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Comparison of water consumption for the conversion of croplands to orchards in dryland ecosystems

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Abstract

Evapotranspiration (ET) is the main ecological and soil water consumption process in terrestrial ecosystems. Previous studies have investigated ET partitioning across sites and plants; however, direct comparisons of water consumption before and after the transition from one crop to another are scarce. The variation in and proportion of ET and its subcomponents as well as the change in soil water storage (SWS) were compared in maize (*Zea mays* L.) croplands and apple (*Malus domestica* auct. non Borkh. cv. Fuji) orchards in four active (approximately May to September) and three inactive growth periods on the southern Loess Plateau, China. Soil water evaporation (E_s) accounted for 36.3 and 37.7% of the total ET for cropland and orchard, respectively, in the active growth period. The canopy interception (I_c) significantly differed between cropland and orchard. The mean I_c /ET for cropland and orchard was 23.1 and 22.7%, respectively, in the active growth period, showing that the effects of I_c on ET partitioning should not be ignored. The mean ratio of transpiration (T) to ET for cropland was 2.8% less than that for orchard during the active growth period. The T /ET of cropland peaked twice in each active growth period. Precipitation (P) met the water consumption requirements of crop growth in the active growth period. The ET of cropland and orchard in the inactive growth period accounted for 29.4 and 31.8% of the ET for the hydrological year, respectively. These results help assess water consumption and soil sustainability under changes in crops in dryland agricultural ecosystems.

1 | INTRODUCTION

Any precipitation (P) that passes through the vegetated landscape is bound to interact with plant surfaces (Van Stan et al., 2020). Before falling to the ground, a portion of P is first

intercepted by the canopy and returned to the atmosphere by evaporation (called canopy interception, I_c) (D. Wang & Wang, 2018a). The P across the canopy replenishes the soil reservoir and is also absorbed by plants (L. Zhao & Zhao, 2014). The interaction between the environment and plants