

Structure stability and water retention near saturation characteristics as affected by soil texture, and polyacrylamide concentration

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Studying the effects of soil properties and amendment application on soil structure stability is important for the development of effective soil management and conservation practices for sustaining semi-arid soil and water quality under climate change scenarios. Two sets of experiments were conducted to evaluate the effects of soil texture and soil amendment polyacrylamide (PAM) rate on soil structural stability expressed in terms of near saturation soil water retention and aggregate stability using the high energy ($0-5 \text{ J kg}^{-1}$) moisture characteristic (HEMC) method. Contribution of (i) soil type were assessed using 30 soil samples varying in texture from sandy to clay taken from long term cultivated lands, covering a range of crop and land management practices, and (ii) anionic PAM concentration ($0, 10, 25, 50, 100 \text{ \& } 200 \text{ mg l}^{-1}$) were tested on selected loam and clay soils. The water retention curves of slow and fast wetted soil samples were characterized by a modified van Genuchten (1980) model that provides (i) model parameters α and n , which represent the location of the inflection point and the steepness of the S-shaped water retention curves, and (ii) a composite soil structure index ($\text{SI} = \text{VDP}/\text{MS}$; VDP-volume of drainable pores, MS-modal suction). The studied treatments had, generally, considerable effects on the shape of the water retention curves (α and n). Soil type, PAM concentration and their interaction had significantly effects on the stability indices (SI, VDP and MS) and the model parameters (α and n). The SI and α increased, and n decreased exponentially with the increase in soil clay content and PAM concentration, but the shape of curves were soil texture and management dependent, since predominant changes were observed in the various range of studied macropores (pore size $> 60 \text{ }\mu\text{m}$). An exponential type of relationship existed between SI and α and n . Effect of PAM contribution and wetting condition was more pronounced in the loam soil at low PAM concentration. The results indicate that for sustaining soil quality and erosion control soil properties (e.g., texture) and condition (e.g., cultivation history, moisture content) should be considered prior to proper rate of amendment application. Detailed influence of treatments on soil structure induces and model parameters, and soil quality indexes, and the relationship between them are discussed in the paper.