

## Role of conservation agriculture in climate change mitigation

Mahima Charan Jitendra and C. Naveen Kumar

Department of Farm Machinery and Power Engineering, College of Technology and Agricultural Engineering (M.P.U.A.T.), Udaipur (Rajasthan) India  
(Email : mahimacharan331@gmail.com)

**Introduction :** Agriculture – on which we all depend for our food – is under threat from climate change. There is no doubt that systems worldwide will have to adapt, but while consumers may barely notice in developed countries, millions of people in developing countries face a very real and direct threat to their food security and livelihoods. Feeding a rapidly rising global population is taking a heavy toll on farmlands, rangelands, fisheries and forests. Water is becoming scarce in many regions. Climate change could be the additional stress that pushes systems over the edge. We know that climate change will mean higher average temperatures, changing rainfall patterns and rising sea levels. There will be more and more intense, extreme events such as droughts, floods and hurricanes. Although there is a lot of uncertainty about the location and magnitude of these changes, there is no doubt that they pose a major threat to agricultural systems. Developing countries are particularly vulnerable because their economies are closely linked to agriculture, and a large proportion of their populations depend directly on agriculture and natural ecosystems for their livelihoods. Thus, climate change has the potential to act as a ‘risk multiplier’ in some of the poorest parts of the world, where agricultural and other natural resource-based systems are already failing to keep pace with the demands on them.

Conservation agriculture is as an approach to farming that seeks to increase food security, alleviate poverty, conserve biodiversity and safeguard ecosystem services. Conservation agriculture practices can also contribute to making agricultural systems more resilient to climate change. In many cases, conservation agriculture has been proven to reduce farming systems’ greenhouse gas emissions and enhance their role as carbon sinks.

- No or minimum soil mechanical disturbance in practice, this means no-till seeding and weeding

- Permanent soil cover, in other words, it means to maintain crop residues and stubble in arable crops and to seed or preserve groundcovers between rows of tree in permanent crops. In this way, soil organic matter and water infiltration into the soil are increasing, weeds are inhibited,

and water evaporation from the soil is limited.

- Cropping system diversification through rotations, sequences and associations involving annuals and perennials. In this way, pests and diseases are better controlled by breaking cycles that are maintained in monocultures, in addition to including crops that can improve the natural fertility of the soil and biodiversity

### **Other mitigation opportunities:**

*Reducing methane emissions from rice systems:* Irrigated systems provide much of the world’s food, but also produce greenhouse gases from chemical reactions between the water, fertilizers, soil bacteria and the plants themselves. Rice fields are often extensively flooded and produce significant amounts of methane. However, some simple changes in water regime can reduce emissions without yield losses. With alternative wetting and drying replaced continuous flooding of rice fields and farmers were able to see that yield was not reduced, and that water was used much more efficiently.

*Reducing nitrous oxide emissions from soils :* Nitrous oxide is produced by microbial action on nitrogen compounds which are usually added as fertilizer. Fertilizers are important for improving yields, but additions are generally highly inefficient, leading to emissions. The key is to increase nitrogen use efficiency by the plants, and there are various ways to do that. Fertilizer best management practices are based on the principle of ‘right source, at the right rate, at the right time, and with the right placement’.

*Reducing deforestation :* Deforestation is a hugely complex issue, and reducing and reversing it requires action at many different levels, from global policy to local empowerment and diverse technologies that promote sustainable forest management.

*Lowering greenhouse gas emissions from livestock systems :* There are many ways to reduce emissions from livestock systems. Feeding better quality diets to ruminants reduces methane emissions and can be facilitated with improved fodder technologies such as improved pasture species and use of legumes. Manipulation of rumen micro



**Fig. 1: Other solutions and approaches to climate change mitigation**

flora and use of feed additives are also effective. Switching livestock species or breeds allows replacement of many low-producing animals with fewer but better fed animals, thus reducing total emissions while maintaining the supply of livestock products.

*Managing soils for carbon sequestration* : Soil carbon sequestration involves adding as much carbon as possible to the soil, and offers the biggest win-win mitigation-adaptation opportunity from farming systems. Management involves no burning and zero tillage.

*Pro-poor bio-fuels* : ICRISAT is assembling the elements of a bio-fuels initiative designed specifically to benefit the poor in regions facing the threat of desertification. One of the initiative's components consists of new varieties of high-sugar sorghum, which can be grown for ethanol production. Since sorghum produces grain and fodder as well, the new varieties should help address the food-feed-fuel dilemma. In addition, sweet sorghum is well adapted to drought-prone environments, requiring only a seventh of the amount of water required for sugarcane, another bio-fuel crop.

**Conclusion** : Climate change promises serious negative impacts on agricultural systems. These same systems and the natural resources that support them are already under severe strain from overexploitation, the current climate and multiple other stresses. Many of the world's most vulnerable people depend directly on these systems for their food and livelihoods; and many countries' economies

are also highly dependent on them. Agriculture is also adding to the climate change problem. This is the story so far.

We are at a crossroads in the development of our planet. The decisions we make now, for agriculture and natural resources as well as for other sectors, may prove to be the most important decisions humankind ever collectively makes. We know what to do to raise our chances of a better future. We know how to make agricultural and other natural resource-based systems more productive and more sustainable. Even without climate change, we have a moral imperative to turn this knowledge into action. Climate change adds urgency to the situation, but it also provides an opportunity. The products of agricultural research are ready to be implemented in adaptation and mitigation strategies that will help people build successful livelihoods despite changing conditions.

#### References:

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