Current Research

i. The innovative uses of different types of organic amendments and biochar for soil fertility improvement, soil remediation and crop growth.

Poor soil fertility coupled with different abiotic factors are the major problems affecting crop growth and development. The increase in industrial activities have also led to the contamination of most agricultural lands with heavy metals thereby reducing agricultural productivity. Different research works are being carried out on the use of different organic amendments as well as biochar to improve soil fertility for increasing crop yield. The use of organic amendments for improving crop yield will reduce over-dependency on synthetic fertilizers as well as removing the health and environmental hazards associated with their use. Similarly, To solve the problem of soil contamination for healthy and improved crop growth, immobilization and transformation techniques for remediation of heavy metal contaminated soil through the use of different organic amendments are being focally studied.

ii. Amelioration of different abiotic stresses in crop plants through the use of organic amendments

Crop Plants are faced with different stresses arising from climate change and industrial activities. Under this research focus, organic amendments are being used to ameliorate the effects of different abiotic stresses such as drought, salt stress, temperature, heavy metal stress and light intensity in crop plants. For tolerance against abiotic stress, the Reactive Oxygen Species (ROS) scavenging ability of crop plant must be enhanced through increase in the enzymatic and non-enzymatic antioxidant activities in plants. The ability of different organic amendments to improve/strengthen the antioxidative system of crop plants are therefore being studied. This will help in increasing the tolerance of crop plants to different abiotic stresses with enhancement of agricultural productivity and resulting sustainable production output.

iii. Study of molecular and genetic mechanisms of heavy metal tolerance, detoxification and hyperaccumulation in plants as well as uptake of essential nutrients by crop plants.
Apart from the use of organic amendments, the use of green technology (Phytoremediation) for the cleaning of metal polluted sites is also being promoted. This involves the use of plants called hyperaccumulators which have the ability of taking up metals (toxic and non-toxic; essential and non-essential) and store it in their above-ground/harvestable parts unlike their counterparts called non-accumulators (Excluders).. For the successful application of this technology, the physiology, molecular and genetic mechanisms which are involved in hyperaccumulation, tolerance and detoxification of metals in hyperaccumulators and excluders are also being studied. The processes involved are grouped under (1) Uptake and root-shoot translocation of metal by plant with the help of metal transporters, (2), Detoxification of metals by binding to cell walls or chelation with various ligands and metal-binding proteins. Understanding of these processes have two advantages: (1) These can be used to mange and optimize the uptake of essential elements by crop plants by developing a nutrition management strategy to ensure optimum/maximum accumulation of essential elements most especially the limiting microelements (Fe and Zn) by mutual displacement of toxic metals. This will help in improving micronutrients uptake by crop plants thereby removing the hidden hunger (2) The understanding of the genetic and molecular mechanisms for hyperaccumulation and tolerance of toxic metals will also help in bioengineering for effective phytoremediation. (3) The mechanisms of toxic metal exclusion can be used to increase tolerance in crop plants.