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Quantifying the limiting role of soil hydraulic conductance on plant water relations during drought

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Soil hydraulic properties regulate water movement from the soil to the leaves and thus impact plant hydraulic functions. Water moves along a pressure gradient that allows the plant to take up water from the soil. As vapor pressure deficit increases and soil water becomes scarce, tension rises in the plant vascular system and leaves progressively lose turgidity. Although the decline in both soil and plant hydraulic conductance has been extensively studied, it is under debate the sequence of the declines in hydraulic conductance along the soil-plant continuum. Precisely it is not clear whether it is the soil that loses its capacity to transport water to plants fast enough, triggering stomatal closure before substantial decline in any plant tissue conductance. Here, we propose a method to quantify and compare the soil and plant hydraulic conductance in plants undergoing soil drying. We studied wheat (*T. Aestivum)* grown in two contrasting soil textures and subjected to a drought treatment. We targeted conditions when water started to be limiting but before excessive soil drying – i.e. when transpiration was about half of its maximum. Together with novel rehydration techniques and high temporal resolution water potential measurements, we quantified and isolated the various compartments within the soil-plant system. Our results show that the soil hydraulic conductance in the coarser soil limits the total hydraulic conductance of the whole system at less negative soil water potentials. Although less limiting to water movement when fully wet, a coarse soil proves to be much more limiting as soon as it starts drying. These results highlight the central role of understanding soil-specific properties when evaluating plant drought resilience.