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Yield Attributes of Linseed as influenced by different Establishment Methods and Nitrogen Management in Rice- Linseed Cropping System

Pragyan Das* and Bijay Kumar Mohapatra
Department of Agronomy,
Odisha University of Agriculture & Technology, Bhubaneswar (Odisha), India.

(Corresponding author: Pragyan Das)*
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ABSTRACT: Linseed is cultivated as *paira* crop in Odisha under residual moisture and minimal management practices which lead to lower productivity of the crop. A field experiment was conducted at Central Research Station, Odisha University of Agriculture and Technology, Bhubaneswar during *rabi* season of 2021. The experiment was laid out in a split-plot design with four replications comprising of five treatments *viz.*, Soil Test Based Nitrogen Recommendation (STBNR) complete inorganic, Integrated Nutrient Management (INM) (50% organic* + 50% inorganic) *Organic= 1/3rd FYM+ 1/3rd poultry manure+ 1/3rd neem oil cake, Organic source (1/3rd FYM+ 1/3rd poultry manure+ 1/3rd neem oil cake), Soil Test Based Nitrogen Recommendation (STBNR)+ $ZnSO_4$ @ 25 kg/ha and Integrated Nutrient Management (T2) + $ZnSO_4$ @ 25 kg/ha in preceding rice crop along with two methods of crop establishment in linseed (*Paira* and conventional tillage) were allotted to the main plots and two nitrogen management practices in linseed (100% RDF and 50% N+ full PK) in the sub-plots. The soil was loamy sand, slightly acidic in reaction, medium in organic carbon, available P_2O_5 and K_2O, and low in available nitrogen. The nitrogen management practices in rice influenced the yield attributes of linseed along with establishment methods and nitrogen management in linseed. The organic treatment in preceding rice crop influenced the most and *paira* cropping also proved to be superior as compared to conventional method.

Keywords: Nitrogen, Linseed, Integrated Nutrient Management, RDN.

INTRODUCTION

Linseed (*Linum usitatissimum* L.), commonly known as flax or flaxseed, occupies a greater importance among oilseeds owing to its various uses and special qualities. According to El-Nagdy *et al.* (2010), linseeds have a protein content of 11–32% and a concentration of essential fatty acids of 30–40%. The oil is the most abundant plant source of linoleic (omega-6) and linolenic (omega-3, ALA, Alpha Linolenic Acid) and Poly Unsaturated Fatty Acids (PUFA), which are essential for human health and cannot be produced by the body and must be taken from food. Linseed contains a class of substances known as lignans that possesses anticancer properties. Linseed oil is used to make linoleum, oilcloth, waterproof fabrics, paints, and varnishes as it has excellent dying properties. A good-quality fiber is produced by the dual-use linseed stalk, which is also known as the "plastic crop" and is used to make paper and plastics. In addition to being an excellent manure and animal feed, linseed cake is also high in micronutrients, vitamins, dietary cellulose, and proteins (up to 38%). The crop is farmed on 326 thousand ha of land in India (rainfed: 63%, utrea: 20%, and irrigated: 17%) with a productivity of 533 kg/ha. Odisha possesses a cultivable area of 12.26 thousand ha and productivity of 485 kg/ha under linseed crop. In *Paira* cropping, the crop's genetic yield potential decreases as a result of nutrition and moisture stress circumstances (Ahmad and Majid 2016). Due to the no-tillage method, *Paira* crops typically give little room for applying manures or fertilizers. Because of this, there is a reduction in nutrient mobilization, which causes crops to experience nutritional stress. The use of biofertilizers and foliar nutrients on *Paira* crops, as well as organic or INM paddy practices, present important research opportunities in this case (Sheraz Mahdi *et al.*, 2010). According to research on crop physiological and agronomical techniques, the yield of *Paira* linseed can be significantly increased by the careful application of fertilizers (Acharya and Nirala 2015). Nitrogen is one of the various nutrients that is quite important. Although nitrogen has a significant impact on the growth, development, and ultimately the yield of crops, this impact is significantly modified by variations in the environment, season, genotype, moisture supply, source, method, and quantity of fertilizer added, particularly in the utera system, where the presence of previous crop residues plays a key role (Pankaj Chopra *et al.*, 2016). Thus, a study on "Yield attributes of linseed as influenced by different establishment methods and nitrogen

management in Rice- linseed cropping system" was carried out at the Central Research Station, Odisha University of Agriculture and Technology (OUAT), Bhubaneswar.

MATERIAL AND METHOD

The experiment was conducted during rabi 2021 at the Central Research Station, Odisha University of Agriculture and Technology, Bhubaneswar (20° 26′N, 85°81′E, Odisha. The field was well-drained medium land with loamy sand texture, slightly acidic in reaction (pH 5.67), medium in organic carbon (0.67%), available P_2O_5(15.4 kg/ha), and available K_2O (159.4 kg/ha) and low in available N (187.5 kg/ha).

The field experiment was laid out in a split- plot design with four replications. Five treatments comprising of nitrogen management from different sources in rice and two methods of establishment in linseed were allotted to the main plots and two nitrogen management practices in linseed were allotted to the sub-plots. Linseed *cv.* 'Arpita' was grown following rice *cv.* 'Lalat' in 2021. The treatments in rice crop were allotted randomly to different experimental units in the replication. *viz.,* Soil Test Based Nitrogen Recommendation (STBNR) complete inorganic, Integrated Nutrient Management (INM) (50% organic*+ 50% inorganic) *Organic= 1/3rd FYM+ 1/3rd poultry manure+ 1/3rd neem oil cake, Organic source (1/3rd FYM+ 1/3rd poultry manure+ 1/3rd neem oil cake), Soil Test Based Nitrogen Recommendation (STBNR)+ $ZnSO_4$ @ 25 kg/ha and Integrated Nutrient Management (T2) + $ZnSO_4$ @ 25 kg/ha along with two methods of crop establishment in linseed (*Paira* and conventional tillage) were allotted to the main plots and two nitrogen management practices in linseed (100% RDF and 50% N+ full PK) in the sub-plots.

For linseed, no prior field preparation was done as crop was broadcast as '*Paira*' crop in standing crop of kharif rice before 15 days of schedule harvest and in case of conventional method of establishment, primary tillage operation was carried out by bullock drawn mould board plough followed by ploughing with bose plough to get a fine tilth. Before sowing linseed, seeds were sieved to remove cuscuta seeds, if any, and were broadcast over the standing paddy crop 15 days before harvest at dough stage, with 1.5 times of recommended seed rate for '*Paira*' and for conventionally tilled plots the crop was sown in rows 30 cm apart behind the plough with a seed rate of 25 kg/ ha. The recommended dose of nitrogen (40 kg N/ha), phosphate (20 kg P_2O_5/ha) and potash (20 kg K_2O/ha) was applied at the time of sowing in conventional tillage and one day before in case of *Paira* sowing. 100% nitrogen (100% RDN) and 50% nitrogen (50% RDN) along with full P and K was applied at the time of sowing.

Linseed crop was harvested manually by uprooting the plants from the net plot area. After 3-4 days of sun drying, threshing was done by beating against a wooden stick and sieving was done to clean the seeds. Seed and stover yields were recorded and converted to per ha basis. All collected data were analyzed with the help of analysis of variance (ANOVA) technique for split plot design. The treatment variations were tested for significance by 'F' test. The standard error of mean SE (m) ± and critical difference (CD) at 5% probability level were calculated (Gomez and Gomez 1984).

RESULT

Yield and Yield Attributes of Linseed:

Capsules per plant. Perusal of data on capsules/plant in Table 1 reveals that the nitrogen management practices and establishment methods in rice-linseed system influenced the number of capsules of linseed plant. Residual effect of organic nutrition on preceding rice resulted in the highest number of capsules/plant of succeeding linseed crop (25.8), which was at par with INM + $ZnSO_4$ practice (24.3). The number of capsules/plant was higher in *Paira* cropping, but was at par with conventional method. Different nitrogen management practices in linseed did not exhibit a marked variation upon number of capsules/plant. Among them, the 100% RDN increased the number of capsules/plant (24.4) but was on a par with the 50% RDN i.e, 23.5.

Seeds per capsule. Data on seeds/capsule given in Table 1. indicate that nutrient management practices in preceding rice varieties did influence the seeds/capsule of linseed crop. The residual effect of organic nutrition on preceding rice resulted in the highest number of seeds/capsule of succeeding linseed crop (9.0), which was at par with INM + $ZnSO_4$ practice (8.6). However, it was not affected by different establishment methods and nitrogen management options in linseed crop.

1000-seed weight. Varied methods of nitrogen management practices followed either in rice or linseed crop were found to be at par with each other with higher test weight in organic management in rice (4.62 g). *Paira* cropping was found to be significantly higher than conventional tillage i.e., 4.60 g.

Seed yield and stalk yield. It is evident from the data presented in Table 1. that the seed yield of linseed crop was affected by the nitrogen management treatments in the system. Furthermore, organic nutrition followed in kharif rice had a higher residual effect on seed yield of succeeding linseed crop (623 kg/ha) and was at par with INM+$ZnSO_4$ (590 kg/ha) as compared to the inorganic (437 kg/ha) which was found to be lowest. *Paira* cropping recorded significant yield over conventional and 100% RDN was also found to be significant over 50% RDN in seed yield of linseed crop. In line with the seed yield, stalk yield of linseed crop was affected by the nitrogen management options in the system. Organic nutrition practice adopted for rice crop impacted highly the linseed stalk yield producing the highest quantity of stalk (935 kg/ha) as compared to the INM and inorganic treatment for rice, which in turn were on a par with each other except for only STBNR+$ZnSO_4$ which was found to have produced lowest stalk yield (722 kg/ha). Similar

results were found for stalk yield as in seed yield in case of establishment methods and nitrogen management treatments.

Harvest Index. The harvest index of linseed crop was worked out for different treatments and presented in Table 1. The harvest index of linseed crop was not influenced by either preceding nitrogen management in rice and establishment methods in linseed except of the nitrogen management treatments in linseed where 100% RDN was found to be significantly higher than 50% RDN in the rice-linseed system.

DISCUSSION

According to Das and Mandal (1986); Sharma and Mittra (1990), the addition of organic manures may have had a positive effect on the succeeding crops. It is reported that, around 65% of the nitrogen in green manure is mineralized during the first crop, 14% during the second, and 3.3% during each subsequent crop Bouldin (1988). Reduced nitrate (NO_3) leaching risk and decreased fertilizer N requirements for subsequent crops are potential benefits of green manuring, in addition to increasing soil physical, chemical, and biological qualities and, consequently, crop yields (Fageria, 2007; Saini *et al.,* 2019). Decomposition of organic manure brought about change and altered the dynamics and mechanics of nutrient mobilization. Accordingly, the part of nutrient remained unutilized by the main crop is expected to help growth and development of succeeding crop in addition to advantages associated with improved physical properties of soil, consequently accumulated N and other nutrients in the soil were gradually mineralized and utilized by the successive crop (Inoko, 1984). According to studies by Banik *et al.* (2006); Behera (2006), adding organic manure (FYM or vermicompost) to the soil increased the amount of organic carbon and readily available nutrients (macro and micro). *Paira* cropping outperformed conventional tillage in terms of maximum capsules per plant, seeds per capsule, and test weight. These results are consistent with earlier research by Mishra *et al*. (2016), who found that utera greatly increased the number of pods per plant and seeds per pod when compared to zero tillage. *Paira* has a larger yield, which can be due to its advanced planting, better availability of soil moisture that is still present, higher accumulation of biomass, and effective partitioning. Higher yield in *Paira* may be attributed to its advanced planting, better availability of residual soil moisture, higher biomass accumulation and its proper partitioning. Nitrogen is a constituent of amino acids, proteins, nucleic acid, porphyrins, flavins, purine and pyrimidine, nucleotides, enzymes, co-enzymes and alkaloids, and phosphorus of maleic acid, phytin and phospholipids when supplied in adequate amounts are expected to favour the production of protein to the maximum extent resulting into a vigorous plant growth. Thus, plants supplied adequately with nitrogen and phosphorus brought about greater accumulation of photosynthates and dry matter accumulation. The results conform the findings of Kantwa and Meena (2002); Gudadhe *et al.* (2005).

Table 1: Effect of nitrogen management and method of establishment in rice-linseed system on yield attributes and yields of linseed.

Particular	Capsules/ plant	Seeds/ capsule	1000 seed wt. (g)	Seed yield (Kg/ha)	Stalk yield (Kg/ha)	Harvest Index (%)
Nitrogen Management in Rice						
STBNR	23.2	7.9	4.15	437	743	36.8
INM	23.5	8.3	4.42	521	884	37.7
ORGANIC	25.8	9.0	4.62	623	935	40.7
STBNR + $ZnSO_4$	22.9	8.2	4.41	437	722	37.5
INM + $ZnSO_4$	24.3	8.6	4.49	590	886	40.1
SEm(±)	0.59	0.14	0.110	31.4	55.0	1.70
CD(0.05)	1.7	0.4	0.32	91	160	NS
Method of establishment						
S1: *Paira*	24.3	8.4	4.24	552	916	38.0
S2: Conventional	23.6	8.4	4.60	491	753	39.1
SEm(±)	0.37	0.09	0.069	19.9	34.8	1.08
CD(0.05)	1.1	NS	0.20	58	101	NS
Nitrogen management in linseed						
N1: 100 % RDF	24.4	8.4	4.39	579	881	39.7
N2: 50 % N+ Full P K	23.5	8.4	4.45	464	787	37.4
SEm(±)	0.39	0.08	0.055	11.4	19.3	0.65
CD(0.05)	1.1	NS	0.16	33	56	1.9

CONCLUSIONS

Among all the nitrogen management practices in the preceding rice crop, organic treatment and INM+$ZnSO_4$ influenced the yield attributes more effectively indicating the residual effect of the previous treatment on the succeeding crop under paira cropping along with 100% RDN.

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Conflict of Interest. None.

REFERENCES

Acharya, S. S. and Nirala, R. B. P. (2015). Impact of biofertilizer and irrigation in enhancing productivity potential of linseed (*Linum usitatissimum* L.) under utera condition. *Annals of Agricultural Research, New Series, 36*(3), 318-323

Ahmad, E. and Majid, A. A. (2016). Selection indices in linseed (*Linum usitatissimum* L.) suitable for rainfed condition. *Annals of Agriculture Research, 37*(1), 100-106.

Banik, P., Ghosal, P. K., Sasmal, T. K., Bhattacharya, S., Sarkar, B. K. and Bagchi, D. K. (2006). Effect of organic and inorganic nutrients for soil quality conservation and yield of rainfed low land rice in subtropical plateau region. *Journal of Agronomy and Crop Sciences, 192*, 331–343.

Behera, U. K. (2006). Sustaining productivity of wheat-soybean cropping system through integrated nutrient management practices in the vertisols of Central India. 18th World Congress of Soil Science in Philadelphia. 2006 from July 9–15.Pennsylvania.USA.

Bouldin, D. R. (1988). The effect of green manure on organic matter content and nitrogen availability. In Green Manuring in Rice Farming, p. 151-163, International Rice Research Institute, Los Banos, Manila, Philippines.

Chopra, Pankaj and Badiyala, D. (2016). Influence of nitrogen fertilization on performance of linseed (*Linum usitatissimum* L.) under utera system. *Himachal Journal of Agricultural Research, 42*(1), 108-110.

Das, D. K. and Mandal, L. N. (1986). Yield and nutrient uptake by rice as affected by moisture regimes, puddling and time of application of organic matter. *Oryza, 23*, 83-88.

El-Nagdy, G. A., Dalia, M. A., Nassar Eman, A. El-Kady and Gelan, S. A. El-Yamanee (2010). Response of flax plant (*Linum usitatissimum* L.) to treatments with mineral and bio-fertilizers from nitrogen and phosphorus. *Journal of American Science, 6*(10), 207-217

Fageria, N. K. (2007). Green manuring in crop production. *Journal of Plant Nutrition, 30*(5), 691-719.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research, A Willey Inter Science Publication, New York, pp.76-83.

Gudadhe, N. N., Mankar, P. S., Khawale, V. S. and Dongarkar, K. P. (2005). Effect of biofertilizers on growth and yield of mustard (*Brassica juncea* L.). *Journal of Soils and Crops, 15*(1), 160-162.

Inoko, A. (1984). Compost as a source of plant nutrients. *Organic Matter and Rice*, 137-145.

Kantwa, S. R. and Meena, N. L. (2002). Effect of irrigation, phosphorus and PSB on growth and yield of mustard, *Annals of Agricultural Research, 23*(3),456-460.

Mishra, J. S., Kumar, R., Kumar, R., Rao, K.K., Singh, S. K., Idris, M., Jha, B. K., Naik, S. K., Mali, S. S. and Bhatt, B. P. (2016). Evaluation of pulses and oilseed under different crop establishment methods in rice-fallows of eastern India. Extended Summaries Vol. 2: 4th International Agronomy Congress. Nov. 22-26, New Delhi, India.

Saini, P. K., Yadav, R. K. and Yadav, G. C. (2019). Green manures in agriculture: A review. *Bhartiya Krishi Anusandhan Patrika, 34*(1), 1-10.

Sharma, A. R. and Mittra, B. N. (1990). In rice-based cropping systems in eastern India organic manures should be combined with chemical fertilizers. *Indian Farming, 40*(9), 40-42.

Sheraz, M., Hassan, S., Samoon, G. I., Rather, S.A., Showkat, H. A., Dar, A. and Zehra, B. (2010). Bio-fertilizers in organic agriculture. *Journal of Phytology, 2*(10), 42-43.

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