

Original Research Article

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Evaluation of Suitable Nutrient Management on Dual Purpose Flax (*Linum usitatissimum* L.) Crop under New Alluvial Zone (NAZ) of West Bengal, India

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ABSTRACT

A field experiment was conducted at BCKV, Mohanpur, West Bengal during *rabi*, 2016-17 to study the effect of different combination of nutrients on quality fibre and seed production of dual purpose flax crop. The experiment was in RBD with eight treatments, replicated thrice. The treatment combinations were, T₁= 100% recommended dose of nitrogen (RDN) from organic sources (mustard cake, FYM, vermicompost, bone meal and liquid manures), T₂= 125% RDN from organic sources, T₃= 75% RDN from organic sources +25% RDN from chemical fertilizer sources (Urea, SSP and MOP), T₄= 50% RDN from organic sources +50% RDN from chemical fertilizer sources, T₅= 100% RDN from chemical fertilizer sources, T₆= 125% RDN from chemical fertilizer sources, T₇= 75% RDN from chemical fertilizer sources+25% RDN from organic sources and T₈= Control. Highest plant height (147.20 cm) was recorded in T₂ though highest basal diameter (0.69 cm) was observed in T₆. Seed yield was significantly highest (15.40 q ha⁻¹) in T₂, followed by T₁ and T₃. Similarly highest fibre yield of 19.13 q ha⁻¹ was obtained in T₂. However significantly lowest plant height, basal diameter, seed as well as fibre yield were recorded in control plots. Regarding fibre quality, better quality fibre with least fineness (2.97 tex) was recorded in T₂ whereas fibre with least strength was found in T₇ though it was at par with T₂. Inferior quality fibre was obtained in control plots. From the observed data it can be recommended that dual purpose flax with 125% of recommended dose of nitrogen (RDN) from different organic sources produce higher yield of both better quality flax fibre and seed under NAZ of West Bengal.

Keywords

Flax, Fibre, RDN,
Basal diameter,
Fineness, Strength

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Introduction

Flax (*Linum usitatissimum* L.) indeed has many uses in the field of industry, food, feed

and even in the medical sector especially for diabetic and heart patients. Flax, which has been grown throughout the world for millennia, is the source of products for

existing, high-value markets in the textile, composites, paper/pulp, and also industrial/nutritional oil sectors. Fine and regular long flax fibres are spun into yarns for linen textiles. More than 70% of linen goes to clothing manufacture, where it is valued for its exceptional coolness in hot weather. It absorbs and releases water quickly, making linen comfortable to wear in hot weather. Like other crops, nutrients like nitrogen, phosphorus, potash etc. are the main limiting factors that regulate the increase or decrease of yield and quality of flax seed as well as fibre.

Flax is a new crop of dual purpose type providing both seed and fibre in the eastern part of our country and has immense scope for profit maximization for the farmers of this agro-climatic zone. The above experiment was conducted to assess the suitable nutrient management practice for sustainable production of quality fibre as well as seed of flax.

Materials and Methods

The experiment was conducted at the Instructional Farm (Latitude 22°56" N, Longitude 88°32" E), Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Soil of the experiment site was loamy soil with pH ranges 7.0 – 7.2, Organic carbon-0.561%, Nitrogen-0.052 %, available P-35kg/ha and available K -23.15kg/ha. The experiment was laid out in Randomized Block Design with 8 (Eight) treatment combinations and 3 replications. The treatment combinations were :T1= 100% recommended dose of nitrogen (RDN) from organic sources (mustard cake, FYM, vermicompost, bone meal and liquid manures), T2= 125% RDN from same organic sources, T3= 75% RDN from same organic sources +25% RDN from chemical fertilizer sources (Urea, SSP and MOP), T4= 50% RDN from same organic sources +50% RDN from the same chemical

fertilizer sources, T5= 100% RDN from same chemical fertilizer sources, T6= 125% RDN from same chemical fertilizer sources, T7= 75% RDN from same chemical fertilizer sources+25% RDN from same organic sources and T8= Control. Mustard cake, FYM, vermicompost, bone meal and liquid manures were used as organic source of nutrients whereas Urea, SSP and MOP were used as inorganic sources. Liquid manure was prepared by mixing fresh cow dung, cow urine, besan (powder of pulses) and molasses with 100 litre of water in the ratio of 10:10:2:2 and by keeping the mixture in earthen pot for fermentation. After 7 days said solution was sprayed on the foliage of the crop. Plant height, basal diameter, dry biomass were recorded at the harvesting stage of the crop. Harvesting of flax was done when 80-90% capsules became yellow or golden brown. Plants were left in the field after harvesting for 2-3 days, then dipped into water in retting tank after separating the seeds and fibre extraction was done through alternate retting and sun drying. Fibre extraction was done by using ICAR-CRIJAF (Indian Council of Agricultural Research – Central Research Institute for Jute and Allied Fibre) flax extractor (scotching machine).

Fibre fineness and strength were estimated by using airflow fineness tester and fibre bundle strength tester respectively. Benefit: cost ratio was calculated by applying the formula gross return/total cost of cultivation. Statistical calculation regarding design of experiment was done by using methodology as described in Rangaswamy (2014). Correlations were estimated as suggested by Al-Jibouri *et al.*, (1958).

Results and Discussion

Plant height

Significant effect of different nutrient

combinations on plant height was observed in the experiment (Table 1).

Highest plant height of 147.2 cm was recorded in T₂ *i.e.*, 125% recommended dose of nitrogen (RDN) supplied from different organic sources (like mustard cake, FYM, vermicompost, bone meal and liquid manure) though it was statistically at par with T₁ *i.e.*, 100% recommended dose of nitrogen (RDN) supplied from different organic sources which might be due to higher levels of available nutrients supplied from organic sources specially from liquid manure. Significantly lowest plant height (81.33 cm) was observed from control plot.

Similar result was also obtained by the scientists of ICAR-CRIJAF, West Bengal (Anonymous, 2016).

Basal diameter

Effect of sole organic, sole inorganic and combination of organic and inorganic sources of nitrogen on basal diameter of flax was found statistically significant (Table 1). Significantly higher basal diameter (0.69 cm) was obtained in T₆ *i.e.*, 125% RDN from same chemical fertilizer sources followed by T₂ (Table 1).

Similar result was also obtained by the scientists of ICAR-CRIJAF, West Bengal (Anonymous, 2016).

Dry biomass

Significantly highest dry biomass (68.0 q ha⁻¹) at harvesting was obtained in T₂ (125% recommended dose of nitrogen (RDN) supplied from different organic sources) followed by T₅ (100% RDN from chemical fertilizer sources) and T₄ (50% RDN from organic sources +50% RDN from the chemical fertilizer sources) (Table 1).

However, control plots showed the least performance (19.36 q ha⁻¹).

Seed yield

Different combination of sources of nitrogen gave significant effect on seed yield of flax. Highest seed yield of 15.40 q ha⁻¹ was obtained in T₂ (125% recommended dose of nitrogen supplied from different organic sources) which was statistically at par with T₁, T₃, T₄, and T₆ and significantly higher over control (3.75 q ha⁻¹) (Table 1) which might be due to the fact that plants of T₂ plots had higher plant height, comparatively greater basal diameter that indicated more number of tillers and branches, higher number of capsules per plant etc.

Fibre yield

Like seed yield, fibre yield of flax was also significantly influenced by different combination of sources of nitrogen.

Highest fibre yield (19.13 q ha⁻¹) was obtained in T₂ (125% recommended dose of nitrogen (RDN) supplied from different organic sources) which was statistically significant over other treatments (Table 1).

Similar observation was also reported by Tripathi and Chaudhary (2015).

Fibre quality

Best quality fibre with least fineness (2.97 tex) was obtained in T₂ *i.e.*, 125% recommended dose of nitrogen (RDN) supplied from different organic sources which was statistically significant over control (Table 1) and it might be due to singleness/separation of individual fibre from each other.

Table.1 Effect of different nutrient management practices on plant growth, seed yield and fibre yield of flax

Treatments	Plant height (cm)	Basal diameter (cm)	Dry biomass (q ha ⁻¹)	Seed yield (q ha ⁻¹)	Fibre yield (q ha ⁻¹)	Fibre strength (g tex ⁻¹)	Fibre fineness (tex)	B:C
T1	143.93	0.55	60.88	13.87	15.27	23.79	3.16	1.95
T2	147.20	0.63	68.00	15.40	19.13	25.34	2.97	2.10
T3	138.93	0.58	57.65	13.85	15.41	21.39	4.27	1.97
T4	138.47	0.60	62.69	12.67	15.93	23.26	3.14	2.04
T5	137.33	0.63	64.64	12.40	16.51	23.32	4.56	2.04
T6	137.07	0.69	50.83	12.64	13.44	22.01	3.39	1.82
T7	138.67	0.63	59.96	11.87	14.92	19.67	5.02	1.60
T8	81.33	0.23	19.36	3.75	3.47	30.29	5.17	0.53
S.Em (±)	1.747	0.073	1.204	0.946	0.978	1.048	0.863	-
CD (5%)	5.292	0.223	3.652	2.869	2.967	3.177	2.616	-

Table.2 Correlation coefficient in seed yield and fibre yield of flax

Parameters	Seed yield	Fibre yield
Plant height	0.982**	0.965**
Basal diameter	0.872**	0.873**
Dry biomass	0.939**	0.989**
Seed yield	-	0.964**
Fibre yield	0.964**	-
Fibre fineness	(-) 0.677	(-) 0.588
Fibre strength	(-) 0.707	(-) 0.628

*significant at 5% level **significant at 1% level



Fig. 2 Flax crop at flower initiation stage



Fig. 1 Flax crop at flowering



Fig. 4 Flax crop at harvesting



Fig. 3 Flax fibre after extraction

However, strength of fibre of flax ranges 20-30 g tex⁻¹ value indicates better quality fibre and the value of 25.34 g tex⁻¹ (Table 1) was recorded in T₂ *i.e.*, 125% recommended dose of nitrogen (RDN) supplied from different organic sources followed by T₁, T₅ and T₄ though which was statistically at par with T₂.

Correlation of seed yield with other parameters

From the observed data it was found that a positive and significant ($p=0.01$) correlation existed between seed yield and plant height, basal diameter, dry biomass and fibre yield of flax (Table 2). However a negative and not significant correlation was obtained between seed yield and fibre quality like fineness and strength of fibre.

Correlation of fibre yield with other parameters

In case of fibre yield also, a positive and significant ($p=0.01$) correlation existed between fibre yield and plant height, basal diameter, dry biomass and seed yield of flax. However a negative and not significant correlation was obtained between fibre yield and fibre quality like fineness and strength of fibre (Table 2).

Economics

Regarding the economic profitability of the different combination of sources of nutrients, higher benefit cost ratio were obtained in sole organic, sole inorganic and organic + inorganic treatments than control plots. Comparatively higher benefit cost ratio of 2.10:1 was obtained in T₂ *i.e.*, 125% recommended dose of nitrogen (RDN) supplied from different organic sources followed by T₄ and T₅, T₁, T₃ which might be due to higher seed and fibre yield in T₂.

Benefit cost ratio was lowest in control plot (0.53) (Table 1).

From the observed data it was found that sole organic sources of nitrogen showed significant effect on plant growth, seed yield, fibre yield and fibre quality over sole inorganic sources or combination of inorganic and organic sources of nitrogen on flax. Better performance regarding plant growth, seed and fibre yield, fibre quality and benefit-cost ratio was recorded in T₂ *i.e.*, 125% recommended dose of nitrogen (RDN) supplied from different organic sources. Plant characters like plant height, basal diameter and dry biomass showed positive and significant relationship with both seed yield and fibre yield whereas fibre quality like fibre fineness and strength had negative and not significant effect on these. Thus, it can be recommended that application of 125% recommended dose of nitrogen (RDN) supplied from different organic sources (like mustard cake, FYM, vermicompost, bone meal and liquid manure) may give higher yields of seed and fibre coupled with superior quality fibre of flax under New Alluvial Zone (NAZ) of West Bengal.

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