN (control).

Keywords: Linseed, organic manure, inorganic fertilizer, vermicompost, consortia, yield, economics

Introduction

Linseed (*Linum usitatissimum* L.) is one of the important *rabi* oilseed crop of India belongs to linaceae family and genus *Linum*. Linseed contains high level of lignin, Omega-3 and Omega-6 fatty acid possesses anti-cancer properties and studies found reduced growth in specific types of tumors. Initial studies suggest benefit with certain types of breast and prostate cancer.

Vermicompost (VC) a product of activity of earthworm is widely used as organic manure in crop production. It is rich source of several plant nutrients, beneficial microorganism like N-fixers, biologically active metabolites, particularly gibberellins, cytokinins, auxins, group B vitamins and several enzymes like lipase, cellulase, chitinase, urease dehydrogenase and nitrogenase Bano *et al.*, (1987) [1].

The role of sulphur on yield and quality improvement of linseed is well established as sulphur is key constituent of oilseeds and directly involved in formation of fatty acids in oil compounds. It is a constituent of three amino acids which contain S are methionine (21% S), cysteine (26% S) and cystine (27% S) and these are building blocks of proteins. Hence, it is a vital for protein production (Tandon, and Marschner, 2011) [6].

NPK consortium used as liquid biofertilizer which contained nitrogen fixing (*Azotobacter chroococcum*, *Azospirillum lipoferum*), phosphate solubilizing and potash mobilizing native bacteria (*Bacillus spp*). It is used as seed treatment (3-5 ml kg⁻¹ seed), soil application (1 L ha⁻¹) and seedling treatment (3-5 ml L⁻¹) & with drip irrigation (1 L ha⁻¹) Jangid *et al.*, (2022) [4].

Materials and Methods

The present field investigation was carried out during *rabi*, 2022-2023 to study the integrated nutrient management in linseed (*Linum usitatissimum* L.) during *rabi* season at Agronomy Farm,

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College of Agriculture, Nagpur, Maharashtra State, India. The experimental soil was vertisol, fairly uniform and levelled. It was low in available nitrogen and available phosphorous, very high in available potassium and slightly alkaline in reaction. Experiment was laid out in randomized block design with three replications and 7 treatment. The experiment included treatments of organic and inorganic sources of fertilizer viz, T₁ - 100% RDN (control), T₂ - 75% RDN + 25% RDN through Vermicompost, T₃ - 75% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹, T₄ - 75% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia, T₅ - 100% RDN + 25% RDN through Vermicompost, T₆ - 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ and T₇ - 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia. The seed was sown at 30 x 5 cm spacing. The gross and net plot size were 3.60 x 2.40 m² and 3.00 x 2.20 m², respectively.

Results and Discussion

A) Yield attributes

Number of capsules plant⁻¹

Table 1 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) recorded significantly maximum number of capsules plant⁻¹ (78.21) over all other treatments, but it was at par with T₆ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹). This is might due to beneficial effect of nutrients particularly N and S in nutrient management in readily available for which were supplied through RDN, Vermicompost and Consortia and Sulphur. Similar findings were also reported by Dubey *et al.*, (2015) [3].

Number of seeds capsules⁻¹

Table 1 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) recorded significantly maximum number of seeds capsules⁻¹ (8.40) over all other treatments, but it was at par with T₆ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹). This is might due to balanced use of fertilizer in soil which increased their availability in soil. Similar findings were also reported by Bonde and Gawande (2017) [2].

Seed yield (kg ha⁻¹)

Table 1 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) recorded significantly maximum seeds yield (1336.33 kg ha⁻¹) over all other treatments, but it was at par with T₆ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹). This is might due to adequate supply of nutrient element at the right time from organic and inorganic sources which help optimum dry matter partitioning from the source to sink during reproductive stage of plant consequently increase the seed yield. Adequate supply of nitrogen as it helps in better capturing of sunlight for photosynthesis, which also increases the sink potential of plants. Similar findings were also reported by Jangid *et al.*, (2022) [4].

Straw yield (kg ha⁻¹)

Table 1 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) recorded significantly maximum straw yield (2495 kg ha⁻¹) over all other treatments, but it was at par with T₆ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹). This is might due to adequate supply of nutrient element at the right time from organic and inorganic sources which help optimum dry matter partitioning from the source to sink during reproductive stage of

plant consequently increase the seed yield. Adequate supply of nitrogen as it helps in better capturing of sunlight for photosynthesis, which also increases the sink potential of plants. Similar findings were also reported by Bonde and Gawande (2017) [2], Jangid *et al.*, (2022) [4].

Test weight (g)

Table 1 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + consortia) recorded highest test weight (7.92 g) while the lowest test weight (7.33 g) was found in T₁ (100% RDN).

B) Economics

Table 2 showed that the treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) recorded significantly maximum gross monetary returns (Rs, 69312 ha⁻¹) over rest of the treatments. Highest net monetary returns was also recorded with treatment T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) (Rs. 31270 ha⁻¹) over all other treatments, except 100% RDN control, where it was at par. The highest benefit cost ratio was registered by the (T₁) 100% RDN (2.24) followed by (T₇) 100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia (1.82).

Table 1: Yield attributes and yield of linseed as influenced by various treatments

Treatments	No. of capsules plant ⁻¹	No. of seeds capsules ⁻¹	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Test weight (g)
T ₁	61.56	6.47	1007.00	1920.00	7.33
T ₂	63.92	6.78	1064.00	1990.00	7.37
T ₃	69.77	7.38	1174.00	2240.00	7.53
T ₄	72.10	7.54	1209.00	2318.00	7.63
T ₅	66.62	7.27	1088.00	2093.00	7.43
T ₆	76.52	8.08	1258.00	2415.00	7.80
T ₇	78.21	8.40	1336.33	2495.00	7.92
SE (m) ±	0.55	0.11	27.08	30.56	0.13
CD at 5%	1.70	0.34	83.43	94.16	NS
GM	69.81	7.42	1162.33	2210.14	7.57

Table 2: Economics of linseed as influenced by various treatments

Treatments	GMR (Rs. ha ⁻¹)	NMR (Rs. ha ⁻¹)	B:C ratio
T ₁ -	52270	28925	2.24
T ₂ -	55190	19544	1.55
T ₃ -	60940	23294	1.62
T ₄ -	62768	24922	1.66
T ₅ -	56493	20651	1.58
T ₆ -	65315	27473	1.73
T ₇ -	69312	31270	1.82
SE (m) ±	1251	1251	-
CD at 5%	3752	3752	-
GM	46921	19564	1.52

Conclusion

Based on the result of one year experimentation, it can be concluded that the application of T₇ (100% RDN + 25% RDN through Vermicompost + 30 kg S ha⁻¹ + Consortia) produces higher yield attributes and yield of linseed. T₇ was most economic with regard to gross monetary returns but B: C ratio was high in 100% RDN (control).

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