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INFLUENCE OF IRRIGATION AND GYPSUM ON WHEAT CULTIVATION IN SALINE SOIL

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A B S T R A C T

Irrigation application and organic amendments could contribute to the improvement of wheat production in coastal areas. Field experiment was carried out at Shamnagar, Satkhira Sadar for the improvement of wheat production in saline areas through irrigation application and gypsum amendments. Two wheat cultivars viz. L-880-43 and BARIghom-26 were used as test crops. There were six treatments such as control (no irrigation); one irrigation at vegetative stage with canal water (canal water means rainwater harvested in natural/man-made canal); one irrigation at vegetative stage with STW water + Gypsum application @ 200 Kg/ha (STW means sallow tube-well); Irrigation at vegetative and heading/flowering stage with canal water; Irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha; Irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha. The treatments were allocated in the main-plot and the cultivars in the sub-plot all experimental plots received recommended doses of urea, triple super phosphate, and muriate of potash. The treatments were imposed accordingly. The results showed that soil salinity caused a significant reduction in growth and yield components of both wheat cultivars. Irrigation application and Gypsum amendments significantly increased the growth and yield components of both cultivars under soil salinity. Soil salinity also reduced grain yields of both cultivars. Combined application of irrigation water and gypsum amendments showed higher yields than that of sole application of irrigation water during saline conditions. Gypsum used as amendments because it reduces the soil salinity. Therefore, the present study suggests that wheat production might be feasible in coastal areas of southern Bangladesh (saline soils) through irrigation application and gypsum amendments.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop and it ranks first both in acreage and production in the world (FAO, 2008). It is an important cereal crop in dry region of the world and it is characterized as being moderately tolerant to salinity. About one-third of the total population in the world lives on wheat grain consumption. There are numerous problems that decrease wheat production such as increasing saline area, traditional cultural practices, poor field management, lake of using proper plant densities, late planting, unavailability of quality seed, use of local cultivars, climatic hazard, intensive cropping, inadequate fertilizer use, irregular irrigation and fertilizer management etc. of which major cause is salinity. It has being estimated that approximately 20% of agricultural land and 50% of crop land in the world is salt stressed (Flowers and Yeo, 1995). Salt in the soil water solution can reduce evapotranspiration by making soil water less available for plant root extraction. Germination and seedling growth are reduced in saline soils with varying responses for species and cultivars (Hampson and Simpson, 1990). In view of another projection, 2.1% of the global dry land agriculture is affected by salinity (FAO, 2008). The main saline area of Bangladesh include the greater districts of Khulna, Patuakhali, Noakahli, Chittagonj and the islands of Bay of Bengal Bhola, Hatya and Sandip. Increased soil salinity due to climate change would significantly reduce food grain production. Agriculture is the most important sector of Bangladesh economy. To feed the thirteen millions, Bangladesh must increase food production in saline area. There are two ways to grow crops successfully in the salt affected area. The first one is to identify salt tolerant crops or varieties and improve the crop yield through management practices. The second one is the reclamation of salt affected land through land leveling, sub-surface drainage, soil amendments and improved irrigation practices. But the reclamation practices are expensive and require continuous management (Ashraf et al., 1990). The selection and improvement of existing crop cultivars to fit into the varying degrees of salinity is therefore more feasible than soil reclamation (Haque et al., 1993).

In Bangladesh, over 30% of the net cultivable area exists in the coastal region. Usually 30-50% yield losses occur depending on the level of soil salinity. Irrigation water management for growing cereal crop assumes importance as majority of cultivated area in the world is under rice, wheat and maize crops (FAO, 2008). Optimum water availability to wheat plants during their growth is essential for realizing the potential yield. Unfortunately about 50% of the total wheat growing area still remains unirrigated and hence depend on residual soil moisture which is depleted rapidly at the later part of crop growth causing a soil moisture stress. Islam and Islam (1991) observed that wheat yield was reduced by 50% due to soil moisture stress. Reduces the productivity of wheat hence, the addition of gypsum, adequate leaching and proper draining must be installed in the field to ensure optimum production on saline soil (Geldermn et al., 2004). Gypsum, calcium sulphate ($CaSO_4$, $2H_2O$), is naturally occurring mineral that is determined for many purpose. Gypsum has calcium content of 23% and sulphur content of 19%. It is usually used for treating Sodium affected soil on farm. The calcium in the applied gypsum enables sodium displacement on the cation exchange capacity of the soil. However, large amount of calcium are required thus it is a mass action process (Geldermn et al., 2004). Salts accumulation in root zone occurs by two processes hence, to control salinity from high saline water table, demands proper draining while salts that accumulate in the root one with irrigation are leached (Stephen, 2002). However, the experiment will be feasible in near future to determine amount of irrigation water and gypsum for saline tolerant variety in wheat.

MATERIALS AND METHODS

Plant and Seed sowing technique

Two wheat cultivars: V_1 = L-880-43 and V_2= BARIghom-26 (as check) were used in the conducting experiment. Seeds of the wheat cultivars were collected from Bangladesh Institute of Nuclear Agriculture, Mymensingh. Healthy seeds of each variety were sown in line in each plot. After germination and plant establishment, line to line and plant to plant distance was maintained.

Intercultural operations

Weeding and Irrigation practices

There were some weeds observed which were uprooted by hand. Irrigation was given as per experimental specification i.e. measured water was added to keep water level up to field capacity to avoid anaerobic condition during different crop growth stages in field. There were also two irrigation applied at most critical stages like 25-30 DAS (Days after sowing) and 45-50 DAS.

Measurement of moisture content of soil

Moisture content of soil of the plot was measured at sowing, before and after 1st and 2nd irrigation and after harvesting of wheat. Soil sample was randomly collected from twelve pot at surface level. In case of plot, soil sample was collected from 4 depths like 0-15 cm, 15-30 cm, 30-45 cm and 45-60 cm. Then the soil sample was oven dried at 105° C. Gravimetric moisture content was converted to volumetric moisture content by multiplying with the bulk density.

Measurement of electrical conductivity of Water

Electrical conductivity of canal water and STW water was measured. Electrical conductivity of canal water at sowing time, 1st irrigation and 2nd irrigation was 2.23, 2.03, 2.63 ds/m. Electrical conductivity of STW water at sowing time, 1st irrigation and 2nd irrigation was 5.47, 4.98, 5.26 ds/m.

Determination of water p^H

Water p^H was determined by p^H meter. P^H of canal water at 1st and 2nd irrigation was 7.2, 7.62. P^H of STW water at 1st irrigation and 2nd irrigation was 7.24, 7.18.

Harvesting, data recording and processing

Maturity of crops was determined when 100% of the spikes become straw colour. After maturity, the whole plant was cut at ground level with the help of sickle. The harvested crop of each pot/plot was bundled separately and tagged properly. After recording data on plant height, length of spike of each plant, plant materials were then sun dried for grain collection. Finally, grain and straw yields and yield contributing parameters were recorded, separately.

Experimental design

The experiment was laid out in a randomized complete block design with three replications. Data analysis was performed by using statistical package MStatC. By using Duncan's multiple range tests (Gomez and Gomez 1984), mean differences were adjudicated.

RESULTS

Plant height

Effect of irrigation treatment

The highest plant height (93.20cm) was found from T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest plant height (84.90cm) was found from T_1 treatment (Control, No irrigation) (Table 2).

Effect of variety

The highest plant height (92.92cm) was found in the variety V_1 (L-880-43) and the lowest plant height (82.48cm) was found in the variety V_2 (BARIghom-26) (Table 1).

Interaction between irrigation treatment and variety

The highest plant height (97.87cm) was found in the interaction of V_1T_6 (Variety L-880-43 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha) and the lowest plant height (79.67cm) was found in the interaction of V_2T_4 (L-880-43 and Irrigation at vegetative and heading/flowering stage with canal water) which was statistically identical with the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water) where plant height was 79.73 cm. (Table 3).

No. of tiller/plant

Effect of irrigation treatment

The highest number of tiller (5.635) was found in T_5 treatment (Irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha) and the lowest number of tiller (4.400) was found in T_2 treatment (One irrigation at vegetative stage with canal water) which was statistically similar with T_1 treatment (control, means no irrigation) where tiller number was 4.400 (Table 2).

Effect of variety

The highest no. of tiller (5.080) was found in the variety V_2 (BARIghom-26) and the lowest no. of tiller (4.822) was found in the variety V_1 (L-880-43) (Table 1).

Interaction between irrigation treatment and variety

The highest no. of tiller (5.870) was found in the interaction of V_1T_5 (Variety L-880-43 and irrigation at vegetative stage with saline canal water + gypsum application @ 200 Kg/ha) and the lowest no. of tiller (4.000) was found in the interaction of V_1T_1 (L-880-43 and control means no irrigation) which was statistically identical with the interaction of V_1T_2 (L-880-43 and one irrigation at vegetative stage with canal water) where no. of tiller was 4.130 (Table 3).

Spike length

Effect of irrigation treatment

The highest spike length (9.015cm) was found in T_3 treatment (One irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) and the lowest spike length (8.250cm) was found in T_5 treatment (irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha). (Table 2)

Effect of variety

The highest spike length (8.645cm) was found in the variety V_1 (L-880-43) and the lowest spike length (8.428cm) was found in the variety V_2 (BARIghom-26) (Table 1).

Interaction between irrigation treatment and variety

The highest spike length (9.200cm) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) and in the lowest spike length (8.170cm) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water) which was statistically similar with the interaction of V_1T_5 (L-880-43 and irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha) (Table 3).

No. of spike

Effect of irrigation treatment

The highest No. of spike (17.67) was found in T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha) which was statistically identical with the T_3 treatment (one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) where no. of spike was (17.60) and the lowest No. of spike (16.14) was found in T_2 treatment (one irrigation at vegetative stage with canal water) (Table 2).

Effect of variety

The highest No. of spike (17.68) was found in the cultivar V_1 (L-880-43) and the lowest No. of spike (16.08) was found in the variety V_2 (BARIghom-26) (Table 1).

Interaction between irrigation treatment and variety

The highest No. of spike (18.80) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) and the lowest No. of spike (15.07) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water) which was statistically identical with the interaction of V_2T_4 (BARIghom-26 and irrigation at vegetative and heading/flowering stage with canal water) where no. of spike was (15.40) (Table 3).

No. of seed/spikelet

Effect of irrigation treatment

The highest no. of seed/spikelet (54.67) was found in T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha) which was statistically identical with the T_3 treatment (irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) where no. of seed/spikelet was (54.03) and the lowest no. of seed/spikelet (48.10) was found in T_2 treatment (one irrigation at vegetative stage with canal water) (Table 2).

Effect of variety

In Table 4.1 variety has shown significant difference. The highest no. of seed/spikelet (54.88) was found in the variety V_1 (L-880-43) and the lowest no. of seed/spikelet (49.49) was found in the variety V_2 (BARI ghom-26) (Table 1).

Interaction between irrigation treatment and variety

The highest no. of seed/spikelet (58.20) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200kg/ha) and the lowest No. of seeds/spikelet (41.07) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water) (Table 3).

Seeds weight

Effect of irrigation treatment

The highest seeds weight (42.42g) was found in T_1 treatment (control means no irrigation) and the lowest seeds weight (39.42g) was found in T_3 treatment (one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 Kg/ha) which was statistically identical with the T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water+ Gypsum application @ 200 Kg/ha) where seeds weight was 39.50g (Table 2).

Effect of variety

The highest seeds weight (43.19g) was found in the variety V_2 (BARIghom-26) and the lowest seeds weight (38.08g) was found in the variety V_1 (L-880-43) (Table 1).

Interaction between irrigation treatment and variety

The 1000 seeds weight was significantly affected due to interaction of irrigation treatment and variety. The highest seeds weight (44.17g) was found in the interaction of V_2T_6 (BARIghom 26 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha) and the lowest seeds weight (34.83g) was found the interaction of V_1T_6 (L-880-43 and irrigation at vegetative and heading/flowering stage with STW water+ Gypsum application @ 200 Kg/ha) (Table 3).

Yield

Effect of irrigation treatment

The highest yield (3.110t/ha) was found in T_5 treatment (irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha) and the lowest yield (2.840 t/ha) was found in T_1 treatment (control means no irrigation) which was statistically identical with theT_4 treatment (irrigation at vegetative and heading/flowering stage with canal water) where yield was 2.995 t/ha.

Effect of variety

The highest yield (3.200t/ha) was found in the variety V_1 (L-880-43) and the lowest yield (2.907t/ha) was found in the variety V_2 (BARIghom-26).

Interaction between irrigation treatment and variety

The highest yield (3.220t/ha) was found in the interaction of V_1T_6 (L-880-43 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 Kg/ha) which was statistically identical with the interaction of V_1T_5 (L-880-43 and irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha) where yield was 3.200t/ha and the lowest yield (2.750t/ha) was found the interaction of V_2T_1 (BARIghom -26 and control means no irrigation).

Table 1. Effect of variety on yield and yield contributing characters

Variety	Plant height (cm)	No. of tiller/plant	Spike length (cm)	No. of spike	No. of seeds/spikelet	1000 seeds wt (g)	Yield (t/ha)
V_1	92.92a	4.822b	8.645a	17.68a	54.88a	38.08b	3.120a
V_2	82.48b	5.080a	8.428b	16.08b	49.49b	43.19a	2.907b
$LSD_{0.05}$	2.22	0.140	0.182	0.381	2.26	1.03	0.022
CV (%)	3.67	4.08	3.10	3.27	6.27	3.67	1.10

The means with the same letter in a column show insignificant difference at the 0.05 level (n=4)
Here, V_1=L-880-43; V_2=BARIghom-26

Table 2. Effect of treatment on yield and yield contributing characters

Treatments	Plant height (cm)	No. of tiller/plant	Spike length (cm)	No. of spike	No. of seeds/spikelet	1000 seeds wt (g)	Yield (t/ha)
T_1	84.90c	4.400	8.435b	16.93b	52.76a	42.42a	2.840d
T_2	85.47bc	4.400	8.535b	16.14c	48.10b	41.58ab	3.035b
T_3	87.13bc	5.135	9.015a	17.60a	54.03a	39.42c	3.035b
T_4	86.30bc	5.135	8.585b	16.57bc	52.00ab	41.17abc	2.995c
T_5	89.20b	5.635	8.250b	16.36bc	51.53ab	39.75bc	3.110a
T_6	93.20a	5.000	8.400b	17.67a	54.67a	39.50c	3.065b
$LSD_{0.05}$	3.83	0.242	0.317	0.660	3.92	1.78	0.038
CV (%)	3.67	4.08	3.10	3.27	6.27	3.67	1.10

The means with the same letter in a column show insignificant difference at the 0.05 level (n=4).
Here, T_1=Control (no irrigation), T_2=One irrigation at vegetative stage with canal water, T_3= One irrigation at vegetative stage with saline STW water + gypsum application @ 120 Kg/ha, T_4=Irrigation at vegetative and heading/flowering stage with canal water, T_5= Irrigation at vegetative stage with saline canal water + gypsum application @ 120 Kg/ha, T_6= Irrigation at vegetative and heading/flowering stage with STW water + gypsum application @ 120 Kg/ha

Table 3. Combined effects of variety and treatment on yield and yield contributing characters

Treatment combination	Plant height (cm)	No. of tiller/plant	Spike length (cm)	No. of spike	No. of seeds/spikelet	1000 seeds wt (g)	Yield (t/ha)
V_1T_1	88.07	4.000f	8.500	16.80cd	56.13ab	41.00bc	2.930de
V_1T_2	91.20	4.130f	8.900	17.20bcd	55.13abc	41.17bc	3.120b
V_1T_3	92.67	5.200bc	9.200	18.80a	58.20a	35.67d	3.140b
V_1T_4	92.93	5.000cde	8.700	17.73bc	53.73abc	39.33c	3.110b
V_1T_5	94.80	5.870a	8.170	17.40bcd	53.47abc	36.50d	3.200a
V_1T_6	97.87	4.730de	8.400	18.13ab	52.60abc	34.83d	3.220a
V_2T_1	81.73	4.800de	8.370	17.07cd	49.40c	43.83ab	2.750f
V_2T_2	79.73	4.670e	8.170	15.07e	41.07d	42.00abc	2.950d
V_2T_3	81.60	5.070bcd	8.830	16.40d	49.87bc	43.17ab	2.930de
V_2T_4	79.67	5.270bc	8.470	15.40e	50.27bc	43.00ab	2.880e
V_2T_5	83.60	5.400b	8.330	15.33e	49.60 c	43.00ab	3.020c
V_2T_6	88.53	5.270bc	8.400	17.20bcd	56.73a	44.17a	2.910de
$LSD_{0.05}$	5.44	0.343	0.448	0.933	5.54	2.52	0.054
CV (%)	3.67	4.08	3.10	3.27	6.27	3.67	1.10

The means with the same letter in a column show insignificant difference at the 0.05 level (n=4).
Here, V_1=L-880-43' V_2=BARIghom-26.
T_1=Control (no irrigation), T_2=One irrigation at vegetative stage with canal water, T_3= One irrigation at vegetative stage with saline STW water + gypsum application @ 120 kg/ha, T_4=Irrigation at vegetative and heading/flowering stage with canal water, T_5= Irrigation at vegetative stage with saline canal water + gypsum application @ 120 kg/ha, T_6= Irrigation at vegetative and heading/flowering stage with STW water +gypsum application @ 120 kg/ha.

Moisture content of soil

Generally at sowing time soil moisture is low and at harvest time soil moisture is high (Figure 1 and 2) because of rainfall and irrigation practices. In this experiment at sowing time moisture was taken from 0-15,15-30,30-45cm depth and at harvest time moisture was taken from 0-15,15-30,30-45,45-60,60-75,75-90 cm depth of soil. It is observed that at harvest time soil moisture is high and at sowing time soil moisture is low.

DISCUSSION

The highest plant height (93.20cm) was found from T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest plant height (84.90cm) was found from T_1 treatment Control (No irrigation). The highest plant height (92.92cm) was found in the variety V_1 (L-880-43) and the lowest plant height (82.48cm) was found in the variety V_2 (BARIghom-26). The highest plant height (97.87cm) was found in the interaction of V_1T_6 (Variety L-880-43 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest plant height (79.67cm) was found in the interaction of V_2T_4 (L-880-43 and Irrigation at vegetative and heading/flowering stage with canal water). In general, increase in water salinity has decreased the plant height significantly. Sidhu *et al.* (2007) conducted an experiment to study the effects of the source of irrigation water on the performance of rice *(Oryza sativa) wheat (Triticum aestivum)* system in different agro-climatic zones of the Trans Gangetic Plain Region covering Punjab and Haryana, India. In the mid- and arid plain zones, the irrigation water was saline to marginal alkaline, and saline to moderately alkaline, respectively. The result of this experiment revealed that the productivity of these sub-plain zones could be increased by the application of gypsum to the irrigation water.

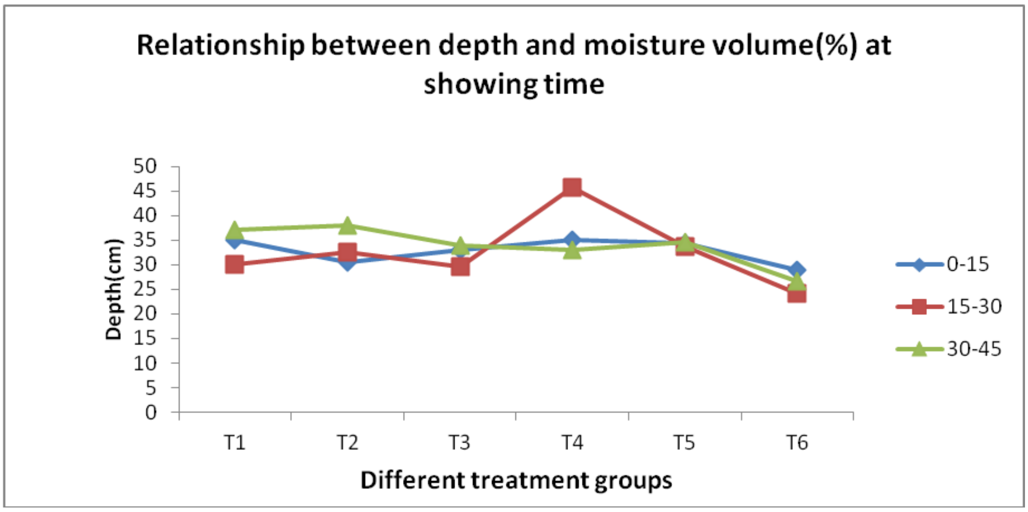

Figure 1. Moisture at sowing time

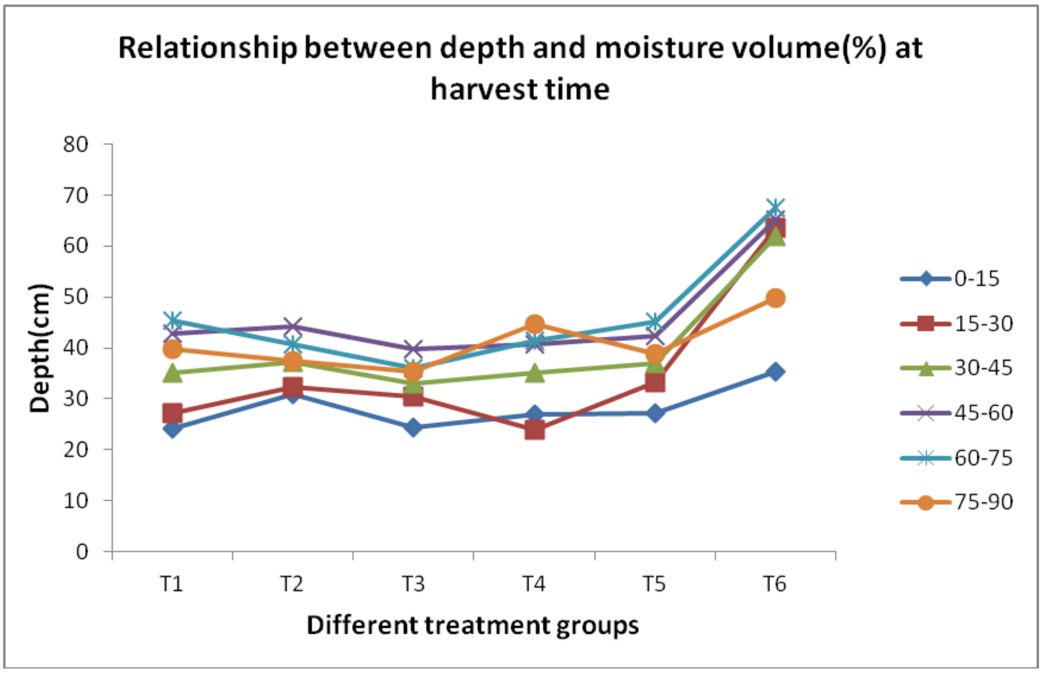

Figure 2. Moisture at harvesting time

The highest number of tiller (5.635) was found in T_5 treatment (Irrigation at vegetative stage with saline canal water + Gypsum application @ 200 Kg/ha) and the lowest number of tiller (4.400) was found in T_2 treatment (One irrigation at vegetative stage with canal water). The highest no. of tiller (5.080) was found in the variety V_2 (BARIghom-26) and the lowest no. of tiller (4.822) was found in the variety V_1 (L-880-43). The highest no. of tiller (5.870) was found in the interaction of V_1T_5 (Variety L-880-43 and irrigation at vegetative stage with saline canal water + gypsum application @ 200 kg/ha) and the lowest no. of tiller (4.000) was found in the interaction of V_1T_1 (L-880-43 and control means no irrigation). In general, increase in water salinity has decreased the number of effective tiller/hill significantly.

The highest spike length (9.015cm) was found in T_3 treatment (One irrigation at vegetative stage with saline STW water + Gypsum application @ 200Kg/ha) and the lowest spike length (8.250cm) was found in T_5 treatment (irrigation at vegetative stage with saline canal water + Gypsum application @ 200 kg/ha). The highest spike length (8.645cm) was found in the variety V_1 (L-880-43) and the lowest spike length (8.428cm) was found in the variety V_2 (BARIghom-26). The highest spike length (9.200cm) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 kg/ha) and the lowest spike length (8.170cm) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water). In general, increase in water salinity has decreased the spike length significantly. Pillal et al. (1982) has also reported that length of ear was reduced by salt stress.

The highest No. of spike (17.67) was found in T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest No. of spike (16.14) was found in T_2 treatment (one irrigation at vegetative stage with canal water). The highest No. of spike (17.68) was found in the variety V_1 (L-880-43) and the lowest No. of spike (16.08) was found in the variety V_2 (BARIghom-26). The highest no. of spike (18.80) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 kg/ha) and the lowest no. of spike (15.07) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water). In general, increase in water salinity has decreased the number of spike/hill significantly. Haqqani *et al.* (1984) reported that increase in soil salinity reduces the numbers of spike/hill. Our present result is in agreement with Haqqani et al. (1984).

The highest no. of seed/spikelet (54.67) was found in T_6 treatment (irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200kg/ha) and the lowest no. of seed/spikelet (48.10) was found in T_2 treatment (one irrigation at vegetative stage with canal water). The highest no. of seed/spikelet (54.88) was found in the variety V_1 (L-880-43) and the lowest no. of seed/spikelet (49.49) was found in the variety V_2 (BARIghom-26). The highest No. of seed/spikelet (58.20) was found in the interaction of V_1T_3 (L-880-43 and one irrigation at vegetative stage with saline STW water + Gypsum application @ 200 kg/ha) and the lowest No. of seeds/spikelet (41.07) was found the interaction of V_2T_2 (BARIghom-26 and one irrigation at vegetative stage with canal water).

The highest seeds weight (42.42g) was found in T_1 treatment (control means no irrigation) and the lowest seeds weight (39.42g) was found in T_3 treatment (one irrigation at vegetative stage with saline STW water + Gypsum application @ 200kg/ha). The highest seeds weight (43.19g) was found in the variety V_2 (BARIghom-26) and the lowest seeds weight (38.08g) was found in the variety V_1 (L-880-43). The highest seeds weight (44.17g) was found in the interaction of V_2T_6 (BARI ghom-26 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest seeds weight (34.83g) was found the interaction of V_1T_6 (L-880-43 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha).

The highest yield (3.110 t/ha) was found in T_5 treatment (irrigation at vegetative stage with saline canal water + Gypsum application @ 200kg/ha) and the lowest yield (2.840 t/ha) was found in T_1 treatment (control means no irrigation). The highest yield (3.120 t/ha) was found in the variety V_1 (L-880-43) and the lowest yield (2.907t/ha) was found in the variety V_2 (BARIghom-26). The highest yield (3.220 t/ha) was found in the interaction of V_1T_6 (L-880-43 and irrigation at vegetative and heading/flowering stage with STW water + Gypsum application @ 200 kg/ha) and the lowest yield (2.750 t/ha) was found the interaction of V_2T_1 (BARI ghom -26 and control means no irrigation). In general, increase in water salinity has decreased the grain yield significantly. Padole et al. (1995) stated from a study that the yield of wheat decreased in highly saline soil. The present result also found to be fully consistent with the findings.

Chaudhry (2001) reported that gypsum doses and application method increased rice yield in saline soil. Islam (2010) conducted a pot experiment to find out the suitable level of gypsum to ameliorate salinity stress in Boro rice cv. BRRI dhan29. Results revealed that rates of gypsum significantly influenced all the parameters and could alleviate the adverse effect of salinity. The highest yield was obtained from lg. gypsum kg^{-1} soil. Yield and all yield parameters were at the lowest value when no gypsum was applied under salinity stress.

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