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Comparative study on CO₂ emissions from different types of alpine meadows during grass exuberance period

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Potentilla fruticosa scrub, Kobresia humilis meadow and Kobresia tibetica meadow are widely distributed on the Qinghai-Tibet Plateau. During the grass exuberance period from 3 July to 4 September, based on close chamber-GC method, a study on CO₂ emissions from different treatments was conducted in these meadows at Haibei research station, CAS. Results indicated that mean CO₂ emission rates from various treatments were 672.09±152.37 mgm⁻²h⁻¹ for FC (grass treatment); 425.41±191.99 mgm⁻²h⁻¹ for FJ (grass exclusion treatment); 280.36±174.83 mgm⁻²h⁻¹ for FL (grass and roots exclusion treatment); 838.95±237.02 mgm⁻²h⁻¹ for GG (scrub+grass treatment); 528.48±205.67 mgm⁻²h⁻¹ for GC (grass treatment); 268.97±99.72 mgm⁻²h⁻¹ for GL (grass and roots exclusion treatment); and 659.20±94.83 mgm⁻²h⁻¹ for LC (grass treatment), respectively (FC, FJ, FL, GG, GC, GL, LC were the Chinese abbreviation for various treatments). Furthermore, Kobresia humilis meadow, Potentilla fruticosa scrub meadow and Kobresia tibetica meadow differed greatly in average CO₂ emission rate of soil-plant system, in the order of GG>FC>LC>GC. Moreover, in Kobresia humilis meadow, heterotrophic and autotrophic respiration accounted for 42% and 58% of the total respiration of soil-plant system respectively, whereas, in Potentilla fruticosa scrub meadow, heterotrophic and autotrophic respiration accounted for 32% and 68% of total system respiration from GG; 49% and 51% from GC. In addition, root respiration from Kobresia humilis meadow approximated 145 mgCO₂m⁻²h⁻¹, contributed 34% to soil respiration. During the experiment period, Kobresia humilis meadow and Potentilla fruticosa scrub meadow had a net carbon fixation of 111.11 gm⁻² and 243.89 gm⁻², respectively. Results also showed that soil temperature was the main factor which influenced CO₂ emission from alpine meadow ecosystem, significant correlations were found between soil temperature at 5 cm depth and CO₂ emission from GG, GC, FC and FJ treatments. In addition, soil moisture may be the inhibitory factor of CO₂ emission from Kobresia tibetica meadow, and more detailed analyses should be done in further research.

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关键词: CO₂; alpine meadow; grass exuberance period; soil respiration; treatment doi: 10.1360/gso40205