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How high can we go: defining and breaching the threshold for soil organic matter to improve soil water holding capacity?

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Soil water holding capacity is an important soil property which influences soil and water conservation as well as land degradation and development. Some studies indicated that field capacity (FC) was increased as soil organic matter (SOM) is improved, but the positive effect of SOM on FC was still contradictory. No consistent reports were found for the SOM potential that could be increased. Whether FC could be improved due to increase in SOM by organic amendment is not well established. It is still unknown whether or not there is benefit of improving SOM for enhancing FC; what is the threshold level of SOM for increasing FC, and how much SOM can be boosted. The field study and literature review were conducted to answer all those questions. Soil samples were taken at four sites manured and not manured in the Southern United States, then SOM and FC were measured. The soils amended with poultry litter had higher SOM (3.2%) and FC (35.38%), while the soils without amendment of poultry litter had lower SOM (1.7%) and FC (30.33%), a positive effect of SOM on FC was observed. For different soils with various clay content, a strong positive relationship was observed for soils with clay content less than 15% ($R^2 = 0.7$). We found that FC started increasing as SOM was increased over 2%, it is the threshold level of SOM for improving FC. Previous research also reported that there was no positive effect on FC for cultivated soils with a mean SOM of 1.2% in Greece. Another study found that the increase in water content is significant for sandy soils with 0 to 20% clay content. Our results revealed a pronounced effect for silt loam soils with 1 to 28% clay as SOM was larger than 2%. The SOM ranged from 0.9 to 5.42 %, with a mean value of 2.60 % for the 167 soil samples we measured. We found the highest level of SOM that amendment of poultry litter can increase was not greater than 6.0 %. We suggest SOM should be increased over 2% for improving FC, there is large room for SOM improvement in subtropical humid regions.