Reprint **ISSN 1923-7766 (Web Version)**

International Journal of Experimental Agriculture

(Int. J. Expt. Agric.)

Volume: 12 **Issue: 1** **July 2022**

Int. J. Expt. Agric. 12(1): 1-4 (July 2022)

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ISSN-1923-7766 (Online)
Int. J. Expt. Agric. 12(1):1-4(July 2022)

SCREENING OF SESAME MUTANTS IN RESPECT OF MORPHOLOGICAL ATTRIBUTES AND YIELD

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Accepted for publication on 25 May 2022

ABSTRACT

Islam MT, Rahman MS, Khatoon M, Akter SE (2022) Screening of sesame mutants in respect of morphological attributes and yield. *Int. J. Expt. Agric.* 12(1), 1-4.

Mutants are the sources of variation and new varieties. Sesame, a crop with high oil content, has the potential capacity to combat nutritional deficiencies in developing countries. An experiment was conducted during March-May 2020 at BINA sub-station, Magura with ten sesame mutants along with a check variety Binatil-2 to screen the genotypes through morphological attributes and yield. The experiment was laid out following a randomized complete block design with three replications. Results revealed that the highest plant height was found in SM-3 followed by Binatil-2. SM-10 produced more number of branches followed by SM-5. The lowest number of branch was found in SM-9. Maximum capsule plant^{-1} was found in mutant SM-4 following SM-10, SM-2. The lowest number of capsule plant^{-1} was found in SM-6. SM-5 showed longer capsule size followed by SM-2. SM-1 produced the highest no. of seed capsule^{-1} followed by SM-7 and SM-2. Seed yield m^{-2} was higher in SM-9, SM-7 and SM-5 than Binatil-2. Five mutants (SM-1, SM-4, SM-5, SM-7 and SM-9) were selected and again evaluated in 2021 at BINA Sub-stations Ishurdi and Magura. Data on morphological attributes and yield attributes were recorded at harvest from 10 randomly selected plants in each plot and yield was taken from whole plot and converted into ton ha^{-1}. Results revealed that almost all the studied parameters were significantly different among the genotypes. The highest seed yield was found in SM-9.

Key words*: sesame, mutants, locations, morphological attributes, yield*

INTRODUCTION

Sesame (*Sesamum indicum*), a crop with high oil content, has the potential capacity to combat nutritional deficiencies in developing regions and countries. Most current cultivars contain 50–60% oil and 18–24% protein in their seeds (Mondal *et al.* 2010). In particular, greater than 80% of its oil is in the form of unsaturated fatty acids, which are more beneficial for human health than are saturated fatty acids. In addition, the antioxidant properties of sesame lignans, primarily sesamin and sesamolin, are used for therapeutic and cosmetic applications (Nakano *et al.* 2006). Sesame is typically considered drought-tolerant but susceptible to water logging, a property that can be ascribed to its suspected origin in Africa or India and its subsequent dispersal to tropical or semitropical regions (Ram *et al.* 1990 and Bedigian 2004). To understand the effects of abiotic stress in an effort to maintain a stable food supply, a number of studies have investigated the responses of model plants and crops to stresses (Rasmussen *et al.* 2013). These studies have revealed that plant responses to different stresses are coordinated by complex and often interconnected signaling pathways that regulate numerous metabolic networks (Miro and Ismail, 2013). At the protein level, low oxygen selectively induces the synthesis of anaerobic proteins, especially enzymes involved in sugar metabolism, glycolysis and fermentation (Komatsu *et al.* 2009). The vast majority of these proteins have been investigated in water logging-susceptible or tolerant strains of Arabidopsis or rice (Nakashima *et al.* 2009; Atkinson *et al.* 2013). Sesame mutants /varieties/land races show some tolerance to water logging (Islam and Khatoon, 2020; Islam and Khatoon, 2018). Water logging reduces gas exchange between plant tissues and the atmosphere, resulting in an imbalance between slow diffusion and rapid consumption of oxygen in the rhizosphere that drastically reduces the oxygen supply and induces anoxia in plants (Sachs *et al.* 1980). Short-term water logging often firstly causes oxygen deficiency (hypoxiaor anoxia) in plants and leads to root damage (Grassini *et al.* 2007). Water logging causes a shortfall in oxygen availability to plants which is felt directly by the root system, and indirectly by the shoots (Capon *et al.* 2009). In tissue suffering hypoxia (and specially anoxia), oxygen-depending processes are suppressed, both carbon assimilation and photosynthate utilization are inhibited, and functional relationships (especially the internal transport of oxygen) between roots and shoots are disrupted (Chugh *et al.* 2012). The response of a plant to hypoxia can be conceptually divided into three stages. Initially, the plant rapidly induces a set of signal transduction components, which then activates the second stage, a metabolic adaptation involving fermentation pathways. Finally, the third stage involves morphological changes such as the formation of gas filled air spaces (aerenchima) and/or adventitious root, depending on the tolerance of the plant (Jackson and Colmer, 2005; Evans 2003; Justin and Armstrong, 1987).

Sesame is cultivated during summer (March-May), when high temperature and water logging are common occurrences. High temperature and water logging are the environmental factors which regulate physiological growth processes and yield of plants. However, different crop cultivars have different ability to respond to these factors.

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Amelioration of these environment factors through management practices are costly involvement and sometimes quite impossible for the poor economic conditions of the farmers. The best alternative is thus developing /screening of the genotypes in different agro-ecological conditions of the country. In this study, morphological attributes and yield of some sesame genotypes were investigated under different agro-ecological conditions.

MATERIALS AND METHODS

The sesame mutants were developed in the project "Developing plant ideotype of lentil, mungbean, sesame and tomato for high yield, quality and stress tolerance under changing climate" of Crop Physiology Division, BINA, Mymensingh. Preliminary yield trial was conducted with ten selected mutants along with Binatil-2 at BINA sub-station Magura in 2020. The experiment was laid out following a randomized complete block design with three replications having a unit plot size of 3 m × 3 m. Row to row and plant to plant distances were 30 cm and 8 cm, respectively. Advanced yield trials were conducted with selected five mutants (SM-1, SM-4, SM-5, SM-7 and SM-9) and the check variety Binatil-2 at BINA sub-stations Ishurdi and Magura in 2021. These two experiments were laid out following a randomized block design with three replications having a unit plot size 3m × 4m. Row to row and plant to plant distances were 30 cm and 8 cm, respectively. Recommended doses of fertilizers were used. Proper cultural practices were done as and when necessary. Data on plant height, morphological attributes, yield and yield attributes were recorded at harvest from 10 randomly selected plants in each plot and yield was taken from whole plot and converted into ton ha^{-1}.

RESULTS AND DISCUSSION

Data of different parameters showed significant differences among the genotypes at $P \leq 0.05$ (Table 1). Results revealed that the highest plant height was found in SM-3 followed by Binatil-2. SM-10 produced more number of branches followed by SM-5. The lowest number of branch was found in SM-9. Maximum capsule plant^{-1} was found in mutant SM-4 following SM-10 and SM-2. The lowest number of capsule plant^{-1} was found in SM-6. SM-5 showed longer capsule size followed by SM-2. SM-1 produced the highest number of seed capsule^{-1} followed by SM-7 and SM-2. Seed yield m^{-2} was higher in SM-9, SM-7 and SM-5 than Binatil-2. SM-1, SM-4, SM-5, SM-7 and SM-9 were selected for further investigation. The results agreed with many authors (Islam and Khatoon, 2020; Islam *et al*. 2017; Wei *et al*. 2013).

Table 1. Yield and yield components of sesame mutants at Magura sub-station in 2020

Mutants	Plant height (cm)	Branch plant^{-1} (no.)	Capsule plant^{-1} (no.)	Capsule length (cm)	Seed capsule^{-1} (no.)	Seed yield m^{-2} (g)
SM-1	134cde	3.30cd	44.0def	2.29cd	87.5a	56.6d
SM-2	129e	3.50bc	53.3ab	2.54ab	76.6b	43.3g
SM-3	145a	3.50bc	42.8ef	2.36c	60.8cd	32.0h
SM-4	132de	3.07ef	57.4a	2.33cd	66.3c	48.5f
SM-5	135cd	3.60ab	44.6def	2.57a	66.3c	63.0b
SM-6	138bc	2.50g	35.7g	2.41bc	63.3c	48.9f
SM-7	135cd	3.23de	50.5bc	2.04e	80.3b	63.4b
SM-8	136cd	3.17def	48.4cd	2.19de	57.1d	52.8e
SM-9	132de	3.00f	46.9cde	2.37c	62.7cd	66.7a
SM-10	132de	3.77a	54.5ab	2.33cd	61.5cd	48.9f
Binatil-2	142ab	3.20def	42.3f	2.31cd	62.9c	60.0c

In a column, the figure(s) with similar letter(s) do not differ significantly by DMRT at $P \leq 0.05$

Results revealed that almost all the studied parameters were significantly different among the genotypes (Table 2 & 3). The highest seed yield was found in SM-9.

Table 2. Morphological attributes and yield of sesame genotypes at BINA Sub-station, Magura in 2021

Genotype	Plant height (cm)	Branch plant^{-1} (no.)	Capsule plant^{-1} (no.)	Capsule length (mm)	Seed capsule^{-1} (no.)	1000 seed wt. (g)	Yield (t ha^{-1})
Binatil-2	112.20a	3.20ab	36.47a	2.56a	71.73a	2.40c	1.71d
SM-1	109.67a	2.87b	39.80a	2.54ab	66.73a	2.62b	1.64e
SM-4	112.67a	3.27ab	39.00a	2.26c	72.20a	2.48bc	1.80b
SM-5	107.53a	3.73ab	42.13a	2.42abc	72.67a	2.63b	1.73c
SM-7	103.93a	3.40ab	37.27a	2.35bc	64.98a	2.63b	1.82b
SM-9	105.33a	4.27a	40.40a	2.49ab	54.13a	2.84a	1.90a
CV (%)	5.35	19.82	15.48	4.34	18.04	3.79	0.79

Values having common letter(s) in a column do not differ significantly at 5% level as per DMRT

Table 3. Morphological attributes and yield of sesame genotypes at BINA Sub-station, Ishurdi in 2021

Genotype	**Plant height (cm)**	**Branch plant^{-1} (No.)**	**Capsule plant^{-1} (no.)**	**Capsule length (mm)**	**Seed capsule^{-1} (no.)**	**1000 seed wt. (g)**	**Yield (t ha^{-1})**
Binatil-2	139.67a	3.20b	60.33a	2.49abc	65.73bc	2.51c	1.70e
SM-1	135.13ab	4.33ab	63.80a	2.63ab	78.80ab	2.67b	1.64f
SM-4	126.47bc	4.00ab	56.80a	2.11d	88.00a	2.53c	1.80c
SM-5	122.93c	3.47ab	65.40a	2.29bcd	88.53a	2.70b	1.74d
SM-7	125.27bc	4.27ab	67.60a	2.23cd	86.13a	2.69b	1.83b
SM-9	120.60c	4.53a	67.87a	2.65a	64.13c	2.89a	1.89a
CV (%)	4.76	17.64	10.00	7.94	9.50	2.66	0.70

Values having common letter(s) in a column do not differ significantly at 5% level as per DMRT

CONCLUSION

SM-4, SM-5, SM-7 and SM-9 were found promising and selected for further investigation.

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