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Title:	SOLUBILITY RELATIONSHIPS OF IRON IN SOILS AND AMELIORATION OF ITS DEFICIENCY UNDER AEROBIC RICE
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Abstract: Aerobic rice is gradually catching the imagination of people due to water crisis threatening the sustainability of irrigated rice ecosystem across the globe. A gradual decline in the productivity of aerobic rice is associated with accentuation of deficiency of Fe in soils, because of insolubility of Fe(III) oxides. Rice is inherently a poor source of Fe and growing it on potentially Fe-deficient soils further reduces Fe concentration in grain. Because of the iron deficiency issues, biofortification of cereal crops with Fe has become a high-priority global issue. With a view to resolve the Fedeficiency syndrome under upland conditions, the solubility relationships of native forms of Fe as well as evaluation of the fertility status of heavy metals in contrasting soils was studied following the Baker soil test (BST) method with a FORTRAN (F- 77) program. A preliminary greenhouse experiment was conducted on calcareous soil to evaluate the effectiveness of soaked seeds of two rice cultivars (IR-64, Feinefficient and Pusa Sughand-3, Fe-efficient) in solutions of 0.5M FeSO4.7H2O, 0.25M FeSO4.7H2O and 0.05M Fe-EDTA for 12 and 24 hours before sowing. As a follow up to the preliminary experiment, second greenhouse experiment was conducted to evaluate the relative effectiveness of soil application (67 mg FeSO4.7H2O kg-1), foliar sprays (3% FeSO4.7H2O solution, thrice 40, 60 and 75 days after sowing of rice) and seed treatment (seed soaked in 0.05M Fe-EDTA for 12 hours) with Fe in alleviating Fe-deficiency using two rice cultivars (IR-64 and Pusa Sugandh-3) grown on alkaline, calcareous, acid and lime-treated acid soils. The results of Baker soil test indicated that the Fe3+ activity in all soils, except acid soils, nearly approached the theoretical solubility line of known minerals namely soil-Fe, amorphous, maghemite and lepidocrocite. The acid soils were sufficient for Fe in term of quantity and intensity factor based on BST rating, while alkaline soils were sufficient only in labile Fe. The rice plant-Fe content and yield of rice were positively associated with intensity parameter of Fe in different soils. The results of preliminary greenhouse experiment showed that significantly higher content of Fe2+ and dry matter yield under soaked with 0.05M Fe-EDTA solutions for 12 hours. Pusa Sugandh-3 performed better under aerobic condition compared to IR-64. Under second greenhouse study, response of both the cultivars was similar to that observed under preliminary experiment. Supplementation of Fe through soil application caused improvement in the DTPA and NH4OAc extractable Fe in soils. The foliar application of Fe (3% FeSO4.7H2O solution, thrice 40, 60 and 75 days after sowing of rice) was more effective and economical in correcting Fe-deficiency, enhancing the yield as well as increasing Fe content of milled rice (grain) grown under aerobic condition as compared to soil application. Ferrous-iron content in rice plants proved to be a better index of Fe nutrition status compared to total plant Fe and chemically extractable soil Fe. The Fe2+ content of ≥ 42 mg kg-1 in plants (on dry weight basis) appeared to be an adequate level at 45 days after sowing for direct seeded rice grown under upland aerobic condition. Among the soils, acid soil (without lime) produced highest yield of aerobic rice followed by alkaline, calcareous and lime-treated acid soils

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