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RESEARCH ARTICLE

Buried straw layer and plastic mulching increase microflora diversity in salinized soil



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Abstract

Salt stress has been increasingly constraining crop productivity in arid lands of the world. In our recent study, salt stress was alleviated and crop productivity was improved remarkably by straw layer burial plus plastic film mulching in a saline soil. However, its impact on the microflora diversity is not well documented. Field micro-plot experiments were conducted from 2010 to 2011 using four tillage methods: (i) deep tillage with plastic film mulching (CK), (ii) straw layer burial at 40 cm (S), (iii) straw layer burial plus surface soil mulching with straw material (S+S), and (iv) plastic film mulching plus buried straw layer (P+S). Culturable microbes and predominant bacterial communities were studied; based on 16S rDNA, bacterial community structure and abundance were characterized using denaturing gradient gel electrophoresis (DGGE) and polymerase chain reaction (PCR). Results showed that P+S was the most favorable for culturable bacteria, actinomycetes and fungi and induced the most diverse genera of bacteria compared to other tillage methods. Soil temperature had significant positive correlations with the number of bacteria, actinomycetes and fungi ($P < 0.01$). However, soil water was poorly correlated with any of the microbes. Salt content had a significant negative correlation with the number of microbes, especially for bacteria and fungi ($P < 0.01$). DGGE analysis showed that the P+S exhibited the highest diversity of bacteria with 20 visible bands followed by S+S, S and CK. Moreover, P+S had the highest similarity (68%) of bacterial communities with CK. The major bacterial genera in all soil samples were *Firmicutes*, *Proteobacteria* and *Actinobacteria*. Given the considerable increase in microbial growth, the combined use of straw layer burial and plastic film mulching could be a practical option for alleviating salt stress effects on soil microbial community and thereby improving crop production in arid saline soils.

Keywords: buried straw layer, plastic mulch, soil microflora changes, PCR-DGGE, microflora diversity, salinized soil

1. Introduction

Soil salinization is a worldwide land degradation problem. According to FAO (2008) survey, it is expected that over 800 million ha will be affected by salinity in the near future, making it a major constraint to food production for a steadily increasing population. Salinity occurs mainly in arid and semi-arid regions, where evapotranspiration exceeds annual precipitation and irrigation is the essential means for crop

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