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CONSERVATION AGRICULTURE FOR ECOFRIENDLY AGRICULTURE

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Abstract

Conservation agriculture (CA) is characterized by minimal soil disturbance, diversified crop rotations, and surface crop residue retention to reduce soil and environmental degradation while sustaining crop production. CA involves changing many conventional farming practices as well as the mindset of farmers to overcome the conventional use of tillage operations. The adoption of CA has both agricultural and environmental benefits but there is a lack of information on the effects and interactions of key CA components which affect yield and hinder its adoption.

INTRODUCTION

Conservation Agriculture (CA) is a farming system that can prevent losses of arable land while regenerating degraded lands. It promotes maintenance of a permanent soil cover, minimum soil disturbance, and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production.

CA principles are universally applicable to all agricultural landscapes and land uses with locally adapted practices. Soil interventions such as mechanical soil disturbance are reduced to an absolute minimum or avoided, and external inputs such as agrochemicals and plant nutrients of mineral or organic origin are applied optimally and in ways and quantities that do not interfere with, or disrupt, the biological processes.

CA facilitates good agronomy, such as timely operations, and improves overall land husbandry for rainfed and irrigated production. Complemented by other known good practices, including the use of quality seeds, and integrated pest, nutrient, weed and water management, etc., CA is a base for sustainable agricultural production intensification. It opens increased options for integration of production sectors, such as crop-livestock integration and the integration of trees and pastures into agricultural landscapes.

The Green Revolution was a movement towards excessive mechanization, fertilization and application of pesticides of agriculture. Slowly, the adverse effects of excessive pesticides, fertilizers and machines started manifesting on the environment, soil and human health. Indian agriculture, today has negatively affected the environmental and soil health due to excess and imbalanced use of fertilizers and

machinery. Conservation agriculture involving zero or minimum-tillage, furrow irrigated raised beds panting technique and innovations in crop residue management (CRM) to avoid straw burning should assist in achieving sustainable productivity and allow farmers to reduce nutrient and water inputs, and reduce risk due to climate change. "Conservation agriculture is a holistic and sustainable farming approach that applies three interlinked principles to mimic natural ecosystem processes, minimum soil disturbance through reduced or no tillage; permanent organic soil cover through cover crops, mulch and residues; and diversified crop rotations and associations"

Zero tillage

Zero tillage or direct seeded is a way of growing crops from year to year without disturbing the soil through tillage. No-till is an agricultural technique which increases the amount of water that infiltrates into the soil and increases organic matter retention and cycling of nutrients in the soil. In many agricultural regions it can reduce or eliminate soil erosion. It increases the amount and variety of life in and on the soil, including disease-causing organisms and disease suppressing organisms. The most powerful benefit of zero tillage is improvement in soil biological fertility, making soils more resilient. Farm operations are made much more efficient, particularly improved time of sowing and better trafficability of farm operations.

There several benefits of zero tillage.

• Reduced labour costs
• Reduced fuels costs
• Reduced machinery costs
• Reduced irrigation
• Increased grain and straw yields due to higher water infiltration and storage capacity
• Reduces erosion
• Improvement in soil structure and soil quality
• No tillage pan means roots can grow deeper
• Smaller, lighter tractors can be used which reduced compaction

Furrow Irrigated

Furrow irrigation avoids flooding the entire field surface by channelling the flow along the primary direction of the field using 'furrows,' 'creases,' or 'corrugations. Water infiltrates through the wetted perimeter and spreads vertically and horizontally to refill the soil reservoir. Furrows are often employed in basins and borders to reduce the effects of topographical variation and crusting. The distinctive feature of furrow irrigation is that the flow into each furrow is independently set and controlled as opposed to furrowed borders and basins where the flow is set and controlled on a border by border or basin by basin basis. Furrows provide better on-farm water management flexibility under many surface irrigation conditions. The discharge per unit width of the field is substantially reduced and topographical variations can be more severe. A smaller wetted area reduces evaporation losses. Furrows provide the irrigator more opportunity to manage irrigations toward higher efficiencies as field conditions change for each irrigation throughout a season. This is not to say, however, that furrow irrigation enjoys higher application efficiencies than borders and basins. However, we hypothesize that many other potential benefits will lead to increased productivity and profitability through the furrow irrigated raised beds.

• Management of irrigation water is improved is simpler, and more efficient. On an average it uses, 30% less water than

flatbed methods and improves crop yields by more than 20%.

• Better upland crop production is possible in the wet monsoon because of better drainage.

• Fertilizer efficiency can be increased because of better placement including top dress applications. • Reduce seed requirement of a range of crop compared with flat surface.

• Reduced lodging can have a significant, positive effect on yield

• Weeds between the beds can be controlled mechanically, early in the crop cycle.

• Herbicide dependence is reduced, and hand weeding and rouging between rows are easier.

• On raised beds, border effects allow the canopy to intercepts more solar radiation, providing directly effect on crop growth.

• Yield potential is enhanced through improved nutrient-water lodging.

• Compaction of soil is limited only to the furrows used as tramlines (tractor tracks)

Residues

Crop residues are the part of the plants left in the field after crops have been harvested, threshed, pruned or processed. Though they have been regarded as waste materials that require disposal but it is now increasingly being realized that these are a tremendous natural resource and not a waste

• Improve soil productivity (Yield)

• To rise soil organic matter

• Reduce soil erosion

• Increase water infiltration rate

• Conserve soil moisture

• Recycle plant nutrients

• Provides habitat for soil organisms including earthworms and microorganisms.

• Reduces surface runoff and decreases sedimentation

• Improves water quality by denaturing and filtering of pollutants.

• Mitigates flooding by holding water on the land rather than allowing it to run off into streams and rivers.

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