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RESEARCH PAPER

Influence of spacing and different seed rates on growth, yield and economics of linseed under irrigation

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Abstract : Row spacing and seed rate are management practices that affect flax seed yield. Hence to find out the optimum quantity of seed rate and spacing for higher production in irrigated linseed, the present experiment was conducted under AICRP on Linseed, College of Agriculture, Nagpur during the Rabi Season of 2019-20. The Experiment was laid out in Factorial Randomized Block Design with three replications in which Factor A consist of two spacing *i.e.* T_1 - 30 cm and T_2 - 45 cm and Factor B includes four seed rate S_1- 10 kg/ha, S_2- 15 kg/ha, S_3- 20 kg/ha, S_4- 25 kg/ha. Results showed significant effects of seed rates and spacing on all growth and yield attributes, which reflecting the importance of seeding rate and spacing for linseed. Maximum plant height was recorded after using the seed rate at 25 kg/ha (S_4) and with 30cm spacing (T_1) which was at par with seed rate 20 kg/ha (S_3). The other growth parameters like number of branches, number of capsules per plant and test weight was found higher in the treatment having the seed rate of 10 kg/ha (S_1) and in the spacing of 45cm (T_2). Seed yield of linseed was recorded highest by using the seed rate at 15 kg/ha, which was at par with at the seed rate of 20 kg/ha and in the closer spacing of 30cm between rows *i.e.* 9.15% more as compare to row spacing of 45cm. Gross monetary returns, net monetary returns and B:C ratio was also recorded maximum in the seed rate of 15 kg/ha and with 30cm row spacing. It is concluded that advancement in seed rate by lowering down up to 15 kg/ha increases the productivity and profitability of linseed.

Key Words : Linseed, Seed rate, Spacing, Growth, Yield

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INTRODUCTION

Linseed (*Linum usitatissimum* L.), also known as flax is a member of genus Linum in the family Linaceae. Linseed is an important oilseed and fiber crop in the world. Linseed oil is suitable for human consumption and is used as a nutritional supplement. It is rich in Omega-3 fatty acids, especially Alpha-Linolenic Acid (C18:3) that was beneficial for heart disease, inflammatory bowel disease, arthritis and a variety of other health conditions. It also contains a group of chemicals called lignans that play a significant role in the prevention of cancer (Budwig, 1994). The meal, which remains after oil extraction, is a valuable feed to animals as a protein supplement and is very good manure. Linseed oil is an excellent drying oil used in manufacturing paints, varnishes, soaps, printing

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inks, oil cloth and linoleum tiles (Rowland *et al*., 1995). Linseed is also used in making papers and plastics. After a certain point, however, the benefits of an increased plant population do not outweigh the cost of additional seed, especially when seed cost is high. In certain cases, however, a high seeding rate may allow farmers to eliminate in-crop herbicide or reduce herbicide rates. Current recommended seed rate for linseed production is 25 kg/ha for row planting which is comparably more. But, several farmers often broadcast more than double and triple rates for linseed production (Abebe *et al.*, 2011). High seed rates are certainly used by the farmers due to many reasons one of them is to reduce weeds pressure, they do not carry out weeding practices in linseed. Linseed is being produced under rainfed, low input and poor management. Concerning fertilizer utilization for linseed production, 89% of the farmers in these zones applied neither organic nor inorganic fertilizer (Abebe *et al.*, 2011). Abdul Wahed (2002) and Kinber (2003) revealed that increasing seeding rate found to increase seed and straw yields m^2. On the other hand, straw and seed yields $plant^{-1}$ were decreased by increasing seeding rate. With respect, Casa *et al.* (1999) and Hassan and Leitch (2000) reported that, plant height was increased by increasing seed rate while, stem diameter was decreased.

Spacing plays an important role in increasing production per unit area. It is well known fact that spacing plays an important role in production of field crops. Spacing is dependent upon the expected growth of a particular crop and variety in a given agro-climatic condition. Therefore, optimum plant spacing is one of the most important factors in increasing the yield per hectare. The main objective of the present Investigation is to find out the find out optimum seed rate and spacing higher production in irrigated linseed.

MATERIAL AND METHODS

The experiment was conducted at the experimental field of AICRP on Linseed, College of Agriculture, Nagpur in the *Rabi* Season of 2019-20. An experiment was designed by choosing PKV NL 260, a high yielding variety of linseed (*Linum usitatissimum* L.). The experimental soil was medium black soil. The seeds were sown in three replications with Factorial Randomized Block Design in which Factor A consist of two spacing *i.e.* T_1 - 30 cm and T_2 - 45 cm and Factor B includes four seed rate S_1- 10 kg/ha, S_2- 15 kg/ha, S_3- 20 kg/ha, S_4- 25 Kg/ha. Final data on plant height, branches $plant^{-1}$, capsules $plant^{-1}$, test weight, seed yield ha^{-1} were recorded at the time of maturity.

RESULTS AND DISCUSSION

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

Effect of spacing:

The effect of spacing on growth parameters was found significant. Plant height was maximum in the spacing 30 cm as compare to wider spacing of 45 cm

Table 1: Effect of spacing and seed rate on growth and seed yield (kg ha^{-1}) of linseed

Treatment No.	Treatments	Plant height (cm)	No. of branches $plant^{-1}$	No. of capsules $plant^{-1}$	Test Weight (g)	Seed yield (kg ha^{-1})
Factor A: Spacing						
1.	T_1- 30 cm	46.06	3.36	69.02	6.80	1145
2.	T_2- 45 cm	42.03	4.32	74.93	7.58	1049
	S.E.±	0.78	0.13	1.70	0.15	16
	C.D. (P=0.05)	2.51	0.42	5.45	0.49	52
Factor B: Seed rate						
1.	S_1-10 Kg ha^{-1}	40.43	4.70	79.62	8.63	863
2.	S_2-15 Kg ha^{-1}	42.88	4.18	74.03	7.45	1244
3.	S_3-20 Kg ha^{-1}	45.27	3.47	68.33	6.75	1235
4.	S_4-25 Kg ha^{-1}	47.60	3.00	65.92	5.93	1046
	S.E.±	1.11	0.18	2.41	0.22	23
	C.D. (P=0.05)	3.54	0.59	7.71	0.70	74
Interaction						
	S.E.±	1.57	0.26	3.41	0.31	33
	C.D. (P=0.05)	-	-	-	-	105
	C.V.	6.16	11.76	8.20	7.44	5

Table 2: Interaction effect of spacing and seed rate combinations on seed yield (kg ha^{-1})

Spacing	Seed rate			
	S_1-10 kg ha^{-1}	S_2-15 kg ha^{-1}	S_3-20 kg ha^{-1}	S_4-25 kg ha^{-1}
T_1- 30 cm	897	1341	1223	1120
T_2- 45 cm	830	1147	1247	973
S.E. ±	33			
C.D. (P=0.05)	105			

Table 3: Effect of spacing and seed rate on seed yield (kg ha^{-1}) and economics of linseed

Treatment 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: Spacing						
1.	T_1- 30 cm	1145	17337	57258	39921	3.30
2.	T_2- 45 cm	1049	17337	52468	35131	3.02
	S.E. ±	16	-	-	819	-
	C.D. (P=0.05)	52	-	-	2618	-
Factor B: Seed rate						
1.	S_1-10 Kg ha^{-1}	863	16587	43168	26581	2.60
2.	S_2-15 Kg ha^{-1}	1244	17087	62208	45121	3.64
3.	S_3-20 Kg ha^{-1}	1235	17587	61750	44163	3.51
4.	S_4-25 Kg ha^{-1}	1046	18087	52324	34237	2.89
	S.E. ±	23	-	-	1158	0.07
	C.D. (P=0.05)	74	-	-	3703	0.21
Interaction						
	S.E. ±	33	-	-	1637	0.10
	C.D. (P=0.05)	105	-	-	5237	0.30
	C.V.	5	-	-	8	5.21

Table 4: Interaction effect of spacing and seed rate on Net Monetary Returns (Rs. ha^{-1})

Spacing	Seed rate			
	S_1-10 kg ha^{-1}	S_2-15 kg ha^{-1}	S_3-20 kg ha^{-1}	S_4-25 kg ha^{-1}
T_1- 30 cm	28246	49963	43580	37894
T_2- 45 cm	24916	40280	44746	30580
S.E.±	1637			
C.D. (P=0.05)	5237			

this might be due to the closer spacing available for growth horizontally, hence grows vertically and increases plant height. Number of branches, number of capsule per plant and test weight was found maximum in the spacing of 45cm, this might be due to wider space available for growth and less competition regarding nutrients, space, solar radiation and moisture as compare to closer spacing of 30 cm.

Highest seed yield was recorded in the closer spacing of 30 cm between rows *i.e.* 1145 kg ha-1 which is 9.15% more as compare to row spacing of 45cm (1049 kg ha^{-1}). This might be due to the more number of plants in closer spacing 30cm as compare to wider spacing 45cm. Hassan and Leitch, 2000 also found similar findings.

Gross monetary returns, net monetary returns and B:C ratio was also found maximum in row spacing of 30 cm due to higher yield in this row spacing as compare to wider row spacing of 45cm.

Effect of Seed rate:

All the growth parameters were significantly affected due to different seed rate. Maximum plant height was recorded after using the seed rate at the rate of 25 kg/ha (S_4), which was at par with seed rate 20 kg/ha. This increase in height is mainly due to the overcrowding of more number of plants in maximum seed rate. Number of branches, number of capsules per plant was at par

with application of seed rate at 15 kg/ha. This might be due to more space available for growth in a lesser amount of seed rate.

Seed yield of linseed was recorded highest by using the seed rate at 15 kg/ha, which was at par with at the seed rate of 20 kg/ha. This might be due to the maximum yield parameters *i.e.* number of branches and number of capsules recorded by using the seed rate at 15 kg/ha. Similar results is also found by Kineber (2003).

Gross monetary returns, net monetary returns and B:C ratio was also recorded maximum in the seed rate of 15 kg/ha. This might be due to the highest yield in this treatment.

Interaction effect:

The interaction effect of seed yield kg/ha and net monetary returns were found significant. The highest seed yield and net monetary returns was recorded in the interaction of row spacing of 30cm with the seed rate of 15 kg/ha which is at par with the interaction of row spacing 45cm and 20 kg/ha seed rate.

Conclusion:

It is concluded that advancement in seed rate by lowering down up to 15 kg/ha increases the productivity and profitability of linseed.

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