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Soil water repellence response to soil water content depends on temperature

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Improving water capture and storage in soils during rainfall in semi-arid areas is important for broad acre rainfed cropping systems, especially where soil water repellence (SWR) occurs. Soil water repellence is problematic in rainfed cropping soils as it restricts water infiltration, decreasing water use efficiency (WUE), inhibits crop germination and growth. Overcoming SWR increases WUE and can potentially improve crop yields. Predicting the severity of SWR at the break of season, typically prior to or during seeding is difficult as it varies non-linearly depending on soil water content (SWC) and temperature. Furthermore, the interaction between SWR and SWC at various temperatures has not been investigated. We investigated how SWR varies at low SWC and at different temperatures in a sandy-textured soil. We hypothesised that SWR would have different but constant response with initial increase in SWC, after which SWR would increase at different rates with temperatures. Soil samples were dried at 20˚C and -0.1 MPa using a vacuum drying oven prior to wetting to different SWCs by exposing them to various relative humidities (10% – 100%) using different saturated salt solutions in separate desiccators, and at 4˚C, 20˚C and 40˚C. Soils are dried at 20˚C to minimise potential temperature effect on SWR. Adjusting SWC using desiccators enabled non-disturb wetting of soils in a controlled environment. Five replicates of 20 g of soils were prepared in 100 mm petri dishes for each different humidity. 15 measurements of molarity ethanol droplet (MED) tests for each replicates were carried out at a 20˚C temperature controlled room and the average MED scores were calculated. SWR did not respond to initial increases in SWC at the tested temperatures; however, at 0.62% gravimetric SWC, SWR increased linearly with increasing SWC, but at different rates depending on soil temperature. As far as we are aware, this is the first time that a relationship between SWR and SWC at different soil temperature have been reported. Temperature and rainfall condition can affect SWR at the break of dry to the rainy season since soil temperature and SWCs vary when the season changes. Our findings provide further insight towards how SWR respond under these different conditions.