



Soil Improvement for Present and Future



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Introduction

Soil is the nonrenewable, finite natural asset for the earth and the living beings on the blue planet. Today 9 billion people required quality of food for better health and long survival. Pressure increased on soil in comparison to the past due to increase in population for more and nutritious food production. The safe ecosystem with food production makes challenge more difficult. There are many factors responsible for the safe ecosystem among that healthy soil makes remarkable contribution in the development of plant and could be considered very essential factor. Our main concern should be for the protection of soil physical, chemical and biological property with production. During last two decades food crops decreased and nonfood crop cultivation increased. Farmers adopted intensive cropping patterns of commercial crops in place of more balance cereal legumes rotation. Intensive cultivation leads to removal large quantities of nutrition from the soil which results in loss of soil fertility. The farmers maintain productivity of soil by applying chemical fertilizer instead of organic fertilizer. Such cropping system makes the soil condition very pitiful because it creates disturbance in the soil physical, chemical and biological condition. They may be major threat for the crop production and food security in future. Soil degradation has several adverse impacts on the environment. It affects global climate through alteration in water cycle and energy balance and disruption of carbon, nitrogen and Sulphur cycles. In order to alleviate the nutrient use efficiency and for soil improvement smart fertilizers technology should be used for the betterment. The development of such fertilizers could be based on the use of the microorganism, biofertilizers and Nano fertilizers. Soil improvement can improve the entire chain of the agricultural commodity.

Green revolution increased the food production with tremendous use of chemical fertilizers, irrigation and pesticide. Apart from this in many places high planting density and other breeding, planting strategy used to enhance production which is responsible for the ruin of soil fertility. Thereafter many years, the achievement of increased crop production and growth rate is gradually declining. Inappropriate crop management practices including from chemical implement to irrigation responsible for

declination. Fertilizers have the pivotal role in the crop production, and its importance is recognized more after the green revolution. As the result of inappropriate and imbalance fertilization for the more production quality of soils declines as well as directly or indirectly effects on crop production. Nano fertilizer a recent technology is very innovative and gives significant results in terms of yield. Nano fertilizers are the important tools in agriculture to improve crop growth, yield, and quality parameter with increasing nutrient use efficiency, reduce wastage of fertilizers and cost of cultivation. In the context of nano fertilizers, nanoparticle have physiochemical properties which are utilized for plant growth and its development. The mechanical behavior of a soil can be improved with addition of nanoparticles, which are not cementitious material but once introduced in a soil they are expected to reduce the interparticle spacing and Nano reinforce. This will promote the improved soil skeleton. Soil chemical stabilization depends on many parameters among that most important associated to the soil properties and cementitious material. The nanomaterials are used as carriers of agrochemicals they facilitate the site targeted delivery of various nutrients needed for better growth and high productivity of plants it can be used as additive for soil improvement. The presence of only small amount of nanomaterial in the soil could influence significantly the physical and chemical behavior of soil due to a very high specific surface area of nanomaterial surface charges and their morphologic properties. In this way, Nano fertilizers are more effective and efficient than traditional fertilizers. Another section of fertilizer is using of microorganism and plants its implementation is safe, cost effective and improved productivity benefits and environmental friendly which would be helpful in maintaining the sustainable soil. In the strategy of microorganism inoculation possess great potential to restore the fertility of degraded soil. These microorganism increases bioavailability through the different process. Demand for sustainable agriculture is driving the use of biological fertilizers, which are composed of the beneficial microorganism ranging from bacteria to blue green alga like rhizobium, *Azotobacter*, *Azospirillum*, *Glomus intraradices*, *Saccharomyces spp*, *pseudomonas* and *bacillus* have invaluable use in sustainable agriculture.

Their capacity has very broad area to improve plant nutrition and yield through biological nitrogen fixation, nutrient solubilisation, biocontrol activities and production of plant growth promoting substances. Use of biofertilizers has been established to increase plant growth and yield as well as improved soil quality with the protecting of the natural environment. Soil and soil microorganism plays important role in providing resources to the plant. Activity of the microorganism can be influenced by the chemical secreted from plants in the form of root exudates. Besides being a rich source of carbon and energy for the heterotrophic organism, Plants roots exudates secreted a variety of carbonaceous materials that can act as a binding agent to increase stability of soil aggregates. Shrubs, herbs and other green plants are used to improve the nutrient content and increase the work area of soil, among that tughutu (*Vernonia subligera*) shrub used as a green manure with rock phosphate for fertilizer in many countries. Any

Elaeagnus shrub plants have the ability to fix nitrogen in the soil. Many legumes, Lupins, green grass like barley, oats, sorghum and cover crop like red clover, white clover, Lucerne, plants used to improve the soil fertility. Dandelion like plant act as bioindicator they have capacity to accumulate heavy metal and reclaims the soil. Comfrey an excellent mineral accumulator and used as excellent liquid fertilizer and mulch. Farmers are very much concern with the declination of soil fertility. Along with the government they have to also initiate to improve the condition of soil. The basic start they do is use green manure. In India, Sikkim is the first state in the adoption of organic farming only this state convert entire state into organic. Today, Sikkim is well recognized as an organic farming state at international level. Apart from government and farmers, scientists should also focus on increased yield per unit area by developing strategy to improve soil. May be that helps to meet the demand of growing population on the arable land.



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