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## Productivity and Water Source of Intercropped Wheat and Rice in a Direct-sown Sequential Cropping System: The Effects of No-tillage and Drought

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**Abstract:** In Japan, wheat-rice crop rotation with the practice of rice transplanting has been quite popular in the past. Mechanized direct-planted wheat-rice sequential cropping was developed at the Aichi Prefecture Agricultural Research Center by intercropping them for two months in spring. An objective of this study was to evaluate the introduction of continuous no-tillage to the cropping system with emphasis on water stress. The water source of intercropped wheat was also elucidated using deuterated heavy water to analyze water competition between crops. Continuous no-tillage of wheat-rice direct planting was performed for six seasons (three years) in an experimental small paddy field. No-tillage resulted in a doubled soil penetration resistance in the surface layer of soil, indicating the risk of suppressing root development. The higher yield of wheat in the dry plot suggested that excess-moisture stress occurs in the field. In the no-tillage plot, light transmission to intercropped rice seedlings increased significantly due to the reduced wheat biomass production. Wheat and rice yields were not statistically lowered by the no-tillage practice. This indicated that it is possible to introduce continuous no-tillage to the cropping system. The no-tillage significantly increased the deuterium concentrations in the xylem sap in wheat after the application of simulated rainfall with deuterated water. This indicated that the water uptake dependency of wheat shifted from stored soil water to recently applied water, which suggested the higher competition between the crops may occur under no-tillage conditions.

**Keywords:** [Competition](#), [Crop rotation](#), [Deuterium](#), [Direct sowing](#), [Hydrogen stable isotope](#), [Intercropping](#), [No-tillage](#), [Water use](#)



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