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Relevance of Conservation Agriculture for Resource Conservation

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SUMMARY

Conventional agriculture has largely been characterized by tillage, which leaves soil vulnerable to erosion. Continuous use of conventional farming practices has degraded the soil resource base and intensified soil degradation, with concomitant decreases in crop production capacity. Thus, Conservation agriculture is a promising technology for rational use of available resources and sustainable productivity in the long-term. Conservation agriculture (CA) is a resource conserving agronomic management practice that combines minimal soil disturbance and permanent soil cover with rotations to derive maximum benefits from inputs and minimize adverse environmental impacts.

INTRODUCTION

Agriculture in India plays a central role in its economy and employs almost half of its population besides meeting the food demands of ever-increasing population. The growing concern for food security through improved soil management techniques demands identification of an environmentally friendly and crop yield sustainable system of tillage. However, adoption of energy intensive conventional tillage (CT) practices has been successful in achieving production goals, but at the same time has contributed to the depletion of natural resources such as deteriorating soil health is reflected through declining soil organic matter, soil biodiversity, multiple nutrient deficiencies and increasing levels of inputs for a given output. This will not ensure farm productivity and food security for the coming years (Ghosh et al., 2010). Therefore, there is an urgent need for developing, standardizing and promoting technologies that can reverse the resource degradation processes. The situation, thus, demands a paradigm shift from the traditional to conservation agriculture (CA). Thus, conservation tillage, along with some complimentary practices such as soil cover and crop diversity has emerged as a viable option to ensure sustainable food production and maintain environmental integrity. This implies that conservation tillage is a component of conservation agriculture (CA) (Shrestha et al., 2020).

Conservation Tillage has been defined as any tillage operation that leaves more than 30% of plant residues at the soil surface after seeding, is a more sustainable cultivation system for the future than those presently practised. Conservation agriculture maintains a permanent or semi-permanent organic soil cover. This can be a growing crop or a dead mulch. Its function is to protect the soil physically from erosion and make the soil productive. The soil micro-organisms and soil fauna take over the tillage function and soil nutrient balancing. Mechanical tillage disturbs this process. Therefore, zero or minimum tillage and direct seeding are important elements of CA. A varied crop rotation is also important to avoid disease and pest problems (FAO, 2009). Conservation agriculture major aims to conserve, improve and make more efficient use of natural resources through the integrated management of available soil, water and biological resources combined with

external inputs to achieve the goal of sustainable agricultural production. Agricultural systems that rely on these strategies are not only capable of promoting high productivity but are also capable of maintaining biodiversity and protecting the environment (Yadav et al., 2017).

Principles of CA in relation to Sustainability

Conservation agriculture has three principles: i) minimal soil disturbance ii) permanent soil cover or residue mulch, and iii) diversified crop rotations including a legume. It is more sustainable cultivation system, which can increase farm system resilience and improve the capacity of farmer to adapt to climate change (FAO, 2011).

Minimal soil disturbance

This practice of low disturbance no-tillage and the respective low disturbance direct seeding. This is achieved by adopting no tillage/zero and reduced tillage for agriculture operations. Soil disturbance in all operations has to be avoided as much as possible, allowing only in very specific conditions disturbance of not more than 25% of the soil surface but not wider than 15 cm in bands. This ensures the minimum destruction of the soil structure, slower mineralization of organic matter and little disruption farmers.

Permanent soil cover

This refers to mulch from crop residues, other organic mulch materials or living crops, including cover crops. The level of soil cover should ideally be 100% of the soil surface, but never less than 30% and should always supply sufficient organic carbon to maintain and enhance soil organic matter levels. It helps in reduction of direct raindrop impact thus reducing soil erosion, reduction in evaporation, suppression of weed growth and provides a buffering effect by protecting against extreme temperature.

Diversified crop rotations

This refers to rotations and sequences of annual crops, mixed-, inter- or relay cropping, cover crops in perennial orchard or plantation crops, including legumes for their nitrogen effect as well as for their flowering in support of pollinator populations. Rotation also helps in pest and disease control by breaking life cycles, nutrient losses are minimized by the use of deep rooting cover crops that recycle nutrients leached from the topsoil.

Potential Advantages from CA

- Agronomic benefits that improve soil productivity, increase organic matter, in-situ soil water conservation, improve soil structure, higher yield.
- Economic benefits it saves time, labour, reduce fuel and maintenance cost and that improve the production efficiency and profitability.

- Environmental and social benefits that protect the soil from soil erosion, improve soil also water quality, improves input use efficiency, increased carbon sequestration and make agriculture more sustainable (Shrestha et al., 2020).

CONCLUSION

Conservation Agriculture, which is rooted in the fundamental principles of providing permanent soil cover (through crop residues, cover crops, agroforestry), minimal soil disturbance and crop rotation is now considered to be the primary route to sustainable agriculture: it is thus a way of achieving higher production goals thus protecting natural resources and the environment.

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