

## Conservation Agriculture: Impacts and Constraints

(\*Tamanna Sharma and Nikhil Thakur)

Sher e Kashmir University of Agricultural Sciences and Technology, Jammu, India

\*Corresponding Author's email: [tamanna.25011999@gmail.com](mailto:tamanna.25011999@gmail.com)

Among the top ten problems which the world will face in the next 50 years are directly related to soil health (Food, water, energy, environment and poverty). Around 1.2 billion hectares of the world land area is under moderate to severe soil degradation which comprises of around 25 % of total world's area. Recently scientists found that 24 billion tons of fertile soil was being lost per year because of unsustainable agricultural practices. Worldwide 3.2 billion people are affected by land degradation especially, rural communities, poor households and small farmers. Several factors like excessive tillage, unsuitable crop rotations, deforestation, excessive grazing, mining, inappropriate agricultural practices etc. have contributed to soil degradation. Therefore, there is a need to implement sustainable agricultural and land management practices that improve soil health. The world population is expected to increase from 7.7 billion in 2019 to 9.7 billion in 2050 (FAO, 2009). In order to feed these extra people, it will obviously be necessary to boost world food production, particularly in developing countries where the greatest rates of population growth currently occur. One of the most important way to attain this is to use the natural resources (water, soils and air) that are needed in food production in the most efficient way. Conservation Agriculture is a widely adopted measure to ensure higher sustainable agricultural production. Basically, conservation agriculture strengthenecological foundation for agriculture. Conservation Agriculture is away of farming that conserves, improves and ensures efficient use of natural resources. It is a concept of resource – saving agricultural crop production that strives to achieve profits together with high and sustained production levels while concurrently conserving the environment (FAO 2010). Conservation of natural resources and sustainable agriculture are the major goals of conservation agriculture. Conservation agriculture is characterized by three interrelated principles: (i) promotes maintenance of a permanent soil cover,(ii) Continuous minimal mechanical oil disturbance, and(iii) Diversification of plant species.

### Impacts of Conservation Agriculture

1. **Impacts on Production:** Conservation agriculture helps in increasing agricultural productivity and profitability by reducing the cost of labour, fuel, machinery, operating costs and maintenance etc. It also enhance the input use efficiency i.e more output for a lower input. In properly managed zero-till planted wheat, yields were invariably higher compared to conventional system for comparable planting dates.

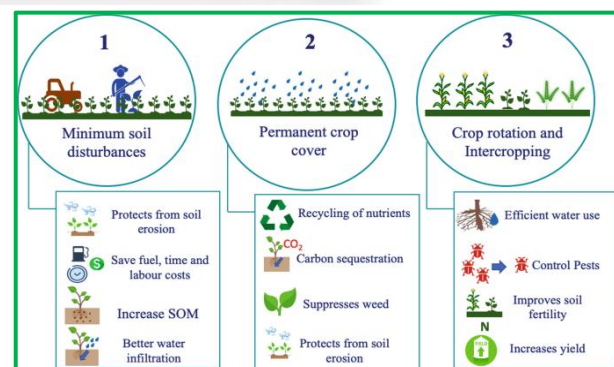


Fig . Benefits of conservation agriculture (Naorem *et al.*,2021)

2. **Impact on Soil Properties:** It ensures the maintenance of soil organic matter which plays an important role in plant growth and development. It also helps in improvement of soil structure and rooting zone by reducing or avoiding the mechanical disturbance of soil and increasing the aggregate stability. Also, the external inputs such as agrochemicals are applied judiciously in such a way that it doesn't interfere or obstruct with the biological processes. It prevents the formation of hardpans and restores soil fertility which will ultimately improve yield (Lal, 2004). Soil carbon sequestration impacts on global climate change and food security. *science*, 304(5677), 1623-1627.. By reduced crusting and surface sealing, Conservation agriculture helps in increasing the water retention and infiltration capacity of soils. It increases the availability of nutrients near the soil surface where crop roots proliferate.
3. **Impact on Environment:** With improved water infiltration, rate of soil erosion also gets reduced which improves the quality of air and water. It helps in maintaining favourable hydrologic balance to combat extreme weather conditions. It reduces the intensity and incidence of desertification. With the adoption of conservation agriculture, most of the residues remain in field and fires, dust etc. would disappear. Conservation agriculture reduces the net global warming as compared to the conventional agriculture as it requires lesser number of tractors and small quantities of fossil fuels gets burnt, thus reducing carbon emissions (Kates *et al.*, 2012). Soils rich in organic matter sequester more carbon which further reduces Greenhouse Gas emissions.
4. **Impact on Society:** As conservation agriculture reduces soil erosion to a greater extent, it will further help in providing more reliable and cleaner water supplies to the people. Also, it reduces incidence of flooding due to better water retention. Due to the low runoff rate, damage to roads, canals, ports and bridges also reduces. Most importantly, it provides food security to the growing population and improves the quality of life.

### Constraints in Adoption of Conservation Agriculture

Although area under conservation agriculture has increased globally. But its adoption is still a challenge specially in developing countries due to lack of education and information among farmers. Some of the prominent constraints in the adoption of conservation agriculture includes:

1. **Lack of specialized equipment :** High initial costs of equipment and high m technical skills to use them is the most common problem among farmers even in India . Lack of appropriate seeders especially for small and medium scale farmers. A lot of efforts have been made in developing and promoting machinery for seeding. But for the successful adoption there is the need for accelerated effort in developing, standardizing and promoting quality machinery for a wide range of crop and cropping sequences. For example: Development of permanent bed and furrow planting systems and harvest operations to manage crop residues (Shrestha *et al.*, 2020).
2. **Burning of crop residues:** Generally, farmers prefer to burn the residues for timely sowing of the next crop. Also, due to the lack of machinery for conservation agriculture they are forced to burn residues. India witness this phenomenon almost every year mainly in the rice-wheat system in north India. This creates environmental problems for the region and reduce the air quality.
3. **Lack of knowledge:** The agriculture leaders, extension agents and farmers are unaware about the potential of conservation agriculture this implies that there is the need of evolution of whole range of practices in conservation agriculture, including planting and harvesting, water and nutrient management, diseases and pest control etc (Kassam *et al.*, 2019). And these practices need to be checked and matched according to the new systems.

4. **Wide spread use of Crop Residues:** Farmers usually face under supply of crop residues due to less biomass production of different crops under rainfed agriculture. Since, residues are widely used for fuel and livestock feed. There is competition between Conservation agriculture practice and livestock feeding for crop residue (Nandan et al., 2021). This is a major constraint for promotion of CA under rainfed situations.
5. **Skilled and Scientific Manpower:** Conservation agriculture systems, will require enhanced capacity of scientists to address problems from a systems point of view and to be able to work in coordination with farmers and other stakeholders. And for this, we need to build up our knowledge and information sharing mechanisms.

## Conclusion

Conservation agriculture offers a new paradigm for agricultural research and development different from the conventional one, which is the best option for ensuring food security. A shift from conventional to Conservation agriculture has become a necessity because of increasing problems of resource degradation. Conservation Agriculture attenuate the effect of climate change and ensures environmental sustainability. Developing and promoting CA systems will be highly demanding in terms of the knowledge base. For the successful promotion and implementation of conservation agriculture practices across different agro climatic regions, appropriate social, technological, economical and political support is required.

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