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Evaluation of sesame *(Sesamum indicum* L.) genotypes for its seed production potential as influenced by bio-fertilizer

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ABSTRACT

An attempt was made during pre-kharif 2005 and 2006 at District seed Farm 'D' Block, Kalyani, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia,West Bengal on seed production of six sesame genotypes after seed inoculation with either *Azotobacter* or *Azosprillum* along with Phospho-bactrin and Potash Solubilising bacteria in both cases, un-inoculated control was included for comparison. Seed inoculation with bio-fertilizer was made with a view to its utilization as supplement of basal application of inorganic fertilizer. Top dressing was made as usual for all the cases. Observations was recorded on plant height, number of primary branches/ plant, number of capsules/ plant, number of seeds/ capsule, test weight and yield per plant. Average performance of un-inoculated control was apparently found to be best for almost all growth parameters studied in both the years as well as in pooled condition. *Azotobacter* was able to produce seeds with either significantly higher or similar 1000 seed weight. Variation in performance of individual genotypes after different bio-fertilizer application indicated existence of genotype specific response for the parameters studied.

Key Words: Sesame, biofertilizer, seed inoculation, seed production.

Sesame (Sesamum indicum L.) is one of the most important oil seed crops in India and it belongs to the order of Tubiflora and family Pedaliaeceae. Sesame is known as the queen of oil seeds due to its excellent qualities of seed, oil and meal from its nutritional point of view. Generally, seeds contain oil ranging from 46.2 to 56.8% (Raheja et al. 1989). Production as well as the average yield of sesame is very low in comparison to other oil seed crops which may be due to its cultivation in the underutilized marginal lands, paying less attention for its management and lack of proper genotypes responsive to higher dose of fertilizers as well as adaptation to varied agro-climatic condition. It has been also observed that continuous use of chemical fertilizers are affecting soil health and lead to a negative impact on soil productivity. Use of biofertilizers may play an important role in crop production to overcome the sustainability problem due to uncontrolled continuous application of chemical fertilizers. Therefore, the present investigation was carried out to assess the general response of sesame for compensation of recommended inorganic fertilizer at least to the extent of 50% through the use of biofertilizer and to observe whether genotypic preference exist or not towards biofertilizer for increasing seed production.

MATERIALS AND METHODS

The experiment was conducted at District Seed Farm 'D' Block, B.C.K.V., Kalyani, Nadia, West Bengal, with six genotypes of sesame viz., R_9 (V_1), B-14 (V_2), B-9 (V_3), B-67 (V_4), IET-2 (V_5), IDP-5 (V_6) during pre-kharif season in 2005 and 2006.

A total number of 15 rows of each genotype were sown in the main plot of each replication. Seeds of each genotype were inoculated with either Azotobacter or Azospirillum. Uninoculated seeds were sown as control for comparison with the inoculated ones, thus leading to three different treatments, viz., T_1 – Uninoculated control, T_2 – Seed treatment with Azotobacter and T_3 – Seed treatment with Azospirillum. Inoculants of phosphobactrin and potash solubilizing bacteria were also included during the preparation of paste of both Azotobacter and Azospirillum. The field experiment was laid down in split-plot design with 3 replications; genotypes were placed in the main plot and fertilizers in the sub-plot. Each sub-plot was consisted of 5 rows with 30 cm spacing for each genotype and plant to plant distance was maintained approximately as 15 cm. Recommended agronomic practices were adopted in varying and maintenance of the crop. Five plants for each sub-plot were randomly selected and labeled at the early growth stage of the crop. Those five plants for each sub-plot were harvested at field maturity stage and observations were recorded on plant height, number of primary branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seed weight and seed yield per plant. Statistical analyses were carried out following split plot design (Gomez and Gomez, 1983).

RESULTS AND DISCUSSION

Significant influence of the genotypes, treatment as well as (genotypes x treatments) interaction were recognized for variation in all the characters in both the years as well as in pooled condition excluding treatment influence on plant height in 2006 and number of primary branches per plant in both the years as well as in pooled condition.

Average plant height was highest for V_2 followed by V_4, V_5, & V_6 though all these genotypes were noted to be statistically at par for this character (Table 1). On the other hand, average shortest plant height was recorded for V_1 in both the years as well as in pooled condition indicating its unique control for this character, which may be less sensitive to environmental fluctuation. For average treatment influence, it could be clearly recognized that T_1, i.e., uninoculated control (application of full dose of inorganic fertilizer) influenced for creation of maximum plant height over the other inoculation treatments, both T_3 and T_2 performed in significantly in different way. While considering the interaction effect, V_1 exhibited significantly shortest plant after all the individual treatments, i.e., irrespective of inoculation and uninoculated treatment. Response of all other genotypes, excepting V_2, towards treatment was noted to be in similar mode as was noted for V_1. Significantly tallest plant was recorded for V_2 against control and it responded similarly towards both the inoculation treatment.

V_5 could be recognized as the best performer for production of average number of primary branches per plant followed by V_3 and V_6 (Table 1), though all these three genotypes were significantly indifferent among themselves for this character. V_1 could be regarded as the genotype expressing its genetic potential for production of least number of primary branches per plant. Though insignificant average highest magnitude for this parameter was noted after uninoculated control over the inoculated ones. Response of individual genotypes towards treatments noted to be varied sharply: Significantly highest value was recorded after V_5 against T_3 followed by T_2 and T_1, it was in reverse mode for V_4 and significantly similar performance could be recognized for all other genotypes irrespective of treatment influence.

For production of number of capsules per plant, V_2, V_5 and V_3 exhibited significantly indifferent best performance, while it was V_5 followed by V_6, V_4 and V_1 for number of seeds per capsule (Table 1 and 2). Influence of treatments could be expressed in order of T_1>T_2>T_3 for both the characters. But consideration of genotype x interaction enlighted different scenario for these two characters. All the genotypes responded similarly towards different treatments for number of capsules/plant excluding V_5 which responded in the order of T_1>T_3 >T_2. But for number of seeds per capsule, indiscriminant response of V_1, V_5 and V_6 could be noted towards seed inoculation, while the other three genotypes produced maximum number of seeds per capsule in uninoculated condition.

Genotypes could be arranged as $V_6>V_2 = V_5> V_4 = V_3>V_1$ for 1000 seed weight and $V_6>V_5>V_4>V_3>V_2>V_1$ for seed yield per plant (Table 2). It is interesting to note that T_2 influenced to the maximum extent for exhibiting average 1000 seed weight followed by T_1 and T_3, which may be due to the creation of favourable micro-environmental condition by *Azotobacter* for seed development and maturation. Average seed yield per plant was recorded to be highest in uninoculated conditions followed by seed treatment with *Azotobacter* and *Azospirillum*. While considering the interaction effect for 1000 seed weight, it could be noted that V_3 and V_4 responded in better way towards T_2 over T_1 and T_3, response of V_5 was better toward T_3 over T_2 and T_1, response of V_6 and V_1 was better in uninoculated condition, and V_2 was the only genotype exhibiting no preference towards seed inoculation for this character. These trends indicated clear existence of genotype specific response for this character. The genotypes V_1, V_2, V_3 and V_4 responded towards inoculation treatments in order of $T_1>T_2>T_3$ for seed yield per plant, while it was $T_1>T_3> T_2$ for V_5 and $T_1 = T_2>T_3$ for V_6. The results could be explained in a better way if critical explanation is made through Table 3 for change (%) in different characters over uninoculated control.

Though information on seed yield as influence by different biofertilizers is lacking, yield of sesame was found to be greatest with nitrogen application along with humic acid over application of *Azospirillum* (Singaravel and Gobindaswami, 1998), which corroborates the finding of the present investigation. Observations of Thanki *et al.* (2004) on plant height, test weight and yield were also noted to be increased with increasing rate of chemical fertilizer; significant influence of biofertilizer could not be recognized.

Still, critical analysis of the present experimental findings could be utilized in making comment that response towards different biofertilizers is strictly genotype-specific and hence, recommendations could be made for seed inoculation for better seed development and maturation, particularly with *Azotobacter* for V_2, V_3 and V_4, and *Azospirillum* for V_5. Seed inoculation may be recommended for V_6 with *Azotobacter* may be made for which atleast 50% application of chemical fertilizer could be compensated for.

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Table 1 : Influence of Biofertilizer on Plant height (cm), Number of Primary branches/ plant and Number of Capsules/ plant of different genotypes (Pooled over two years)

T / V	Plant Height (cm)			Mean (V)	Number of Primary branches per Plant			Mean (V)	Number of Capsules/Plant			Mean (V)
	T_1	T_2	T_3		T_1	T_2	T_3		T_1	T_2	T_3	
V_1	65.11	60.99	57.77	61.37	2.35	2.18	2.26	2.27	51.33	50.36	47.63	49.84
V_2	101.53	92.85	87.49	93.36	2.66	2.60	2.60	2.62	66.51	65.63	61.40	64.51
V_3	92.17	85.30	89.25	88.93	2.88	3.09	2.55	2.85	71.40	67.16	58.06	65.54
V_4	100.09	88.91	90.68	93.21	3.03	2.56	1.79	2.55	67.92	58.75	54.87	60.51
V_5	96.09	84.82	89.56	90.14	2.73	2.80	3.76	3.10	73.86	48.03	59.83	60.57
V_6	95.52	86.20	86.06	89.22	2.84	2.93	2.56	2.78	63.55	60.73	53.33	59.20
Mean(T)	**91.73**	**83.18**	**83.50**		**2.75**	**2.69**	**2.63**		**65.79**	**58.44**	**55.85**	
	S.Em±	**C.D. at 5%**	**C.D. at 1%**		**S.Em±**	**C.D. at 5%**	**C.D. at 1%**		**S.Em±**	**C.D. at 5%**	**C.D. at 1%**	
V	1.66	4.89	6.67		0.13	0.40	0.52		2.01	5.91	8.07	
T	1.15	3.27	4.35		0.09	NS	NS		1.66	4.72	6.29	
(V x T)	3.98	11.32	15.08		0.31	0.88	1.19		5.75	16.36	21.79	

Table 2 : Influence of Biofertilizer on Number of seeds / capsule, 1000 seed weight (mg) and seed yield / plant (gm) of different genotypes (Pooled over two years)

T / V	Number of seeds per capsule			Mean (V)	1000 seed weight (mg)			Mean (V)	Seed yield per plant (gm)			Mean (V)
	T_1	T_2	T_3		T_1	T_2	T_3		T_1	T_2	T_3	
V_1	58.43	56.23	54.43	56.36	2.48	2.25	2.28	2.32	7.69	6.40	6.06	6.72
V_2	56.53	52.53	51.83	53.63	2.52	2.59	2.49	2.53	8.53	7.88	7.25	7.88
V_3	55.96	50.93	49.36	52.08	2.42	2.60	2.28	2.44	8.81	8.24	7.57	8.21
V_4	61.10	56.43	55.46	57.66	2.45	2.68	2.29	2.47	9.50	8.84	7.44	8.59
V_5	61.98	62.33	64.43	62.91	2.28	2.48	2.81	2.52	10.50	8.38	9.23	9.37
V_6	58.63	56.00	56.26	56.96	2.81	2.67	2.43	2.64	10.18	10.10	9.14	9.81
Mean(T)	**58.77**	**55.74**	**55.30**		**2.49**	**2.54**	**2.43**		**9.20**	**8.31**	**7.78**	
	S.Em±	**C.D. at 5%**	**C.D. at 1%**		**S.Em±**	**C.D. at 5%**	**C.D. at 1%**		**S.Em±**	**C.D. at 5%**	**C.D. at 1%**	
V	0.63	1.87	2.55		0.013	0.043	0.052		0.05	0.15	0.20	
T	0.45	1.32	1.80		0.008	0.027	0.034		0.03	0.08	0.12	
(V x T)	1.55	4.41	5.87		0.031	0.086	0.115		0.11	0.31	0.42	

Table 3 : Change (%) in different character due to seed inoculation over uninoculated control (Pooled over two years)

Genotypes	Plant Height		Primary Branch/plant		No. of Capsule/plant		No. of Seeds/ capsule		1000 Seed weight		Seed Yield/ plant	
	T_2	T_3	T_2	T_3	T_2	T_3	T_2	T_3	T_2	T_3	T_2	T_3
V_1	-6.38	-10.58	-7.72	-3.82	-2.27	-7.50	-3.76	-6.84	-9.24	-8.06	-16.77	-18.59
V_2	-8.20	-12.88	-2.25	-2.25	-1.32	-7.68	-7.07	-8.31	2.77	-1.13	-7.62	-15.00
V_3	-7.80	-3.05	7.29	-11.40	-5.90	-18.60	-8.98	-11.79	7.43	-5.73	-6.46	-14.07
V_4	-11.15	-9.43	-15.50	-40.90	-13.50	-19.21	-7.64	-9.23	9.37	-6.93	-4.84	-21.69
V_5	-11.75	-6.87	2.56	37.90	-34.90	-18.99	0.56	3.95	8.77	23.16	-20.19	-12.09
V_6	-9.35	-9.67	3.16	-9.85	-4.43	-16.08	-4.48	-4.04	-4.93	-13.52	-0.7	-10.21