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# YIELD PERFORMANCE STUDY OF BINA DEVELOPED SESAME VARIETIES UNDER AGRO-ECOLOGICAL CONDITIONS OF MYMENSINGH DISTRICT IN BANGLADESH

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**ABSTRACT**

An investigation was done during the Kharif-I (Summer) season 2022 at Sadar Upazilla of Mymensingh district in Bangladesh to explore the yield and factors affecting the yield of four sesame varieties developed by the Bangladesh Institute of Nuclear Agriculture (BINA). Three replications of a Randomized Complete Block Design (RCBD) were used, where Binatil-1, Binatil-2, Binatil-3, and Binatil-4 were the varieties. The experiment's findings showed that Binatil-1 contained the tallest plant (107.00 cm), whereas Binatil-3 contained the shortest plant (79.55 cm). It was noted that Binatil-2 had the greatest number of plant-1 branches (4.95), whereas Binatil-1 had the least amount (2.14). Additionally, Binatil-3 displayed the highest number of plant-1 pods (95.65), whereas Binatil-1 provided the lowest amount (51.27). Binatil-1 had the largest pod (3.56 cm), whereas Binatil-4 had the smallest (2.57 cm). It was noted that Binatil-1 displayed the greatest count of seeds in pod-1 (78.15), while Binatil-4 displayed the least amount (61.12). The highest 1000 seed weight was obtained from Binatil-2 (3.15 g), whereas the lowest 1000 seed weight was recorded in Binatil-1 (2.95 g). The established genotype Binatil-2 had the maximum seed yield (1.42 t ha-1), whereas Binatil-1 had the least (1.27 t ha-1). Among the cultivars, Binatil-3 matured in the fewest days (87), whereas Binatil-2 required the most days (95). At Binatil-2, significant yield performance was found from the Kharif-I (summer) season experiment. A simple correlation was done where branches per plant per thousand seed weight had a significant positive correlation and pod breadth had a negative impact on seed yield for all genotypes. This experiment will be helpful for oil crop breeders and the farming community to choose promising sesame genotypes with high yield potential and future breeding stock.

**Keywords:** *Sesame, Yield, Correlation, Agro-ecological, Comparison*

## Introduction

One of the oldest annual oilseed crops in the world is sesame (*Sesamum indicum* L.) (Bedigan and Harlan, 1986). It has been cultivated as a crop in Asia for about 5,000 years (Bisht *et al*., 1998). It is the third largest source of edible oil in Bangladesh (Roy *et al*., 2022). On an area of 83,168

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acres (BBS, 2020), 31,786 tons of sesame are produced. Sesame is used extensively in several countries' bakery, medicine, and nutraceutical sectors, because of its high oil content, protein, and antioxidant characteristics (Kamal *et al*., 1992; Elleuch *et al*., 2007).

Sesame seeds contain around 35-63% of quality-grade esculent oil, according to Kim *et al.* (2006). Yermanos *et al*., (1972) explored that oil from different sesame genotypes has markedly varied carboxylic acid compositions. After the oil has been extracted, the residual meal, which is high in tryptophan and methionine, binds 35 to 50% of its protein. Sesame seed hulls are rich in calcium (1.3% of dry weight) and other valuable minerals (Johnson *et al*., 1979). Sesame is adaptable to various cropping patterns and has a moderate tolerance for drought. Small to medium farmers, however, hardly ever grow sesame in areas with little precipitation and limited management inputs (Silme and Airgan, 2010). The emanation of sesame in Bangladesh is, however, lower than anticipated; therefore, the potential may be noticeably good. Inadequate input, poor management, exposure to abiotic and biotic stresses, and, most importantly, a lack of acceptable genetic stock all contribute to low yields (Pham *et al*., 2010). It's likely that the conditions in which sesame is grown have an effect on its performance (Geleta *et al*., 2002).

In the present, multiple research institutes in Bangladesh are developing numerous high-yielding sesame types. Farmers persist in planting native varieties despite their poor productivity owing to a lack of information. As a result, farmers in Bangladesh will be given assistance in improving yields and encourage sesame production by using suitable production techniques on good cultivars. The purpose of this study was, therefore, to evaluate the potential yield of four BINA-developed cultivars of sesame under Mymensingh agro-ecological conditions.

## Materials and Methods

### Study location

To examine the production potential of four sesame cultivars developed by BINA using the same agronomic management approaches, the experiment was carried out at Sadar, Mymensingh, which is situated at 24°47' North latitude and 90°21' East longitude.

### Climatic condition

The experimental location experienced a subtropical climate with periods of significant rainfall between February and June 2022 and periods of little precipitation during the rest of the year. From February through June of 2022, the area received a total of 928 mm of rain. The average temperatures for the high and low were 28.3°C and 20.75°C, respectively. Average relative humidity was 50%, and there were 12.6 hours of sunshine per day (Fig. 1) (BAUWS'2022).

### Experimental design and data collection

The experimental investigation utilized four different sesame (*S. indicum* L.) varieties: Binatil-1, Binatil-2, Binatil-3, and Binatil-4. By the Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh, the varieties have been made public. The experiment had just one element, as variety was the factor and recorded parameters were days to maturity, height of plant, number of developed branches, count of pods, length of pods, pod breadth, seeds contain each pod, 1000 seeds weight and yield of seeds. In an RCBD with three replications, the experiment was set up. There were 12 plots altogether, each with 4 types and 3 replications. Each unit area was 4.0 × 2.5

meters in size. The Bangladesh Agricultural Research Council (BARC) prepared a fertilizer suggestion guide (2018), and the experimental plots were fertilized in accordance with it. The physio-chemical properties of the experiment site are given in Table 1.

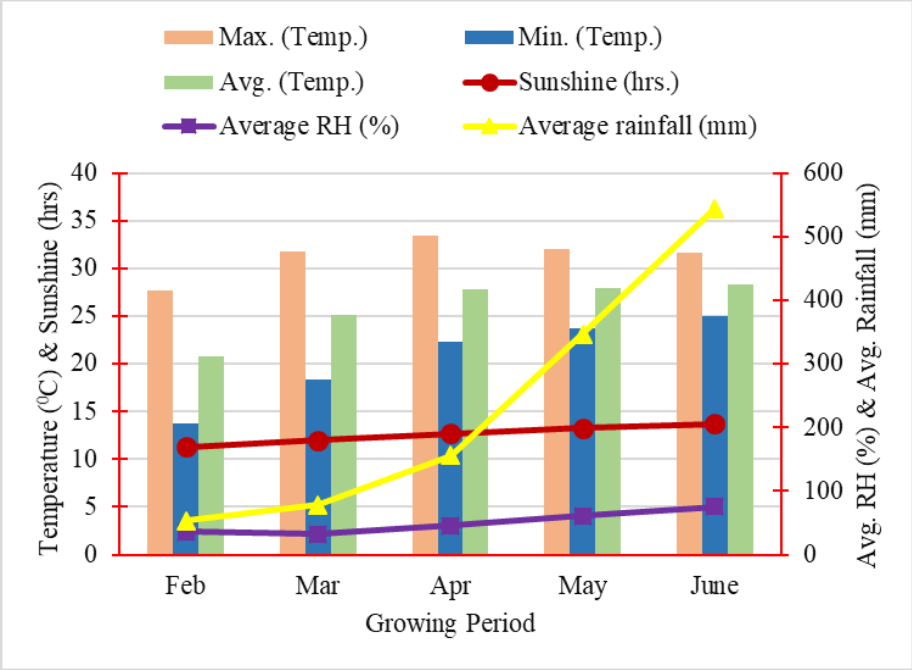


Fig. 1. Climatic conditions during crop growing period.

Table 1. Physio-chemical features of the initial soil (0-15 cm depth)

| | | |
|---|---|---|
| % Sand (0.2-.02 mm) | : | 22 |
| % Silt (0.02-0.002 mm) | : | 66 |
| % Clay (<0.002 mm) | : | 12 |
| Textural class | : | Silt loam |
| PH | : | 6.21 |
| OM (%) | : | 1.65 |
| Total Nitrogen (%) | : | 0.11 |
| Available Phosphorus (ppm) | : | 26.05 |
| Exchangeable Potassium (me%) | : | 0.15 |
| Available Sulphur (ppm) | : | 14.00 |

Statistical analysis

The mean value of the obtained data was statistically analyzed using the MSTAT computer package. The analysis of variance, and the mean differences were done using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984). Utilizing the software Past 4.03, functional correlations between yield and yield attributes were constructed.

**Results and Discussion**

Days to maturity

The maturity period lasted between 87 and 95 days (Table 2). Binatil-3 had the earliest maturity ever noted (87 days). At every other genotype, it was noticeably different. The longest maturity duration was displayed by Binatil-2 (95 days), which was statistically different from Binatil-1 (90 days) and Binatil-4 (92 days). Same agronomic practices for different genotypes of a species triggered their flowering and pod formation periods due to effects on their trait responsible genes. Saha and Paul (2017) reported that different gamma-irradiated sesame genotypes matured at various periods due to changes in their genetic makeup and inherent characters.

Plant height (cm)

In comparison to the other types, Binatil-1 had the tallest plants (107.00 cm), whereas Binatil-3 had the shortest plants (79.55 cm) followed by Binatil-2 (87 cm) and Binatil-4 (94 cm) (Table 2). The primary factor causing differences in plant height across cultivars and varieties is varietal variation. According to Caliskan *et al*., (2004) varietal differences were the cause of varying plant height. Briatia *et al*., (2017) reported that due to different genetic and morphologic traits plant height and other agronomic parameters may varied.

Table 2. Effect of varieties on yield contributing attributes and yields of sesame

| Variety | Days to Maturity (Days) | Plant height (cm) | Branch plant$^{-1}$ | Pod length (cm) | Pod breadth (cm) | Pods plant$^{-1}$ (no.) | Seeds pod$^{-1}$ (no.) | 1000 seed weight (g) |
|---|---|---|---|---|---|---|---|---|
| Binatil-1 | 90c | 107.00a | 2.14b | 3.56a | 0.81a | 51.27b | 78.15a | 2.95a |
| Binatil-2 | 95a | 87.00bc | 4.95a | 2.75b | 0.66b | 77.25ab | 67.33b | 3.15a |
| Binatil-3 | 87d | 79.55c | 4.25a | 2.62b | 0.73a | 95.65a | 62.45b | 3.08a |
| Binatil-4 | 92b | 94.00b | 4.21a | 2.57b | 0.78a | 84.33ab | 61.12b | 3.11a |
| LSD | 2.56 | 14.61 | 1.62 | 0.56 | 0.11 | 35.65 | 6.85 | 0.41 |
| CV (%) | 6.13 | 8.56 | 22.37 | 12.27 | 4.24 | 23.42 | 7.25 | 7.28 |

Values in a column that share the same letter (s) do not significantly differ at the 5% level using LSD.

Number of branches plant$^{-1}$

The variety with the most branches per plant was recorded in Binatil-2 (4.95), while Binatil-1 (2.14) had the lowest branching frequency and intermediates were found in Binatil-3 and Binatil-4 (Table 2). In Binatil-2 highest branching was found because of its genetic makeup developed by using gamma irradiation and also for favorable environmental status. Sesame genotypes receiving same treatment showed variation in branching frequency (Elobied, 2010).

Pod length (cm)

The material Binatil-1 generated a longer pod (3.56 cm), whereas Binatil-2 gave a comparatively less long capsule (2.75 cm). Other genotypes, Binatil-3 and Binatil-4, had capsule lengths of 2.62 cm and 2.57 cm, respectively, and were statistically comparable to Binatil-1 (Table 2). Variations in a variety's yield features were influenced by its genetic potential (Iqbal *et al*., 2016).

Pod breadth (cm)

The broader pod (0.81 cm) was created by the variety Binatil-1, while the lower-breathing pod (0.66 cm) was produced by the variety Binatil-2. According to statistics, the other two types, Binatil-3 and Binatil-4, also had pods that were 0.73 and 0.78 cm wide, respectively (Table 2). Ancestral traits were more responsible in off springs either for morphologic and yield contributing traits where same management practice and environment were not the major issue to make variation and these findings are in good agreement with Alege *et al*., (2013).

Number of pods plant$^{-1}$

The variety with the most pods per plant was Binatil-3 (95.65) which was statistically significant to other sesame genotypes, whereas the variety with the fewest pods per plant was Binatil-1 (51.27) (Table 2). Pod number is a highly linked gene oriented trait and varies on genotypes due to their different genetic constituents. According to Tahir *et al*., (2012) variety had an impact on number of pod formation in plants.

Number of seeds pod$^{-1}$

Consideration of the data showed that Binatil-1 had the most seeds (78.15) in a single pod which was significant among four studied varieties, while Binatil-4 had the fewest seeds (61.12) (Table 2).Due to different yield potential of each individual variety seed count in pod varied. According to Begum *et al*., (2001) the count of seeds per capsule varied depending on the variety.

1000 seed weight (g)

Binatil-2 had the highest thousand seeds wt. (3.15 g), according to (Table 2), whereas Binatil-1 had the lowest thousand seeds wt. (2.95 g). This trait was very positively correlated with seed yield and controlled by the parental genetic contribution. The findings concur with those of a prior study by Li *et al*., (2015) who found that under ideal circumstances, the genotype primarily regulated the 1000 seed weight.

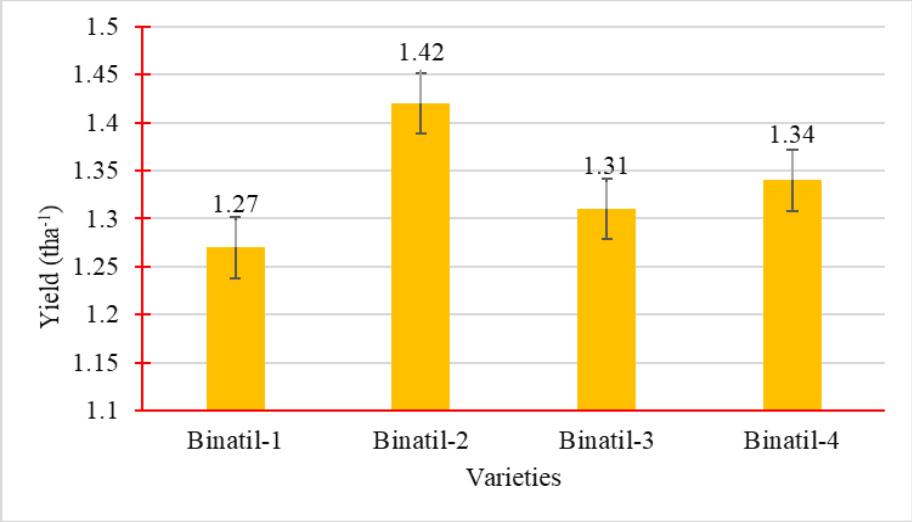


Fig. 2. Yield comparison of four sesame varieties developed by BINA under Agro-ecological circumstances in Mymensingh.

Seed yield (t ha$^{-1}$)

Information pertaining to seed yield of sesame varieties can be found from Fig. 2. Comparing the seed yields of the different grown kinds, Binatil-2 (1.42 t ha$^{-1}$) had the highest seed yield and Binatil-1 (1.27 t ha$^{-1}$) had the lowest it was statistically significant. The finding is similar with Akondo *et al*., (2022). While the actual number of pods per plant and the number of seeds per pod have the best immediate impact on seed yield and seed yield is strongly correlated with the number of branches (Lal *et al*., 2016). According to Uzun *et al*., (2002) there was a sizable direct influence of the quantity of fruiting branches on sesame seed yield. Variety has a prominent impact on output and yield-contributing characteristics in sesame, according to Roy *et al*., (2009).

Correlations among agronomic traits

The associations between seed yield and days to maturity (DM), 1000 seeds weight. (1000SW), and branches per plant (BPP) were all positive and statistically significant (Fig. 3). According to Kante *et al*., (2022), various agronomic parameters are positively correlated with the seed yield of different genotypes of sesame. Days to maturity, 1000 seed weight and branches per plant were identified as significant yield-related features which can be substantiated by the correlation analysis. Similarly, the number of branches per plant showed substantial and positive associations with 1000 seeds weight and the link between seeds per pod and pod length was significant and favorable (Sumithi *et al*., 2007; Khan *et al*., 2001). On the modern plant, the number of pods per plant and seeds per pod had a substantial negative association (Fig. 3). Pod breadth displayed a negative correlation with respect to 1000 seeds weight and seed yield.

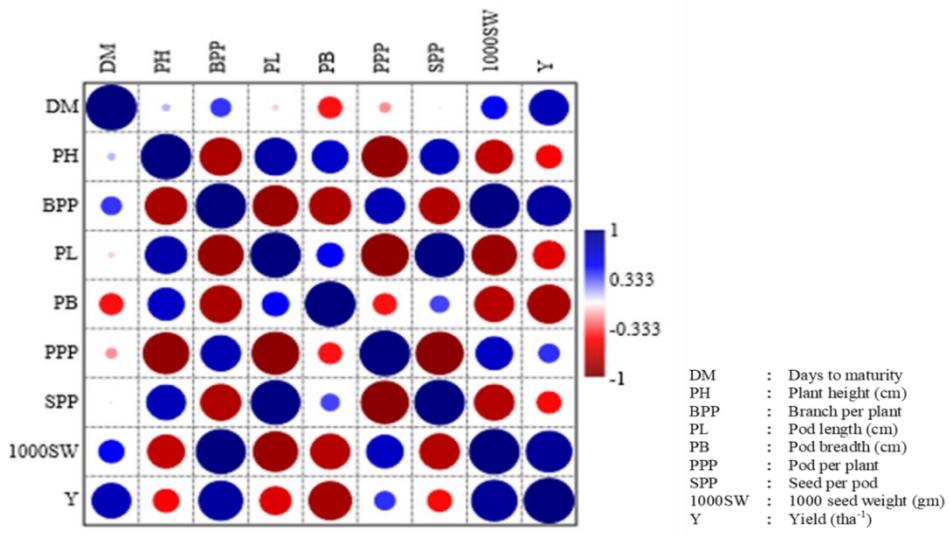


Fig. 3. Correlation among the studied traits of the sesame genotypes.

**Conclusion**

The goal of the experiment was to determine how BINA-developed sesame varieties would react in terms of growth and yield under the agroecology of Mymensingh district. . In terms of production during the Kharif-I (Summer) season, the sesame variety Binatil-2 would be the most

promising one. However, this study will be useful for future sesame breeding initiatives in Bangladesh as well as farmers for selection of varieties with high yield potential.

Competing Interest

The author claims to have no conflicts of interest.

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