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Effect of sowing dates and varieties of sesame (*Sesamum indicum* L.) for higher productivity during *pre-kharif* season in New Alluvial Zone of West Bengal

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Abstract
In the context of optimizing sowing dates and varieties for realizing higher productivity notably for sesame an experiment with varying sowing dates and varieties was executed under the climatic scenario of New Alluvial Zone of West Bengal. The experimental findings reveal that crop sown on 15th March (2017) recorded highest seed yield (760.1 kg/ha.), which was 3.4, 3.9 and 18.3% higher than the sowing time of 1st March, 1st April and 15th February , respectively during 2017. Among the three varieties, Rama registered highest seed yield (782.7 kg/ha.) and oil content (38.3%) because of significant improvement in yield components and seed quality.

Keywords: sesame, sowing date, variety, seed yield

Introduction
Sesame (*Sesamum indicum* L.), is one of the oldest oilseed crops, which is traditionally grown in our country for thousands of years. In West Bengal, it is cultivated in *pre-kharif* and *kharif* season with low inputs, and less care and management. Besides, delayed harvesting of preceding crops causes delay in sowing of sesame in different districts of the state. As per recent estimate, it is grown in 196000 ha land in the state with annual production of 185200 tons and productivity of 942 kg/ha (Agriculture statistics, Ministry of Agriculture, Govt. of India, 2013-14). The low yield of sesame varieties under delayed sown conditions leads to discourage growers resulting to less total area under sesame cultivation.
Although genetic potentiality of varieties is important for improved yield and quality of sesame, but sowing time influences the growth and production to a great extent. Sharma (2005) [1] reported 69 and 39% variation in seed yield of sesame due to differences in temperature and variety, respectively. Thus, present-day research on Sesame should emphasize on optimization of sowing time along with selection of suitable varieties for desirable production in a particular region.

Materials and Methods
A field experiment was conducted at the Instructional Farm (22°93' N latitude, 88°53' E longitude and 9.75 m above mean sea level) of Bidhan Chandra Krishi Viswavidyalaya, Jaguli, Nadia, West Bengal to study the performance of sesame varieties under varied sowing dates during summer (*pre-kharif*) season of 2017. The experiment was laid out in a split-plot design with 3 replications, which consisted of 4 sowing dates (15February, 1March, 15March and 1April) in main plots and 3 sesame varieties (Tilottama, Rama and Savitri) in sub-plots. The soil was well-drained gangetic alluvial, neutral in reaction (pH 7.0), low in organic carbon (0.57%), available N (330.4 kg ha^{-1}), P (44.5 kg ha^{-1}) and K (238.6 kg ha^{-1}). Seeds of sesame varieties were sown in furrows at 30 cm apart in 4 m × 3 m plots and thinning was done at 18 days after sowing (DAS) to maintain optimum population. A uniform fertilizer does of 60:40:40 kg ha^{-1} of N: P_2O_5: K_2O including N in 2 splits was applied to all the experimental units. Sesame as a *pre-kharif* crop was grown under norwester showers along with need-based irrigation during the cropping period.The growth attributes like duration, plant height, dry matter (DM) production and crop growth rate (CGR) were determined at different stages; while yield components and seed yield were noted at maturity Growing degree days (GDD) for life cycle of sesame was calculated taking 5 ^{0}C as the base temperature (Nuttonson, 1955) [2].

The oil content (%) in seed was determined using Soxhlet apparatus with hexane as an organic solvent according to A.O.A.C. (1995) [3], and then oil yield was calculated. The data obtained in the study were analyzed using 'Analysis of Variance' technique (ANOVA) following standard statistical procedures (Gomez and Gomez, 1984) [4].

Results and Discussion

Delay in sowing from 15 February to 1 April shortened the duration of sesame by 24.8 days (100.2 *vs* 75.4 days) and GDD by 258^{0}C days (1710 *vs* 1452^{0}C days) in the study (Table 1), which could be supported by Sondarva *et al*., (2014) [5]. Tilottama had longest duration (91.2 days) and accumulated maximum GDD (1654^{0}C days) for life cycle compared to other two varieties. Delayed sowing on 1 and 15 March (108.7 and 112.5 cm) and 1 April (107.7 cm) resulted in greater plant height due to rising temperature favouring vegetative growth of sesame compared to earlier sowing on 15 February (100.1 cm) at Jaguli, Nadia. Sesame sown on 15 March recorded highest aerial dry matter in at 42 DAS (112.7 g m^{-2}) and 63 DAS (202.3 g m^{-2}) due to greater plant height, more number of branches/plant and foliage growth in the experiment. Rama (3.58 g m^{-2}day^{-1}) and Savitri (4.07 g m^{-2} day^{-1}) had highest CGR at 21-42 DAS and 42-63 DAS, respectively.

Sowing date and variety exerted significant influence on yield components, seed yield and oil content of sesame in the investigation (Table 2). Sesame sown on 15 March recorded maximum number of branches (5.21 plant^{-1}), capsules (75.7 plant^{-1}), seeds (46.3 capsule^{-1}) and 1000 seed weight (2.64 g). Rama produced maximum number of capsules plant^{-1} (68.6) and seeds capsule^{-1} (46.0); and all three varieties had low test weight (2.50-2.59 g) with variation in seed colour. Sesame sown on 15 March produced the highest seed yield (760.1 kg ha^{-1}), which was 3.4, 3.8 and 18.3% greater over 1 March, 1 April and 15 February, respectively. The finding contradicted Nath *et al*., (1997) [6], where maximum seed yield of sesame varieties was obtained with sowing on 19 February compared to early (10 February) and delayed sowings (1 March to 28 April) at Kalyani, Nadia, West Bengal. Among three varieties, Rama recorded the highest seed yield (731.8 kg ha^{-1}) due to significant improvement in yield components, stover yield (2390.0 kg ha^{-1}) and oil content (38.4%). Chongdar *et al*., (2015) [7] also reported similar trend of seed yield among these 3 varieties but with lower values of sesame at Kalimpong, Darjeeling. Sesame sown on 1 March recorded maximum oil content (39.5%), but too early (15 February) and too late (1 April) sowings resulted is <37.5% oil content in the study.

Table 1: Effect of sowing dates and varieties of sesame on growth attributes and thermal units of sesame during *pre-kharif* season

Treatment	Duration (Days)	Growing degree days (^{0}C day)	Plant height (cm)	Dry matter accumulation (g/m^2)		CGR (g/m^2/day)	
				42 DAS	63 DAS	21-42 DAS	42-63 DAS
Sowing date							
15 February	100.2	1710	100.1	92.9	169.7	3.28	3.65
1 March	91.1	1622	108.7	102.6	187.7	3.51	3.88
15March	84.3	1555	112.5	112.7	202.3	3.74	4.14
1 April	75.4	1452	107.7	105.6	198.5	3.53	4.25
S Em ±	0.18	4.8	1.38	0.30	0.40	0.02	0.01
CD (P=0.05)	0.64	16.9	4.89	1.06	1.41	0.05	0.03
Variety							
'Tilottama'	91.2	1654	108.9	100.5	186.1	3.42	3.89
'Rama'	85.2	1533	106.3	105.8	192.4	3.58	3.98
'Savitri'	87.0	1568	106.6	104.1	190.0	3.55	4.07
S Em ±	0.19	5.0	0.96	0.19	0.22	0.10	0.02
CD (P=0.05)	0.59	15.2	NS	0.59	0.66	0.03	0.06

Table 2: Effect of sowing date and variety on yield components, yield and oil content (%) of sesame during *pre-kharif* season

Treatment	Yield components				Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)	Oil Content (%)
	Branches/ plant	Capsules/ plant	Seeds/ Capsule	1000 seed Weight (g)				
Sowing date								
15February	4.88	58.6	42.4	2.45	642.5	2002.3	24.3	37.4
1 March	5.07	67.9	45.6	2.48	735.1	2220.6	24.9	39.5
15 March	5.21	75.7	46.3	2.64	760.1	2491.9	23.4	38.4
1 April	5.03	64.7	46.8	2.59	731.8	2570.2	22.2	37.1
S Em ±	0.15	1.68	0.48	0.01	6.12	32.37	0.29	0.22
CD (P=0.05)	NS	5.95	1.69	0.03	21.57	114.19	1.02	0.78
Variety								
'Tilottama'	4.69	63.0	45.5	2.50	698.7	2206.8	24.1	38.1
'Rama'	5.52	68.6	46.00	2.59	731.8	2390.0	23.5	38.4
'Savitri'	4.94	68.5	44.4	2.53	721.7	2367.0	23.5	37.9
S Em ±	0.14	1.07	0.36	0.01	6.37	20.54	0.24	0.14
CD (P=0.05)	0.43	3.24	1.09	0.03	19.27	62.09	NS	NS

Conclusion

Thus, it could be concluded that sesame might be sown during first fortnight of March for better yield and quality, while Rama might be preferred as a suitable variety due to highest seed rate and oil content in New Alluvial Zone of West Bengal.

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