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Conservation Agriculture: A Key for Sustainable Agriculture

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SUMMARY

Conservation agriculture (CA) includes low-impact soil disturbance, permanent soil cover from crop residues or cover crops, and crop rotation for increased productivity. Even though there are a number of obstacles that prevent CA from being widely adopted, initiatives to develop, improve, and disseminate conservation-based agricultural technology have been ongoing in India for about 20 years and have achieved great progress since then. In the Indo-Gangetic plains, significant effort has been put into no-till wheat cultivation in a rice-wheat rotation. Adopting CA has more benefits than drawbacks, but both adopters and promoters are aware of the balance between the two. However, there are still barriers to the promotion of CA technologies. These include the lack of suitable seeders, particularly for small and medium-sized farmers, the conflict between CA use and livestock feeding over crop residues, the burning of crop residues, the lack of skilled and scientific labour, and the need to change people's perceptions about tillage. To promote CA in the area, it is vital that the policy framework and marketing plans be developed. This article examines the growing challenges brought on by the widespread use of conventional agriculture systems and examines the barriers, opportunities, policy concerns, and research requirements for conservation agriculture in India.

INTRODUCTION

India’s agriculture attained reliance on self in production of foodgrains although the production is still centred on rice and wheat. The country continues to face growing concerns regarding a variety of agricultural issues, such as the growing issues of land degradation, spiralling cost of inputs, volatile food prices, water scarcity, increasing climate vulnerability, and rapid urbanisation that limits the potential for agricultural territorial expansion. The biggest challenge is to make the agricultural systems sustainable and climate resilient in order to ensure the country's food security. Globally agriculture can cause environmental problems, emit greenhouse gases, and accelerate climate change if it is not carried out sustainably. Sustainable farming practises, on the other hand, can boost climate change resilience, save biodiversity, and sustainably utilise natural resources. One of these strategies is conservation agricultural (CA).

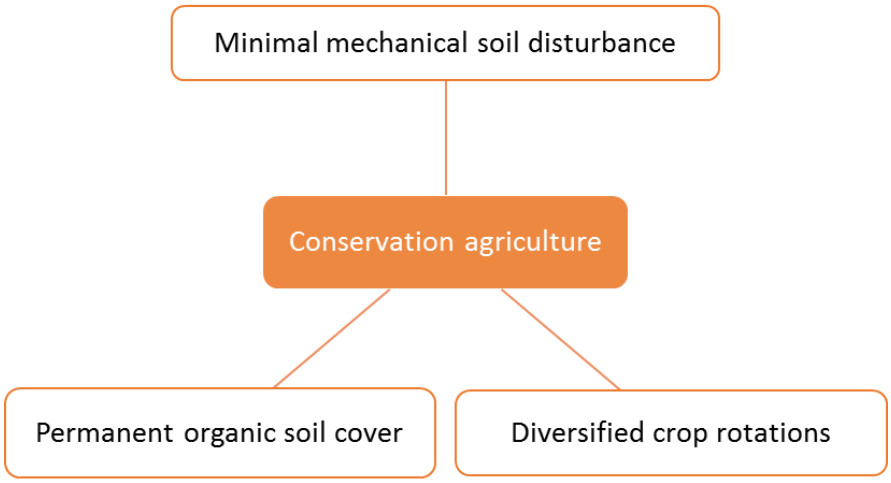
Concerns about the sustainability of agriculture around the world led to the development of the concept of conservation agriculture, which has slowly spread to occupy around 8% of the world's arable land. CA is a resource-saving agricultural production system that aims to achieve production intensification and high yields while enhancing the natural resource base through compliance with three interrelated principles, along with other good production practices of plant nutrition and pest management. It also conserves biodiversity, natural resources and labour; it reduces heat and drought stress, increases available soil water with build-up of soil health in long run. Minimum traffic on agricultural operations, making a permanent soil cover by managing crop residues, and crop diversification through temporal or spatial means are the three basic principles which are applied to make it a viable system.

CA spread in India and the world scenario

Although the term "conservation agriculture" was first used in the 1990s, the notion of minimising soil disturbance actually dates back to the 1930s, to the time of the Dust Bowl in the United States of America. CA was initially introduced in Brazil in the early 1970s to combat soil erosion, but considering its positive effects on crops, it took another twenty years and it was in early 1990s when there was a significant adoption level in CA in Latin American countries. CA spread to the developed industrialised countries including the USA, Canada, and Australia at the end of the 1990s. Even though attempts to implement and promote CA technology have been made since the middle of the 1990s, things have picked up speed in India over the past 8–10 years. The majority of the spread of the CA technologies is attributed to the rice-wheat cropping system in irrigated agriculture. There is undoubtedly a location in our nation where CA operations are taking place beneath an irrigation system for rice and wheat in Punjab, Haryana, and Western UP. Although State Agricultural

Universities and ICAR worked together to spread CA methods across agricultural communities, the development is still unsatisfactory in the rainfed semi-arid tropics as well as the arid and mountainous regions, which account for a large amount of Indian agriculture. Still our major focus on CA is based on zero till seed cum-fertilizer drill for wheat in rice-wheat system. However other potential technologies like laser land levelling, raised bed planting, surface seeding, un-puddled rice transplanting, etc. are to be promoted.

Principles of Conservation Agriculture:



CA vs traditional agriculture vs organic agriculture

Both CA and organic agriculture protect the soil organic matter and maintains a balance between resources and agriculture, but organic agriculture uses soil tillage without using inorganic fertilizers; whereas CA use a permanent soil cover with less soil disturbances. To enhance food production and improve food security globally, we sometimes ignore yield stability. A global meta-analysis reflects significantly lower temporal stability (-15%) under organic farming as compared to conventional farming. It means despite organic farming takes into account biodiversity conservation and being environment friendly, yield stability is a great concern. In contrast, CA does not differ significantly in terms of temporal stability (-3%) indicating its applicability to a greater extent.

Key benefits of CA

By causing the least amount of soil disturbance and using external inputs sparingly, CA helps to preserve biodiversity and the natural biological processes by not interfering with their diverse above- and below-ground processes. We may state that CA encourages most soils to produce a stronger structure and cohesion, as well as a greater biodiversity and bioactivity. It has been documented from several regions of the world that CA methods improved the soil's physico-chemical characteristics, which in turn supports the cropping systems' long-term productivity. Additionally, it offers a stronger natural defence against unusual or unfavourable weather conditions. Secondly, it lessens the damaging impacts of climatic aberrations and safeguards surface and groundwater resources from contamination. CA is viewed as a competitive alternative to conventional agriculture from the standpoint of saving money, time, and fossil fuels. Therefore, the potential advantages of CA include a decrease in production costs, improved soil quality, carbon-sequestration, and soil organic matter accumulation, improved nutrient and water use efficiency, a decrease in greenhouse gas emissions, protection of the environment, improved resource use efficiency, and a decrease in weeds with the provision of crop diversification and intensification. The use of CA is a possible solution for addressing this issue in the context of residue burning.

Prospects of CA in India

Modern intensive chemo-centric agriculture has a direct impact on the natural resource base, energy security, and climate change. It is very necessary to safeguard our future generations against these dangers due to the steadily rising cost of manufacturing and the steady depletion of natural resources. With less vulnerable pathways, CA may play a critical part in maintaining our natural resource base. From the standpoint of Indian farmers, the most alluring advantages of CA are the lower production costs achieved by reducing the use of water, nutrients, and labour while increasing yields. CA that incorporates residue retention and zero-till planting provides an excellent potential to solve the residue burning issue and so prevents the significant loss of plant

nutrients with a significant reduction in greenhouse gas emissions. Every year, India experiences a significant problem with widespread crop residue burning. A proper government involvement to promote CA practises could lessen the severity of this issue. Improved soil structure is achieved through zero tillage and residue management, which also increases nutrient availability and recycling. Utilizing surface waste as mulch will lower evaporation, lower soil temperature, and promote biological activity. CA can provide a diversity of crops that can be integrated into new systems from the perspective of crop diversification.

Constraints to the adoption of CA

It is challenging to persuade farmers of CA's potential. To change farmers' mindsets, it is vital for farmers, technicians, extensionists, and researchers to shift their thinking away from soil-degrading tillage practises and toward sustainable production systems like no tillage. The main obstacles to its adoption are the equipment issues. The lack of suitable seeders, especially for small and fragmented estates, high equipment costs and poor availability are major obstacles. The management of crop residues, especially under rainfed conditions, is very difficult because the amount of biomass is lower in rainfed agriculture; In addition, these are mainly used as fuel and animal feed. Even with irrigated farming, farmers are starting to burn crop residues to free up the field earlier for subsequent crops for timely sowing. The application of CA equipment in crop residue management will be demonstrated on a large scale to address the issue. Since the cultivation method differs greatly from traditional practices, more and more expansion programs need to be organized to make people aware of CA technologies. Access to various information related to CA, namely grades, process packages, machines etc. is also a big problem. Finally, skills are very important to be successful by adopting CA technologies. We often lack qualified support staff and trained scientific staff.

Policy concerns and approaches

For spreading CA techniques across the nation, institutional arrangements and policy choices are crucial. What other technologies do CA technologies integrate with? How may CA practises be expanded at the regional and federal levels? How can CA handle the security of one's livelihood? Will there be any funding or financial assistance for the marketing of CA technologies? How can we aid in the validation and adoption of technologies? How can CA be mainstreamed with various pertinent ministries, departments, or organisations? These are the issues that will be dealt with by effective policy initiatives. Our observations have shown that local service providers are essential to the deployment of CA solutions. To make it a long-term viable choice, however, adequate integration of institutional-technological-policy related concerns is urgently required. Building partnerships between farmers, scientists, extension agents, policy makers, and private entities is crucial for the development and promotion of CA technology since CA systems are very complex.

CONCLUSION

Conservation agriculture offers a new perspective for agricultural research and development, which was primarily focused on meeting specific food grain production targets in India. A paradigm shift is now necessary due to the extensive issues with resource degradation that have accompanied the methods used in the past to increase production while giving little thought to resource integrity. In order to achieve continuous productivity growth, it is now essential to integrate issues related to productivity, resource conservation, soil quality, and the environment. The knowledge base required for creating and promoting CA systems will be extremely difficult to meet. For this, scientists' ability to approach issues from a systems viewpoint, collaborate closely with farmers and other stakeholders, and promote knowledge and information-sharing must all be significantly increased. Through lowering cultivation costs, increasing resource use efficiency, competitiveness, and sustainability in agriculture, conservation agriculture provides a chance to halt and reverse the downward spiral of resource degradation. The new mission must be "Conserving resources - boosting production."

REFERENCES

Bhan S and Behera UK, 2014. International Soil and Water Conservation Research, Volume. 2, Issue 4, 1-12.

Jat ML, Malik RK, Saharawat YS, Gupta R, Bhag M, & Paroda R, 2012. Proceedings of Regional Dialogue on Conservation Agricultural in South Asia, New Delhi, India, APAARI, CIMMYT, ICAR, 32

Abrol IP and Sangar S, 2006. Sustaining Indian agriculture-conservation agriculture the way forward. Current Science, Volume 91, Issue 8, 1020-2015