Improving the water retention capacity of soils

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1. INTRODUCTION

In recent years, climate change has significantly increased the length of dry periods and the frequency of flash floods. This has reduced the soil's ability to retain water over long periods. By testing soil and soil mixtures, we would like to make proposals to increase their water retention capacity, so that we can retain more water in agricultural areas and thus shift the water balance of our country in a positive direction.

2. METHODS AND MATERIALS

This involved the analysis of 40 years of meteorological data from Szekszárd. After analysing and processing these data, soil samples were collected and investigated according to the Hungarian Standard MSZ 21470. My study focused on the effects of soil improvers (perlite, alginate, zeolite, compost, peat, cattle manure, clay pebbles, mulch) on soil texture, humus content, pH, water -holding capacity was evaluated using two different methods. In the first I planted wheat in 120 pots over a 13-week period, with weekly sampling. The second method was a standard water-holding capacity test. The standard water-holding capacity of soils was then calculated using the following formula

$$WHC\% = \frac{m_n - m_{sz}}{m_{sz}} \cdot 100\%$$

where *WHC%*: water holding capacity of the soil sample in %, m_n is the exact weight in grams of the wet soil sample taken from the cylinder, m_{sz} is the weight in grams of the sample dried to constant weight at 105 °C for 24 hours **[Fig. 1]**

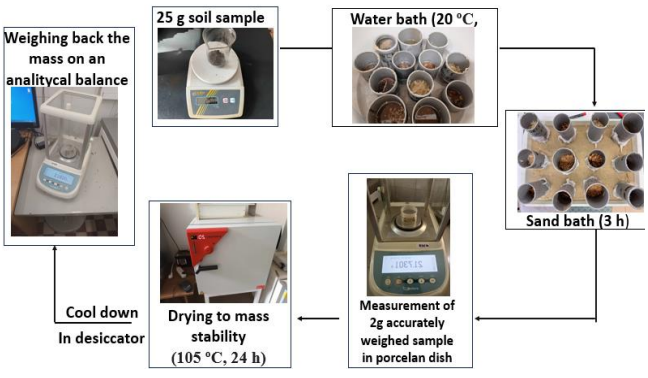

Figure 1. Water-holding capacity test.

3. RESULTS

The increase in precipitation extremes was confirmed by our analysis of meteorological data. The texture of the soils studied (silt, silty loam) has shifted towards the sand fraction because of soil improvers. The soil improvers significantly increased the water-holding capacity **[Fig. 2.]** and shifted the pH towards alkaline, but when applying soil improvers, care must be taken to maintain the optimum pH, which is on average between 6.5 and 7 pH for crops grown in Hungary. The weekly tests on the water-holding capacity of soil mixtures have shown that soil mixtures and soil cover methods are much more effective. Thus, it can be concluded that the best water retention method is a combination of soil cover and soil mixes.

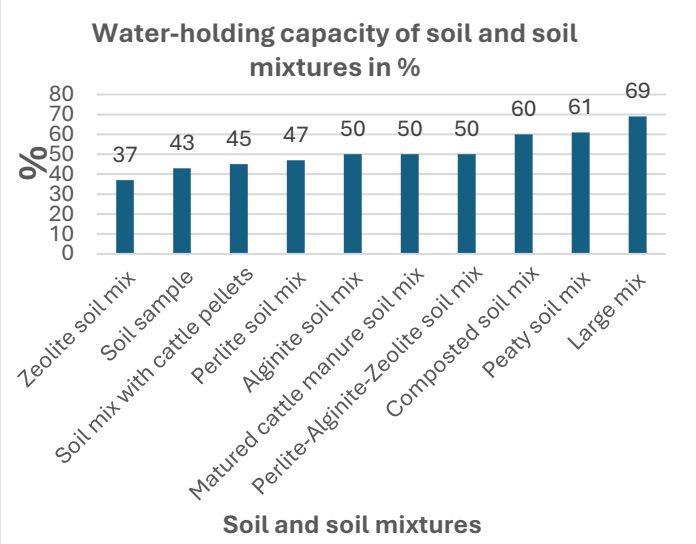

Figure 2. Water-holding capacity of soil mixtures.

4. CONCLUSIONS

Hungary's water balance could be improved significantly if soil improvers were used in agricultural areas. If the top 40 cm layer were supplemented with 20% of soil improvers, we could retain more than 5 cubic kilometres water in the country. This method, with additional melioration options such as terracing or building reservoirs, could even result in a positive water balance.

5. REFERENCES

[1] Csaba Kirchkeszner: Application of biochar and compost produced by pyrolysis of organic waste for soil improvement in the spirit of sustainable agriculture and waste utilization. Workshop Study. Budapest University of Technology and Economics, Budapest, 2017.