

TECHNICAL BULLETIN

43

SOIL-WATER RELATIONSHIP OF INDIAN SOILS

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

A Review on Soil-Water Relationship of Indian Soils

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INTRODUCTION

Soil-water retention and its rate of movement are of considerable importance in agriculture and are being actively investigated. The interactions between the active soil fractions and soil-water give rise to water retention forces. Clays and clay minerals forming the finer and active fractions of the soil have much higher specific surface area than the sand and silt fraction forming the coarse fractions. Clay minerals are negatively charged owing to the isomorphic substitution of ions in the silica and alumina sheets and exposed hydroxyl groups at the broken edges. Water molecules being dipole in nature, get oriented by this negative charge, and are held on the soil surface by the short range adhesion and cohesive forces or so-called 'Vander Waal' forces. The water held in the soil by these forces is relatively immobile, and is sometimes referred to as film water. Its thickening continues until the water starts accumulating at the contact points of the particles in the soil pore, and develops an air-water interface.

The pressure difference across the air-water interface, or so-called soil-moisture tension, determines the amount of water held in a soil against the force of gravity. However, the magnitude of the pressure difference is inversely proportional to the size distribution of the pores which is determined by the textural and structural arrangement of the soil particles. Various groups in which the soils of India have broadly been divided, namely, Alluvial, Black, Red, Laterite and Lateritic, Mountain and Forest, Desert, Saline and Alkaline, and Peat, vary in their textural and structural classifications. The type of clay minerals vary from kaolinitic in Red and Laterite groups, illitic in Alluvial and Desert groups, to montmorillonitic in Black group. The amount of organic matter varies from less than 0.4 per cent in Desert and Alluvial soils to more than four per cent in Mountain and Forest, and Peat soils.

A considerable amount of work has been done in India to evaluate the soil-water relationships of these divergent soils, specially the soil moisture characteristics and infiltration rates. The objective of this review is to bring together the information available on soils of India.