

Characteristics of Natural Clay Deposits in Saudi Arabia and Their Potential Use for Nutrients and Water Conservation

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Abstract. Clay minerals in soils are the key component controlling water storage and movement in irrigated arid lands. Previous studies proved that the application of high quality clay minerals even in low quantities to coarse textured desert soils improved dramatically the water conservation and water use efficiency. The main objective of this research was to identify and characterize clay deposits and their desired characteristics for water conservation and source of nutrients. Forty-seven representative clay deposit samples were collected from different regions of Saudi Arabia. Samples were subjected to physical, chemical, nutrient status and mineralogical characterization. Results indicated that most of the selected sites were rich in natural clays, some were found at the surface while others were exposed in the slopes of the mountainous areas. Data showed relatively high variations in the clay deposit characteristics, particularly in clay contents, salinity, alkalinity and the dominant clay minerals. Smectite clays dominated the clay fraction of deposits collected from Khulays, Jeddah, Al-Hassa and Al-Kharj areas beside attapulgite, kaolinite and other minerals. Dhurma and Rawdat deposits were dominated mostly by kaolinite, illite and smectites. The characteristics of the studied clay deposits as follows: clay content (20-96%), saturation percentage (29-184%), field capacity (14-140%), wilting point (6-64%), available water content (8-77%), ECe dS/m (0.66-47.0), pH (6.82-8.36), CaCO₃ (1-52.9%) and CEC cmole/kg (10.3-77.2). It appears that samples with high clay contents have high available water and field capacity. Soluble B was relatively high in some samples collected from Al-Kharj. Nutrient status indicated that available Fe was very high in all samples while other nutrients (K, Mn, Zn and Cu) were high to moderate. Heavy metals (Cd, Ni, Pb and Co) were low to moderate in most of the studied samples and relatively high in few samples, particularly that collected from the western region. Free Fe oxide (Fe_d) was the dominant component of the amorphous and free oxides. Amorphous Si and Al were quite variable, Dhurma-Marrat clays contain relatively high Al_{am} than Si_{am} other clays have mostly high Si_{am} than Al_{am}. The presence of oxides and amorphous materials of Fe, Si and Al plays a major role for nutrient retention and water holding.