Carbon & Nitrogen Cycling

Using the 13C stable isotope approach and yield monitor data to evaluate C and N cycling in an eastern South Dakota field

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ABSTRACT: Ecologists have been challenged with quantifying C and N cycling in complex landscapes. The objective of this study was to determine the influence of landscape position, on changes in surface soil organic C, yields, and the amount of post harvest C residues returned to soil. Soil samples (0- to- 15 cm depth) from 30 by 30 m grid were collected in 1995 and 2003. At fifty geographically referenced points, corn grain, corn stover, and soybean grain yields were measured each year. The amount of organic C returned to the soil was estimated. Plant and soil samples were analyzed for total C, 13C discrimination (Γêå), total N, and ∩üñ15N. Landscape position influenced soil organic C accumulation. In a footslope/backslope position (elevation < 523.05 m) organic C was lost at a rate of 432 kg C (ha y)-1 even though estimated annual C inputs ranged from 5540 to 6670 kg C (ha y)-1. This decrease was attributed increased oxidation of organic C due to tile line repairs. In the backslope position (elevations between 525.47 and 527.3 m), estimated organic C input ranging from 5470 to 6520 kg C (ha y)-1 contributed to soil organic C that increased at a rate of 197 kg C (ha y)-1. In upper backslope, summit and shoulder areas (elevations > 527.3 m) soil organic C levels were maintained by organic C input levels that ranged from 4910 to 6280 kg C (ha y)-1. Results from this study suggest that in the fields of rolling topography in east central South Dakota soil organic C contents can be maintained or increased by in corn followed by soybean rotation where residues are returned. In tile drained areas, organic C was lost from the soil even if corn stover is returned. Carbon budgets suggest that soil organic C can be maintained in continuous corn rotation where 75% of the above ground post-harvest residues are harvested for ethanol production.