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N, P, K AND S STATUS OF WHEAT PLANT GROWN ON SALINE SOILS AS INFLUENCED BY GYPSUM, RICE HULL AND DIFFERENT SALINITY LEVELS

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ABSTRACT

The content and uptake of N, P and K in wheat decreased with the increased levels of salinity (6, 12 dS m^{-1}) and plant age. But the content and uptake of S increased with the increased level of salinity and then decreased with plant age. The highest content of N, P and K in wheat at maturity was found 67.50 and 74.52, 45.68 and 55.97, 94.01 and 97.48 C mol kg^{-1} in Sonagazi and Badarkhali saline soils, respectively with the treatment of $EC_0G_{300}H_8$. But in the both soils S contents were highest with the treatment of $EC_{12}G_{300}H_8$ at maturity stage. In Sonagazi soils the highest content of S was 46 C mol kg^{-1} which is 33.80% more as compared with control ($EC_0G_0H_0$). But in Badarkhali soil the highest content of S in wheat was 47.61 C mol kg^{-1} which is 89.30% more as compared with control ($EC_0G_0H_0$). The combined application of gypsum 300 kg ha^{-1} and rice hull 8 t ha^{-1} significantly ($P \leq 0.05$) increased the N, P, K and S content in wheat at maturity as compared with controlled in both saline soils.

Keywords: Wheat, Gypsum, Rice hull, Salinity

1. INTRODUCTION

The harmful effect of salinity on the mineral content of surviving plants is a well established fact. Saline water irrigation had a marked effect on the availability as well as on the translocation of nutrient in plant. This is because the salinity lowers the water potential in soil and thereby the water potential gradient from the soil to the plant cell. Again ion-species present in excess have specific effects on some plants. Besides, salinity causes nutrient imbalances which may also adversely affect the mineral nutrition of plants.

Salinity and sodicity of soil could be corrected by the use of which gypsum was considered to be very effective [1]. Sodium induced the Ca deficiency in saline soil [2], but addition of Ca^{2+} to the media improved the growth rate of plants under saline environments [3]. Salinity has a negative effect on the assimilation of N, P and K by rice but the application of gypsum significantly effective for the uptake of N, P and K, irrespective of salinity [4]. Many researchers reported that the application of saline water with gypsum increased the removal of Na from the soil profile, appreciably decrease the soil pH, improved water infiltration rate and raised crop yield. Rice hull also improved water holding capacity of soil. Based on this background, we studied the influence of gypsum, rice hull and intermittent saline irrigation on N, P, K and S uptake by wheat at different stage under different saline environments.

Keeping all these views in consideration, the present research work has been undertaking with the following objectives:

1. Reclamation of saline soils by using different doses of gypsum and rice hall and their different combination; and
2. The effect of different levels of salinity, gypsum and rice hull, and their interaction on the growth, yield and mineral nutrition of wheat grown in different saline soils.

2. MATERIAL AND METHODS

The pot experiment on saline soil reclamation or improvement was arranged in the net house of the Department of Soil Science, University of Dhaka, to evaluate the efficiency of gypsum and rice hull in two saline soils for the uptake of N, P, K and S by wheat. The soil used in the experiment representing plough layer depth (0-15 cm) collected from Sonagazi thana of Feni and Badarkhali thana of Chokoria (Cox's Bazar). Both soils used for this experiments were Silty Clay Loam affected by various degrees of salinity, in Sonagazi soil moisture content 3% [5], EC_e 4.6 dS m^{-1}, pH 7.6, organic matter 1.11%, total N 0.12% , C/N ratio 9.6, available N 52 mg kg^{-1}, available S 329 mg kg^{-1}, available P 2.7 mg kg^{-1} [6], carbonate nil [6], bicarbonate 0.06% [6], CEC 23.03 C mol kg^{-1} [7], water soluble ions viz. Na 0.45 C mol kg^{-1}, K 0.07 C mol kg^{-1} (flame photometer), Ca 0.50 C mol kg^{-1} , Mg 2.12 C mol kg^{-1} (EDTA method), exchangeable cations viz. Ca 7.50 C mol kg^{-1}, Mg 3.75 C mol kg^{-1}, Na 0.83 C mol kg^{-1}, K 0.32 C mol kg^{-1} and in Badarkhali soil moisture content 2.3% [5], EC_e 9.2

dS m^{-1}, pH 6.4, organic matter 1.50%, total N 0.17% , C/N ratio 8.9, available N 31 mg kg^{-1}, available S 451 mg kg^{-1}, available P 1.6 mg kg^{-1} [6], carbonate nil [6], bicarbonate 0.06% [6], CEC 28.74 C mol kg^{-1} [7], water soluble ions viz. Na 1.74 C mol kg^{-1}, K 0.19 C mol kg^{-1} (flame photometer), Ca 0.50 C mol kg^{-1} , Mg 1.50 C mol kg^{-1} (EDTA method), exchangeable cations viz. Ca 6.25 C mol kg^{-1}, Mg 7.50 C mol kg^{-1} , Na 2.22 C mol kg^{-1}, K 0.77 C mol kg^{-1}. The soil samples were put in plastic bags and taken to the Department. The collected soil sample were air dried, ground and screened to pass through a 2.0 mm sieve and then mixed thoroughly to make it a composite sample. Dry roots, grasses and other vegetative residual parts were discarded from the soil. One kg of composite sample was kept in the plastic container for chemical analysis. Wheat was selected for this experiment. Its varietal name is Gourave (BARI-20). The seeds were collected from the courtesy of Bangladesh Agriculture Research Institute (BARI), Gajipur. As a basal dose half of Urea and TSP fertilizers are mixed with the soil of each pot as respectively 240 kg ha^{-1} and 450 kg ha^{-1}. Then the soil was irrigated with tap water. Seeds were sown in the pot. After sowing soils were irrigated with tap water by sprinkler process when required. Weeding was done after 15 days of seedling. Another half of Urea and TSP were given in the pot on that day. Irrigation with saline water started after 55days of seedling. Each pot required 300 ml of saline water.

Plant samples were collected at three stage of the plant growth –early stage (ES=15 days after seedling), middle stage (MS= 55 days after seedling) and maturity stage (Mat= 100 days after seedling). The soil samples were collected in polythene bags for analyzing nutrient elements. At fully maturity stage the crops were harvested after 100 days of seedling. During harvesting the plants were cuts off at ground level and sun dried. The total N, P, K and S were determined by digestion with a mixture of conc. HNO_3 and $HClO_4$ [8]. Total P was determined by yellow color method [8] and S was estimated by turbidimetric method [9]. Lay out of the experiment is in Table 1.

Table 1: Layout of the experiment

Sonagazi soil									
Salinity level EC (dS m^{-1})	Control	Gypsum (kg ha^{-1})		Rice hull (t ha^{-1})		Gypsum + Rice hull			
		200	300	4	8	200 + 4	200 + 8	300 + 4	300 + 8
0	T_1	T_4	T_7	T_{10}	T_{13}	T_{16}	T_{19}	T_{22}	T_{25}
6	T_2	T_5	T_8	T_{11}	T_{14}	T_{17}	T_{20}	T_{23}	T_{26}
12	T_3	T_6	T_9	T_{12}	T_{15}	T_{18}	T_{21}	T_{24}	T_{27}
Badarkhali soil									
Salinity level EC (dS m^{-1})	Control	Gypsum (kg ha^{-1})		Rice hull (t ha^{-1})		Gypsum + Rice hull			
		200	300	4	8	200 + 4	200 + 8	300 + 4	300 + 8
0	T_{28}	T_{31}	T_{34}	T_{37}	T_{40}	T_{43}	T_{46}	T_{49}	T_{52}
6	T_{29}	T_{32}	T_{35}	T_{38}	T_{41}	T_{44}	T_{47}	T_{50}	T_{53}
12	T_{30}	T_{33}	T_{36}	T_{39}	T_{42}	T_{45}	T_{48}	T_{51}	T_{54}

3. RESULTS AND DISCUSSION

Nitrogen

The present investigation revealed that the total nitrogen content of straw decreased with the increased of salinity levels (Fig. 1 and 2). Peak values of N concentration were found with the treatment of $EC_0G_{300}H_8$ in both Sonagazi and Badarkhali saline soils, which indicated that the combined application of gypsum at the rate of 300 kg ha^{-1} and rice hull of 8 t ha^{-1} were the best treatment among all the combinations. In Sonagazi saline soil, the maximum N content was 62 C mol kg^{-1} and in Badarkhali saline soil, it was 69.88 C mol kg^{-1} at maturity. The minimum concentration 55.14 C mol kg^{-1} of N was found in $EC_{12}G_0H_8$ (T_{12}) at Sonagazi soils but in Badarkhali saline soils, the minimum N was 60.6 mol kg^{-1} in the $EC_{12}G_0H_0$ (T_{30}).The concentration of N in wheat significantly varies with the application of gypsum at the rate of 200 and 300 kg ha^{-1} both in Sonagazi and Badarkhali saline soils. The N uptake by wheat was obtained high where gypsum was applied at the rate of 300 kg h^{-1}. Rice hull at the rate of 8 t ha^{-1} was comparatively better in both soils, which significantly varied with the application of rice hull at 4 t ha^{-1}. Almost similar results were reported by several scientists. Salinity reduced nitrogen accumulation in plants [10]. A drastic reduction in leaf nitrate concentration was observed in response to salinity [11]. Higher SAR value or conductivity of the irrigated water decreased the nitrogen content of different crops [12]. In present study, the combined application of gypsum and rice hull was effective in increasing the uptake of N by wheat under saline soil even with the higher saline irrigation. Presumably the supply of Ca and S from gypsum might have helped in N uptake by wheat.

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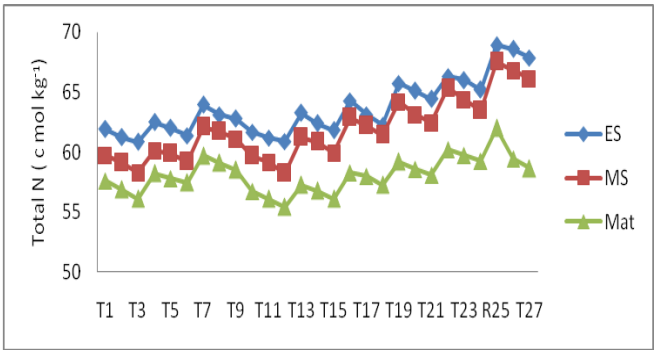

Fig1: Effect of gypsum, rice hull and salinity on the content of N in wheat at different growth stage that grown on Sonagazi saline soils

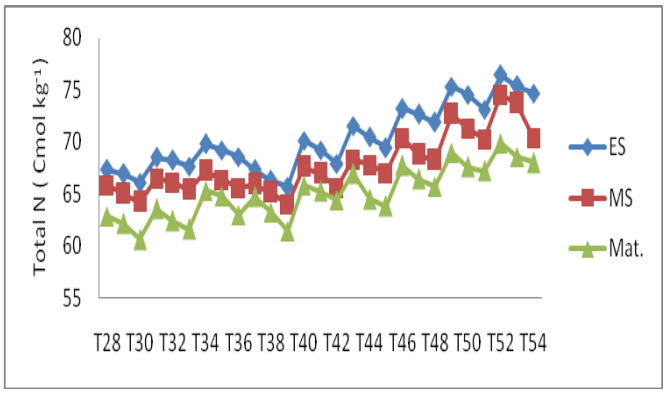

Fig 2: Effect of gypsum, rice hull and salinity on the content of N in wheat at different growth stage that grown on Badarkhali saline soils.

Phosphorous

Concentration of P was determined maximum at EC_0 and decreased with the higher EC of water. Phosphorous concentration were maximum with the treatment $EC_0G_{300}H_8$ in both saline soils at all growth stage, which indicate that the combined performance of gypsum 300 kg ha^{-1} and rice hull 8 t ha^{-1} were the best treatment among the all treatments (Table 2 and 3).

The concentration of P in wheat significantly varies with the application of gypsum at the rate of 200 and 300 kg ha^{-1} both in Sonagazi and Badarkhali saline soils. Uptake of P by wheat was obtained high where gypsum was applied at the rate of 300 kg h^{-1}were applied. In both soils P uptake with the application of 300 kg ha^{-1} significantly ($P \leq 0.05$) varied at the maturity stage of wheat though higher level of saline water had applied. Rice hull at the rate of 8 t ha^{-1} was comparatively better in both soils, which significantly ($P \leq 0.05$) varied with the application of rice hull at 4 t ha^{-1}. A negative relationship between the P content of plant and salinity was observed [13].

Potassium

Potassium content in wheat plant significantly decreased with increased levels of salinity (Fig: 3 and 4). These decreased in content and uptake of the K may be attributed to an antagonistic effect between K and Na [14, 15]. The K content also gradually decreased with the advent of time. In both soils at the treatment $EC_0G_{300}H_8$ the concentrations of K were maximum, which indicate that the combinations between gypsum 300 kg ha^{-1} and rice hull 8 t ha^{-1} were the best treatment among the all combinations. In Sonagazi saline soil the maximum value of K was 39.40 C mol kg^{-1} and in Badarkhali saline soil the value was 82.38 C mol kg^{-1} at maturity.

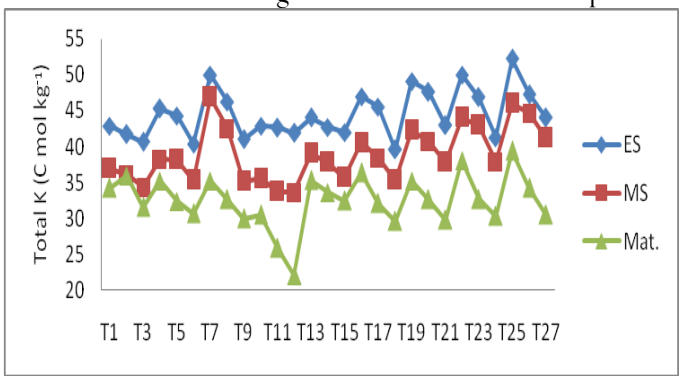

Fig 3: Effect of gypsum, rice hull and salinity on the content of K in wheat at different growth stage that grown on Sonagazi saline soils.

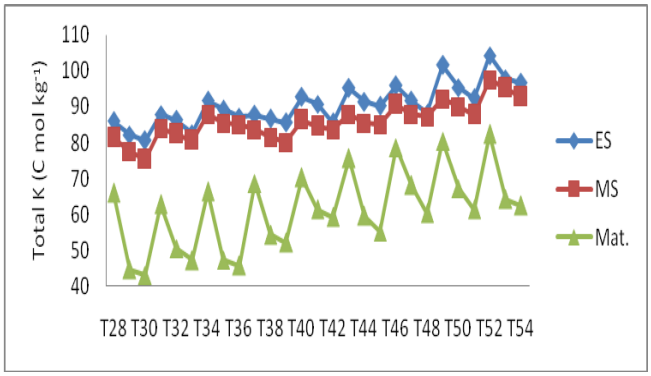

Fig 4: Effect of gypsum, rice hull and salinity on the content of K in wheat at different growth stage that grown on Badarkhali saline soils.

Table 2: Comparison of P content of wheat (BARI-20) on Sonagazi soil at different stage of growth as influenced by added gypsum and rice hull in association with alternate saline water irrigation

Salinity (EC)/ Gypsum (G)	Rice hull(H): t ha^{-1} 0 kg ha^{-1}	4 kg ha^{-1}	8 kg ha^{-1}	EC-Mean	G-Mean
a) Total P at Early Stage					
G (0 kg ha^{-1})					
0 dS m^{-1}	23.51	33.68	39.05	32.08	30.62 a
6 dS m^{-1}	32.05	32.73	37.94	31.24	
12 dS m^{-1}	22.54	32.53	30.57	28.55	
G (200 kg ha^{-1})					
0 dS m^{-1}	34.12	40.25	32.25	35.54	34.65 b
6 dS m^{-1}	33.94	39.04	30.85	34.61	
12 dS m^{-1}	32.79	38.51	30.12	33.81	
G (300 kg ha^{-1})					
0 dS m^{-1}	36.02	42.00	45.68	41.23	40.45 c
6 dS m^{-1}	35.28	41.56	44.07	40.30	
12 dS m^{-1}	34.92	40.50	44.00	39.81	
H-Mean	30.69A	37.87 B	37.17 B		
b) Total P at middle stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	21.78	31.34	37.50	30.21	28.09 a
6 dS m^{-1}	20.12	30.53	36.61	29.09	
12 dS m^{-1}	20.25	29.67	25.00	24.97	
G(200 kg ha^{-1})					
0 dS m^{-1}	30.24	37.10	27.94	31.76	29.99 a
6 dS m^{-1}	28.56	34.27	27.20	30.01	
12 dS m^{-1}	26.32	32.50	25.81	28.21	
G(300 kg ha^{-1})					
0 dS m^{-1}	34.28	35.40	39.50	36.39	34.90 b
6 dS m^{-1}	32.22	34.90	38.72	35.21	
12 dS m^{-1}	30.25	32.42	36.66	33.11	
H-Mean	27.11 A	33.13 B	32.77 B		
c) Total P at maturity stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	20.17	23.79	25.61	23.19	22.94 a
6 dS m^{-1}	20.03	23.90	24.54	22.82	
12 dS m^{-1}	20.16	24.23	24.02	22.80	
G(200 kg ha^{-1})					
0 dS m^{-1}	23.80	25.92	23.03	24.25	24.36 a
6 dS m^{-1}	23.52	24.72	25.61	24.62	
12 dS m^{-1}	22.04	24.54	26.02	24.20	
G(300 kg ha^{-1})				26.97	
0 dS m^{-1}	25.81	27.54	27.55	27.22	26.76 b
6 dS m^{-1}	27.42	26.84	27.41	26.10	
12 dS m^{-1}	26.02	26.25	26.04		
H-Mean	23.22 A	25.30 A	25.54 B		

In a column and row, means followed by a common letter are not significantly differ at 5 per cent level by DMRT

Table 3: Comparison of P content of wheat (BARI-20) on Badarkhali soil at different stage of growth as influenced by added gypsum and rice hull in association with alternate saline water irrigation

Salinity (EC)/ Gypsum (G)	Rice hull(H): t ha^{-1} 0 kg ha^{-1}	4 kg ha^{-1}	8 kg ha^{-1}	EC-Mean	G-Mean
a) Total P at Early Stage					
G (0 kg ha^{-1})					
0 dS m^{-1}	36.44	41.63	47.11	41.73	38.04 a
6 dS m^{-1}	32.61	37.24	41.25	37.03	
12 dS m^{-1}	31.25	34.61	40.21	35.36	
G (200 kg ha^{-1})					
0 dS m^{-1}	39.45	48.94	50.36	46.25	43.49 b
6 dS m^{-1}	36.92	44.42	48.91	43.42	
12 dS m^{-1}	35.63	41.25	45.55	40.81	
G (300 kg ha^{-1})					
0 dS m^{-1}	42.31	53.68	60.10	52.03	48.71c
6 dS m^{-1}	37.81	51.54	55.55	48.30	
12 dS m^{-1}	35.88	48.27	53.20	45.79	
H-Mean	36.48 A	44.62 B	49.14 C		
b) Total P at middle stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	30.25	35.64	41.95	35.95	34.14 a
6 dS m^{-1}	28.67	35.06	40.52	34.75	
12 dS m^{-1}	27.02	32.94	35.22	31.73	
G(200 kg ha^{-1})					
0 dS m^{-1}	34.34	42.35	46.94	41.21	39.56 b
6 dS m^{-1}	32.11	40.68	46.05	39.61	
12 dS m^{-1}	32.04	39.26	42.25	37.85	
G(300 kg ha^{-1})					
0 dS m^{-1}	39.12	47.25	55.97	47.45	45.15 c
6 dS m^{-1}	35.66	46.29	51.92	44.62	
12 dS m^{-1}	34.95	43.61	51.54	43.37	
H-Mean	32.68 A	40.33 B	45.82 C		
c) Total P at maturity stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	27.03	24.05	23.90	24.99	24.96 a
6 dS m^{-1}	24.23	25.97	25.97	25.39	
12 dS m^{-1}	23.53	23.97	26.02	24.51	
G(200 kg ha^{-1})					
0 dS m^{-1}	20.03	25.61	26.02	23.89	24.31 a
6 dS m^{-1}	20.16	25.97	26.35	24.16	
12 dS m^{-1}	24.72	25.92	23.97	24.87	
G(300 kg ha^{-1})					
0 dS m^{-1}	22.43	27.51	30.42	26.79	27.41 b
6 dS m^{-1}	25.81	28.05	31.24	28.37	
12 dS m^{-1}	23.65	27.55	30.04	27.08	
H-Mean	23.51A	26.07 B	27.10 B		

In a column and row, means followed by a common letter are not significantly differ at 5 per cent level by DMRT

The individual applications of gypsum and rice hull were not significant for the K content of wheat in both soils. K uptake by wheat with individual application of gypsum 300 kg ha^{-1} or rice hull of 8 t ha^{-1} was comparatively better in both soils, which significantly varied with the other application of gypsum or rice hull. The accumulation of K content in wheat straw decreased with the increased of soil salinity [16].

Sulphur

The combined application of gypsum 300 kg ha^{-1} and rice hull 8 t ha^{-1} was the best treatment among the all combinations in both Sonagazi and Badarkhali saline soils though both soils were irrigated with higher level of saline water. In Sonagazi saline

soils the maximum value of S was 46 C mol kg^{-1} and in Badarkhali the value was 47.61 C mol kg^{-1} at maturity. The minimum concentration of S 33.62 C mol kg^{-1} was found in $EC_0H_4(T_{10})$ in Sonagazi soil but in Badarkhali saline soils the minimum value of S was found 25.15 C mol kg^{-1} in $EC_0G_0(T_1)$. The individual applications of gypsum and rice hull and the combination of gypsum and rice hull were significant ($P \leq 0.05$) for the S content in wheat in both Sonagazi and Badarkhali saline soils (Table 4 and 5). The S uptake by wheat was high where gypsum at the rate of 300 kg ha^{-1} was applied. Rice hull at the rate of 8 t ha^{-1} was comparatively better in both soils, which significantly ($P \leq 0.05$) vary with the application of rice hull at the rate of 4 t ha^{-1}

Table 4: Comparison of S content of wheat (BARI-20) on Sonagazi soil at different stage of growth as influenced by added gypsum and rice hull in association with alternate saline water irrigation

Salinity (EC)/ Gypsum (G)	Rice hull(H): t ha^{-1} 0 kg ha^{-1}	4 kg ha^{-1}	8 kg ha^{-1}	EC-Mean	G-Mean
a) Total S at Early Stage					
G (0 kg ha^{-1})					
0 dS m^{-1}	64.37	60.92	64.96	63.42	67.14a
6 dS m^{-1}	67.22	64.35	70.18	67.25	
12 dS m^{-1}	67.42	70.25	74.55	70.74	
G (200 kg ha^{-1})					
0 dS m^{-1}	64.15	63.81	71.51	66.49	69.95a
6 dS m^{-1}	65.36	70.70	75.15	70.40	
12 dS m^{-1}	68.48	73.99	76.43	72.97	
G (300 kg ha^{-1})					
0 dS m^{-1}	62.22	72.19	75.64	70.01	72.85a
6 dS m^{-1}	65.94	74.63	77.45	72.67	
12 dS m^{-1}	70.55	77.45	79.57	75.86	
H-Mean	66.19A	69.81A	73.94B		
b) Total S at middle stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	40.64	41.94	42.00	41.53	42.40 a
6 dS m^{-1}	41.75	42.67	42.73	42.38	
12 dS m^{-1}	42.88	42.92	44.08	43.30	
G(200 kg ha^{-1})					
0 dS m^{-1}	40.36	39.57	42.94	40.96	44.64 a
6 dS m^{-1}	44.34	45.55	47.64	45.84	
12 dS m^{-1}	45.36	47.00	49.15	47.13	
G(300 kg ha^{-1})				42.10	
0 dS m^{-1}	40.98	41.29	44.03	46.81	46.56 b
6 dS m^{-1}	46.29	46.84	47.29	50.77	
12 dS m^{-1}	50.04	50.00	52.26		
H-Mean	43.61 A	44.20 A	50.69 B		
c) Total S at maturity stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	34.38	33.62	35.64	34.55	35.86 a
6 dS m^{-1}	36.12	33.75	37.77	35.88	
12 dS m^{-1}	36.88	35.55	39.03	37.15	
G(200 kg ha^{-1})					
0 dS m^{-1}	35.36	35.31	37.83	36.17	38.54 a
6 dS m^{-1}	38.20	38.47	40.73	39.13	
12 dS m^{-1}	38.25	40.53	42.22	40.33	
G(300 kg ha^{-1})					
0 dS m^{-1}	35.15	37.94	41.23	38.11	42.38 b
6 dS m^{-1}	42.55	42.94	44.68	43.39	
12 dS m^{-1}	46.88	44.02	46.00	45.63	
H-Mean	38.20 A	38.01 A	40.57 B		

In a column and row, means followed by a common letter are not significantly differ at 5 per cent level by DMRT.

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Table 5: Comparison of S content of wheat (BARI-20) on Badarkhali soil at different stage of growth as influenced by added gypsum and rice hull in association with alternate saline water irrigation

Salinity (EC)/ Gypsum (G)	Rice hull(H): t ha^{-1}			EC-Mean	G-Mean
	0 kg ha^{-1}	4 kg ha^{-1}	8 kg ha^{-1}		
a) Total S at Early Stage					
G (0 kg ha^{-1})					
0 dS m^{-1}	50.39	55.50	55.72	53.87	57.33 a
6 dS m^{-1}	53.22	58.67	61.25	57.71	
12 dS m^{-1}	56.34	61.50	63.37	60.40	
G (200 kg ha^{-1})					
0 dS m^{-1}	50.97	57.83	60.55	56.45	59.79 a
6 dS m^{-1}	57.25	60.76	62.95	60.32	
12 dS m^{-1}	58.67	63.98	65.14	62.60	
G (300 kg ha^{-1})					
0 dS m^{-1}	58.41	62.85	66.55	62.60	64.52 b
6 dS m^{-1}	60.12	65.50	67.10	64.24	
12 dS m^{-1}	63.85	66.04	70.25	66.71	
H-Mean	56.58 A	61.40 A	63.65 B		
b) Total S at middle stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	44.68	50.50	52.95	49.38	51.80 a
6 dS m^{-1}	48.94	52.67	55.24	52.28	
12 dS m^{-1}	50.36	54.14	56.75	53.75	
G(200 kg ha^{-1})					
0 dS m^{-1}	49.87	52.13	54.35	52.12	55.25 a
6 dS m^{-1}	54.13	59.94	58.22	56.43	
12 dS m^{-1}	54.57	57.58	59.51	57.22	
G(300 kg ha^{-1})					
0 dS m^{-1}	55.25	60.57	65.12	60.31	62.12 b
6 dS m^{-1}	58.34	62.04	66.50	62.29	
12 dS m^{-1}	59.52	63.54	68.22	63.76	
H-Mean	52.85 A	56.68 B	59.65 B		
c) Total S at maturity stage					
G(0 kg ha^{-1})					
0 dS m^{-1}	25.15	34.38	30.94	30.16	34.64 a
6 dS m^{-1}	31.40	35.94	36.71	34.68	
12 dS m^{-1}	35.15	37.56	44.53	39.08	
G(200 kg ha^{-1})					
0 dS m^{-1}	28.12	34.61	42.19	34.97	37.26 a
6 dS m^{-1}	33.59	35.16	43.70	37.48	
12 dS m^{-1}	36.72	37.50	43.75	39.32	
G(300 kg ha^{-1})					
0 dS m^{-1}	32.03	40.20	46.25	39.49	41.16 b
6 dS m^{-1}	36.72	40.51	46.90	41.38	
12 dS m^{-1}	37.50	42.68	47.61	42.60	
H-Mean	32.93 A	37.62 B	42.51 C		

In a column and row, means followed by a common letter are not significantly differ at 5 per cent level by DMRT.

In the present experiment it was found that the concentration of S in wheat increases with the increased level of salinity. The improved uptake of S might have been due to the synergistic effect of S of gypsum [17, 18]. The accumulation of S increased with the increased of salt concentration in the substrate [19].

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