生态学报 2006 26 (2006(01)): 48～53 ISSN: 1004-616x CN: 44-1063/R

研究论文

大气CO_2浓度升高对不同施氮土壤酶活性的影响

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收稿日期 2004-10-10 修回日期 2005-4-11 网络版发布日期: 2006-1-25

摘要 利用中国唯一的无锡FACE（Free-air CO_2 enrichment，开放式空气CO_2浓度升高）平台，研究了大气CO_2浓度升高对土壤β-葡糖苷酶、转化酶、脲酶、酸性磷酸酶、β-氨基葡糖苷酶的影响。研究发现，不同氮肥处理下大气CO_2浓度升高对某些土壤酶活性的影响不同。在低氮施肥处理中，大气CO_2浓度升高显著降低β-葡糖苷酶活性，但是在高氮施肥处理下，大气CO_2浓度升高显著增加β-葡糖苷酶活性。在低氮和常氮施肥处理中大气CO_2浓度升高显著增加了土壤脲酶活性，但在高氮水平下影响不显著。在低氮、常氮施肥处理中，大气CO_2浓度升高对土壤酸性磷酸酶活性没有影响，而在高氮施肥处理中显著增强了土壤中磷酸酶活性。大气CO_2浓度升高对土壤转化酶活性和β-氨基葡糖苷酶的活性有增加趋势，但影响不显著。研究还发现，在不同的CO_2浓度下，土壤酶活性对不同氮肥处理的响应也不同。在正常CO_2浓度下，土壤中β-葡糖苷酶活性随着氮肥施用量的增加而降低，而在大气CO_2浓度升高条件下，却随着氮肥施用量的增加而增加。在大气CO_2浓度升高条件下，高氮施肥显著增加了转化酶和酸性磷酸酶活性，而在正常CO_2浓度下，影响不显著。在大气CO_2浓度升高条件下，氮肥处理对脲酶活性的影响不大，但在正常CO_2浓度下，脲酶活性随着氮肥施用量的增加而增加。氮肥对β-氨基葡糖苷酶活性的影响不明显。

关键词 大气CO_2浓度升高；土壤酶活性；氮肥处理

分类号 Q143,S154.1,S154.3

Effects of elevated atmospheric CO_2 on soil enzyme activities at different nitrogen level

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Abstract It has been predicted that elevated atmospheric CO_2 will increase enzyme activity as a result of CO_2-induced carbon entering the soil. The objective of this study was to investigate the effects of elevated atmospheric CO2 on soil enzyme activities under a rice/wheat rotation. This experiment was conducted in Wuxi, Jiangsu, China under China FACE (Free Air Carbon dioxide Enrichment) Project system. Two atmospheric CO2 concentrations ((580±60) and (380±4

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0) μmol•mol^{-1})) and three N application treatments (low nitrogen,LN 150 kg•hm^{-2}, normal nitrogen, NN 250 kg•hm-2 and high nitrogen, HN 350kg•hm^{-2}) were included. Soil samples (0～10 cm) were collected for analysis of β-glucosidase, invertase, urease, acid phosphates and β-glucosaminidase activities. Results revealed that with elevated atmospheric CO_2 β-glucosidase activity significantly decreased (p<0.05) at low N application rates; had no significant effect with a normal N application rate; and significantly increased (p<0.05) with a high N application rate. For urease activity, at low and normal N application rates (but not high N application rate), elevated atmospheric CO_2 significa ntly increased (p<0.05) it. With acid phosphatase elevated atmospheric CO_2 only had significant higher effects (p<0.05) at high N application rates. Under different CO_2 concentration, effects of N fertilization are also different. Soil β-glucosidase activity at ambient CO_2 concentration decreased with N fertilization, while it increased at elevated CO_2 concentration. In addition, invertase and acid phosphatase activities at elevated CO_2 concentrations, significantly increased (p<0.05) with N treatments, but there was no effect with the ambient CO_2 concentration. For urease activity, at ambient CO_2 concentrations, N fertilization increased it significantly (p< 0.05), whereas at elevated CO2 concentrations were not significant. Additionally, with β-glucosaminidase activity, there were no significant effects from N application. In general, then, elevated atmospheric CO_2 increased soil enzyme activity, which may be attributed to the following two factors: (1) elevated atmospheric CO_2 leading to more plant biomass in the soil, which in turn stimulated soil microbial biomass and activity; and (2) elevated atmospheric CO_2 that increased plant photosynthesis, thereby increasing plant-derived soil enzymes.

Key words elevated atmospheric CO_2 soil enzyme activity N fertilization treatment

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