

Rooted in Tradition, Branching into Tech : Next-Gen Agriculture

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Traditionally, we have used cow dung as a fertilizer for plant growth. Cow dung has a carbon-to-nitrogen (C/N) ratio much below 30 which makes it easily biodegradable. It contains nitrogen (N), phosphorus (P), and potassium (K) needed for plant growth. Further, it contains copper (Cu), magnesium (Mg), iron (Fe), and calcium (Ca). Conversion of cow dung into biochar enhances the concentration of P and K while raising the C/N ratio to about 30. Even with the increased C/N, cow dung biochar remains biodegradable. While cow dung is a great soil amendment and helps in increasing the carbon content in the soil, biochar may be a better choice. Biochar provides a large surface area for phytosymbiotic microflora growth. The high C/N ratio also helps in sustaining a healthy microbial population. Biochar typically has phenolic, lactonic, carboxylic, peroxide, and amine functional groups and these functional groups are capable of complexing with toxicants and heavy metals present in the soil, thus making our food crop and fodder safe for human and animal consumption. Biochar also can act as the matrix for sorption and subsequent slow release of plant nutrients. Biochar technology can also help in more social acceptance of animal excreta-based fertilizers. Production of biochar from cow dung can be taken up at an entrepreneurial scale to help in the economic growth of small communities. In addition to cow manure, several other bio-based materials were used in our agriculture. These include some components (leaves and/or stems) of plants like kochu (taro, *Colocasia esculenta*), posotiya (*Vitex negundo*), and neem (*Azadirachta indica*) for soil health improvement. The kochu leaves contain phenolic compounds and metals which are now known to be herbicidal and needed for plant growth. The phenolic compounds may also interact with soil constituents leading to the development of plant stimulating compounds. The research done at North Dakota State University has shown the potential of nanotechnology-based bioproducts for agricultural applications. The research explores the connections between traditional and modern agriculture and the possibilities of low-investment research and development for greener agriculture. Research and development on traditional fertilizers and pesticides are imperative for sustainable agriculture and the protection of our ecosystem.

Keywords: Cow dung; biochar; slow-release fertilizer; kochu (taro); posotiya (vitex); phenolic compounds; green agriculture.