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The U.S. Government's Global Hunger & Food Security Initiative

RESILIENT AGRICULTURAL MARKETS ACTIVITY – BEIRA CORRIDOR

Impact Report: Boosting Agricultural Productivity and Climate Resilience in Mozambique

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LAND O'LAKES VENTURE 37

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BACKGROUND

Rural households in central Mozambique face a complex web of interconnected shocks and stresses. Farming families struggle to adapt to these reoccurring crises and trends — threatened by unstable markets; lack of access to finance; and climate-related challenges such as drought, flooding, cyclones, poor soil fertility, and emergent crop and livestock pests/diseases that cause annual losses of $790 million.[1] With seasonal rains often delayed for up to two months, variable weather patterns are the greatest risk in central Mozambique, making it difficult for families to plan and combat the threat of pests and disease. Between these shocks, ongoing stresses — such as unmanaged soil degradation and gender-based violence — limit household resilience. High rates of illness, resulting from poor access to clean water and sanitation, and intractable malnutrition due to pervasively low agricultural productivity perpetuate a cycle of poverty that is reinforced by climatic, economic, and social shocks.

What is Climate-Smart Agriculture?

A systems-level approach that aims to:

1. Increase agricultural productivity and profitability;
2. Build adaptivity and resilience to climate change, and;
3. Reduce or remove greenhouse gas emissions in agriculture.

To address these challenges, USAID launched the $10.5 million Resilient Agricultural Markets Activity in the Beira Corridor (RAMA-BC), a Feed the Future initiative implemented by Land O'Lakes Venture37 (Venture37) from 2016 to 2022. The project focused on equitably improving agricultural productivity, profitability, and resiliency by increasing the adoption of climate-smart agriculture (CSA) technologies and practices through four distinct components:

Behavior Change Communication (BCC). Development and implementation of a comprehensive BCC strategy, multimedia campaign, and local promotion through private partners and civil society;

Model Family Farms (MFFs). Provision of technical assistance services through a network of community-based demonstration fields and one-hectare observation units (based in agricultural colleges);

Sustainable Extension Services. Strengthening of private extension services through MFFs and local and community-based service providers, in coordination with public extension services networks; and

Strengthened Market Systems. Tailored technical assistance to private sector partners and assistance to ignite innovation in the agricultural sector.

[1] CIAT; World Bank. 2017. Climate-Smart Agriculture in Mozambique. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); World Bank. Washington, D.C. 25 p.

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A WHOLE FARM SYSTEM APPROACH

RAMA-BC supported a "whole farm system" approach — that is, an innovative integration of the relationships between landscape, community, and family that gives rise to low input regenerative agriculture through multispecies crops/livestock and income generating activities for long-term sustainability and profitability. The project components are reflected in the following activities (see icons below) to form an interconnected, multi-faceted effort that builds resiliency via diversification both on and off the farm.

Building Farm Skills

Model Family Farms

Picture 1 : Intercropped maize and jackbean on a MFF

Since the onset of the project, RAMA-BC has worked with 146 MFFs across 11 districts in three provinces to showcase climate-smart technologies and practices under actual farm conditions. Intercropping is one such technique that has been widely tested on MFFs, and just as widely adopted by community members. The activity coached MFFs to plant leguminous crops in the same field and at the same time as maize, in the spaces between the rows, to increase soil coverage and soil fertility. Other CSA techniques that were showcased on MFFs include mulching, minimal tillage, and the use of organic fertilizers. The project hosted 144 farmer field days with nearly 7,252 participants in attendance, including community members, seed companies, partners, and farmers. The farmer field days have influenced widespread adoption of CSA practices, particularly intercropping.

Vermicompost

As an alternative to increasingly expensive chemical fertilizer, RAMA-BC engaged a variety of groups to produce vermicompost, using earthworms to transform organic waste into quality fertilizer. Through partnerships with actors such as Café de Manica, Manica Superior Polytechnic Institute, markets in Chimoio, small business associations, and vegetable producers in Chimoio, organic waste is being collected, initially decomposed, and then processed into vermicompost by earthworms. The process creates an organic fertilizer rich in nitrogen, minerals, and organic matter that improves soil and high value crop production in urban environments. To date, RAMA-BC has supported the production of 122 tons of vermicompost, which has been sold for a value of 116,870 MZN (USD $1,830.57) with increasing quantities being sold by project participants.

Picture 2 : Fully processed vermicompost product

Climate-Smart Root Crops

Climate-related shocks such as drought, erratic rainfall, and flooding are detrimental to Mozambique farmers' staple crop, maize. To strengthen farmer's resiliency to these shocks and foster more food secure households, RAMA-BC advocated for alternative staples to maize, such as cassava and orange fleshed sweet potato. RAMA-BC engaged 27 farmers to act as multipliers of improved cassava and orange fleshed sweet potato varieties. The multipliers generated a supply of these varieties in their own fields for the market and distributed the cuttings and vines to households in the Sofala region of Mozambique that were impacted by Cyclone Idai in 2019. More than 17,000 farmers have received these improved varieties.

Crop-Livestock Integration

Picture 3 : Jabulani Simango using a mobile night kraal.

In Mozambique, farmers typically keep livestock separate from their crop fields, housed in crowded permanent structures that accumulate waste. This method not only squanders free fertilizer, but also creates poor conditions for the animals. This is especially true during the rainy season, when cattle are often up to their knees in mud and manure. To address this, the RAMA-BC project employed mobile night "kraals" (i.e. corrals, pens) to reintegrate cattle, chickens, pigs, and goats into the cropping system. Depending on the animal, the structures are moved on a daily or weekly basis to uniformly disperse grazing and manure across the fields before planting season. In partnership with the Centre for Technological Transformation (CITT) in Manica, the program provided mobile pens to a group of 15 small and commercial farmers using locally sourced, low-cost materials that are available and accessible to farmers. Farmers were trained on the proper use and management of mobile pens to contribute to healthier, more productive livestock, and more fertile fields.

Fostering Private Sector Engagement

Agrodealers

The formal seed sector in Mozambique is hampered by fake seeds in the market, lack of trust in agrodealers by seed companies, and free or subsidized seeds undermining demand. To combat these issues, RAMA-BC created sustainable market access to improved seed varieties of maize and legume seeds by fostering relationships between seed companies and agrodealers. The project provided 2,882 intercropped seed packets to agrodealers that sold for a total of $45,572. Agrodealers grew the seed varieties they were selling near their shops to demonstrate to consumers the quality of the seeds and the technique of intercropping. RAMA-BC provided further support to agrodealers through business management coaching to improve record keeping, stock control, cash flow, and profitability.

Picture 4 : Agrodealers in their new shop

Finally, RAMA-BC partnered with seed companies during farmer field days to showcase the improved varieties being sold. As a direct result of this partnership, two new lines of intercrop seed, jack bean and lablab, are now being grown and sold by Phoenix Seed.

Local Business Partnerships

Beyond agrodealers and seed companies, RAMA-BC also collaborated with several other private sector actors. In the montane forested Chimanimani National Park buffer zone, the project engaged with an emerging organic coffee company, Café de Manica, to intercrop coffee seedlings with leguminous plants and use vermicompost as an organic fertilizer. RAMA-BC connected the small producers and vegetable markets that produce vermicompost in Chimoio with Café de Manica, and the producers now sell their vermicompost to the coffee company. This holds promise for more private sector engagement, for example with organic macadamia producers.

Microfinance

RAMA-BC has facilitated microbusiness development by leveraging Village Savings and Loans Associations (VSLAs) to establish 320 women-owned businesses, aided by $137,570 in loans. Through RAMA-BC's engagement with the private sector, small- and medium-sized informal and formal businesses have been started, new products developed, and innovations adopted.

Cross-Cutting: Gender and Nutrition

Food and Nutrition

RAMA-BC recognized the critical role women play in building a food-secure future. Women comprise 61 percent of agricultural labor in Mozambique[2]. Due to cultural gender norms, they are also responsible for child-rearing and household management. RAMA-BC distributed improved varieties of cassava and orange-flesh sweet potato that offer enhanced nutrition and food security to communities displaced by Cyclone Idai. Women, in particular, use these crops to feed their families, propagate within their networks, and gain additional income from their sales. Additionally, RAMA-BC hosted cooking demos using local dishes to explain nutrition concepts and offer training on new preservation methods, like dehydration. The project published a cookbook titled *Cozinha Moçambicana* ("Mozambican Cuisine"), a practical farm-to-fork cooking guide that helps households re-discover traditional recipes through the lens of a healthy, balanced diet.

Picture 5 : RAMA-BC Cooking Demonstration

Village Savings and Loan Associations

Through VSLAs, RAMA-BC fostered financial empowerment amongst women and promoted gender-inclusive ideas. VSLAs hosted group discussions on women's rights and decision making, encouraging its majority-female members to

[2] CIAT; World Bank. 2017. Climate-Smart Agriculture in Mozambique. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); World Bank. Washington, D.C. 25 p.

take on leadership roles. The savings component of the groups provided members with access to finance to start income generating activities, which in turn enabled them to buy improved varieties of seeds and start micro businesses.

Gender Equality Awareness

RAMA-BC conducted a campaign to spread awareness about gender-based violence and premature marriage, reaching a total of 4,550 people over the course of five years in Manica province and two years in Sofala province. The multimedia campaign included the production and distribution of brochures and a group sensitization manual. Additionally, theatrical plays were performed in communities and audio recorded to reach a broader audience through monthly radio spots.

Building Partnerships and Promoting Research

Advocacy

RAMA-BC found that partnerships with public and educational institutions at the local level fulfill a key advocacy role when promoting and exposing decision makers to the unique practices of CSA when partners are directly engaged in designing and executing research on a particular innovation. These partnerships open a door for effective advocacy on technical efficacy at the highest level. RAMA-BC has long-standing partnerships with the Agricultural Research Institute of Mozambique (IIAM), University of Eduardo Mondlane (UEM), two Centres for the Integration of Technology Transfer (CITTs), and UniZambeze.

Research

Besides advocacy, these partnerships supported key research related to CSA techniques and practices that are adapted to the local environment. Research with IIAM and UEM evaluated the effect of intercropping on maize yield and on fall armyworm control. UniZambeze's research focuses on the effects of mobile night kraals on maize productivity, soil fertility, and gross margins. RAMA-BC also partnered with the government agricultural extension service, District Economic Activity Services, which has set up 11 CSA/intercropped demonstration plots of their own for a fifth season.

OUR IMPACT

By the Numbers

40%
Increase in yield of intercropped maize over sole maize

37,642
Individuals applying improved management practices or technologies

23%
Increase in women's decision-making index over household decisions related to agriculture & income use

2,882
Seed kits sold over the last two seasons, valued at $45,572

Food Security Through Improved Productivity, Profitability, and Resiliency

As a result of the CSA practices that RAMA-BC promotes, project participants are reaping the benefits of increased productivity, profitability, and resiliency – all of which serve to strengthen food security in Mozambique.

Productivity

Activities that build CSA farm skills led to expanded harvests (per unit area cultivated) and reduced post-harvest losses. In particular, intercropping with leguminous crops that provide maize with the necessary nutrients resulted in **192 to 233 percent higher maize yields** compared to fields where maize alone was planted. Farmers stated that the increased maize yields now meet their families' needs until the following year's harvest, while the legumes provide an additional nutritious food source. Farmers who used this technique also saw **58% less damage from pests like fall armyworm and noxious weeds like *striga asiatica,* which saves labor time by 33-66%.** The advantages are most notable in Báruè district, Manica province where intercropping has become an almost universal practice by farmers, spreading far beyond project participants. Besides maize, the use of improved root crop germplasm also **increased yields by 126 to 191 percent compared to local varieties, while** also **diversifying crop systems and household nutrition**, especially for women.

Value-Added Processing: Farmers Aurelio and Ana of Dondo replaced their 1 hectare of cassava with the improved varieties from RAMA-BC, which provide steady yields, free from mosaic disease. Now, they process their surplus of tubers into cassava chips, flour, and starch as well as bake it into cakes, buns, and cookies. They sell their value-added products in two locations and are reaping the benefits of additional household income.

These results and others have been **replicated in scientific studies** led by IIAM, UEM, and UniZambeze. Research on mobile night kraals showed **150 to 200 percent higher maize yields** compared to plots with no fertilizer and **109 to 124 percent increase in soil organic matter** compared to fields where chemical fertilizer was applied. The evidence bolsters mobile kraals as a practical and low-cost alternative to chemical fertilizers, with added benefits to animal health for livestock farmers, which can be incorporated into agricultural school curriculums.

Profitability

By implementing CSA skills learned during RAMA-BC trainings, farmers reported **yields that surpassed their household's needs**, which they sold for additional income, as well as **decreased costs related to fertilizer, pesticides, and herbicides** — resulting in a 2.5x higher return on investments in labor and agricultural inputs. Income also flowed to **small agribusinesses**, with sales of intercropped seed packets and **new connections forged with local seed companies.** Research led by students from Manica Superior Polytechnic Institute showed that **vermicompost had up to 80 times more NPK** (plant macronutrients) than normal soil in Manica province, which producers can sell as well as apply to their own fields. One vegetable farmer stated that he has never had carrots bigger and brighter than he has after he applied vermicompost as topdressing.

VSLAs proved to be an important source of **financial security for rural communities, especially for women**. With cost savings and increased incomes, project participants have been able to establish savings, pay their children's schools fees, and expand their homes or build new homes for their families.

Resilience

RAMA-BC increased resilience to climate-related challenges — like irregular rainfall patterns and cyclones — through its advocacy of staple alternatives, like cassava and orange fleshed sweet potato. Besides being naturally drought resistant, farmers who used them in their fields and homes also attested that the RAMA-promoted improved varieties were **disease resistant, nutritious, and tasty**, making them an attractive option. Trainings for farmers on how to multiply, distribute, and store root crops served **to diversify food sources and reserves**, which can be expanded over time as farmers continue to cultivate and pass on the improved plant materials. To complement its extension of root crops, cooking demonstrations showcased the ways the tubers and leaves could be **prepared into nutritious meals, reaching 7,708 participants**.

Through **the establishment of 79 VSLAs**, rural communities were able to implement a new, self-sustaining system of microfinance that helps to smooth fluctuations in household income/expenses, cope with shocks, and provide capital to small business entrepreneurs. Throughout these activities, in addition to behavior change communications regarding gender-based violence and premature marriage, RAMA-BC recognized the essential role that gender equity plays in strengthening food and financial security in Mozambique.

Soil Fertility: Francisco Jo (left), a farmer from Báruè, installed a mobile night kraal for his cattle in 2021. "When I started using the mobile cattle kraal, I thought I would compact my land and that it could have low yields; but now I see the plot where the kraal passed, maize is very green, despite the whole of February without rain," says Francisco, adding that the fertilized soil stays "lighter" and retains moisture better after a rain.

LESSONS LEARNED

Intercropping is ingenious. This CSA technique offers farmers a complete package and diminishes the need for irrigation, pesticides, or chemical fertilizers by increasing soil health and fertility, improving water retention, and combating pests and diseases. It also creates a staggered harvest that coincides with times of food scarcity. By maximizing this technique and promoting it fully, the RAMA-BC project has provided farmers with a labor-saving, regenerative practice that enhances their food security and resilience.

Picture 6 : Farmer inspects field intercropped with maize and lablab bean.

Vermicomposting is viable for high-value crops. Vermicompost is a superior fertilizer and is cheap and accessible, particularly in urban areas where waste management is an issue. It has proven market potential for high-value crops such as coffee and macadamia. By exploring this practice, RAMA-BC introduced a brand-new product to Mozambique that is easy to make, natural, and marketable.

Root crops promote resiliency. Root crops, while often overlooked, are a hidden gem. These crops are drought resistant and tolerant of high temperature and poor soils — they flourish in Mozambique. They are also nutritious, offering complex carbs and dark green, nutrient-dense leaves. Typically grown by women, the expansion of this crop will bring additional income to women. By promoting root crops, RAMA-BC is improving nutrition, strengthening resiliency to climate shocks, and increasing household incomes.

Livestock bring higher yields. By integrating livestock into the farm system through mobile pens, the RAMA-BC project has given livestock farmers a new tool that not only improves soil fertility and increases their yields, but also creates a cleaner and healthier environment for the livestock to thrive, reducing feed and veterinary costs.

IN CONCLUSION

As one of the most vulnerable countries in the world to the effects of climate change, it is critical for Mozambique to increase the productivity and profitability of its agriculture sector while building resilience to climatic shocks and stressors among populations most at risk. CSA carries significant potential to reduce poverty and contribute to Mozambique's food secure future given the sector's importance to the economy and to rural livelihoods. By helping smallholder farmers equitably build CSA skills, connect with the private sector, improve household nutrition, and access relevant research by local public institutions, RAMA-BC's "whole farm system" approach is a viable strategy for other implementors to adopt and adapt to their local contexts.

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