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Water Competition of Intercropped Pearl Millet with Cowpea under Drought and Soil Compaction Stresses

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Abstract: Intercropping pearl millet with cowpea is a common practice in semiarid areas. Under limited water environments, competition for soil water between intercropped plants may be strong. Furthermore, the increasing soil compaction problems, due to the use of heavy machinery, may intensify competition for limited resources, particularly in the topsoil. Two field trials were conducted to evaluate the water competition ability of intercropped pearl millet when subjected to drought and soil compaction during the 2004 Japanese summer. For this purpose plant water sources were determined by the hydrogen stable isotope (deuterium) technique. Plant water relations and biomass production were also evaluated. According to the deuterium concentration values in xylem sap, pearl millet water sources were changed by the competition with cowpea. Pearl millet was forced to rely more on recently supplied (irrigation/rainfall) water. In contrast, the water sources of cowpea were unchanged by plant competition. When plants were subjected to drought, the transpiration rate of pearl millet was reduced by 40 % of its monocropped potential by competition, but that of cowpea was not. Moreover, intercropped pearl millet, under drought and soil compaction, showed lower leaf water potential and biomass than their respective monocropped counterparts. Cowpea had a higher competitive ratio under wet, dry, and compaction treatments, while pearl millet was more competitive under loose conditions. In conclusion, under drought and soil compaction, water competition restricted the water use of intercropped pearl millet, forcing pearl millet to shift to the recently supplied water. In contrast, cowpea did not show any significant changes under these stress

conditions.

Keywords: [Deuterium](#), [Heavy water](#), [Leaf water potential](#), [Mechanical stress](#), [Stable isotope](#), [Water source](#), [Water uptake](#)



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