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Effects of soil environment on soil carbon flux of Robinia pseudoacacia forest at different stand ages in Longdong Loess Plateau, China

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Vegetation carbon cycles play an important role in efforts to understand and mitigate climate change. Soil environment is one of the key elements affecting soil carbon flux on artificial plantations. This study investigated the mechanisms between soil environmental factors and soil carbon flux thus distinguishing the main driving factors for soil carbon flux, which remained poorly understood to date. The in-situ monitoring of soil carbon flux of Robinia pseudoacacia at different restoration periods (12, 14, 15, and 18 years) were carried out in the Longdong Loess Plateau by Li-8100 system. Grassland was used as control. Meanwhile, the soil environmental factors such as soil organic matter, soil moisture soil temperature at 5 cm and surface temperature were detected simultaneously. The results showed that: 1) the surface temperature and soil temperature were significantly correlated with soil carbon flux ($P < 0.01$), the degree of fitting was 64.64% -96.27%. Compared with surface temperature, Soil carbon flux is more sensitive to soil temperature, and the values of Q10 varied from 2.21 to 4.36. The highest value was detected in 15 and 18 years, whereas the grassland exhibited the lowest. 2) There was a significant linear correlation between soil carbon flux and soil moisture ($P < 0.01$), while the regression model can only explain the variation of soil carbon flux by 19.57% - 36.70%. 3). Total nitrogen, available nitrogen, available phosphorus, available potassium and soil organic matter showed similar trend in different stand ages, all of these decreased with the increase of soil depth. In the top soil layer (0-10 cm), soil nutrients showed highest value while the lowest values were presented at 60-100 cm soil layer.The level of soil nutrient contents affected the release rate of soil carbon flux. The soil nutrient contents of 14 and 15 years increased rapidly. Soil temperature was the main driving factors for determining soil carbon flux. Our results could provide data for exploring the mechanism of soil carbon flux in the Longdong Loess Plateau.