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Research Article

PERFORMANCE OF SEVENTEEN MUSTARD VARIETIES UNDER FARMERS' FIELD CONDITIONS IN SYLHET, BANGLADESH

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Abstract

Mustard productivity in Bangladesh remains low due to the continued cultivation of low-yielding varieties. To identify high-performing cultivars suitable for cultivation in post-7. Aman fallow lands utilizing residual soil moisture, a field experiment was conducted under farmers' field conditions during the *rabi* season (November 2019 to February 2020) at Sotero, Shiberbazar, Sylhet. Seventeen rapeseed–mustard varieties comprising BARI, BINA, and local cultivars were evaluated in a randomized complete block design with three replications. Significant varietal differences were observed for all growth and yield attributes. BARI Sarisha-11 produced the tallest plants, whereas BARI Sarisha-8 recorded the shortest. BARI Sarisha-14 produced the highest number of branches per plant (4.40), followed by BARI Sarisha-10 (3.80), while Tori-7 produced the fewest (1.53). Safal produced the highest fresh biomass, whereas BARI Sarisha-13 recorded the lowest. Tori-7 produced the highest plant population, while BARI Sarisha-13 had the lowest. BARI Sarisha-10 recorded the highest number of siliquae per plant (45.40), followed by Daulat (40.27), whereas BARI Sarisha-17 produced the fewest (15.00). BINA Sarisha-10 produced the highest number of seeds per silique (18.33), while Daulat recorded the lowest (10.73). BARI Sarisha-17 exhibited the highest 1000-seed weight while Tori-7 was the lowest. The highest seed yield was obtained from BARI Sarisha-15 (1.43 t ha⁻¹), followed by Agroni (1.23 t ha⁻¹), Safal (1.20 t ha⁻¹), and BARI Sarisha-11 (1.14 t ha⁻¹), whereas BINA Sarisha-10 produced the lowest yield (0.68 t ha⁻¹). Overall, the findings indicate that BARI Sarisha-15, BARI Sarisha-11, Agroni, and Safal are promising varieties for mustard cultivation under Sylhet conditions due to their superior yield performance and adaptability under the experimental conditions.

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Introduction

Mustard (*Brassica juncea*) together with rapeseed (*Brassica campestris* and *Brassica napus*) represents the major edible oilseed crops of the Brassicaceae family cultivated in Bangladesh, ranking second globally after soybean in terms of output (Rahman et al., 2022). These crops exhibit both photo- and thermo-sensitivity (Sharif et al., 2016). Although botanically distinct, both are commercially marketed as "mustard" in Bangladesh (USDA, 2022). Mustard seeds contain 28–36% protein and 28–45% oil, though these values vary with cultivar, growing region, and crop year (Sarker et al., 2021). The crops occupy about 3% of the nation's agricultural area and contribute 59.4% of total oilseed production (AIS, 2010). Globally, rapeseed accounted for 64.3 million of the 497 million tons of edible oil produced from major oilseeds in 2012–2013 (BBS, 2024). In Bangladesh, mustard oil is extensively used for both culinary purposes and traditional medicinal applications (Halim et al., 2023).

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Although mustard is an important oilseed crop, Bangladesh continues to experience a substantial deficit in edible oil production and relies on imports to meet more than 70% of its domestic demand (Ministry of Commerce, 2024). In FY 2023–24, the nation imported approximately 2.3 million tons of non-refined edible oil, with a cost of USD 2.1925 billion (Bangladesh Bank, 2024; Ministry of Commerce, 2024). Despite domestic oilseed production reaching 1.268 million tons in FY 2024–25, annual demand remains 2.4–2.9 million tons, resulting in edible oil imports costing over USD 2.89 billion annually (BBS, 2025; Ministry of Commerce, 2024). In FY 2024–25, mustard remained the country's largest oilseed crop, accounting for 644,000 tons of production, with total oilseed production reaching 1.268 million tons harvested from 1.535 million acres of farmland (BBS, 2025). Meanwhile, population growth continues to drive up edible oil demand.

Currently, mustard is cultivated on 11.44 lac acres annually, producing 6.38 lac metric tons (BBS, 2024). However, average grain yield remains very low at approximately 0.61 t ha⁻¹ compared to other mustard-growing nations (BBS, 2024). Mustard productivity remains low primarily because farmers continue to cultivate low-yielding varieties and often follow suboptimal field management practices (Alam, 2026). Therefore, introducing high-yielding varieties (HYVs) alongside improved management practices is critical for raising unit-area production. Recently, several research groups have released high-yielding mustard cultivars with yield prospective up to 2.5 t ha⁻¹, which have significantly contributed to yield increases where adopted.

Mustard is cultivated extensively in many parts of Bangladesh, particularly in the districts of Cumilla, Tangail, Jessore, Sirajganj, Sylhet, Faridpur, Pabna, Madaripur, Jamalpur, Rajshahi, Dinajpur, Kushtia, Kishoreganj, Rangpur, and Dhaka (BBS, 2024). The present investigation was carried out in Sylhet, a high-rainfall region located in the northeastern part of the country within Agro-Ecological Zone (AEZ)-20, known as the Eastern Surma–Kushiara Floodplain. The predominant cropping systems in this region are Boro–Fallow–T. Aman, Fallow–Aus–T. Aman, and Fallow–T. Aman–Fallow. After T. Aman harvest during the Rabi season, large areas remain fallow with residual soil moisture, suitable for mustard cultivation using appropriate varieties. However, most farmers in Sylhet still grow the low-yielding, pest-susceptible indigenous variety ‘Tori-7’. Thus, there is substantial opportunity to increase mustard production by selecting high-yielding, short-duration varieties suitable for post-rice fallow conditions. This study was undertaken to evaluate the adaptability and yield efficiency of selected mustard varieties under farmers' field conditions in Sylhet with the aim of identifying promising cultivars for wider cultivation.

Materials and Method

The field experiment was carried out during the 2019–2020 rabi season at a farmer's field located in Sotero, Shiberbazar, Sylhet Sadar, Bangladesh (24°54'33.2" N, 91°54'7.15" E; 30 m above mean sea level). The experimental site is situated within the Khadimnagar soil series of the Surma–Kushiyara Floodplain under Agro-Ecological Zone (AEZ)-20 (Fig. 1). The soil was clay loam in texture with a pH of 5.80. Throughout the growing season, the average maximum and minimum air temperatures were 30.1°C and 12.9°C, respectively.

Seventeen rapeseed–mustard varieties were included in the study: BARI Sarisha-17, BARI Sarisha-15, BARI Sarisha-14, BARI Sarisha-13, BARI Sarisha-12, BARI Sarisha-11, BARI Sarisha-10, BARI Sarisha-9, BARI Sarisha-8, BARI Sarisha-6, BINA Sarisha-10, Safal, Agroni, Sampod, Rai-5, Tori-7, and Daulat. The experiment was arranged in a randomized complete block design (RCBD) with three replications. Seeds of the selected varieties were obtained from the Bangladesh Agricultural Research Institute (BARI) and the Bangladesh Institute of Nuclear Agriculture (BINA). Seed viability was assessed before sowing through a

germination test, and the seeding rate was standardized at 7 kg ha^{-1} . Each experimental unit measured $3 \text{ m} \times 8 \text{ m}$, while spacing of 0.5 m between adjacent plots and 1.0 m between replications was maintained throughout the experiment.

The land was thoroughly prepared by repeated ploughing, cross-ploughing, and laddering to obtain a fine and uniform seedbed. Fertilizers were applied at the recommended rates of 250 kg urea, 170 kg triple superphosphate (TSP), 85 kg muriate of potash (MoP), 150 kg gypsum, 5 kg zinc sulfate (ZnSO_4), and 5 kg boric acid per hectare. During the final land preparation, the entire amounts of TSP, MoP, gypsum, zinc sulfate, and boric acid, together with half of the required urea, were incorporated into the soil. The remaining half of the urea was applied as a top dressing at 24 days after sowing (DAS).

A pre-sowing irrigation was provided to ensure adequate soil moisture for uniform seed germination. Sowing was carried out by broadcasting the seeds on 16 November 2019, followed immediately by laddering to cover the seeds with soil. Additional irrigations were applied at 20 and 50 days after sowing (DAS) to support crop growth. Weed competition was minimized through manual weeding at 10 and 25 DAS, while aphid infestation was controlled by applying Sumithion 50 EC during the pod development stage.

Plant population (plants m^{-2}), plant height (cm), number of branches per plant, and fresh biomass (t ha^{-1}) were recorded at 15-day intervals from crop establishment until harvest. Before harvesting, ten representative plants were randomly selected from each plot to determine the number of siliquae per plant, seeds per siliqua, and 1000-seed weight. Harvesting was performed when nearly 80% of the siliquae had attained a yellow colour, indicating physiological maturity. A net harvested area of $3 \text{ m} \times 2 \text{ m}$ was maintained in each plot for yield estimation. The harvested plants were transported to the threshing floor, sun-dried, and then manually threshed. The seeds were further dried under sunlight for 3–4 days until the moisture content reached approximately 12%, after which seed yield was measured on a plot basis and expressed as t ha^{-1} .

The collected data were subjected to statistical analysis using R software. Analysis of variance (ANOVA) was performed to evaluate the effects of the treatments, and treatment means were separated using the Least Significant Difference (LSD) test at the 5% level of significance.

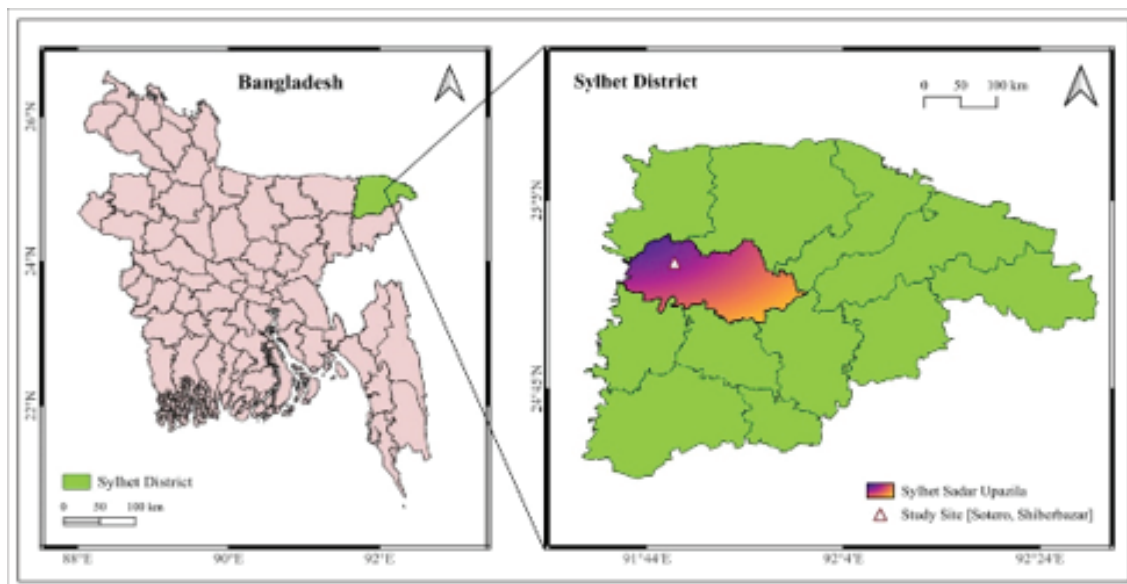


Figure 1. Study places on a map of Sylhet Sadar Upazila (Bangladesh, 2025).

Results and Discussion

3.1 Performance of several rapeseed-mustard cultivars' yield-contributing characteristics:

3.1.1 Plant height (cm)

Plant height differed significantly among the evaluated mustard varieties (Fig. 2). The tallest plants were recorded in BARI Sarisha-11 (81.13 cm), which did not differ significantly from Agroni (80.53 cm), Daulat (77.13 cm), BARI Sarisha-6 (76.73 cm), Safal (76.53 cm), and Sampod (76.33 cm). In contrast, BARI Sarisha-8 produced the shortest plants (42.13 cm), followed by BINA Sarisha-10 (42.20 cm) and BARI Sarisha-9 (46.80 cm), with no significant differences among these varieties. Similar varietal differences in plant height were reported by Ahmed and Kashem (2017), who identified BARI Sarisha-11 as the tallest genotype among the tested varieties. Plant height is an important growth attribute and is strongly influenced by the genetic makeup of cultivars, as reported by Sana et al. (2003). The observed differences among the varieties in the present study may also be associated with their varying capacities to utilize available light, water, and soil nutrients efficiently. Earlier findings by Alam (2004) likewise demonstrated significant variation in plant height among mustard and rapeseed genotypes.

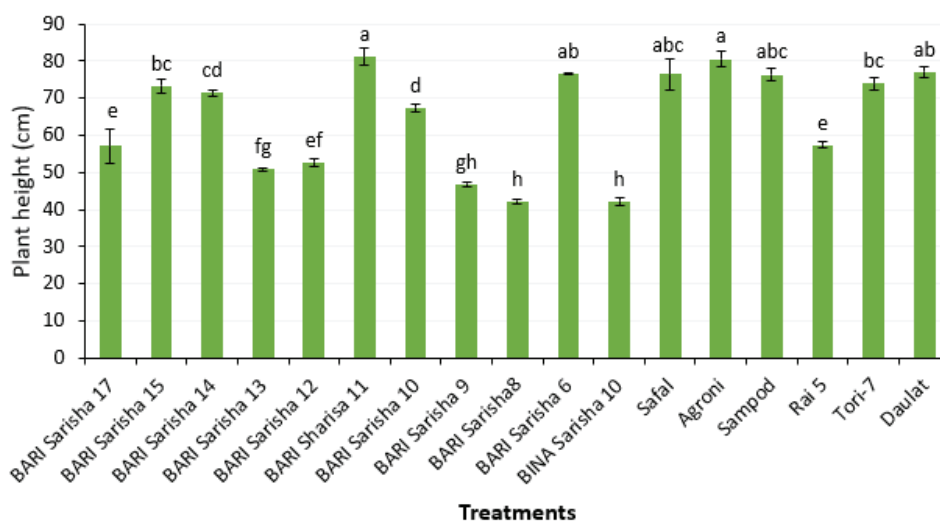


Figure 2. Variation in plant height among different mustard varieties.

3.1.2 Number of branches/plants

The number of branches per plant is an important yield-related trait, as increased branching enhances leaf production and pod formation, thereby contributing to greater photosynthetic capacity and seed yield. Significant differences in the number of branches per plant were observed among the evaluated mustard varieties (Fig. 3). BARI Sarisha-14 produced the highest number of branches (4.40 plant⁻¹), which was statistically comparable to BARI Sarisha-10 (3.80 plant⁻¹). Moderate branching was recorded in BARI Sarisha-15 (3.40 plant⁻¹), BARI Sarisha-12 (3.40 plant⁻¹), BARI Sarisha-9 (3.07 plant⁻¹), and BARI Sarisha-8 (3.07 plant⁻¹). In contrast, Tori-7 exhibited the fewest branches per plant (1.53), showing no significant difference from Safal (1.67), BARI Sarisha-17 (1.80), and Agroni (1.87). Similar observations were reported by Rahman et al. (2022), who also identified Tori-7 as producing the lowest number of branches per plant. The variation in branching among the tested varieties is likely associated with differences in their genetic potential and the interaction between genotype and the prevailing environmental conditions. Comparable varietal differences in primary branch production have also been documented by Sana et al. (2003).

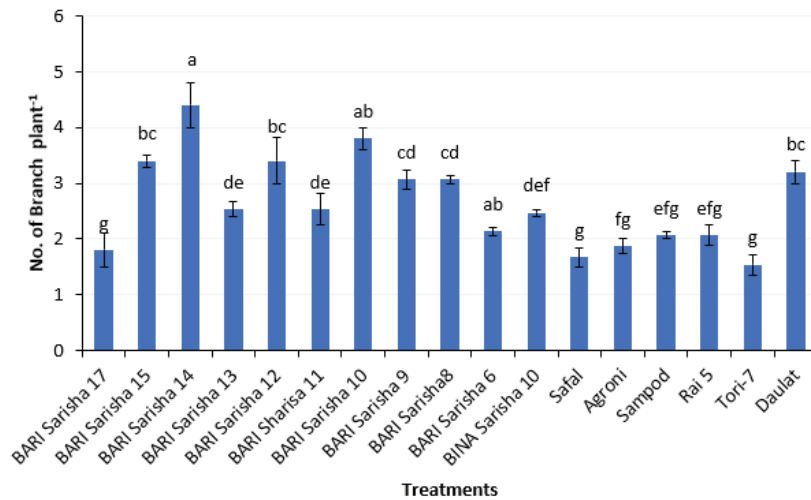


Figure 3. Number of branches plant⁻¹ of different mustard varieties.

3.1.3 Fresh weight of plant (t/ha)

Fresh biomass production differed significantly among the evaluated mustard varieties (Fig. 4). Safal produced the highest fresh weight (15.23 t ha⁻¹), which may be attributed to its superior vegetative growth, including greater plant height and increased branching. Comparatively high fresh biomass was also recorded in Sampod (13.30 t ha⁻¹), BARI Sarisha-15 (11.90 t ha⁻¹), BARI Sarisha-8 (11.50 t ha⁻¹), and Agroni (11.27 t ha⁻¹). In contrast, BARI Sarisha-13 produced the lowest fresh weight (4.17 t ha⁻¹), although its performance was statistically similar to that of BARI Sarisha-12 (5.63 t ha⁻¹), BINA Sarisha-10 (5.80 t ha⁻¹), and BARI Sarisha-10 (5.93 t ha⁻¹). The observed variation in fresh biomass among the varieties is likely associated with differences in their genetic potential for vegetative growth and biomass accumulation under the prevailing field conditions.

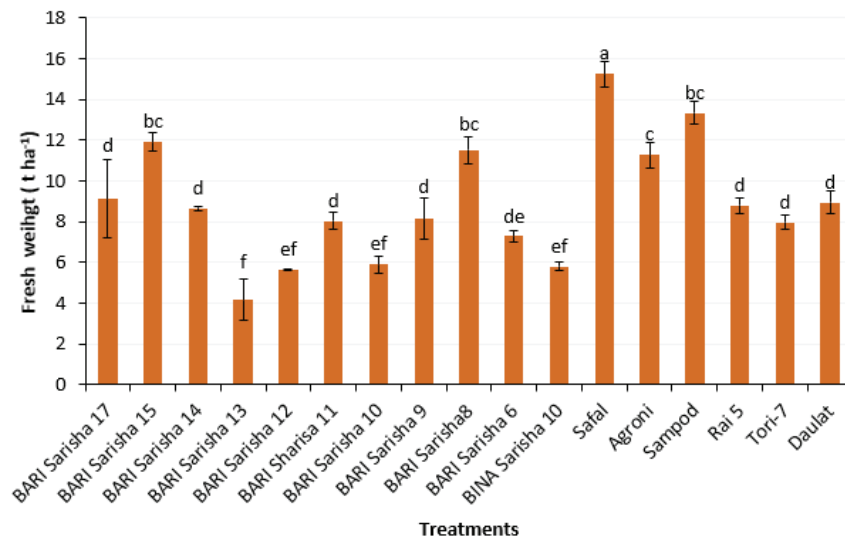


Figure 4. Fresh weight of plant of different mustard varieties.

3.2 Performance of several rapeseed-mustard cultivars' yield characteristics:

3.2.1. Plant population/m²

Plant population per square meter differed significantly among the evaluated mustard varieties (Table 1). Highest plant density (361.33 plants m⁻²) recorded in Tori-7, followed by BINA Sarisha-10 (309.33 plants m⁻²). In contrast, BARI Sarisha-13 recorded the lowest plant population (96.00 plants m⁻²), although it did not differ significantly from BARI Sarisha-10 (118.67 plants m⁻²). The superior plant population observed in Tori-7 may reflect its better seedling establishment and field emergence under the prevailing growing conditions. These results are consistent with the findings of Rahman et al. (2022), who also reported that Tori-7 achieved the highest initial plant population among the evaluated mustard varieties. Likewise, Islam et al. (2015) noted that BARI Sarisha-13 produced the lowest plant density. Plant population plays a crucial role in determining crop yield. These varietal differences of plant population are likely the result of inherent genetic characteristics together with variations in cultivation practices. Varieties with relatively smaller plant size can be grown at higher densities per unit area. Moreover, the availability of soil nutrients and moisture significantly influences plant growth and survival, which in turn affects plant population. Helal et al. (2016) also reported this he mentioned noticeable variation in plant population among mustard varieties under farmers' field conditions in the Sylhet region. Therefore, selecting appropriate varieties along with maintaining an optimum plant population is essential for achieving higher mustard yield.

Table 1. Various mustard cultivar's yields and yield characteristics at Sylhet farmer's field

Treatment	Plant population/m ²	Siliqua plant ⁻¹ (no.)	Siliqua length (cm)	Seeds siliqua ⁻¹ (no.)	1000 seed wt. (g)	Seed yield (t/ha)
BARI Sarisha 17	210.67fg	15.00i	3.95g	18.27b	4.03a	0.76def
BARI Sarisha 15	181.33h	22.47cdefg	5.13cd	16.33d	3.57cdef	1.43a
BARI Sarisha 14	184.00gh	20.47defgh	4.98cd	15.53e	3.73bcd	0.95bcde
BARI Sarisha 13	96.00j	22.67cdef	6.69a	17.27c	3.73bcd	0.92bcde
BARI Sarisha 12	170.67hi	17.27ghi	6.46a	15.00efg	3.37fg	0.72def
BARI Sharisa 11	212.00fg	26.60bc	4.07fg	10.80i	3.80abc	1.14abc
BARI Sarisha 10	118.67j	45.40a	4.43ef	10.80i	3.67cde	1.00bcd
BARI Sarisha 9	174.67hi	28.07b	5.86b	15.13ef	3.27g	0.78def
BARI Sarisha8	256.00cd	20.27defghi	5.40bc	14.60fgh	3.60cdef	0.98bcde
BARI Sarisha 6	152.00i	20.40defgh	5.02cd	14.67fgh	3.50defg	0.90cde
BINA Sarisha 10	309.33b	16.87hi	4.28efg	18.33b	3.40fg	0.68ef
Safal	260.00cd	25.47bcd	4.67de	18.26b	3.47efg	1.20abc
Agroni	236.00def	24.33bcde	5.27c	18.00bc	3.50defg	1.23ab
Sampod	268.00c	22.67cdef	3.97fg	15.47e	3.67cde	0.82def
Rai 5	248.00cde	29.00b	2.90h	14.27gh	3.37fg	0.92cde
Tori-7	361.33a	19.13efghi	4.73de	14.13h	3.00h	0.81def
Daulat	236.00def	40.27a	4.06fg	10.73i	3.37fg	0.93bcde
LSD (0.05)	28.68	5.28	0.48	0.74	0.25	0.30
CV (%)	7.81	13.24	5.83	2.95	4.21	20.11

3.2.2 Number of siliqua/plant

Siliquea production per plant, an important determinant of seed yield in mustard, varied significantly among the tested varieties. The observed variation in siliquea production was likely linked to branching potential, since increased branching typically enhances siliquea formation. BARI Sarisha-10 exhibited the maximum number of siliquea per plant (45.40), closely followed by Daulat (40.27), with no significant difference between the two. In contrast, BARI Sarisha-17 had the lowest number (15.00). Other varieties like BINA Sarisha-10 (16.87), BARI Sarisha-12 (17.27), and Tori-7 (19.13) also produced fewer siliquea. Some varieties, such as BARI Sarisha-11 (26.60), Safal (25.47), BARI Sarisha-15 (22.47), Agroni (24.33), BARI Sarisha-13 (22.67), and Sampod (22.67), showed moderate and similar results (Table 1). Since siliquea hold the seeds, more siliquea per plant usually means higher yield. These findings are consistent with those of Mamun et al. (2014), who identified the number of siliquea per plant as one of the key determinants of seed yield in mustard and rapeseed.

3.2.3 Length of siliqua (cm)

A significant varietal effect was observed for siliquea length (Table 1). The maximum siliquea length was recorded in BARI Sarisha-13 (6.69 cm), which did not differ significantly from BARI Sarisha-12 (6.46 cm). Conversely, Rai-5 produced the shortest siliquea (2.90 cm), while BARI Sarisha-17 (3.95 cm) and Sampod (3.97 cm) also exhibited relatively shorter siliquea. As an important yield component, siliquea length influences seed production by determining the capacity of each pod to develop and accommodate seeds. Usually, longer siliquea can contain more seeds per siliquea. Longer siliquea can hold more seeds than shorter ones, which may influence yield. Similar finding was reported by Das et al. (1999) at Dinajpur.

3.2.4 Number of seeds/siliquea

The number of seeds per siliquea, an important yield component in mustard, varied significantly among the evaluated varieties (Table 1). BINA Sarisha-10 recorded the highest number of seeds per siliquea (18.33), followed closely by BARI Sarisha-17 (18.27), Safal (18.26), Agroni (18.00), and BARI Sarisha-13 (17.27), all of which exhibited comparable performance. In contrast, Daulat produced the fewest seeds per siliquea (10.73), although its value did not differ significantly from those of BARI Sarisha-11 (10.80) and BARI Sarisha-10 (10.80). The observed variation in seed number per siliquea is likely associated with differences in the genetic potential of the varieties and their capacity to allocate assimilates during reproductive development. These results indicate that varieties with more seeds per siliquea can give higher yield, because more seeds are produced in each pod. This is especially important for oilseed crops like mustard. For higher yield in *Brassica juncea*, varieties with a higher number of seeds per siliquea are preferred. Similar findings have been reported in previous studies, where seeds per siliquea were identified as a key yield-contributing trait.

3.2.5 1000- seed weight (g)

The 1000-seed weight exhibited significant variation among the evaluated mustard varieties (Table 1), indicating the influence of genetic differences on seed size. Similar varietal effects on 1000-seed weight have been reported by Dinda et al. (2015) and Monshi and Malek (2013). Among the tested cultivars, BARI Sarisha-17 recorded the highest 1000-seed weight (4.03 g), followed by BARI Sarisha-11 (3.80 g). In contrast, Tori-7 produced the lowest 1000-seed weight (3.00 g), while comparatively lower values were also observed in BARI Sarisha-9 (3.27 g), BARI Sarisha-12 (3.37 g), Rai-5 (3.37 g), and Daulat (3.37 g). These findings are in agreement with Rahman et al. (2022), who likewise identified BARI Sarisha-17 as the variety with the highest 1000-seed weight and Tori-7 as the lowest. Since 1000-seed weight is a major yield component, greater seed weight generally reflects enhanced grain filling and contributes to improved yield

potential. This interpretation is further supported by Mamun et al. (2014), who emphasized the significant contribution of seed weight to overall mustard yield.

3.2.6 Seed yield (t/ha)

Seed yield differed significantly among the evaluated mustard varieties (Table 1), demonstrating considerable genetic variability in yield performance. Comparable varietal differences in seed yield and associated yield attributes were also reported by Nazeri et al. (2018). Among the tested cultivars, BARI Sarisha-15 achieved the highest seed yield (1.43 t ha⁻¹), although its performance was statistically comparable to that of Agroni (1.23 t ha⁻¹), Safal (1.20 t ha⁻¹), and BARI Sarisha-11. The superior performance of BARI Sarisha-15 is consistent with the findings of Mamun et al. (2014), who reported a seed yield of 1.07 t ha⁻¹ for this variety at a plant population of 100 plants m⁻². Conversely, BINA Sarisha-10 recorded the lowest seed yield (0.68 t ha⁻¹), with no significant difference from BARI Sarisha-12 (0.72 t ha⁻¹), BARI Sarisha-17 (0.76 t ha⁻¹), BARI Sarisha-9 (0.78 t ha⁻¹), Tori-7 (0.81 t ha⁻¹), and Sampod (0.82 t ha⁻¹). The observed differences in seed yield among the varieties are likely attributable to variation in their genetic potential and the combined influence of yield-contributing traits. Similar varietal differences were also documented by Islam et al. (2023), who reported the highest seed yield in BARI Sarisha-8, followed by BARI Sarisha-11 (2.00–2.50 t ha⁻¹).

Conclusion

In this study, BARI Sarisha-15, BARI Sarisha-11, Agroni, and Safal produced higher seed yields than the other varieties, indicating good adaptation to Sylhet's agro-ecological conditions. These varieties appear promising for cultivation in fallow lands after Aman rice harvest, which could help improve land use and increase oilseed production in the region. However, although some varieties showed superior performance at specific locations, further multi-location and multi-year trials are needed to confirm their wider adaptability.

Competing Interests

Authors have declared that no competing interests exist.

Author's Contributions

All of the authors equally contributed to this work.

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