P394-TH

RARE EARTH ELEMENT ENHANCED SLURRIES FOR EROSION AND LEACHING STUDIES IN GRASSLANDS

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Rare earth elements (Lanthanide elements; atomic numbers 57 to 71) have generally comparable low background concentration, limited mobility and low solubility in soil and can therefore be used as simultaneous multiple tracers with similar chemical properties, but different element signatures. Rare earth elements have in recent years been successfully used in as tracers for soil erosion studies after mixing them into soils during fallow periods in the cropping cycle (Zhang et. al. 2001, Polyakov and Nearing 2003). The latter method of rare earth element (REE) incorporation in the soil can not be applied to some grassland systems because of permanent plant cover on soil surface in the absence of ploughing. However, organic fertiliser amendments (manure or slurries) are applied several times each year to the soil surface. We therefore examined in pot and field experiments: i) the binding capacity of five REE (Gd, La, Nd, Pr, and Sm) oxides incorporated into cattle slurry and ii) its suitability as a tracer for surface applied slurry derived sediment in soil erosion studies in grasslands.

The binding of the Gd, La, Nd, Pr, and Sm was tested by directly mixing them into soil or first into three different slurry (fractions), i.e. whole slurry, liquid slurry phase; solid slurry phase >2 mm). We added similar rates of these REE enhanced slurries to the dry sieved (<2 mm) soil and measured the retention of REE in the soil (0-1 cm, 1-2 cm, 2-4 cm, 4-8 cm) after the soils had been extensively leached by deionised water.

Five REE were mixed to either into whole slurry or pre-sampled soil and then applied to slightly sloping grassland soil (four replicate plots each). The slurry was isotopically labelled, the liquid phase (urine) with ^{15}N urea (~16at%) and solid phase (dung) was naturally enriched ^{13}C (ca. -12 $^{o}/_{oo}$) compared to the soil (ca. -28 $^{o}/_{oo}$) in order to obtain the correlation of between potential differential movement of the liquid and solid phase of the REE enhanced slurry following an artificial rain event (500 mm rainfall). Preliminary result showed that i) REEs oxides showed strong retention in soils and slurry during leaching and ii) when incorporated as REE enhanced slurry, remained associated with slurry rather than the grassland soil even during lateral transfer down the slope following (artificial) rain.

REFERENCES

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