2.1.2 SUB-MODULE 2: CLIMATE SMART AND CONSERVATION AGRICULTURE AS A RESPONSE TO CLIMATE CHANGE AND CLIMATE VIABILITY

Rain-fed agricultural production is heavily dependent on the amount and timing of rainfall, which in many areas is highly variable. On the other hand, small-scale farming faces the challenge of increasing production and preservation of the natural resources at the same time. CV and change increases already existing agricultural problems and risks. The year-to year variability of rainfall is a significant limitation to the sustainability of rain-fed farming systems. Thus, there is a need for CSA and CA agriculture practices to adapt to CC and CV.

Climate Smart Agriculture

This is defined as an approach for changing and shaping agricultural development differently under the new realities of climate change. Agriculture that increases productivity, enhances resilience (adaptation), reduces/ removes GHGs (mitigation), and achieves national food security and development goals in a sustainable way. This definition identifies the main goal of CSA as food security and development; while productivity, adaptation, and mitigation are identified as the other three interlinked pillars necessary for achieving this goal.

There are several reasons that call for the quick change of the present agricultural production system to a more climate-smart and resilient production system in these times of Climate Change and climate-related problems. The following are the six important reasons:

- The demand for food is increasing and thus more food has to be produced with the same amount of resources such as the land, water and capital.
- There is an overall reduction and degradation of natural resources that sustains agriculture production.
- Subsistence farming is highly vulnerable to the impacts of Climate Change and there is an immediate need to adopt a more sustainable approach for adaptation to Climate Change.
- There is need for enhancing food security while lowering effects of Climate Change and reducing destruction of the natural resource base.
- With the dangers brought about by Climate Change the agricultural production systems have to be more productive, efficient, predictable, stable in their outputs and more resilient to risks, shocks and long-term climate variability.
- Awareness and understanding of the farming communities on the potential impacts of Climate Change on agriculture is low and must be quickly increased to build their capacity for adaptation.

Climate Smart Agriculture (CSA) is anchored on 3 pillars: productivity, adaptation and mitigation:

- **Productivity:** CSA aims to increase agricultural production and incomes while eliminating negative impacts on the environment. Resulting from this effort, there is an increase in food and nutritional security in a sustainable way.
- **Adaptation:** CSA targets to reduce the exposure of farmers to risks while also strengthening their flexibility by building their capacity to adjust and grow when they encounter shocks and long-term stresses.
- **Mitigation:** CSA works to lower GHG emissions. As a result of this there are reduced emissions in production processes. It lowers deforestation from agriculture as soils and trees are managed to regulate carbon dioxide from the atmosphere.

Characteristic Approaches of Climate Smart Agriculture

- It chooses multiple technologies, innovation and management practices that work at the farm level to give the desirable level of production.
- It deals with climate change through taking note of its impacts in planning and developing agricultural systems for adoption.
- It adopts the environmental conservation that is supportive of agricultural production.
- It incorporates multiple goals i.e. increase in productivity, higher resilience and lower GHG emissions into planning.
- It takes into account impacts of climate change on gender and engages different stakeholders to identify the most appropriate interventions.
- It being context specific, it employs different interventions for different landscapes. In doing so, it handles each landscape in a unique way.

The CSA is framed and put forth as the concept for sustainable agricultural development for food security under Climate Change, but its core comprises sustainable farm-based agricultural land management practices. These CSA Practices include; conservation agriculture; water harvesting, conservation measures, integrated soil fertility management and agroforestry (Module two), integrated crop management (Module three) and agricultural insurance (Module four under section three) of this manual.

Conservation Agriculture

The CA is a method of farming that conserves, improves and uses natural resources more efficiently through sustainable intensification (integration) of locally available resources. The system contributes to environmental conservation as well as to enhancement of and sustained agricultural production. It can also be referred to as resource efficient agriculture. Conventional agriculture involves intensive tillage and has been claimed to cause soil degradation, particularly when practised in areas of marginal productivity. The goal of CA is therefore to maintain and improve yields and resilience against crop water stress while stimulating biological functioning of the soil environment. CA operatives on three principles or pillars namely: Minimum soil disturbance; Permanent soil cover and crop diversification/crop rotation and intercropping.

Minimum Soil Disturbance

The farmer tills the soil as little as possible or disturbs the soils as little as possible. The soil should only be dug where the seed, fertiliser and manure are to be placed

Minimum soil disturbance

Permanent Soil Cover

Crop residues, cover crops, tree biomass provides soil cover, or even biomass produced ex-situ. Cover crops can be intercropped with the main crop to serve the physical attributes of soil cover, biological nitrogen fixation and mineralization from the N rich biomass.

Permanent soil cover

Crop Diversification

It is a farming system that allows growing several crops. This is done through embracing crop rotation or intercropping systems. It encompasses both crop rotation and intercropping. Crop rotation is the systematic planting of different crops in a particular order over several seasons/years in the same farm unit. The process helps maintain nutrients in the soil, reduce soil erosion, and prevents plant diseases and pests. Intercropping is a system where two or more (multiple) crops are grown (companion planting) in the same farm unit in the same season/year making use of resources or ecological processes that would otherwise not be utilised by a single crop. The practice is most common in areas where land for cultivation is limited due to high population.

Economic benefits of Conservation Agriculture

- Resource saving: Fewer inputs are required before planting. Reduced ploughing saves farmers energy, labour and time. Farmers who use tractors to plough are able to reduce their fuel use for farm operations by two-thirds. Labour savings mean more time for members of the farm family to pursue other livelihood options, interests and investments.
- Time savings: Time savings allow farmers to plant earlier, perhaps by weeks.
- Pest and disease control: Crop rotation helps break crop disease cycles.
- Reduces crop failure risks: Diversified crops offers expanded crop sales and lowers risk of no harvest.
- Improved soil water management. Improved water infiltration and reduced water loss by evaporation and runoff. This improves yield even with small amounts of moisture. Refraining from ploughing can reduce evaporation loss by the equivalent of 20-30 mm, or between a fifth and a third.
- Reduction in labour use. In the case of animal traction, the reduction in labour when applying conservation agriculture can be as high as 86%. Time required to prepare the land using a tractor is reduced by 58% under conservation agriculture.
- Reduction in the cost of production. Overall, with equal or slightly higher yields and reduced costs, the farm income increases under conservation agriculture. Production systems that use manual labour or animal traction physical exercise of the farmer are also reduced considerably. Besides a reduction in time required for field activities, the costs for operation and maintenance are also reduced. Ploughing activities are eliminated, farmers do not need heavy machinery or tractors, resulting in lower investment or write-off costs.
- Generally, the costs for inputs are a bit higher in conservation agriculture compared to conventional tillage, due to cover crop seeds and agrochemicals.

Environmental Benefits

- Soil health. A core benefit is that soil that is little disturbed develops better soil structure. Good soil structure absorbs and retains water for crops more effectively. Nutrients from crop residues enables better nutrient cycling. Crop residues physically protect soil to reduce the wind and water erosion that inevitably diminishes soils left bare by ploughing. Conservation agriculture can reduce soil erosion by up to 96%. Biological activity continues uninterrupted in largely undisturbed soil, and nutrient-rich organic matter is left to accumulate there. All these factors contribute to long-term increases in yield and productivity.

- Reduced greenhouse gas emissions and water use. Soil with higher organic matter content sequesters more carbon than does depleted soil. Reduced need for mineral fertilisers also reduces emissions.
- Cleaner surface water. Improved water infiltration into healthy soil and reduced water erosion of bare ploughing soils keeps water, soil and agricultural inputs such as fertiliser, herbicides and pesticides in the field where they are needed and desired.
- Reduced loss of genetic biodiversity. The rotation of crops and cover crops restrains the loss of genetic biodiversity, which is a consequence of mono cropping.

Agronomic Benefits

The constant addition of crop residues leads to an increase of the organic matter content of the soil. Organic matter improves fertiliser use efficiency, water holding capacity, soil tilth, rooting environment and nutrient retention. The increased organic matter content together with soil cover leads to increased water holding capacity of the soil.

GENDER IN CLIMATE SMART AGRICULTURE AND CONSERVATION AGRICULTURE

The role of gender in CSA and CA are seen in the three Pillars and Principles of CSA and CA, respectively.

Pillar 1. Sustainably increase agricultural productivity and incomes

Some of the efforts to address gender in the context of this Pillar 1 include:

- Systematic gender analysis to identify any differences in men’s, women’s and youth’s productivity.
- Resolving the challenges or constraints that women and youths experience in accessing, using, and supervising
- Improving women’s and youth’s access to productive inputs and resources such as extension services; technologies, innovations and management practices.
- Improving women’s and youth’s use of agricultural inputs like seeds and fertilisers.
- Improving women’s and youth’s tenure of natural resources e.g. land.
- Participatory identification and implementation of income-generating opportunities.

Pillar 2. Adapt to and Build Resilience to Climate Change

The impacts of CC and related adaptive strategies are not gender-neutral because vulnerability is often determined by socio-economic factors, livelihoods, people's capacity and access to knowledge, information, services and support – all of which may differ along lines of gender. In addition, men, women and youth may have different coping strategies.

As resilience-enhancing practices and approaches are developed, it is critical that climate information is made available and accessible to men, women and youth (boys and girls), and that any potential increase in workload is minimised.

Pillar 3. Reduce and/or Remove Greenhouse Gas Emissions, Where possible

When pursuing practices that contribute to CC mitigation, it is good to note that women, men and youth are often in different starting positions to take them up. For example, agroforestry may be less accessible or offer fewer incentives to those with weaker land tenure rights, and soil and water conservation may be difficult if hiring labour is not possible. On the other hand, some practices, like improved cooking stoves, biomass for energy and biogas, may be more attractive to women for their labour-saving features. Proposed mitigation actions therefore should harness the experiences, expertise, and realities of women and men alike.

Further Reading

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