Studies on the nutrition of rice plants

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CONCLUSIONSFour experiments were carried out on rice as anindicator plant. Two experiments out of the four wereconducted in greenhouse at Giza, the other two were conductedin the field at Kafr EI-Sheikh Governorate.The first pot experiment was initiated to study theeffect of phosphorus, iron and zinc fertilizations on drymatter yield, mineral content and uptake of rice plant. Thetreatments consisted of all possible combinations of threelevels of phosphorus 0, 60 and 120 ppm ; as superphosphate15% P20s' three levels of iron; 0,5 and 10 ppm,;!as FeS04.7H20and three levels of zinc; 0,5 and 10 ppm; as ZnS04.7 H20Each treatment was replicated three times in factorial designand arranged randomizely in the greenhouse. The soil usedin the experiment was clay loam.The first field experiment was carried-out to studythe effect of the fertilization with P, Fe and Zn on theyield and chemical composition of rice plant. In a factorialdesign, P, Fe and Zn were applied at levels equivalent to °(PO), 30 (Pl) and 60 (P2) Kg P20s/fed. as superphosphate;° (Fe 0), 3 (Fel) and 6 (Fe2) kg Fe Ifed as FeS04and O(ZnO)3(Zn 1">and 6 (Zn 2) Kg Zn/fed. as zns04• The soil where theexperiment was conducted was clay.-~ -~~--123The second pot experiment was devoted to study theeffect of nitrogen and manganese fertilization on dry matteryield, mineral content and uptake of rice plant. Three levelsof nitrogen and manganese., 0, 90 and 180 ppm N, as ammoniumsulphate and 0, 5 and 10 ppm Mn as MnS04were used. Theagronomic practices were the same as in the first pot experiment.The second field experiment was conducted to examinethe effect of soil fertilization with nitrogen and manganeseon the yield components and chemical composition of rice plant.The treatments consisted of all possible combinations ofthree levels of nitrogen; 0, 40 and 80 kgN/fed.; and threelevels of manganese; 0,3 and 6 kg Mn/fed. as MnS04.The Results obtained had shown the following1- Pot experiment (I)1.1. Dry weight of rice shoots and roots increased highlysignificant and progressively as a result of phosphorusapplication. Application of iron has a slightor no effect on increasing the dry weight of riceshoots and roots. Zinc application high significantlyincreased the dry weight of rice shoots and roots.1.2. Addition of phosphorus increased the beneficial effectof iron and zinc. Maximum dry matter yield of riceshoots and roots was obtained with application ofthe second levels of P, Fe and Zn.-- --~----- 124 -1.3. Application of phosphorus gradually increased P-contentof both shoots and roots. However, phosphorusefficiency tended to decrease upon increasing therate of P application especially for shoot fraction.Phosphorus content of rice shoots and roots did notshow a distinct response to the different treatmentsof iron and zinc, except for Zn2 level compined withPI level where a noticeable increase was observedonly with shoots fraction.1.4. Phosphorus uptake of rice shoots and roots highlysignificant increased with increasing the rate ofphosphorus application. Addition of iron has slightor no effect on the amount of phosphorus uptake byrice shoots, although the amount of phosphorus uptakenby rice roots increased as affected by thedifferent iron treatments.1.5 Application of Zinc has a significant increase onphosphorus uptaken by rice shoots and roots. Thehighest phosphorus uptake was recorded with thevJif; reatment of PI combined Fe2 and Zn2.1.6 Application of phosphorus led to increase the mean '/values of iron content of rice plants. However, theconcentration of iron of both shoots and roots tendedto decrease wity increasing the rate of phosphorusapplication. Iron content of rice plants progressivelyinceased with application of iron levels. On the other--- ~------- --~ ~---- 125-hand, application of first level of Zinc increasediron content of shoots and roots, but with increasingthe rate of applied Zinc, iron content diminished toalmost its content of control plants.1.7. Applioation of phosphorus highly significant increasedthe

amount of Fe-uptake of rice shoots and roots.Application of iron first level significantly increasediron uptake of shoots and roots, however theeffect of second level showed a slight increase.Addition of Zinc at the first level highly significantincreased iron uptake of rice shoots and roots; whilethe addition of the second level has a slight or noeffect on iron uptake of rice shoots and roots. Themutual effect of P, Fe and Zn showed statisticalinsignificancy on iron uptake of rice shoots and roots.1.8. Application of phosphorus gradually and highly significantincreased Zn-content and uptake of rice shootsand roots. Iron application has slight or no effecton Zinc-content and uptake of rice shoots. However._the effect of iron application was of a higher mangitudein decreasing Zn-content of roots fraction thanin shoots. Application of Zinc levels gradually andmaterially increased Zinc content and uptake of riceshoots and roots.1.9. Statistical analysis showed that the interactionbetween phosphorus and Zinc was significant in riceshoots, whereas was not significant with rice roots.The highest Zn-uptake was recorded for ”P11eo,zn2”treatment.2. Field experiment (I)2.1. Application of phosphorus up to the second levels,highly significant increased both straw and grainyield. Iron application has slight effect on ricestraw yield, but showed no effect on grain yield.Zinc application highly significant increased bothstraw and grain yield with increasing the rate ofapplied zinc.2.2. The interaction effect between phosphorus, iron andzinc on rice straw and grain was insignificant ,although the highest yield was recorded at~p~Fel~n2~treatment for straw and P2FelZn2 treatment for grains.2.3. Phosphorus application progressively increased phosphoruscontent and uptake of both straw and grainwithincreasing phosphorus levels. Iron applicationhas slight or no effect on phosphorus content anduptake of rice straw and grain. Zinc application hasslight effect on phosphorus content of straw andgrain. However, phosphorus uptake in both straw andgrain highly significant increased with znSo4applications.2.4. The interaction between phosphorus and zinc wassignificant in increasing phosphorus uptake of strawwhereas showed non significant effects on phosphorusuptake of grains.2.5. Application of phosphorus highly significant increasedFe-uptake ·of rice straw and grain at all rates of Papplication. Addition of FeS04 significantly increasedFe-uptake of straw, but has no effect on grain. Znapplication has slight effect on Fe-uptake of ricestraw, while Fe-uptake of rice grain significantlyincreased with increasing zinc fertilization.2.6. Phosphorus application at both levels used highly significantincreased Zn-uptake of rice straw and grain.The application of FeS04 at all levels of Zn applicationsignificantly decreased Zn-uptake of straw, butnot in grain. Zn application highly significant increasedZn-uptake of both straw and grain. A highlysignificant positive interaction between phosphorusand Zinc was recorded only in rice straw. The mutualeffects of phosphorus, iron and zinc showed insignificanteffect on the amount of zn-uptake of both ricestraw and grain.3~ Pot experiment (II):3.1. Dry matter of rice shoots and roots highly significantincreased with nitrogen applications ~p to 180 ppm.Dry weight of rice shoots and roots remains stableor slightly increased with application of manganese.3.2. Nitrogen content and uptake of rice shoots and rootssignificantly and progressively increased with applicationof nitrogen. Application of manganese showed noeffect on nitrogen content of rice plants, whilenitrogen uptake slightly increased with applicationof manganese sulphate. The mutual effect of nitrogenand manganese on nitrogen uptake of rice shoots androots was slight at all levels used, except with”N2,Hn2”treatment where the highest nit/rogen uptakewas recorded.3.3. Application of nitrogen highly significant increasedmanganese content and uptake of rice plants. Manganesecontent and uptake increased progressively with manganeseapplication for shoots. Nitrogen and manganeseinteraction on manganese uptaken was significant forshoots, but non significant for roots.4. Field experiment (II)4.1. Yields of both grain and straw high significantlyincreased with increasing nitrogen application.Application of MnS04 at the low dose resulted in aslight increase in rice dry weight, while the highdose tended to show an adverse effect. Applicationof nitrogen in presence of manganese caused a slightdecrease in the yields of rice grain and straw,especially at the higher dose of applied manganese.4.2. Application of nitrogen highly significant increasedthe nitrogen uptake of rice grain and straw withincreasing nitrogen application. The mutual effectof nitrogen and manganese application on nitrogenuptake of rice grains and straw was not significantat all levels used, however the highest nigrogenuptake was obtained with combination of N2,Mnl foreither rice grains or straw.4.3. Application of nitrogen significantly increasedmanganese content and uptake of rice plants. Themutual effect of nitrogen and

manganese on manganeseuptaken by rice straw and grains was not significant.