Effect Of Integrated Nutrient Management On Growth And Yield Of Indian Linseed (*Linum Usit Atissimum)*

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ABSTRACT:
The present investigation entitled, "Effect of Integrated Nutrient Management on growth, yield and quality of linseed" was conducted at School of Agriculture (SOA), Uttaranchal university, Dehradun, Uttarakhand during rabi season of year 2021-2022 in a randomised block design (RBD) with three replications. The treatments include T_1 - Control (NPK)100%, T_2 - 75%RDF + S10, T_3 - 50%RDF + S20, T_4 - 75%RDF + S30, T_5 - 50%RDF + S10 + VC, T_6 - 75%RDF + S20 + VC and T_7 - 50%RDF+ S30 + VC. The results of the study shows that application of T_6 - 75%RDF + S20 + VC recorded highest number of growth, yield attributes and quality parameters i.e., plant height, number of branches, seed and straw yield, protein and oil per cent.

Keywords: Integrated nutrient management, Linseed, Organic, Sulphur, Vermicompost.

INTRODUCTION:

Linseed (*Linumusit atissimum L.*) is one of the important oilseed crop of the world from very beginning of the human civilization. It belongs to the genus Linum of the family Lennoaceae, having 13 genera, but only *Linumusit atissimum* is the only cultivated species of genus Linum. It is believed that this crop species originated from *Linum angusti folium* Hud native to the Mediterranean region. The name Linum was derived from Latin Lin or "thread" and the species name usitatissimum meaning "most useful". The word 'flax' is used when it is grown for fibre, 'linseed' is used when it is grown for oil purpose and 'dual purpose flax' when grown for both oil and fibre. It is also popularly known as Asli, Tiksi, Jawars, Akebia in Indian languages. Linseed is currently cultivated in Russia, U.S.A., Argentina, Uruguay, India, Pakistan, China, Japan, Morocco, Australia, Ireland, Scotland, Poland, and a few other European countries.

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In India, linseed is grown in a total area of about 2.63 lakh hectares with a production of about 1.26 lakh metric tons and productivity 477 kilograms per hectare (2015-16). It is widely cultivated in Rajasthan, Bihar, Uttar Pradesh, Assam, Jharkhand followed by other states. Madhya Pradesh has largest growing area (1.16 lakh ha) and production (0.55 lakh tones) with 474 kg/ha productivity Nutritional value of linseed is depended upon various factors such as genetics, growing conditions, biotic and abiotic stresses, post-harvest handling(processing) and even in the end consumer usage. Linseed is an amazing source of essential fatty acids and it can be seen as an alternate source of omega-3 fatty acids for vegetarians. It contains about 33 to 47% ofoil content which may vary due to a number of factors. In India, about

20% of the total oil produced is used by the farmer and the rest 80% oil goes to industries in various forms such as boiled oil, borated oil, epoxidized oil, aluminates oil, urethane oil, isomerizes oil etc. Linseed oil is rich in alpha-linolenic acid (ALA) and contains about 55% ALA. It also contains high levels of dietary fibre as well as lignin. Abundance of micronutrient and omega-3 fatty acids are also present.

MATERIALS AND METHOD:

The present investigation entitled, "Effect of Integrated Nutrient Management on growth, yield and quality of linseed *(Linumusit atissimum L.)* varieties" was carried out during rabi season of 2021-2022 at Uttaranchal University, School Of Agriculture, Dehradun, Uttarakhand. The effect of different sowing times, growth, yield and variety Garima was planned and conducted in a Randomised Block Design(RBD) out of which six treatments including control was conducted in three replications. The experimental findings of this investigation are summarised below. The soil of the experimental field was sandy clay loam. All the treatments were sown using a seed rate of 30 kg ha^{-1} at a row spacing of 30 cm. Nitrogen, phosphorous and potassium were applied through Urea (46% N), Di-ammonium Phosphate (46% P_2O_5 and 18% N) and Muriate of Potash (60% K_2O), respectively. A recommended dose of 63g/p, 39g/p and 60g/p were applied to crop along with S and vermicompost.

RESULTS AND DISCUSSION:

Growth parameters of linseed as influenced by INM:

Plant height (cm)

The treatment T_6 - 75% RDF + S20 + VC shows maximum plant height at the time of harvest i.e., 88.17 cm which was significant over control. The maximum plant height at harvest stands at 82.77 cm with control. It shows that all the treatments are found significant over the control. An interception of the data revealed that shoot elongation continued to increase with the age of the plants. **Jagtap (2003)** reported that application sulphur with increasing level up to 30 kg ha^{-1} increased plant height over control in linseed.

Number of branches $Plant^{-1}$

The highest number of primary and secondary branches per plant was 5.58 and 9.5 with T_6 - 75%RDF + S20 + VC. The lowest number of primary and secondary branches was with control i.e., 2.79 and 4.61. These results also corroborate with the findings of **Kalita *et al.* (2005)at Assam and Ganga *et al.* (2015)**.

Table 1: Effect of INM on plant height and number of branches/plant of linseed

Treatments	Plant height (cm)	Number of branches per plant	
		Primary	Secondary
T_1 – Control (NPK) 100 %	82.77	2.79	4.61
T_2 – 75 % RDF + S10	85.13	3.27	3.77
T_3 – 50 % RDF + S20	85.06	3.76	4.61
T_4 – 75 % RDF + S30	87.71	4.35	8.43
T_5 – 50 % RDF + S10 + VC	86.74	3.95	7.61
T_6 – 75 % RDF + S20 + VC	88.17	5.58	9.5
T_7 – 75 % RDF + S30 + VC	85.74	3.55	5.57
SEm±	0.16	0.07	0.09
C.D. at 5%	0.71	0.49	0.54

Yield attributes of linseed as influenced by INM:

Number of seeds/capsule

75 % RDF + S20 + VC produced significantly higher number of seeds/capsule (9.28). The least number of seeds/capsule was 7.39 with control. This was due to plants grown wider spacing produce more branches, which stimulate the formation of a larger number of capsules and seeds on the stems. The result obtained by **Soji *et al.* (2007)** at Gonidia and **Gohil *et al.* (2016)** at Navsari also confirm the findings of present investigation.

Test weight (g):

The highest test weight of 7.65 g was with the application of 75 per cent RDF + S20 + VC (T_6) and the lowest was 5.02 g with control (T_1). This might be due to large amount of sulphur found in the seed. These results lend support to those reported by **Khan *et al.* (2005)**, **Chaudhary (2009)** and **Gohil *et al.* (2016)**.

Seed yield (kg/ha):

The maximum seed yield of 1643 kg/ha was obtained with the application of 75 per cent RDF + S20+ VC (T_6) and the minimum seed yield of 1013 kg/ha was obtained with control (T_1). Higher seed yield might be the result of cumulative effect of improvement in growth and yield attributes. These findings are recognized with the results **of El-Mohsen *et al.* (2013) and Ganga *et al.* (2015)**.

Straw yield (kg/ha):

The highest Stover yield was recorded to be 3633 kg/ha on T_6 (75 % RDF + S20 + VC) and the lowest Stover yield was recorded as 2004 kg/ha on T_1 (Control). Higher straw yield might be the result of cumulative effect of improvement in

growth and yield attributes. These findings are recognized with the results **Singh *et al.* (2011)** and **Chaudhary *et al.* (2010).**

Table 2: Effect of INM on number of seeds/capsule, test weight(g), seed yield (kg/ha) and straw yield (kg/ha)

Treatments	No. of seeds/capsule	Test weight (g)	Seed yield(kg/ha)	Straw yield(kg/ha)
T_1 – Control (NPK) 100 %	7.39	5.02	1013	2004
T_2 – 75 % RDF + S10	7.81	6.51	1093	2195
T_3 – 50 % RDF + S20	8.25	6.48	1120	2323
T_4 – 75 % RDF + S30	8.93	5.74	1441	3072
T_5 – 50 % RDF + S10 + VC	8.75	5.22	1305	2772
T_6 – 75 % RDF + S20 + VC	9.28	7.65	1643	3633
T_7 – 75 % RDF + S30 + VC	8.54	6.63	1155	2452
SEm±	0.01	0.55	0.64	0.19
C.D. at 5%	0.19	1.32	1.42	0.77

Quality parameters of linseed as influenced by INM:

Oil content (%):

75 per cent RDF + S20+ VC (T_6) resulted in significantly highest oil content of 41.43 % and Control resulted in lowest oil content of 39.3 %. The increase in oil content might be due to increased availability of S that involvesin an increased conversion of primary fatty acids metabolites to the end products of fatty acids. Similar findings were reported by **Chauhan *et al.* (2008).**

Oil yield (kg/ha):

75 per cent RDF + S20+ VC (T_6) resulted in significantly highest oil yield of 680 kg ha^{-1} and Control resulted inlowest oil yield of 398 kg ha^{-1}. The increased in oil yield might be due to the higher dry matter production under integrated application of organic and inorganic sources of nutrients. Similar findings were found by **Dubey *et al.*(2005).**

Protein content (%):

The highest protein content was recorded as 27.91 % with 75 % RDF + S20 + VC and the lowest was 21.25 % with Control. The higher content of protein might be due to the availability of NPK throughout the crop growth. Similar findings were reported by **Khan *et al.* (2010).**

Table 3: Effect of INM on oil content, oil yield and protein content of linseed

Treatments	Oil Content (%)	Oil yield (kg/ha)	Protein content (%)
T_1 – Control (NPK) 100 %	39.3	398	21.25
T_2 – 75 % RDF + S10	39.36	430	21.58
T_3 – 50 % RDF + S20	39.43	441	23.12
T_5 – 50 % RDF + S10 + VC	40.66	530	25.2
T_6 – 75 % RDF + S20 + VC	41.43	680	27.91
T_7 – 75 % RDF + S30 + VC	39.8	459	23.95
SEm±	0.15	0.11	0.1
C.D. at 5%	0.7	0.61	0.56

CONCLUSION:

The result shows that Integrated Nutrient Management was important for the linseed crop as it improves thegrowth, yield and quality of the mustard crop. Among the integrated nutrient treatments, 75 per cent RDF + S20 + VC (T_6) is so far the best treatment as compared to the other remaining treatments.

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