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YIELD ENHANCEMENT OF T. AMAN RICE IN SALINITY AFFECTED AREA OF NOAKHALI DISTRICT OF BANGLADESH THROUGH ADOPTION OF VARIETY AND GYPSUM FERTILIZER APPLICATION

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ABSTRACT

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An experiment was conducted in the farmer's field at the Moddho Jutkhali village, Subornochar, Noakhali, a salinity affected area of Bangladesh to investigate the effect of variety and gypsum fertilizer on the yield of transplant *aman* rice under salinity condition during July to December, 2017. The experiment was laid out in a two factor split-plot design with three replications consisting of three *aman* rice varieties viz., Swarna (V_1 , an indian variety adapted to that locality), BRRI dhan52 (V_2) and Binadhan-7 (V_3) and three levels of gypsum fertilizer viz., 0, 75 and 150 kg gypsum ha^{-1} . Yield components and yield of transplant *aman* rice were significantly influenced by variety, level of gypsum and their interactions. Among the varieties, Swarna produced the tallest plant height (126.7 cm), highest number of grains panicle⁻¹ (76.30), weight of 1000 grains (25.80 g), grain yield (5.44 t ha^{-1}), straw yield (7.07 t ha^{-1}), and biological yield (12.51 t ha^{-1}) while Binadhan-7 showed lowest values of these respective parameters but number of total tillers hill⁻¹ (9.99) and number of effective tillers hill⁻¹ (8.94) were maximum in Binadhan-7. Among three gypsum levels, most of the yield contributing characters showed highest values for 150 kg gypsum ha^{-1} that's why grain yield was also highest (5.32 t ha^{-1}) for this treatment. On the other hand lowest grain yield (4.92 t ha^{-1}) was found when no gypsum was applied. In case of treatment interaction, highest number of grains panicle⁻¹ (80.23) and highest grain yield (5.69 t ha^{-1}) were produced when Swarna was cultivated with 75 kg gypsum ha^{-1} while lowest values of grain, straw and biological yields (4.36, 5.11 and 9.47 t ha^{-1} , respectively) were found when Binadhan-7 was cultivated without applying any gypsum. Therefore, it can be concluded that the variety Swarna with 75 kg gypsum ha^{-1} can be practiced for the cultivation of transplant *aman* rice in the salinity affected area of Noakhali, Bangladesh to obtain the highest grain yield.

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INTRODUCTION

Rice is the staple food crop of Bangladesh contributing about 92% of the total food grains produced in the country. In respect of area and production of rice, Bangladesh ranks fourth following China, India and Indonesia (FAO, 2012). Currently, rice is cultivated at about 11.677 million hectares of land with the production of 36.279 million tons (BBS, 2019). In Bangladesh, there are three diverse growing seasons of rice namely- *aus*, *aman* and *boro*. Among different rice groups of Bangladesh *aman* rice covers 5.62 million ha, which is 48.14% of total rice area with production of 14.05 million tons (BBS, 2019). Due to the increasing population, Bangladesh will require more rice production for the next years. But the total area of rice production is shrinking day by day. Moreover, the coastal areas of Bangladesh cover about 30% of arable land of the country. About 53% of coastal areas are salinity affected (Haque et al., 2015; Uddin et al., 2010). Salt-affected areas in the coastal region of Bangladesh increased by 26.71% in 2009 from 1973 (SRDI, 2010). High soil salinity or salt-affected soils defined as having a high concentration of soluble salts affect highly enough to plant growth and the process of increasing the salt content is known as salinization. In saline soils, plant may exhibit signs of drought even the soil is wet or water logged. Other signs of salt damage may be water pooling on the surface without penetrating. Under this circumstance, horizontal expansion of rice area in the coastal region of Bangladesh is not possible. There is only one avenue left is to increase production of rice by vertical means through introduction of high yielding varieties and appropriate management practices (Islam et al., 2016; Sohel et al., 2009). Since transplant *aman* rice is the most dominating crop in the coastal area including Noakhali district, selection of appropriate variety would be very crucial for increasing transplant *aman* rice yield in that area. Among the management practices, judicious use of fertilizer is the most important one and gypsum is an important fertilizer especially for salinity affected area.

Gypsum reduces soil salinity by removing the salt ions from the plant root zone thus enhances crop growth (Mahmoodabadi et al., 2013). It saves crop plants from the negative impact of salinity stress and thus increases crop production. Gypsum supplies bio-available calcium and sulphur, vital elements necessary for proper plant growth and development (Francisco et al., 2020). Gypsum binds with aluminium in the soils to move it deeper in the soil temporarily correcting pH levels and prevent aluminium toxicity (Gergichevich et al., 2010). It provides calcium which can flocculate clay soils and reduce the swelling of smectite and open pore spaces improving the penetration of water, air and roots into the soil. Gypsum is the main source of sulphur (S) which helps in protein synthesis and present in a variety of metabolites (thiamine, pyrophosphate, glucosinolates, glutathione and phytochelatins), which play an obligatory role in building blocks of protein, formation of chlorophyll, activation of enzymes etc. (Islam et al., 2016). Many of the farmers of Bangladesh grow transplant rice without using gypsum fertilizer. But gypsum may have significant influence in rice yield, especially in the coastal area of the country by its salinity amelioration effect. From the above discussion we can say that, it is very important to find out the suitable variety and to ensure gypsum application with proper dose for improving the yield of transplant *aman* rice especially in the salinity affected area of Bangladesh. This research was therefore initiated to reveal these facts.

MATERIALS AND METHODS

Experimental Site and Soil

The experiment was conducted at Moddho Jutkhali, Subornochar upazila situated in Noakhali district, southern part of Bangladesh (22°26" to 22°56" N latitude and 90°24" to 90°54" E longitude) at an altitude of 9 m above mean sea level. The experimental site belongs to the Young Meghna Estuarine Floodplain Agro-ecological zone (AEZ-18). It occupies young alluvial land in and adjoining the Meghna estuary. Soil of the experimental plot was silt loam with low organic carbon and low available nitrogen with alkaline reaction.

Experimental Treatments and Design

The experiment was laid out in a Split-plot design with two factors followed by three replications. The treatments comprised of three *aman* rice varieties viz., *Swarna* (V₁), BRR1 dhan52 (V₂) and Binadhan-7 (V₃) and three levels of gypsum viz., 0, 75 and 150 kg gypsum ha⁻¹. The size of the unit plot was 10 m² (4 m × 2.5 m) and the spaces between blocks and plots were 1 m and 0.5 m, respectively. Various levels of gypsum were given in the main plots whereas different varieties were transplanted in the sub-plots.

Varietal Description

Swarna

Swarna is an indian variety adapted to the Southern region of Bangladesh. Grain type is short bold with brown husk. The duration of the variety is 150-155 days and it has a yield potential of 5.6 to 6.0 ton ha⁻¹. It can be cultivated in *aman* season in coastal delayed area and low rainfed area.

BRRRI dhan52

This rice variety is released by Bangladesh Rice Research Institute (BRRRI) in the year of 2010. Duration is 140-145 days. Panicle is heavy with high grain number. Grain weight is 22 g per 1000-grains. The quality of the grain is medium to slender. The yield potential of the variety is 4.5 to 5 ton ha⁻¹. Special feature of this variety is that it can survive under flooded condition for about 15 days. Culm of the plant is strong and the plant is slightly photosensitive.

Binadhan-7

It is a short duration and high yielding transplant *aman* rice variety released by Bangladesh Institute of Nuclear Agriculture (BINA) in 2007. Crop duration is about 110-120 days from seed to seed. As the variety is early maturing facilitate *rabi* crop cultivation like potato, mustard, wheat etc. It is more tolerant to sheath blight, leaf blight and stem rot. Yield potential is about 5 to 5.5 ton ha⁻¹. It has long fine and bright color grain.

Crop Husbandry

Sprouted rice seeds were sown in the wet nursery bed on 23 June 2017. Thirty three days old seedlings were transplanted in the puddled main field using two seedlings hill⁻¹ on 26 July 2017. Row to row and plant to plant spacing adopted for transplanting were 25 cm and 15 cm, respectively. The recommended dose of 160-50-70-5 kg ha⁻¹ urea, triple super phosphate, muriate of potash, and zinc sulphate, respectively were applied uniformly to all the plots. All other fertilizers except urea and gypsum were applied as basal dose during final land preparation. Gypsum was applied as per the treatments. Nitrogen was applied in the form of urea in three equal splits-one at basal, one at tillering and final one at panicle initiation stage. Intercultural operations were done as and when necessary. Weeds were removed from the plots manually twice at 30 and 45 days after transplanting (DAT) and the plots were kept weed free. The crop was raised as rainfed. At the time of transplanting, a thin film of water was maintained for the easy establishment of seedlings. In general, 6-9 cm stagnant water was present in the field during most part of its growth. From panicle initiation stage, 5 cm depth of water was maintained up to dough stage. After dough stage, water was gradually drained out to facilitate proper maturity and easy harvest. No major incidence of pest and diseases was observed except minor incidence of leaf folder which was managed by spraying chlorpyrifos @ 2 ml L⁻¹ of water.

Data Collection

Five hills (excluding border hills) were randomly selected from each unit plot prior to harvest for recording data on plant characters, yield and yield components. The date of harvesting was determined when 90% of the grains became golden yellow in color. For individual plot, whole plot was manually harvested from the ground level to take grain and straw yields. The harvested crop was then threshed, cleaned and dried to a moisture content of 14% (for grain). Straws were sun dried properly. Weight of grain and straw were recorded and converted into t ha⁻¹.

Statistical Analysis

Data obtained were analyzed by MSTATC-statistical computer package program using the 'Analysis of variance' (ANOVA) technique and mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of Variety

At harvest, all the plant characters and yield of *t. aman* rice except panicle length were significantly influenced by varieties (Table 1). The tallest plant (126.7 cm) was found for the variety Swarna and the shortest plant (97.02 cm) was found for Binadhan-7 (Table 1). But, the highest number of total (9.99), effective

(8.94) and non-effective tillers hill⁻¹ (1.06) were found in Binadhan-7. Swarna produced the highest number of grains panicle⁻¹ (76.30) and 1000-grain weight (25.80 g). The highest grain, straw and biological yields (5.44, 7.07 and 12.51 t ha⁻¹, respectively) were also produced by Swarna (Table 1). But, the harvest index was highest in Binadhan-7 (46.63 %) and lowest in Swarna (43.54 %) (Table 1). The yield reducing trait *viz.*, number of sterile spikelets panicle⁻¹ was highest in BRRI dhan52 (29.02) and lowest in Binadhan-7 (12.08). The lowest number of total (8.32) and effective tillers hill⁻¹ (7.89) were found in BRRI dhan52. But, the lowest number of non-effective tillers hill⁻¹ (0.32) was found in Swarna. The lowest number of grains panicle⁻¹ (61.03) and 1000-grain weight (23.52 g) were produced by Binadhan-7. The lowest grain, straw and biological yields (4.69, 5.36 and 10.05 t ha⁻¹, respectively) were also found in Binadhan-7 (Table 1).

As the yield contributing characters i.e., number of grains panicle⁻¹ and 1000-grain weight were highest for Swarna that's why the grain yield was also highest for this variety. The tallest plant of Swarna led this variety to become the highest straw yielder. Although the number of total and effective tillers hill⁻¹ were highest for Binadhan-7 but the number of grains panicle⁻¹ and 1000-grain weight were lowest for this variety that's why grain yield was also lowest in Binadhan-7.

Results revealed that, the variety Swarna gave best performance with highest yield than that of BRRI dhan52 and Binadhan-7 which might be due to the variation in genetic characteristics and also the variation in adaptability with the study area (Shirazy et al., 2016). It also indicated that the plant of the variety Swarna were highly effective for improving their growth and yield under salinity condition which might be due to its higher salt tolerance capability than that of other varieties and its higher capability to utilize the soil nutrients in the root zone of plant, increased photosynthetic activity and proper conduction of other physiological functions than other varieties under the study area. Khandker et al. (2014); Rashid et al. (2017) etc. also reported the similar results.

Effect of Level of Gypsum

Various levels of gypsum significantly influenced all the yield contributing characters and yield of *t. aman* rice except plant height at harvest and harvest index (Table 2). The highest number of total tillers hill⁻¹ (9.19) was produced when gypsum was applied @ 75 kg ha⁻¹ (G₁) which was statistically identical with 150 kg gypsum ha⁻¹ (G₂) (9.15) (Table 2). The highest number of effective tillers hill⁻¹ (8.67), longest panicle (23.47 cm), highest number of grains panicle⁻¹ (70.52), maximum 1000-grain weight (25.36 g) and lowest number of non-effective tillers hill⁻¹ (0.48) were produced by 150 kg gypsum ha⁻¹ (Table 2). The highest grain, straw and biological yields (5.32, 6.64 and 11.96 t ha⁻¹, respectively) were also produced by 150 kg gypsum ha⁻¹ which were statistically identical with 75 kg gypsum ha⁻¹ for all cases (Table 2). On the other hand, the lowest number of total tillers hill⁻¹ (8.51), effective tillers hill⁻¹ (7.82), shortest panicle (22.87 cm), lowest number of grains panicle⁻¹ (68.24) and lowest 1000-grain weight (24.00 g) with highest number of non-effective tillers hill⁻¹ (0.69) and sterile spikelets panicle⁻¹ (24.69) were produced when no gypsum (G₀) was applied (Table 2). Zero gypsum (G₀) applied condition also produced the lowest values of grain, straw and biological yields (4.92, 5.99 and 10.91 t ha⁻¹, respectively) (Table 2).

The results revealed that, as the yield contributing characters i.e., number of effective tillers hill⁻¹, grains panicle⁻¹, 1000-grain weight etc. were highest and yield reducing traits i.e., number of non-effective tillers hill⁻¹ was lowest for 150 kg gypsum ha⁻¹ (G₂) that's why grain yield was highest for this treatment. Reverse things have occurred in case of no gypsum application (G₀). That's why grain yield was lowest for this treatment. Application of gypsum @ 150 kg ha⁻¹ might have reduced the soil salinity properly by removing the salt ions from the plant root zone which enhanced more nutrients and water uptake by the crop plants and thus facilitated improved growth and yield of rice. In addition, gypsum might have reduced the hazards of the saline-sodic soil which improved soil properties, rice growth and its productivity as well as grain and straw yields. Reverse things might have occurred for no gypsum application. Hossain and Sarker (2015) also reported that the salinity is a limiting factor for growth and development, since it affects several physiological processes in plants. Gypsum amendment was also suggested by them to mitigate soil salinity thereby, improving the crop productivity of the salt affected lands. Hossain et al. (2016); Kaniz and Khan (2013) etc. also reported the similar results.

Table 1. Effect of variety on yield and yield contributing characters of transplant *aman* rice

Variety	Plant height (cm)	No. of total tillers hill ⁻¹	No. of effective tillers hill ⁻¹	No. of non-effective tillers hill ⁻¹	Panicle length (cm)	No. of grains panicle ⁻¹	No. of sterile spikelets panicle ⁻¹	1000-grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
V ₁	126.7 a	8.53 b	8.22 b	0.32 c	23.27	76.30 a	27.85 a	25.80 a	5.44 a	7.07 a	12.51 a	43.54 b
V ₂	112.4 b	8.32 b	7.89 c	0.43 b	23.58	71.51 b	29.02 a	24.86 ab	5.31 b	6.76 b	12.06 b	44.01 b
V ₃	97.02 c	9.99 a	8.94 a	1.06 a	22.84	61.03 c	12.08 b	23.52 b	4.69 c	5.36 c	10.05 c	46.63 a
LSD _{0.05}	3.77	0.234	0.160	0.072	1.03	1.50	2.70	1.75	0.131	0.215	0.336	0.492
S \bar{x}	0.960	0.059	0.041	0.018	0.261	0.383	0.688	0.445	0.033	0.055	0.086	0.125
Level of significance	**	**	**	**	NS	**	**	*	**	**	**	**
CV (%)	3.81	2.18	2.00	7.43	2.09	2.61	8.77	3.77	3.25	3.35	3.05	1.55

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).

** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant;

V₁ = Swarna, V₂ = BRRI dhan52, V₃ = Bindhan-7

Table 2. Effect of level of gypsum on yield and yield contributing characters of transplant *aman* rice

Levels of gypsum	Plant height (cm)	No. of total tillers hill ⁻¹	No. of effective tillers hill ⁻¹	No. of non-effective tillers hill ⁻¹	Panicle length (cm)	No. of grains panicle ⁻¹	No. of sterile spikelets panicle ⁻¹	1000-grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
G ₀	112.62	8.51 b	7.82 b	0.69 a	22.87 b	68.24 b	24.69 a	24.00 b	4.92 b	5.99 b	10.91 b	45.13
G ₁	112.38	9.19 a	8.56 a	0.63 b	23.36 ab	70.08 ab	22.11 b	24.82 ab	5.20 a	6.56 a	11.76 a	44.42
G ₂	111.13	9.15 a	8.67 a	0.48 c	23.47 a	70.52 a	22.16 b	25.36 a	5.32 a	6.64 a	11.96 a	44.64
LSD _{0.05}	4.38	0.200	0.172	0.046	0.499	1.87	2.07	0.958	0.172	0.22	0.362	0.713
S \bar{x}	1.42	0.065	0.056	0.015	0.162	0.606	0.672	0.311	0.056	0.071	0.117	0.231
Level of significance	NS	**	**	**	*	*	*	*	**	**	**	NS
CV (%)	2.57	2.00	1.47	9.10	3.38	1.65	8.97	5.40	1.94	2.57	2.23	0.84

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT)

** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant;

G₀ = Gypsum @ 0 kg ha⁻¹; G₁ = Gypsum @ 75 kg ha⁻¹; G₂ = Gypsum @ 150 kg ha⁻¹

Table 3. Interaction effects of variety and level of gypsum on yield and yield contributing characters of transplant *aman* rice

Interaction (variety x level of gypsum)	Plant height (cm)	No. of total tillers hill ⁻¹	No. of effective tillers hill ⁻¹	No. of non-effective tillers hill ⁻¹	Panicle length (cm)	No. of grains panicle ⁻¹	No. of sterile spikelets panicle ⁻¹	1000-grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
V ₁ xG ₀	128.73	8.13 ef	7.81 e	0.32 f	23.07	73.23 bc	29.71	25.00	5.13 c	6.46 d	11.59 b	44.26 cd
V ₂ xG ₀	113.33	8.07 f	7.39 f	0.68 d	23.60	71.38 cd	30.14	24.00	5.26 bc	6.41 d	11.67 b	45.07 bc
V ₃ xG ₀	95.80	9.33 b	8.25 cd	1.08 b	21.93	60.10 e	14.21	23.00	4.36 e	5.11 f	9.47 d	46.04 ab
V ₁ xG ₁	124.47	8.87 c	8.47 c	0.40 e	23.53	80.23 a	26.03	25.70	5.69 a	7.52 a	13.21 a	43.08 d
V ₂ xG ₁	114.27	8.43 def	8.12 d	0.31 fg	23.53	68.97 d	28.87	25.00	5.19 bc	6.75 cd	11.94 b	43.47 d
V ₃ xG ₁	98.40	10.27 a	9.09 b	1.18 a	23.00	61.03 e	11.42	23.77	4.73 d	5.40 ef	10.13 c	46.70 a
V ₁ xG ₂	127.00	8.60 cd	8.37 cd	0.23 g	23.20	75.43 b	27.82	26.70	5.51 ab	7.22 ab	12.73 a	43.29 d
V ₂ xG ₂	109.53	8.47 de	8.17 cd	0.30 fg	23.60	74.17 bc	28.05	25.57	5.47 ab	7.11 bc	12.58 a	43.48 d
V ₃ xG ₂	96.87	10.39 a	9.47 a	0.92 c	23.60	61.97 e	10.61	23.80	4.98 cd	5.58 e	10.56 c	47.16 a
LSD _{0.05}	7.59	0.347	0.297	0.080	0.864	3.23	3.59	1.66	0.297	0.382	0.626	1.24
S \bar{x}	2.46	0.113	0.097	0.026	0.280	1.05	1.16	0.538	0.096	0.124	0.203	0.401
Level of significance	NS	*	*	**	NS	**	NS	NS	*	*	*	*
CV (%)	3.81	2.18	2.00	7.43	2.09	2.61	8.77	3.77	3.25	3.35	3.05	1.55

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT);

** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant;

G₀ = Gypsum @ 0 kg ha⁻¹; G₁ = Gypsum @ 75 kg ha⁻¹; G₂ = Gypsum @ 150 kg ha⁻¹; V₁ = Swarna; V₂ = BRRI dhan52; V₃ = Binadhan-7

Effect of Interaction between Variety and Level of Gypsum

At harvest, yield and most of the yield contributing characters of *t. aman* rice were significantly influenced by the interaction effects of variety and level of gypsum (Table 3). The highest number of total tillers hill⁻¹ (10.39) were found for the treatment interaction V₃ x G₂ (Binadhan-7 x gypsum @ 150 kg ha⁻¹) which was statistically identical with V₃ x G₁ (Binadhan-7 x gypsum @ 75 kg ha⁻¹) (10.27) (Table 3). The highest number of effective tillers hill⁻¹ (9.47) was also found for the treatment interaction V₃ x G₂ (Binadhan-7 x gypsum @ 150 kg ha⁻¹). The lowest values of these parameters were found in V₂ x G₀ (BRR1 dhan52 x gypsum @ 0 kg ha⁻¹). Number of non-effective tillers hill⁻¹ was highest in V₃ x G₁ (Binadhan-7 x gypsum @ 75 kg ha⁻¹) (1.18) and was lowest in V₁ x G₂ (Swarna x gypsum @ 150 kg ha⁻¹) (0.23). The highest number of grains panicle⁻¹ (80.23) was found in V₁ x G₁ (Swarna x gypsum @ 75 kg ha⁻¹) and the lowest number of grains panicle⁻¹ (60.10) was found in V₃ x G₀ (Binadhan-7 x gypsum @ 0 kg ha⁻¹) (Table 3). The highest grain yield (5.69 t ha⁻¹) was found in V₁ x G₁ (Swarna x gypsum @ 75 kg ha⁻¹) which was statistically identical in order with V₁ x G₂ (Swarna x gypsum @ 150 kg ha⁻¹) (5.51 t ha⁻¹) and V₂ x G₂ (BRR1 dhan52 x gypsum @ 150 kg ha⁻¹) (5.47 t ha⁻¹). The highest straw and biological yields (7.52 and 13.21 t ha⁻¹, respectively) were also found in V₁ x G₁ (Swarna x gypsum @ 75 kg ha⁻¹). The lowest values of grain, straw and biological yields (4.36, 5.11 and 9.47 t ha⁻¹, respectively) were found in V₃ x G₀ (Binadhan-7 x gypsum @ 0 kg ha⁻¹). But, the harvest index was highest (47.16 %) in V₃ x G₂ (Binadhan-7 x gypsum @ 150 kg ha⁻¹) and lowest (43.08 %) in V₁ x G₁ (Swarna x gypsum @ 75 kg ha⁻¹) (Table 3).

As the major yield contributing character i.e., number of grains panicle⁻¹ was highest in V₁ x G₁ (Swarna x gypsum @ 75 kg ha⁻¹) that's why the grain yield was also highest for this treatment interaction. Application of gypsum @ 75 kg ha⁻¹ might have reduced the soil salinity properly by removing the salt ions from the root zone of Swarna and thus facilitated relatively more uptakes of nutrients and water by the crop plants resulted improve growth and highest yield of the Swarna variety. Reverse thing might have occurred in case of V₃ x G₀ (Binadhan-7 x gypsum @ 0 kg ha⁻¹). Haque et al. (2017); Akter et al. (2014) etc. also reported the similar results.

CONCLUSION

Finally, it can be concluded that, the variety Swarna was found as superior for rice production in the salinity affected area of Noakhali. Among the levels of gypsum, 150 kg gypsum ha⁻¹ was best in producing rice in that area. But in case of treatment interaction, the variety Swarna applied with 75 kg gypsum ha⁻¹ appeared as the promising practice for transplant *aman* rice cultivation in the salinity affected area of Noakhali, Bangladesh in terms of grain and straw yields.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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