

Converting alfalfa pasture into annual cropland achieved high productivity and zero loss of soil organic carbon in a semiarid area

Xu-long Zhang¹, Yangyang Zhao¹, Wenjuan Gao², Xin Song¹, Xintan Zhang¹, Xiaoyan Shi¹, and Fengmin Li¹

¹Lanzhou University

²Institute of Hydrobiology Chinese Academy of Sciences

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Abstract

Converting alfalfa (*Medicago sativa* L.) into cropland (rotation cropland, RC) is a common way of land use to reuse degraded alfalfa pasture. However, it is a big challenge for RC to achieve high productivity and maintain high soil organic carbon (SOC) achieved by previous alfalfa. Here, we conducted a nine-year field experiment, with continuous cropland (CC) under plastic film mulching as reference, to evaluate soil moisture restoration, crop productivity, and SOC in RC also under plastic film mulching, in the case of fertilization and non-fertilization, respectively. SOC and total soil N in the alfalfa pasture before conversion were 12.3% and 7.7% higher, but the available P and inorganic-N were 59.2% and 71.5% lower than in CC, respectively. The crop yield and biomass were not significant between RC and CC following the second year of conversion in both fertilization and without fertilization cases. The SOC and total soil N in RC with fertilization were similar to the previous alfalfa pasture throughout the nine-year experiment, while decreased in RC without fertilization by 8.3% and 7.5% after the nine years. Soil moisture in RC at 0-0.6 m restored to the level of CC only one year after the conversion, and restored from 77.6% and 56.2% of CC to 95.3% and 69.2% at 0.6-2 and 2-5 m through nine-years after conversion. These findings help to dispel the worries about the long-term low production and rapid decline of SOC in RC and support for sustainable high-productivity and high SOC sequestration in dryland farming.

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