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RESEARCH PAPER

Yield potential of linseed genotypes influenced by nutrient levels under rainfed condition in Vidarbha region

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Abstract : All India coordinated Research Project on linseed conducted a field experiment on Agriculture Farm, College of Agriculture, Nagpur under Dr. PDKV, Akola, Maharashtra during *Rabi* Season of 2019-20 in Factorial Randomized Block Design with three replication. Three genotypes NL – 356, JLS-95, T-397 were tested with three nutrient levels i.e. 50 % RDF, 100% RDF and 150 % RDF. The result revealed yield potential of the entry NL-356 was 26% highest over JLS-95 and 13% more on T-397 under *rainfed* condition. However, the increase in nutrient level from 50 % RDF to 150 % RDF influence the growth and yield attributes which favours the increase in yield. Therefore, it is concluded that genotype NL 356 with 100 % RDF achieve higher growth rate *i.e.* plant height, number of branches as well as yield attributes number of capsules per plant, number of seed per capsule and highest NMR and B:C ratio.

Key Words : Nutrient level, Genotype, Linseed, Rainfed

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INTRODUCTION

Linseed (*Linum usitatissimum* L.) is the most important oilseed crop of India followed by rapeseed-mustard grown as *rabi* oil seed in terms of area and production. Linseed grown as dual purpose crop for oil and fibre, from seed and stem respectively. Beside this Linseed has many industrial and medicinal use. The industrial oil is an important ingredient in the manufacture of paint, varnish and linoleum. Flax fibre has good strength, light weight and gaining momentum as key ingredient in the manufacturing industry *i.e.* used for the production of paper, coarse textiles, rope, fibre board, molded panels and insulation material. Linseed oil is used for human consumption and contains a-linolenic acid (ALA), a polyunsaturated fatty acid that has nutritional and health benefits (Neil, 2003). Apart from ALA, linseed is widely used as nutritional and functional food in the western world due to its high contents of therapeutic health promoting substances such as omega-3 fatty acid, soluble and insoluble fibre and lignans and its suitability to use with bread, breakfast cereals and other food product, Meena *et al.* (2011).

In the world, India contributes 10.81 % in area and 5.30% in production of linseed. In India linseed area is 1.72 lakh ha yielding 0. 99 lakh tones with an average productivity of 574 kg ha^{-1} (Anonymous, 2019). The

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major linseed growing states of country are Madhya Pradesh, Chattisgarh, Uttar Pradesh, Maharashtra, Bihar, Jharkhand, Karnataka, Nagaland and Assam accounting for about 97 % of total area of nation. In Maharashtra it occupies an area of 8,700 ha yielding 2,600 tones with an average productivity of 299 kg ha^{-1} in the Maharashtra (2019-20). In Vidarbha region the crop occupies 6570 ha with production of 2120 tones with productivity of 323 kg ha^{-1} (Anonymous, 2019).

Despite the potential uses of linseed fibre especially for composites and bio-based industries linseed fibre production is still economically marginal (Rennebaum *et al.,* 2002). Linseed is mostly grown under conserved moisture and limited nutrient conditions with poor management practices. Linseed production and productivity in India are very low, mainly due to its cultivation in residual moisture during *Rabi* season where the crop experiences moisture stress at one or the other stages. To sustain the linseed production there is a need to develop appropriate agronomic practices to obtain higher crop yield. In dry land area fertilization especially nitrogen, phosphorus, potassium and sulphur and seed rates are the key factors that determine the crop yield and quality, Singh *et al.* (2007). Hence the emphasis has given on above point to increase the yield of Linseed. Nutrient management influences the production of linseed, therefore, the present investigation was carried out to study the influence of nutrients levels on genotypes of Linseed.

Material and Methods

A field experiment was laid out at Agriculture Farm, College of Agriculture, Nagpur under Dr. PDKV, Akola, Maharashtra in *Rabi* Season 2019-20 under All India Coordinated Research Project on Linseed. Experimental design was Factorial Randomized Block Design with three replication. Three genotypes NL – 356, JLS-95, T-397 were tested with three nutrient levels *i.e.* 50 % RDF, 100% RDF and 150 % RDF. The soil of experimental site was medium black having low in organic carbon and available nitrogen and medium in available phosphorus. The spacing 30 cm was taken in between two rows. Growth attributes like Plant height, number of branches as well as yield attributes like number of capsules and number of seeds per capsules were recorded at the time of harvest. GMR, NMR were recorded at harvest. The observed data were analysed statistically and the appropriate standard error of mean SE (m±) and the critical difference (CD) were calculated at 5 % level of significance (Panse and Sukhatme, 1954).

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on growth parameters:

Plant population:

The data depicted in Table 1 reveals that the plant population of linseed genotypes was found non-significant. Effect of various nutrient levels was also did not affect the plant population of linseed.

Plant height :

Plant height of linseed was significantly influenced by different genotypes and recorded maximum plant height in the genotype JLS - 95 which is significantly superior over other two genotypes. However, the nutrient level at 150 % RDF recorded highest plant height followed by 100 % RDF which are at par with each other while significantly superior over 50 % RDF. This might be due to the balance application of nutrient level enhances tissue cell division, cell multiplication and tissue differentiation this ultimately increases the plant height, Meena *et al.* (2011) also found the similar results.

Number of branches:

Similar to that of plant height different genotypes and seed rate also shows significant influence of number of branches per plant. Genotypes NL 356 produced significantly higher number of branches per plant over other JLS 95 and T-397. Increase in nutrient level increases the number of branches was observed and recorded maximum under 150 % RDF, but it was at par with 100 % RDF. Dubey and Khan (1993) also reported same findings.

Yield Attributes:

Number of capsules per plant:

Among different genotype number of capsules per plant was significantly superior in the genotype NL 356 as compared to JLS 95 and T-397. Different nutrient levels were significantly influenced the number of capsules per plant and highest capsules per plant was observed after application of 150 % RDF which is at par with 100 % RDF. The increase in number of capsule

with the increase in nutrient level resulted due to availability of nutrients. The increase in the yield attributing character of linseed with the increase in nutrient level has been reported by Choube and Dwiwedi (1995).

Number of Seed per capsule:

Highest number of seed per capsule was recorded in the genotype NL 356 which was significantly superior over JLS-95 and T 397. Amongst the nutrient levels number of seed per capsule was recorded highest in the highest nutrient level *i.e.* 150 % RDF followed by 100 % RDF treatment. However, these two treatments were significantly superior over 50 % RDF. Results are in collaborate with the findings of Choube and Dwiwedi (1995).

Yield:

Seed yield was significantly affected due to various entries tested. Highest seed yield was observed in the entry NL 356 which is significantly superior over JLS 95 and T-397. The entry NL-356 was recorded 26% more seed yield on JLS-95 and 13% more seed yield T-397 under *rainfed* condition. This increase in yield of this genotype is mainly due to highest yield contributing characters was observed in NL 356 genotype.

Table 1: Effect of nutrient management on growth and yield attributes of different linseed genotypes

Tr. No.	Treatments	Plant Population (000' ha)	Plant height (cm)	No. of branches plant^{-1}	No. of capsules plant^{-1}	No. of Seeds per capsule
Factor A: Entries						
1.	NL 356	656	45.44	5.78	68.02	8.48
2.	JLS-95	652	54.91	4.38	49.07	7.18
3.	T-397	653	48.93	5.20	57.06	7.57
	S.E.±	11	0.85	0.21	2.45	0.24
	C.D. (P=0.05)	NS	2.56	0.63	7.35	0.73
Factor B: Nutrient Levels						
1.	50% RDF	655	46.42	4.04	46.00	6.82
2.	100% RDF	653	50.40	5.52	61.89	8.10
3.	150% RDF	655	52.47	5.79	66.26	8.31
	S.E.±	11	0.85	0.21	2.45	0.24
	C.D. (P=0.05)	NS	2.56	0.63	7.35	0.73
Interaction						
	S.E.±	20	1.48	0.37	4.25	0.42
	C.D. (P=0.05)	NS	-	-	-	-

NS=Non-significant

Table 2 : Effect of nutrient management on yield and economics of different linseed genotypes

Tr. No.	Treatments	Seed yield (kg ha^{-1})	Cost of cultivation (Rs ha^{-1})	GMR (Rs ha^{-1})	NMR (Rs ha^{-1})	B:C ratio
Factor A: Entries						
1.	NL 356	845	17187	42257	25070	2.46
2.	JLS-95	671	17187	33542	16355	1.94
3.	T-397	748	17187	37400	20213	2.18
	S.E.±	8	-	-	415	-
	C.D. (P=0.05)	25	-	-	1244	-
Factor B: Nutrient Levels						
1.	50% RDF	650	15919	32508	16589	2.04
2.	100% RDF	804	17187	40177	22990	2.34
3.	150% RDF	810	18456	40514	22059	2.20
	S.E.±	8	-	-	415	-
	C.D. (P=0.05)	25	-	-	1244	-
Interaction						
	S.E.±	14	-	-	719	-
	C.D. (P=0.05)	43	-	-	2155	-

Table 3 : Interaction effect of various treatment combinations on Seed yield (kg ha^{-1})

Linseed Genotypes	Nutrient levels		
	50% RDF	100% RDF	150% RDF
NL 356	734	895	906
JLS-95 (ZC)	530	742	740
T-397 (NC)	686	773	785
S.E. ±	14		
C.D. (P=0.05)	43		

Table 4: Interaction effect of various treatment combinations on NMR (Rs ha^{-1})

Linseed Genotypes	Nutrient levels		
	50% RDF	100% RDF	150% RDF
NL 356	20798	27587	26825
JLS-95 (ZC)	10583	19916	18566
T-397 (NC)	18387	21467	20786
S.E.±	719		
C.D. (P=0.05)	2155		

The seed yield was significantly affected due to different nutrient levels and recorded maximum seed yield in the treatment where 150 % RDF was applied which was at par with the treatment 100 % RDF. The increase yield in 150% RDF is only 0.8% than 100% RDF, whereas 100% RDF was recorded 23.6 % higher yield than 50% RDF. The favourable effect of increase in yield attributing characters reflects in the increase in yield of linseed. These results corroborate the findings of Singh *et al.* (2000). Badiyala and Chopra (2011) reported significantly higher seed yield of linseed when full dose of NPK was applied along with 5 tonnes/ha of FYM, while significantly lower seed yield recorded with 50% of recommended dose of fertilizer.

Economics:

The gross monetary return, net monetary return and B:C ratio have been significantly affected due to different entries tested and highest was recorded in the entry NL-356. Net monetary return was observed significantly superior over JLS-95 and T-397.

Nutrient levels significantly affected the gross monetary return, net monetary return and B:C ratio. The gross monetary returns was recorded highest under 150% RDF, but the net monetary return and B:C ratio was recorded higher at 100% RDF. This might be due to the low cost of treatment *i.e.* 100 % RDF than 150% RDF. Similar results were reported by Meena *et al.* (2011).

Effect of interaction:

The interaction effect of linseed genotypes and nutrient levels was found significant on seed yield (kg ha^{-1}) and net monetary return of linseed. Highest seed yield (905 kg ha^{-1}) was recorded in the interaction of entry NL-356 with RDF 150% which was at par with 100% RDF in the same entry NL-356 *i.e.* 895 kg ha^{-1}. Net monetary return was recorded highest in the interaction of entry NL-356 with RDF 100% (27587 Rs.ha^{-1}).

Conclusion:

The study revealed that the yield potential of the entry NL-356 was 26% highest over JLS-95 and 13% more on T-397 under *rainfed* condition. The genotype NL 356 with 100 % RDF achieve higher growth parameters, yield and highest NMR with B:C ratio. It is concluded that genotype NL-356 is highest yield potential under rainfed condition.

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