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Role of conservation agriculture for sustaining soil quality

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No-tillage is a system based on cultivating the soil without previous plowing. In this way, the crop residues are left on the topsoil, creating a permanent layer which protects against hydric and wind erosion. According to FAO, Conservation agriculture is a concept for resource-saving agricultural crop production which is based on enhancing natural and biological process above and below the ground. India is a country of about more than one billion people where seventy per cent or more of India's population lives in rural areas and practice agriculture as their main occupation. Indian agriculture is characterized by small farm holdings. Around 93 per cent of farmers have land holdings smaller than 4 ha with the average farm size of only 1.57 hectare. Only 1.6 per cent of the farmers have operational land holdings above 10 ha and they utilize 17.4 per cent of the total cultivated land. Inelasticity of land factor and increasing population with the threat of environmental degradation are the main concerns of today's streak. Thus there is a need to develop and enhance the concept of conservation agriculture.

Conservation agriculture in the Indian context is becoming a distinct and integrated system for overall agricultural production, because of its feature of allocation of inelastic factors of production amongst competing for crop choices (Naresh *et al*., 2013). Jin *et al*. (2011) reported that long-term no-tillage treatment, significantly increased soil organic matter, available N and P in the top 10cm soillayer by 16.1 per cent, 31.0 per cent and 29.6 per cent, respectively, as compared to conventional tillage treatment in annual double cropping system of winter-wheat and summer-maize over a 11-year period of time (1998–2009).They also found the mean percentage of macro-aggregates (>0.25 mm, +8.1%) and macro-porosity (>60mm, +43.3%) to be enhanced statistically in the 0–30 cm soil layer. Ram *et al*. (2011) reported that straw mulch significantly decreased bulk density (from 1.47 g cm^{-3} in no mulch treatment to 1.37 g cm^{-3} in 6 t ha^{-1} mulch treatment) in the surface soil (0–15 cm) and soil organiccarbon increased from 0.148 per cent in no mulch to 0.189 per cent with the 6 t ha^{-1} mulch treatment continuously for three years. Ghosh *et al*. (2010) conducted an experiment and reported that with no-tillage treatment soil microbial biomass carbon, dehydrogenase activity, and earthworm population was recorded highest among conventional tillage and minimum tillage treatment. The average of 3 years of wheat yield data revealed that zero tillage implementation has a significant effect on grain yield and yield attributing components. Yield recorded in zero tillage was found to be highest (4.49 t ha^{-1}) followed by reducing tillage (4.27 t ha^{-1}), rotavator tillage (4.24 t ha^{-1}) and conventional tillage (4.09 t ha^{-1}) (Kumar *et al.*, 2013).

The benefits of the conservation agriculture can be seen at farm, regional and national level as well. The benefits can be classified into three broad categories: (i) agronomic benefits that improve soil productivity; (ii) economic benefits that improve the production efficiency and profitability; and (iii) environmental and social benefits that protect the soil and make agriculture more sustainable.

Conservation agriculture as an upcoming paradigm for raising crops will require an innovative system perspective to deal with diverse, flexible and context-specific needs of technologies and their management. Conservation agriculture thus will call for several innovative features to address the challenge such as understanding of conservation agriculture system, building a system and farming system perspective, technological challenges, long-term research perspective and so on.

Conservation agriculture plays an important role in maintaining soil physical, chemical, and biological properties and thus ensuring the goal of sustaining soil quality. Conservation agriculture also helps in improving

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