Influence of cover crops on soil structure and water balance

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Overview

Cover crops, on the one hand, consume water as they grow, depleting soil water supplies. On the other hand, the mulch of their litter materials and their root activity provide reduced evaporation and improved water infiltration. How do these mechanisms affect the water availability of the following crop? We investigated this question would be the 2018 and 2019 tock years through continuous monitoring of soil water reserves (0-90 cm) and soil structure analyses.

Continuous monitoring of soil water supply

Despite depletion of soil water reserves in the fall, cover crops compensate for transpiration losses by reducing evaporation. A prerequisite, however, is that the intercrops freeze or are killed. Thus, transpiration ceases and the biomass covers the soil as mulch.
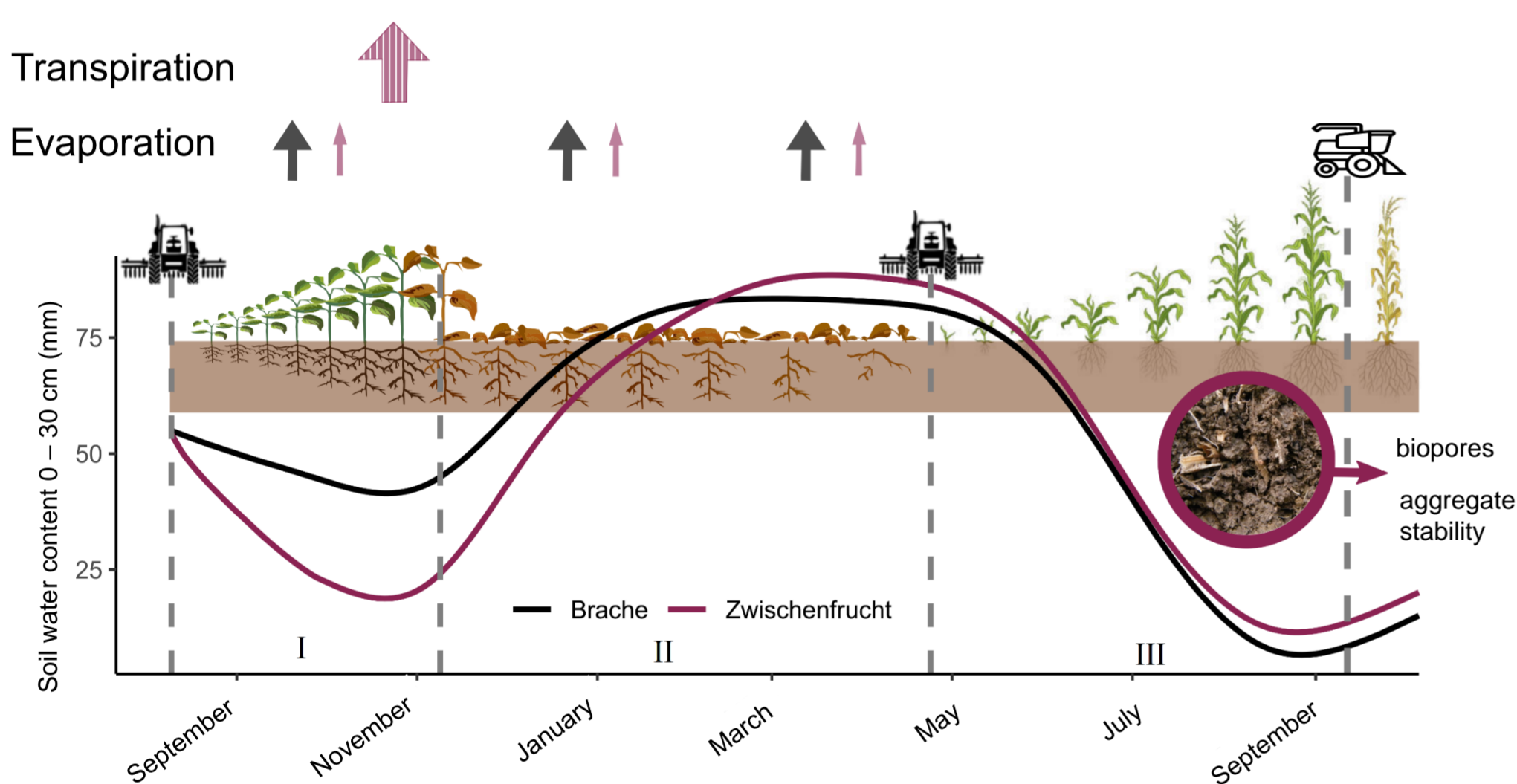

Fig. 1: Observation of soil water contents under catch crops and fallow over one year 2018/2019. Lines are mean values from 3 (fallow) and 18 (catch crops) measurement replicates.

Higher soil water contents after cover crops

All cover crop variants showed higher soil water contents up to 90 cm depth compared to fallow. Thus, more plant-available water was available to the corn during the growing season. The better water supply is reflected in significantly higher yields in the dry year 2019 after catch crops.
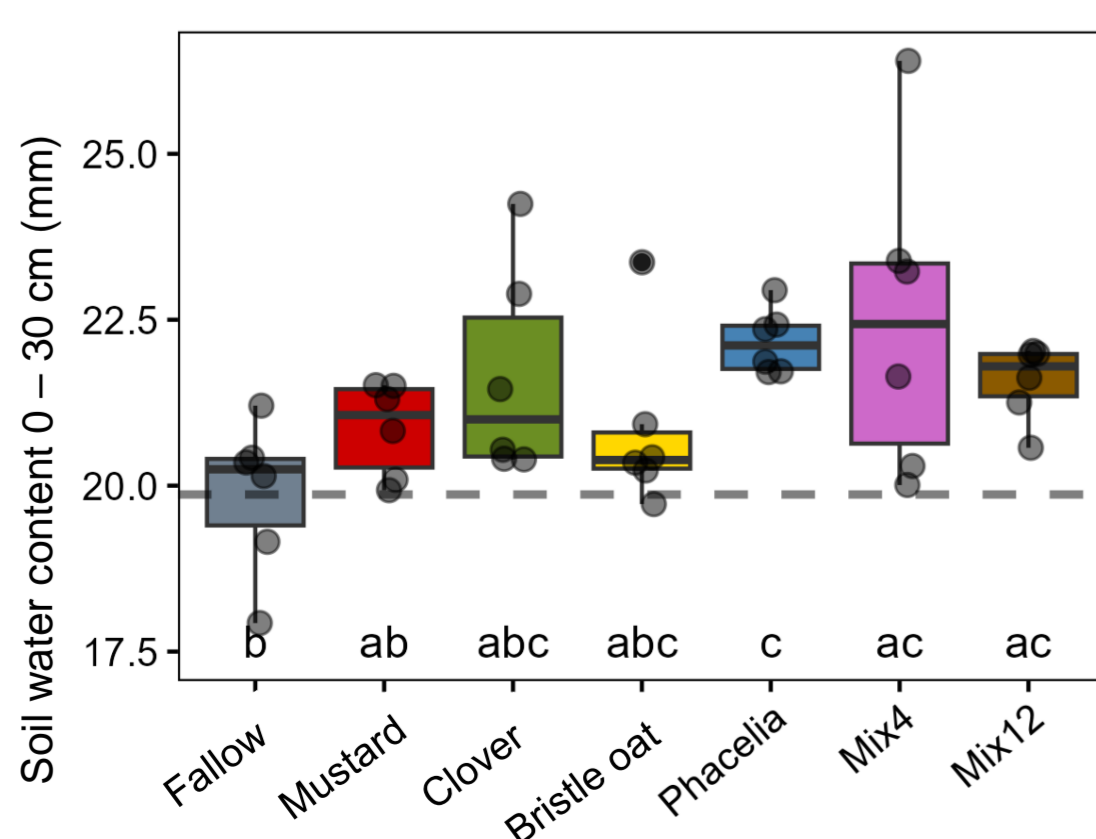

Fig. 2: Volumetric water content at different times during the main crop corn. Significant differences between the treatments are marked with lowercase letters. The dashed line marks the mean value of the fallow.

Cover crops improve soil structure

Studies on aggregate stability show that long-term integration of catch crops into the crop rotation leads to larger and more stable aggregates in the soil. Intercrop mixtures tend to increase the positive effects, but are not statistically different from pure seeds.
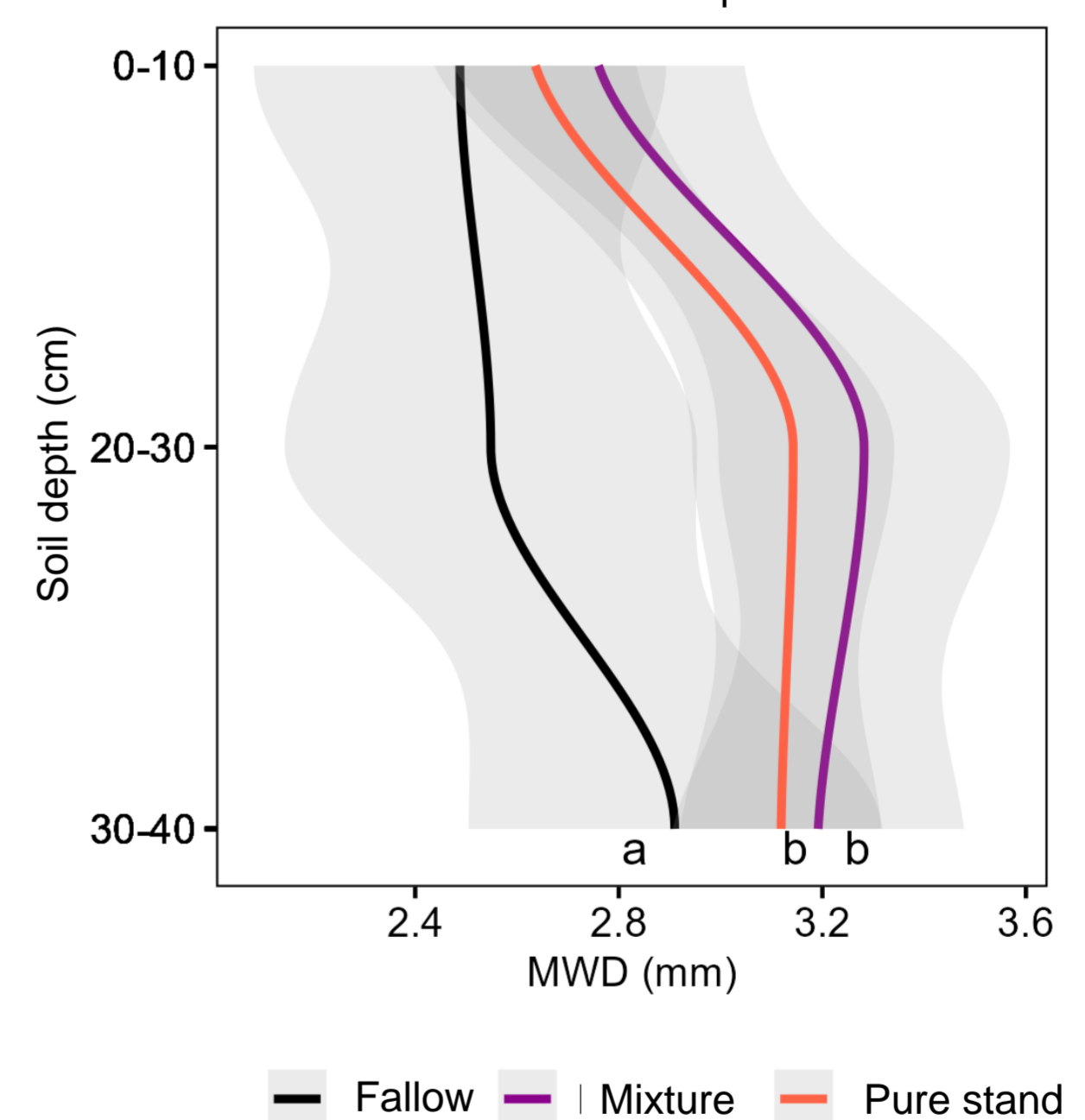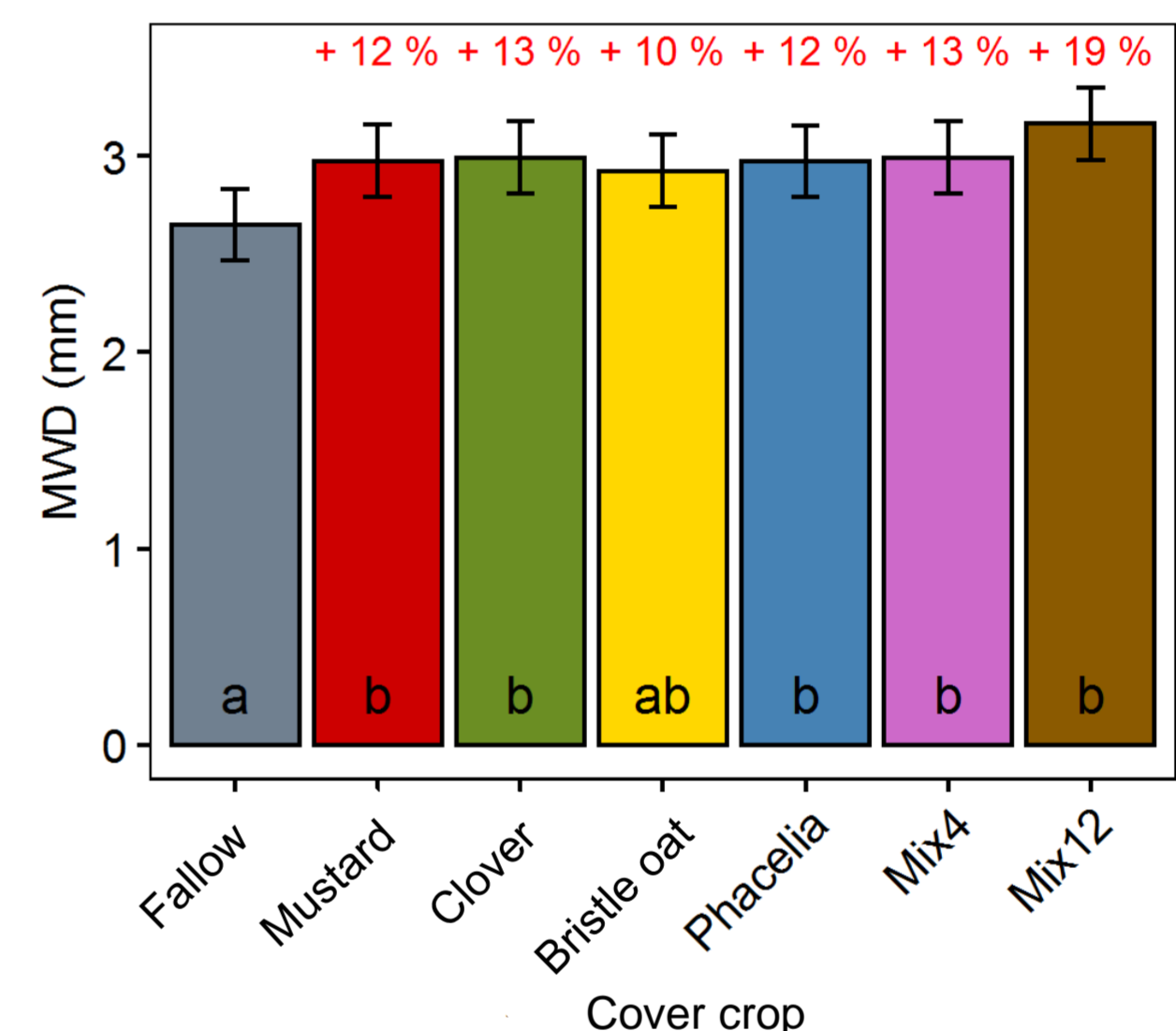

Fig. 2-3: Mean weighted diameter (MWD) of water-stable aggregates. The higher the MWD index, the larger and more stable the soil aggregates. Significant differences between treatments are marked with lowercase letters.