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REGULAR ARTICLE

Over twenty years farmland reforestation decreases fungal diversity of soils, but stimulates the return of ectomycorrhizal fungal communities

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Abstract
Background and Aims Although soil-inhabiting fungi can affect tree health and biomass production in managed and pristine forests, little is known about the sensitivity of the plant-fungal associations to long-term changes in land use. We aimed to investigate how reforestation of farmlands change soil characteristics and affected the recovery of soil fungal functional guilds.
Methods We examined edaphic conditions and fungal communities (Illumina Sequencing) in three land-use types: primary forests (PF), secondary forests (SF, established over two decades ago) and active farmlands during May, July and September in Wuying, China.
Results Edaphic conditions and general fungal communities varied with land-use. Interestingly, overall fungal diversity was higher in soils at the farmland than at the forested sites, possibly as a result of recurring disturbances (tilling) allowing competitive release as described by the intermediate disturbance hypothesis. Although ectomycorrhizal fungal diversity and richness were marginally higher in PF than in SF, the latter still hosted surprisingly diverse and abundant ectomycorrhizal fungal communities.
Conclusions Reforestation largely restored fungal communities that were still in transition, as their composition in SF was distinct from that in PF. Our results highlight the ability of fungi grown in previously strongly managed agricultural land to rapidly respond to reforestation and thus provide support for forest trees.

Keywords Fungal community development · Reforestation · Fungal functional guild · Atrazine · Ectomycorrhizal fungal community

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Introduction

Environmental restoration has received considerable attention in the past decades. For example, the Grain for Green (GFG) project, one of the world's largest environmental rehabilitation projects, was launched in China in 1999. The GFG project aimed to convert low-yield farmlands into forests and pastures, thus restoring regional ecosystems (Lei et al. 2012). Recent studies within GFG have shown that implementation of the GFG strategy generally results in favorable ecological outcomes on, for example, carbon sequestration and soil organic carbon storage (Chang et al. 2011; Song et al.