IMPACT OF BIOCHAR GRAIN SIZE ON WATER RETENTION IN MEADOW SOIL

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INTRODUCTION

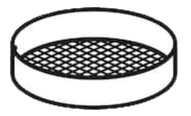
Biochar, a product of pyrolysis (thermal conversion in partial absence of oxygen) of natural organic material is considered as a soil-improving amendment. For example it changes water retention by modifying soil textural and structural properties [1]. However, the optimal production conditions and application proportions that will enhance soil quality (e.g. fertility and water availability for plants) are widely studied but still not precisely known [2,3]. In our research we investigated which granulometric fraction (particle size) of biochar made from sunflower husk affects the soil water retention in most effective way. For this purpose, water retention curves of soil-biochar mixtures were examinated. Soil was obtained from meadow areas (Sękow, Poland) and mixed with different percentage content of biochar mass (0.95, 2.36, 4.76 and 9.52% of sample weight). One sample contained only one granulometric fraction (particles size: 250-100 μm, 100-50 μm and less than 50 μm) of biochar. Soil water retention curves were obtained by measure soil moisture of samples in pressure range of 0-5 bar, which corresponds to pF parameter values of 0-3.7. The course of water retention curve primarily depends on the texture, compaction, aggregation, specific surface area of soil [4] - which can be affected by the presence of different biochar fractions [5]. The research method we use allows obtaining information about available water content by comparing differences in water content between points corresponding to a pressure of 0.06 and 5 bar (1.85-3.7 pF). Our results clearly shown that samples containing biochar particles with size below 100 μm had more water available for plants than soil with bigger biochar fractions. However, the biochar impact is not linear and at high biochar concentrations this effect is opposite, and deterioration of soil water retention occurs.

EXPERIMENTAL METHOD

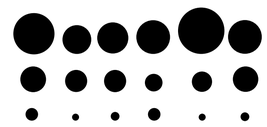
Air-dry soil from Sekow pass through a 2-mm sieve

Sand: 83 %
Slit: 15%
Clay: 2%

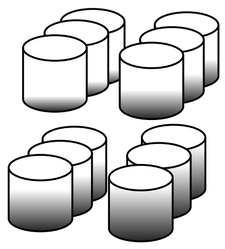
Air-dry biochar form sunflower husk separated into fractions by sieve mesh size



250-100 μm
100-50 μm
< 50 μm

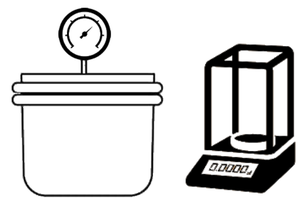


Mixing soil with biochar fractions in fixed mass proportions



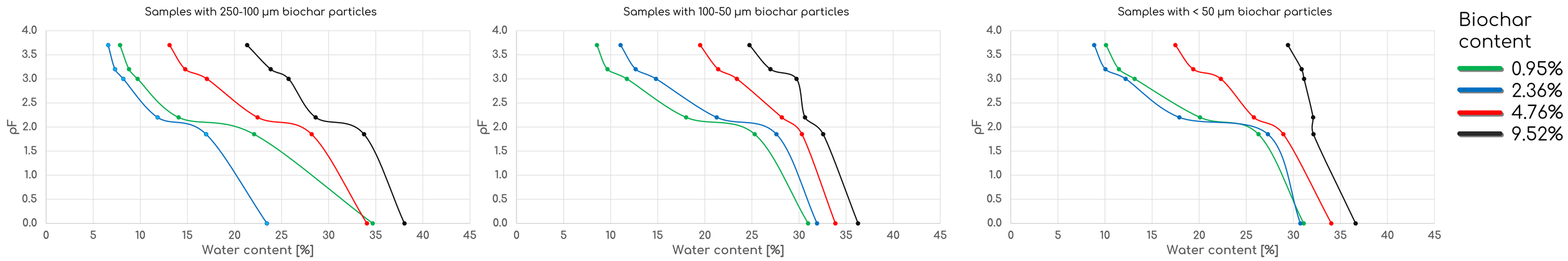
Mass biochar content in soil	Tons per hectare equivalent
0.95%	20
2.36%	50
4.76%	100
9.52%	200

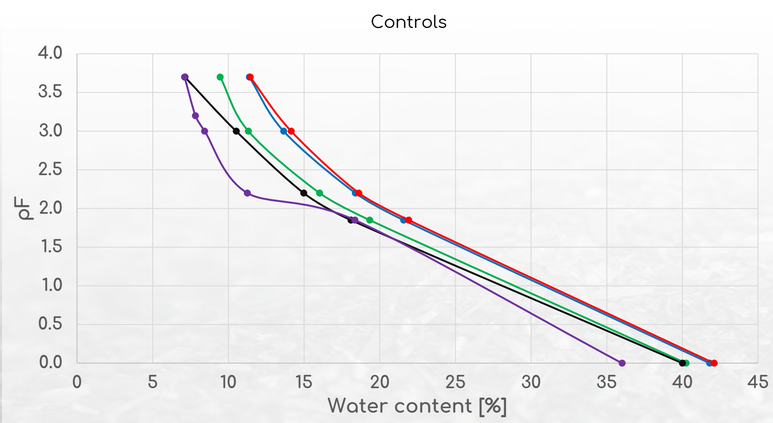
Measurement of soil water retention in pressure chambers. Weighing water loss in samples.

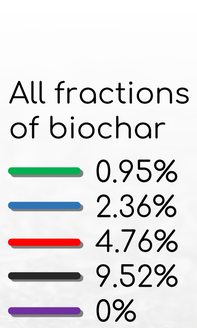


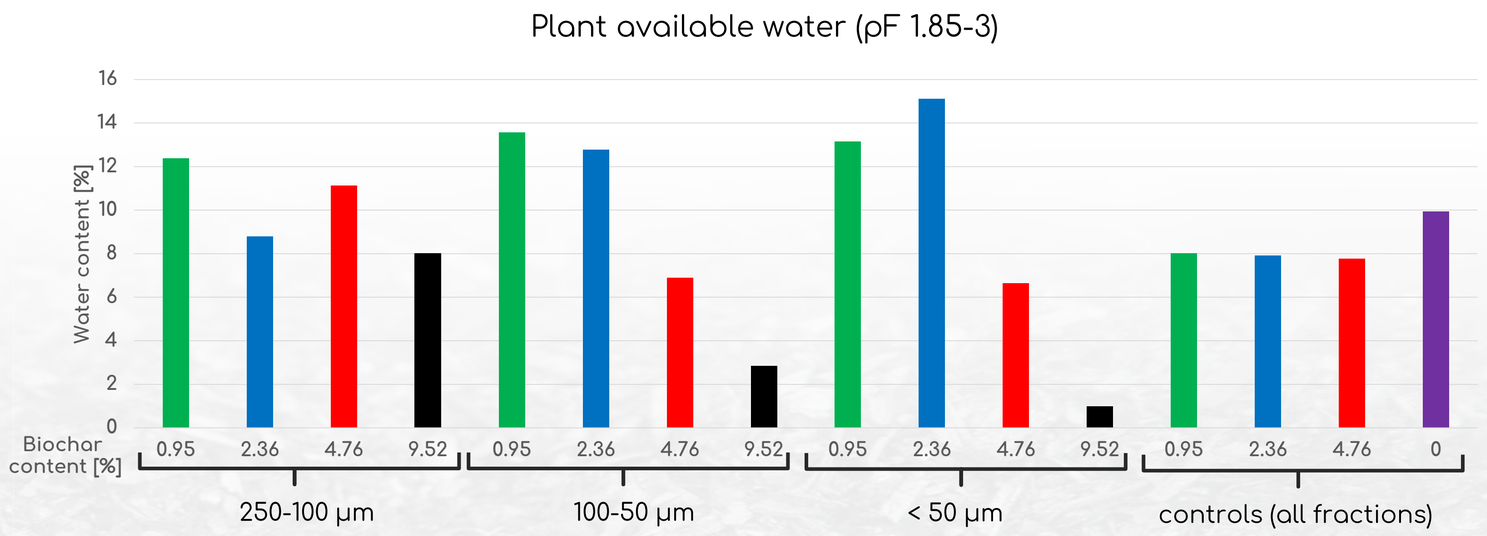
pF	Pressure [bar]	Height of water column [cm]
1.8	0.06	63
2.2	0.16	160
3	1	1000
3.2	1.58	1585
3.7	5	5012

RESULTS









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ACKNOWLEDGMENTS: The research was conducted under the project "Water in soil - satellite monitoring and improving the retention using biochar" no. BIOSTRATEG3/345940/7/NCBR/2017, which was financed by the Polish National Centre for Research and Development in the framework of "Environment, agriculture and forestry" - BIOSTRATEG strategic R&D programme.