Effects of Yearly Simulated Temperature Rise and Nitrogen Deposition on Soil Nutrient in the Songnen Meadow Steppes of Northeast China

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Key words : soil nutrient , nitrogen (N) , phosphorus (P) , soil net N mineralization , global warming , N deposition , the Songnen meadow steppes , NE China

Introduction Soil is the largest carbon store in terrestrial ecosystems . Effects of global environmental change on soil carbon and nutrient cycling are consequently an area of intense research interest (Mosier , 1998) . Nutrinet cycling is inherently couples with soil C cycling (Lal , 2004) . The objectives of this study were (1) to quantify the effects of soil heating and N deposition on soil total N (TN) , soil total P (TP) , available N (AN) , and available P (AP) ; (2) to understand how the soil nutrient processes and functions of the Songnen meadow steppes respond to a single year of warming and increased N deposition , and to evaluate the potential consequences of climate change .

Materials and methods The measurements were carried out in the Northern Meadow Plot at the Changling Songnen Meadow Steppes Ecology Research Station (123°45′E , 44°45′N) , Jilin , China , beginning from March 2006 . The steppes are situated at the east edge of the Eurasian Steppes . Perennial grasses are the community dominants , in which *Leymus chinensis* and *Stipa grandis* indicate local climax communities . Annual averaged temperature is about 4. 9℃ , and annual rainfall is about 470 mm . Soils are calcareous black soils , sodic saline meadow soils and sandy soils . The experiment was a completely randomized block design with two factors and two levels : atmospheric temperature (heating and ambient) ; soil N (increased and ambient) . Each treatment combination was replicated six times . We exposed plots to warming (160 W m^{-2} of thermal radiation , resulting in a soil-surface warming of 1 .7-2℃) , and N deposition (increased by 10 g m^{-2} yr^{-1}) in one-to two-way treatment combinations . Warming was applied with infrared lamps suspended 2 .5 m high over plot centers . N deposition was administered with crystal $Ca(NO_3)_2$ applications in summer . We began treatments in March 2006 and report responses observed at the end of one year of treatment . Data were analyzed using three-way ANOVA analysis in SAS 9 .0 .

Results Soil net nitrogen mineralization rate (NMR) responded positively to warming on the steppes but with N deposition or N deposition and warming together . Warming had no statistically significant effect upon either TN or AN , while N deposition and its interaction with warming both had significant effects upon AN but not TN . Warming , N deposition and their interactions overall had no significant effect upon AP . Except that increases in N deposition had a positive effect on TP of about 40% , TP responded with no significance to warming or warming combined to N deposition .

Conclusions In genera , warming and N deposition would both add to future warming and aggravate local non-point source pollutions with respect to the findings from our case study . Since this report is a short-term examination of soil nutrient responses to the single and combined effects of warming and N deposition , the degree to which these findings relate to long-term change is needs to be pursued in subsequent investigations .

References

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