PLANT NUTRITION AND FERT

ISSN 1008-505X
CN 11-3996/S

植物营养与肥料学报 » 2010, Vol. 16 » Issue (3) :626-633 DOI:

小麦和玉米秸秆腐解特点及对土壤中碳、氮含量的影响

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Decomposition characteristics of maize and wheat straw and their effects on soil carbon and nitrogen contents

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摘要 通过室内模拟培养试验，揭示了不同水分条件下小麦和玉米秸秆在土壤中的腐解特点及对土壤碳、氮含量的影响。结果表明， 1）水分条件对有机物质腐解的影响较大，在32 d 的培养期间，相对含水量为60%（M_{60}）时，土壤CO_2释放速率始终低于含水量80%（M_{80}）的处理。M_{60}条件下释放的CO_2-C 量占秸秆腐解过程中释放碳总量的40.1%，而M_{80}条件下达到51.5%； M_{60}条件下，添加秸秆土壤中有机碳含量平均提高2.24 g/kg，显著高于M_{80}条件下的1.43 g/kg。2）添加玉米秸秆的土壤，在培养期内CO_2释放速率始终高于小麦秸秆处理，CO_2-C 累积释放量和有机碳净增量分别为408.35 mg/pot和2.12 g/kg； 而小麦秸秆处理分别仅为378.94 mg/pot和1.56 g/kg，两种秸秆混合的处理介于二者之间。3）与未添加秸秆相比，土壤中添加小麦或玉米秸秆后，土壤有机碳、微生物量碳、全氮和微生物量氮含量均显著提高，且数量上总体趋势表现为： 玉米秸秆＞两种秸秆混合＞小麦秸秆。可见，适宜水分条件有利于秸秆腐解过程中秸秆中碳向无机碳方向转化，而不利于向土壤有机碳方向转化； 且玉米秸秆比小麦秸秆更易腐解。秸秆在土壤中腐解对补充土壤碳、氮作用很大，可改善土壤微生物生存条件，提高土壤质量。

关键词： 秸秆腐解 CO_2释放 土壤有机碳 微生物量碳 微生物量氮

Abstract： An incubation experiment was carried out to reveal decomposition characteristics of straw of maize and wheat and their effects on soil carbon and nitrogen contents. The experiment was lasted in dynamic microcosms for 32 days at 30℃ with 8 treatments combined with 2 moisture levels, namely, relative water content of 60% (M_{60}) and 80% (M_{80}), and 4 straw levels, namely, maize straw addition, wheat straw addition, mixed addition and no addition. The results show that，1) there is a strong influence of soil water content on the decomposition of the both crop straw in soils, and the rate of CO_2 evolution at RCW 60% is lower than that at RCW 80% throughout the incubation period. Moreover, the ratios of CO_2-C derived from straw to the total released C from straw are 40.1% and 51.5% under the M_{60} and M_{80} treatments, respectively, and the increases of SOC content are 2.24 and 1.43 g/kg for the two treatments. 2) The rate of CO_2-C evolution from maize straw decomposition is consistently higher than that from wheat straw. In the treatments where maize straw are added, the cumulative amount of CO_2-C evolution and net SOC increase are 408.35 mg/pot and 2.12 g/kg, and those for wheat straw additions are 378.94 mg/pot and 1.56 g/kg. When the two types of straw are mixed with soil, the two values range between those of solely additions. 3) Compared to no straw addition at the end of 32 d incubation, the contents of SOC, microbial biomass C, total N and microbial biomass N in the straw addition treatments are significantly increased, and they are almost ranked in maize straw＞maize and wheat straw＞wheat straw. Therefore, it is more easily to transform the straw carbon into inorganic C (CO_2) than into SOC under high water condition, and maize straw decomposition is easier than that of wheat straw. In conclusion, the high contribution of straw returning to soil can be regarded as a supplement to soil carbon pool and nutritious elements including N, and microbe, and thus soil quality is improved.

Keywords： straw decomposition CO_2-C evolution soil organic carbon microbial biomass C microbial biomass N

Received 2009-09-21;

Fund:

国家科技支撑计划课题（2007BAD89B16、2006BAD05B07）； 国家自然科学基金面上项目（40971179）资助。

引用本文:

南雄雄, 田霄鸿, 张琳, 游东海, 吴玉红, 曹玉贤.小麦和玉米秸秆腐解特点及对土壤中碳、氮含量的影响[J] 植物营养与肥料学报, 2010,V16(3): 626-633

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