应用生态学报 » 2013, Vol. 24 » Issue (7): 1849-1855 DOI:

黄土高原不同侵蚀类型区生物结皮固氮活性及对水热因子的响应

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Biological soil crust nitrogenase activity and its responses to hydro-thermic factors in different erosion regions on the Loess Plateau, China.

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全文: PDF (586 KB) HTML (KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要

在野外调查的基础上,采集不同侵蚀类型区内发育至稳定阶段的生物结皮,分析水分和温度变化对生物结皮固氮活性的影响.结果表明:水蚀区、水蚀风蚀交错区、风蚀区生物结皮固氮活性表现为水蚀区(127.7 μmol·m^{-2}·h^{-1})>水蚀风蚀交错区(34.6 μmol·m^{-2}·h^{-1}) >风蚀区(6.0 μmol·m^{-2}·h^{-1});3个侵蚀类型区生物结皮固氮的最适温度分别为35、25和15 ℃.在最适温度条件下,水蚀区及水蚀风蚀交错区生物结皮固氮活性在100%~40%田间持水量时差异不显著;风蚀区生物结皮固氮活性对水分变化较为敏感,当含水量降至80%田间持水量时固氮活性开始显著降低,降至20%田间持水量时,生物结皮固氮作用停止.3个侵蚀类型区生物结皮固氮活性及其对水分与温度变化响应的差异与不同侵蚀类型区的气候、环境及生物结皮物种组成有关.

关键词: 生物结皮 侵蚀类型区 乙炔还原法 固氮活性 环境因子

Abstract:

Based on field survey, the biological soil crusts at their stable development stage were collected from the water erosion region, water-wind erosion region, and wind erosion region on the Loess Plateau, aimed to study the effects of the variations of moisture and temperature on the crusts nitrogenase activity (NA). The NA of the crusts in the erosion regions decreased in the order of water erosion region (127.7 μmol·m^{-2}·h^{-1}) > water-wind erosion region (34.6 μmol·m^{-2}·h^{-1}) > wind erosion region (6.0 μmol·m^{-2}·h^{-1}), and the optimal temperature for the crust nitrogen fixation was 35 ℃, 25 ℃, and 15 ℃, respectively. At the optimal temperature and 100%-40% field water-holding capacity, the NA of the crusts from the water erosion and water-wind erosion regions had no significant difference. The NA of the crusts from the wind erosion region was more sensitive to the variation of moisture, showing a dramatic decline when the moisture decreased to 80% field water-holding capacity, and totally lost when the moisture decreased to 20% field water-holding capacity. The differences in the NA of the crusts from the three erosion regions and the responses of the NA to the variations of moisture and temperature were likely associated with the climate, environment, and the crust species composition.

Key words: biological soil crust erosion region acetylene reduction assay (ARA) nitrogenase activity environmental factor.

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