IMPACT OF BORON ON RELEASE OF MINERAL-N FROM WATER HYACINTH IN COASTAL AND ALLUVIAL SOILS

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The impact of boron (0, 1.25, 2.50, and 3.75 $\mu g\ B\ g^{-1}$) on release of mineral-N from decomposed water hyacinth (*Eichhornia crassips*) (50 mg N 100 g^{-1} soil) in coastel floodplain, acid sulphate and alluvial soils in an incubation experiment has been examined. Results revealed that application of boron caused a significant release of mineral-N from added water hyacinth at the initial phase with a subsequent fall in the same after 7 days of incubation. Release of mineral-N from water hyacinth increased significantly with added boron upto 2.5 $\mu g\ B\ g^{-1}$ in coastal floodplain and alluvial soils, and upto 3.75 $\mu g\ B\ g^{-1}$ in acid sulphate soil. Boron exerted a similar stimulatory effect on nitrogen mineralizing organism in all the soils.

Keywords: *Boron; Coastal soils; N-Mineralization; Water hyacinth.*

Introduction

Water hyacinth (*Eichhornia crassips*) is a common indigenous source of organic matter generally in Haor and Beel areas occurring in most of the districts of Bangladesh. Farmers usually use decomposed water hyacinth particularly in low land rice fields. Sometimes, they also use it as a source of nutrients after burning for various rabi crops especially in areas where it grows luxuriantly during rainy season due to flooding of the lands at least for 3 to 6 months.

Water hyacinth contain an appreciable proportion of nitrogen (1.63%). Nevertheless, it is of no use for the growing plants unless gets mineralized and becomes avaliable. However, release of organically bound nitrogen is a microbial process and is influenced by a number of abiotic factor. The significant positive role of nitrogenous and phosphatic fertilizers in nitrogen mineralization has already been established. Literature review suggests that significance of trace elements in nitrogen metabolism reaction in soil can not be overlooked [1-3]. However, due to limited information[4], an incubation experiment was designed to follow the effect of added boron on release of nitrogen from water hyacinth in coastal and alluvial soils of Bangladesh.

Materials and Methods

Samples of coastal floodplain, acid sulphate and alluvial soils were collected from Hatia, Badarkhali and Sara series belonging to the districts of Cox's Bazar and Munshiganj respectively. The samples were air-dried and grounded to pass through 100 mesh.

Decomposition of water hyacinth : Collected water hyacinth (*Eichhornia crassips*) sample was allowed to decompose in gunny bags for a period of one month in the net house. Water was added as and when required to maintain the moist condition. The sample was taken out, air dried and pulverized after stipulated time of decomposition.

Analytical Techniques : Both processed soil and decomposed water hyacinth samples were used for some physical and chemical analysis (Table 1). Determinations were made of pH (soil:water ratio of 1:2), cation exchange capacity (1N NH_4OAc)[5], exchangeable cations by atomic absorption spectrophotometer (PYE UNICAM SP 9), available sulphur colorimetrically[6-7], available boron[8-9], and water holding capacity (WHC)[10]. Estimations were done for organic carbon[11], total nitrogen[12] and 2M KCl extractable available nitrogen[13].

Incubation Techniques : One hundred gram air dried coastal floodplain soil was taken into clean dry 500 ml Kilnar jars. The weighed samples were treated with 0, 1.25, 2.50 and 3.75 $\mu g\ B\ g^{-1}$ with and without 3.1g powdered decomposed water hyacinth to achieve 50 mg N 100 g^{-1} soil separately. Boron was added in the form of aqueous

Table 1. Certain physical and chemiacl properties of the soil and decomposed water hyacinth samples.

Soil	Texture	WHC (%)	pH	ECe (dSm^{-1})	Organic carbon	Total N	CEC	Exch. cations Ca	Mg	Na	K	Available N	S	B
					Per cent		meq 100 g^{-1} soil					mg 100 g^{-1}		
Coastal floodplain	SCL	63.6	7.1	0.92	0.95	0.10	17.61	3.21	4.35	6.51	3.62	3.64	0.10	0.09
Acid sulphate	SC	64.2	4.0	1.90	0.70	0.11	12.45	3.50	1.78	3.32	3.85	4.15	1.04	0.54
Alluvial	SL	61.3	6.6	0.34	0.20	0.07	8.91	2.41	1.93	0.25	4.32	4.04	0.50	0.03
Water hyacinth					24.80	1.63						4.20	0.09	0.001

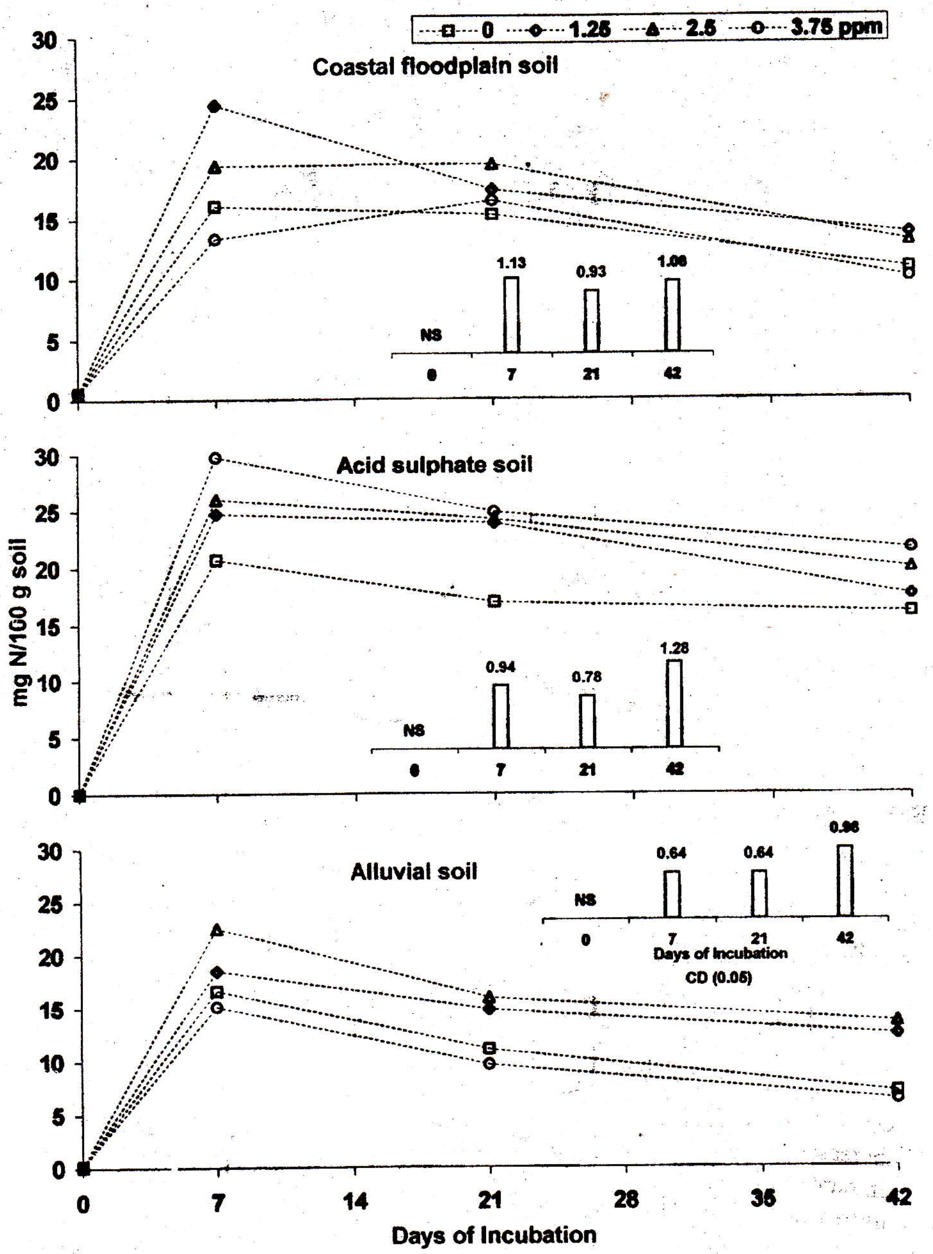

Fig.1. Effect of boron on release of mineral-N from water hyacinth in soil incubated at 50% WHC.

solution of reagent grade borax. Taking quantities of water added as solution into account, an extra calculated amount of water was added to bring the soil into 50% WHC. The jars were covered with perforated parafilm for diffusion of air and was placed at room temperature, 30^0 C ($\pm 0.5\ ^0$C). Eight treatments, in triplicate, were arranged in a completely randomized block design. Constant moisture content was maintained all through by making up the loss of moisture every day gravimetrically. Similar two other incubation experiments were conducted with acid sulphate and alluvial soils separately.

Samples of soil (5 g), in duplicate, from each treatment were collected at 0, 7, 21 and 42 days of incubation for 2M KCl extractable nitrogen and moisture. The amount of mineral-N (($NH_4 + NO_2 + NO_3$)-N) released from decomposed water hyacinth during mineralization was estimated from the following formula.

Mineralized N from water hyacinth = (Boron + water hyacinth treated)-N-(Boron treated)-N.

Results and Discussion

The release of mineral-N from decomposed water hyacinth as influenced by added boron in three soils has been assessed and the desults thus obtained are presented in Fig. 1.

Accumulation of mineral-N from water hyacinth showed a significant flush at 7 days of incubation and thereafter a gradual fall with time in all the soils incubated with boron (Fig. 1). The release in mineral-N increased significantly with the increase in amount of added boron in acid sulphate soil upto the concentration used. However, incorporation of highest level of boron (3.75 $\mu g\ B\ g^{-1}$)caused a significant decrease in release of mineral-N in alluvial soil all through the incubation period when compared with the control. This possibly suggests that 3.75 $\mu g\ B\ g^{-1}$ was found to be toxic so for the release of nitrogen from water hyacinth is concerned. However, addition of boron upto 2.5 $\mu g\ g^{-1}$ in coastal floodplain and alluvial soils and 3.75 $\mu g\ g^{-1}$ in acid sulphate soil was found to be playing a stimulatory role in promoting the activities of nitrogen mineralizing microorganisms resulting an accumulation of mineral-N from water hyacinth.

The initial release in mineral-N might be associated with the mineralization of easily decomposeable nitrogenous compounds present in water hyacinth. However, the subsequent fall in accumulation of mineral-N could possibly be due to the exhaustion of mineralizable nitrogen substrates of the N source used. in alluvial soil, instead of release, a significant immobilization occurred at 7 days of incubation. Nevertheless, the release of mineral-N delayed and showed an insignificant accumulation at 21 days of incubation.

It could be seen that about 26.6 to 48.8, 41.3 to 59.5 and 33.3 to 45.0 per cent of nitrogen from water hyacinth was released in coastal floodplain, acid sulphate and alluvial soils, respectively, during the initial phase of mineralization i. e. within the first 7 days of incubation. The initial rapid release of mineral-N is a quite common phenomenon in such soils[4] . The picture pattern in changes of mineral-N from water hyacinth was found to be very similar irrespective of the soils under investigation.

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