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Salinity Effect on Yield and Component Characters in Rapeseed and Mustard Varieties

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Abstract: Varieties Rai-5, Shambal and Daulat of *Brassica juncea* and varieties Barisarisa-7 and Barisarisa-8 of *Brassica napus* were tested for yield and component characters under different levels of soil salinity. The variations due to salinity levels, varieties and variety-salinity (interaction) were significant for different characters. The variable degrees of increase and decrease of regression coefficient estimates (curve estimation) indicated the performance as influenced by different salinity levels. The performance of the variety Barisarisa-7 in plant height and days to first flowering is the best followed by Barisarisa-8 and Daulat. Barisarisa-8 showed the best performance in days to maturity followed by Barisarisa-7 and Shambal. Shambal followed by Daulat and Barisarisa-7was performed incase of number of siliqua per plant. Daulat performed better than others incase of seed per plant and seed yield per plant followed by Rai-5. Considering all the characters the most tolerance ability was found in Daulat under *B. juncea* and Barisarisa-7 under *B. napus* which were followed by Barisarisa-8 of *B. napus* against different levels of salinity.

Key words: Rapeseed, mustard, salinity, yield, Bangladesh

Introduction

Rapeseed and mustard is adaptive in Bangladesh not only as a source of edible oil but also many other usages. Rapeseed and mustard is the third most important edible oil source in world after soybean and palm but it is the top ranking oilseed crop of Bangladesh that covers 50.74% of the total oilseed production (BBS, 1995). Out of 2.85 million hectares of the coastal and offshore landmass, about 0.83 m ha are affected by different degrees of salinity in Bangladesh (Karim *et al*, 1990). After harvesting Aman rice, a vast area of land in this coastal belt remains either unused or covered by some minor crops at marginal level of production practices. Due to high intensity of rice cultivation in Boro season the cultivable land area for rapeseed and mustard become smaller in day to day at the favourable environment. Therefore, there was a great opportunity to adopt the salt tolerant rapeseed and mustard varieties in the coastal belt.

Among the oil seed crops, *B. juncea* and *B. napus* are the amphidiploid in origin. Rana *et al*. (1980) reported that the amphidiploid species *B. juncea*, *B. napus* and *B. carinata* of rapeseed and mustard were superior over the diploid species, like, *B. campestris* and *B. nigra*, in saline situation in terms of yield and seedling growth. Chhabra and Yadava (1997) described a procedure of pot culture experiments to study the effect of salinity.

This experiment was conducted to identify the better varieties of rapeseed and mustard tolerant to different salinity levels considering yield and component characters. These identified varieties would be used as commercial ones at the coastal belt or further improvement of existing commercial varieties.

Materials and Methods

This experiment was carried out at Bangladesh Agricultural University, Mymensingh in rabi season in 1997. Three mustard varieties (Rai-5, Shambal and Daulat) of *Brassica juncea* and two rapeseed varieties (Barisarisa-7 and Barisarisa-8) under *Brassica napus* were evaluated. The plants were grown in plastic pots containing six levels of salinity viz. 0, 3, 6, 9, 12 and 15 dS m^{-1} Electrical Conductivity (EC). Plastic pots of 2L capacity were used and each pot was filled with 1.5 kg growth media composed of soil, cow dung and required amount of salt (sodium chloride) for each level of salinity. Six seeds were sown per pot and thinning of seedlings were done keeping three for each pot at 15 days after sowing. The pots were irrigated with tap water to grow crop without moisture stress. Dimecron 100 EC was sprayed to control the infestation of aphids.

Data on plant height, days to first flowering, days to maturity, number of siliqua per plant, seeds per siliqua and seed yield per plant were recorded. Plant height was measured from the base of a plant to tip of the inflorescence at harvest time.

Total 90 pots were prepared for six levels of salinity, five varieties and three replications. The pots were arranged in a split plot design with levels of salinity in the main plots and varieties in the sub-plots. The analysis of variance for each of the character under study was performed by F-test (Cochran and Cox, 1957). Regression coefficient for each character was calculated using the mean values of different treatments for each variety taking varietal effect as dependent and treatment effect as independent variables following the methods as cited by Zaman *et al*. (1982).

Results and Discussion

Analysis of variance showed the significant variations for treatment (salinity levels), varieties and interaction (salinity - varieties) effect for all the characters. These results indicated that levels of salinity had differential influence and the varieties had differential response.

Plant height was found to decrease gradually with an increase of salinity levels for all the five varieties (Fig.1). At control condition (0 dS m^{-1}), Shambal showed the highest plant height and Barisarisa-7 is the lowest, this was due to different genetical characteristics of different varieties. In 12 dS m^{-1}, all the three varieties of *B.juncea* showed almost the same plant height but they had different plant height at control and lower salinity levels. This result was indicated that salinity affect the plant height at higher salinity levels. The figure clearly showed that among the *B.juncea* varieties, Daulat was the best performer under different levels of salinity and Barisarisa-7 incase of *B. napus*. Considering the regression coefficient value (Table 1), Barisarisa-7 performed the best followed by Barisarisa-8 and Daulat. This result indicated that the

Table 1: Regression coefficient values of five rapeseed and mustard varieties of different characters grown under different salinity levels

Variety	Pl. height (cm)	Days to first flowering	Days to maturity	No. of siliqua/ plant	No. of seeds/ siliqua	Seed yield/ plant
Rai-5	-1.4476**	0.5619**	0.3048**	0.0181	-0.2962**	-0.0116**
Shambal	-1.8162**	0.6133**	0.0752	0.3971	-0.3581**	-0.0247**
Daulat	-1.2514**	0.4619*	0.1248	0.3857	-0.2343**	-0.0069**
Bari sarisa-7	-0.6352**	0.2981**	0.0248	0.1162	-0.5876	-0.0117**
Bari sarisa-8	-1.0629**	0.3790	-0.2476*	0.1010	-0.8419	-0.0230**

Note: * and ** indicate at 5% and 1% levels, respectively

Table 2: Ranking score of different varieties against different levels of salinity on the basis of regression coefficient values

Variety	Ranking score							
	Plant height (cm)	Days to first flowering	Days to maturity	No. of siliqu/plant	No. of seeds/siliqua	Seed yield/ plant	Mean	Varietal position
Rai-5	4	4	5	5	2	2	3.67	3
Shambal	5	5	3	1	3	5	3.67	3
Daulat	3	3	4	2	1	1	2.33	1
Bari sarisa-7	1	1	2	3	4	3	2.33	1
Bari sarisa-8	2	2	1	4	5	4	3.00	2

Note: The lowest value for each trait indicates the best one

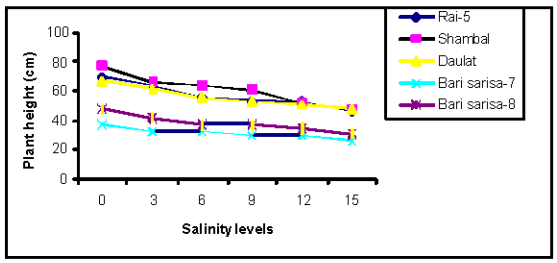

Fig. 1: Plant height performance of five rapeseed and mustard varieties of different characters grown under different salinity levels

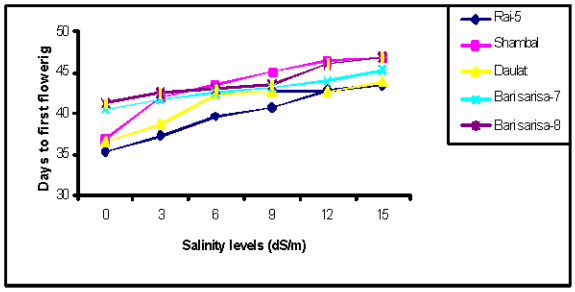

Fig. 2: Days to first flowering performance of five rapeseed and mustard varieties of different characters grown under different levels.

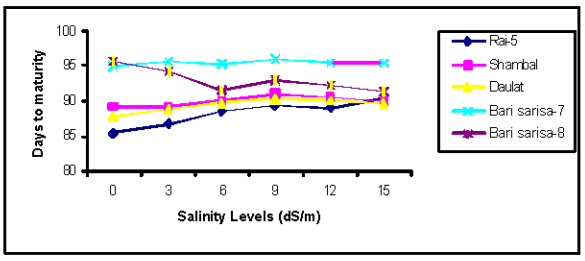

Fig. 3: Days to maturity performance of five rapeseed and mustard varieties of different characters grown under different salinity levels

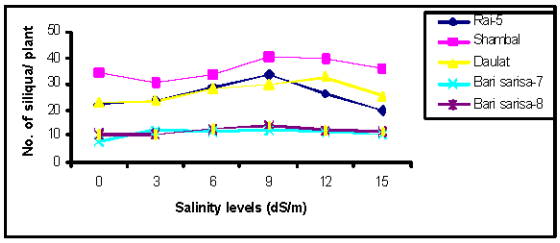

Fig. 4: Number of siliqua/plant performance of five rapeseed and mustard varieties of different characters grown under different salinity levels

regression coefficient values were slightly influenced by varietal characters with salinity reactions. Ashraf *et al*. (1987), Kuhad *et al*. (1989), Sinha (1991) and Shannon *et al*. (1993) reported similar results, decreased in plant height with an increase of salinity in rapeseed and mustard.

With an increase of salinity levels the days to first flowering were increased for all the five varieties of rapeseed and mustard was observed (Fig. 2). Among the five, Barisarisa-7 was clearly found the slower increase in days to first flowering than others. Whereas, Daulat showed sharp increase at 6 dS m^{-1} than static in higher salinity levels. Shambal showed the highest degrees of increase in days to first flowering than others. These results were indicated that Daulat was more tolerant in higher salinity levels and Shambal was less than others. According to regression coefficient values (Table 1), the best performance was found in Barisarisa-7 followed by Barisarisa-8 and Daulat. These results wereindicated that the varieties under *B. napus* were more tolerant than *B. juncea* considering this character.

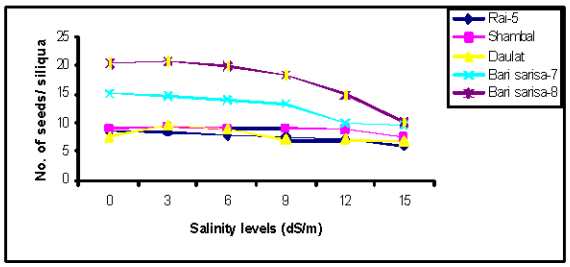

Fig. 5: Number of seeds/siliqua performance of five rapeseed and mustard varieties of different characters grown under different salinity levels

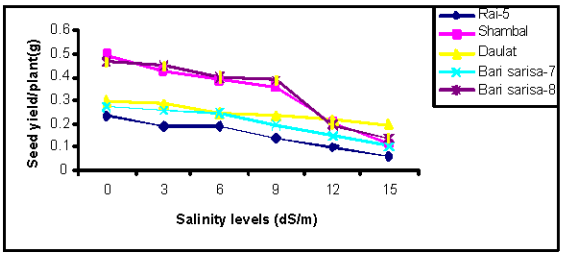

Fig. 6: Seed yield per plant performance of five rapeseed and mustard varieties of different characters grown under different salinity levels

Except Barisarisa-8 all the varieties showed that days to maturity is increased with an increase of salinity levels (Fig. 3). This result indicated that Barisarisa-8 showed the negative response to increase the salinity levels for this character. It might be its genetical character to salinity. The rate of increase days to maturity of Barisarisa-7 and Shambal were less than others and Rai-5 had the highest. Considering the regression coefficient values, the best performance was showed by Barisarisa-8 followed by Barisarisa-7 and Shambal. Total number of siliqua in a plant found that most of the varieties showed higher in number up to 9 dS m^{-1} than control, then decline (Fig. 4). It showed that most of the varieties showed positive response to increase total number of siliqua in lower salinity levels but in higher levels they drastically decline. Variety Shambal showed the highest value both in control and 15 dS m^{-1} salinity levels. It was indicated that Shambal have the genetical character to produce high number of siliqua followed by Daulat and Rai-5. Two *B. napus* varieties Barisarisa-7 and Barisarisa-8 were showed the lowest number of siliqua but they are more or less static in all salinity levels. According to regression coefficient values (Table 1), the variety Shambal performed the best followed by Daulat and Barisarisa-7.

Incase of seeds per siliqua Barisarisa-7 and Barisarisa-8 of *B. napus* gradually declined after 3 dS m^{-1} salinity level and the rest three varieties of *B. juncea* were more or less static in all levels of salinity (Fig. 5). These results were indicated that the varieties of *B. juncea* were more tolerant than *B. napus* varieties for this character. It also indicated that an increase of salinity levels the sterility percentage of *B. napus* were increased and the varieties of *B. juncea* have lower sterility. Daulat performed the best followed by Rai-5 and Shambal considering the regression coefficient values (Table 1).

All the five varieties showed decreasing trend in yield performance for increasing the salinity levels (Fig. 6). Among five varieties, the variety Daulat under *B. juncea* showed more static trend than others. This result indicated that the variety Daulat is more tolerant than others. Shambal and Barisarisa-8 showed more decreasing trend in yield. The yield performance of Daulat was probably influenced by the higher number of seeds per siliqua, low sterility percentage and higher number of siliqua per plant. Considering the regression coefficient values (Table 1) the best performance showed Daulat that was followed by Rai-5 and Barisarisa-7. Decrease of seed yield and increase of salinity levels was also reported by Chauhan *et al*. (1988), Shannon *et al*. (1993), Hamdy *et al*. (1993) and Kumar (1993) which was similar to these results in rapeseed and mustard. Kumar (1990) reported that amphidiploid species were superior over the diploid species in respect of seed yield under different levels of salinity.

Ranking score was given of five rapeseed and mustard varieties on the basis of regression coefficient (curve estimation) values for all the characters (Table 2). The mean score was calculated and mentioned the varietal position in respect of tolerance ability of all five varieties. Considering all the characters the varieties Daulat under *B. juncea* and Barisarisa-7 under *B. napus* jointly stood first position in the means of salinity tolerance ability followed by Barisarisa-8 of *B. napus*. Rai-5 and Shambal under *B. juncea* performed the lowest tolerance ability among the five.

Daulat of *B. juncea* and Barisarisa-7 of *B. napus* found the most tolerant among the five varieties considering all the characters. Barisarisa-7 showed better response in plant height, days to first flowering and days to maturity, on the other hand, Daulat in number of siliqua per plant, number of seeds per siliqua and seed yield per plant. These results indicated that Daulat of *B. juncea* is better than Barisarisa-7 for seed yield. Rai-5 and Shambal of *B. juncea* were identified as most susceptible among the five.

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