



Cotton Production Practices Change Soil Properties

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Historically, indigenous Asiatic cottons (*Gossypium arboreum*) were cultivated with minimal inputs in India. The introduction of the Upland cottons (*G. hirsutum*) and later the hybrid (H-4) triggered a whole set of intensified agronomic management with reliance on high doses of fertilisers and pesticide usage. In 2002, the transgenic Bt cotton hybrids were introduced and released for commercial cultivation. Presently, more than 95% of the nearly 12.2 million hectares of cotton area is under the Bt transgenic hybrids. These hybrids are not only high yielding but have reduced the dependence on pesticide because of an effective control of the lepidopteran pests. Thus, a change in the management practices is evident over the years. In this paper, we discuss the impact of two major agronomic management practices namely, nutrient management and tillage besides organic cotton cultivation in the rainfed cotton growing regions of central India characterized by sub-humid to semi-arid climate and dominated by Vertisols.

Long-term studies at Nagpur, Maharashtra indicated the importance of integrated nutrient management (INM) wherein a part of the nutrient needs through fertiliser was substituted with organic manures such as farmyard manure (FYM). With the application of mineral fertilisers alone, soils became deficient in micronutrients. This was not observed with the FYM amended plots. Further, the manure amended plots had a better soil physical properties and the water holding capacity of the soil improved due to improvements in soil organic matter (SOM). Similarly, in a separate experiment, an improvement in SOM was observed in the organically managed fields because of continuous addition of organic residues. Further, it resulted in greater biological activity compared to the conventionally managed fields. Conservation tillage systems such as reduced tillage (RT) are a means to improve soil health and crop productivity. Long-term studies on tillage practices such as conventional tillage {CT}, RT with two inter-row cultivations {RT1} and RT with no inter-row cultivation {RT2} were conducted for 11 years. At the end of the study, an improvement in the soil physical properties such as water stable aggregates and mean weight diameter were observed in the RT system and the plots amended with green manure (GM) cover crop compared to those without. Further, available soil moisture content was greater in the GM mulched plots up to 0.60 m depth compared to the without GM treatment. The RT systems, too, had a higher SOM content than the CT probably due to less soil disturbance and greater retention of crop residues.

INM and conservation tillage are strategies to sequester C and reduce emissions. It can also mitigate green house gas emissions because less of fertiliser would be used in the INM treatments. Studies conducted, thus far, have not indicated any adverse effect of Bt cotton cultivation. However, there could be a possibility, of nutrient depletion with the cultivation of Bt transgenic hybrids because of higher biomass and nutrient removal increasing the nutrient demand. Studies on these aspects are needed to understand how long-term cultivation of Bt cotton hybrids will alter the soil properties.