



Original Research Article

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Effect of Sowing Dates and Planting Geometry on Yield attributes, Yield and Economics of Linseed under the North Hill Zone of Chhattisgarh

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A field experiment was conducted during the *rabi* season of 2019-20 at Indira Gandhi Krishi Vishwavidyalaya University, Raipur, Rajmohini Devi College of Agriculture and Research Station, Ambikapur, to study the effect of sowing dates and planting geometry on yield attributes, yield and economics of linseed. The treatments comprised of 4 sowing dates, viz. D₁: 4th week of October, D₂: 1st week of November, D₃: 2nd week of November and D₄: 3rd week of November in main plots and 3 spacing, S₁: 22.5 cm x 5 cm, S₂: 22.5 cm x 7.5 cm and S₃: 22.5 cm x 10 cm in sub-plots with replicated three times in a split plot design. Sowing dates as well as spacing significantly affected yield attributes, yield, and economics. The results of the experiment showed significantly higher number of capsule/plant (40.01), weight of capsule / plant (16.16 g), seed yield (12.61 q/ha), straw yield (32.75 q/ha), biological yield (45.58 q/ha), harvest index (27.79 %), oil yield (479 kg/ha) and accrued highest gross monetary return (Rs 56745 ha⁻¹), net monetary return (Rs. 39145 ha⁻¹) with B:C (2.22) were recorded in sowing on 4th week of October (D₁). Sowing of linseed with planting geometry S₃ (22.5 cm x 10 cm) was recorded significantly higher yield attributes but yield and economics were higher with S₁ (22.5×5 cm) per unit area.

Introduction

Linseed (*Linum usitatissimum* L) also known as flax is a member of genus *Linum* in the family Linaceae. It is commonly known as Alashi or Alsi. Every part of the linseed plant is utilized commercially, either directly or after processing. In India linseed is cultivated in about 3.30 lakh hectares with contribution of 1.72 lakh tones to the annual oilseed production of the country. The average productivity of linseed is 523 kg/ha and it contributes 7 per cent to the world linseed

production (Anonymous, 2017). Major linseed growing states in India are Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Bihar, Rajasthan, Orissa and Karnataka. At present Chhattisgarh cultivated over 28 thousand ha area with a production of 12.58 thousand tones and productivity of 446 kg/ha (3rd Advance Estimates of DES, 2017-18)). It is a major crop grown as “Utera” during Rabi season. In Surguja district, linseed is cultivated over 3.016 thousand ha area with a production of 1.508 thousand tones and productivity of 500 kg/ha (State Chhattisgarh,

Agriculture Contingency Plan for District Surguja, 2017-18).

The Optimum sowing time is one of the most important agronomic factor and non-monetary input but has noticeable impact on productivity of crop. Sowing dates significantly affect growth character, yield and its components as well as oil yield in flax (Al-Door, 2012). The sowing date was a very important management tool in minimizing the negative impact of high temperature and moisture stress during the critical flowering and seed filling periods (Chauhan *et al.*, 2008). Sowing date plays a key role in the yield of crops and the knowledge of this factor is imperative in working out a strategy for enhancing the yield of oil and fiber. Delay in sowing leads to an increase in temperature of the environment during the reproductive growth stage of the crop decline the crop yield. In case of plant geometry the proper row spacing is an important aspect for better growth and enhancing production potential of a crop by optimizing the utilization of moisture, nutrients and interception of light, CO₂, among others. These planting processes can lead to intraspecific competition (between plants) and interspecific competition (with other plants) for environmental resources causing damages in growth, development, and consequently the production of crops (Zanine and Santos, 2004).

Materials and Methods

The present experiment was conducted during rabi 2019-20 at Research-cum instructional farm of Raj Mohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Chhattisgarh. Geographically, Ambikapur is situated in the north of Chhattisgarh. The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.7), medium in organic carbon (0.56), available nitrogen (234 kg ha⁻¹), available phosphorus (8.4 kg ha⁻¹) and available

potassium (268 kg ha⁻¹). The experiment was carried out in split plot design (SPD) with 3 replications. With four levels of date of sowing, i.e. D₁: 4th week of October, D₂: 1st week of November, D₃: 2nd week of November and D₄: 3rd week of November in the main plot and three levels of planting geometry, viz. S₁: 22.5 cm × 5 cm, S₂: 22.5 cm × 7.5 cm and S₃: 22.5 cm × 10 cm in the sub plots.

Results and Discussion

Effect of sowing dates

Effect on yield attributes

Significantly highest number of capsules/plant (40.01), weight of capsule/plant (16.16 g), number of seeds/capsule (6.88) were recorded under treatment D₁ (4th week of October) sown crop as compared to delayed sowing dates but which was at par with D₂ (1st week of November) sown crop. This was possibly due to timely planting and crop exposure to favourable weather during the whole growth period and thus different phases of crop were completed at appropriate timings, which ultimately resulted in production of more number of branches/plant providing more sites for reproductive structures viz., number of capsules/plant, weight of capsule/plant, number of seeds/capsule. This also confirms the results of Ganga *et al.*, (2015) at Varanasi and Maurya *et al.*, (2017) at Varanasi and Raundal *et al.*, (2015) at Pune and also confirm the findings of present investigation (Table 1).

Effect on yield

Treatment D₁ (4th week of October) were recorded significantly higher 1000 seed weight (6.33), seed yield (12.61 q/ha), straw yield (32.75 q/ha), biological yield (45.58 q/ha), harvest index (27.79 %), oil content (38

%), oil yield (479 kg/ha), sown crop as compared to delayed sowing dates but which was at par with D₂ (1st week of November) sown crop. This due to timely sown crop got an advantage because after having completed its vegetative growth satisfactorily it came in the reproductive stage when the temperature was quite favourable. The results lend support to those reported by; El-Mohsen *et al.*, (2013) at Egypt and Maurya *et al.*, (2017) at Varanasi and ; Ganga *et al.*, (2015) at Varanasi and Al-Doori (2012) at Mousul (Table 2)

Economics

Various date of sowing D₁(4th week of October)also recorded the highest gross monetary returns (Rs 56,745 ha⁻¹), net monetary returns of (Rs 39,145 ha⁻¹) with B:C of (2.22). These findings are substantiated with those reported by Gohil *et al.*, (2016) at Navsari and Maurya *et al.*, (2017) at Varanasi (Table 3).

Effect of spacing

Effect on yield attributes

Number of capsules/plant and weight of capsule/plant, number of seeds/capsule were also indicated that significantly influenced due to different planting geometry. Treatment S₃ (22.5 cm× 10 cm) recorded remarkable higher number of capsules/plant (40.01), weight of capsule/plant (13.66 g), number of seeds/capsule (6.68), which was on par with S₂ (22.5× 7.5 cm), while, lowest number of capsules plant⁻¹ (37.75), weight of capsule/plant (11.26 g), number of seed/capsule (6.27)were noted under treatment S₁ (22.5× 5 cm). This also confirms the results of Kushwaha *et al.*, (2006) at Kanpur, Chaudhary (2009) at Kanpur, Raundal *et al.*, (2015) at Pune and Maurya *et al.*, (2017) at Varanasi (Table 1).

Effect on yield

Planting geometry of S₁ (22.5 cm× 5 cm) was recorded significantly higher seed yield (12.72 q/ha), straw yield (33.17 q/ha), biological yield (45.89 q/ha), harvest index (27.81 %), oil yield (458 kg/ha) per unit area. But oil content (38%), 1000 seed weight (5.78 g) were recorded higher with planting geometry S₃ (22.5 cm× 10 cm). This due to timely sown crop got an advantage because after having completed its vegetative growth satisfactorily it came in the reproductive stage when the temperature was quite favourable. The results lend support to those reported by; El-Mohsen *et al.*, (2013) at Egypt, Maurya *et al.*, (2017) at Varanasi, Ganga *et al.*, (2015) at Varanasi and Al-Doori (2012) at Mousul (Table-2).

Economics

Economic studies of different treatments differed significantly due to different planting geometry. The crop sown on S₁ (22.5 × 5 cm) closer spacing gave the highest gross monetary returns (Rs 57,240 ha⁻¹), net monetary return (Rs 39,640 ha⁻¹) and benefit: cost ratio (2.25) followed by S₂ (22.5 × 7.5 cm) and S₃ (22.5 × 10cm) wider sown crops. This also confirms the results of Ganga *et al.*, (2015) and Maurya *et al.*, (2017) at Varanasi (Table 3).

Interaction effect

Effect on yield attributes

The interaction effect between date of sowing and planting geometry produce significant effect on number of capsules/plant, weight of capsule/plant (g) and number of seed/capsule. The data presented in Table 1 revealed that the interaction effect of date of sowing and planting geometry were found to be significantly superior highest number of

capsules/plant (42.10), weight of capsule/plant (18.50 g), number of seed/capsule (7.30) with treatment of D₁xS₃ (4th week of October with 22.5×10 cm spacing). These findings are substantiated with those reported by Gohil *et al.*, (2016) at Navsari.

Effect on yield

The interaction effect between date of sowing and planting geometry produce significant effect on seed yield (14.22 q/ha), straw yield (34.20 q/ha), biological yield (48.96 q/ha), harvest index (29.05 %), oil yield (526 kg/ha), were recorded highest with treatment D₁xS₁ (4th week of October with 22.5×5 cm spacing) per unit area but oil content(40%) and 1000 seed weight (8.60 g) were recorded

highest with treatment D₁xS₃ (4th week of October with 22.5×10 cm spacing) closer spacing sown crop as compared to wider sown crop. The results lend support to those reported by; El-Mohsen *et al.*, (2013) at Egypt.

Economics

The interaction effect between date of sowing and planting geometry produce significant effect on gross monetary returns (Rs 58,230 ha⁻¹), net monetary return (Rs 40,763 ha⁻¹) and benefit: cost ratio (2.33), were recorded highest with treatment D₁xS₁ (4th week of October with 22.5×5 cm spacing). This also confirms the results of Ganga *et al.*, (2015) and Maurya *et al.*, (2017) at Varanasi.

Table.1 Effect of sowing dates and spacing on yield attributes of linseed

Treatment	Number of capsules/plant	Weight of capsules/plant(g)	Number of seed/capsule
Date of sowing (D)			
D ₁	40.01	16.16	6.88
D ₂	39.83	13.48	6.65
D ₃	38.11	10.94	6.22
D ₄	37.18	9.00	6.07
S.Em. ±	0.85	1.73	0.19
C.D.at 5%	2.55	5.19	NS
Planting geometry (S)			
S ₁	37.75	11.26	6.27
S ₂	38.8	12.27	6.38
S ₃	40.01	13.66	6.68
S.Em. ±	0.38	0.73	0.16
C.D.at 5%	1.11	2.19	NS
Interaction			
S.Em. ±	0.27	1.19	0.32
C.D.at 5%	NS	3.67	NS

(D₁: 4th week of October – 23 October, D₂: 1st week of November – 3 November, D₃: 2nd week of November – 13 November, D₄: 3rd week of November – 23 November, S₁: 22.5 cm × 5 cm, S₂: 22.5 cm × 7.5 cm, S₃: 22.5 cm × 10 cm)

Table.2 Effect of sowing dates and spacing on yield of linseed

Treatment	Oil content (%)	Oil yield (kg/ha)	1000 seed weight	Seed yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
Date of sowing (D)							
D₁	38	479	6.33	12.61	32.75	45.58	27.79
D₂	37	429	5.99	11.60	31.30	42.56	26.94
D₃	36	368	5.44	10.22	30.59	40.68	25.12
D₄	36	331	4.98	9.22	27.65	39.90	24.91
S.Em. ±	1	31.2	0.35	0.74	0.75	2.01	0.83
C.D.at 5%	NS	94.8	1.04	2.30	2.33	5.98	2.62
Planting geometry (S)							
S₁	36	458	5.53	12.72	33.17	45.89	27.81
S₂	36	366	5.72	10.17	30.12	40.35	25.41
S₃	38	374	5.78	9.83	28.42	38.30	25.24
S.Em. ±	2	95.0	0.19	1.02	1.52	2.74	1.42
C.D.at 5%	NS	NS	NS	NS	NS	NS	NS
Interaction							
S.Em. ±	0.80	0.40	0.46	1.04	1.70	2.17	2.95
C.D.at 5%	NS	NS	NS	NS	NS	NS	NS

Table.3 Effect of sowing dates and spacing on economics of linseed

Treatment	Gross monetary return (Rs/ha)	Total cost of cultivation (Rs/ha)	Net monetary return (Rs/ha)	B:C ratio
Date of sowing (D)				
D₁	56745	17600	39145	2.22
D₂	52200	17600	34600	1.96
D₃	45990	17600	28390	1.61
D₄	41400	17600	23800	1.35
S.Em. ±	3228	-	3094	0.20
C.D.at 5%	11233	-	10700	0.60
Planting geometry (S)				
S₁	57240	17600	39640	2.25
S₂	45765	17600	28165	1.60
S₃	44235	17600	26635	1.51
S.Em. ±	1879	-	1667	0.65
C.D.at 5%	NS	-	NS	NS
Interaction				
S.Em. ±	4602	-	4274	0.32
C.D.at 5%	NS	-	NS	NS

In conclusion, the date of sowing revealed that crop sown on D₁ (4th week of October) significantly influenced and recorded highest yield attributes and yields and economics. The next better performing date of sowing was D₂ (1st week of November). The wider planting geometry S₃ (22.5 × 10 cm) recorded significantly higher yield attributes, but in case of yields and economics, closer planting geometry S₁ (22.5 × 5 cm) recoded higher value per unit area as compared to wider planting geometry. Linseed crop should be sown on D₁ (4th week of October) with S₁ (22.5 × 5 cm) planting geometry archiving higher yields and net monetary return per unit area.

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