Contribution of Heterotrophic Respiration to Total Soil Respiration in a Wheat Field

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ABSTRACT

The contribution of soil respiration needs to be understood to evaluate the implications of environmental change on soil carbon cycling and sequestration. The response of soil respiration to varying environmental factors was studied in a wheat field. The continuous soil gradient method combined with the trench method was used to (1) determine the temporal variation of total soil respiration (Rs) and heterotrophic respiration (Rh) and (2) investigate the relative effect of soil temperature (T_s) and soil water content (W_s) which control soil respiration. The result showed that temporal variations of soil respiration were dominantly controlled by T_s during the days. The variation in Rs and Rh showed a similar pattern of seasonal change in T_s (0.69 to 4.17 μmol $m^{-2}s^{-1}$ and 0.45 to 2.95 μmol $m^{-2}s^{-1}$, respectively). Rh ranged from 36% - 86% of Rs. The Rs was limited by Ws while Ts played as a secondary role; Rh, however, appeared to be correlated with both T_s and W_s. These results suggested that the factors controlling the variation in soil respiration differed between Rh and Rs. Additionally, two-variable equations could be better used to model the relationships of soil respiration to both T_s and W_s together, with the R^2 ranging from 0.53 to 0.83.

Key words: Heterotrophic respiration, Soil respiration, Soil temperature, Soil water content

INTRODUCTION

Carbon dioxide (CO_2) emission from the soils is an important component of the global carbon (C) cycle and has been shown to play a role in global warming. Extensive evidence suggests that this is associated with the increasing atmospheric CO_2 concentration (Schlesinger and Andrews, 2000). Soil respiration typically accounts for more than three-quarters of the CO_2 released through ecosystem respiration (Law et al., 2001) and is primarily controlled by temperature and soil moisture (Lloyd and Taylor, 1994; Davidson et al., 1998; Fang and Moncrieff, 1999; Jassal et al., 2008). It is thought that even a small increase in global