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Effect of Moisture Regimes on the Availability of Iron and Manganese

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A green house study with three soil groups of Tamil Nadu using IR. 22 rice as test crop under three moisture regimes, viz., submergence at 5 cm. depth, near field capacity and wetting and drying was conducted. The available Fe and available Mn released from the soils under different stages are discussed. Alluvial soils released more of available Fe followed by red and black soils while available Mn remained almost uniform for all the soils studied. Restricted moisture has no influence on the available Fe and Mn and the yield of rice under such conditions was fouud to be more than that of submergence.

The dynamics of water logged soils can be precisely predicted with the reduction process that are set in motion. Consequently the various soil components are reduced in the thermodynamic sequence, the oxidised forms are reduced as a results of facultative and true anaerobes. The chemical transformation on of Fe^{3+} to Fe^{2+} and Mn^{4+} to Mn^{2+} is important to rice culture (Anon, 1972). As rice is being cultivated in different soils as well as under different moisture conditions, the pattern of release of Fe and Mn will be quite different under such conditions. The present study was taken up to understand the behaviour of the Fe and Mn in red, black and alluvial soils and also under various moisture conditions.

MATERIALS AND METHODS

A greenhouse study with three soil groups of Tamilnadu *viz.*, red, black and alluvial soils under three moisture levels viz., submergence at 5 cm. depth, near field capacity and wetting and drying was conducted with two replications. Four plants of 30 day old IR. 22 rice seedlings were transplanted in each pot. Periodical soil samples at tillering, flower initation and harvest stages were drawn and analysed for available Fe (exchangeable + water soluble Fe) (Olsen and Corlson, 1950) and for available Mn (exchangeable + water soluble Mn) Willard and Great House, 1917).

RESULTS AND DISCUSSION

The mean available Fe and Mn contents of the soils at different stages of rice growth, under different moisture conditions are presented in Table. The black soil was rich in clay percentage, course fractions were more in red soil and fine sand fractions were more in alluvial soils. High iron content was

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TABLE. The available Fe and Mn status of the soils under different moisture regimes (Mean values at different stages of rice growth) (ppm)

Place of collection	Available Fe			Available Mn		
	at submergence	at field capacity	at wetting & drying	at submergence	at field capacity	at wetting & drying
	ppm					
I. RED SOILS						
Perundurai, Coimbatore District	2.5	2.1	2.7	239	223	241
Thulukkanur, Salem District	2.2	2.0	1.7	239	242	221
Palligoundampalayam, Coimbatore District	1.4	1.5	0.7	244	235	211
II. BLACK SOILS						
Kovilpatti, Tirunelveli District	2.2	2.2	2.2	130	163	136
R.S. Puram, Coimbatore District	1.3	1.3	1.2	122	131	131
Agricultural College Farm, Coimbatore District	1.4	1.2	1.2	133	115	118
III. ALLUVIAL SOILS						
Thanjavur, Thanjavur District	3.2	2.9	2.9	133	139	127
Vellamperambu, Thanjavur District	3.0	3.0	2.5	99	129	110
Aduthurai, Thanjavur District	3.0	2.8	2.5	113	110	92

seen in red and alluvial soils. Occurrence of these soils under wide range of climate and elevation and frequent cultivation of these soils mostly for rice crop also contribute to the variation in the levels of these nutrients. Available Fe was more in alluvial soils than the other two soil groups. Available Mn was more or less uniform in all the soils studied.

Available Fe : The major transformation under submergence due to anerobic condition is the reduction of $Fe^{3}+$ to $Fe^{2}+$ (Mandal, 1961, Patrick and Mahapatra, 1968). In the present study, the available iron was estimated under different moisture regimes showed that under submergence, almost all soils recorded more of available Fe. The alluvial soil released the available Fe more or less uniformly under submergence and this is indicated by the better performance of the crop under such condition. These results corraborated with those of Broeshart *et al.* (1965) and Chakravarti and Kar (1970).

The black and red soils were generally low in the release of available Fe and hence the growth and yield of the crop remained lower when compared to

alluvial soils. The black soils registered reduction of iron and the higher cation exchange capacity accentuated it.

Available Mn : Although certain similarity in the behaviour of iron and manganese was apparent, still marked differences were seen with the soils studied. Available Mn increased immediately after sub-mergence and actually Mn came into solution much earlier than iron (Mandal, 1961). Similar observations were noted in the present study also. Among the soil groups available Mn did not show much variation under different moisture regimes. The black soil released low available Mn. Sharma and Shinde (1968) stated that the black soils of India are rich in total Mn but low in available Mn. This might be due to the predominantly montmorillonitic type of clay minerals in black soil which have high fixation capacity. The increasing amounts of $CaCO_3$ in black soils as well as in red soils could be implicated in seeking explanation for this tendancy on the exchange complex. Similar results were reported by Misra and Misra (1969). In alluvial soils the release of available Mn remained more or less the same but the yield of rice was more even under wetting and drying conditions than the other two moisture regimes. Francis *et al.* (1957) observed similar results in their study and reported that marked yield response was obtained in upland cultures. The level of available-Mn in all the soils under the various moisture regimes indicated that rice has high requirement for Mn and has exceptionally high tolerance to Mn.

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