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REVIEW ARTICLE **OPEN ACCESS**

Role of Conservation Agriculture in Crop Production With Special Reference to Rice

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ABSTRACT
Rice (Oryza sativa L.), a staple food for more than half of the world population, is commonly grown by transplanting seedlings into puddled soil (wet tillage) in Asia. This production system is labour-, water-, and energy-intensive and is becoming less profitable as these resources are becoming increasingly scarce. It also deteriorates the physical properties of soil and contributes to methane emissions. However, combining dry seeding (Dry-DSR) with zero/reduced tillage (e.g., conservation agriculture (CA)) is gaining momentum as a pathway to address rising water and labour scarcity, and to enhance system sustainability. Benefits from direct seeding compared with puddled transplanting, which typically include similar yields; savings in irrigation water, labour, and production cost, higher net economic returns; and a reduction in methane emissions.
Keywords: *Rice, wet tillage, zero tillage, conservation Agriculture*

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INTRODUCTION

Rice production increased almost three fold over the last five decades and contributes handsomely to the nutritional security of the country. Climatic change casts a huge shadow in the horizon of agricultural productivity, especially in rainfed areas which occupy 62% of the total rice area of the country. A variety of factors including declining yields and less land, water and labour, effects of economic growth, pressure on land use, and climate change, threatens future rice production.

BACKGROUND OF CONSERVATION AGRICULTURE

Production of conventional puddled transplanted rice is facing severe constraints because of water and labour scarcity and climatic changes. Direct-seeded rice (DSR) is a feasible alternative to conventional puddled transplanted rice with good potential to save water, reduce labour requirement, mitigate green-house gas (GHG) emission and adapt to climatic risks. The yields are comparable with transplanted rice if crop is properly managed [4, 6].

CA is not a single specific technology, rather it is a concept developed to encompass a number of technologies directed to improved land husbandry in a sustainable manner CA is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. CA is characterised by three linked principles, namely: Continuous minimum mechanical soil disturbance. Permanent organic soil cover and Diversification of cover crop species grown in sequence and/or associations" [3].

Avtar Singh and Rajneesh Kumar [1] revealed that the plant height, number of tillers / m^2 was higher in zero tillage and dry matter accumulation was significantly influenced and statistically at par with conventional tillage with wheat straw followed by conventional tillage with wheat straw in both the years.

Bhale *et al* [2] revealed that conservation Agriculture practices results in resource improvement only gradually and benefit in crop yields may not come about immediately, evaluation and impact of CA practices therefore need a longer term and broader perspective which goes beyond yield increases only.

Rana *et al*. [5] at IARI, New Delhi revealed that in moisture conservation practices significant improvement in grain yield was recorded under FYM + dust mulch + straw mulch treatment, followed by Kaolin + dust mulch + straw mulch.

Goal of CA: To conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with external inputs.

Benefits of CA : Reduced erosion and environmental degradation, Improved soil structure and biology , Improved soil moisture retention , Higher soil Carbon levels , Increased yields , Reduced input costs (low external input) , Reduced CO_2 emissions (reduced use of fossil fuels) , Long term sustainability both environmental and economic.

Challenges of CA: Changing the farmers mind set, Farming – a high risk business, Path dependence, Differing soil and climatic conditions, Lack of long term support for farmers.

Soil does not need tillage for effective crop production. Tillage is not necessary for crop production. Crop residues are a very valuable part of farming system and must be retained in full remain on the surface as a mulch., Permanent all year round soil cover is essential, Control and promotion of natural biological soil process through rotation , Soil degradation and erosion is a symptom of an unsuitable farming system, Increased SOM, Improved soil quality, Increased available plant nutrients, Less runoff and increased plant available water, Reduced soil erosion, Improved crop production economics, Reduced labour requirements, Reduced machinery costs Reduced fossil fuel inputs , Improved global environment

Benefits of CA: Agronomic: Improve Soil Productivity, Increase Organic matter, Conserve Soil Moisture, Improve Soil Structure

Economic: Time Saving, Less Manpower Requirement, Increased Efficiency, Reduced Costs

Environmental: Reduce Soil Erosion, Help Improve Water Quality, Maintain Biodiversity, Carbon Sequestration.

Constraints in CA : Education & Awareness of the farmers , Time taken to sustain: Initial yield loss , Lack of availability of Improved Technology , Financial status: Farmers not accepting or unable to switch on CA , Narrow vision to see beyond the level: Unable to tap Forthcoming problems: climate change, scarcity of water, prone to diseases & pest.

CONCLUSIONS

CA does not solve ALL problems (NO panacea) but complemented with other good practices, CA is potentially applicable in most if not all agro-ecosystems as a basis for sustainable intensification using locally formulated and adapted practices by small and large farmer, CA offers improved output and productivity (efficiency) enhancement with on-site and large-scale ecosystem services, better system resilience and climate change adaptability and mitigation , CA is capable of rehabilitating degraded lands. Conservation Agriculture is environmentally sustainable and generate considerable net social gains to society. Caution must be taken to avoid blanket adoption of CA just everywhere; it should be site-specific and need based.

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