PAK. J. SOIL SCI., VOL. 13 (1-4), 1997

RESPONSE OF RICE TO NITROGEN AND ZINC FERTILIZATION WITH OR WITHOUT COPPER

S.M. Alam, A. Latif and Zafar Iqbal[1]

ABSTRACT

The soils of Pakistan are recognised to be deficient in available nitrogen (N),phosphorus(P) and zinc(Zn) but are believed to be adequate in copper(Cu). However, in certain soils application of zinc along with N and P fertilizers does not result in sizeable increase in crop yield. Application of these fertilizers to rice soils may induce Cu defeciency or it may enhance Cu requirement of rice at reproductive stage and hence may limit yield. Greenhouse pot experiments were conducted to test the hypothesis and ascertain the effect of Cu application on paddy yield. The result showed that on zinc deficient soils, application of Zn along with N reduced paddy yield drastically compared to N alone while the straw yield was not affected. The reduced paddy yield could be attributed to decreased number and weight of grains and low percentage of filled grains per panicle. Application of Cu along with Zn significantly increased the paddy yield over control or Zn alone application as well as Zn and Cu uptake by the plants. Therefore, addition of small amounts of Cu along with Zn should be encouraged to get optimum rice response from costly N and P fertilizer application.

INTRODUCTION

Almost all soils of Pakistan are alkaline and calcareous and are generally deficient in available nitrogen (N) and phosphorus(P) (Sillanpaa, 1982). A large number of these soils are also recognised to be deficient in available zinc(Zn) but are believed to be adequate in Copper(Cu) (Khattak *et al.*, 1988). Field trials (1994) found that all the soil samples were well supplied with Cu, but 50% of the associated plant samples were deficient in Cu content. Similarly Chhibba *et al.*(1988), in a survey of soils and associated rice plants in alkali land under reclamation found that while soil analyses (DTPA extractable) showed no Cu deficiency, leaf analysis indicated that 92% of the rice samples were suffering from Cu deficiency. Experiments conducted in pots using soil deficient in Zn showed that rice often produced similar or reduced dry matter yield with Zn application (Alam *et al.*, 1985; Tahir *et al.*, 1992). Analysis of whole shoots showed reduced concentration of Cu in the plants. It was therefore, suspected that application of N, P and Zn fertilizer to rice may stimulate plant growth but decrease Cu concentration in plants and limit yield at later stages of growth. The objective of the experiments reported here was to test the above hypothesis and to ascertain the effect of Cu application on rice growth and yield.

MATERIALS AND METHODS

Experiment 1. Bulk soil samples from the rice growing area of Mangtanwala (Sheikhupura) and NIAB farm (Faisalabad) were collected, crushed, passed through 2 mm sieve and 8 kg portions weighed into polythene lined plastic pots. The physico-chemical properties of soils are given in Table 1. Deionized water was added to the soil and left for three days to equilibriate. Eight seedlings (3 weeks old) of