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Effect of simulated N deposition on soil respiration in an old Korean pine (Pinus koraiensis) broad-leaved forest and a young secondary poplar and birch mixed forest in Northeastern China

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Responses of soil respiration to simulated N deposition were studied in an old –growth broad-leaved Korean pine forest (BKF) and a young secondary poplar (Populus davidiana) and birth (Betulla platyphylla) mixed forest (SPBF) in northeastern China from 2007 to 2008. Three N treatments (control, no N addition; Low-N, 2.5 g N m-2 yr-1; High-N, 5.0 g N m-2 yr-1) have been applied continuously since 2006. Soil respiration was measured using LI-COR 6400. The objectives of this study were to test the following hypothesis: 1) old forest has higher soil respiration than young forest; 2) soil respiration is more sensitive to N addition in young forests than in old forest because of younger tree age structure in the former; and 3) soil heterotrophic and autotrophic respirations do not show the same responses to N addition. Results showed that soil respiration had clear seasonal pattern, with the highest rates observed in summer and the lowest rates in spring and autumn in both forests. Soil respiration rates exhibited significant positive exponential relationship with soil temperature at 5 cm below surface and were independent of soil moisture variations. BKF had lower soil respiration rates than SPBF. Soil respiration in both forests did not show unanimous responses to N addition. In BKF, soil respiration was improved by the highest N addition but depressed by low N addition. In SPBF, it increased with increasing N addition gradient. Soil respiration was more sensitive to N addition in SPBF than in BKP, and the differences among treatments were more evident in summer than in autumn and spring. The effects of experimental N deposition were mainly attributed to root respiration because soil microbial respiration did not differ among three N treatments. Our results suggested that responses of soil respiration to the increase of atmospheric N deposition in north forests might vary depending on the rate of N deposition and forest type.

Key words: N deposition, soil respiration rate, soil temperature, broad-leaved Korean pine forest, secondary poplar and birch mixed forest