

## Effect of soil temperature and soil moisture on soil respiration of ungrazed grassland in Loess Plateau , Gansu

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**Key words :** soil respiration , soil temperature , soil moisture , grassland , Loess Plateau

**Introduction** Soil respiration (SR) is a major component of greenhouse gas emission and is a crucial pathway of the C cycle . The potential increase of SR caused by global warming may present a positive feedback effect on atmospheric CO<sub>2</sub> and climate change (Kirschbaum ,1995) . However , the factors that control the exchange of CO<sub>2</sub> between soil and atmosphere in Loess Plateau , Gansu are not well understood . The results in this paper represent a preliminary exercise in studying SR variations and its correlation with soil temperature (Ts) and soil moisture (Ms) .

**Materials and methods** Monthly measurements of SR were made from August 2006 to July 2007 in a fenced *Stipa . bungeana* grassland (free from grazing since Oct . 2005) which located in the Semi-Arid Climate and Environment Observatory Station of Lanzhou University ( 35° 57' N , 104° 09' E) . The measurements of SR were made by using a LICOR 6400 portable photosynthesis system fitted with a soil respiration chamber (LICOR , Inc . , Lincoln NE) . SR was measured between 8 :00~10 :00 . 12 PVC collars that held the SR chamber were set 24 hours before SR measuring . Ts at 2 , 5cm depths and Ms down to 10cm were measured simultaneously .

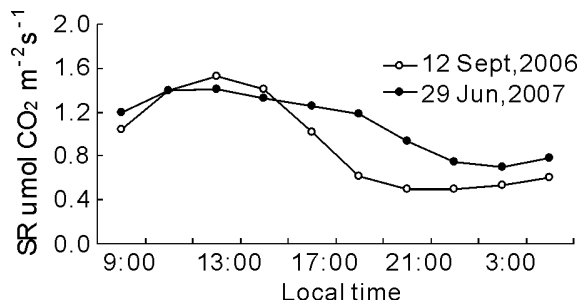


Figure 1 Diurnal variations of SR .

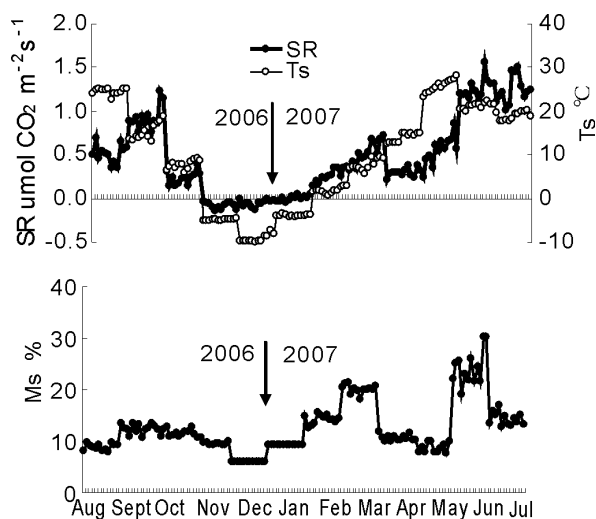


Figure 2 Seasonal variations of SR , Ts and Ms .

**Results** Diurnal variations of SR could be expressed as one-humped curves , reaching to the maximum around 13 :00 and falling to the minimum between 0 :00 ~ 3 :00 in different growing periods . Ts at 5cm depth was the dominant factor controlling SR (  $P < 0 . 001$  ) . Ms had relatively little effect on diurnal SR variation as it changed little within one day . Seasonal SR variation was dominated by Ts-Ms interaction and root biomass . The maximum of SR was observed in Jun , 2007 , while the minimum in Nov , 2006 . Negative CO<sub>2</sub> efflux was observed from Nov , 2006 to Jan , 2007 . The correlation between Ts at 2cm , 5cm depths and SR were much remarkable ( $R^2 = 0 . 54$  and  $R^2 = 0 . 56$  ,  $P < 0 . 001$  ) . Ms was secondary factor controlling SR variation at seasonal scale . The single Ms effect on SR was examined by normalizing SR at a reference value of 20°C , and the correlation was significant ( $R^2 = 0 . 39$  ,  $P < 0 . 001$  ) . When both Ts and Ms effects on SR were considered , SR could be given better simulations :  $SR = 0 . 024T + 0 . 039Ms - 0 . 26$  ( $R^2 = 0 . 73$  ,  $P < 0 . 001$  ) .

**Conclusions** Ts was dominant factor controlling diurnal SR variation when Ms was relatively stable . Both Ts and Ms effects on SR could better reveal SR variation at seasonal scale , thus the predictive capacity of the model about SR variation has been improved .

### Reference

Kirschbaum , M . U . F . , 1995 . The temperature dependence of soil organic matter decomposition , and the effect on global warming on soil organic C storage . *Soil Biol . Biochem .* 27 , 753-760 .