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# Performance of mustard varieties under saline prone areas of Bangladesh

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**This study was conducted at farmers' field with three disperse replicas in three different places viz. Satkhira (AEZ-11), Koyra (AEZ-13), and Bagerhat (AEZ-11) of Khulna division in the *Rabi* season of 2019-2020 to determine salt tolerant varieties for maximizing mustard yield, as well as farmers' income. Characterization was done with six varieties namely BARI Sarisha-11, BARI Sarisha-14, BARI Sarisha-16, BARI Sarisha-17, and BARI Sarisha-18 (Canola) and a control variety Tori-7 under saline stress condition in coastal area of Bangladesh. Seed Tori-7, BARI Sarisha-11, BARI Sarisha-16, and BARI Sarisha-18 (Canola) were pingol in color while BARI Sarisha-14 and BARI Sarisha-17 were yellow. The yields range of the varieties was 1.13 to 2.09 t ha$^{-1}$ and oil was 41.37 to 43.40%. Variety BARI Sarisha-18 (Canola) produced the maximum yield (2.09 t ha$^{-1}$) followed by BARI Sarisha-16 (1.98 t ha$^{-1}$) and BARI Sarisha-11 (1.84 t ha$^{-1}$). Because BARI Sarisha-18 (Canola) and BARI Sarisha-16 are suitable for coastal areas, combining this variety with a coastal area cropping pattern will increase cropping intensity, which will benefit farmers both economically and nutritionally.**

**Key word:** Mustard variety, soil salinity, tolerance, growth, yields performance.

## INTRODUCTION

Mustard (*Brassica juncea* L.), is an important edible oilseed crop in Bangladesh belonging to the family Brassicaceae. It is known to Greeks, Romans, Indians, and Chinese 2000 years ago. Genus *Brassica* comprises five cultivated species *viz., B. juncea* (Indian mustard), *Brassica campestris* (Toria), *Brassica nigra* (Banarasi rye), *Brassica napus* (Gobhisarson), and *Brassica carinata* (Abyesinian mustard) predominantly grown in China, India, Canada, Pakistan, USSR, and Europe. *Brassica* oilseed species now hold the third position among oilseed crops and is an important source of vegetable oil. The most common *Brassica* oilseed crops grown for commercial purposes are rape seeds (*B. campestris* L. and *B. napus* L.) and mustards (*B. juncea* L. Czern. and Coss. and *B. carinata* A.Br.). Mustard is a leading oilseed crop, covering about 80% of the total

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oilseed area and contributed more than 60% of the total oilseed production in Bangladesh. It is a cold loving crop grown during *Rabi* season (Miah et al., 2015).

Plant growth and productivity optimization are required to meet the world's projected population of 9.1 billion by 2050 (FAO, 2009). Various environmental risk factors including low or high temperatures, salt stress, heavy metals, and drought have impacted the development (yield) of plants (Sehar et al., 2019). Salt stress is one of the world's disastrous environmental pressures and is anticipated to escalate drastically as a result of climate change (Munns and Tester, 2008; Silva et al., 2017; Reddy et al., 2017). It has been proven to be elevated in 7% of the world's soil and almost 20% of the land planted and 33% of the irrigated field of the world suffer from salt stress (Schroeder et al., 2013; Kibria et al., 2017; Machado and Serralheiro, 2017). The increased stress of high salt has an adverse effects on growth and development as $Na^+$ and $Cl^-$ ions accumulate in plant bodies cause photosynthetic process and photosynthesis damage, impairing the nutritional and the water balance, inhibiting enzymes, contributing to metabolic dysfunction and hindering other significant biochemical and physiological processes that lead to the death of plants ultimately (Munns and Tester, 2008; Fatma et al., 2013; Khan et al., 2014; Rahman et al., 2017).

*Brassica* is considered salinity resistant (Maas and Hoffman, 1977). The threshold values are greater (that is, 9.0 dS/m), but the yield declining rate over thresholds are significantly larger than other plant species (Mass, 1993). Sodium ($Na^+$) ions build up faster than tolerable cultivars with salinity-sensitive genotypes, and this build-up of ions contributes to leaf death and gradual death of the plant (Munns, 2002). Considering the facts, mustard cultivation especially salt tolerant genotypes in saline-sodic soils could be good option for farmers to upsurge their annual production.

The huge demand for edible oil makes oilseed crops so important in the economy of Bangladesh. Mustard is the top ranked oilseed crop. It covers about 78% of the total oilseeds acreage and 62% of the total production (BBS, 2020). The oilseed crop occupies 5% of the total cropped area. Out of this, 73% is covered by rapeseed and mustard, 18% by sesame and 9% by groundnut (BBS, 2020). Total production of rapeseed and mustard was 311740 M tons from 667242 acres (BBS, 2020). In Bangladesh, over 30% of cultivated areas are in the coastal belt. Arable land is just 0.88 million ha out of 2.85 million ha, which constitute about 52.8% of the cultivable area. In comparison, the region affected by salt continues to rise continuously. But salinity affects the growth and yield attributes of *Brassica* species (Javaid et al., 2002). In most of the areas, farmers do not have any suitable crop to bring this land under cultivation in several months (middle of November to June). There is a possibility of bringing this vast fallow saline land under cultivation with salt tolerant mustard varieties in *Rabi* season (November to February). Considering these facts, an experiment was laid out to evaluate the yield performances of six mustard varieties under different salinity levels.

## MATERIALS AND METHODS

Farmer's field was chosen to conduct the experiment in the form of three replication in three different locations viz. Satkhira, Koyra, and Bagerhat of Khulna division in the *Rabi* season of 2019-2020. The land type was medium highland with salinity level 2.96 to 4.22 $dSm^{-1}$ at the time of planting and at harvesting period, salinity was 7.04 $dSm^{-1}$. Six varieties were tested with th experimental material, viz. Tori-7, BARI Sarisha-11, BARI Sarisha-14, BARI Sarisha-16, BARI Sarisha-17 and BARI Sarisha-18. Tori-7 was used as check. These six varieties were collected from Bangladesh Agricultural Research Institute (BARI), Joydepur, Gazipur. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The total numbers of plot were 18. The size of the plot was 4 m × 5 m. Cowdung, Urea, Triple Super Phosphate, Muriate of Potash, Gypsum and Boron were applied to the plots at 10000, 300, 170, 100, 150 and 10 kg $ha^{-1}$, respectively (BARC, BARI). Total amount of Cowdung, Urea, Triple Super Phosphate, Muriate of Potash, Gypsum and Boron were applied as basal dose during the final land preparation. The remaining urea was applied during flower initiation. Seeds were sown on December 05, 2019 by maintaining row to row spacing of 20 cm. Weeding was done manually from 15 DAS up to final harvest. Weeding was done 6 times to keep the plots free from weeds. Aktara (Thiamethoxam) 25 WG at 0.2 g $L^{-1}$ was sprayed for controlling aphid. First irrigation was done at 25 days after planting and second irrigation was done during fruit initiation stage. Soil salinity of the experimental plots was recorded at 15 days' interval from planting to harvest. Soil samples were collected before planting and after harvesting of mustard to determine the nutrient status of soil in the experimental plots. Ten mustard plants from each plot were selected randomly for collecting data. The plants of the outer rows and the extreme end of the middle rows were excluded from data collection. Data on the morphological and yield parameters were initial plant population/$m^2$, final plant population/$m^2$, plant height (cm), number of leaves $plant^{-1}$ at 60 DAS, number of branches $plant^{-1}$, number of siliquae $plant^{-1}$, number of seed $siliquae^{-1}$, 1000 seed weight, crop duration (days), yield (t $ha^{-1}$) and oil (%) from the selected plants during experimental period. The data were subjected to analysis of variance using the R (4.0.2) software (Tables 1 and 2 and Figure 1).

## RESULTS AND DISCUSSION

### Plant population/$m^2$

There existed varietal difference in respect of plant population/$m^2$. There was a non-significant variation in initial plant population among the varieties but significant variation was final plant population/$m^2$ among the varieties (Table 2 and Figure 2). Initial plant population/$m^2$ for different varieties was Tori-7 (105), BARI Sarisha-11 (102), BARI Sarisha-14 (104), BARI Sarisha-16 (104), BARI Sarisha-17 (101) and BARI Sarisha-18 (106). At the final plant population/$m^2$, the highest was BARI Sarisha-11 (78.26) and the lowest plant population was Tori-7 (51.00). Islam et al. (2015)

**Table 1.** Monthly average air temperature, total rainfall and total rainy days during the experimental period from November 2019 to March 2020 in Satkhira, Koyra and Bagerhat.

| District | Month/2019-2020 | Monthly average air temperature (°C) | | Average humidity (%) | Total rainfall (mm) |
|---|---|---|---|---|---|
| | | Maximum average | Minimum average | | |
| Satkhira | November | 29.76 | 20.05 | 80 | 171.9 |
| | December | 25 | 14.75 | 87 | 11.4 |
| | January | 24.36 | 13.39 | 87 | 34.4 |
| | February | 27.00 | 14.76 | 89 | 2.5 |
| | March | 31.95 | 20.14 | 91 | 84.8 |
| Koyra | November | 31.5 | 17.2 | 81 | 0.00 |
| | December | 27.5 | 11.6 | 84 | 0.00 |
| | January | 29 | 11.3 | 78 | 0.00 |
| | February | 30.5 | 10.8 | 74 | 2.5 |
| | March | 34.5 | 19.5 | 71 | 10.00 |
| Bagerhat | November | 32.5 | 17.4 | 76 | 0 |
| | December | 28.80 | 9.6 | 77 | 2.4 |
| | January | 30.80 | 10.90 | 71 | 0 |
| | February | 33.40 | 12.00 | 67 | 10 |
| | March | 35.50 | 14.70 | 64 | 41.6 |

Source: Satkhira, Khulna and Bagerhat Meteorological Station.

**Table 2.** Effects of varieties on morphological characters of mustard.

| Variety | Initial plant population/m$^2$ | Final plant population/m$^2$ | Plant height (cm) | Number of leaves plant$^{-1}$ at 60 DAS | Number of branches Plant$^{-1}$ |
|---|---|---|---|---|---|
| Tori-7 | 105 | 51.00$^d$ | 65.33$^e$ | 17.66$^c$ | 2.56$^b$ |
| BARI Sarisha-11 | 102 | 78.26$^a$ | 125.04$^b$ | 26.12$^b$ | 4.67$^a$ |
| BARI Sarisha-14 | 104 | 69.35$^{bc}$ | 103.26$^d$ | 24.01$^b$ | 2.67$^b$ |
| BARI Sarisha-16 | 104 | 66.76$^c$ | 143.77$^a$ | 30.67$^a$ | 5.33$^a$ |
| BARI Sarisha-17 | 101 | 73.13$^{ab}$ | 109.67$^{cd}$ | 26.00$^b$ | 4.12$^{ab}$ |
| BARI Sarisha-18 | 106 | 75.88$^{ab}$ | 115.00$^c$ | 32.75$^a$ | 5.00$^a$ |
| CV (%) | 2.13 | 5.22 | 3.56 | 7.44 | 22.048 |
| Level of significance | NS | *** | *** | *** | * |

Mean(s) within a column bearing similar letter(s) are statistically similar. Level of significance: '***' 0.001, '**' 0.01, '*' 0.05, 'NS' Non-significant.
Source: Data were collected from the experimental field from three locations Satkhira, Koyra and Bagerhat and analyzed by software R.

found out non-significant variation where the lowest plant population/m$^2$ was found in BARI Sarisha-13 (55) and highest in BARI Sarisha-15 (60). Kapila et al. (2012) reported that initial plant population was 90 to 110 and final plant population was 71 to 90.

## Plant height (cm)

Wide variation was observed among the varieties in plant height (Table 2). The tallest (143.77 cm) height was observed in the variety BARI Sarisha-16 and the shortest was Tori-7 (55.27 cm) including BARI Sarisha-11 (125.04 cm), BARI Sarisha-14 (103.26 cm), BARI Sarisha-17 (109.67 cm) and BARI Sarisha-18 (115.00 cm). Except Tori-7 and BARI Sarisha-14 all other varieties' plant height was found to be taller. Ahmed and Kashem (2017) registered significant variation among five varieties and those more or less similar in comparison with this finding, whereas the tallest variety was BARI Sarisha-11 (126.33 cm) and smallest was BARI Sarisha-14 (8384 cm). Alom et al. (2014) observed significant variation among 30 genotypes where the shortest and tallest plant height was similar with same varieties used in the present study in which the shortest resuit was found in Tori-7 (85 cm) and tallest plant height was BARI Sarisha-16 (141 cm).

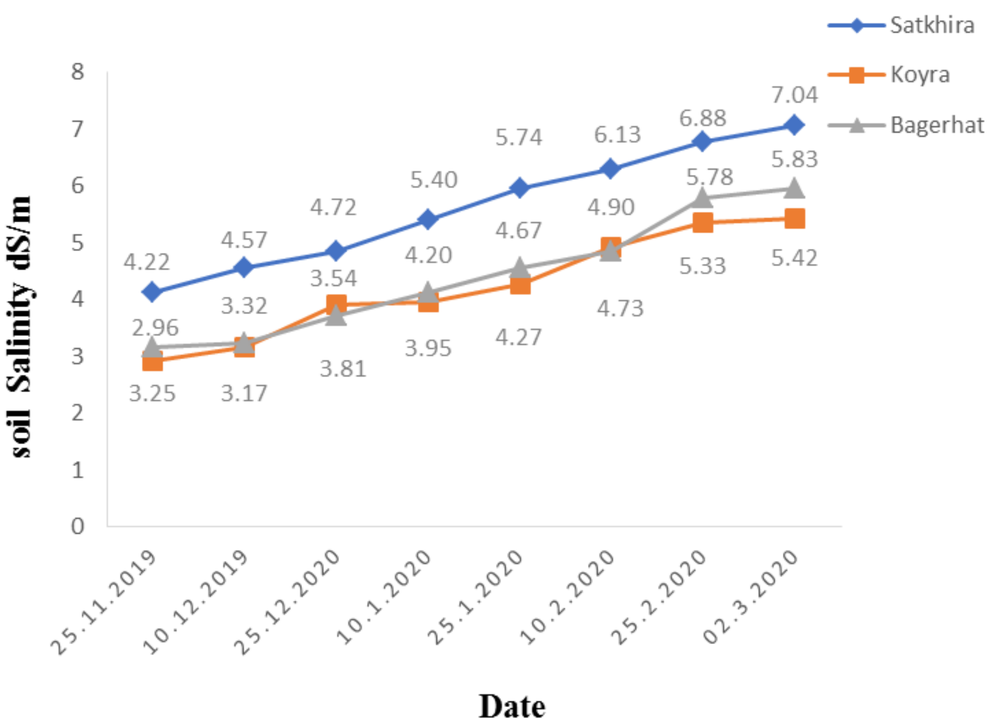


**Figure 1.** Soil salinity during crop growing period at Satkhira, Koyra and Bagerhat districts.
Source: Soil salinity determine , On Farm Research Division, BARI, Khulna labouratory by Electrical Conductivity (EC) meter.

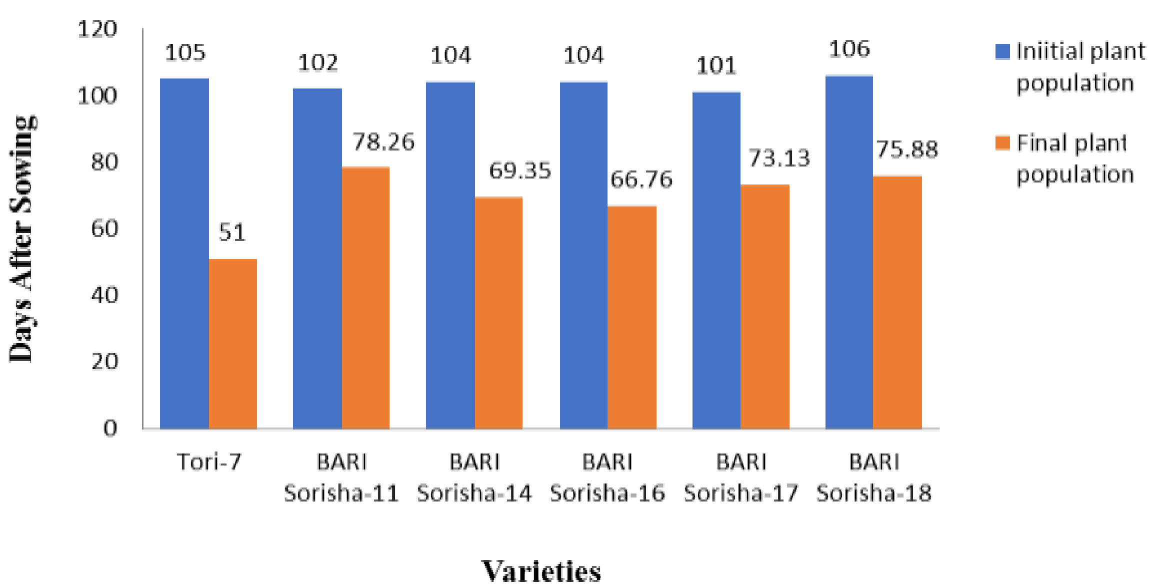


**Figure 2.** Variations in initial plant population and final plant population at mustard varieties.
Source: Authors

Salinity hampers the normal metabolism of the plants and retards the cell division as well as cell expansion which causes plant height and fresh weight reduction of the plants Rahman et al. (2016).

### Number of leaves plant$^{-1}$ at 60 DAS

There was a significant variation in the number of leaves plant$^{-1}$ among the varieties (Table 2). At 60 DAS, the

**Table 3.** Effects of varieties on yield and yield contributing characteristics of mustard.

| Variety | Number of siliquae plant$^{-1}$ | Number of seed siliquae$^{-1}$ | 1000 seed weight (g) | Crop duration (Days) | Yield (tha$^{-1}$) | Oil (%) |
|---|---|---|---|---|---|---|
| Tori-7 | 56.12$^{d}$ | 10.00$^{e}$ | 2.36$^{c}$ | 75$^{f}$ | 1.13$^{e}$ | 41.37$^{f}$ |
| BARI Sarisha-11 | 103.67$^{ab}$ | 22.52$^{c}$ | 3.16$^{b}$ | 109$^{b}$ | 1.84$^{bc}$ | 41.43$^{e}$ |
| BARI Sarisha-14 | 81.26$^{c}$ | 18.80$^{d}$ | 3.24$^{b}$ | 79$^{e}$ | 1.48$^{d}$ | 43.00$^{b}$ |
| BARI Sarisha-16 | 118.39$^{a}$ | 17.77$^{d}$ | 3.13$^{b}$ | 115$^{a}$ | 1.98$^{ab}$ | 42.30$^{c}$ |
| BARI Sarisha-17 | 87.06$^{bc}$ | 25.20$^{b}$ | 3.73$^{a}$ | 84$^{d}$ | 1.67$^{c}$ | 41.73$^{d}$ |
| BARI Sarisha-18 | 102.53$^{ab}$ | 29.20$^{a}$ | 3.63$^{a}$ | 99$^{c}$ | 2.09$^{a}$ | 43.40$^{a}$ |
| CV (%) | 12.61 | 5.80 | 5.97 | 2.32 | 6.02 | 0.177 |
| Level of significance | ** | *** | *** | *** | *** | *** |

Mean(s) within a column bearing similar letter(s) are statistically similar. Level of significance: '***' 0.001, '**' 0.01, '*' 0.05. 'NS' Non-significant.
Source: Authors

highest number of leaves plant$^{-1}$ was obtained from BARI Sarisha-18 (32.75) which is statistically similar with BARI Sarisha-16 (30.67). The lowest number of leaves plant$^{-1}$ (17.66) was recorded from Tori-7 variety. BARI Sarisha-11, BARI Sarisha-14 and BARI Sarisha-17 had 26.12, 24.01 and 26.00 leaves plant$^{-1}$, respectively to be statistically similar. Laila (2014) found out significant result among the varieties at 60 DAS where the highest leaves' number was SAU SR-03 (32.27) which was similar with variety BARI Sarisha-18 (32.75) and the lowest was BARI Sarisha-13 (18.37) which was similar with variety Tori-7 (17.66). Under saline condition, plants tried to modify its physical and physiological structure to withstand the physiological stress. More leaves transpire more water and as physiological drought prevails under salinity, so plants reduce its leaf numbers to tolerate saline stress (Acosta-Motos et al., 2017). Number of leaves and biomass accumulation is reduced under salinity and leaf primordia disruption is the plausible cause of lower leaves number under saline condition (khanam et al., 2018)..

## Number of branches plant$^{-1}$

The number of branches plant$^{-1}$ was significantly influenced by different varieties of mustard (Table 2). The highest number of branches plant$^{-1}$ (5.33) was obtained from BARI Sarisha-16, which was statistically similar with BARI Sarisha-18 (5.00) followed by BARI Sarisha-11 (4.67). The lowest number of branches plant$^{-1}$ (2.56) was recorded from Tori-7, which was statistically similar to BARI Sarisha-14 (2.67). The minimum number of primary branches plant$^{-1}$ of 2.90 was found in Jatarai which was identical to BARI Sarisha-8. Similar report was also found by Hossain et al. (1996). The findings were not in conformity with the result of the present study. But it is partially in conformity such that the variety affects significantly on the number of branches plant$^{-1}$. Laila (2014) found significant result among the varieties where the highest number of branch plant$^{-1}$ was found in SAU SR-03 (5.20) and lowest was BARI Sarisha-13 (2.92). Ahmed and Kashem (2017) found out non-significant variation where the highest branches plant$^{-1}$ was BARI Sarisha-11 (5.00) and lowest was BADC-1 (4.73). Roy (2007) and Akhter (2005)'s results were also in conformity with the findings of the present study. Plants uptake more Na than K and Ca in saline condition and maximum number of Na ion was accumulated in the branch of the plant.

## Number of siliqua plant$^{-1}$

The number of siliqua plant$^{-1}$ showed significant variation among the varieties (Table 3). The highest number of siliqua plant$^{-1}$ (118.39) was obtained from BARI Sarisha-16, which was statistically similar with BARI Sarisha-11 (103.67) and BARI Sarisha-18 (102.53) and the lowest number of siliquae plant$^{-1}$ (56.12) was obtained from Tori-7. Laila (2014) found significant result among the varieties where the highest number of siliqua plant$^{-1}$ was BARI Sarisha-16 (143.7) and lowest was BARI Sarisa-15 (83.95); this result was more or less similar with the present result. Ahmed and Kashem (2017) observed significant variation; the highest number of capsule plant$^{-1}$ was BARI Sarisha-11 (147.53) and lowest was SAU Sarisha-3 (80.16). Islam et al. (2015) also found significant variation among the varieties where the highest number of siliqua plant$^{-1}$ was BARI Sarisha-16 (146) and lowest was BARI Sarisha-14 (44); this result agrees with the present result. Akhter (2005), Roy (2007) and Mamun et al. (2014) agreed with the result of this study that the number of siliquae plant$^{-1}$ of rapeseed mustard was significantly affected by the varieties. Shamsuddin et al. (1987) reported that the number of siliquae plant$^{-1}$ was significantly varied for rapeseed and mustard varieties and the highest number of siliquae was found from mustard varieties. Mondal et al. (1992) found the maximum number of siliquae plant$^{-1}$ (136) in the


**Plate 1.** Pictorial presentation of different potato varieties during study period.
Source: Authors

variety J-5004; which was identical with the variety Tori-7. The lowest number of siliquae plant$^{-1}$ (45.9) was found in the variety SS-75. Similar result was also found by Hossain et al. (1996) (Plate 1). Nutrient uptake as well as water uptake is severely hampered due to osmotic imbalance of the saline soil solution. Nutrients and water are essential to develop morphological and yield character of the plants. Uptake of low input reduces the photosynthesis process and ultimately prevents the proper translocation of carbohydrate to form the yield contributing characters (Zaman et al., 2015; Cruz et al., 2018).

### Number of seed siliqua$^{-1}$

The varieties showed significant difference in the number of seed siliqua$^{-1}$ (Table 3). The highest number of seeds siliqua$^{-1}$ (29.20) was produced and the lowest number of seeds siliqua$^{-1}$ (10.00) was observed in the variety Tori-7. The number of seed siliquae$^{-1}$ BARI Sarisha-14 and BARI Sarisha-16 was statistically similar 18.80 and 17.77, respectively. Alam et al. (2014) observed significant variation among 30 genotypes where the highest number of seed siliquae$^{-1}$ was Nap-0538 (25.01) and the lowest was BJDH-11 (10.1); this result agree with the present result. Islam et al. (2015) found significant result where 31 seed siliquae$^{-1}$ was found BARI sarisha-14 (31) and the lowest was BARI Sarisha-11 (12); this result is similar with the present result. Ahmed and Kashem (2017) observed significant variation where the highest seed siliquae$^{-1}$ was BARI Sarisha-14 (22.93) and lowest was BADC-1 (9.71).

Variation number of seeds siliqua$^{-1}$ among the varieties was in conformity with Mamun et al. (2014), who found the highest seeds siliqua$^{-1}$ in BARI Sarisha-13 and the lowest seeds siliqua$^{-1}$ in BARI Sarisha-16 and this result supports the findings of Jahan and Zakaria (1997) and Gurjar and Chauhan (1997). Variation in seeds siliqua$^{-1}$ among the varieties was also in conformity with Islam et al. (1994) who found a significant variation in the number of seeds siliqua$^{-1}$ among different varieties of mustard and rapeseed. But the result was contradictory to Roy (2007) who found the highest seeds siliqua$^{-1}$ in Tori-7 and lowest number of seeds siliqua$^{-1}$ in SAU Sarisha$^{-1}$. Seeds are the sink of the plants and its development fully depends on the supply capacity of the source. Salinity disrupts the photosystem-II and hampers the photosynthesis process by reducing $CO_2$ uptake, rubisco enzyme activity and normal metabolism of the plants (Seemann and Critchley, 1985; Jahan et al., 2020). Photosynthesis is the only process to produce food and translocate to sink for proper development. Reduction and disruption of sink (seeds, growing primordia and root) are the output of the hampered photosynthesis (Kumari et al., 2010; Shanker et al., 2011).

## 1000 seed weight (g)

The weight of the seed is relation with the magnitude of seed development as an important yield determinant and plays a decisive role on expression of yield potential of a variety (Sana et al., 2003). The weight of the seed expresses the magnitude of seed development which is an important yield determinant and plays a decisive role in showing off the yield potential of a crop (Mamun et al., 2014). Variety is significantly affected by the 1000-seed weight (Table 3). BARI Sarisha-17 produced the highest 1000-seed weight (3.63 g) which was statistically similar with BARI Sarisha-18 (3.63 g) and the lowest 1000-seed weight was produced by Tori-7 (2.63 g). Alam et al. (2014) found significant variation among the variety where the highest 1000 seed weight was BJDH-20 (3.41 g) and lowest was Tori-7 (2.23); this result is similar with the present result. Ahmed and Kashem (2017) reported that significant variation occurred among their varieties where the highest 1000 seed weight was BARI Sarisha-11 (3.00) and lowest was BADC-1 (2.16 g).

The result of this finding was in conformity with Mamun et al. (2014). They also observed that BARI Sarisha-13 had the highest 1000 seed weight (4.00 g) whereas the lowest (2.82 g) was found in SAU Sarisha-3. The 1000-seed weight is the stable part of yield and it varies from variety to variety which was supported by Mondal and Wahab (2001). Roy (2007) and Karim et al. (2000) suggested that the weight of 1000 seeds varies from variety to variety and from species to species. Moreover, inadequate supply of photo assimilates to the seed due to the fact that salinity is one of the major causes of seed weight reduction under saline condition (Flowers et al., 1991; Zaman et al., 2015).

## Crop duration (days)

Significant variation was found in crop duration among the varieties (Table 3). Tori-7 was found to be the shortest in crop duration (75 days). The maximum duration was found in BARI Sarisha-11 (115 days). The duration of BARI Sarisha-11, BARI Sarisha-14, BARI Sarisha-17 and BARI Sarisha-18 were 109, 79, 84 and 99 days, respectively (Table 3). Ahmed and Kashem (2017) observed significant variation among 5 varieties. They also observed that BARI Sarisha-11 was the highest crop duration (115 days) and shortest was BARI Sarisha-14 (82 days) (Plate 1).

Crop duration is influenced by environmental and genetic characteristics of the plants. Stress hampers the normal physiological process of the plants and influences its duration (Poonam et al., 2017). Moreover, to tackle the stress like salinity, plants produce different secondary metabolite for osmotic adjustment instead of normal growth and metabolism (Ramakrishna and Ravishankar, 2011). This is another cause of variability of the crop duration under saline condition.

## Yield (t ha$^{-1}$)

The performance of the varieties significantly affected the seed yield (Table 3). BARI Sarisha-18 produced the highest seed yield (2.09 t ha$^{-1}$) while the lowest seed yield was produced by Tori-7 (1.13 t ha$^{-1}$). Yield of BARI Sarisha-11, BARI Sarisha-14, BARI Sarisha-16 and BARI Sarisha-17 was 1.84, 1.48, 1.98 and 1.67 t ha$^{-1}$. The result agreed with Ahmed and Kashem (2017), Islam et al. (2015), Alam et al. (2014), Rahman (2002), BARI (2019) and Mondal (1995) who reported that seed yield of rapeseed and mustard varied with the varieties. Yeasmin (2013) also found significant effects on seed yield of the varieties. This finding was in conformity with the findings of Zaman et al. (1991) and Chakraborty et al. (1991) who reported that yields were different among the varieties. The performance of yield contributing characteristics was severely affected by salinity stress. Reduction of silique per plant, seeds per siliqua, and 1000 seed weight was the main cause of reduction in saline condition (Shanker et al., 2011). Reduction of photosynthesis, nutrient uptake and translocation efficiency significantly lowers the crops total yield (Akhtar et al., 2015; Acosta-Motos et al., 2017; Zörb et al., 2019).

## Oil content (%)

Oil was significantly influenced by the varieties (Table 3). The highest oil content in seed (43.40%) was recorded from BARI Sarisha-18 and the lowest (41.37%) was recorded from Tori-7. The result agreed with Ahmed et al. (2014), whereas the highest oil content was found in BARI Sarisha-14 (44.00%) and the lowest in BJDH-12 (38.6%). Ali et al. (2013) reported that the oil of five varieties varied from 31.35 to 41.03. Nutritional imbalance and inadequate uptake of essential nutrients under saline condition retard the oil production of mustards (Ali et al., 2013; Mahmood et al., 2007). Moreover, insufficient supply of photo assimilates, synthesis of secondary metabolites for osmotic adjustment and early maturity of the plants are responsible for lower oil production in mustards (Cucci et al., 2007; Toorchi et al., 2011).

## Conclusion

Better production could be obtained from saline-sodic soils by cultivation of suitable genotypes tolerant to salinity and sodicity. The utilization of saline-sodic soils is itself an advantage in 1999. Salt tolerance potential in different *Brassica* spp. is in addition to crop yields. Among all genotypes under study, BARI Sarisha-18 (Canola) and BARI Sarisha-16 produced more comparable seed yield and high oil content. These results lead to the conclusion that BARI Sarisha-18 (Canola) and BARI Sarisha-16 may be superior and could successfully be cultivated on saline-sodic soils having an Ece=7.04 $dSm^{-1}$ without the application of any amendment.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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