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ABUNDANCE OF INDIGENOUS CYANOBACTERIA IN SALINE RICE FIELD ECOSYSTEM OF GANGES TIDAL FLOODPLAIN AS INFLUENCED BY K AND Zn

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The growth pattern of indigenous cyanobacteria in a saline rice field of Ganges Tidal Floodplain as influenced by applied K (0, 20, 40 kg ha^{-1}) and Zn (0, 2.5, 5.0 kg ha^{-1}) was assessed. Results showed that supplementation of lower rate of Zn stimulated the growth of cyanobacteria significantly. Contrary to this, higher level of Zn rather inhibited the propagation of cyanobacterial flora significantly. K also promoted the growth of cyanobacteria though not significantly. Interaction of the fertilizers acted positively and significantly to boost up the growth up to moderate level and thereafter a negative role was observed.

Keyword : Cyanobacteria; Potassium; Rice; Saline soil; Zinc.

Introduction

The role of algal biofertilizer particularly in tropical agriculture is now-a-days gaining momentum for dual reasons, firstly to maintain good soil health[1-7] and secondly to enrich the paddy field through molecular N_2 fixation[1-12]. The paddy field ecosystem provides an environment favourable for the growth of cyanobacteria ; however, their relative occurrence varies with large limits[9,10]. The growth behaviours of blue green algae in normal agricultural soils have been studied extensively[3,10]. However, very little is known about their quantitative incidence in problem soil for instance saline soil[9,12]. A vast rice growing area of Bangladesh comprises the floodplain zone. The southern part of Bangladesh partly encompassed by salinity where the culture of rice is a common practice. However, very little work has been done on abundance of cyanobacteria in saline soil[13,14]. It would be therefore useful to check whether K and Zn in combination promote preferentially the indigenous cyanobacterial flora in saline rice field.

Material and Methods

A rice based field experiment was arranged during *Boro* season in a salinity induced field of Ganges Tidal Floodplain at Teligati in Khulna district. Three rates of each of potassium (0, 20, 40 kg ha^{-1}) and zinc (0, 2.5, 5.0 kg ha^{-1}) in all possible combinations were applied in the experiment as MP and $ZnSO_4 \cdot 7H_2O$ respectively. Nitrogen (50% of 110 kg N ha^{-1}, urea) and phosphorus (60kg P ha^{-1}, TSP) were applied as basal fertilizers. Rest 50% of nitrogen was applied at maximum tillering stage of the crop. A full factorial combination of K_0Zn_0, $K_0Zn_{2.5}$, $K_0Zn_{5.0}$, $K_{20}Zn_0$, $K_{20}Zn_{2.5}$, $K_{20}Zn_5$, $K_{40}Zn_0$, $K_{40}Zn_{2.5}$ and $K_{40}Zn_5$ treatments were allocated according to a randomized block design. The experimental plot was mechanically ploughed, watered and leveled. The plot was divided into three blocks. Each block was again sub-plotted into nine units. The size of the unit plot was 4m x 2m separated from one another by levy. Healthy and uniform rice seedlings of HYV BR-28 (30 days old) collected from seedbed were transplanted at the rate of 3 seedlings hill^{-1} . The hill to hill distance was 6 inches. Agronomic practices were done accordingly required up to the ripening stage of the crop. Samples of soil (0 to 15cm) were collected at 30, 60 and 90 days of transplantation to enumerate the abundance of indigenous cyanobacteria following standard MPN method.

Results and Discussion

From Table 1 it is apparent that variable number of cyanobacterial flora was observed due to variation of applied doses of potassium and zinc alone and in combination at 30, 60 and 90 days of transplantation of rice seedlings in the salinity induced field.

At 30 days of transplantation, application of potassium at lower level (20 kg K ha^{-1}) caused a nonsignificant increase in the growth of cyanobacterial flora ranging from 22.90 × 10^4 to 25.33 × 10^4g^{-1} soil.

Table 1. Effect of potassium and zinc on the growth of indigenous cyanobacteria (×10^4 g^{-1} soil) in rice field of Teligati at 30, 60 and 90 days of transplantation.

Treatments	Days of transplantation		
	30	60	90
K_0Zn_0	22.90 ef	27.27 cde	23.43 c
$K_0Zn_{2.5}$	44.97 a	62.83 a	53.83 a
K_0Zn_5	19.13 f	24.87 de	21.63 cd
$K_{20}Zn_0$	25.33 de	26.83 cde	21.43 cd
$K_{20}Zn_{2.5}$	31.17 c	37.53 b	32.30 b
$K_{20}Zn_5$	28.47 cd	32.27 bc	26.83 bc
$K_{40}Zn_0$	27.67 cd	29.23 cd	26.30 c
$K_{40}Zn_{2.5}$	40.80 b	24.37 de	23.70 c
$K_{40}Zn_5$	19.33 f	21.73 e	16.27 d

Level of significance, $P = 0.05$.

In a column figures having similar letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly as per DMRT.

Results showed that when potassium was applied at the rate of 40 kg ha^{-1}, cyanobacterial flora increased in number significantly accounting about 20.8 % higher than that of the control. It may be noted that the difference between K treatments was not significant at all so far growth of cyanobacterrial flora is concerned. Moderate dose of K (20 kg ha^{-1}) caused about only 10.6 % more in growth of cyanobacteria than the control. However, application of moderate dose of zinc (2.5 kg Zn ha^{-1}) showed a significant increase in the number (22.90 × 10^4 to 44.97 × $10^4 g^{-1}$ soil) of cyanobacteria. Zinc added at the rate of 5 kg ha^{-1} caused a nonsignificant decrease in the number of cyanobacterial flora from 22.90 × 10^4 to 19.13 × $10^4 g^{-1}$ soil.

Results further showed that application of the highest rate of zinc interacted negatively with the highest rate of potassium on the growth of cyanobacterial flora causing a drastic reduction in the number of the same accounting to 19.33 × 10^4 from 44.97 × $10^4 g^{-1}$ soil significantly when compared with lower dose of Zn applied *i.e.* 2.5 kg ha^{-1}. It has been observed that interaction of K × Zn at their highest dose resulted a significant decrease only in comparison to their individual effects except the highest level of Zn though not significantly. The rest of the interactions revealed no significant change irrespective of the doses of Zn applied with lower dose of K.

At 60 days of transplantation, maximum number of cyanobacterial flora (62.83 × $10^4 g^{-1}$ soil) was observed in the treatment having 2.5 kg Zn ha^{-1}. The number of cyanobacterial flora was recorded to be 37.53 × $10^4 g^{-1}$ soil when 2.5 kg Zn and 20 kg K ha^{-1} combindly applied to the soil. The lowest number of cyanobacterial flora (21.73 × 10^4 g^{-1} soil) was found in the treatment receiving 5 kg Zn along with 40 kg K ha^{-1}.

At 90 days of transplantation of rice seedlings, when the soil sample was analysed for cyanobacterial population, the highest number of cyanobacteria (53.83 × $10^4 g^{-1}$ soil) was recorded in the plot treated with moderate dose of Zn (2.5 kg ha^{-1}) only. The second highest number of cyanobacterial flora (32.30 × $10^4 g^{-1}$soil) was accounted in the plot supplemented with 2.5 kg Zn and 20 kg K ha^{-1} together. The lowest number of cyanobacterial flora (16.27 × $10^4 g^{-1}$ soil) was observed in the treatment where the highest amount of Zn and K were applied combindly. This number was found to be even less than that of the control. The variation was marked to be statistically significant. Thus, from Table1 it is apparent that the highest number of cyanobacteria was recorded when moderate dose of zinc was applied in the rice field.

The results demonstrated that supply of K enhanced the number of cyanobacteria with the amount applied though not significantly. The results further showed that the highest dose of K (40 kg ha^{-1}) applied in the experiment was found to be ineffective to promote the number of cyanobacteria significantly. Contrary to this, the highest dose of Zn was ascertained to be nonsignificantly toxic and inhibitory in comparison to the control so far the growth of cyanobacteria is concerned in the rice field under experiment (Table 1).

The growth of cyanobacteria increased up to 60 days *i.e.* at maximum tillering stage and then fall at 90 days of transplantation in all the treatments (Table 1). Similar views were expressed by Roger and Raymond[15] in Senegal. In contrast, maximal preponderance of algal biomos was recorded a little later in wetland rice of India[16]. Watanabe and Alimagno[17] further reported that algal density reached to maximum just after heading of rice crop during dry season in the Philippines. Roger and Raymond[18] concluded that cyanobacteria are generally sensitive to high light intensities and may be regarded as low light species . Luxuriant canopy produced after two months in transplanted rice can decrease light intensities up to 95% and plants attaining 60cm height can cut off 90% of light[19].

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