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Purpose of Conservation Agriculture for Sustainable Crop Production

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Abstract
Conservation agriculture protects natural resources, biodiversity, and labour. It increases soil water availability, decreases heat and drought stress, and gradually improves soil health. Conservation agriculture (CA) is an important future cultivation technique, keeping and saving future production resources for sustainable crop production through minimal soil disturbance (no-till, NT) and permanent soil cover (mulch) associated with cycles. Conservation agriculture (CA) is a more environmentally friendly and sustainable crop management technique that increased soil microbial population, which has a direct influence on soil fertility; hence, conservation agriculture increased soil fertility for long-term crop production. To satisfy rising population demands, agriculture will need to produce more food from less area over the next decade while using natural resources more efficiently and with minimal environmental impact. This objective can be accomplished by promoting and deploying CA management solutions..

Introduction
The world population is projected to reach 7.8 billion in 2020 to 9.9 billion by 2050. This level represents an increase of more than **25%** from 2020. Therefore, in order to increase food production in a more sustainable way and satisfy global food demand, agricultural systems must alter globally. Despite its limits, conservation agriculture (CA) has been defined as an agricultural system capable of achieving the sustainable intensification needed to meet global food demand. No-till (NT) little soil disturbance, permanent soil cover (leaving at least 30% of the soil covered between harvest and planting), and a variety of crop species, including legumes, are all considered to be conservation agriculture (CA). In agriculture, cultivation and tillage are essential. Before introducing conservation tillage (CT), a practise that arose from the American dust bowl of the 1930s, the advantages of tillage in agriculture are investigated. The benefits of CA, a suggested improvement on CT, are described next, where NT, mulch, and rotations considerably increase soil characteristics and other biotic variables. Case crop studies from the rice-wheat areas of South Asia's Indo-Gangetic Plains and Northwest Mexico's irrigated maize wheat systems are used to show how CA methods have been applied to increase production sustainably and profitably in these two ecosystems. The advantages of reducing greenhouse gas emissions and their impact on global warming are also explored. Role of conservation Agriculture in sustainability: With regionally modified approaches, CA concepts are generally applicable to all agricultural landscapes and land uses. External inputs such as agrochemicals and plant nutrients of mineral or organic origin are delivered optimally and in ways and quantities that do not

interfere with or disrupt biological processes, and soil interventions such as mechanical soil disturbance are kept to a bare minimum or avoided. CA increases overall land husbandry for rainfed and irrigated crops by facilitating good agronomy, such as timely operations. Other well-known good practises, including as the use of high-quality seeds and integrated pest, nutrient, weed, and water management, are also recommended and CA is a base for sustainable agricultural production intensification.

Principles of Conservation Agriculture

1. Permanent soil organic cover

- reduces runoff and allows water to seep into the soil;
- reduces evaporation and thus conserves moisture for the crop;
- suppresses weed emergence;
- Organic residues improve organic matter content and soil nutrient status;
- provides a beneficial environment for soil organisms such as worms and millipedes that are beneficial to the crop

2. Mechanical soil disturbance to a minimum Only the soil where the seed, fertiliser, and manure will be applied should be disturbed.

- does not expose soil to wind and water erosion;
- improves water infiltration rates;
- slows the rate at which organic matter is mineralized and oxidised, resulting in organic matter build-up;
- causes little disruption to soil organisms.
- saves time, energy, and money because less land is tilled.

3. Crop rotation

- Efficient Use of Inputs
- Timely Operations
- Precise Operations

Benefits of Conservation Agriculture

- Reduces Production Cost.
- Improves Yields.
- Overcomes shortages of labour and farm power.

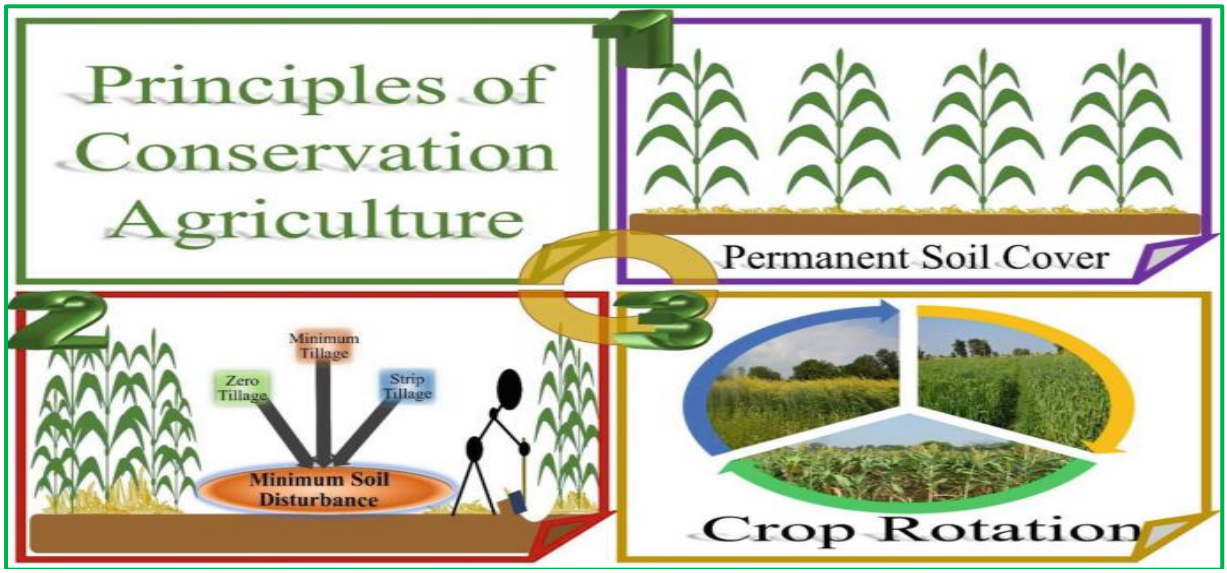

Fig. 1 Principles of Conservation Agriculture

Equipment's for conservation agriculture: There are some outstanding assessments of the zero-tillage equipment requirements. A technique to handle loose straw (cutting or moving aside), seed and fertilizer placement, furrow closing, and seed/soil compaction are the key equipment requirements in a Conservation agriculture system. Small-scale farmers must also adapt direct-drill seeding equipment to manual, animal, or small tractor power sources (reduced weight and draught requirements) and reduce costs so that the equipment is affordable to them, though the use of rental and service providers allows small-scale farmers to use this system even if they do not own a tractor or a seeder. Bolivian small-scale animal-powered farmers have built a simple three-row tiny grain seeder. To conserve weight, this machine employs a shovel instead of a disc opener. Straw wheels are added to the coulter to assist in moving leftovers aside and preventing blockage. It also has the advantage of being able to be employed in both ploughed and unplugged soil. Farmers noted that the biggest advantage of this drill was the time savings; it takes 10 hours to plant a hectare with this machinery and 12 days to plant a hectare with the Transplanting and Seeding method. New machines deliver precise seed distribution through constant soil penetration and depth, as well as fertilizer in bands, which is critical for minimizing nutrient losses in zero-till systems (Wang *et al.*, 2018). Climate Change and Need of Conservation Agriculture: Climate change is expected to have a significant impact on rice–wheat, rice–rice, and maize– based cropping systems, which currently account for more than 80% of total cereals grown on more than 100 Mha-1 of agricultural land in South Asia. Global warming may be advantageous in some areas but dangerous in others where ideal temperatures already exist; for example, the rice–wheat mega-environments in the Indo Gangetic Plains (IGP), which account for 15% of global wheat production, are an example. By minimizing tillage and residue burning and boosting nitrogen usage efficiency, agronomic and crop management strategies must seek to reduce CO^2 and other greenhouse gas emissions. In the IGP, resource-conserving methods are expanding in rice–wheat cropping systems, saving 50–60 l of diesel per haK1 plus labor, and reducing CO^2 emissions significantly. In puddled anaerobic paddy fields and when residues are burned, methane emissions with a warming potential 21 times that of CO2 are prevalent and important. By switching to an aerobic, direct seeded, or Non transplanted (NT) rice system, this GHG output can be reduced. The warming potential of nitrous oxide is 310 times that of carbon dioxide, and its emissions are influenced by inadequate nitrogen management. In Eastern-IGP, drought are major climatic constraints and delayed sowing of crops leads to economic losses to farming society. Climate Smart Agriculture based technologies like CA are one of the option with strong base to mitigate the ill effects of changing climate (Tamta et al., 2020). Sensor-based methods for detecting normalised differential vegetative index and moisture index have been used in Mexico and South Asia to boost nitrogen application efficiency and reduce nitrous oxide emissions. (Wang *et al.*, 2018).

Conclusions

A key component of crop production that is sustainable is conservation agriculture. By recycling crop straw, causing the least amount of soil disturbance, and keeping the soil covered during the growing season, conservation agriculture increases the microbiological activity of the soil. These methods have a direct impact on the physical, chemical, and biological aspects of the soil and are crucial for the sustainable cultivation of crops.

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