

Effect of soil amendments on yield and iron content of rice in iron toxic soil

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ABSTRACT

A field experiment was conducted in an iron toxic soil (*Aeric Haplaquept*) to study the effect of fly ash, lime, potash, zinc and manganese on yield and iron content of rice plant. Symptoms of iron toxicity were appeared at 25-30 days after transplanting (DAT) and bronzing symptoms were scored as per IRRRI standards (1-6 scale). The score values ranged from 3-8 in susceptible Jajati variety and from 1-3 in tolerant Mahsuri variety. The mean grain yield and iron concentration in leaf ranged from 19.04 to 24.29 q ha⁻¹ and 719.10-936.85 ppm, respectively with application of NPK only (control). By application of different soil amendments the grain yield increased by 10.93 to 63.95 per cent and iron content in plant reduced by 2.73 to 43.04 per cent over control. Among the soil amendments lime and zinc were found superior to other soil amendments. However, fly ash, a by product of thermal power plant with high silica content can be used as a low cost amendment for correction of iron toxicity.

Key words : Iron toxicity, Tolerance to iron, Soil amendments, Integrated approach.

Iron toxicity occurs in hill bottom red and lateritic soils (alfisol, oxisol, ultisol) under undulating topography and impeded drainage condition. Rice shows bronzing symptoms when iron in the soil solution ranged from 10-1680 ppm (De and Mandal, 1957). Sahu (1968) reported that wetland rice in states of Orissa, Bihar, Madhya Pradesh and West Bengal suffered since a long time due to excess iron or iron toxicity. Verma and Tripathi (1989) reported that about 42 per cent of wetland rice in Himachal Pradesh showed bronzing symptoms. Iron toxicity has been reported to reduce low land rice yield by 12-100 per cent depending on the intensity of iron toxicity and tolerance of rice cultivars (Sahrawat *et al.*, 1996).

In Orissa about 0.75 lakh hectare of wet land rice suffered due to iron toxicity (Sahu *et al.*, 2001) and the yield level was as low as 5 q ha⁻¹ (Jena, 2002). Keeping this in view a field experiment was conducted during 2000 and 2001 *kharif* season on iron toxic soil at Central Research Station, Orissa University of Agriculture and Technology, Bhubaneswar to study the effect of different soil amendments on rice yield and nutrient content of rice plant.

MATERIALS AND METHODS

The soil of the experimental site is an *Aeric Haplaquept* derived from highly weathered material with pH 5.1, sandy loam texture, CEC 5.0 c mol (p+) kg⁻¹, O.C. 0.62%. The soil was non saline, low in available nitrogen (210 kg ha⁻¹), phosphorus (7.2 kg ha⁻¹) and medium in available potassium (255 kg ha⁻¹). The exchangeable

Ca, Mg and K were 2.4, 1.1 and 0.05 c mol (p+) kg⁻¹, respectively. The soil had DTPA Fe 400 ppm, Mn 5.0 ppm and Zn 0.45 ppm.

The experiment was laid out in a complete randomized block design with three replications. Two rice varieties such as Jajati and Mahsuri were taken in main plot. The sub plot treatments were : Control (T₁), Raw cow dung @ 5 t ha⁻¹ (T₂), Lime @ 0.5LR (T₃), Lime @ 0.25 LR (T₄), Fly ash @ 20 t ha⁻¹ (T₅), Flyash @ 10 t ha⁻¹ (T₆), Potash @ 40 kg ha⁻¹ (T₇), Zn @ 10 kg ha⁻¹ (T₈), Zn @ 5 kg ha⁻¹ (T₉), Foliar spray of MnSO₄ (0.6%) (T₁₀)

Rice (cv. JAJATI AND MASHURI) seedlings of 25-30 days duration were transplanted during last week of July (both year) with recommended fertilizer dose of 80-40-40 kg N-P₂O₅-K₂O per ha through DAP, Urea and Murate of potash, respectively. All P and K and 25 % N were applied at transplanting. The rest 50 and 25% N were applied at tillering and panicle initiation, respectively. Full dose of lime (paper mill sludge). Fly ash and Zn (zinc sulphate) as per the treatments were applied as basal. In T₇, remaining 40 kg of potassium per hectare was applied at tillering. Two spray of MnSO₄ (0.6 %) were applied after 15 and 30 days of transplanting. The crop was harvested at full mature stage. The 3rd and 4th leaf samples were collected at 45 days of planting, processed, digested and analysed for total iron by Atomic Absorption SpectroPhotometer.

RESULTS AND DISCUSSION

Symptoms of Fe toxicity as per IRRRI in 1-9 score :

Symptoms of iron toxicity were appeared at 25-30