proMove AGRIBIZ

Feasibility Study for Organic Cashew Production in Mozambique

Co-financiado pela União Europeia

cooperação alemã DEUTSCHE ZUSAMMENARBEIT

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

AICAJU

Feasibility Study
for
Organic Cashew Production in Mozambique

Subject: 83404312 Consulting for Developing a Technical Feasibility Study to Establish Organic Cashew Production in Mozambique

Commissioned by: GIZ in the framework of the projects "ProEcon - Sustainable Economic Development Program in Mozambique" and "PROMOVE Agribiz" (funded by the German Government and European Union)

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The opinions in this report are those of the consultants and not necessarily of GIZ.

When quoting from this report, the whole report should be cited as: ProEcon Technical Feasibility Study to Establish Organic Cashew Production in Mozambique, Sabine Lydia Mueller (2022), GIZ Nampula, Mozambique.

Executive Summary

This study was commissioned by GIZ to better understand the feasibility of organic RCN production in Mozambique and to establish a plan to develop organic RCN production at the smallholder level in a Northern province, from which the processors grouped in the AICAJU association, can obtain the raw material, process it under organic procedures and supply the final product with the organic certification to end customers.

The consultant visited four provinces to get an overview of the current cultivation methods of the farmers who produce RCN. In extensive conversation with over 50 very diverse growers with different plot sizes, soils, and resources, she found out that the vast majority of cashew farmers who have trees affected by PMD see the chemical spray as the only possible weapon against the disease. With the exception of a single cooperative that has worked with agroecology for several years, the farmers unfortunately had no vision on how they could improve their situation concerning attacks of pests and disease.

Farmers see no parallels between the composition of the soil and the tree's environment with the general tree health and its immune defense. When surveyed, the farmers did not make any comments about the health of the trees, either independently or when asked. Since common practice is to thoroughly clean and empty the space, cashew trees usually stand in monoculture in a desert-like sandy and degraded landscape. In nature, trees usually absorb nutrients in the area of their roots within the outer radius of their canopy. Decomposed leaves, dead wood, feces of small animals, dead insects and companion plants create a top soil layer that is full of healthy soil microorganisms and nutrients which are missing in the monoculture systems in current RCN production. The additional and diverse cover crops act as weed suppressants, repel insects, and attract pest predators. The Regenerative process provides additional crops, improving the overall yield and income of the farm.

Farmers have merely no access to information about agroecology. except for IAM staff visiting them to recommend cleaning the soil, pruning the trees regularly and using chemicals against PMD. No other tools are given to the farmers.

As it's IAMs target to significantly reduce pesticide subsidies in the coming years, the consultant sees a chance to provide farmers with training to independently improve their trees' resilience through GAP like soil cover and no tilling, AFS and good IPM in place. In case of infestations, the farmer should be able to produce their own pesticides and be provided sulfur to combat PMD. Therefore, the cashew law should include the provision and subsidy of inputs such as sulfur that are (in proper doses) harmless to humans and the environment and are approved for organic cultivation.

The majority of farmers know little about the laws of nature, for example water or nutrient cycles and the importance of biodiversity for plant health and yields. There is a huge backlog demand for trainings on these subjects, for example in FFS. Inspiring and training farmers and encouraging them to step by step adapt new agricultural practices is the main challenge of going organic.

As soon as the farmers have a holistic view of nature and understand that everything happens in a cycle and that you cannot isolate a tree, there will be the opportunity to actively involve the farmers in environmental protection and in more sustainable, regenerative and – in the long term – perhaps even organic production schemes.

Since the main problem with organic farming is the risk of contamination with any kind of non-allowed inputs, it is not enough to simply pass on rules to farmers top down. They need to be considered as partners and to understand the context so that they can draw conclusions on their own. Attending trainings will allow them to become self-reliant experts who know the organic rules and can improve soil quality and tree health and thus substantially increase income and achieve food safety for themselves and the following generations.

Instead of IAM being commercially involved in producing seedlings in their own nurseries, they could reconsider the cost-intensive production and transport of seedlings and try to supply good polyclonal

seeds and planting instructions to farmers instead. Trees planted directly bear fruit more quickly because they adapt to the new environment in less time. The study showed some evidence that direct planted trees develop a broader root system, which increases nutrient uptake and gives them greater stability and resilience to storms, fire and drought.

The carefree use of synthetic chemicals to control powdery mildew and other diseases, should also be urgently reconsidered. In the long run, it makes more sense to maintain tree health through ground cover with consortiums planting and sophisticated IPM strategies.

In order to improve the basic conditions for the implementation of any environmentally sound practices at the national level, lobbying for regenerative and organic cultivation must be started. The consultant advises the creation of an Organic Growers Association, which in the long term could be a valuable source of stimulus for new legislation and creation of start-ups along the value chain.

In the long term, only an organic agriculture regulation will provide guidance, legal certainty and reliable rules. Farmer training and lobbying are therefore the pioneering tools to create a stable basis for organic cultivation of RCN in Mozambique.

A small parallel organic RCN value chain already exists in Mozambique with some field experiences in place. Since July 2022, a Helvetas-led cashew project has received organic certification. Half a dozen cooperatives are now the first organic cashew OGGs in the country. Many other support actors from the field of development aid and NGOs have also been working towards a more environmentally friendly and socially responsible way of agriculture in recent years. And so a foundation has been built from which further certifications are now in reach. New projects can learn from the field experiences in place instead of starting off the ground.

The organic industry has grown strongly worldwide in recent years. Organic food has left the niche achieving top prices on the world markets due to increasing demand for healthy, non-toxic, environmentally conscious and ethically traded products. Investing in organic production of RCN can be economically viable if holistically approached and if all stakeholders and if all parties deal with each other on an equal footing. It can open the door for premium markets and at the same time protect the soil health and biodiversity while naturally leading to greater food security and resilience for smallholder farmers.

After careful consideration of all the advantages and disadvantages, the consultant believes that the production of organic cashews is a wise investment that will be worthwhile in the long run.

If the governmental authorities now focus on their task of regulating the industry and leave the commercial activities of seedling production and distribution of agrochemicals to the free economy, a lot of time and money will be freed up, which could be used for long overdue studies, e.g. research into traditional African medicine with regard to effective alternative biosprays, which would be logical for a country that has numerous active healers. In addition, it would be desirable that an organic legislation is brought on the way, which determines the basic conditions for organic cultivation, as well as the application of synthetic sprays only with a permit and an appropriate mapping.

The information from IAM received by the consultant gives reason to hope that the current practices will soon be put to the test and that consequences will be drawn. Once the state withdraws from the pesticide and nursery business and free enterprise regulates the market, a huge lever will be created to use all the natural and often free or very cheap and local possibilities to strengthen the immune system of the cash crop RCN, to increase harvests and to increase the independence of the 99% famers with less than 5 hectares of land in Mozambique.

List of abbreviations

ACA	Accredited Certifying Agent
ACB	African Centre of Biodiversity
ADPP	Ajuda de Desenvolvimento de Povo para Povo (People-to-People Development Aid)
ADRA	Adventist Development and Relief Agency International
AE	Agroecological
AESA	Agro-ecosystem analysis
AFS	Agroforestry system
AICAJU	Associação dos Industrias do Caju (Cashew Industry Association)
AKF	Aga Khan Foundation
AMCANE	Amendoim, Cajú e Negócios (Peanuts, Cashew and Business) project of HELVETAS
AMPCM	Associação Moçambicana de Promoção do Cooperativismo Moderno (Mozambican Association for the Promotion of Modern Corporativism)
CARI	Cooperativa Agroecológica Ramiane Ituculo (Agroecological Cooperative R.I.)
CB	Certification Body
CENART	Community Empowerment through Natural, Agricultural Resources and Technology·
CSA	Climate Smart Agriculture
EM/IM	Effective Microorganisms / Indigenous Microorganisms
EOS	European Organic Standard
EU	European Union
EUR	Euro (€)
FAO	The Food and Agriculture Organization
FBS	Farmer Business School
FFS	Farmer Field School
GAP	Good Agricultural Practices
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GMO	Genetically Modified Organism
IAM	Instituto de Amêndoas de Moçambique IP (Institute of Nuts Mozambique)
CIFOR-ICRAF	Center for International Forestry Research and World Agroforestry
ICS	Internal Control System
IFOAM	International Federation of Organic Agriculture Movements
INA	Initiative für nachhaltige Agrarlieferketten (Initiative for sustainable agricultural supply chains)
INCAJU	Instituto de Fomento do Cajú (Cashew Promotion Institute)
IPM	Integrated Pest Management
MZN	Metical
NIBIO	Norwegian Institute of Bioeconomic Research
NOP	National Organic Program (United States of America)
NORGES VEL	The Royal Norwegian Society for Development
OGG	Organic Grower Group (new from 2023 on: Group of Operators: GoO)
OMRI	The Organic Materials Review Institute
OSP	Organic System Plan
PMD	Powdery Mildew Disease
PRM	Plant Reproductive Material
RCN	Raw Cashew Nuts

SDG	Sustainable Development Goals
SIDI	Solidarité Internationale pour le Développement et l'Investissement (International Solidarity for Development and Investment)
SOC	Soil Organic Carbon
TA	Technical Assistance
UNAC	União Nacional de Camponeses (National Farmers Union)
USAID	U.S. Agency for International Development
USDA	United States Department of Agriculture
USP	Unique selling proposition

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1 Background

This study was commissioned by GIZ to better understand the feasibility of organic RCN production in Mozambique and to establish a plan to develop organic RCN production at the smallholder level in a Northern province, from which the processors grouped in the AICAJU association, can obtain the raw material, process it under organic procedures and supply the final product with the organic certification to end customers.

The terms of reference were defined in the framework of a larger set of GIZ and EU actions and activities focusing on the development of an environment supporting agricultural value-chains, of market-oriented sustainable and resilient agriculture, inclusive rural markets and competitive agricultural value-chains.

Since April 2019, the Program for Sustainable Economic Development in Mozambique - ProEcon - has been implementing activities in the provinces of Nampula and Zambezia through the PROMOVE-Agribiz project, co-financed by the German Government and the European Union. This initiative has two strategic objectives,

a) to improve food security and resilience of smallholders through smallholders through smart and nutrition-sensitive agricultural development and

b) increase rural competitiveness through improved participation of smallholders and MSMEs in activities related to economic growth, economic diversification, value addition, improved access to rural services and improving the rural investment climate in Nampula and Zambezia provinces.

In this context, the production of cashew nuts was identified as an important opportunity, so that a set of actions have been launched – through a Development Partnership with the Private Sector - for fostering the sustainable engagement of farmers and farm-industry on this crop, with a particular focus on:

- The improvement of input supply for the value chain;
- The strengthening of the capacities of cashew producers, in particular by promoting better agricultural practices and farmer business schools;
- The strengthening of the local processing industry.

A special reference in this context consists of the linkage with two main clients of the Mozambican Cashew nuts producers, namely Lorenz Snack-World and the Norwegian Brynild Gruppen AS, which - together with NORGESVEL– participate in the Private Sector Development partnership mentioned above.

The study considers the experiences already in progress in Mozambique, including that of organic certified processing company Condor Anacardium, those of NGOs, international aid actors (e.g. projects of Helvetas, Norges Vel and the GIZ itself), and those of smallholder farmers producing Cashew in the provinces of Gaza, Inhambane, Zambezia and Nampula.

A third key reference consists of the international standards for organic agriculture, with a particular focus on those used in the EU. The opportunities existing in Mozambique were evaluated against the EOS European Organic Standard, identifying the constraints and obstacles to be removed, the practices that can be promoted and the tools and infrastructures that need to be developed.

2 Methodology

2.1 Documentary analysis

In order to make the most of existing technical knowledge and of documented experiences, avoiding the replication of mistakes or unsuccessful experiences, a broad range of documentary sources was analyzed focusing on:

- Reports on RCN production and value-chain in Mozambique (by government agencies, international aid agencies, NGOs and private sector actors)
- Practices and experiences in organic RCN certification worldwide
- Academic research reports on pests/diseases, IPM, soil and other conditions, opportunities and constraints for organic production in Mozambique
- Reports on experiences focusing on organic production, alternative agricultural practices and other innovation processes related to RCN value chain
- Legal information and normative policies that regulate the production, processing, marketing and export of RCN in Mozambique.
- Information relevant to economic and social areas.

A complete list of literature pursued is available in ANNEX I.

2.2 Interviews with key informants

Semi-structured interviews with:

- Representatives of key actors involved in the development of cashew nut value chain and in the development of organic agricultural products value chains in Mozambique, including: IAM, AICAJU, GIZ, ACAMOZ Project, Norges Vel, AMPCM, Helvetas and many more.
- Representatives of key actors supporting farmers in Mozambique, including: the Ministry of Agriculture extension service, the NGOs involved in value chain development and in cashew nut production improvement (e.g. Nitidae, TechnoServe).
- Cashew nut small producers, individually and through their associations.
- Cashew nut processing firms, individually and through their associations.
- Cashew nut market actors (product aggregators and market operators linking producers to processing opportunities; export companies, internal marketing main distribution firms, etc.), individually and through their associations.
- Representatives of key actors/stakeholders involved in the development of organic cashew nut value chains in other African countries, e.g. BIOTAN (Tanzania).

The consultation of key informants focused on their specific fields of action, with the aim to:

- Understand the geography and political economy of cashew nut production in Mozambique
- The agricultural innovation processes and the obstacles hindering their success
- The resources for developing organic cashew nut production and for linking producers to existing/developing value chains
- The issues related to certification of agricultural products, in particular with a focus on "organic production"

A complete list of key informants interviewed is available in ANNEX II.

2.3 Focus group discussions with farmers

Informal field visits and direct observation of production practices to an opportunistic sample of cashew nut producers. The sample was based on the identification of farmers that could be capable

of transitioning toward organic production and willing to be visited in key production areas. In particular visits to Gilé (Zambezia) and Monapo (Nampula) were carried out using focus group discussions with approximately 20-25 farmers including as many women as possible. Female participants were encouraged to speak up to identify issues related to gender.

2.4 Direct field-observations

The direct field-observations in the districts of Gaza, Inhambane, Zambezia and Nampula were conducted through field visits to farmers in different locations and production sites, in particular aiming to identify and evaluate current practices, as well opportunities and obstacles for organic cashew nut production, using the Rural Rapid Appraisal techniques (informal interview, transect, etc.).

2.5 Validation meetings

Findings and recommendations were presented at a validation meeting in the middle and at the end of the consultancy with stakeholders such as development partners and the associations of actors potentially or currently involved in cashew nut value chains. Suggestions and recommendations were incorporated in this report.

2.6 Feasibility assessment criteria (farmer interviews)

In order to compare and evaluate the different conditions and farming systems, questions have been developed taking into account to the needs and conditions for assessing the feasibility of organic production and value chain. The feasibility is based on:

- The identification of criteria for organic certification (with a specific attention to those used in the EU)
- The identification of opportunities and constraints for certification
- The identification of opportunities and constraints for production and for integration of small farmers into an "organic cashew nut value chain"

Each question was given a score from 0 (not adequate for organic farming) to 5 (very relevant for organic certificate; best score). The better the score, the higher the chance that the specific farmer will be able to convert to organic farming more effortless and easily.

The data collected during the field visits analyzed three key areas: Farm History, Farm Practices, and External Factors.

Farm History	External Factors	Farm Practices
• Chemical inputs / spray • Mildew infestation • Soil fertility • Tree Age / Mix • Productivity / Yield	• Climate • Water Access • Seedlings • Money / Investment • Workforce Availability • Farmer Organization • Access to Information • Access to Services	• GAP • Awareness • Pruning • Organic pesticide/fungicide • IPM • Organic Fertilizer • Spacing • Pollinators • Knowledge about Organic Agriculture • Awareness • Readiness for Organic Production

3 Findings

3.1 Cashew market and industry

The cashew industry plays an important role in the Mozambican economy. "The processing sector provides formal employment to more than 10,000 individuals supporting their families and local communities." (INA, 2022) A total of 1,3 million farmers grow cashews and 99% of all farmers in Mozambique are considered to be smallholders with less than 5 hectares of land. (Ministry of Agriculture and Food Security, 2015).

Intensive literature research and discussions with dozens of experts revealed that Mozambique has all the prerequisites to export significantly more RCN than it does now. If yields could be increased through better cultivation methods and domestic processing could be expanded, all actors along the well-established national supply chain could benefit. By exporting over a million tons of RCN from Africa for deshelling in Asia more than 100 thousand jobs in Africa are lost. (INA, 2022)

Producing organic certified RCN could be another big driver of competitiveness on the world RCN market. Consumers worldwide are gradually willing to pay a higher price for healthy, chemical-free food, and becoming conscious about the social and environmental impacts of their purchases. The whole cashew sector is open to moving towards sustainable production and the approach to "go organic" was well received by industry and farmers.

3.2 Key Support Actors involved in organic production

Currently the organic value chain in Mozambique is still strongly depending on external factors. All efforts of organic RCN promotion are facilitated and sustained by donors like NGOs and development agencies. For the future it would be desirable that the organic sector is developing and the tasks are transferred to the direct actors. The key support actors will then just play a role as support. The most active support actors in the field of sustainable or organic production are:

TechnoServe

From 2013 to 2018, TechnoServe implemented the MozaCajú project supporting the Mozambican cashew nut industry with financial support from USDA. They had activities in the fields of production, inputs, processing, finance and marketing.

"As an important part of supporting sustained, quality cashew production, community nurseries and seed providers were established across the cashew production zones of the country. As detailed in the 2017 MozaCajú Impact Report, Mozambican cashew farmers who participated in the project experienced a 53 percent increase in cashew tree productivity and a corresponding 66 percent increase in income. Similarly, MozaCajú has seen a 55 percent increase in the exports of Mozambican processors who participated in the project, which has amounted to an additional $20 million of kernel sold in the international market and a 64 percent increase in revenue." (TechnoServe, 2022)

In 2014 TechnoServe commissioned the elaboration of a "Strategy for Organic Certification of Cashew in Northern Mozambique". Although the set-up for the ICS of the OGG was described in detail no pilot has been set up and no organic production has evolved despite all efforts. When speaking to the main actors from the former TechnoServe team, Daria Gage, Angelo Levi and Rui Matos, all agreed that it would have been too costly to set up an ICS and no buyer could be localized that would have been willing to pay the organic fee which is around 20% higher than the price of conventionally grown RCN.

Nitidae

With their ACAMOZ project Nitidae is working in communities in the Gile and Pebane district in Zambezia since 2019 training farmers on the adoption of agroecological practices and agroforestry systems based on cashew. According to their information 1.998 beneficiaries including 42% of women were trained and more than 150.000 cashew seedlings were planted. The NGO gives training on pruning cashew trees, protection against wildfires and supports 42 initiatives, associations or cooperatives with the formal legalization of associations, trainings on governance and decision-making, financial and project management. Nitidae supports 1.600 families with market information, negotiation, and joint sale of 385 tons of RCN (250% increase from 2019 to 2021). Selling prices improved 5 to 107% compared to individual sales. (de Rouvrou, 2022)

Helvetas

In partnership with the AKF and PAKKA, Helvetas launched the Small Business Sustainable Peanut and Cashew project (AMCANE), "which aims to increase the sustainability of production systems (of peanuts and cashews), improve the livelihoods of small farmers and small entrepreneurs as well as facilitate the availability and accessibility of good quality and nutritious food for local, national and export markets in Cabo Delgado, Nampula and Niassa." (AMCANE, 2022)

A big success of the project is the very recent organic certification of the organic RCN production by Helvetas in cooperation with Eco Energia. Six smallholder farmer cooperatives with a total of 628 members in Nampula now produce RCN as an OGG. The CB who did the audit was Ecocert. The Helvetas organic cashew pilots are located in the districts Erati, Meconta, Mogovolas, Monapo in Nampula and Chiúre, Montepuez, Namuno e Balama in Cabo Delgado. The cashew productivity, on average, has increased from 4 kg/tree to 10 kg/tree.

Below the producer business model from Helvetas.

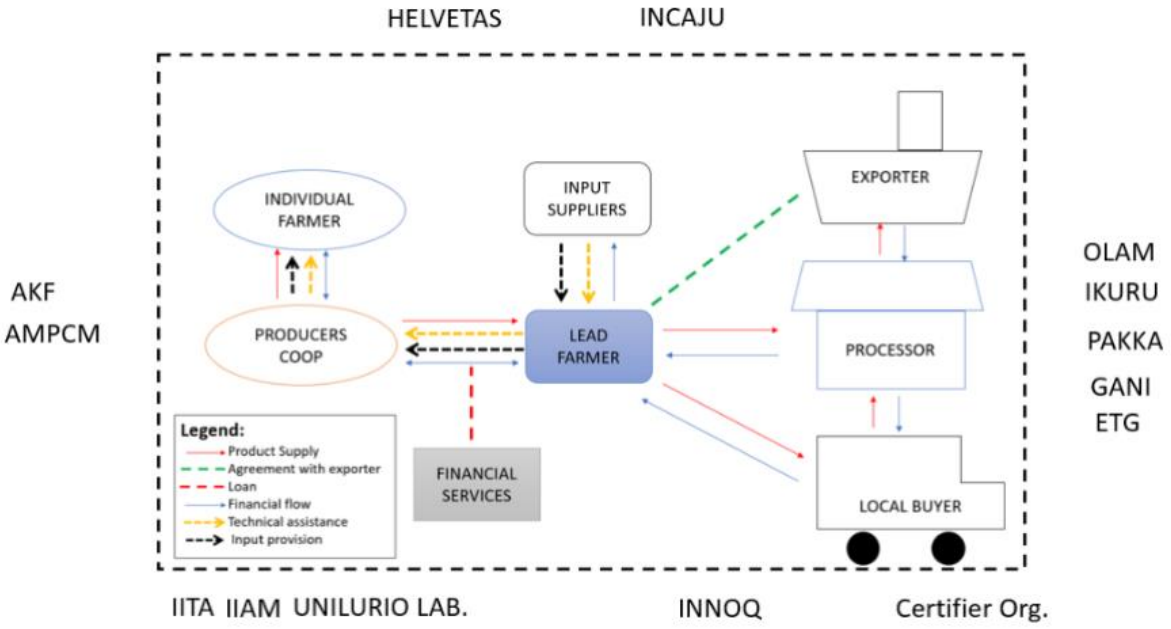

Figure 1 AMCANE Producer Business Model

Norges Vel

The Norges Vel team in cooperation with their local partner AMPCM has set up a polyclonal seed production on land in Nemetil, Nampula province. They harvested 300 kg (40-50k seeds) for the first year's harvest in 4Q21 and they estimate that next year the harvest should double. There are now 36 Norges Vel funded micro nurseries across Nampula and some in Zambezia province. A new big nursery is currently set up in Namita, Nampula together with another polyclonal seed production that will give production in 3-4 years. The Norges Vel nurseries distribute non-grafted polyclonal

seedlings directly to farmers. Noreges Vel trusts that their trees from polyclonal seeds are of better quality and more resistant and without grafting these seedlings are cheaper to produce. All of the approximately 100k seedlings distributed this year were from own polyclonal seeds.

Norges Vel sees a major challenge in giving farmers good planting material and instructions to one day also be able to promote direct planting instead of the expensive distribution of seedlings. But before this is possible they want to build trust in their products, the polyclonal seeds and install means of more rigorous tracing. In 2 - 4 years Norges Vel would then like to hand out polyclonal seeds and planting instructions to farmers as they do believe that planting from seed is generally better for the trees root development, resilience and health then planting seedlings from the bag.

Below the current data for 2022 production, 1st Q planting season from Norges Vel[1]. The data were collected as part of the report to their partners Brynild and Lorenz that co-finance their efforts to improve the cashew value chain.

Type	District	# of nurseries	Name of the seedling	Planned	Produced/sold Qty
Cashew	Angoche	4	Cashew	19.000	10.141
	Meconta	3	Cashew	12.000	8.400
	Mogovolas	11	Cashew	64.000	29.750
	Ribaue	1	Cashew	5.000	6.342
	Moma	2	Cashew	10.000	4.120
	Monapo	2	Cashew	10.000	3.700
	Murrupula	4	Cashew	17.500	10.330
	Rapale	2 (Nemetil included.)	Cashew	60.000	88.100
	Gilé (Alto-Liginha)	7	Cashew	31.200	23.000
TOTAL		**34**		**228.700**	**183.883**

Table 1 Micro Nurseries and Central Nemetil Nursery Info from Norges Vel

3.3 Companies involved in RCN processing in Mozambique

Condor Anacardium

The cashew nut processor is located in Macia, in the Southern Mozambican province of Gaza. Since 2018 Condor Anacardium sells RCN to clients in USA and Europe. With the financial support of USAID Condor Anacardium in 2021 became successfully certified organic by CB Ecocert SA and is now authorized to process and sell organic RCN. The company is highly interested in sourcing organically produces RCN from Mozambican smallholder farmers and cooperatives.

Eco Energia (Ouro Verde)

In 2021 Eco Energia (Ouro Verde) together with AKF, COSEBO and Helvetas started to work with 782 cooperative members producing RCN close to the companies' farm in Ocua, Chiúre district, Cabo Delgado province. They selected growers who met the minimum requirements to participate in an external organic certification audit conducted by Ecocert SA. The CB issued the organic certificate in June 2022. Eco Energia can now officially process and sell the first organic certified RCN ever made in Mozambique. The RCN are marketed under the "Cabo Caju" brand. Formerly based in Cabo Delgado, RCN processor Cabo Caju was acquired by Eco Energia in 2019. The pioneering company had tried to obtain organic certification in 2014, as reported by former owner Jurg Reiser, and surrendered because it was too difficult to prevent fraud without overly burdensome, costly controls.

[1] Email from Karsten Gjefle / Norges Vel on 29.06.2022.

3.4 Current Production Status

In this chapter we analyze the actual current production status, the system, methods, resources, and deliver a general description of its main elements.

To thoroughly investigate the production, the consultant conducted in-depth personal interviews:

- with over 50 growers
- in 8 different locations
- from 4 districts (Gaza, Inhambane, Zambezia, Nampula)

1) Posto Administrativo de Messano, localidd de Mamonho, povoado Machenganhane, Gaza.
2) Posto Admnstrativo de Mazivila, Localidade Olombe, povoado Macanhe, Gaza
3) Viveiro Central em Namita, projeto com sementes polyclonais de Norges Vel, Nampula,
4) CARI Monapo – Ramiane (Ituculo), projeto de AMPCM & NorgesVel, Nampula*
5) Cooperative in Mucaua, projeto de Nitidae, Mt. Gilé, Zambezia, *
6) productor commercial, Sr. Machado, Nampula
7) Tome, Distrito de Funhalouro, Inhambane

*these 2 were focus group discussions, each with a 20-25 farmers

and telephone interviews with RCN growers from:

8) Deep Roots Farm, Corrane, Nampula
9) Eco Energia (Ouro Verde), projeto de Helvetas, Nampula
10) Biotan, Dar-E-Salaam, Tanzania

Complementary information from key stakeholder interviews contributed to the evaluation of the current production status.

3.4.1 Farm History

a) Chemical inputs / spray

Only four of total of seven visited areas had not sprayed at all: Monapo (Nampula), Tome (Inhambane) as well as Machenganhane and Macanhe (Gaza).

All the other farmers visited use synthetic chemicals spray. If the growers spray they are supposed to do three campaigns. IAM distributes the chemicals (a mix of fungicide and pesticide) for free. But most of the farmers can't reach this interval, as the IAM struggles to provide this amount of spray for everyone. Service providers who apply the spray get paid for the service. They receive cash or other commodities, for example RCN or other farm products.

The service providers are very powerful as they can decide who receives the spray and which farmers must fight the disease attacks without the spray. Off the records, growers stated that this makes the service providers susceptible to bribes. Farmers also reported that chemicals are illegally sold to neighboring countries like Tanzania.

The safety directions on the spray state that the "repeat exposure may cause allergic disorder to skin", "may damage fertility or the unborn child" therefore one should "avoid breathing fumes, mists, vapors or spray" and to "NOT get on clothing". Therefore, special gear (cotton overall, chemical resistant gloves, hat, etc.) must be worn to avoid any contact with skin, eyes or tissues. [2]

The interviews revealed that the service providers are mostly the growers themselves, people who due to lack of money often don't follow these safety instructions and therefore put themselves at risk of long-term health problems. IAM employees in the provinces stated that service providers are advised to "only do the job for 5 years" as it would be harmful to expose themselves day by day to

[2] Label/Leaflet of Defend 400 EC Fungicide - Imtrade CropScience

the dangerous chemicals. Nevertheless, the analysis of studies on the long-term effects and toxicity of the products available in Mozambique is beyond the scope of this evaluation.

As the producers and distributors of the agrochemicals carry out their duty of informing about the health-related risks, it's difficult to hold them liable.

IAM and the Ministry of Health were asked if they have studies and statistics on the

- Symptoms of illness associated with pesticide/fungicide spraying?
- Number of sprayers who have suffered health problems during or after their activity, e.g. respiratory diseases or cancer?
- Number of civilians who have been diagnosed with these symptoms?
- Any other findings about the toxicity of chemicals to humans and nature?

IAM answered[3] "IAM, IP has never conducted studies, nor does it have statistics of people with symptoms of diseases associated with pesticide use, number of civilians affected, nor finding on toxicity of pesticides to humans and the environment. There is only relative and/or speculative information, not systematized and yet insufficient to compose a database. Additional information can be obtained from the National Directorate of Agricultural Health and Biosafety or requested from the Ministry of Health."

At IAM Maputo, Américo Uaciquete research program coordinator and plant pathologist, shared the cost of subsidies for pesticides from acquisition to the delivery, which shows that a growing number of cashew trees is being chemically treated with spray the IAM distributes every year and that the cost for the pesticides rose over 40% in the last two years. In 2021 alone about 350.000.000 MZN, over 5 million EUR were spent on pesticides.

YEAR	TARGET CHEMICAL TREATMENT	NUMBER OF TREATED CASHEW TREES	PESTICIDE COST* (MZN)
2019	5.300.000	6.017.837	242.000.000,00
2020	8.000.000	7.408.736	391.058.940,00
2021	8.300.000	8.247.487	349.893.680,00

Table 2 Pesticide purchase and distribution costs for 2019 – 2021/ Acquisition cost until delivery to the provincial level.

"The costs of acquisition and transportation of pesticides in the period in reference were supported by IAM, IP. The spraying service providers supported the costs inherent to the spraying service and the producers paid for the service provided by the provider (chemical treatment of cashew trees)."

IAM does not register areas where there is spraying nor is there any mapping available.

The government has the plan to gradually phase out the subsidies for the chemical spraying of cashew trees.

Mildew infestation

Growers in Monapo (Nampula) and Tome (Inhambane) report that they have no or nearly no problem with PMD and don't spray. Growers in Machenganhane and Macanhe (Gaza) also don't spray but sometimes do have infestations if cold weather occurs in time of florescence of cashew flower.

All other areas visited spray chemicals provided by IAM mainly against PMD but also against pests. All interviews revealed that mildew attacks mainly during the florescence are one of the main causes of very low productivity of cashew trees in Mozambique.

[3] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

b) Soil fertility

Most farmers visited pronounced that their soils are normal to rather dry and poor.

The common infertility and silting of the soil are exacerbated by frequent "cleaning" of the soil in the orchards, as propagated by IAM. The assumption of the growers is that the cleaner the soil is around the trunk and in the radius of the crown under the cashew tree, the less fungal and pest infestation will occur. Also, the farmers assume that the less other plants grow, the more water and nutrients will be available for RCN - the cash crop. Likewise, by clearing and emptying the areas, the farmer wants to make harvesting easier and prevent the germination of the falling fruit.

Although technical literature states that cashew trees prefer fertile soils, "Prefers deep, fertile, sandy soils but will grow well on most soils except pure clays or soils that are otherwise impermeable, poorly drained or subject to periodic flooding." (CGIAR / Worldagroforestry, 2022), nevertheless, cashew trees in conventional cultivation in Mozambique to day do not receive any kind of fertilizer treatment or other measures to increase nutrient availability for the tree.

Except for the members of the CARI cooperative, none of the farmers do anything to actively improve the soil fertility in their cashew tree orchards. CARI members not only strategically use cover crops to improve soil, but they produce natural fertilizer. The so-called bokashi – an anaerobic fertilizer invented in Japan – can be produced with local ingredients. The farmers mix 25 kilos of cassava, 25 kilos of sweet potato, each 50 kilos of coal dust, cow manure, bran as well as egg shells, molasses and virgin earth with microorganisms from an untouched part of the local forest. The ingredients all get put into a black canvas where they get humidified and then remain closed for 90 days before ready to use. A few inputs the cooperative members buy from a place only 7 km away: the cow manure (100 MZN) and the bran (150 MZN). These are easily and cost effectively transported via bicycle or with local buses. The CARI members report that the bokashi fertilized their soils immensely in recent years.

c) Tree Age / Mix

Commercial orchards all have many mature trees and plenty of newly planted seedlings. In Macanhe (Gaza) unmanaged orchards were observed. The growers had not planted any young trees.

d) Productivity / Yield

The farmers measured sales in cups and had a very hard time calculating their average yield. Good trees seem to produce a yield of up to 10kg/tree with old mature trees giving 20kg/tree sometimes. Farmers who do group sales supported by NGOs are trained in FBS in financial literacy and marketing issues and therefore know their yield better than other growers. Overaged orchards, unpruned trees plus untreated PMD severely lower the yields. If PMD occurs yields can go down to zero.

3.4.2 External Factors

a) Climate

Cashew trees are genuinely tropical and very frost sensitive. The climate of Mozambique is well suited for growing RCN, but in all interviews, farmers said that a certain cold weather in the phase of flowering attracts PMD. This can happen in any area, but cooler areas e.g. the ones closer to sea seem to be more likely to get infestations.

"Powdery mildews are favored by warm days and cool nights and moderate temperatures (20° to 30°C). At leaf temperatures above 32°C, some mildew spores and colonies are killed. Shade or low light intensities as well as high relative humidity (greater than 95%) favor powdery mildew fungi." (University of California, 2020)

b) Water Access

Nearly none of the farmers has access to water for irrigation. Seedlings are usually planted at the beginning of the rainy season so that additional watering is mostly not necessary. Mature cashew trees do not get watered by anyone visited.

c) Seedlings, PRM, Nurseries

Most farmers receive seedlings from IAM nurseries or plant directly with their own seeds. Very few farmers have experience with direct planting with good polyclonal seeds.

Despite the high cost of production of seedlings and transport to producers, only an estimated one fourth of the seedlings survive according to experts like Angelo Levi, former TechnoServe MozaCajú project leader.

Reinier Visser from Deep Roots Lda. in Corrane discovered that seedlings from nurseries often have underdeveloped roots. His observation after a cyclone was that the majority of his IAM seedlings had fallen. He states "A normal tree with good roots does not develop such a hole from a storm. There are lateral roots all around starting from the top, which stabilize it. If it gets tilted or uprooted it takes the surrounding soil with it. The trees in the pictures do not have roots at the top, or just one as visible in the bottom picture. That's why the trunk can move back and forth even in the soil." Reinier works with polyclonal seeds as his best option for drought, fire and pest resistance and best harvest. He observed that direct planting produces healthy and well-rooted trees and he has his first RCN harvest after 3 years.

Photo 1 Storm damaged young cashew tree uprooted, at Deep Roots Farm, Corrane

d) Money / Investment

Most cashew farmers don't have extra money to spend. Everyday practices like cutting the grass, weeding under cashew trees and pruning are mostly done by family members already. So, hiring extra workforce would be a major investment.

Sprayers /service providers are often paid in food or other available commodities.

e) Workforce Availability

All farmers stated that they were working at the limit of their capacity and had no additional labor available. They could only afford to invest more into the management, the necessary workforce for an organic orchard, if the retail price would be higher.

f) Farmer Organization

The majority of farmers become members of an association to benefit from group sales. Together, the harvest is commercialized and thus a much better selling price is negotiated.

Half of the farmers were organized, the North more than Southern producers. Growers from the South achieve much higher retail prices, sometimes double the amount for their RCN due to the good connection to the premium sales market in Maputo.

g) Access to Information

Producers indicated that they receive information related to the cultivation, breeding, management and sale of RCN exclusively from IAM. The interest in acquiring additional training is high.

One very big commercial farmer with over 10.000 trees stated he had contact with: GIZ, Helvetas, Norges Vel for a pilot in organic growing of RCN and use of bio-spray some years ago. The project was discontinued after two years.

h) Access to Services

Most growers have access to service providers but lack money to pay these.

3.4.3 Farm Practices

a) GAP (Good Agricultural Practices) & Awareness of GAP

By definition of IAM the main GAP are ground cleaning, spraying chemicals and pruning.

Whereas other description (FAO, 2022) (Economic Research Service of the U.S. Department of Agriculture , 2022) (German Environment Agency , 2022) of GAP define a larger number of other relevant practices:

- No slash & burn
- Preservation of soil structure by limiting heavy tillage
- Permanent ground cover and soil fertilization
- Intercropping of leguminous nitrogen-fixers and crop rotation
- IPM (alternative pest/disease management)

During the consultants visit she could witness for example in Tome, in the Funhalouro District in Inhambane new orchards that were obviously fire-cleared. Here all life was burnt, the only green was from the young cashew trees, that had gotten planted after the fire.

A farmer speaking on behalf of his fellow colleagues stated that clearing the natural flora by hand would take many days and tie up an incredible amount of labor.

The farmer alone would not be able to plant new orchards. He would have to hire outside contractors and also buy heavy-duty equipment such as chainsaws, and he would need electricity to charge the battery of the saw - a costly operation as opposed to simply starting a fire. If nature conservation and protection of biodiversity is desired here by the buyers from Europe, the additional work must also be paid for, according to the view of the farmers. This practice is not necessary if new cashew orchards only would be started on already deforested or degenerated landscapes.

b) Pruning

The majority of RCN producers prunes their trees. Sanitary pruning prevents the branches from hanging to the ground, facilitates harvesting, improves air circulation. Old and rotten branches are

removed to provide little surface for pest and fungal attack. The tree crown can also be removed and replanted, i.e. grafted and rejuvenated. In addition, different cashew tree varieties have different growth so that the pruning is oriented to the respective variety.

If farmers don't prune, they lack manpower, service providers, technical knowledge or tools (e.g. good machete, scissors or pruning saw). All of them understand the importance of pruning. Some farmers know how to prune, others have to employ/pay service providers to support them.

c) Organic pesticide/fungicide

Few farmers have ever used organic products to control pests/illnesses. CARI members in Monapo-Ramiane have some years of experience in producing a broad range of locally grown natural remedies (neem, tobacco, etc.+ bokashi fertilizer).

There seems to be little to no research about possibilities for „locally produced bio-spray" at universities or by IAM scientists themselves. For further research on the topic, the consultant asked IAM "As I have seen so far, in addition to IAM, mainly foreign agencies and NGOs are involved when it comes to optimizing the cashew value chain. Were there or are there plans with local universities, such as UEM, to test the effect of indigenous plants, for example, as biopesticides? (Considering that Mozambique, according to my information, has about 800 medicinal plants already known and thousands of other possible plant species that could be useful as organic pesticides)." IAM answered[4]: "(…) Considering that organic production is a more value-adding mode of agricultural production, various options of biological products such as Biospray, Trichoderma and other formulated products like Problad Plus have been tested in partnership with development agencies, NGOs, academia and other research institutions. However, although identifying and testing biological products and natural repellents is part of the almond research plan, medicinal plants with potential for pest and/or disease control of cashew have not yet been objectively tested."

The word "bio-spray" is used for a variety of natural remedies combating illnesses and pests.

Bio-Spray

The INA has documented much testing with bio spray and describes the results as following: "Bio-Spray is a cocktail of active beneficial microbes and Effective Microorganisms (EM) of three yeasts, three lactobacilli, three phototropic bacteria and at least four actinomycetes that are used as a biological enhancer of natural processes in the canopy. One of the anecdotes the current research would like to confirm or reject is that the sugars in the Bio Spray that are derived from the cashew apples itself attract a particular type of red ants and the nutrients boost the trees natural protections. After three years of testing it looks like bio-spray can become a scalable solution based on a demonstrated ability to protect cashew tree flowering and reduce the harmful application of traditional chemical spraying. The Bio-Spray testing has demonstrated that cashew trees using Bio-Spray have produced up to 10-12kg, three times more than the national average of 3-4 kg of nuts per tree. One of the benefits verified through testing, is that the cashew apples from trees sprayed with Bio-spray do not contain harmful toxins and may be consumed safely. As such, the cashew apple can be used for human food products as well as animal feed. By broadening the use of the cashew apple and promoting food crops grown between the trees the test-runs have opened a window of possibilities leading to increased interest among farmers to plant cashew trees, secure the creation of new jobs, contribute to food security and improve the income of rural families." (INA, 2022)

IAM and NIBIO have recently conducted a study on the effectiveness of Bio-spray in the Control of PMD. Many experts from the cashew sector have expressed their disappointment that the promising preparation is unfortunately not cheap enough to mass produce. The report states that "In the shade

[4] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

house, the success of powdery mildew inoculation was very low, with no difference among treatments. (...) The area under the disease progress curve (AUDPC) showed that the bio-spray concentrations tested did not reduce powdery mildew severity and incidence when compared with the untreated control. (...) More research is needed on identification of effective microorganisms, multiplication strategies, and storage conditions on the efficacy of the bio-spray." (Mateus J. Comé[1], 2021)

Sulfur

None of the farmers has ever used sulfur. Sulfur is not yet broadly available at the Mozambican market. Although sulfur is mined in Mozambique it was not possible to find out where it is available.[5]: "IAM, IP has not yet carried out studies on the availability and professional extraction of sulfur in Mozambique, nor the possibility of producing pesticides from sulfur in the country. However, there are indications of the existence of thermal waters in the District of Monapo, Province of Nampula, with a high concentration of sulfur, whose effect has been proven to control cashew powdery mildew. However, although the possibility of its massive use was considered, it was not operationalized for logistical and legal reasons. IAM, IP has no record of national or foreign companies that have expressed an interest and/or tried to start a sulfur extraction business in the country, for commercial use in the control of cashew diseases."

More info to sulfur see 4.3.1 Researching inputs allowed for organic certification (EOS/NOP).

d) Integrated Pest Management (IPM)

The majority of producers don't know any way of naturally combating PMD. Neither with natural sprays, nor with adequate practices to help the tree to be healthier and therefore not get attacked. Only at CARI the growers are more pro-active and try to combat pests naturally.

The interest of farmers about this topic was enormous. All of them said they would very much enjoy to learn more about IPM, when explaining them that it is a way of empowering them in helping themselves when getting attacked. Unfortunately, the farmers also do not know much about the pests and diseases that attack their trees and other plants. They usually only know the name in the local language and therefore have no chance to do any research online or in books.

e) Organic Fertilizer

Only the CARI members produce and use fertilizer and compost (bokashi) that the cooperative produces jointly. The vast majority of all interviewed farmers have never heard about DIY fertilizer.

f) Spacing

The spacing in the orchards is mostly 10 x 10m, 12 x 12m or 15 x 15m depending on varieties and style. Some famers that inherited their orchards from their ancestors have no regular spacing but a very natural pattern of trees, no system. Others lack meters to measure distances and so estimate the distances.

g) Pollinators

Farmers have no knowledge & don't identify and measure pollinators. Most of them state though that their orchards don't have pollinator problems.

h) Knowledge about Organic Agriculture

Most farmers think organic is "natural" to just not do anything, to leave the plant alone. They have never heard of organic management of an orchard. Most people believe that not managed fields are organic by default. Their mindset is also manipulated by crop protection manufacturers that want to sell their products. The farmers believe they are the victims and the bad pests and diseases attack

[5] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

them. They do not know how to help themselves and feel at the mercy of nature. The believe is that nature is rather the enemy and it needs to be defeated with harsh methods like with chemical weapons.

i) Readiness for Organic Production

The intensive interviews with cashew growers in various places showed that the farmers lack basic knowledge about plant ecology, agroecological practices, IPM, self-sufficient farming methods and they have no habit of observing nature to independently draw conclusions about nutritional deficiencies or diseases and other plant and soil needs. Therefore, the visited farmers are very skeptical and seem to not mentally ready for organic production except for the CARI agroecology cooperative.

Nevertheless, all visited farmers articulated that they believe it would be a benefit for their health and for the environment to use as little chemicals as possible. They just see it as utopia and lack knowledge on how to farm in harmony with nature while maintaining or improving yields.

3.5 Opportunities for and feasibility of diffusing organic production

As the Mozambican government plans to slowly phase out the pesticide subsidies, RCN growers will soon be forced to find alternatives to combat diseases and pests. At this turning point, it is strategically and economically important to look at the problem of diseases and attacks on cashew trees from a new perspective. Here, turning to more sustainable production methods can not only save money, but also promote the health of people and environment at the same time. "For years the National Cashew Institute (INCAJU)[6] has subsidized imported chemicals used in Mozambique to prevent mildew. This has been very costly and INCAJU has notified the cashew stakeholders that in 2020 the transition to reduce and soon eliminate this subsidy will begin. The cost of chemical pesticides is prohibitive under the current cost structure and alternative less costly methods of disease prevention should be promoted." (INA, 2022)

Ongoing projects of the GIZ partners e.g. supporting agencies like Helvetas and Norges Vel and GIZ itself lead the way here and give valuable impulses to the whole value chain. From using better PRM to the production of organic fertilizer or intercropping to improve nutrients and soil health, many initiatives indicate that organic RCN farming will increase and become more popular in the coming years. The Helvetas project in cooperation with Eco Energia (Ouro Verde), certified organic since July 2022, is now leading the way to include smallholder cooperatives in the certification process by creating OGGs.

To include smallholder farmers in the organic production of RCN an OGG has to be set up to make the organic certification via a CB feasible and economically viable.

Smallholder farmers that are:

- organized in any kind of legal entity like a registered association or cooperative
- consisting of not more then 2.000 individual members
- in geographical proximity to each other
- with the size of each holding being either less or equal to 5 hectares
- generating an annual turnover of less then 25.000€
- working under similar production systems or farming practices (same procedures, etc.)
- who's use of inputs is done under the centralized management and responsibility of an ICS
- commercializing their organic products exclusively through the group legal representative

…are eligible to become an OGG. (Ecocert, 2022)

[6] INCAJU – nowadays IAM

The 2022 newly introduced EU organic regulation brings key changes for organic producer groups in third Countries (outside the EU). The consultant attended an IFOAM webinar to be aware of all upcoming changes. A PDF by IFOAM that will be available in July 2022 explains the fundamental changes for a certified group's composition, size & legal set-up and the new ICS requirements.[7]

[7] 27 June 2022, from 15:00 to 17:00 CEST, webinar on the new EU organic regulation: "Key Changes for Organic Producer Groups", by IFOAM - Organics International together with FIBL, IFOAM – Organics Europe

4 Recommendations

4.1 Planting & PRM (seeds/seedlings)

Due to the high cost of seedling production the industry should rethink production of seedlings and transport and favor direct planting with own-produced high-quality polyclonal seeds which don't need grafting and often give their first harvest after 3 years. Norges Vel expert Cornelius J. von Blerk indicated to consider though that direct sowing of cashew must coincide with the arrival of the first rains and this could complicate logistics. In this sense sourcing of seedlings from a nursery that uses irrigation is lower risk.

IAM[8] informed that "The number of seedlings produced varies from year to year, depending on the target. In the year 2021, for example, a little over 5.2 million seedlings were produced; of which about 4.2 million were distributed and another 3.8 million planted. The post-planting survival rate is about 80% average. Seedling production costs are about 25.00 MZN/seedling on average; and transportation from the nursery to the planting sites is about 7.00 MZN/seedling on average".

= 5,2 million seedlings for 25 MZN + 7 MZN transport = 32 MZN each[9]

= 166.400.000 MZN / p.a. ….and only ca. 25%-50% of all these seedlings survive.

The consultant asked IAM if there are any results/studies from IAM or from other institutions about the differences between

(1) natural cashew seedlings from direct planting (no till) of good polyclonal seeds

compared to

(2) grafted seedlings of good polyclonal seeds coming from nurseries?

In the fields of:

- Disease resistance
- Tolerance to drought or forest fires
- Maturity / first harvest
- Production costs

IAM answered that "IAM, IP has no information or results of studies conducted by other institutions containing the differences between grafted seedlings and seedlings from polyclonal seedling regarding disease tolerance, productivity and production costs."[10]

Therefore, the consultant suggests to do field trials with direct planting of polyclonal seeds in AFS.

Recommendation:

Reduce the cost-intensive production and transport of seedlings by supplying good polyclonal seeds and planting instructions to cashew farmers instead.

[8] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

[9] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

[10] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

4.2 Crop and soil management

Instead of focusing on warding off diseases and pest attacks it is really worthwhile working on a balanced soil nutrition. It's simple: A healthy soil leads to healthy plants. Similar to humans, the cashew tree also has an immune system. It can survive in poor soil, but it will thrive if it gets managed according to its needs.

„In organic farming, [the] most important aspect is maintaining the soil fertility status. When organic materials are added to the soil, the soil microbes work on them and convert them into readily available nutrients for the plants besides improving the soil structure. Earthworms, millipedes, centipedes and many more soil macro-fauna also play a major role in improving the soil properties" (Kalaivanan & Rupa, 2017)

4.2.1 GAP

Applying GAP in combination with effective input use, are one of the best ways to increase smallholder productivity.

GAP should be trained all over Mozambique in FFS and with specially created information material, for example a song, a video, something modern, which appeals to the majority of farmers. The information provided should aim to be simple and catchy and does not contain any regulations, but a comprehensive and understandable explanation of how the individual segments of nature form a symbiosis and a nutrient cycle and how the water cycle is also part of it. It would be desirable that farmers understand that biomass is valuable fertilizer and that no plant parts should be burned anymore. Dead material is brought back into the cycle through sequestration and thus directly improves the climate.

The focus should not be on the fight against the infestation of a plant with pests or with fungi, viruses, bacteria, but the protection against such attacks. A healthy plant does not get sick. Therefore, it is important to convey that - as in humans - a healthy immune system depends much on the supply of nutrients and prevention, and that therefore the IPM - next to soil cover - is the most important part of the management that farmers must be aware of in organic or regenerative agriculture.

Maintaining the soil structure, limiting heavy tillage practice, soil fertilization, permanent soil cover, intercropping plants, crop rotation, pruning and sanitation pruning specifically for the removal of diseased or otherwise unhealthy wood hedging and IPM, are just a few of the many possible practices that will enhance a tree's wellbeing, yield and life-expectancy.

Recommendation:

Training farmers on GAP in combination with effective input use to avoid pests and disease of cashew trees and other crops.

4.2.2 Cover crops / Intercropping / Green Manure

Cover crops protect the soil from drying out, reduce weed infestation and risk of bush fire. Using companion plans to intercrop enhances soil life, saves water, helps root growth and makes good use of the space. It's also an excellent way of ensuring food security for the small hold farmers and potentially generating an extra income if crops are being sold. This increases the resilience of the subsistence farmers and guarantees a good supply with nutrients for them and their families

The use of green manures crops grown specifically for building and maintaining soil fertility and structure is a basic component of intercropping. They are normally incorporated back into the soil, either directly, or after removal and composting.

Companion planting with trees is done as long as the cashew trees are small. These trees get regularly pruned and the cuttings are located close to the soil so that funguses can start to decompose the wood as soon as possible

Cover crops are easily implementable as farmers have good access to local seeds. They might need more and adequate tools to cut the additional crops.

"The growing of crops to complement cashew needs to be carefully considered in terms of what they do to soil life and composition," advises long time expert for regenerative farming in Mozambique, Allan Schwarz, water and the spread or prevention of disease and parasites. Make sure there is easy access to all the crops. Also look at what local people eat, so tsunga (mustard greens) and Cove (kale) are good as are onions and garlic and chilies. Start out with planting calendula as cashews tend to encourage nematodes, and calendula chases them away. I would start off with low plants which do not cut out light from the cashews, unless they are mature tall trees. So no maize or sorghum also watch out for amaranth in the early stages as it is also quite tall. The best low plants are nhemba (cow peas) and peanuts in the first rotation, then leaf, fruit and root vegetables, with a bean crop in between each rotation. Mix in lots of aromatics. Avoid plants which may also suffer from mildew like tomatoes, eggplant and okra as this may risk infecting the cashews. Also, be very careful with melons and cucumber and gourds, they also feed and provide habitat to the bugs which eat the cashew fruit. Maybe enough to attract them away from the cashews in season but not more." Schwarz is owner of the Mezimbite Forest Center in Beira and designs AFS in Mozambique for over 30 years.

"Adding fruit trees to the system will be an extra effort but it is possible." says Felipe Caltabiano, from the Agroforestry Academy in Brazil. He refers to the fact that many fruit trees do not like pruning at all and each fruit tree has different sensitivities and needs an individual pruning plan. "The most simple system will have many service plants that either give nutrients or organic matter. The final selection of appropriate cover crops is to be done by AFS expert depending on many factors like rainfall, soil quality, management, seed availability, etc."

Recommendation:

Use various companion plants to build and maintain soil fertility and resilience of the cashew trees.

4.2.3 Agroforestry / Regenerative Agriculture

The consultant strongly advises to guide cashew farmers to the adoption of agroforestry systems (AFS) to restore and recover altered and degraded areas. AFS should also be tested in demo plots: densely planted and abundant systems, with close spacing of cashew trees and intercropped with nitrogen fixing, nutrient rich and local trees Acacia, Gliricidia, Tephrosia, Moringa and using soil cover plants /green manure nitrogen-fixers like pulses/beans and other annual plants for food security. (Miccolis, et al., 2016) (Gietzen, 2019)

With the aim to:

- prevent soil erosion and salinity
- increase/restore soil fertility and close nutrient cycles

- increase tree productivity due to plant root symbiosis
- prevent water runoff/benefit from improved water storage
- have little or no need to use agrochemicals
- increase biodiversity and therefore increase pollinators and natural predators of pests
- carbon sequestration and climate change mitigation

"The research program for almonds does not include trials to test cultivation in agroforestry systems." Mr: Uaciquete of IAM reports. "However, it has been suggested to survey the existing cashew production systems by agro-ecological zones, in order to improve the plan. In another perspective, the establishment of test orchards for the production of polyclonal cashew seed using this approach is being considered."

The actual design of the system strongly depends on the conditions on site. To date there are no studies about cashews in AFS in Mozambique or Southern Africa available. However, a meta-analysis shows that within agroforestry systems in sub-Saharan Africa yields are greater on average. "Average crop yield was almost twice as high in agroforestry as in non-agroforestry systems; soil fertility was improved by a factor of 1.2, control of runoff and soil loss was five and nine times better with agroforestry, and infiltration was three times higher in agroforestry compared to the control" (Kuyah, et al., 2019)

It's unlikely that there will be competition for nutrients, water or light if AFS is considered from the beginning and the companion plants are used to feed the cash crop. The additional trees are usually heavily pruned and provide biomass or firewood in the first years of growth of the cashew tree. As soon as the cash crop has a broader canopy and needs lighter, the companion trees are gradually thinned out. All additional plants are integrated into the system in such a way that they give back more than they need. The more plants, the lusher the roots can grow better and connect and soil and roots can store more water.

Examples of Agroforestry Systems:

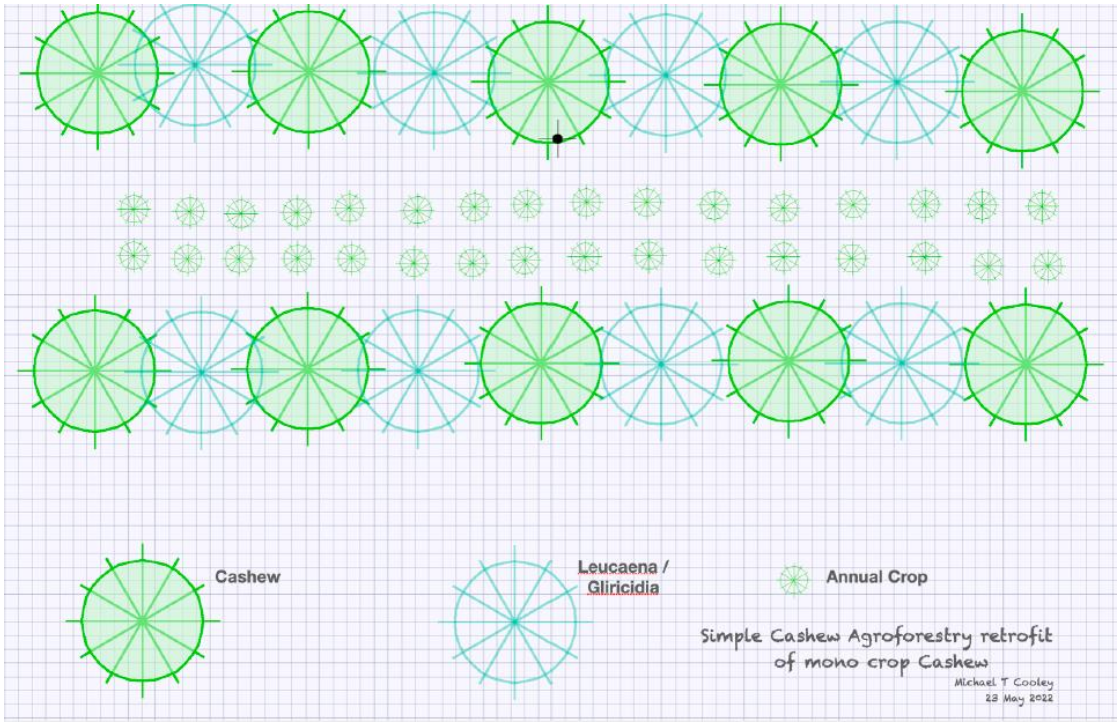

Figure 2 Simple Cashew Agroforestry system of Michael T. Cooley

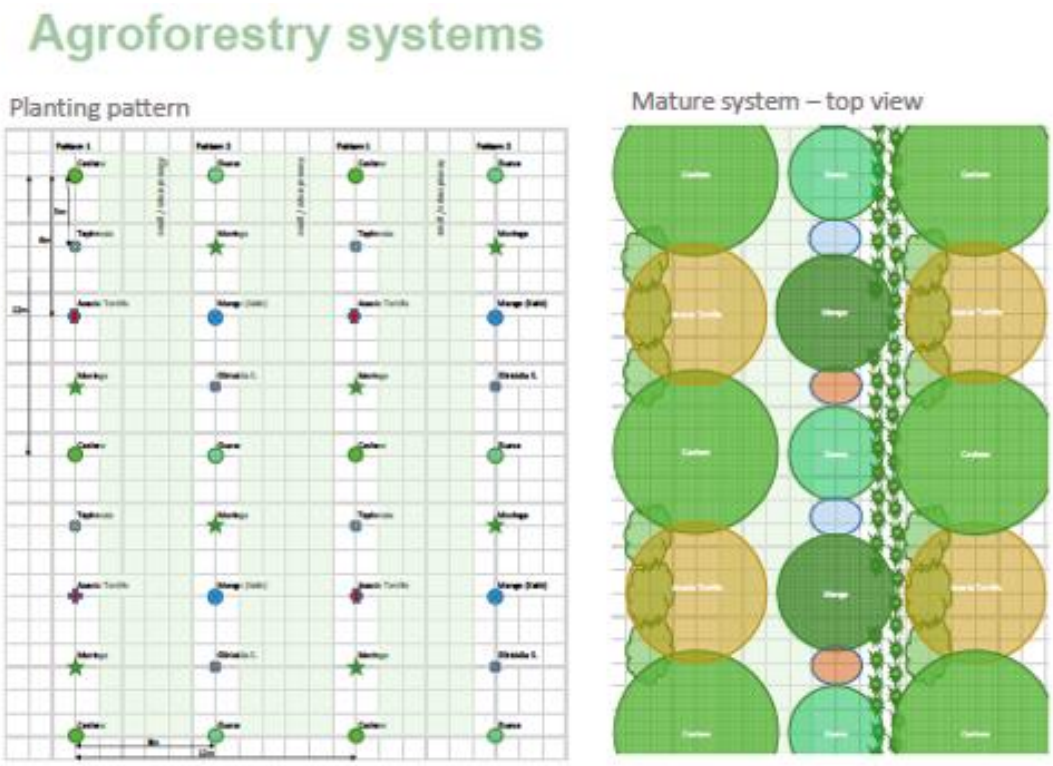

Figure 3 Agroforestry System of Deep Roots Farm Lda.

Recommendation:

Use Regenerative Agriculture methods such as AFS to create a healthy environment for the cashew trees and achieve food security for growers.

Create demo plots that scientifically record AFS and other agricultural systems under identical conditions to obtain valid results.

4.3 Pest control & disease management

4.3.1 Researching inputs allowed for organic certification (EOS/NOP)

In organic agriculture, most of the inputs are allowed with restrictions. Both standards require prevention techniques before the use of inputs.

A) <u>NOP:</u>

<u>Before use of pesticides (§205.206):</u>

- Crop rotation
- Sanitation measures
- Selection of plant species and varieties
- Use of predators or parasites
- Development of habitat for natural enemies of pests
- Natural lures, traps, and repellents

Allowed Inputs: The National List of Allowed and Prohibited Substances is the main source to research allowed inputs (U.S. Department of Agriculture, 2022).

- The active matter of pest control products has to respect:
  §205.601: positive list of synthetic substances allowed and/or
  §205.602: negative list of non-synthetic substances forbidden
- Inerts have to be listed on EPA 4A or 4B lists

Products: The OMRI list is the most complete directory of products for organic production or processing, with over 8,000 products that are "OMRI Listed®" to USDA National Organic Program standards. https://www.omri.org/omri-lists

B) EOS:

Prevention techniques:

- Protection by natural enemies (beetles, ducks, owls..)
- Choice of species and varieties (resistant to pests and disease)
- Cover crops
- Cultivation techniques (pruning)
- Mechanical and thermal processes

Allowed Inputs: If plants still can't be protected from pests and diseases,

- Active ingredients listed in Annex II of EOSv5.2 may be used. (Ecocert, 2021).
- Specific conditions described in the annex must be verified as well (ex: fungicides, traps...).
- Inerts do not need to be listed in Annex II, but they must be GMO free.

Products: On the page http://www.inputs.bio/ CB Ecocert offers a "list of products reviewed or attested by Ecocert as suitable for international organic farming, in compliance with European, American, and other regulations. It lists the inputs voluntarily submitted to Ecocert SA by the manufacturer or distributor, in order to allow a non-mandatory checking of their eligibility as 'Suitable for Organic Farming', via our Inputs Documentary Review service or our Inputs Attestation service." (Ecocert, 2022)

A list of some ALLOWED INPUTS & list of Mozambican DEALERS is available in ANNEX III.

4.3.2 Sulfur

A) NOP:

The OMRI list allows the use of sulfur with restrictions. "Sulfur: For use as plant disease control, or as an insecticide (including acaricide or mite control). For use as slug and snail bait. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices." (OMRI , 2022)

B) EOS:

According to Annex II of the Ecocert Organic Standard, sulfur can be used as plant protection product "In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011" (Ecocert, 2021)

C) Background & History:

Sulfur (or sulphur in British English) is a chemical element with the symbol S and atomic number 16. It is abundant, nonmetallic and multivalent. Elemental sulfur is bright yellow, crystalline solid at room temperature. By mass sulfur is the tenth most abundant element in the universe and the fifth most on Earth. Ancient cultures in China, Greece and India and all knew about sulfur. It is even referred to in the Bible as "brimstone". In 1777, French chemist Antoine Lavoisier proved that sulfur was one of the elements and not a compound.

Sulfur is an essential element for all life and one of the core chemical elements needed for biochemical functioning and is an elemental macronutrient for all living organisms.

Elemental sulfur is one of the oldest known fungicides and pesticides and most important in organic production. "Dusting sulfur", elemental sulfur in powdered form, has a good efficacy against a big variety of powdery mildew diseases and black spot. It is applied to crops with a sulfur duster. As sulfur doesn't react with water, "wettable sulfur" is formulated with additional ingredients to make it water soluble. Wettable Sulfur is a fine powder, a colloidal form of elemental sulfur, which is easy to mix and apply and which gives a high degree of control of powdery mildew, scab, rust and mites. It kills fungus on contact and prevents the formation of fungal spores that spread the disease.

D) Availability in Mozambique:

Sulfur is mined in Mozambique and in 2020 $192k were exported to Zambia and $129k to Democratic Republic of the Congo, at the same time Mozambique imported $40.5k of sulfur from Egypt ($24.7k), South Africa ($15.6k) and Portugal ($208). (oec.world, 2020). Although being minded in Mozambique, the consultant was unable to find domestic production of sulfur fungicide. The increasing demand could become a driver for the establishment of companies producing fungicide with domestic sulfur.

Mozambican based company BioAgro, Nampula sells the following product: Kumulos DF, Enxofre 100 solúvel (wettable sulfur) costs 720MZN/kg. The recommendation from owner Mr. Peraza is to use 3kg/ha cashew orchard, so, to spray 1ha the cost would be 2.160 MZN. (This applies for an orchard with no specification to spacing of trees). So, the amount could be used for 80-100 trees if planted 12 or 10m apart.

E) Risk of Soil Acidification:

Extensive studies from Tanzania show that using sulfur to treat PMD for many years, can cause a moderate acidification of the soil. Clay rich soils and soils with much organic matter (from biomass, compost) can better buffers the acidity then sandy soils. However, sandy soils and soils with low content of weatherable minerals are prone to acidification

To avoid acidification that could especially harm the intercrops, sulfur dust / wettable sulfur should be used as little as possible and just in case of acute infestation of trees and not preventative. (Dondeyne, 2003)

F) Recommendation:

In line with my strategy, Stefaan Dondeyne, Postdoctoral Researcher at Ghent University and expert on sulfur for RCN production in Tanzania recommends[11]:

- Training the farmers on IPM techniques, which include monitoring the status of powdery mildew in cashew groves, thinning and pruning twigs below the canopy and using sulfur correctly, has been proven to be effective to reduce the infection levels in cashew groves (Nathaniels, Sijaona, Shoo, & Katinila, 2003) the correct and efficient use of sulfur. E.g. Pruning infested branches immediately,
- Implement IPM to avoid application of much sulfur.
- Trying to source sulfur directly from Mozambican mines/extractors to lower cost for input.
- Subsidizing sulfur the same way as conventional pesticides/fungicides.
- Setting up a distribution to supply organic farmers with sulfur.
- Using Agroforestry systems with many different intercropped plants in between the trees and in the rows to help the soil buffer the acidity of the sulfur spray.

[11] Email from Stefaan Dondeyne / Postdoctoral Researcher at Ghent University to consultant on 18.06.2022.

4.3.3 IPM

IPM should be an integral part of a farmer's daily work. It's a cost-effective and independent way of managing illnesses and pests and it should be introduced to all smallholders. Especially in organic production where synthetic chemical solutions are not permitted, IPM and monitoring the plants is a cost-effective and ecological way to prevent attacks.

Learning from other successful projects e.g. how to make neem pest repellent or how to start managing weaver ant colonies on trees can be a way of being independent from buying pesticides „Weaver ants (Oecophylla longinoda) have been documented as effective biocontrol agents of a range of cashew and mango insect pests in Africa." (Peng, 2015)

Mr. Uaciquete stated that IAM also has conducted tests with the weaver ant[12]: "The red ant, Oecophylla spp., was tested and proved its potential for biological control of Helopeltis spp. on cashew in Mozambique. Trials on red ant colony identification, colony management, colony transplantation and colony maintenance for Helopeltis spp. control were conducted in partnership with ADRA Mozambique. In addition to this pest, ADRA studies indicate that the red ant also has potential for control of stink bugs and cashew borers." The consultant thinks that these interesting studies should be made available to a wider public, especially to the smallholders though.

Margaret Mulaa IPM Expert, director of CENART NGO and former member of the Pest Control Products Board (PCPB) in Kenia provided a list of options[13] for IPM and more based on her previous experience in research and training:

- Analyze pests and diseases and other constraints on cashew nuts and have proper diagnosis.
- Document and have meetings with farmers and let them rank the pests and options used or those they are aware of.
- Have a baseline of natural enemies associated with those pests using FFS approach and set up pest zoos for the farmers to observe weekly.
- Look at the current farming practices related to cashew e.g the intercrops and the benefit cost ratios.
- Find out if the recommended agronomic practices are being followed by farmers e.g use of disease-free correct varieties, time of planting, spacing, fertilizer rates, pruning methodology and intervals etc.
- Emphasis should be on prevention of pests and diseases by selective thinning of non-productive overcrowded trees, removal of infected shoots, gaps to be filled with improved high yielding tolerant healthy seedlings. The varieties should be the ones preferred by the current market.
- Intercropping with food crops and Agroforest trees which have other value to farmers e.g nitrogen fixing leguminous trees which also attract natural enemies and other beneficial insects like bees to improve pollination as well as honey production, firewood, timber, some trees can also have medicinal or pesticidal value e.g. Neem tree.
- You need to find out what trees they already have and also consult with researchers in Agroforestry any research they have conducted and recommendations that they have for farmers to avoid promoting invasive species.
- For a good IPM strategy: have a baseline of what is existing and conduct an Agro-ecosystem analysis (AESA).
- Do proper diagnosis of the Biotic factors (pests/diseases/beneficial organisms) and abiotic factors (e.g. soil nutrients) and if possible rank them by Gender for each site or region and have photo sheets to help farmers with the diagnostics.

[12] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

[13] Email from Margaret Mulaa / IPM Expert to consultant on 15.06.2022.

- Monitoring for pest/disease/ natural enemies' incidence is key in IPM. Find out if threshold levels for pesticide application are already available to guide farmers on when to apply pesticides so that pesticides are applied only when it is necessary to avoid unnecessary use of pesticides and unfavorable impacts on non- target organisms and environment, less toxic pesticides should be considered first. The pesticides should be used as per label.
- IPM emphasizes conservation of natural enemies by establishing suitable landscapes for natural enemies and less attractive to pests and diseases (e.g suitable species of Agroforestry and cover crops).
- Demonstration plots of the technologies should be designed jointly with farmers, they need training in leadership, group dynamics, diagnosis, data collection etc.
- Farmer field days and evaluation of the technologies will help scale up the technologies recommended.
- Training materials and curriculum are key and have to be developed by a team and may be approved by the Ministry of Agriculture depending on the current policies in Mozambique.

Recommendation:

Focus on avoiding pests and disease with good pruning and an effective IPM strategy.

In case of PMD infestation use sulfur punctually and intercrop plants to buffer acidity.

4.4 Availability/enthusiasm of farmers

During the field visits and all interviews, the consultant understood that the majority of farmers would very much like to do away with pesticides and other chemicals. However, there is a strong lack of expertise and alternatives.

If fundamental changes are to be made, it would be necessary to start educating farmers at the very beginning with the "flowers and bees" and to involve the whole family, especially the farmers' children. Only when the farmers learn to understand the connections, can they start to observe nature themselves and draw smaller scientific conclusions. This includes a basic understanding of pollinators, beneficial insects and the definition of pests, water cycles and material cycles in general, soil science and soil fertility along with experiments on microorganisms and earthworms and other insects living in the soil.

Recommendation:

Use FFS to allow growers to become self-reliant experts who know the organic rules and can improve soil quality and yields and thus dramatically increase food safety for themselves and the following generations.

4.5 Viability at the start of organic production

The whole project stands and falls with the willingness and the desire of the farmers to see their world with different eyes. Changing a world view of a person requires sufficient and good training. Therefore, the biggest constraint in this system is the human being. As soon as the farmer recognizes

the full cycle and turns away from the exploitative "consuming" of the earth to the circular thinking, he unfolds the whole potential and will be able to integrate the changes easily.

The general conditions for organic cashew farming in Mozambique are good. Inputs allowed in organic agriculture are available and the processor wants to buy organic certified goods. If the market is willing to accept slightly higher costs for certification, then nothing stands in the way to select to set up an OGG.

"Grower group certification means that the Certification Body (CB) gives the possibility to an entity to be certified for the whole organic production provided by the members within the group. To qualify for group certification, the entity commits to comply with specific requirements as described hereby, operating a documented Internal System (Internal Control System – ICS / Internal Quality System – IQS) for the management of the group.

Depending on the internal system of the group, two types of inspection by Ecocert are possible:

A) ECOCERT carries out annual external inspection on a sample of growers (sample size and selection of growers defined by Ecocert) to check the relevance and efficiency of the ICS.

otherwise

B) ECOCERT carries out external annual inspection on 100% of the growers included in the group, when their number permits it, and checks the relevance of the Internal Quality System. It implies that inspection and certification costs may be higher than in the first case but in case of critical non-conformities found at the level of single producers, the risk of downgrading could be limited to the non-conform producer and not to the whole group" (Ecocert, 2022)

As the risk of contamination with any kind of prohibited inputs is very big when working with OGGs farmers have to understand what they are doing. Instead of the top down approach, they have to be seen as partners and need to fully understand the organic philosophy before setting up costly structures to obtain an organic certificate.

Behavioral change activities like FFS but also more entertaining programs like rural cinemas, fairs, discussions about regenerative and organic farming should be introduced. The production of diverting, easily digestible and at the same time educating materials such as songs or video clips can help to promote organic agriculture even to illiterate and off grid growers. Education about the general cycle of nature should also be a given at the kindergarten and elementary school level.

According to information on its website FAO has set up a school garden in Inhassoro, Mozambique where the students are introduced to agricultural practices, including organic farming techniques, "to raise awareness among the students and their families of the critical role that agriculture and related rural development activities can play in a given society as part of the educational and vocational training goals" and to "improve their diet and contribute to food security." (FAO Organic Agriculture, 2022)

If the organic certificate is too expensive or the change in farming method is too big for the farmers, there is still the possibility to do regenerative agriculture first and only after this taking the step to organic certification.

Recommendation:

Before setting up and ICS and/or an OGG consider to inspire and educate farmers on organic and regenerative agriculture practices first to avoid risk of later downgrading the yields by CB due to severe non-conformities like cross-contamination with synthetic pesticides.

4.6 Resources needed for organic production

The following table shows a comparison of three different agricultural practices in relation to cost, time and inputs used: The conventional agriculture that most farmers are practicing right now, organic agriculture according to the European regulation EOS and the refined method suggested by the consultant, a combination of agroecological practices, AFS, CSA and regenerative agriculture, called regenerative agriculture.

The conventional and regenerative systems differ mainly in the following three crucial points:

1. **Re-educating the growers** will take time and care. Farmers need to be trained and educated for IPM and become excited about the new way of a more self-reliant farming.

2. **Caution in the selection of inputs**, e.g. pesticides and fertilizers, as well as seeds and other RPM, must be allowed for organic farming if certification is desired.

3. **Increased effort in sowing, cultivating and harvesting of cover crops**. Which the consultant believes will be offset by the added value of increasing yields of RCN and the benefit of additional food security for the subsistence farmers.

	AGRICULTURAL PRACTICES			CHANGES REQUIRED FOR REGENERATIVE METHOD			
	CONVENTIONAL	**ORGANIC (EOS)**	**REGENERATIVE [14]**	**TIME**	**MONEY**	**INPUTS**	**OTHER**
soil preparation	slash & burn	no burning allowed as it degrades soil and decreases biodiversity	no burning, no tilling!	it takes more time to manually clear a plot if burning is not allowed, farmers will need training on new agricultural system	producer might need to buy tools and pay worker(s) to help prepare a plot	tools like machete, saw, axe.	
soil fertilization	none	organic fertilizers allowed (and green manure)	green manure + pruning rests /organic matter - composting (e.g. bokashi), using EM/IM, ashes, other fertilizers allowed in organic production	buying and application will cost time	buying organic fertilizer will be costing money	using different local ingredients for compost + bokashi needed	e.g. buying larger quantities of manure can be organized by the cooperative to save time and money.
soil cover / intercropping	mostly bare soil or some gras, no or not much intercropping	new EU Organic Regulation: Mandatory cover crops to improve soil fertility for perennial plants	intercropping service plants as green manure, nitrogen fixers, native trees, aromatics, plants that attract pollinators/pest predators and medicinal plants	more time will be needed to plant the intercrops. And then more time to prune the trees and cut/harvest the annual plants	harvest of food crops will improve food security and/or income for farmer; medicinal plants may increase health and lower health related spending	tools like mattock hoes might be needed, fertilizers for service plants as well as new knowledge e.g. on species of appropriate legumes, planting density, succession etc.	DEVIATION must be requested at CB and granted, BEFORE any new seed can be planted
PRM (seed/seedlings)	cashew tree monoculture	only organic seeds or non-treated seeds may be used, if organic seeds not available; deviation has to be requested from CB before ANY new planting activities on certified fields	use organic seeds + set up an informal seed network within the cooperative, ICS staff can request deviation for new seeds introduced into the system	buying, checking and approving / deviation of seeds with CB will take some time and admin efforts	buying seeds for soil cover	seeds and a place for storing seeds	preferring polyclonal seeds/seedlings for cashew

[14] agroecological practices, AFS, CSA & regenerative agriculture

AGRICULTURAL PRACTICES				CHANGES REQUIRED FOR REGENERATIVE METHOD			
	CONVENTIONAL	ORGANIC (EOS)	REGENERATIVE [14]	TIME	MONEY	INPUTS	OTHER
planting cashew trees		no rule	experiment with DIRECT seed planting (polyclonal seeds)	saves time in planting	saves a lot of money (production of seedlings in nurseries + transport)	polyclonal seeds need to be distributed with a manual on how to plant them	direct planting must be overviewed so that the farmers REALLY use these seeds as planting material (risk!)
pruning	regularly	no rule	regularly also intercropped plants need to be pruned regularly to produce organic matter and maintain optimal sunlight	pruning intercropped trees and bushes will cost some extra time		more pruning tools might be needed	pruning rests should be incorporated in the soil as fertilizer
pest management	chemical synthetic spray	only use of "allowed inputs" e.g. tobacco, neem, etc. to combat pests	IPM + biological control + allowed inputs (no preventive use but just use in case of attack/infestation)	time to learn about IPM, time and knowledge to prepare natural remedies, etc.	training on IPM will have to be paid for by someone	equipment to prepare and store remedies, etc. is needed	monitor the development of pest or disease and only use a control once you reach a certain level of infection, analyze and record the attacks and treatments.
disease management (e.g. PMD)	chemical synthetic spray	Only use "allowed inputs" e.g. sulfur (may only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices."	if 10% of tree is infested with PMD, sulfur will be sprayed. (no preventive use but just use in case of attack/infestation)	farmers need to be trained on how and at what intervals to apply sulfur to cashew trees.	sulfur might be supplied for free from IAM. If not = extra cost!	sulfur / wettable sulfur needs to be sourced and transported to farmers	
harvest	harvest from "clean" ground, just sand	soil cover is obligatory	soil cover + managing crops under canopy (cut) before the harvest begins, e.g. creating a mulch bed for the falling fruits/nuts	fruits that fell down, must be picked up quickly to avoid germination of cashew nuts			

	AGRICULTURAL PRACTICES			CHANGES REQUIRED FOR REGENERATIVE METHOD			
	CONVENTIONAL	ORGANIC (EOS)	REGENERATIVE [14]	TIME	MONEY	INPUTS	OTHER
water management	bare/uncovered soil = water evaporation, runoff and drainage	no rule	implement systems with soil cover, build SOC and create contour lines to increase water infiltration & water holding capacity and reduce run-off	depending on methods time will be needed to implement			increase in climate change resilience. AFS is water wise farming. It increases water use efficiency, retains water for crops and maintains water quality
organization	individuals or cooperative	OGG - Organic Grower Group hast to be in place in order to group certify smallholders	OGG in the best case: OGG = cooperative of smallholders	set-up and running the ICS for the OGG will need much time	wages of new employees of ICS		

Table 3 Comparison conventional vs. organic and regenerative RCN production

Recommendation:

Use FFS to allow growers to become self-reliant experts who know the organic rules and can improve soil quality and yields and thus increase food safety for themselves and the following generations.

4.7 Enabling environment: regulatory frameworks, lobby, advocacy & organic networks

4.7.1 Cashew Law

When the consultant asked IAM: "Does the law governing subsidization of farm inputs allow pesticides/fungicides allowed in organic farming to also be subsidized by the government? "

The answer of IAM Américo Uaciquete[15] was:" Regarding the Cashew Law (Law no. 13/99, of November 1) and the Regulation for the Promotion, Production, Commercialization, Processing and Export of Cashew Nuts (Decree 78/2018, of December 6), there is no specific reference on organic farming in this perspective. However, the implement of innovative management practices of cashew trees for cashew production is encouraged, with respect for the preservation of biodiversity and the protection of the environment and living beings, including humans."

According to the consultant, this excerpt from the law proves that it should be possible to subsidize sulfur in the same way as synthetic pesticides and even to promote organic farming. Because the above-mentioned goals of protection of biodiversity, environment and humans could be better achieved with sustainable cultivation and natural plant protection methods.

The consultant asked in the same mail "Are there any findings from IAM or from universities or NGOs about changes in biodiversity, for example, loss of pollinators or other beneficial insects or decline of endangered plant or animal species in the sprayed areas? "

The answer of Americo Uaciquete was:" IAM, IP does not conduct studies on changes in biodiversity. Related studies are conducted by the Social and Environmental Safeguards Office of MADER and by other entities, public and private, with interest in this specific area."

Because of what the law says and because of how the law seems to encourage the efforts of avoiding harmful substances, the consultant strongly advises to ask/lobby for subsidies for inputs that are allowed in organic agriculture.

Recommendation:

Cashew law should include the provision and subsidy of inputs such as sulfur that are (in proper doses) harmless to humans and the environment and are approved for organic production.

4.7.2 Lobbying for update of IAM trainings

During the study it became evident that IAM focuses on spraying pesticides to prevent PMD and pest attacks. Elídio Bacar, delegate of IAM in Inhambane, said that in the trainings IAM also teaches more options on how to fertilize the soils and how to do integrated pest management, using natural remedies, etc. When asking Elídio Bacar about what exactly is the content of the IAM classes/workshops for farmers? He answered via mail [16]

"On average the delegation assists 11.600 producers in the scope of integrated cashew management, of these about 8.000 producers benefit from spraying their cashew trees against pests

[15] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

[16] Email from Elídio Bacar / IAM to consultant on 01.06.2022.

and diseases and the difference is recommended to find other options for the control of pests and diseases. Considering, the integrated management of the cashew tree is a set of options of management of the cashew trees, the producer makes decision which options he will use for control and this includes cleaning, pruning, incorporation of organic matter in the soil, biological control of pests, chemical treatment of among others.

Aware that pesticides are insufficient for all producers, it is recommended the adoption of alternatives for the control of pests and diseases and, even so, a large part of cashew producers do not benefit from pesticides (more than 90%)."[17]

The consultant recommends that the IAM incorporate the use of natural practices more into its curriculum for RCN growers.

Recommendation:

Lobby for improved IAM trainings including substantially more information for the use of GAP, IPM and AFS!

4.7.3 Lobbying for organic agriculture regulation in Mozambique

Mozambique has no organic agriculture regulation. Becoming certified organic helps producers to access fast-growing international and local markets, support local economies, receive premium prices for their products and access additional funding and TA.

On the African continent, Tunisia is the only country with a fully implemented organic agriculture regulation. While Ghana's regulation is not fully implemented yet, Cameroon, Egypt, Madagascar and South Africa have regulations in development.

IAM stated in their mail[18]: "Regarding organic certification, there is still no specific law on production, preparation, distribution, import and export of organic products in Mozambique; therefore, there are no known contact persons that can facilitate the respective procedures."

A start could be the foundation of an Organic Growers Association. In Malawi MOGA - the Organic Growers Association was founded in 2000 and officially started to operate in 2005. The MOGA's main focus is to improve the profitability and sustainability of organic farming as practiced by smallholder producers.

"The Mozambique Agrarian Research Institute (IIAM) could potentially support EOA for farmers, but requires more funding and staff. In contrast, farmers' organizations are relatively stronger in Mozambique than in some other African countries." Mozambique is mentioned as one of the ten African countries that have a "Nascent EOA awareness"." (Prof Raymond Auerbach, 2019)

[18] Email from Américo Uaciquete / IAM to consultant on 07.06.2022.

Typology	Type	Organic Policy	Product standard	Govt support	Farmers organised	Export & domestic market	Countries	No
Advanced EOA country	1	Yes	Yes	Strong	NOAM	Yes, both	Morocco Tunisia	2
Active EOA Country	2	Coming	Yes	Promise	NOAM	Yes, both	Burkino Faso Egypt Ghana Madagascar Mali Mauritius São Tomé & Principe Senegal Seychelles Sudan Togo	11
Infant EOA Country	3	No	Yes or No	Little	Yes	Yes Export; Domestic developing	Algeria Benin Cameroon Liberia Namibia Nigeria South Africa Zambia Zimbabwe	9
Nascent EOA Awareness	4	No	No	None	Weak	Some export; Little domestic	Cape Verde DRCongo Gambia Guinea Rep Ivory Coast Malawi Mauritania Mozambique Niger Sierra Leone	10
Awaiting Inspiration	5	No	No	None	None	None	Angola Botswana Central Afr Rep Chad Comoros Congo Republic Djibouti Equator. Guinea Eritrea Eswatini Gabon Guinea-Bissau Lesotho Libya W Sahara	15

Table 4 Assessment for the African Union Commission of North, West, Central and Southern Africa, with a view to mainstreaming Ecological Organic Agriculture (EOA)

On the public client directory of Ecocert South Africa there's eleven certified organic clients in Mozambique. (Ecocert Clients Directory, 2022) They export moringa, baobab, cashew, bananas, etc.

And there's even a small domestic niche market in the country capital Maputo: about a dozen tiny shops, mini markets and delivery service are claiming to sell "organic" and or locally produced and healthy products. The number of these small start-ups has increased by more than 100% in recent years and will continue to rise, following the trend in industrialized nations. One example is ComOrganico: "PGS project implemented by ABIODES. More than 100 farmers involved, 62 more actively of which 14 are men and 48 women. Production takes place in the districts of Kamavota and Kamubukwana and products are sold in Maputo through various channels, among which through "ComOrganico", a company integrated in the PGS and supporting commercialization through online sales and a store. (IFOAM, 2022)

Recommendation:

Lobby for a national organic regulation and found an Organic Growers Association in Mozambique.

4.7.4 Embracing the SDG agenda

The proposed recommendations to shift to a more sustainable production method of RCN help achieve the following Sustainable Development Goals (SDGs):

Goal 1: End poverty in all its forms everywhere
Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3: Ensure healthy lives and promote well-being for all at all ages
Goal 5: Achieve gender equality and empower all women and girls
Goal 6: Ensure availability and sustainable management of water and sanitation for all
Goal 12: Ensure sustainable consumption and production patterns
Goal 13: Take urgent action to combat climate change and its impacts
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Figure 4 SDGs

The SDGs offer a roadmap for businesses to create new sustainable strategies and innovations and to engage with stakeholders.

Nowadays, if a company tells their story of their sustainable product correctly, this will inevitably attract customers. Marketing with the SDGs can be a unique selling proposition to stand out from competitors. Incorporating Agenda 2030 should therefore not be seen as an unnecessary cost, but rather a business management factor that can, on the contrary, increase revenue. According to a global study of PwC 78% of citizens said they were more likely to buy the goods and services of companies that have embraced the SDG agenda. (PWC, 2015)

Recommendation:

Shifting towards a more sustainable production method for RCN can help to achieve important SDGs while creating a USP and attracting new customers!

5 Pilot

5.1 Introduction

CARI cooperative in Monapo-Ramiane (Posto of Ituculo) in Nampula district was created in 2018 by 44 members. Today it has 300 members of which 83.3% are women. All members agree to the statutes: to have at least 2 ha land, to aggregate products, and to accept to use agroecological practices in the production of both food as well as products for trade.

The cooperative defines agroecology as agriculture practices based on natural knowledge, using local, healthy and economical resources. This agriculture aims to preserve the environment and produce healthy food. Members use agroecological techniques such as production of natural solid and liquid fertilizers, repellents made from local plant material, green manure and mulch. Members are experts in the production of Bokashi and other bio-pesticides. The members are very curious, proactive, enthusiastic and proud of their agroecological achievements.

Photo 2 Members of CARI cooperative in Monapo-Ramiane (Posto de Ituculo) in Nampula during visit of consultant

The 300 members have a total of 670 ha of land that they cultivate. The spacing used for cashew trees can be 15 x15 m or 12 x 12 m. The cover crops between their rows of cashew trees are beans, banana leaves (in a few cases) and *Mucuna pruriens*. Seeds that are easily accessible are maize, sesame, oloco beans (Vigna radiata), and nhemba beans (Vigna unguiculata). In addition to RCN, the cooperative has the following cash crops: sesame, oloco beans (Vigna radiata), peanuts and horticultural crops. The cooperative owns peanut shelling machines as agricultural machines. The tools used are hoes, machetes, and axes.

The group so far has been supported by AMPCM with funds from Norgesvel, SIDI, and UNAC of Nampula.

5.2 Membership growth

CARI is growing and is expected to grow further according to development of the members. The growth of the cooperative will gradually reduce the costs for joint activities like fertilizer/bio-pesticides production and seed procurement, etc.

Year	New members	Total members
2018	44	44
2019	78	122
2020	68	190
2021	110	300
2022	*n.n.*	*n.n.*

Table 5 CARI membership growth per year

5.3 Sales of RCN

The group sold a total of 30 tons of RCN in 2021 and CARI plans to produce 55 tons of RCN in 2022[19].

The sales of RCN of CARI are growing and are expected to grow further according to the development of the sales in the chart.

Year	Quantity sale RCN (kg)
2018	7.500
2019	11.900
2020	14.500
2021	30.000
2022	*n.n.*

Table 6 CARI Sales of RCN since foundation

5.4 Possibility of organic certification

This cooperative is more ready to be included in the certification process than other groups visited as they already use practices that are similar to the above designed best practice model of producing RCN in an organic and regenerative way.

Therefore, the pilot for organic production of RCN could take place there. The OGG would have to be set up introducing an ICS. The OGG needs to appoint a sufficient number of competent ICS inspectors for annual inspection of all members.

ICS must have documented procedures on:

- Registration of OGG members
- Internal inspection of all group members
- Approval of new members
- Training of ICS inspectors
- Training of OGG members
- The control of documents & records
- Measures in case of non-compliance

Farmers with land smaller than 5ha are eligible to become members of an OGG if their land is bigger than the annual turnover of organic production of the farm can't be higher than 25.000€.

[19] Message from CARI president Mrs. Angelina Manuel Fernando Naquite

The cooperative must be registered under national law. Only farmers under the size/turnover restrictions can be OGG members and be certified as a group.

44 Farmers have been members for more than 3 years and therefore have not treated their fields with any kind of agrochemicals, pesticides, fungicides, synthetic fertilizers, etc. So the harvest of these long-term members could become certified organic from the 2022 harvest if the group applies for a retroactive recognition of conversion of this part of the land at the CB.

Types of crops	Conversion Period	Products may be sold as 'in-conversion C2'	Products may be sold as 'organic'
Annual & semi-perennial	24 months	If harvest falls 12 months after conversion start date on a designated plot of land	If sowing falls 24 months after conversion start date on a designated plot of land
Grassland and Perennial forage	24 months	If use as feed after 12 months, feed is in conversion to organic farming	If use as feed after 24 months, feed is organic
Perennial	**36 months**	**If harvest falls 12 months after conversion start date on a designated plot of land**	**If harvest falls 36 months after conversion start date on a designated plot**

Table 7 Conversion periods for different crops (EOS)

When comparing the agricultural practice of CARI members to the best practice example shown in Table 3: Comparison conventional vs. organic and regenerative RCN production, it is evident that the practice is nearly identical to the agroecological practice of CARI members. FFS trainings both on the organic standard EOS and on the IPM including the spraying would have to be conducted.

The major change for the group would be that all crops in the organic certified units must be managed in line with the organic production rules. This means that all seeds and PRM must be either of organic origin or untreated and a deviation must be applied for any new seeds. The ICS staff can request deviations and manage the pool of allowed seeds.

Non-organic units need to be registered by ICS and strictly separated. The member shall not grow the same certified organic crop in the organic and non-organic farm unit. Meaning that all cashew trees of the members of the OGG need to be managed organically. Parallel production of the same crop is not allowed! (Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products, 2022) Art. 9.7&9.8

It would be necessary to conduct a baseline study to determine what soil and weather conditions are present. Soil tests would be done to understand if the soil might need fertilizers. And product residue tests shall give information if any kind of (cross-)contamination has occurred or if the products are good to be certified organic.

More or new inputs like seeds, fertilizer and fungicide and tools to prune and cut the newly intercropped plants might have to be bought.

At the end the certification would have to be paid. The price of the certification depends on the size of the OGG, number of members, how far apart the fields of the farmers are, how many crops will be certified and much more. A detailed quotation will be available from the CB only after filling in the OSP.

Below is a preliminary/simplified cost analysis that shows what the transition from CARI to a cooperative with an ICS where the farmers are organized in an OGG could possibly cost. The budget proposal is calculated for all 300 members and their 670 ha of land.

Some positions cannot be filled because CARI members indicated that they do not have PMD problems and are already completely regenerative. Only an initial baseline study at the beginning can determine exactly what kind of inputs might be needed.

Cost center	Cost item	Quant.	Unit	Price	Total	Remarks
TA	Baseline study conditions in Monapo	2	expert days	MTn25.000,00	MTn50.000,00	weather, soil, etc.
TA	Soil tests[20]	10	tests	MTn3.000,00	MTn30.000,00	plus transport to IIAM Nampula
TA	Residue Tests in final product	5	tests		MTn0,00	various samples of RCN
TA	Set-up ICS + wages for ICS staff				MTn0,00	
Training	Training ICS staff				MTn0,00	
Training	FFS / Training on EOS (definition, rules, certificate)	5	expert days	MTn25.000,00	MTn125.000,00	300 members with 30 per group = 10 trainings of 3 hours each. 2 per day possible
Training	FFS / Training on IPM	5	expert days	MTn25.000,00	MTn125.000,00	300 members with 30 per group = 10 trainings of 3 hours each. 2 per day possible
Training	FFS materials (print, paper, etc.)	300	packs	MTn200,00	MTn60.000,00	300 booklets, paper and pens, etc.
Inputs	Organic or untreated seeds	300	sets	MTn100,00	MTn30.000,00	cover crops / intercropping
Inputs	own fertilizer production			*own contribution*	MTn0,00	e.g. manure for bokahsi production
Inputs	own bio-pesticide production			*own contribution*	MTn0,00	e.g. EM or molasses
Inputs	buying fungicide		kg	MTn720,00	MTn0,00	e.g. sulphur (3kg/ha necessary)
Inputs	Transport of products bought				MTn0,00	car or small truck
Tools	Tools for cutting crops, pruning trees	300	lump sum	MTn1.000,00	MTn300.000,00	sikle, rake, saw, machete
Tools	Tools for IPM				MTn0,00	
Tools	Tools for ICS				MTn0,00	e.g. for data processing, storage of records
Tools	Storage for RCN, IPM and inputs				MTn0,00	
Marketing	Certification (EOS)[21]	1	OGG/EOS		MTn0,00	depending on size of OGG, location, etc.
Other	Flights	3	tickets	MTn30.000,00	MTn90.000,00	possibly flight within Mozambique
Other	Transport	12	Days	MTn4.000,00	MTn48.000,00	300km/day Nampula - Monapo - Nampula
Other	Accommodation & catering	12	Days	MTn4.000,00	MTn48.000,00	Hotel: 3.000, Food 1.000 MTn/day
Other	FFS catering	300	Days	MTn200,00	MTn60.000,00	300 members participates 2 x ½ day = 1 day training
				Total	**MTn906.000,00**	

Table 8 Budget proposal for organic certification of all members of CARI cooperative

[20] Soil tests can be personally brought to the IIAM laboratory for Soil Analysis in Nampula or sent via courier or plane. Depending on the consistency and humidity of the soil sample, the technician Mr. Ibraim says it can take up to 30 days to receive the result. Cost: 3.000 MZN per sample. IIAM Laboratory for Soil Analysis // Momade Mamudo Ibraim, IIAM Biotechnology Lab - Av. das FPLM nº 2698, Caixa postal 622, Nampula, Mozambique, Tel: +258-82-0681070, mmomade1964@gmail.com (Mr. Ibraim), no homepage.

[21] For a quotation CB needs OSP to be entirely filled out. Applications can be addressed to office.southafrica@ecocert.com, Ecocert South Africa – Baker Square, Paardevlei, De Beers Avenue, Somerset West, South Africa.

ANNEX I References

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ANNEX II Resource persons list

Surname	Name	Institution / Company	Topic / value chain focus
Abdurramane	Halahala	IAM Nampula	Nampula producers
Albino	Bonifacio	COSEBO	certification process OGG
Almeida Matos	Mário	Biochem	Organic fertilizers, pesticieds, fungicides
Anselmo	Idelson	TechnoServe	cashew value chain
Bacar	Elídio	IAM	Inhambane producers, trainings of IAM
Bande	Ilídifo Afonso	IAM	IAM projects, synthetic pesticides
Barnete	Natalino José	AMPCM	cooperatives in Northern Mozambique
Binda	Jeronimo	Helvetas	certification process OGG
Booth	Kevin	consultant (formerly TechnoServe)	feasilbility of organic RCN in Northern Mozambique
Branks	Monika	EcoEnergia (Ouro Verde) / Cabo Caju	certification process OGG
Caltabiano	Felipe	Agroforestry Academy	agroforestry / AFS, soil fertilization
Chingore	Reinaldo	UNAC	Moz farmers
Comini	Bruno	KUVANGA	cooperative in Inhambane
Cooley	Michael T.	Re-Nature	agroforestry consultant, AFS
Correia	Gonçalo	AICAJU	industry expectations
de Rourroy	Charline	ACAMOZ (NITIDAE)	projects Mt. Gilé
Dondeyne	Stefaan	University of Gent	Ssulfur, soil acidification
Felber	Georg	Helvetas	organic value chain and market
Gafar	Yunuss Abdul	Gani Comercial, Lda. + AICAJU	organic certification
Gage	Daria	freelancer (formerly TechnoServe)	Mozambican cashew industry, MozaCajú project
Gamez	Mirko	GIZ	cashew value chain
Gjefle	Karsten	Norgesvel	nurseries, AFS, value chain approach
Gyamfi	Miriam	African Cashew Alliance (ex employee)	pan African cashew production
Ibraim	Momade	IIAM Laboratory for Soil Analysis	Soil analysis
Kalinganire	Dr. Antoine	ICRAF	cashew AFS, PMD resistant seeds
Langa	Julio	IAM Nampula	Nampula producers
Lavarini	Julien	Lorenz Switzerland AG	organic RCN / regenerative agriculture
Levi	Angelo	Gorongosa (formerly TechnoServe)	experience with TechnoServe MozaCajú project
Magido	Ali	Helvetas	certification process OGG
Maltez	Helena Maria	Mutirão Agroflorestal	agroforestry / AFS
Matos	Rui	AMPCM (formerly TechnoServe)	MozaCajú project + Norges Vel nurseries
Milz	Joachim	Ecotop Consult	agroforestry consultation / AFS
Miranda	Jeremi	Deep Roots Farm Lda.	producing cashews in AFS
Mulaa	Margaret	CENART CONSORT NGO	IPM, FFS
Naquite	Angelina M.F.	CARI	members, intercropping, fertilizers, yield
Ochoa	Max	FAO	cashew value chain
Pedro	Jordão	IAM	Gaza producers
Peraza	José	BioAgro	Organic fertilizers, pesticieds, fungicides
Reiser	Jurg	Cabo Caju (former owner)	experience with attempt to certify fair trade
Roelens	Jean-Baptiste	ACAMOZ (NITIDAE)	projects Mt. Gilé
Schreilechner	Paul	Biotan	organic cashew production/processing in Tanzania
Schwarz	Allan	Mezimbite Forest Center	intercropping, IPM, nurseries, AFS
Uaciquete	Américo	IAM	spraying program/synthetic pesticides, IAM
van Blerk	Cornelius J.	Norges Vel	nurseries, AFS, value chain approach, resilience
Visser	Reinier	Deep Roots Farm Lda.	set-up of AFS farm, intercropping trees
Zenén	Félix	consultant / Norges Vel	soil fertilization, bokashi

ANNEX III ALLOWED INPUTS & DEALERS

NOP:

	Lime Sulfur
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	For use as plant disease control, or as an insecticide (including acaricide or mite control). For use as slug and snail bait. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.
RULE REFERENCE:	NOP Reference 205.206(e), 205.601(e)(5); 205.601(h)(2); 205.601(i)(10)
DATE ACTIVE:	15-Jan.-2020
	Elemental Sulfur
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	For use as plant disease control, or as an insecticide (including acaricide or mite control). For use as slug and snail bait. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.
RULE REFERENCE:	NOP Reference 205.206(e), 205.601(e)(5); 205.601(h)(2); 205.601(i)(10)
DATE ACTIVE:	15-Jan.-2020
	Sulfuric Acid
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	Classified as an inert of minimal risk (EPA List 4B). May be used as either an adjuvant or inert ingredient in combination with active pesticidal substances that are permitted as pesticides in organic production.
RELATED CATEGORIES:	Inerts, List 4
RULE REFERENCE:	NOP Reference 205.601(m)
DATE ACTIVE:	4-Apr.-2019
	Neem and Neem Derivates
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Non-Synthetic
DESCRIPTION:	Includes neem cake and neem oil. Azadirachtin, an extract of neem, is also permitted. For use as a pest lure, repellent, or as part of a trap, or as a disease control. May be used for other pesticidal purposes if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.

RELATED CATEGORIES:	Botanical Pesticides
RULE REFERENCE:	NOP Reference 205.206(a),(b),(c),(d) & (e)
DATE ACTIVE:	25-Sep-2019
	Limestone
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Non-Synthetic
DESCRIPTION:	For use as a pest lure, repellent, or as part of a trap, or as a disease control. May be used for other pesticidal purposes if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.
RULE REFERENCE:	NOP Reference 205.105, 205.206(b), 205.206(d) & 205.206(e)
DATE ACTIVE:	4-Apr.-2019
	Spinosad
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Non-Synthetic
DESCRIPTION:	Derived from Saccharopolyspora spinosa. For use as a pest lure, repellent, or as part of a trap, or as a disease control. May be used for other pesticidal purposes if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.
RELATED CATEGORIES:	Biological Controls
RULE REFERENCE:	NOP Reference 205.206(e)
DATE ACTIVE:	25-Sep-2019
	Copper Sulfate
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	For plant disease control, must be used in a manner that minimizes accumulation of copper in the soil. For use as an algicide in aquatic rice systems and for tadpole shrimp control in aquatic rice systems, must not exceed one application per field during any 24-month period. Application rates are limited to those which do not increase baseline soil test values for copper over a time frame agreed upon by the producer and accredited certifying agent. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices.
RELATED CATEGORIES:	Copper Products
RULE REFERENCE:	NOP Reference 205.601(i)(3); 205.601(a)(3); 205.601(e)(4)
DATE ACTIVE:	4-Apr.-2019
	Copper Fixed
RULING BODY:	NOP

STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	Copper products that are exempt from tolerance by 40 CFR Part 180. These include: Bordeaux mixture, basic copper carbonate (malachite), copper-ethylenediamine complex, copper hydroxide, copper-lime mixtures, copper linoleate, copper oleate, copper oxychloride, copper octanoate, copper sulfate basic, copper sulfate pentahydrate, cupric oxide, cuprous oxide. For plant disease control. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices. Must be used in a manner that minimizes copper accumulation in the soil.
RELATED CATEGORIES:	Copper Sulfate
RULE REFERENCE:	NOP Reference 205.601(i)(3); 205.601(i)(2)
DATE ACTIVE:	20-Jun-2019
	Bordeaux Mixes
RULING BODY:	NOP
STATUS:	Allowed With Restrictions
CLASSIFICATIONS:	Crop Pest, Weed, and Disease Control
ORIGIN:	Synthetic
DESCRIPTION:	See Glossary for definition of "Bordeaux mix." For plant disease control. May only be used if the requirements of 205.206(e) are met, which requires the use of preventive, mechanical, physical, and other pest, weed, and disease management practices. Must not be used as an herbicide, defoliant or desiccant. Must be used in a manner that minimizes copper accumulation in the soil.
RELATED CATEGORIES:	Hydrated Lime, Coppers, fixed
RULE REFERENCE:	NOP Reference 205.601(i)(3) & 205.601(i)(4)
DATE ACTIVE:	20-Jun-2019

Table 9 Excerpt from OMRI directory of products for organic production

EOS:

5. Other substances from traditional use in organic farming	
Copper compounds in the form of: copper hydroxide, copper oxychloride, copper oxide, Bordeaux mixture, and tribasic copper sulphate	Only uses resulting in a total application of maximum 28 kg of copper per hectare over a period of 7 years (water and non-target organisms shall be protected, risk mitigation measures, such as buffer zones, shall be applied where appropriate) In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Ethylene	
Carbon dioxide	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Fatty acid	All uses in compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011 authorized except herbicide
Hydrogen peroxide	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Lime sulphur (calcium polysulphide)	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Paraffin oil	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Quartz sand	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011
Sulphur	In compliance with the conditions for use as specified in the Annex to R(EU) N° 540/2011

Table 10 Excerpt from Annex II of Ecocert Organic Standard vO5.3

Dealers in Mozambique:

The following dealers sell organic Ecocert approved plant protection products and fertilizers.

Biochem // Mário Jorge Almeida Matos

Biochem is a Mozambican company present in the market since 2003, specializing in the supply of effective and technologically most advanced products on the market for the improvement of production, soil management and the environment.

Biochem, Av. Emília Daússe Nº 1695, Maputo, Mozambique.

Tel: +258-21-312495, info@biochem.co.mz, http://www.biochem.co.mz/

BioAgro // José Efraín Solano Peraza

BioAgro offers EM•1®, effective microorganisms for the production of RCN in order to increase the sustainable production, as well as to carry out the biological correction of the soil, improve soil structure and promote pest and disease control. They state that "EM•1® is an extremely economical probiotic and totally adaptable to pre-existing planting and operating conditions. As the technology is based on the use of microorganisms, the product is not ready for use, and before using it, it is necessary to carry out a dilution/activation using natural sugarcane molasses, or molasses."

BioAgro, Marrere Expansão, Marrere, Nampula, Mozambique.

Tel. +258-879994319, bioagromz@gmail.com, https://bioagro-em.co.mz/