18. SOIL RELATED CONSTRAINTS AND THEIR MANAGEMENT

A constraint free soil environment is very important for achieving higher food production. The major soil constraints affecting the crop production in Tamil Nadu are

a) Chemical constraints : salinity, sodicity, acidity and nutrient toxicities
b) Physical constraints : high or low permeability, sub soil hard pan, surface crusting, fluffy paddy soils, sandy soils etc.

1. Saline soils

Saline soils are characterised by higher amount of water soluble salt, due to which the crop growth is affected. For these soils with electrical conductivity of more than 4 dS m^{-1}, provision of lateral and main drainage channels of 60 cm deep and 45 cm wide and leaching of salts could reclaim the soils. Application of farm yard manure at 5 t ha^{-1} at 10 - 15 days before transplanting in the case of paddy crop and before sowing in the case of garden land crops can alleviate the problems of salinity.

2. Sodic soils

Sodic soils are characterised by the predominance of sodium in the complex with the exchangeable sodium percentage exceeding 15 and the pH more than 8.5 .To reclaim the sodic soils, plough the soil at optimum soil moisture regime, apply gypsum at 50% gypsum requirement uniformly, impound water, provide drainage for leaching out the soluble salts and apply green manure @ 5 t ha^{-1} 10 to 15 days before transplanting in the case of paddy crop.

3. Acid soils

Acid soils are characteristically low in pH (< 6.0). Predominance of H^+ and Al^{3+} cause acidity resulting in deficiency of P, K, Ca, Mg , Mo and B. These soils are prevalent in a) hilly tracts of Ooty, Kodaikkanal and Yercaud b) Laterite soils of Pudukkottai, Kanyakumari etc Application of lime **(**as per the lime requirement test**)** uniformly by broadcast and incorporation is recommended. The alternate amendments like dolomite, basic slag, flue dust, wood ash, pulp mill lime may also be used on lime equivalent basis**.**

4. Iron and Aluminium toxicity

These are characterized by the presence of higher concentration of Fe^{2+} and Al^{3+} more specifically in flooded soils. prevalent in Kanyakumari and Pudukkottai Districts. Application of lime as per the lime requirement along with the recommended dose of NPK and organic manure will suppress the toxicity.

For ` Ela ` soils of Kanyakumari district (Alfisols, pH : 4-5) ,. application of lime as per lime requirement with recommended NPK + foliar spray of 0.5 % $ZnSO_4$ + 0.2% $CuSO_4$ +1% DAP + 1% MOP thrice during AT to PI will help to overcome the problem in rice. Based on the screening tests, the rice cultivars of the region have been rated for their tolerance to Fe toxicity

Highly susceptible	:	ADT 36
Mod. susceptible	:	ADT 42, IR 50, CORH 1
Less susceptible	:	TPS 1, ASD 16 & 18, IR 64, JJ 92, TKM 9, CO 37 & CO 41

5. Fluffy paddy soils

The traditional method of preparing the soil for transplanting rice consists of puddling which results in substantial break down of aggregates with uniform structures less mass. Under continuous flooding and submergence of soil in a rice-rice-rice cropping system, the soil particles are always in a state of flux and the mechanical strength is lost leading to the fluffy ness. This is further aggrevated by *insitu* application of rice stubbles and weeds during puddling. They are characterized by low bulk density of the top soil resulting in the sinking of farm animals and labourers as well as poor anchorage to paddy seedlings. For such soils, passing of 400 kg stone roller or oil drum with sand inside eight times at proper moisture level (moisture level at friable condition of soil which is approximately 13 per cent) once in two to three years.

6. Sandy soils

Sandy soils are containing predominant amounts of sand resulting in higher percolation rates and nutrient losses. Campacting the soil with 400 kg stone roller or oil drum with sand / stones inside eight times at proper moisture level (moisture level at friable condition of soil which is approximately 13 per cent) once in two to three years could reduce the percolation losses. Addition of tank silt for coastal sandy soils is recommended for enhancing their productivity.

7. Sub Soil hard pan

Hard pan occurs in red soil areas due to the movement of clay and iron hydroxides and calcium carbonate and settling at shallow depth, which increases the soil bulk density to more than 1.8 g/cc, thereby preventing the root proliferation. These soils can be reclaimed by chiselling the soils with chisel plough at 0.5 m interval first in one direction and then in the direction perpendicular to the previous one, once in two to three years. Applications of FYM or composted coir pith at 12.5 t ha^{-1}could bring additional yields of about 30 per cent over control. Deep ploughing of the field during summer season can be followed to open up the sub soil. Cultivation of deep rooted crops like tapioca, cotton and semi-perennial crop like mulberry encourage natural breaking of the hard-pan.

8. Surface crusted soils

Surface crusting occurs due to the presence of colloidal oxides of Iron and Aluminium in Alfisols which binds the soil particles under wet regimes. On drying it forms a hard mass on the surface and prevents the emerging seedlings and arrest the free exchange of gases between the soil and atmosphere. The surface crust can be easily broken by harrowing or cultivator ploughing and its formation can be prevented by improving the aggregate stability by the application of lime or gypsum at 2 t ha^{-1} and FYM at 12.5 t ha^{-1}. Sprinkle water at periodic intervals. Bold grain crops like cowpea may be grown

9. Heavy textured clay soils

The clay soils are containing major amounts of clay resulting in the poor permeability and nutrient fixation. Such soils can be reclaimed by the addition of river sand at 100 t ha^{-1} or managed by deep ploughing the field with mould board plough or disc plough during summer or forming contour and compartmental bunds and also adoption of ridges and furrows to enhance the infiltration and percolation.

10. Low permeable black soils

These soils are having infiltration rate less than 6 cm per day due to high clay content. The amount of water entering in to the soil is reduced, resulting in high run off encouraging the erosion of surface soil with nutrients. Heavy clay and high capillary porosity results in impeded drainage and reduced soil conditions. Application of 100 cart loads of red loam soil or river sand and deep ploughing the field with mould board plough or disc plough during summer to enhance the infiltration and percolation. Application of FYM , composted coir pith or pressmud at 25 t ha^{-1} per year will improve the physical properties and internal drainage of the soil.

11. High permeable red soils

These soils are having sand exceeding 70 per cent and are not able to retain water and nutrients. These soils are devoid of finer particles and organic matter, thus aggregates are weakly formed; presence of high non capillary pores results in poor soil structure. Compacting the soil with 15 passes after 24 hours of irrigation, application of tank silt or black soil @ 25 t ha^{-1} per year along with FYM, composted coir pith to improve the water holding capacity of the soil. Providing asphalt, polythene sheet etc below the soil surface will reduce infiltration.