HARVESTING SUSTAINABILITY NURTURING CLIMATE-SMART AGRICULTURE FOR A GREENER TOMORROW

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Agriculture is at the forefront of development in an era where sustainable practices are critically needed. According to the World Bank estimates climate change could push an additional 100 million people into extreme poverty by 2030 as global food security is being threatened by climate change, thus innovative approaches that protect the environment while ensuring productivity

are essential. Climate-smart agriculture (CSA) is a comprehensive paradigm that combines resilience to climate variability, adaptability to climate change, and sustainable practices. The majority of the world's poor live in rural areas and agriculture is their most important income source. Developing the potential to increase the productivity and incomes from smallholder crop, livestock, fish and forest production systems will be the key to achieving global food security over the next twenty years. Climate change is expected to hit developing countries the hardest. Its effects include higher temperatures, changes in precipitation patterns, rising sea levels and more frequent extreme weather events. All of these pose risks for agriculture, food and water supplies. Resilience is therefore a predominant concern. Agriculture is a major source of greenhouse gas emissions. Mitigation can often be a significant co-benefit of actions to strengthen adaptation and enhance food security, and thus mitigation action compatible with national development priorities for agriculture is an important aspect of Climate-smart agriculture (CSA).

PILLARS OF CLIMATE-SMART AGRICULTURE

Climate-smart agriculture encompasses a range of practices aimed at enhancing agricultural productivity while minimizing environmental impact and building resilience to climate change. Its three main pillars are (Figure 1):

- **Sustainable Intensification**: CSA emphasizes the need to increase agricultural productivity sustainably, ensuring efficient use of resources such as land, water, and inputs like fertilizers and pesticides. This involves adopting practices such as precision farming, agroforestry, and conservation agriculture to optimize yields while minimizing ecological footprint.

- **Adaptation:** With climate change altering weather patterns and increasing the frequency of extreme events, adaptation is crucial for agricultural systems to remain resilient. CSA promotes the adoption of resilient crop varieties, improved water management techniques, and diversified farming systems that can withstand climatic stresses.

- **Mitigation:** Agriculture is a significant contributor to greenhouse gas emissions, primarily through deforestation, livestock production, and the use of synthetic fertilizers. CSA seeks to mitigate these emissions by promoting practices that sequester carbon in soils, reduce emissions from livestock, and enhance energy efficiency in agricultural operations.
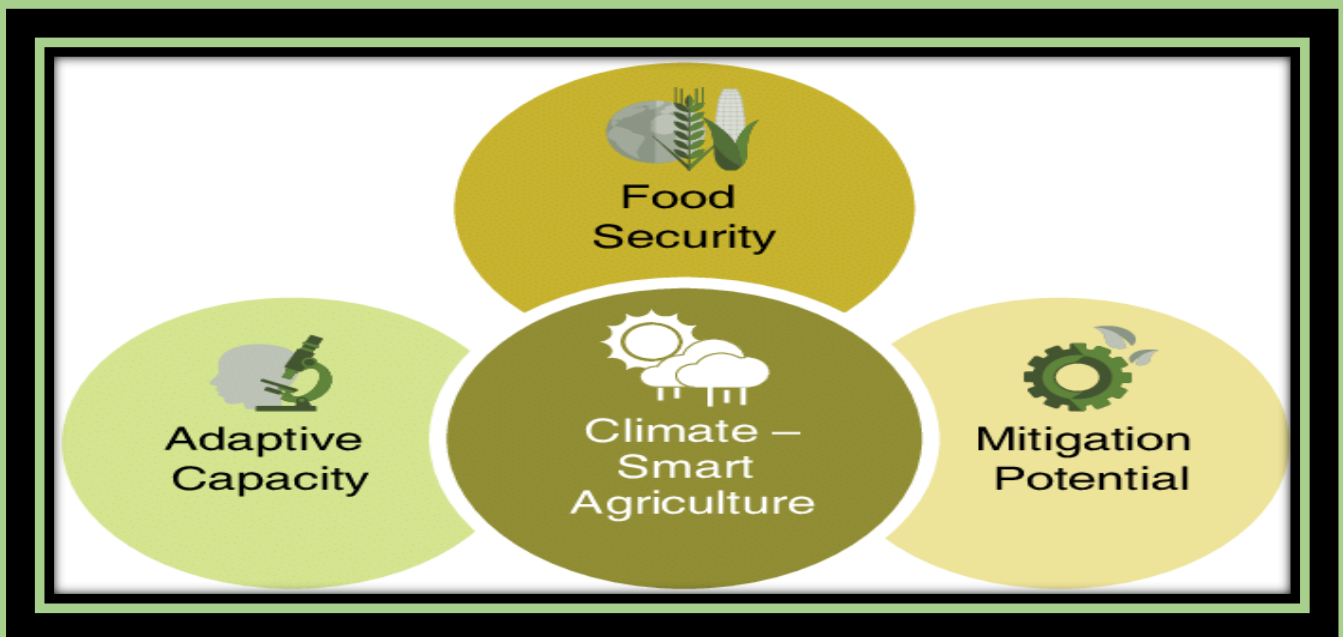

Figure 1: Pillars of Climate-Smart Agriculture (CSA) *Source: FAO*

CLIMATE-SMART AGRICULTURE (CSA) PRACTICES

Climate-smart agriculture (CSA) practices have been developed to address the challenges posed by climate change while ensuring sustainable food production as follows:

- **Conservation Agriculture (CA):** Conservation agriculture involves minimal soil disturbance, permanent soil cover, and crop rotations. Scientific studies have demonstrated that CA enhances soil health by promoting soil organic matter accumulation, and improving soil structure while reducing erosion up to 50%. This practice increases soil water retention, thereby enhancing resilience to droughts and floods. Additionally, CA sequesters carbon

in the soil, mitigating greenhouse gas emissions.

- **Agroforestry:** Agroforestry integrates trees and shrubs into agricultural landscapes, providing multiple benefits such as increased crop yields by up to 128% compared to monoculture systems, improved soil fertility, enhanced biodiversity, and increased resilience to climate variability. Agroforestry systems can improve soil carbon sequestration, regulate microclimate conditions, and provide additional sources of income for farmers through timber, fruits, and other non-timber forest products.

- **Water Harvesting and Management:** Sustainable water management practices, including rainwater harvesting, drip irrigation, and water-efficient irrigation techniques, are essential for climate-smart agriculture. These practices can increase water use efficiency, reduce water losses through evaporation and runoff, and improve crop yields by up to 20-50% while reducing water use by 20-40%, particularly in water-limited environments addition to

that, water management strategies help mitigate the impacts of droughts and water scarcity on agricultural production.

- **Crop Diversification and Rotation:** Diversifying crops and implementing crop rotation systems can improve soil health, reduce pest and disease pressure, and enhance resilience to climate variability. Crop diversification enhances ecosystem services such as biological pest control, nutrient cycling, and soil fertility improvement. Moreover, crop rotation can break pest cycles, suppress weed growth, and improve soil structure, leading to increased productivity and resilience in agricultural systems.

- **Integrated Pest Management (IPM):** IPM combines various pest management strategies, including biological control, cultural practices, and judicious use of pesticides, to minimize pest damage while reducing environmental impacts. It can effectively control pests and diseases while preserving natural enemies and reducing pesticide use by 73%. By promoting ecological

balance and reducing reliance on chemical inputs, IPM contributes to the sustainability of agricultural production systems.

- **Climate-Resilient Crop Varieties:** Breeding and selecting crop varieties that are adapted to local climatic conditions and tolerant to biotic and abiotic stresses are essential for climate-smart agriculture. The adoption of climate-resilient crop varieties could increase global maize and wheat yields by up to 10-25% by 2050.

BENEFITS OF CLIMATE-SMART AGRICULTURE

Climate-smart agriculture offers numerous benefits, both for farmers and the environment:

- **Resilience:** CSA helps farmers mitigate the risks associated with climate change, such as droughts, floods, and pest outbreaks, thereby safeguarding their livelihoods.

- **Sustainability:** By promoting resource-efficient practices, CSA contributes to the long-term sustainability of agricultural systems, ensuring food security for future generations.

- **Environmental Protection:** By reducing greenhouse gas emissions, conserving natural resources, and preserving biodiversity, CSA helps mitigate the environmental impacts of agriculture and contributes to climate change mitigation efforts.

- **Economic Viability:** Adopting climate-smart practices can enhance farm productivity and profitability while reducing production costs in the long run.

CONCLUSION

As the global population continues to grow and climate change threatens agricultural systems worldwide, the need for sustainable solutions has never been more urgent. Thus, Climate-smart agriculture offers a pathway towards a greener, more resilient future for agriculture. Moreover, embracing sustainable intensification, and adaptation of mitigation strategies not only mitigates the impacts of climate change but also contributes to building a more sustainable and food-secure world.

References:

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