Current Biotica 7(4): 251-252, 2014 ISSN 0973-4031

Scientific correspondence

Pseudo-imitation through Phospholipid fatty acid (PLFA) analysis- possibly paves the way to sustainability

K Arun Kumar* and *G K Mahapatro

Indian Agricultural Research Institute, New Delhi – 110 012, India
E-mail: gagan_gk@rediffmail.com

High yielding varieties coupled with various agrochemical intensification no doubt bring India it's much needed self sufficiency in food grains (Heitzman and Worden, 1995); but the ecological and ill effects on health raised crucial concerns (Schiermeier, 2013) and make us to rethink what green earth we earned in this greed race. This is the worst situation in Indian context, as our limiting lands are deficient in multiple micronutrients, continually losing its rich microbial diversity as a result of injudicious and faulty fertilizer use pattern (Rajshekhar, 2011). Green revolution was a grand success in India in terms of yield and quality of cereals in 1960-70; regrettably it also forces us to reflect the old story of what the greedy farmer did to his hen that was laying golden eggs.

Soil has unique physical, chemical and notably biological signature that clues for sustainable crop productivity. Universally, soils differ in gram positive and gram negative bacterial composition, fungal to bacterial ratio and actinomycetes profile. Inorganic or organic fertilizers generally narrow down the microbial diversity. Intensive cropping as an anthropogenic activity is just opposite to the natural systems that demands judicious and scrupulous way of amendments for greater sustainability.

Modern techniques such as phospholipid fatty acid (PLFA) analysis help us to insight in to the microbial characteristics and community composition for a particular environment. The soil microbial composition or fingerprint governs the biogeochemical cycles and the organic matter turnover. Phospholipid membranes are essential component of all viable cells and not found in dead cells (Tunlid and White, 1992; Zelles, 1999). These phospholipid fatty acid components are unique for a particular soil, which allow evaluating the patterns of microbial community composition and biomass (Zelles, 1999) and so act as an efficient indicator of metabolic diversity of soil microbial communities (Steenwerth *et al.*, 2005). However, PLFA does not provide the indication of change in individual species population, but gives the information on microbial ratio for particular soil, which can be easily imitated by the use of culture dependent microbes.

Different functional groups of microorganisms respond differently to prevailing environmental conditions, possibly for each soil type and cropping systems sustainable microbial composition amendment can be standardized. We hypothesize that *"For a particular agriculture soil it is possible to pseudo-imitate the natural soil microorganism content by amending the cultivable beneficial microorganisms similar to the PLFA profile of the particular soil. And this pseudo-imitation may maintain the gram positive to gram-negative ratio, fungal to bacterial ratio and percentage of actinomycetes and which may act as self regulatory matrix similar to natural without or adding inorganic fertilizers throughout the agriculture."* As ecologist David Tilman of the University of Minnesota writes in journal *Nature,"* In comparison with conventional,

high-intensity agricultural methods, 'organic' alternatives can improve soil fertility and have fewer detrimental effects on the environment. These alternatives can also produce equivalent crop yields to conventional methods." Soil natural cultivable bacteria, fungi and actinomycetes may be that organic alternative which may help in maintain the similar natural soil microbial composition and reduce the impact of chemical fertilizer on soil microbial composition throughout the agricultural procedures. '*Gaia principle*' proposes that organisms interact with their inorganic surroundings of earth to maintain the conditions of life on the plant (Lovelock 1972). Although, the agriculture (inorganic/organic) disturbs such surroundings, we can at least try to maintain such biological surroundings, which may maintain natural microbial composition and make soil alive.

Soil analyses are mostly limited to its physical and chemical properties, paying least importance to biological component of the soil. We opine that one should adapt this molecular technique in addition to the soil testing laboratories for proper evaluation of agricultural lands before and after harvesting to monitor the soil microbial health. We are in the midst of catastrophic soil deteriorating stage, cotemporary to the much debated global climate climax, and this is the time to nurture our agricultural lands to make them sustainable. There is much debate over the GM release in India, but the scenario for such sustainable soil conservation is neglected.

Agricultural soil conservation is neglected for a longer period. If we continue to lose our soil microbial diversity the way it goes today, it will certainly drag our future to the zero-zone or no productivity zone of agriculture; and we will face the acrimonious effects of modern agriculture in the near future.

REFERENCES

Heitzman, J., Worden, R.L., editors. 1995, India: A Country Study. Washington: GPO for the Library of Congress.

Lovelock, J.E., 1972, Cover image Letter to the editors Gaia as seen through the atmosphere. *Atmospheric Environment* 6:579–580.

Rajshekhar, M., 2011, India's soil crisis: Land is weakening and withering. Economic Times Bureau, (http://articles.economictimes.indiatimes.com/2011-07-12/news/29765398_1_soils-farmers-cereal-production).

Schiermeier, Q., 2013, Farmers dig into soil quality. Nature, 502: 607. (doi:10.1038/502607a).

Steenwerth, K., Jackson, L., Calderon, F., Scow, K., Rolston, D. 2005, Response of microbial community composition and activity in agricultural and grassland soils after a simulated rainfall. Soil Biol Biochem 37:2249-2262.

Tilman, D., 1998, The greening of the green revolution. Nature 396:211-212 doi:10.1038/24254.

Tunlid, A., White, D.C., 1992. Biochemical analysis of biomass, community structure, nutritional status, and metabolic activity of microbial communities in soil. *Soil Biochem* 7: 229-262.

Zelles, L., 1999, Fatty acid patterns of phospholipids and lipopolysaccharides in the characterisation of microbial communities in soil: a review *Biol Fertil Soils* 29 :111–129.