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"Resilience of agricultural systems against crises"

Effects of Activated Charcoal and Tannin Amendments on Yields of Sweet Corn and Radish on an Irrigated Sandy Soil in Northern Oman

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Abstract

Crop production in Northern Oman is characterised by irrigated agriculture on sandy soils under hot climatic conditions which favour fast microbial turnover of soil organic matter. Nutrient losses are high due to the soil's low CEC and water holding capacity. Charcoal and tannins are known to have positive effects on soil physico-chemical properties and may help retain nutrients in the soil. To test this, activated charcoal or tannins were added to goat manure, either by mixing with goat manure or by adding to the goats' feed. Amended manures were applied to sweet corn and radish plots at rates of 1.7 t activated charcoal ha^{-1} a^{-1} and 2.2 t tannins ha^{-1} a^{-1} in a two-year field experiment. Manure was applied at a rate of 200 kg N ha^{-1} on sweet corn and 135 kg N ha^{-1} on radish. Phosphorus (P) and potassium (K) in manures was determined and application rates adjusted with mineral fertiliser to reach 56 kg P ha^{-1} and 130 kg K ha^{-1} in sweet corn and 38 kg P ha^{-1} and 90 kg K ha^{-1} in radish. Mineral fertiliser and un-amended manure served as controls. Yields were generally low for both, sweet corn (1.26–8.66 t ha^{-1}) and radish (4.2–10.8 t ha^{-1}). Tannins had a negative effect on plant growth and yield of both sweet corn and radish (27–32 % yield reduction for sweet corn and 42–46 % yield reduction for radish in the vegetation period 2011/12). SPAD values indicate that nitrogen (N) availability was insufficient which might result from lower mineralisation rates due to tannin effects on mineralisation. When fed to goats, charcoal had a slightly depressing effect on sweet corn and radish growth compared to un-amended manure, whereas charcoal mixed to manure had no or a slightly positive effect on sweet corn and radish growth. To determine whether it was possible to increase the efficiency of nutrient release from manure for plant nutrition and reduce nutrient losses using activated charcoal or tannin amendments, soil analyses, leaching losses and gas emissions are under way.

Keywords: Charcoal, nutrient turnover, oasis agriculture, organic matter, tannins, vegetable production

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