Performance and Yield of Linseed (*Linum Usitatissimum* L.) Under Different Nutrient Levels

Shrikant D. Shelke[1], Ambrish Thaokar[2], Narendra D. Raut[3], Kevin A. Gawali[4], Prajwal Ishwarkar[5]
[1,5]*P. G. Student, Agronomy Section, School of Agricultural Sciences, G H Raisoni University, Saikheda*
[2]*Assistant Professor, Agronomy Section, School of Agricultural Sciences, G H Raisoni University, Saikheda*
[3]*P. G. Student, Agronomy Section, College of Agriculture, Nagpur*
[4]*Associate Dean, School of Agricultural Sciences, G H Raisoni University, Saikheda*

Abstract- A field experiment was conducted during *rabi*, 2023-24 on clayey soil at the Agronomy Farm, Department of Agronomy, School of Agricultural sciences, G.H. Raisoni University, Saikheda, Chhindwara (M. P.), to study the performance and yield of linseed (*Linum usitatissimum* L.) under different nutrient levels. The experiment consisted of seven treatments which were replicated thrice in RBD Design. Result indicated that Among the nutrient levels tested T_1- Spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS recorded significantly higher growth parameters *viz.*, plant height (48.87 cm), No. of branches/plant (4.44), Plant dry weight (4.27 g/plant), capsules/plant (70.43) and higher grain yield 1551 kg/ha) and straw yield (2221 kg/ha) compared to other combination but was at par with spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_2).

Key words: Linseed, Nutrients, Spraying, Growth, Yield, Nano fertilizers.

INTRODUCTION

Commonly referred to as flax seed, linseed (*Linum usitassimum* L.) is an annual herbaceous plant in the Linaceae family. In terms of area and productivity, it is regarded as India's most significant oilseed crop, ranking second only to rapeseed-mustard during the winter (Rabi) season. About 20% of the entire oil is used by the farmers, and the seed is directly used for food purposes on a very modest scale.In India, it is typically grown from October through November through March or April. The annual herbaceous plant known as linseed can reach heights of 30 to 120 cm. Compared to seed types, fiber types grow taller and have fewer branches.

Only a tiny amount is utilized straight for food. About 20% of the oil produced is used by farmers, with the remaining 80% going to industry in the form of urethane, isomerized, borated, boiled, and eposidized oil, among other products. Its seed contains complex carbohydrates, vitamins, minerals, higher order linolenic acid (the highest polyunsaturated omega-3 fatty acid in the plant kingdom), complete protein rich in eight necessary amino acids, and complex carbs. It is the best herbal source of omega-3 (57%) and omega-6 (8%) fatty acids, which aid in nervous system regulation, according to recent advances in neurobiology.

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 1.26 lakh tonnes per annum and productivity of 642 kg ha-1. India has 18.8 percent of worlds recorded linseed area but produces less than 10% of total world production. In India, Madhya Pradesh leads in yield and acreage, followed by Uttar Pradesh, Maharashtra, Bihar, Rajasthan, Karnataka and West Bengal also grow linseed in large areas. Madhya Pradesh and Uttar Pradesh together contribute to national linseed production to the extent of about 70 per cent. In Madhya Pradesh linseed is grown on 47 thousand ha. area producing 36 thousand tones with an average yield of 783 kg ha-1 (Anonymous, 2022).

In order to prevent the uneven and excessive use of urea and DAP, the Nano Biotechnology Research Centre, in collaboration with Indian Farmers Fertilizers Cooperative Limited, produces the environmentally friendly liquid formulations of nano urea and nano DAP. One source of nitrogen that is necessary for a plant's healthy growth and

development is liquid nano urea. The use of conventional urea is decreased and crop productivity is increased with nano urea. The nitrogen particles found in nano urea are small and have a large surface area—10,000 times more than that of a 1 mm urea particle. 55,000 nanoparticles are also present in nano urea, and when applied topically, these tiny particles enter the plant cell directly and release nitrogen into the cell. The application of nano urea to crop leaves initiates the process of nitrogen uptake and assimilation within the plants. Therefore, applying nano urea topically increases the amount of nitrogen that is available through the stomata on leaves through gaseous absorption, which may activate a number of enzymes engaged in biochemical processes for the repair of biological membranes.

Additionally, Nano DAP (Liquid) provides phosphorus and nitrogen, both of which are necessary for crop growth and development. In its nano form, Nano DAP comprises 8% nitrogen and 16% phosphorus by weight. Applying nano DAP topically and immersing seedlings are two ways to increase its efficiency. Crop nitrogen and phosphorus requirements are efficiently met by seedling treatment and foliar application of Nano DAP (Al-Khuzai et al., 2020). According to Tarafdar and Rathore (2015), dipping seedlings in Nano DAP increases their vigor and encourages root growth, which raises biomass production. According to Swetha et al. (2017), seedling dipping with Nano DAP also increases rice grain production by 10 to 50% while reducing applied phosphorus by 40–60%. However, when Nano DAP is applied topically, it penetrates the leaf through stomatal and cuticular pores, increasing the concentration of phosphorus in both the shoots and the roots. This, in turn, speeds up the rice crop's uptake of phosphorus (Talboys et al., 2020).

Thus, research is being done on how to increase the yield of linseed by applying additional nutrient combinations Very little information is available regarding the nutrient management in linseed through different combinations of nutrients. Hence, the intent of present investigation was to study the performance and yield of linseed (*Linum usitatissimum* L.) under different nutrient levels

MATERIAL AND METHODS

The field experiment was conducted during *rabi* 2023-2024 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 seven treatments and three replications. The treatment consists of T_1- Spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS, T_2- Spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS, T_3- Spraying of Chelated Magnesium 6% 0.500 gm / Lt 40 DAS, T_4- Spraying of Zinc EDTA 12% 0.500 gm + Boron 2gm/ Lt water 49 DAS, T_5- Spraying of Mono Ammonium phosphate [N-12:P-61: K-0] 3gm 58 DAS, T_6- Spraying of nano urea 2 ml/ Lt 64 DAS and T_7- Spraying of potash (K-50%) 3.5 gm/ Lt water 70 DAS.

RESULT AND DISCUSSION

Growth attributes

Growth attributes like plant height, number of branches and dry matter production plant^{-1} recorded significantly higher at application of spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS (T_1). 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 spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS (T_1) recorded higher plant height (48.87 cm). It was, however, comparable to Spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_2). This may be due to availability of these micronutrients to the crop at suitable vegetative stage, which may have increased the nutrient uptake and chlorophyll content and resulted in increases plant height. Similar result was also observed by Mousa et al., (2010) and Singh et al., (2020).

Table 1: Growth attributes of linseed influenced by different nutrients levels

Treatments		Plant height (cm)	No. of branches plant^{-1}	Dry matter production plant^{-1}
T_1	Spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS	48.87	4.44	4.27

T_2	Spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS	44.16	4.06	4.19
T_3	Spraying of Chelated Magnesium 6% 0.500 gm / Lt 40 DAS	40.42	3.44	3.68
T_4	Spraying of Zinc EDTA 12% 0.500 gm + Boron 2gm/ Lt water 49 DAS	44.12	3.70	3.80
T_5	Spraying of Mono Ammonium phosphate [N-12:P-61: K-0] 3gm 58 DAS	39.97	3.73	3.74
T_6	Spraying of nano urea 2 ml/ Lt 64 DAS	41.87	3.91	3.91
T_7	Spraying of potash (K-50%) 3.5 gm/ Lt water 70 DAS.	36.38	3.05	3.65
	SE (m) ±	2.01	0.18	0.8
	CD at 5%	6.02	0.55	0.24
	GM	42.25	3.76	3.89

The data on number of branches per plant were recorded and presented in Table 1. At harvest, spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26 DAS (T_1) recorded significantly higher number of branches per plant (4.62). It was at par with application of of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_2).

The data found on dry matter accumulation plant^{-1} recorded and analyzed is presented in Table 1. At harvest, spraying of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) recorded a greater number of leaves plant^{-1} than all other treatments, but it was comparable to Spraying of nano DAP [N-8: P-16: K-0] 2ml / Lt 32 DAS (T_2) at those same dates. The significant increase in dry matter accumulation might be due to availability of these micronutrients to the crop at appropriate vegetative stage, resulted in increase in plant growth and it also might have improvement in photosynthetic area of plant that cumulatively contributed to higher dry matter accumulation. These results are in accordance with Alam et al., (2021) in linseed.

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 spraying of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) but at par with Spraying of nano DAP [N-8: P-16: K-0] 2ml / Lt 32 DAS (T_2) (Table 2).

Significantly higher numbers of capsules per plant, observed with spraying of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) but was at par with spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_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) and Penalosa *et al.* (1988).

The data found on yield recorded and analyzed is presented in Table 2. The maximum grain yield was recorded significantly with spraying of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) (1551 kg ha^{-1}). It was at par with spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_2). It might be due to the foliar application of N P K along with Zn enhance seed yield. Similar result was revealed by Khan and Khan (2016).

Significantly highest straw yield kg ha^{-1} were recorded with spraying of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) (2221 kg ha^{-1}). It was at par with spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS (T_2). (Table 2).

Table 2: Yield attributes of linseed influenced by different nutrients levels

Treatments		No. of capsules plant^{-1}	Grain yield ha^{-1} (kg)	Straw yield ha^{-1} (kg)
T_1	Spraying of balanced NPK (N-19:P-19: K-19) 3gm/ Lt 26	70.43	1551	2221
T_2	Spraying of nano DAP [N-8:P-16: K-0] 2ml / Lt 32 DAS	70.24	1499	2158
T_3	Spraying of Chelated Magnesium 6% 0.500 gm / Lt 40 DAS	59.33	1292	1866

T_4	Spraying of Zinc EDTA 12% 0.500 gm + Boron 2gm/ Lt water 49 DAS	65.01	1439	2079
T_5	Spraying of Mono Ammonium phosphate [N-12:P-61: K-0] 3gm 58 DAS	61.67	1320	1927
T_6	Spraying of nano urea 2 ml/ Lt 64 DAS	68.33	1487	2128
T_7	Spraying of potash (K-50%) 3.5 gm/ Lt water 70 DAS	55.27	1207	1774
	SE (m) ±	3.85	82	119
	CD at 5%	11.50	247	356
	GM	64.32	1399	2022

CONCLUSION

Application of balanced NPK (N-19: P-19: K-19) 3gm/ Lt 26 DAS (T_1) 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 spraying of nano DAP [N-8: P-16: K-0] 2ml / Lt 32 DAS (T_2).

REFERENCE

[1] Alam, M. P., Menka, K., & Sulochna (2021). Effect of zinc and boron on growth, yield and economics of linseed (*Linum usitatissimum L.*) under medium land of Jharkhand. The Pharma Innovation J., 4: 462-465.

[2] Al-Khuzai, H. G. and Al-Juthery, H. W. A. 2020. Effect of DAP fertilizer source and nano fertilizers (Silicon and Complete) spray on some growth and yield indicators of rice (Oryza sativa L. cv. Anber.33) 1st Scientific International Virtual Agricultural Conference. *Earth and Environmental Science*. pp 553.

[3] *Anonymous* 2020. Third advance estimate of area, production and productivity of crops in respect of Madhya Pradesh state for the year 2021-2022.

[4] FAO, 2020. Food and Agriculture organization of the united nation, (http://www.fao.org.statistics/en/).

[5] Khan, R. and N. Khan, 2016. Effect of plant growth regulators on physiological and biochemical parameters in soybean. MSc. (Ag.) Thesis, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, pp. 103.

[6] Mousa, M.A., ElKady, E.A., & Zedan, Z.S. (2010). Effect of nitrogen fertilizers and some micro-nutrients on flax yield and chemical composition characters. *Journal of Plant Production,* 5: 713-720.

[7] Penalosa, J. M., O. Carpena and P. Zornoza, 1988. A study of nutrient uptake by tomato plants in sand culture. *Soilless Culture*, **4**: 41-50.

[8] Rensang., K., G. S. Dhaked, M. Meghwal and B. Kent, 2022. Effect of organic manure on growth and yield of linseed (*Linum usitatissimum* L.). *International Journal of Advanced Technology in engineering and Sciences,* **10**(11): 16-24.

[9] Singh, A., Singh, D., Verma, V. K., Pyare, R., & Hussain, M. F. (2020). Studies on the effect of zinc and boron on growth and yield of linseed (Linum usitatissimum L.) under limited irrigation. *International Journal of Chemical Studies*, 5: 1964-1966.

[10] Swetha, M. K., Rao, P. C., Padmaja, G., Ramulu, V., Saritha, J. D. and Ramakrishna, K. 2017. Effect of bio and nano phosphorus on yield, yield attributes and oil content of crop growth and yield benefits to soil applications together with greater groundnut (Arachis hypogaea. l). Environment Conservation Journal, 18 (3): 21 26.

[11] Talboys, P. J., Healey, J. R., Withers, P. J. A., Roose, T., Edwards, A. C., Pavinato, P. S and Jones, D. L. 2020. Combining seed dressing and foliar applications of phosphorus fertilizer can give similar recovery rates. Frontiers in Agronomy, 2: 605-655.

[12] Tarafdar, J. C. and Rathore, I. 2015. Perspectives of biosynthesized magnesium 93 nanoparticles in foliar application of wheat plant. Journal of Bionanosciences, 9 (3): 209-214.