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The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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Carbon exchange from four agro-ecosystems on the Loess Plateau , China

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Keywords : carbon exchange , agro-ecosystem , Loess Plateau

Introduction Soil CO₂ flux to the atmosphere is a significant component of the global C cycle , approximately 10% of the atmospheric CO₂ pool (Jenkinson *et al.* , 1991) and the second largest flux between terrestrial ecosystems and the atmosphere (Raich and Tufekcioglu , 2000) . The Loess Plateau has one of the more developed agricultural systems in the world and has the longest cropping history in China . The objective of this study was to estimate the amount of carbon sequestration and soil emissions from different agro-ecosystems in the representative areas of the Loess Plateau .

Material and methods The experiment was conducted in 2006 in Huanxian County (37 .1° N , 106 .8° E , 1650m , 359mm precipitation—mostly in summer , 1993mm evaporation) Gansu province , China . Four agro-ecosystems were compared ; rangeland systems , cropping systems (annual crops) , sown grassland system (perennial alfalfa) and agroforestry systems (poplar-alfalfa) . Above and below-ground plant biomass were measured at the peak of the growing season (August) . Soil CO₂ flux was determined in May , August and December with the LI-COR 6400 gas exchange system (LI-COR , Lincoln , NE , U S . A .) .

Results Carbon sequestration in vegetation was significantly higher in the sown grassland system than other agro-ecosystems (Table 1) . Cropland had the lowest biomass , 33% lower carbon emissions from the soil surface and 8 .5% higher soil organic carbon content than other systems . There were no significant differences on the carbon emission from the soil surface between rangeland , sown grassland and agroforestry systems .

Table 1 Carbon sequestration and emissions from four different agro-ecosystems on Loess Plateau (units : t ha⁻¹) .

Production system	Utilisation	Carbon sequestered in vegetation (±SE ²)	Carbon emission from soil surface (±SE)	Soil organic carbon (±SE)
Rangeland	Grazing	6 .3±0 .4 c ¹	3 .3±0 .3 a	39 .3±0 .5 b
Sown grassland	Hay production	14 .3±1 .5 a	3 .2±0 .3 a	39 .1±0 .7 b
Cropland	Crop production	4 .7±0 .7 d	2 .2±0 .2 b	42 .0±0 .2 a
Agroforestry	Hay and timber	10 .5±0 .4 b	3 .5±0 .3 a	37 .7±0 .4 b

¹ Value accompanied by different letters differ significantly ($P < 0 .05$) ; ² SE : standard error

Conclusions Increasing plant growth did not result in more soil carbon stored or greater carbon emissions from soils , the additional carbon was sequestered within plant biomass . In cropland there may be reduced soil microbial activity which reduces the breakdown of soil carbon and the rate of carbon emission , or there may be reduced root respiration or these are better soils that store more carbon .

References

- Jenkinson , D . S . , Adams , D . E . , and Wild , A . 1991 . Model estimates of carbon dioxide emissions from soil in response to global warming . *Nature* 351 , 304-406 .
Raich , J . W . , and Tufekcioglu , A . , 2000 . Vegetation and soil respiration : Correlations and controls . *Biogeochemistry* 48 , 71-90 .