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Performance of some promising M_5 sesame mutant lines

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Abstract: : An experiment was carried out at the BINA sub-station farms, Magura and Ishurdi during kharif-I of 2008 to evaluate the performance of twelve M_5 sesame mutant lines (SM-01-04, SM-02-04, SM-03-04, SM-04-04, SM-05-04, SM-06-04, SM-07-04, SM-08-04, SM-09-04, SM-10-04, SM-11-04 and SM-12-04) along with two check varieties (Binatil-1 and Baritil-2). Plant height, branches per plant, capsules per plant, seeds per capsule, days to maturity and yield per hectare were studied to determine the performance of the selected mutant lines. Highly significant variations were observed both in individual locations and in combined over locations for all the traits. In combined over locations, the highest number of branches (2.8) and capsules (65) per plant were obtained in the mutant line SM-10 with short duration (84 days). Mutant line SM-11 produced the highest yield (1779 kg/ha) followed by SM-10 (1773 kg/ha). The highest yield (2184kg/ha) was found in Magura sub-station than Ishurdi (1053kg/ha) with minimum time (81 days).
Key words: Performance, Mutants, Sesame, Promising

Introduction

Sesame (*Sesamum indicum*) is an ancient oilseed, first recorded as a crop in Babylon and Assyria over 4,000 years ago. The biggest area of production is currently believed to be India, but the crop is also grown in China, Korea, Russia, Turkey, Mexico, South America and several countries of Africa. Sesame ranks sixth in the world production of edible oil seeds (3,312,986 million tons) and twelveth in world vegetable oil (907,440 million tons) production (FAO, 2005). Sesame seeds containing 50% oil and 25% protein are used in baking, candy making, and other food industries. Oil from the seed is used in cooking and salad oils and margarine and contains about 47% oleic and 39% linoleic acid. Sesame oil and foods fried in sesame oil have a long shelf life because the oil contains an antioxidant called sesamol. Sesame is the second important oil crop in Bangladesh. The total production of sesame in Bangladesh in 2006-2007 was 29000 m tons from an area of 36033 hectares and the average yield was about 0.80 m tons per hectare (BBS, 2008). Mutation breeding is one of the effective techniques of improving seed yield and related characters that may help breeders selecting desirable traits. Varietals improvement could be done successfully by inducing variability in the adapted cultivar through mutation breeding techniques Das *et al.* (2004), Ashri (1982), Potan *et al.* (1994) and Rahman and Das (1994). At present the domestic oilseed production is 0.63 million tons from 0.584 million hectares of land. It gives only 0.20 million ton of edible oil and can meet only 25-30% of our requirement (Hossain and Rahman, 2008). Realizing the importance of increasing the domestic oil seed production, Bangladesh Institute of Nuclear Agriculture (BINA) has undertaken a varietal improvement program of sesame using gamma rays. The main objective of the program was to develop sesame variety having earliness, short stature, suitable plant type, heavy bearing and high seed and oil content. The mutants after proper evaluation and selection need to be further tested in different agro-ecological zones to determine its general and location-specific suitability for utilization (Ottai *et. al.*, 2005). This experiment was undertaken to evaluate the performance of twelve M_5 sesame mutant lines in the farms of BINA sub-station at Magura and Ishurdi.

Materials and Methods

The trial was carried out at the BINA (Bangladesh Institute of Nuclear Agriculture) sub-station farms, Magura and Ishurdi during kharif-I of 2008. Twelve M_5 mutant lines (SM-01-04, SM-02-04, SM-03-04, SM-04-04, SM-05-04, SM-06-04, SM-07-04, SM-08-04, SM-09-04, SM-10-04, SM-11-04 and SM-12-04) along with two check varieties (Binatil-1 and Baritil-2) were evaluated by laying out in a randomized complete block design with three replications. Unit plot size was 12 m^2 (4m x 3m) keeping 25 cm spacing between rows and 8-10 cm between plants in a row. At both the locations, seeds were sown in the 23 to 27 February, 2008. The crop was fertilized with cow dung, urea, TSP and MoP @ 8 tons, 180 kg, 130 kg and 80 kg per ha, respectively. Recommended production package like weeding, thinning, irrigation, application of pesticide etc. were followed to ensure normal plant growth and development. Data were taken for plant height, branches per plant, capsules per plant and seeds per capsule from 10 randomly selected plants from each plot. Maturity period was counted when 80% capsules were matured and turned into yellowish colour in each plot. Seed yield of each plot was recoded after harvest and then converted into kg/ha. Statistical analyses were performed and the mean values of each character were done by Duncan’s Multiple Range Test (Steel and Torrie, 1960).

Results and Discussion

The mean values for different characters of the mutant and check varieties of two locations and combined over two locations are presented in Table 1. Results showed significant variation among the mutants and check varieties for all the characters at both locations and combined over locations.

Plant height: A significant variation was observed on the plant height both in individual locations and combined over locations. At Magura, mutant line SM-09 produced the tallest plants (153 cm) followed by SM-12 and Binatil-1(151 cm). At Ishurdi, mutant line SM-04 produced the tallest plants (111 cm) followed by Binatil-1(110 cm) while the lowest was in SM-10 (85 cm). Regarding combined means over locations, SM-09-04 and Binatil-1 produced the tallest plants (131 cm) followed by SM-11-04 (127 cm) and SM-12-04 (126 cm) while the shortest plants were observed in SM-07-04 (108 cm). Uzun and Cagırgan (2006) also found that the plant height influenced by gamma radiation which is an agreement with the present findings.

Table 1. Mean of M_5 sesame mutants and check varieties for different quantitative characters

Mutants/ varieties	Plant height (cm)	No. of branches/plant	No. of capsules/plant	No. of seeds/ capsule	Days to maturity	Yield (kg/ha)
			Magura			
SM-01-04	141a-c	0.5cd	54a-d	81cd	79ef	2122c-e
SM-02-04	131cd	1.6bc	49b-d	79de	78fg	1957e
SM-03-04	135b-d	0.0d	55a-d	88ab	81d	2278a-c
SM-04-04	136a-d	0.4cd	49cd	69gh	85bc	1974de
SM-05-04	139a-d	0.0d	58a-c	80c-e	77g	2344ab
SM-06-04	137a-d	0.2d	44d	68h	87ab	2061de
SM-07-04	114e	0.0d	56a-d	79de	78fg	2167b-d
SM-08-04	123de	0.0d	59a-c	85bc	81de	2417a
SM-09-04	153a	0.8cd	47cd	72f-h	85c	2000de
SM-10-04	136a-d	3.3a	68a	79c-e	75h	2419a
SM-11-04	146a-c	0.0d	55a-d	83b-d	88a	2419a
SM-12-04	151ab	2.1b	56a-d	78d-f	77g	2017de
Baritil-2	146a-c	2.0b	50b-d	74e-g	82d	2050de
Binatil-1	151ab	0.0d	63ab	93a	77g	2350ab
			Ishurdi			
SM-01-04	94d-f	1.8bc	54ab	66b-d	95de	1083bc
SM-02-04	106a-c	2.5a-c	55ab	65b-e	95de	983bc
SM-03-04	103a-e	1.4c	48ab	70ab	96cd	1110b
SM-04-04	111a	2.3a-c	51ab	68a-d	99a	1094bc
SM-05-04	95c-f	0.4d	48ab	62de	92f	983bc
SM-06-04	105a-d	2.7ab	42b	70a-c	95d	907c
SM-07-04	102a-e	2.2a-c	52ab	64c-e	95d	1020bc
SM-08-04	106a-c	2.5a-c	45b	63de	95d	956bc
SM-09-04	109ab	2.5a-c	48ab	62de	95d	1003bc
SM-10-04	85f	2.3a-c	42a	59ef	92f	1128b
SM-11-04	108ab	1.9bc	48ab	72a	98ab	1139b
SM-12-04	100b-e	2.0a-c	51ab	64c-e	99a	996bc
Baritil-2	93ef	3.1a	41ab	55f	97bc	1033bc
Binatil-1	110ab	0.0d	54ab	72a	93ef	1313a
			Combined means over two locations			
SM-01-04	118b-d	1.2de	54bc	74de	87fg	1603c-e
SM-02-04	119b-d	2.0bc	52b-d	72d-f	87fg	1470f
SM-03-04	119b-d	0.7e-g	52b-d	79ab	89e	1694bc
SM-04-04	124abc	1.3cde	50b-d	69f-h	92ab	1534ef
SM-05-04	117b-e	2.0fg	53b-d	71d-g	85hi	1664b-d
SM-06-04	121bc	1.4c-e	43d	69f-h	91bc	1484ef
SM-07-04	108e	1.1de	54bc	71d-g	87fg	1593c-f
SM-08-04	115c-e	1.3c-e	52b-d	74cd	88ef	1686bc
SM-09-04	131a	1.6cd	48cd	67gh	90cd	1502ef
SM-10-04	111de	2.8a	65a	69e-g	84i	1773ab
SM-11-04	127ab	0.9d-f	51b-d	78bc	93a	1779ab
SM-12-04	126ab	2.0bc	54bc	71d-g	88ef	1506ef
Baritil-2	120b-d	2.5ab	49b-d	65h	90d	1542d-f
Binatil-1	131a	0.0g	59ab	82a	85h	1832a
			Location means			
Magura	139a	0.8b	55	79a	81b	2184a
Ishurdi	102b	2.0a	50	65b	95a	1053b

In a column, figures having similar letter(s) do not differ significantly where as figure (s) bearing dissimilar letter(s) differ significantly by DMRT.

Number of branches plant^{-1}: Number of branches per plant was significantly difference both in individual locations and combined over locations. At Magura, the mutant SM-10 produced the highest number of branches (3.3) per plant followed by SM-12 (2.1) while SM-03, SM-05, SM-07, SM-08 SM-11 and control variety Binatil-

1 was unicom. At Ishurdi, Baritil-2 produced higher number of branches (3.1) per plant followed by SM-06 (2.7) while Binatil-1 was Unicom. In combined over locations, Number of branches per plant varied from 0.0 (Binatil-1) to 2.8 (line SM-10-04). It indicates that there was substantial variation among the mutants/varieties which is supported by Das *et al.* (2003). They found significant variation in respect of number of branches per plant.

Number of capsules plant^{-1}: At Magura, the number of capsules per plant was the highest in SM-10 (68) followed by Binatil-1 (63) while the lowest in SM-06 (44). At Ishurdi, the number of capsules per plant was the highest in SM-2 (55) followed by SM-01 and Binatil-1 (54) while the lowest in Baritil-2 (41). The highest number of capsules per plant was obtained from SM-10 (65) followed by Binatil-1 (59) while the lowest was obtained from SM-06 (43) in combined over locations. The above results indicate the presence of substantial variation among the mutants/varieties. The significant genetic variations for number of capsules per plant were observed by Rahman *et al*. (1992) and Uzun and Cagırgan (2006).

Number of seeds capsules^{-1}: A significant variation was found on the number of seeds per capsules both in individual locations and combined over locations. At Magura, number of seeds per capsule was the highest (93) in Binatil-1 while the lowest in SM-06 (68). Number of seeds per capsule was the highest (72) in SM-11 and Binatil-1 while lowest in SM-10 (59) at Ishurdi. In combined over locations, Number of seeds per capsule was the highest in Binatil-1 (82) followed by SM-03 (79), SM-11 (78) and the lowest in Baritil-2 (65). Das *et al.* (2004) found the similar results.

Maturity period: The mutant line SM-11 needed long duration (88 days) followed by SM-06 (87 days) while mutant SM-10 was needed possible short duration (75 days) at Magura. The mutant line SM-04 and SM-12 needed long duration (99 days) followed by SM-11 (98 days) while mutant SM-5 was needed possible short duration (92 days) at Ishurdi. In combined over locations, SM-11 needed long duration (93 days) followed by SM-04 (92 days) while mutant SM-10 was needed possible short duration (84 days) (Table 1). Rajput *et al.* (1994) also found genetic variation for earliness in maturity and high yield in sesame.

Seed yield: Mutant line SM-10 and SM-11 produced the highest seed yield (2419 kg/ha) and it was closely followed by SM-08 (2417 kg/ha) and Binatil-1 (2350 kg/ha) while the lowest seed yield was produced in SM-02 (1957 kg/ha) at Magura (Table 1). Binatil-1 produced the highest seed yield (1313 kg/ha) followed by SM-11-04, which produced seed yield of 1139 kg/ha while SM-06-04 produced the lowest seed yield (907 kg/ha) at Ishurdi. In combined over locations, the highest seed yield was produced in Binatil-1 (1832 kg/ha), which showed non-significant difference with SM-10-04 (1773 kg/ha) and SM-11-04 (1779 kg/ha). These findings are in agreement with Murty and Oropeza (1995). Between two locations, seed yield and yield contributing characters were observed better at Magura.

From the above experiment, it can be stated that mutation breeding is the most relevant tool to create genetic variations in quantitative characters of plant species which have narrow genetic base. Thus, plant breeders could get a good scope for selection of mutation with desirable characters, such as with early maturing mutants with tolerance to stresses (salinity and drought) and high seed yield and oil content yields.

Therefore, it can be concluded that gamma irradiation could create useful variability in most of the characters studied in sesame genotypes that helped in selection of promising mutants in M_6 and M_7 generations.

References

Ashri, A. 1982. Status for breeding and prospects for mutation in peanut, sesame and castor bean. *In*: Improvement of oilseed and industrial crops by induced mutation. IAEA, Vienna. 65-80.

BBS (Bangladesh Bureau of Statistics). 2008. Monthly Statistical Bulletin. Statistics Division, Ministry of Planning, Govt. People's Republic Bangladesh, Dhaka. p 66.

Das, M.L., Malek, M.A., Kashem, M.A., Hassan, A.A. and Pathan, A.J. 2004. Binatil-1: A new gamma ray induced mutant variety of sesame (*Sesamum indicum* L.). Bangladesh J. Pl. Breed. Genet. 17(2): 15-56.

Das, M.L., Rahman, A. and Malek, M.A. 2003. Variability studies in the gamma irradiated population of sesame (*Sesamum indicum* L.) genotypes. Bangladesh J. Bot. 32(1): 1-4.

FAO (Food and Agriculture Organization). 2005. FAO production Yearbook. UNDP, Rome, Italy. Vol. 57: 115-133.

Hossain, M.D. and Rahman, M.A. 2008. *Toil beez fasal utpadan briddhir somosya o tar somadhaner loskhe BARI udbhabita projukti somuha.* In: Krishi Projukti Manual, M. Nazim Uddin, M. Ahmed, M.S. Alam, R.U. Shamim, S. Ullah and K.M. Salahuddin (eds), Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. 39-43.

Murty, B.R. and Oropeza, F. 1995. Generation testing of different sesame lines under variable environments. Journal Euphytica. 82(1):73-78.

Ottai, M.E.S., Ibrahim, M.M. and Hassanein, M.S. 2005. Performance of different sesame (*Sesamum indicum* L.) varieties under variable environments. Annals Agric. Sci. 50(1): 229-245.

Potan, N., Rungsipiyakulm, D. and Chareonral, S. 1994. Improvement of sesame by induced mutation in Thailand. IAEA-TECDOC-781. 13-18.

Rahman, A. and Das, M.L. 1994. Evaluation of improved varieties of rapeseed/mustard through induced mutation. IAEA-TECDOC-781. 13-18.

Rahman, A., Das, M.L. and Pathan, M.A.J. 1992. New high yielding mutant varieties of mustard (*Brassica campestris* L. var. Yellow Saron). Indian J. Nuclear Agric. Biol. 21 (4): 281-285.

Rajput, M.A., Sarwar, G. and Siddiqui, K.A. 1994. Genetic improvement of sesame for plant architecture and grain

yield through nuclear techniques. IAEA-TECDOC-781. 89-96.
Steel, R.G.D. and Torrie, J.H. 1960. Principles and procedures of statistics. Mc Graw-Hill. New York.
Uzun, B. and Cagırgan, M.I. 2006. Selection and morphological characterization of induced determinate mutants in sesame. Field Crops Research. 96(1): 19-24.