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RESEARCH PAPER

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Yield performance assessment of different mustard cultivars under field conditions

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ABSTRACT

Mustard (*Brassica* spp.) is a vital oilseed crop in Bangladesh, significantly contributing to domestic edible oil production and the rural economy. This study was conducted at the BINA Sub-station Farm, Ishurdi, Pabna during the 2023–24 at rabi season to evaluate the yield performance and agronomic variability of five mustard cultivars—Binasarisha-4, Binasarisha-9, Binasarisha-11, BARI Sarisha-14, and BARI Sarisha-17. The experiment followed a Randomized Complete Block Design (RCBD) with three replications. Key traits including plant height, branching, siliqua number, seed characteristics, and yield were measured and analyzed through ANOVA. Significant differences were observed among cultivars, indicating substantial genetic variability. Binasarisha-9 demonstrated superior performance in plant height, number of siliqua per plant, seeds per siliqua, and seed yield (1.86 t/ha), followed by BARI Sarisha-17 and Binasarisha-4. Conversely, Binasarisha-11 and BARI Sarisha-14 exhibited lower yields despite high primary branching, likely due to poor siliqua development. These results underline the importance of genotype selection in enhancing mustard productivity and recommend Binasarisha-9, Binasarisha-4, and BARI Sarisha-17 for cultivation in the target agro-climatic zone. The findings contribute to ongoing efforts to improve mustard yield and support food security through strategic varietal selection.

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INTRODUCTION

One of the most significant oilseed crops grown worldwide is mustard (*Brassica* spp.), which is valued for its edible oil, nutritional value, and variety of industrial uses. *Brassica campestris* L., *Brassica juncea* L., and *Brassica napus* L. are among the commonly grown species that are widely distributed throughout different agro-ecological zones. In South Asia, especially in Bangladesh and India, mustard is essential to rural livelihoods, culinary traditions, and sustainable agriculture.

Mustard is an important oilseed crop in Bangladesh that contributes to the agricultural economy and helps meet the country's needs for edible oil. With mustard making up around 72% of the nation's total oilseed production, mustard oil is a common cooking medium in rural families.

According to Pandey *et al.* (2013), mustard seeds typically have 30–43% oil, 17–25% protein, 8–10% fiber, 6–10% moisture, and 10–12% extractable compounds. In addition to its nutritional benefits, mustard oil improves the taste of a lot of traditional foods (Aziz *et al.*, 2011).

Over 1.34 million hectares of oilseeds were grown in Bangladesh during the fiscal year 2023–2024, yielding approximately 1.83 million metric ton. Approximately 60% of all oilseed farming was made up of 0.336 million hectares of rapeseed/mustard alone. Among all the crops cultivated, mustard occupies a very important position due to its dual purpose: as an essential oilseed crop and as a source of income for countless farmers (Abrol, 2024). Cultivation of mustard not only helps meet the domestic demand for edible oil but also reduces import dependency, saving foreign exchange in the process (Rahman *et al.,* 2024).

However, there has only been a slight increase in the yield of rapeseed/mustard, from 672 kg/ha to 757 kg/ha, which represents a moderate yearly growth rate of 1.26% (Rahman *et al.,* 2002).

The lack of high-yielding varieties, inadequate crop management techniques, and less-than-ideal planting timings are the main causes of this low production. Agronomic techniques, environmental factors, genetic variety, biotic and abiotic stressors all have an impact on Bangladesh's mustard productivity, which varies greatly. Increasing mustard production through the adoption of better cultivars has become a national priority due to the growing demand for edible oils and the need to lessen reliance on imports. Important tactics in this endeavor include crop diversification and the discovery of high-yielding cultivars appropriate for regional conditions.

Several studies have shown that mustard genotypes differ significantly in terms of yield and yield-related characteristics, including the number of siliquae per plant, seed weight, and oil content (Singh *et al.,* 2020) Genetic variability and genotype-by-environment (G×E) interactions are frequently blamed for these variations, which call for methodical multi-location and multi-season assessments (Islam *et al.,* 2019). Finding genotypes that are both high-yielding and stable in a range of environmental circumstances is made possible by field-level performance testing (Meena *et al.,* 2020).

A key component of any crop development program is genetic diversity. Breeders can find stable lines that are resistant to pests, diseases, and drought by screening a variety of germplasm (Kumar *et al.,* 2019). The accuracy of cultivar selection has been further improved by recent developments in molecular breeding, such as the discovery of QTLs connected to yield traits (Yadav *et al.,* 2021).

In Bangladesh, there is still a significant knowledge vacuum regarding the evaluation of varietal performance in local field circumstances. To increase productivity and improve food security, it is crucial to choose cultivars that are appropriate for a certain agro-ecological zone (Rahman *et al.,* 2016). Field evaluation is essential for appropriate cultivar recommendation because mustard genotypes differ significantly in important agronomic parameters (Rana *et al.,* 2019).

Therefore, the present study aims to evaluate the yield performance and variability among selected mustard varieties under field conditions in Ishurdi, Pabna. The goal is to identify genotypes with superior agronomic traits and stable yield potential, thereby contributing to ongoing efforts in varietal selection, agricultural sustainability, and enhanced mustard cultivation across the country.

MATERIALS AND METHODS

The study was conducted at BINA Sub-station Farm. Ishurdi, Pabna during the 2023-24 at rabi season. The site is characterized by silt loam soil type, climatic conditions, average rainfall etc. The total number of five mustard (*Brassica* spp.) varieties (Binasarisha-4, Binasarisha-9, Binasarisha-11, BARI Sarisha-14, and BARI Sarisha-17) were selected for the experiment.

These varieties were sourced from Bangladesh Institute of Nuclear Agriculture (BINA) and Bangladesh Agricultural Research Institute (BARI). The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Each plot measured with appropriate spacing between rows and plants (30 cm × 10 cm). Standard agronomic practices for mustard cultivation were followed throughout the growing season. Fertilizer application, irrigation, weed control, and pest management were carried out uniformly across all plots to ensure consistency (Table 1).

Table 1. Properties of initial soil and interpretation of soil test values at BINA substation, Ishurdi

Texture	pH	OC (%)	Total N (%)	P (μgg^{-1})	K (meq %)	S (μgg^{-1})
Silt loam	7.4	1.2	0.11	17.0	0.185	15.4
	Slightly alkaline	Low	Low	Medium	Medium	Medium

Note: OC= Organic Carbon, meq%= milliequivalent percent, µgg-1= microgram per gram

Data collection

Data were recorded on various agronomic and yield-contributing traits, including:

1. Plant height (cm)
2. Number of primary branches per plant
3. Number of secondary branches per plant
4. Number of siliqua per plant
5. Number of seeds per siliqua
6. 1000-seed weight (g)
7. Seed yield per plot (g) and extrapolated yield (kg/ha)

Statistical analysis

The collected data were analyzed using Analysis of Variance (ANOVA) to determine the significance of differences among cultivars. The significance of the differences among pairs of treatment means was estimated by the Least Significant Difference (LSD) test at 5% and 1% level of probability and DMRT was calculated (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the mustard cultivars for all the studied traits, indicating the presence of considerable genetic variability. The results for plant height, branching pattern, siliqua characteristics, seed weight, and yield are summarized in Table 2.

Plant height

The tallest plants were observed in Binasarisha-9 (79.56 cm), which was significantly higher than most other cultivars, followed by Binasarisha-4 (73.67 cm). The shortest plants were recorded in BARI Sarisha-14 (61.67 cm). The variation in plant height could be attributed to genetic factors as well as differences in growth vigor among genotypes. Similar variability in plant height among mustard varieties was reported by Singh *et al.* (2020).

Primary and secondary branches per plant

Binasarisha-11, BARI Sarisha-14, and BARI Sarisha-17 exhibited significantly higher numbers of primary branches per plant (ranging from 5.22 to 5.55), while Binasarisha-4 had the fewest (2.89). In contrast, Binasarisha-4 and Binasarisha-9 had the highest numbers of secondary branches per plant (2.78 and 2.89, respectively), which were statistically superior to the rest. The branching pattern contributes significantly to yield potential by influencing the number of flowering sites. The results conform to the findings of Tripathi *et al.* (2021) that the number of branches per plant varies greatly depending on the variety.

Siliqua per plant

The number of siliqua per plant showed marked differences among cultivars. Binasarisha-9 produced the highest number (104), followed by Binasarisha-4 (81.22). The lowest was recorded in Binasarisha-11 (55). This trait directly contributes to seed yield and is closely linked to the number of effective branches.

Seed per siliqua and siliqua length

Seed count per siliqua was highest in Binasarisha-9 (30.89) and BARI Sarisha-17 (30.67), indicating superior reproductive efficiency. In contrast, Binasarisha-11 and BARI Sarisha-14 had significantly fewer seeds per siliqua (23.78). Similarly, siliqua length was greatest in Binasarisha-4 (7.36 cm), while the shortest siliquae were recorded in Binasarisha-11 (4.50 cm).

Different varieties had a significant impact on siliqua length. These findings are in agreement with Kumar *et al.* (2017). These traits are essential components of overall seed yield and contribute to the sink capacity of the plant.

1000-seed weight

Seed weight is a critical yield determinant and affects market quality. The highest 1000-seed weight was observed in BARI Sarisha-17 (3.15 g) and BARI Sarisha-14 (3.08 g), followed closely by Binasarisha-9 (3.02 g). The lowest was recorded in Binasarisha-11 (2.52 g). The variation could be a result of differences in seed filling duration and nutrient assimilation efficiency. The findings was similar by Singh *et al.* (2022) that the seed yield/ plant had a significant positive correlation with 1000 seed weight.

Table 2. Yield and yield contributing characters of five mustard cultivars

Treatments	Plant height (cm)	Primary branches plant^{-1}	Secondary branches plant^{-1}	Siliqua plant^{-1}	Seed siliqua^{-1}	Siliqua length (cm)	1000-seed weight (g)	Yield (tha^{-1})
Binasarisha-4	73.67 ab	2.89 c	2.78 a	81.22 b	28.22 a	7.36 a	2.76 ab	1.53 b
Binasarisha-9	79.56 a	3.67 b	2.89 a	104.00 a	30.89 a	6.67 b	3.02 a	1.86 a
Binasarisha-11	66.67 bc	5.55 a	0.33 b	55.00 d	23.78 b	4.50c	2.52 b	1.20 c
BARI Sarisha-14	61.67 c	5.22a	0.44 b	63.11 cd	23.78 b	4.89 c	3.08 a	1.23 c
BARI Sarisha-17	68.11 bc	5.22 a	0.56 b	67.78 c	30.67 a	4.91 c	3.15 a	1.55 b
$Lsd_{0.05}$	11.35	0.48	0.34	10.46	3.76	0.55	0.42	0.25
CV	8.62	5.67	12.74	7.49	7.26	5.18	7.67	9.06

Seed yield

Significant differences were observed in seed yield among the cultivars. Binasarisha-9 achieved the highest yield (1.86 t/ha), followed by BARI Sarisha-17 (1.55 t/ha) and Binasarisha-4 (1.53 t/ha). Binasarisha-11 and BARI Sarisha-14 recorded the lowest yields (1.20 and 1.23 t/ha, respectively). The superior performance of Binasarisha-9 can be attributed to its higher siliqua number, greater seed count per siliqua, and favorable seed weight. Nazeri *et al.* (2018) stated that seed yield and other yield contributing characters significantly varied among the varieties.

CONCLUSION

The present study revealed significant variability among mustard cultivars in terms of growth and yield-related traits under field conditions. Among the tested cultivars, Binasarisha-9 consistently outperformed others, showing superior plant height, siliqua number, seed per siliqua, and ultimately the highest seed yield (1.86 t/ha). Binasarisha-4 and BARI Sarisha-17 also demonstrated promising yield potential, indicating their suitability for cultivation in the given agro-climatic zone. Conversely, cultivars such as Binasarisha-11 and BARI Sarisha-14, despite having more primary branches, recorded lower seed yields, possibly due to fewer siliqua and shorter siliqua length. These findings confirm the presence of genetic diversity among cultivars and highlight the importance of selecting appropriate genotypes to maximize productivity under specific field conditions. Besides, the findings of this study will contribute to informed decision-making in mustard breeding programs, cultivar recommendations, and improved agronomic practices.

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