Soil Physical Constraints and Management Technologies

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Abstract
The alleviation of soil physical constraints limiting crop production is considered important to increase agricultural production and sustaining the productivity of soils. The major soil physical constraints include high soil permeability, soil surface crusting, sub-surface mechanical impedance, and soil hardening. Studies indicated that the management of highly permeable soils such as by compaction increased yields of various crops. Soil surface crusting could be managed by the application of FYM on seed lines at the rate of 4 t/ha. Application of tank silt has improved the physical properties of soil like reduces the bulk density and improved the water holding capacity of the soil.

Highly Permeable Soils
The nature of excessive permeability of the sandy soils results in very poor water retention capacity, very high hydraulic conductivity and infiltration rates. Excessively permeable soils are those having a high amount of sand exceeding 70- percent. Due to this, the soils are inert and unable to retain nutrients and water. These soils being devoid of finer particles and organic matter, the aggregates are weakly formed, the non-capillary pores dominating with very poor soil structure. So whatever the nutrients and water added to these soils are not utilized by the crops and subjected to loss of nutrients and water (Agrawal et al., 1995). Besides, it is not providing anchorage to the crops grown. The physical properties of the soil are as follows:

- Sand - > 70 per cent
- Clay - >15 per cent
- Water holding capacity - 20 cm/hr

Management Technology
- The soils should be ploughed uniformly.
- Twenty four hours after a good rainfall or irrigation, the soil should be rolled 10 times with 400 kg stone roller of 1 m
long or an empty tar drum filled with 400 kg sand at optimum moisture (13%). Then shallow ploughing should be given and crops can be raised.

- Application of clay soil up to a level 100 t ha⁻¹ based on the severity of the problem and availability of clay materials.
- Application of organic materials like farmyard manure, compost, press mud, sugar factory slurry, composted coir pith, sewage sludge, etc.
- Providing asphalt sheet, polythene sheets, etc. below the soil surface to reduce the infiltration rate.
- Crop rotation with green manure crops like Sunhemp, sesbania, daincha, kolinchi, etc.

### Improving Water and Nutrient Holding Capacities

- Application of organics like compost, Farm Yard Manure, Green manures, and Green leaf manures,
- Soil breeding (adding tank silt or soil from other fields to increase the clay and silt contents of sandy soil)
- Frequent irrigation with low quantity of water
- Frequent split application of fertilizers
- Application of slow-release fertilizers

### Fluffy Paddy Soils

#### Causes

The traditional method of preparing the soil for transplanting rice consists of puddling which results in a substantial break down of soil aggregates into a uniform structureless mass. The solid and liquid phases of the soil are thus changed. Under continuous flooding and submergence of the soil for rice cultivation in a cropping sequence of rice-rice-rice, as in many parts of Tamil Nadu, the soil particles are always in a state of flux and the mechanical strength is lost leading to the fluffiness of the soils. This is further aggravated by in situ incorporations of rice stubbles and weeds during puddling.

#### Impact of Fluffiness

The sinking of draught animals and laborers is one of the problems during puddling in rice fields in many parts of Tamil Nadu. This has been thus, an invisible drain of finance for the farmers due to high pulling power needed for the bullocks and slow movement of laborers during the puddling operations. Further, the fluffiness of the soil leads to very low bulk density and thereby leading to very rapid hydraulic conductivity and in turn, the soil does not provide a good anchorage to the roots and the potential yield of crops is adversely affected.

### Management Techniques

- The irrigation should be stopped 10 days before the harvest of rice crop
- After the harvest of rice, when the soil is under semi-dry condition proctor moisture level), compact the field by passing 400 kg stone roller or an empty tar drum filled with 400 kg sand 8 times.
- The usual preparatory cultivation is carried out after compaction.

### Conclusion

The soil physical constraints limiting nutrient utilization and crop production could be alleviated by adopting certain soil management practices that moderate soil environment. The adoption of such practices may be of more value for dryland areas facing frequent moisture stress and having low fertilizer use efficiency. The practice of covering soils with waste organic residues greatly aids in moderating soil hydro-thermal regimes and enhancing nutrient availability.

### References

