

免耕和秸秆还田对小麦生长期土壤酶活性的影响

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Effects of No-Tillage and Straw Incorporation on Soil Enzyme Activity During Wheat Growth

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摘要

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摘要 利用中国科学院封丘农业生态实验站保护性耕作定位试验平台, 研究全翻耕、常规耕作、免耕、全翻耕+秸秆还田、常规耕作+秸秆还田和免耕+秸秆还田6种耕作方式对小麦生长期土壤酶活性的影响。结果表明: (1) 在小麦整个生育期, 土壤碱性磷酸酶、转化酶、脲酶活性表现为免耕处理大于常耕处理, 翻耕处理小于常耕处理, 有秸秆处理大于无秸秆处理, 3种酶活性以免耕+秸秆还田处理为最高, 翻耕处理最低。(2) 在小麦成熟期, 土壤脱氢酶活性表现为免耕处理小于常耕处理, 其他生育期土壤脱氢酶活性表现为免耕处理大于常耕处理, 有秸秆处理大于无秸秆处理。(3) 在小麦不同生育期, 各处理土壤酶活性表现出不同的规律性: 碱性磷酸酶活性在苗期较低, 至孕穗期达到峰值, 至成熟期又有所降低; 转化酶活性呈现在拔节期大幅升高而后降低的变化趋势; 脲酶活性分别在苗期和孕穗期较高; 脱氢酶活性在整个生育期一直增加, 成熟期达到峰值。(4) 4种土壤酶活性之间相关性均达显著水平, 聚类分析表明, 按照土壤总体酶活性水平可将6个处理划分为3组, 酶活性水平最高的为免耕+秸秆还田处理, 免耕结合秸秆还田能较好地提升土壤酶活性。

关键词: 免耕 秸秆还田 玉米-小麦轮作 土壤酶活性

Abstract: A field experiment was carried out to evaluate effects of conservative tillage on soil enzyme activity following a cropping rotation system of corn and wheat in the Fengqiu National Agro-Ecological Experiment Station, China. The experiment was designed to have 6 treatments or tillage practices, i.e., tillages for both corn and wheat (C_TW_T), no-tillage for corn and tillage for wheat ($C_{NT}W_T$), no-tillage for either corn or wheat ($C_{NT}W_{NT}$), tillages for both corn and wheat with straw incorporated ($C_TW_T S$), no-tillage for corn and tillage for wheat with straw incorporated ($C_{NT}W_T S$) and no-tillage for either corn or wheat with straw incorporated ($C_{NT}W_{NT} S$). Results show that Treatment $C_{NT}W_{NT}$ was higher than Treatment $C_{NT}W_T$, Treatment $C_{NT}W_T$ was higher than Treatment C_TW_T , and the treatments with straw incorporated were higher than those without in activities of urease, alkaline phosphatase and sucrose in the soil during the entire wheat growing period. Obviously, Treatment $C_{NT}W_{NT} S$ was the highest and Treatment C_TW_T the lowest. Soil dehydrogenase differed from the other 3 soil enzymes in response. Its activity was higher in Treatment $C_{NT}W_T$ than in Treatment $C_{NT}W_{NT}$ in the wheat maturing period, and higher in Treatment $C_{NT}W_{NT}$ than in Treatment $C_{NT}W_T$ and in the treatments with straw incorporated than in those without during the other growth periods. The enzymes differed in response to different treatments at different wheat growth stages. Alkaline phosphatase tended to be low in activity at the seedling stage, peaked at the booting stage and went down at the maturing stage; invertase soared up at the elongation stage and then declined; soil urease tended to be high at the seeding and booting stages; and dehydrogenase increased steadily throughout the whole growth period and peaked at the maturing stage. Correlations between the four soil enzymes all remained at a significant level. Cluster analysis further indicates that the 6 treatments could be sorted into three groups according to the enzyme activity level in the soil as a whole. Treatment $C_{NT}W_{NT} S$ is the highest in enzyme activity, demonstrating that the practice can quite well improve soil enzyme activity.

Keywords: no-tillage straw incorporation wheat-corn rotation soil enzyme activity

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