RESPONSE OF WHEAT (TRITICUM AESTIVUM) TO FERTILIZERS IN THE COASTAL SALINE SOIL OF BANGLADESH.

A.C. Aich [1]
R. Mandal [2]
A. Iqbal [3]

ABSTRACT

A field experiment with fertilizers was conducted on wheat in the coastal saline soil of Satkhira for two consecutive years. Fertilizers were applied at the rate of 60, 80, 100, 120, kgha^{-1} of N; 40, 60, 80, 100 kgha^{-1} of P_2O_5 and 30, 40, 50, 60 kgha^{-1} of K_2O respectively in all possible combinations. In 1992 highest yield (4.36 t ha^{-1}) was obtained at 80-40-50 kg NPK ha^{-1}, This was followed by 4.22 t ha^{-1} was recorded for 100-40-50 kg NPK ha^{-1} which was followed by 4.59 tha^{-1} for 100-40-30 kg NPK ha^{-1}. From statistical analysis of two years results, It was indicated that for potential yield (av. 4.35 tha^{-1}) of Agrani variety of wheat in coastal saline soil, the levels per hectare of NPK may be recommended in the ratio of 100-80-30 kgha^{-1}.

INTRODUCTION

There are about 27 m ha of coastal saline soils in south and Southeast Asia (Akbar and Ponnamerum, 1982) of which approximately 1m ha occurs in Bangladesh (karim et al. 1990; Islam, 1992), Most of these areas of Bangladesh are monocropped with paddy grown during T. Aman season when the salinity of the soil is low, During the remaining period of the year, the land usually remain fallow due to higher salinity of soil and scarcity of quality irrigation water (Aich et al., 1993; Iqbal and Shoaib, 1993), Salt affected soil is very poor in N content and the large amount of applied N is lost through volatilization (Bandyopadhya, 1990). Consequently, application of N in such soil could significantly increase the yield of rice and wheat (Srivasta and Srivastava, 1992), Together with N, application of phosphate fertilizer has also been reported to enhance better growth and yield of crops under saline or sodic water irrigation (Gupta and Gupta, 1987). Singh and Swarup (1987) reported that supply of P can significantly increase grain and straw yield of wheat. In saline condition, plants take up excessive amounts of Na at the cost of K and Ca (Kuiper, 1984), Singh and Singh (1988) Observed that grain yield and uptake of P increased with increasing level of K upto 66 kg ha^{-1}. Ali et al. (1987) suggested that the assimilation of NH4-N and NO3-N increased in the presence of K resulting enhanced yield of wheat. However, information on the effect of applied N P K on growth and yield of crops in saline soils of Bangladesh is meagre. Thus, an experiment was conducted to evaluate impact of fertilization on yield of wheat in saline soil of Bangladesh for two consecutive years (1992 and 1993)

1. Deputy Chief Agriculture Survey Officer, Bangladesh Water Development Board, Dhaka
2. Professor, Department of Soil science, University of Dhaka, Dhaka- 1000.
3. Principal Scientific Officer (S & I), BARC, Farmgate, Dhaka

MATERIALS AND METHODS

The important physico-chemical properties of the soil before initiationn of the experiment were determined by standard methods (Table-1), N P K fertilizers were applied at the rate of 60, 80, 100 and 120 kg N Ha^{-1}; 40, 60 80 and 100 kg P_2-O_5 ha^{-1} and 30, 40, 50 and 60 kg K_2O_5 ha^{-1} respectively in all possible combinations, Sixty four treatments were arranged in a split plot design with three replications. P and K and half of N were applied as a basal dose and rest of the N was applied at crown root initiation stage of growth along witth irrigation water. Agrani variety of wheat was used as a test crop. The seeds were sown in the first week of December at the rate of 150 kg ha^{-1} in continuous line of 25 cm apart in 2.25 m^2 plot. Irrigation (5 cm) from reserve pond water (EC 1.5-2.0 dSm^{-1}) was given at crwon root initiation, booting, flowering and grain filling stages of growth Weeds were removed as and whenever appeared. At maturity (107 days) yields of grain was recorded

RESULTS AND DISCUSSION

Application of nitrogen individually showed an increase in average yield of wheat with the increase in level of fertilizer except the highest level in 1993. The value of yield ranged from 3.076 to 4.036 and 3.553 to 4.108 t ha^{-1} in the years 1992 and 1993 respectively (T^2-T^3). Similarly, fertilization with phosphorus also showed an average increase in yield of wheat grain with increasing dose of fertilizer ranging from 3.025 to 3.665 t ha^{-1} in the year 1992. The amount of yield in 1993 was not very promissing rather a slight decrement was observed (T^3). Application of K fertilizer also showed a similar behaviour in yield response of wheat in both the years (T^2-T^3), Higher levels of nitrogen and phosphorus produced significant increase in yield in the year 1992 over the lowest dose. Contrary to this, the average yield in 1993 due to phosphorus application was not significant when the higher doses were compared, However, the differences in yield among the higher levels of N and P fertilizers in most of the treatments were not statistically significant.

Results further showed that the yield of wheat

Table 1 Some physico-chemical properties of soil before initiation of the experiment.

Soil charactristics	1991-92	1992-93
Sand (%)	28.3	
Silt (%)	40.3	
Clay (%)	31.4	
pH	8.2	8.3
ECe dSm^{-1} at 25°C	4.2	4.6
Ttal N (%)	0.12	0.13
Available 'p' (mg Kg^{-1})	9.50	10.5
CEC (mgq/100g soil)	22.4	23.1
Exchangeable cations (meq/100g soil)		
Na	3.2	3.4
Ca	9.8	10.1
Mg	8.8	9.0
K	0.4	0.5
ESP	14.3	14.7
O.M. (%)	1.24	1.32

Table 2. Grain yield (t ha-1) of wheat (Agrani) under different combinations of N-P-K fertilizers in coastal saline soil of Satkhira during 1991-92.

Level N kg/ha	P kg/ha K kg/ha	40	60	80	100	Av. of K		Av. of N
60	30	2.835	2.855	3.168	3.208	3.016	3.706	3.076
	40	3.165	3.022	3.042	3.209	3.104		
	50	2.918	2.958	3.101	3.339	3.079		
	60	3.332	2.898	3.165	2.998	3.089		
80	30	3.605	3.685	3.718	4.075	3.771		3.730
	40	3.522	3.542	3.789	3.982	3.708	3.662	
	50	4.355	3.605	3.752	3.708	3.885		
	60	3.522	3.665	3.655	3.505	3.587		
100	30	3.688	3.734	4.102	4.219	3.935		3.819
	40	3.475	3.812	3.872	3.939	3.774		
	50	3.708	3.769	3.792	3.939	3.802	3.652	
	60	3.748	3.809	3.748	3.749	3.764		
120	30	3.855	4.209	4.262	4.072	4.100		4.036
	40	3.945	4.102	4.125	4.082	4.064		
	50	3.708	3.812	3.103	3.752	3.844		
	60	4.085	4.126	4.209	4.132	4.138	3.644	
Av. of	P	3.025	3.600	3.725	3.744	3.665		

DMRT (0.05) value for comparing any two adjacent yield = 0.534, Coefficient of variation (C.V.) - 9%

Table 3. Grain yield (tha-1) of wheat (Agrani) under different combinations of NPK fertilizers in coastal Saline soil of Satkhira during 1992-93.

Level N kg/ha	P kg/ha K kg/ha	40	60	80	100	Av. of K		Av. of N
60	30	3.502	3.502	3.502	3.628	3.533	3.910	3.553
	40	3.395	3.342	3.442	3.532	3.427		
	50	3.502	3.502	3.685	3.595	3.571		
	60	3.434	3.315	3.722	3.738	3.698		
80	30	3.655	3.405	3.782	3.812	3.663		3.727
	40	3.873	3.875	3.682	3.812	3.664	3.861	
	50	3.592	3.875	3.532	3.752	3.688		
	60	3.628	3.625	3.849	3.748	3.712		
100	30	3.812	4.249	4.592	4.125	4.195		4.137
	40	4.372	4.099	4.062	4.129	4.165		
	50	4.346	4.312	3.812	3.872	4.085	3.824	
	60	4.752	4.939	3.718	4.002	4.103		
120	30	3.962	4.442	4.142	4.469	4.249		4.108
	40	3.722	4.503	4.529	3.752	4.187		
	50	3.655	4.022	4.189	3.876	3.953		
	60	4.456	3.859	3.845	4.252	4.103	3.904	
Av. of	P	3.884	3.871	3.879	3.891	3.875		

DMRT (0.05) value for comparing any two adjacent yield = 0.363, Co-efficient of variation (C.V.) = 6%.

was much higher when N was applied at 80 kgha^{-1} or more compared to 60 kgha^{-1} of N at all levels of P and K in 1992 except for 40 kgha^{-1} of P and 50 khgh^{-1} of K (T^2). Application of 120 kgha^{-1} of N always gave higher yield at all levels of P and K (F-1). Sharma and Lal (1975) observed that increasing application of N upto 180 kgha^{-1} in wheat did not give response over 150 kgha^{-1} when irrigated with water having EC 6.3 dSm^{-1}. Bandyopadhy (1990) reported that salt affected soil is very poor in N content and loss of N from soil was higher in saline condition. Significant effect of N and P indicated that both N and P are major yield contributing nutrients in 1992 (T-1). Similarly, Singh et al (1990) proposed that the application of P considerably improved P content and uptake of wheat, the effect being more pronounced at high soil salinity. Addition of P significantly increased the grain and straw yield of wheat in saline soil were also reported by other investigators (Singh and Swarup, 1987; Gupta and Gupta, 1987). Furthermore, no significant interaction was observed among NPK fertilizers though a positive sign of interaction between N and K was evident at 40 kgha^{-1} of P (Fig-1)

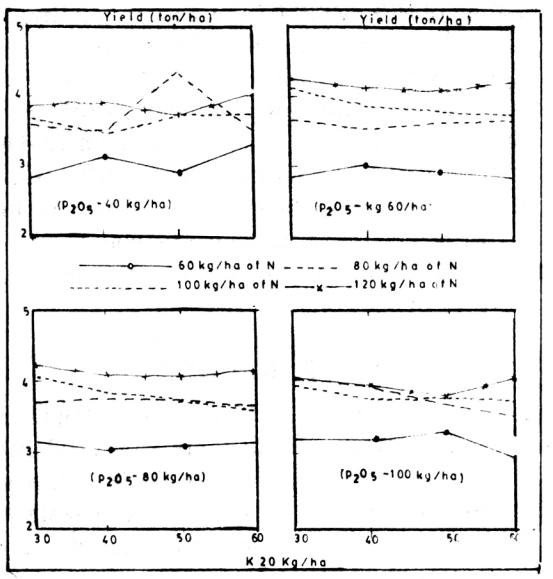

Fig. 1 Effeet of N P K on the yield of Agroni variety of wheal satkhira. 1991-92.
D M R T (5%) Volue for Comparing ony Two Adjacent yield 0.534
Coefficient of Varia- 6%

Biswas and Bhattacharya (1987) proposed that yield of rice could be improved by simultaneous application of N in conjunction with K. As a reason Ali et al. (1987) stated that assimilation of NH4-N and NO_3-N into protein decreased in absence of K in wheat plants. Srivastava and Srivastava (1992) also observed that the application of N in salt affected soil significantly increased the CEC of root and dry matter of wheat with an ultimate increase in grain yield.

The response of NPK on yield of wheat was better in 1993 than 1992. Statistical analysis revealed significant interaction among NPK fertilizers (Table 3). Dissimilar interaction in two consecutive years might be due to variation in rainfall. A total rainfall of 113.5 and 28.5 mm were recorded during growing period of the crop in 1992 respectively. High rainfall probably affected the respiration of wheat root resulting in a slightly lower grain yield. Results of 1992 further indicated that the highest yield (4.36 tha^{-1}) was obtained at 80-40-50 kgha^{-1} of NPK (F-1). However, in

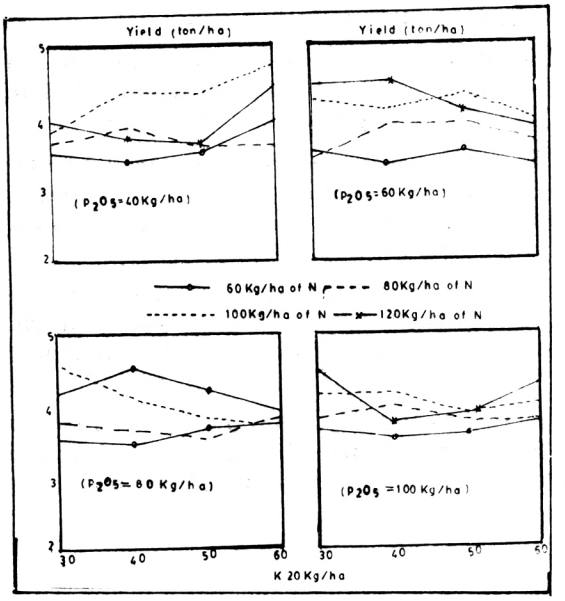

Fig. 2 Effeet of N P K on Theyield of Agrani Variety of Wheat Satkhira (19992-93)
DMRT (5%) for Comparing any two Adjacent yield= 0.363 Coefficient of Variation (c) = 6%

1993 this yield was 4.75 t ha^{-1} at 100-40-60 $kgha^{-1}$ of NPK (F-2). It is further noted that in both the years, the yield due to 100-80-30 $kgha^{-1}$ of NPK did not differ significantly from the corresponding highest yield. At this level of NPK, the yield was 4.10t ha^{-1} in 1992 and in 1993 this yield increased upto 4.59 tha^{-1}. Summerization of the results indicate that for growing wheat in coastal saline soil, the best level of NPK per hectare may be considered as 100-80-30 kg respectively.

REFERENCES

Aich, A.C., Mandal, R, Khan, E.H. and Sarker, O.H. (1993) Influence of salinity on yield and mineral composition of grains of wheat, barley, millet and cheena in some coastal soils of Bangladesh. J. Indian Soc. coastal agric, Res. 11 (2), 81-87.

Akbar, M. And Ponnamperuma (1982). Saline soils of South and South East Asia as potential rice lands. In Rice research strategies for the future. International Rice Research Institute. Los Banos, Philippines. P. 265-281.

Ali, A.A., Ikeda, M. and Yamada (1987), Effect of the supply of potassium, calcium and magnesium on the absorption, translocation and assimilation of ammonium and nitrate nitrogen in the wheat plants. Soil Sci. Plant Nutri, 33 (4): 585-594.

Bandyopadhyay, K.B. (1990). Fertility of salt affected soils in India. An overview of J. Indian Soc. Coastal Agric. Res. 8 (2), 61-78.

Biswas, R.C. and Bhattacharya (1987) Fertilizer management in rice under coastal saline soil condition. J. Indian Soc. coastal agric. Res. (5 (1), 61-66.

Gupta, S.R. and Gupta, C.I. (1987). Management of saline soils and water of India, Nohanprimlani for oxford and IBH publishing Co. Pvt. Ltd. New Delhi, India, 100-101.

Islam, A. (1992), A key note presented at Seventh Annual Bangladesh Science Conference. IPSA. Gazipur May 6-9.

Iqbal, A. and Shoaib, J. (1993). Evaluation of soil and water salinity for cropping in the coastal region of Bangladesh. J. NOAMI, 10(1), 12-18.

Karim. Z; Hussain, S.G. and Ahmed, M. (1990), Salinity problems and crop intensification in the coastal regions of Bangladesh BARC. Dhaka. Publication No- 33.

Kuiper, P.J.C. (1984). Functioning of plant cell membrane under saline conditions. Membrane and lipid composition and A T paser In: Salinity Tolerance in plants Eds. R.C. Staples and G.H. Toennicesen pp. 77-81. Wiley New york.

Nair, K.P.P., Khulbe, N.C. (1990). Differential response of wheat and barley genotypes to substrate-induced salinity under North Indian conditions. Experimental Agriculture. 26 (2), 221-225.

Sharma, G. and Lal, P. (1975). Effect of nitrogen level and leaching regimes on the use of saline water for wheat crop grown on sandy and clay loam soils. J. India Soc. Soil Sci. 23:302-309.

Singh, N.M., Anand Swarup, Sharma, P.D. and Rao, K.G.V.K. (1990). Influence of sub-surface drainage and phosphoruse application in soil salinity and uptake of phosphorus by wheat in saline soil. J. Indian Soc. Soil. Sci Vol. 38: 511-515.

Singh, B.P. and Singh, B.N. (1988). Response of rice (Oryzasativa) to potassium application under two water management practices. Indian Journal of Agril. Sciences. 58:11, 851-853.

Singh and Swarup. (1987). Performance of crops under different spacing and sub-surface drains and NPK levels in a saline soil. Annual Report. Central Soil Salinity Research Institute (CSSRI). p. 28-29.

Srivastava, K.A. and Srivastava, p.O. (1992). Cation-exchange capacity of roots in relation to response of fertilizer nutrients in salt affected soil. Indian Journal of Agricultural Sciences. 62 (3): 200-4.