



Tropentag, October 6-8, 2009, Hamburg

“Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
of Natural Resources”

Effect of Feeding of Fat-tailed Sheep and Manure Treatment on Nitrogen Fluxes in the Soil-plant System

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Abstract

Alternative feeds used in sheep production in dry areas often contain bioactive ingredients. The impact of applying manure from these feeding systems on the nitrogen (N) flux in the soil-plant system has not been investigated. Fresh (frozen) feces and composted manure composed of feces, urine and straw (10:2:1 of fresh weight) were obtained from ten sheep diets including agricultural by-products, crop residues, Atriplex and traditional feeds. All manure treatments were added to soil at a rate of 90 mg N/kg dry soil and their effects were tested on i) microbiological and chemical soil properties in a soil incubation experiment over 12 weeks and ii) on dry matter (DM) yield of barley (*Hordeum vulgare*, var. *harmal*) grown in pots for seven weeks. Simultaneously, fresh olive mill waste was applied to soil in four rates in addition to ammonium-sulfate fertilisation and non-amended soil. Contents and evolution of mineral N (ammonium and nitrate) in the soil clearly differed among treatments. Net mineralisation in the non-amended soil during incubation was 15 mg N/kg soil. The effect of fresh manure treatments on soil mineral N content ranged from net immobilisation to net mineralisation. In contrast, all composted manure treatments resulted in net N mineralisation. Olive waste manure decreased mineral soil N by 20 mg N/kg soil compared to the non-amended soil, irrespective of the application rate. The ongoing analysis of soil microbial biomass N and chemical properties will clarify the role of microbial immobilisation versus antioxidative and/or binding effects of polyphenols on soil N dynamics. The mineral N contents in the soil were reflected in barley DM production. Only two out of ten fresh manure treatments increased shoot DM production, while this was the case for nine compost treatments. Still, none of the manure treatments reached the 2.4 g shoot DM per pot obtained from ammonium sulfate fertilisation. Fresh manure from olive waste significantly depressed plant productivity (≤ 0.4 vs. 1.2 g DM per pot in the non-amended soil). Barley tissue N will be analysed to calculate N recovery in the plant and to relate plant N uptake to N flux in the soil-plant-animal system.

Keywords: Composting, dry areas, manure, N fertilisation, N mineralisation, sheep feeding