



# Inventory of approaches and practices comprising climate-smart agriculture technologies in Southern Africa

Inventory Report



**AICCRA**  
Accelerating Impacts of CGIAR  
Climate Research for Africa



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The authors would like to thank...

## About AICCRA Reports

Titles in this series aim to disseminate interim research on the scaling of climate services and climate-smart agriculture in Africa in order to stimulate feedback from the scientific community.

## Photos

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## About AICCRA



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# ABBREVIATIONS

<b>AICCRA</b>	Accelerating Impacts of CGIAR Climate Research in Africa
<b>AU</b>	African Union
<b>AUC</b>	African Union Commission
<b>AUDA</b>	African Union Development Agency
<b>BAU</b>	business as usual
<b>CA</b>	conservation agriculture
<b>CAADP</b>	Comprehensive Africa Agriculture Development Programme
<b>CBA</b>	cost-benefit analysis
<b>CCAFS</b>	Climate Change Agriculture and Food Security
<b>CGIAR</b>	Consultative Group of International Agricultural Research Centres
<b>CIS</b>	climate information services
<b>CSA</b>	climate-smart agriculture
<b>CSAIP</b>	climate-smart agriculture investment plan
<b>CSEP</b>	Climate-Smart Agriculture Education and Policy Project
<b>CSV</b>	climate-smart village
<b>FANRPAN</b>	Food, Agriculture and Natural Resources Policy Analysis Network
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FNS</b>	food and nutrition security
<b>GCCASP</b>	Gender Climate Change and Agriculture Support Programme
<b>ICT</b>	information and communications technology
<b>iNGO</b>	international non-governmental organisation
<b>IRR</b>	internal rate of return
<b>MoAMID</b>	Ministries of Agriculture, Mechanisation and Irrigation Development
<b>MSP</b>	multi-stakeholder platform
<b>NDE</b>	National Designated Entity
<b>NEPAD</b>	New Partnership for Africa's Development
<b>NGO</b>	non-governmental organisation
<b>NPV</b>	net present value
<b>PICZ</b>	Professional Insurance Company of Zambia
<b>REC</b>	Regional Economic Community

# INVENTORY OF APPROACHES AND PRACTICES COMPRISING CSA TECHNOLOGIES IN SOUTHERN AFRICA

The inventory of CSA approaches, practices, and technologies was compiled as an output of the CSA Writeshop that CCARDESA convened in October 2022 under the auspices of the AICCRA and GCCA+ projects with the primary objective of developing the CSA Handbook as well as a training manual for use in SADC region. The CSA Handbook has provided an elaboration of best-bet CSA options that have been categorized along the three pillars of CSA: increased productivity, adaptation, and mitigation. CSA aims to achieve food security and broader development goals under a changing climate and increasing food demand by applying options related to the three pillars. Planning is required to address trade-offs and synergies between these essential pillars. The priority is to achieve more efficient, effective, and equitable food systems that address environmental, social, and economic challenges across productive landscapes. While the CSA handbook has been the primary source of the options in the inventory, only some of the information is excluded from the CSA handbook. Other sources have included other CCARDESA-supported CC projects as well as other relevant CSA literature sources.

The inventory has been developed as a quick source of reference for CSA practitioners when making quick decisions on what approaches/practices of CSA technologies to employ, particularly to meet the different needs for addressing Climate Change challenges more effectively and efficiently. It also serves as a guide for the AICCRA project in selecting the most appropriate approaches and practices for the CSA demonstrations for the Magugu model village site of Eastern Province. The objective of setting up the demonstration plots for CSA at the model village is to provide an opportunity for the farmers to validate the options and thus contribute to the efforts of upscaling these options to spill over countries within the SADC region.

**Table 1:** List of approaches/practices/technologies

Thematic Area	Approaches/practices/technologies	Definition	Contributions/benefits	Adaptation	Mitigation
<b>Crop production technologies</b>	Conservation agriculture	It is a way of farming that conserves, improves, and makes more efficient use of resources through the integrated use of available resources and external inputs.	Improvement in water infiltration and conservation; Precision in fertilizer application; Improvement in nutrient use efficiency; Reduction in cost of crop establishment when mechanized CA is used.	+	+
	Multiple cropping	Growing two or more different crops together on the same piece of land in the same cropping season.	Benefits from output and income from two or more crops instead of one; Reduction in cost of production from crop protection benefits and shared management practices; Spreading the risk of total crop failure in the event of a major drought.	+	+
	Water management practices	These water management practices promote efficient water utilization at the field level to optimize productivity and income generation by farmers.	The selection of crops and varieties adapted to low water requirements, the precise application of water through drip irrigation, and deficit irrigation that targets the critical stages of growth improve water use efficiency; this can, in turn, improve nutrient use efficiency and crop yield.	+	
	Irrigation Management	The act of timing and regulating irrigation water application in a way that will satisfy the water requirement of the crop grown.	Efficient utilization of water; two or more crop cycles per year; stabilization of crop yields.	+	
	New and improved crop varieties	Crop types have been developed to address a given objective, for example, drought and heat tolerance.	Stable crop growth and yield performance under CC stress.	+	+
	Crop diversification	Addition of new crops to agricultural production systems	Diversity of crops leads to break in pests and diseases, Increased	+	

		on a particular farm, considering the different returns from the added crops with complementary marketing opportunities.	incomes arising from new markets; Spread of risks associated with failure of one crop; Diversity of food in the community is increased.		
	Conservation of plant genetic resources for food and agriculture	Conserved and characterized plant genetic resources for food and agriculture need to be used as 'raw materials for developing varieties resistant to abiotic and biotic stresses.	To address the challenges posed by climate change, there is an increasingly urgent need to invest more excellent resources and efforts in safeguarding the broadest possible diversity of plant genetic resources for food and agriculture in their natural habitats in situ, on farms, and in gene banks ex-situ.	+	+
	Crop varietal development	Practice that supports plant breeders to develop an increasingly diverse portfolio of varieties of various crops to adapt production systems to climate change.	It generates novel varieties by harnessing obtaining heritable variations, especially from the non-adapted materials, including crop wild relatives, that breeders do not usually use for enhanced performance, value, resilience, and other productivity environmental and socio-economic benefits.	+	+
	Integrated pest and disease management	Integrated Pest Management (IPM) is a practical and environmentally sensitive approach to pest management that relies on a combination of standard practices, with the use of chemicals usually the last option. It uses information on the life cycles of pests and their interaction with the environment.	Helps to reduce pest management costs, thus, in the long term, reducing production costs and improving the profitability of the farming enterprise. Reducing chemical use will also minimize environmental pollution, thereby encouraging biota thriving, which is beneficial for soil fertility.		

	Improved post-harvest handling and storage.	This appropriately handles harvested produce to maintain quality and add value where possible.	Efficient post-harvest processing will reduce post-harvest losses while maintaining high-quality produce, facilitating access to more profitable markets. At the same time, value addition will ensure higher income from the value-added produce.		
	Sustainable mechanization	Using appropriate machinery to carry out sustainable crop management practices increases productivity per unit of land.	It increases efficiency in the various production and processing operations, show, extraction, and transport of agricultural inputs and crop production.	+	
Livestock Management systems	New and tolerant breeds	Breeds that are drought tolerant, heat hardy, and efficient in utilization of feed.	Crossing breeds that are hardy to CC and have higher feed conversion rates create permanent germplasm/breeds. Survival under harsh conditions means increased livestock assets.	+	
	Livestock Diversification	Addition of new livestock breeds and types and livestock rearing systems to agricultural production on a particular farm taking into account the different returns from the value-added livestock products with complementary marketing opportunities.	Small ruminant animals such as boar goats, and Merino sheep have reduced demand for food. Poultry types are cheaper to procure and sell.	+	+
	Forage/fodder production and conservation.	Feed for domesticated livestock that can be either hay, silage, stover or pasture.	An increase in feed conversion allows for fast growth, higher egg and milk production, earliness to first birthing and therefore increased incomes.		
	Improved pasture management	This involves planting new pasture varieties (e.g., <i>Stylosanthes</i> ) and rotational grazing of	Increased pasture diversity Increases yield of pasture hence growth	+	+

		livestock to minimize land degradation.	Reduced pressure on fields.		
	Grassland restoration.	The regeneration of grassland ecosystems as a means of supplying natural feed.	Reduction in erosion; reduction in distances covered by livestock for feeding.	+	
	Improved animal manure treatment.	Manure is a product from livestock waste and urine mixed with water that needs to be treated to reduce losses and GHG emissions is the optimal, site-specific handling of livestock manure from collection, through treatment and storage, up to application to crops (and aquaculture)	Wet handling and fast collection and decomposition Aids in nutrient cycling. Non-exposure of manure to the sun and rain by using roofed housing and tarpaulin covers.		+
	Improved housing for small ruminant livestock.	Housing designed to keep livestock to meet CC standards.	Reduce pest and disease exposure.		
Soil management	Contour planting in mountainous or ordinary farming areas.	Planting of crops or agroforestry trees/shrubs across the slope of the land.	Reduces soil erosion, harvests rainwater, and conserves soil moisture.		
	Terracing	Levelling of land in areas with slopes that are greater than 15 degrees slope.	Reduce soil erosion and soil movement; promote water infiltration and moisture retention.	+	
	Soil pH testing	Testing the soil to determine the acidity or alkalinity of the soil that influences plant nutrient availability.	Reduced application of inorganic fertilizers.		+
	Liming	Addition of agricultural lime or wood ash to increase the soil pH.	Availability of more nutrients; reduces toxicity to plants.		
	Biochar Application	Addition of charred organic material to the soil	Infiltration improved Soil Physical structure improved and sustained	+	+
	Organic and inorganic fertilizer addition	Complementary application of organic manures and mineral fertilizer.	Improves fertilizer utilization.	+	+

	Integrated Soil Fertility Management.	A holistic approach to soil fertility management that includes seed selection, cultivation practices, cropping systems and soil amendments.	Improves soil fertility hence yields; Increases soil structure hence water retention.	+	+
	Crop residue management	It is cropping management practices that regulate the composition of the residues accumulating on the soil surface, and the potential to augment soil carbon stocks	Crop residues foster an average carbon-to-nitrogen ratio in the range of 25 to 30 can be achieved by rotating between crops high in carbon and crops high in nitrogen	+	+
<b>Agroforestry</b>	Nitrogen-fixing trees.	Incorporating trees/shrubs into the farming system – a dynamic and ecological method of land management involving the simultaneous cultivation of farm crops and trees.	Nutrient cycling; Increase in organic matter content; reduction in soil erosion and runoff, increased crop yields.		+
	Alley cropping.	It is the planting of rows of trees and/or shrubs to create alleys within which agricultural or horticultural crops are produced in complex, multilayered systems that can produce a diverse range of agricultural products.	The annual crops grown in alleys can provide short-term annual income until the trees are mature. The versatile nature of this practice allows a producer to react to markets, labour limitations and changing goals.		+
	Silvopasture	Is deliberate integration of trees and grazing livestock operations on the same land	Source of both forest products and forage, providing both short- and long-term income sources.	+	+
	Forest farming	It is the cultivation of high-value crops under the protection of a managed tree canopy. This is an approach that supports crop production intentionally using both vertical space and the interactions	Forest farming supplement family income, reintroduce and grow the desired NTFP and reduces harvest pressure on wild plant populations		+

		of the plants and microclimate.			
	Windbreaks	Are linear plantings of trees and shrubs designed to provide economic, environmental and community benefits?	It slows the wind which creates a more beneficial condition for soils, crops, livestock, wildlife and people. Windbreaks, sometimes called shelterbelts, can also function in ways not related to wind reduction	+	+
	Riparian forest buffer	Is an area adjacent to a stream, lake, or wetland that contains a combination of trees, shrubs, and/or other perennial plants and is managed differently from the surrounding landscape, primarily to provide conservation benefits.	Source of filtering nutrients, pesticides, and animal waste from agricultural land runoff; stabilizing eroding banks; filtering sediment from runoff; providing shade, shelter, and food for fish and other aquatic organisms; providing wildlife habitat and corridors for terrestrial organisms; protecting cropland and downstream communities from flood damage; producing income from farmland that is frequently flooded or has poor yields; providing space for recreation; and diversifying landowner income.		+
	Intercropping with Leguminous trees and shrubs	Use of leguminous plant species in place of herbaceous plants in the farming system.	Reduced erosion; Soil moisture retention; Soil nutrients increase as the pruned material rots.		+
<b>Fisheries</b>	Integrated fish farming systems	Integrating capture and successful aquaculture species by either restocking or breeding and rearing.	Assisted reproduction and rearing result in big catches; Increased incomes; Sustainable catches and right-sized fishes.	+	
	Feed Manufacturing	Replacing fish meal and oil in new feeds.	Increased growth rates; Less expenditure on fish meal oil-based	+	

			feeds and production costs.		
	Improving stocks and fingerlings; Production and other nursery materials for abalone, oyster, seaweed and others	Breeding and screening of local fish types or introduction of exotic ones.  Production of fingerlings in hatcheries.	Fast growth reduces costs of production, hence increasing incomes and increasing volumes of production.	+	
	Fish pond culture for freshwater fish	Fish culture production is a practice that relies on the use of freshwater ponds which hold and exchange water, receive fertilizer or feed, and allow for holding, rearing and harvesting of fish	increased emphasis on higher value catfishes for urban markets, on marine species of fish and crustaceans for select national markets and export	+	
	Raceways and floating cages for marine species	Culture-based fisheries in lakes and reservoirs	Increased production through extended production areas of lagoons which are almost unexploited	+	

+ refers to whether the technology also poses attributes on adaptation and mitigation.



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