MANURE/FERTILIZERS

NPARR 4(1), 2013-053 Long-term impacts of manure, straw, and fertilizer on amino sugars in a silty clay loam soil under temperate conditions

There is increasing evidence that microorganisms participate in soil C sequestration and stabilization in the form of resistant microbial residues. The type of fertilizers influences microbial activity and community composition; however, little is known about its effect on the microbial residues and their relative contribution to soil C storage. The aim of this study was to investigate the long-term impact (21 years) of different fertilizer treatments (chemical fertilizer, crop straw, and organic manure) on microbial residues in a silty clay loam soil (Udolls, USDA Soil Taxonomy). Amino sugars were used to indicate the presence and origin of microbial residues. The five treatments were: CK, unfertilized control; NPK, chemical fertilizer NPK; NPKS1, NPK plus crop straw; NPKS2, NPK plus double amounts of straw; and NPKM, NPK plus pig manure. Long-term application of inorganic fertilizers and organic amendments increased the total amino sugar concentrations (4.4–8.4 %) as compared with the control; and this effect was more evident in the plots that continuously received pig manure (P<0.05). The increase in total amino sugar stock was less pronounced in the straw-treated plots than the NPKM. These results indicate that the accumulation of soil amino sugars is largely influenced by the type of organic fertilizers entering the soil. Individual amino sugar enrichment in soil organic carbon was differentially influenced by the various fertilizer treatments, with a preferential accumulation of bacterial-derived amino sugars compared with fungal-derived glucosamine in manured soil [Xueli Ding*, Xiaozeng Han and Xudong Zhang (Key Laboratory of Mollisols Agroecology, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Harbin, 150081, People’s Republic of China), Biology and Fertility of Soils, 2013].

NPARR 4(1), 2013-054 Green manuring, mustard residue recycling and fertilizer application affects productivity and sustainability of Indian mustard (Brassica juncea L.) in Indian semi-arid tropics

An experiment was conducted for five-years (2005–06 to 2009–10) to evaluate the impact of Sesbania green-manuring (GM), mustard-residue recycling and fertilizers on soil health and productivity of Indian mustard under fallow–mustard sequence. Sesbania (GM) significantly increased SOC, carbon-sequestration-potential rate, infiltration rate, available NPK status but decreased bulk density. Supplementing mustard-residue recycling 2.5 t ha⁻¹ further improved the soil quality attributes significantly. The increase in fertilizer from N₄₀P₈.₇K₀ to N₈₀P₁₇.₄K₃₃.₃ also improved the soil attributes gradually. This improvement in soil properties due to Sesbania (GM) and mustard-residue recycling significantly influenced plant height, branches/plant, siliquae/plant, seeds/siliqua and ultimately seed and oil yield compared to existing fallow–mustard practice. The mustard seed yield was increased by 42.3% due to Sesbania (GM) and by 63.9% due to supplementary mustard residue recycling in five years. Increase in fertilizers levels from N₄₀ to N₈₀ and P₈.₇ to P₁₇.₄ significantly improved mustard yield attributes, seed and oil yield while results of K application was inconsistent. The combined application of N₈₀P₁₇.₄K₃₃.₃ synergistically increased the seed yield by 82.1% over N₄₀P₈.₇K₀. Sustainability yield index, partial factor productivity, production efficiency and incremental benefit cost ratio also showed significant improvement due to Sesbania (GM), mustard-residue recycling and judicious fertilizer use [O.P. Premi*, B.K. Kandpal, S.S. Rathore, Kapila Shekhawat, J.S. Chauhan (Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur 321303, Rajasthan, India), Industrial Crops and Products, 2013, 41, 423-429].
Integrated biological treatment of fowl manure for nitrogen recovery and reuse

Biowaste such as animal manure poses an environmental threat, due to among others, uncontrolled emissions of ammonia and additional hazardous gases to the atmosphere. This study presents a quantitative analysis of an alternative biowaste management approach aimed at nitrogen recovery and reduction of contamination risks. The suggested technology combines anaerobic digestion of nitrogen-rich biowaste with biofiltration of the resulting gaseous ammonia. A compost-based biofilter is used to capture the ammonia and convert it to nitrate by nitrifying microorganisms. Nitrogen mass balance was applied to quantify the system’s capacity under various fowl manure-loading regimes and ammonia loading rates. The produced nitrate was recovered and its use as liquid fertilizer was evaluated with cucumber plant as a model crop. In addition, emissions of other hazardous gases (N₂O, CH₄ and H₂S) were monitored before and after biofiltration to evaluate the efficiency of the system for treating these gases. It was found that nitrate-rich liquid fertilizer can be continuously produced using the suggested approach, with an over 67 percentage of nitrogen recovery, under an ammonia loading rate of up to 40 g NH₃ per cubic meter biofilter per hour. Complete elimination of NH₃, H₂S, CH₄ and N₂O was achieved, demonstrating the potential of the suggested technology for mitigating emission of these gases from fowl manure. Moreover, the quality of the recovered fertilizer was demonstrated by higher yield performance of cucumber plant compared with control plants treated with a commonly applied organic liquid fertilizer [Roy Posmanik*, Ali Nejidat, Boaz Bar-Sinay, and Amit Gross (Albert Katz International School for Desert Studies, Department of Environmental Hydrology and Microbiology, Zuckerberg Institute for Water Research, The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus, 84990, Israel), Journal of Environmental Management, 2013, 117, 172-179].

Use of compost supplemented human urine in sweet pepper (Capsicum annuum L.) production

Human urine, rich in plant nutrients, is a readily available fertilizer but limited information is available about the best use of human urine in crop production. A field experiment was carried out in Kathmandu, Nepal during the year 2011 to evaluate the fertilizer value of human urine in different combination and compare the value with compost, urea and their combinations based on plant performance. The experiment was laid out in Randomized complete block design (RCBD) consisting of eight treatments with three replications. Each treatment was fixed to a supply of 100kg N ha⁻¹. California Wonder, a popular open pollinated sweet pepper (Capsicum annuum L.) variety was selected as an experimental crop. The highest plant height (54.7 cm), number of fruits per plant (9.1), and fruit yield per plant (553.9 g/plant) were recorded with the plants fertilized with human urine in combination with compost. Human urine supplemented with 50 kg PK/ha gave highest fruit weight (67.2g) and fruit diameter (5.5 cm). Plants fertilized with the combination of human urine and compost showed better growth and yield compared to the application of fertilizer sources alone. The results indicated that the human urine performs better when used in combination with compost, and can be used as a promising fertilizer source in sweet pepper production [Debendra Shrestha*, Arvind Srivastava, Shanta Man Shakya, Janardan Khadka and Bharat Sharma Acharya (Department of Horticulture, Institute of Agriculture and Animal Science, Chitwan, Nepal), Scientia Horticulturae, 2013, 153, 8-12].