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Pearl Millet Developed Deep Roots and Changed Water Sources by Competition with Intercropped Cowpea in the Semiarid Environment of Northern Namibia

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Abstract: The practice of intercropping pearl millet with cowpea is widespread among subsistence farmers in northern Namibia. In this region, the scarce and erratic rainfall may enhance competition for the limited soil water between intercropped plants. Trials were conducted on a field of the University of Namibia (on-station) and on a farmer's field (off-station) to determine the effects of competition between pearl millet and cowpea on the water sources and plant growth of each crop. The deuterium analysis showed that pearl millet, intercropped with cowpea, significantly increased its dependence on the recently supplied labeled irrigation water. Intercropped cowpea also showed an increased trend of the dependence but it was not statistically significant. At the university field, intercropped pearl millet showed higher dependence on the irrigation water than monocropped pearl millet. At the farmer's field, the dependence of intercropped pearl millet on the irrigation water was low in the pearl millet-dominant zone. In contrast, the dependence on the irrigation water was high in the cowpea-dominant zone, indicating that the dependence on the irrigation water changes according to the size of the pearl millet canopy. The water sources of cowpea did not show a significant difference at either pearl millet-dominant or cowpea-dominant zone, indicating a stable water uptake trend under competitive conditions. Competition with cowpea significantly increased the root-weight density of intercropped pearl millet in the deep soil layers, but decreased that in the shallow layers.

The root-weight density of intercropped cowpea, however, was reduced in most of the soil layers. In conclusion, cowpea has a higher ability to acquire existing soil water, forcing pearl millet to develop deep roots and shift to the surface irrigation water.

Keywords: Heavy water, Leaf water potential, Rooting pattern, Stable isotope, Water stress, Water uptake

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