PROBLEM SOILS OF SRI LANKA

Programme Leader : Dr Felix Ponnamperuma

Venue : IFS Conference Hall,
Hantana Road, Kandy

7 March 1987

Programme Director : *Professor Cyril Ponnamperuma*
Programme Coordinator : *Professor Kapila Dahanayake*
Programme Editor : *Daya De Silva*

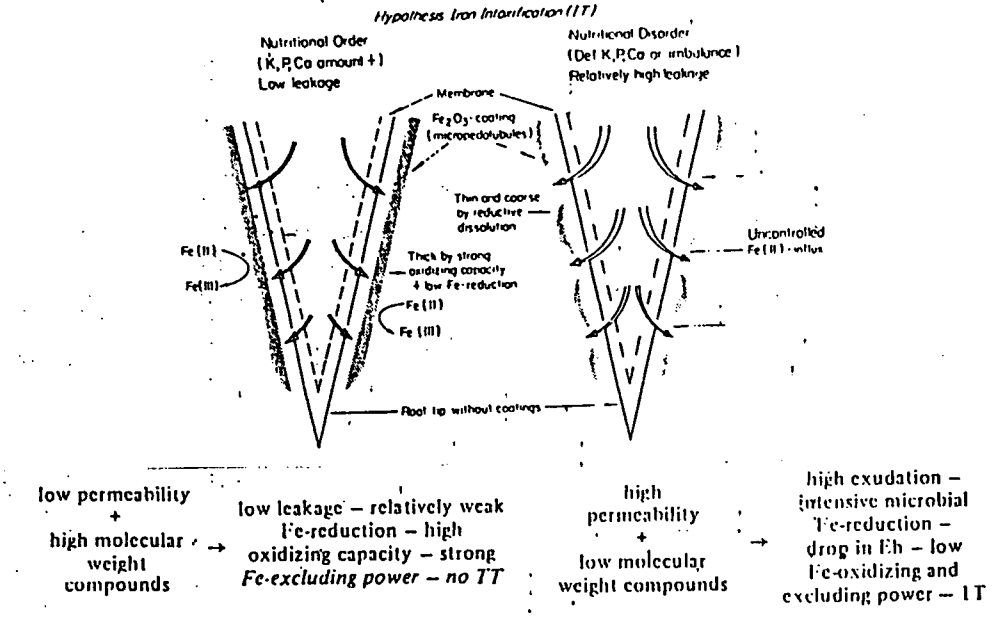


Fig. 1 Model for iron toxicity of wetland rice as a physiological disorder caused by multiple soil stress (deficiency in P, K and Ca).

Left: Well nourished rice plants (adequately supplied with P, K and Ca) are characterized by a low leakage of organic metabolites (exudates) and a high iron-excluding capacity (O_2 – exudation, peroxidases?) that prevents soluble Fe(II) from entering the roots

Right: Deficiencies in K (relative accumulation of low molecular weight compounds), P (disturbed energy transfer, synthetic processes and root growth) and Ca (increased root permeability) are the essential prerequisites for an increased exudation and rhizoflora activity. The high leakage in metabolites causes an increased O_2 demand and the use of Fe(III) as an alternative electron acceptor by "iron-reducing" bacteria. This culminates in the breakdown of the Fe-excluding mechanism (dissolution of Fe_2O_3 – micropedotubules)

TODAY'S PROGRAMME

10.00 - 11.00 a.m.	*Problem Soils of Sri Lanka, by* **Dr Felix Ponnamperuma**
11.00 - 11.30 a.m.	*T E A*
11.30 - 12.30 a.m.	*Illustrated Talk on - Occurrence of Iron Toxicity in Wetland Rice Soils, by* **Mr Pol Deturck** (Belgian Coordinator of IFS-Beligium-Ruhuna University Iron Toxicity Project)
12.30 - 1.30 p.m.	*L U N C H*
1.30 - 2.30 p.m.	*Laboratory Demonstration - Chemical Analysis of Paddy Soils, by* **Mr Pol Deturck, Mr J De Coninck and Mr K De Silva** (Research Assistants-IFS)
2.30 - 3.30 p.m.	*Discussion*
3.30 - 4.30 p.m.	*Quiz*
4.00 p.m.	*T E A*

End of Day's Programme

Problem Soils of Sri Lanka

by

Dr. Felix Ponnamperuma

SOILS

Soils are the thin layer of loose material made up of minerals, organic matter, and living organisms that covers the surface of the earth. They are formed by the action of sun, rain, and living things on rocks. There are thousands of kinds of soils, They can be recognized by their visible, chemical, and physical properties.

SOIL CLASSIFICATION

Soils are classified into 10 Orders (Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, Vertisols), 47 Suborders, and over 200 Great Groups. Sri Lanka has 9 of the 10 Orders, 18 of the Suborders and 23 of the Great Soil Groups.

PROBLEM SOILS

Soil problems fall into three main classes :

1. Mechanical
2. Hydrological
3. Chemical

There is no clear-cut definition of a problem soil. A soil is called a problem soil if a crop suited to a particular climatic zone and landscape cannot be grown with economic inputs or there is danger of soil degradation when cultivated.

(Cont'd.....2/-)

CHEMICAL PROBLEMS

The main chemical problems include :

1. Salinity
2. Alkalinity
3. Strong acidity
4. Iron toxicity
5. Excess organic matter
6. Nutrient deficiencies
7. Ionic imbalance.

Saline Soils

These soils contain too much salts for normal plant growth. Soils with an electrical conductivity (EC_e) exceeding 4 dS/m are harmful to most plants. Above 15 dS/m only salt-tolerant plants can grow. Salinity may be due to influx of sea water regardless of climate or to accumulation of salts in dry areas. The remedy is to prevent the entry of salts, wash out the salts, and grow salt-tolerant crops. Salt-tolerant rice varieties such as Pokkali and IR 36 are widely grown in saline tracts.

Alkalinity or Sodicity

Alkali or sodic soils usually have a pH greater than 8.5 and a high percentage of sodium. They usually occur in dry areas. Growth-limiting factors are excess sodium and deficiences of calcium, phosphorus, nitrogen, and zinc. The remedy is to remove the excess sodium by applying gypsum ($CaSO_4 2H_2O$), leaching the soil, correcting nutrient deficiences, and growing alkali-tolerant crops.

(Cont'd.....3/-)

Strong acid soils

These include Ultisols, Oxisols, Spodosols, and acid sulfate soils. The pH value of these soils is less than 5.5. The main growth-limiting factors for dryland crops are aluminium and manganese toxicities and phosphorus deficiency. Most of the tea and rubber lands of Sri Lanka are strongly acidic. Fortunately, tea, rubber, and coconut are acid-tolerant crops. But because these soils are deficient in calcium and magnesium, use of dolomite ($CaCO_3MgCO_3$) is advisable.

Iron toxic soils

Iron toxicity of wetland rice is common on the Ultisols and Oxisols of Sri Lanka. It occurs in the wet zone from Mirigama to Matara. Iron toxicity is caused by excess water-soluble iron in the soil solution. Nutrient deficiencies make it worse. The remedy is to apply lime, manganese dioxide, and grow resistant varieties. The Sri Lanka Department of Agriculture has bred many tolerant rice varieties and the International Rice Research Institute has identified many iron-tolerant varieties.

Excess organic matter

This is a problem on Histosols. The main problems are deficiencies of nutrients, especially nitrogen, phosphorus, potassium, zinc, and copper. Some organic substances are also believed to interfere with nutrient uptake or to poison the plant directly. The remedy is to fertilize the soil and grow adapted varieties.

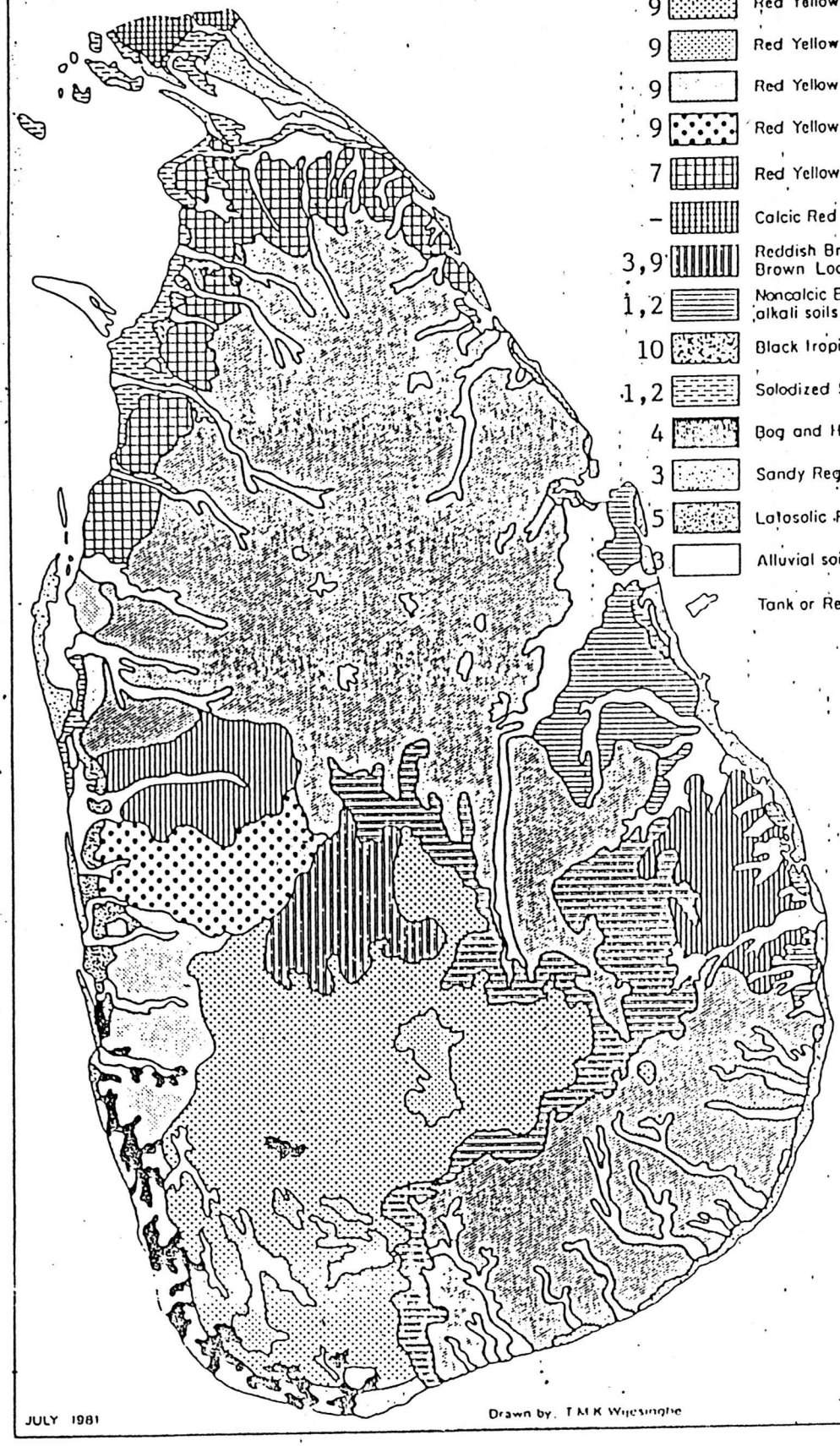
(Cont'd.....4/-)

Nutrient deficiencies

Sandy soils are deficient in all nutrients. Besides they lose fertilizer fast. They need complete fertilizer in small doses.

Most soils of Sri Lanka especially those of the Dry Zone are deficient in nitrogen. Because of heavy phosphate fertilization of tea, rubber, coconut, and vegetables, phosphorus deficiency may not be common. Phosphates applied to soils are held in the top soil for several years whereas nitrogen and potassium are easily lost. Zinc deficiency is likely to occur on high-pH soils and on soils high in organic matter. Iron deficiency is likely to occur on high pH, dryland soils.

(SRI LANKA)
GENERALIZED SOIL MAP
(Scale: – 1:2,000,000)



LEGEND

1	Reddish Brown Earths & Low Humic Gley soils
1,5	Reddish Brown Earths & Immature Brown Loams
1	Reddish Brown Earths & Noncalcic Brown soils
9	Red Yellow Podzolic soils
9	Red Yellow Podzolic soils with prominent A_1 horizon
9	Red Yellow Podzolic soils with Laterite
9	Red Yellow Podzolic soils with mottled subsoil
7	Red Yellow Latosols
–	Calcic Red Yellow Latosols
3,9	Reddish Brown Latosolic soils and Immature Brown Loams
1,2	Noncalcic Brown soils, soils on old alluvium and alkali soils
10	Black tropical clay soils (GRUMUSOLS)
1,2	Solodized Solonetz and Solonchaks
4	Bog and Half Bog soils
3	Sandy Regosols on recent beach and dune sands
5	Latosolic Regosols
3	Alluvial soils
	Tank or Reservoir

1. Alfisols
2. Aridisols
3. Entisols
4. Histosols
5. Inceptisols
6. Mollisols
7. Oxisols
8. Spodosols
9. Ultisols
10. Vertisols

JULY 1981

Drawn by. T.M.K Wijesinghe