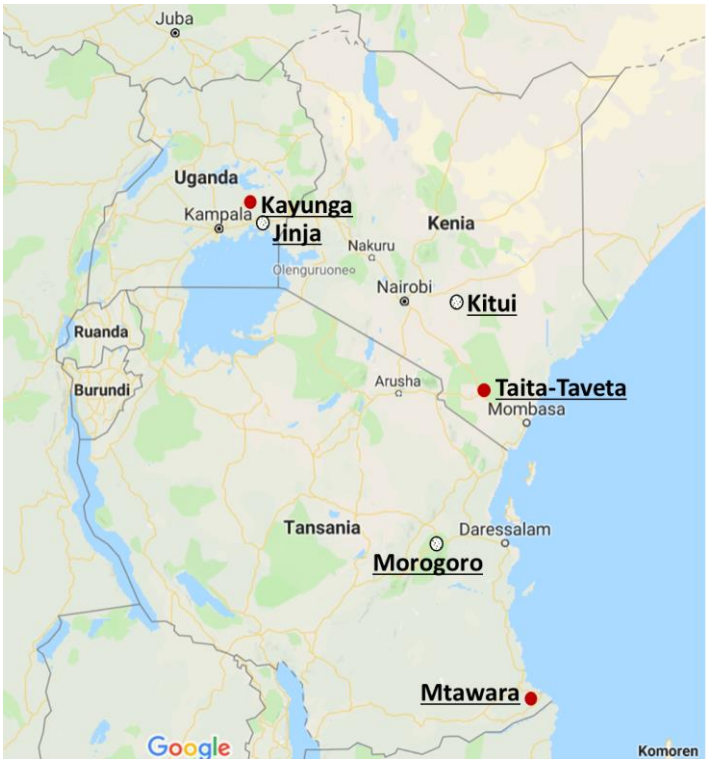
Bundesanstalt für Landwirtschaft und Ernährung

Projektträger Bundesanstalt für Landwirtschaft und Ernährung

Project update

Project title (Acronym):	**FruVaSe**
Geographical focus:	Kenya: Kitui and Taita-Taveta Tanzania: Morogoro and Mtwara Uganda: Jinja and Kayunga
Call reference:	Innovative approaches to process local food in Sub-Saharan Africa and Southeast Asia, which contribute to improved nutrition, as well as qualitative and quantitative reduction of losses
Cooperating partners:	University of Göttingen; Erfurt University of Applied Sciences; University of Nairobi and University of Eldoret, Kenya; Nelson Mandela Institution of Science and Technology, Tanzania; Makerere University, Uganda
Duration:	1st September 2018 – 31st Dezember 2021
Budget:	983,559.08 €



Map of the FruVaSe research regions in East Africa © Google Maps

Aim of the project:
The FruVaSe project aims to contribute to the fight against vitamin and mineral deficiencies in human nutrition in East Africa and to address the challenge of using fruit and vegetable waste, especially seasonal waste, in the value chain. Sub-goals are i) to select the most promising varieties of guava, cashew apple and jackfruit as well as the green leafy vegetables cowpea leaves, African nightshade and cassava leaves and ii) to evaluate traditional processing and shelf life extension technologies as well as to develop and evaluate new technologies, with a focus on juices, dried products such as fruit bars; sauces, seasonings and pickles as well as instant soups and dried leaves; iii) the new products should be tested for consumer acceptance and possibly commercialized in pilot projects.
The FruVaSe project pursues an integrated system approach (water-energy-food-waste nexus) in order to iv) develop a model for energy-independent, resource-efficient processing methods embedded in a business model for empowering women in rural areas. In a life cycle concept, most of the plant parts of the selected fruits and vegetables are to be used: both for human consumption and as animal feed (guava in Kenya as chicken feed) or for biogas production (jackfruit in Uganda); v) in addition, a recycling concept for water and the analysis and purification of drinking water for juice production is being developed (Tanzania).

Results:
Different **products** were developed by two doctoral students per project country, one doctoral student in Germany and a total of 5 MSc students:

Country	Fruit/ vegetable	Product	Student
Kenya	Guava	Nectar*	Duke Gekonge (PhD)
	Cowpea leaves	Instant soup mix*	Joshua Ombaka (PhD)
Tanzania	Cashew apple	Juice	Angela Aluko (PhD)
		Dried fruit slices*	Noel Dimoso (MSc)
	African nightshade	Vegetable relish/ pickle*	Frank Sangija (PhD
		Dried leaves*	Marynurce Kazosi (MSc)
Uganda	Jackfruit	Dried fruit	Sophie Nansereko (PhD)
		Juice/ pulp*	Sam Agaba (MSc)
	Cassava leaves	Dried leaves	Sheilla Natukunda (PhD)
	Cowpea leaves	Dried leaves*	Michael Waswa (MSc)
Germany	Jackfruit and guava	Fruit-nut-bars*	Sirui Xing (MSc)
	Afr. nightshade and cowpea leaves	Sauce	Amina Ahmed (PhD)

* This product was or will be tested in the consumer acceptance study

The **situation** of the selected **fruit species** with regard to **consumption and processing** was very similar for all three species: fruits were mainly consumed fresh, methods of preservation were not known or were not applied due to lack of technical conditions, in the case of jackfruit in Uganda only in a small cooperation.
The selected **vegetables** were mainly consumed freshly cooked, the drying of the leaves was known and was partly used, especially as direct sun drying. The simply dried leaves were not popular because of their poor sensory properties and could not be marketed well (e.g. in Kenya).

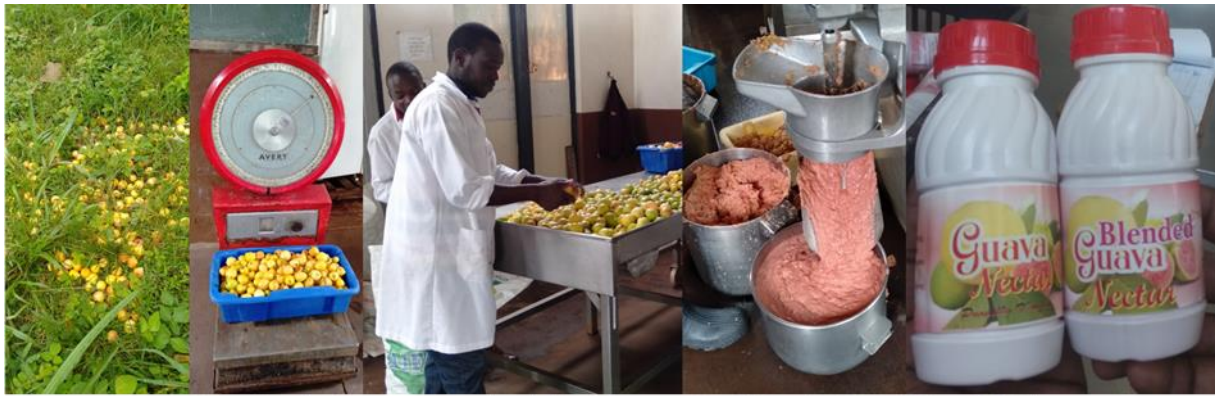
The first **laboratory analyses** of different products and different processing methods showed the following results:

- **Guava, Kenya**: partly analysed; among others, the vitamin C and ß-carotene content in nectar without moringa leaves is significantly higher; in nectar with moringa leaves the iron content is significantly higher.
- **Cashew apple, Tanzania**: first results for the dried cashew apple leaves show high values for carotenoids and vitamin C; data for the juice are not yet available.
- **Jackfruit, Uganda**: Higher values of vitamin C and carotenoids in jackfruit pulp after drying using Refractance Window™ technology compared to oven drying; jackfruit variety "Mweyasa" has particularly high iron values, jackfruit variety "Serebera" has particularly high zinc and low oxalate contents.
- **Jackfruit and guava-nut bars, Germany**: Guava bars with lemon juice had the highest vitamin C content; the total phenol content was highest in jackfruit bars; iron and zinc contents are relatively high in all bar varieties.
- **Cowpea leaves, Kenya**: iron, vitamin C and ß-carotene contents are significantly lower in dried leaves than in fresh leaves (Owade et al. 2019); final data on the soup mix are not yet available.
- **African nightshade leaves, Tanzania**: partly analysed, vitamin C contents in fermented leaves are low, but ß-carotene contents are relatively high.
- **Cassava leaves, Uganda**: "Nase 14" (newly cultivated variety) has particularly high iron, zinc and vitamin C contents; "TME 14" (newly cultivated variety) has particularly high contents of total phenols, flavonoids, condensed tannins, protein and fat; "Akalinga" (local variety) has a high oil retention capacity, which is an important cooking property; analyses in the processed leaves are still pending.
- **Cowpea leaves, Uganda**: in solar-dried leaves, the contents of vitamins A, C, total phenols and flavonoids are higher than in leaves that are first cooked and then sun-dried; further analyses are pending.

First results in the field of **water treatment, Tanzania**: A new type of water purification column developed by Autarcon for the removal of fluorides, based on aluminium and electrocoagulation, was installed in the Autarcon unit which was transferred to Tanzania in 2018. In piston tests the mechanism of fluoride removal was successfully demonstrated. An adaptation to the chemical properties of the water (including hardness) in Tanzania is still pending.

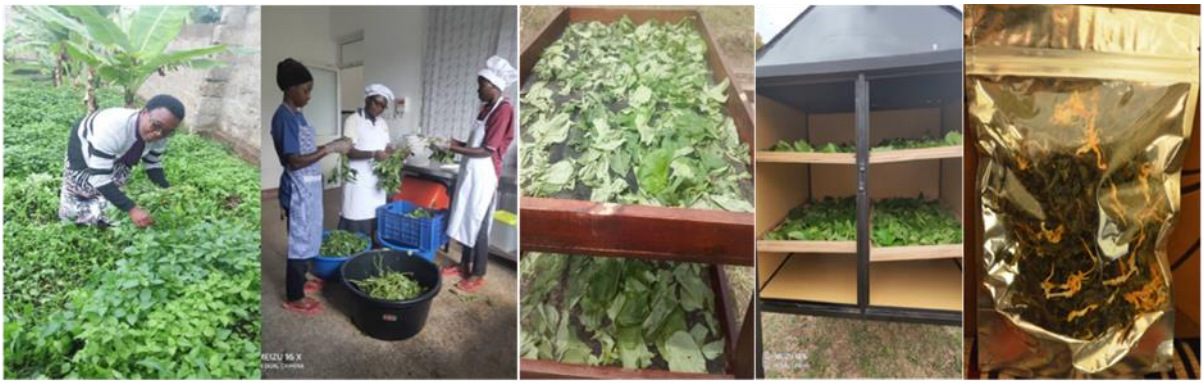
Investigations into the use of fruit residues in **biogas plants in Uganda** showed the following initial results: A literature research and expert survey showed that biogas plants are not suitable for small households. Two innovative biogas plants, suitable for commercial plants/large amounts of waste, were transferred to Makerere University, Uganda, and tested, students were trained. The chemical and energetic characteristics of the liquid and solid fractions of jackfruit and other fruit waste and water hyacinth were determined, briquettes were produced and analysed.

Jackfruit or Guava fruit-nut-bar, cooked mixture, dried mixture, bars for testing © S.Xing, G.Ooko, G.Keding

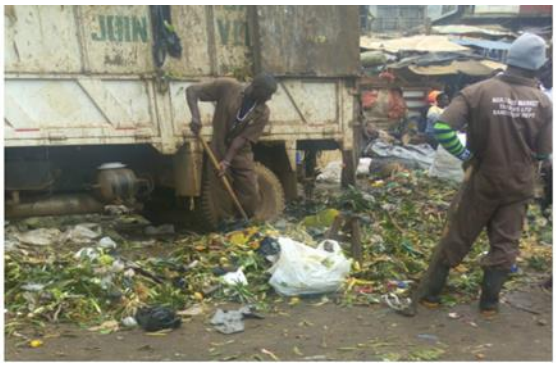


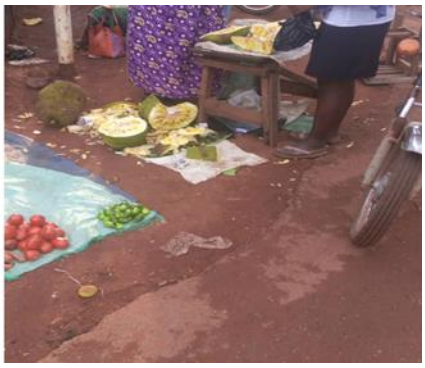
Guava surplus production, sorting, cleaning, processing and ready blended guava nectar at University of Nairobi, Kenya © D.Gekonge

African Nightshade transport, weighing, mixing ingredients for fermentation, packaging and packaged pickle/relish at NM-AIST, Arusha, Tanzania © F. Sangija

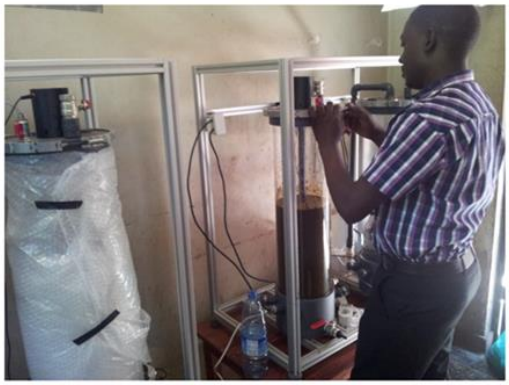


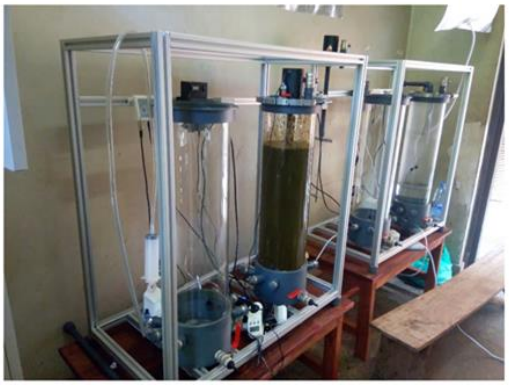
African Nightshade harvesting , preparation, drying, and packaged product at NM-AIST, Arusha, Tanzania © M.Kazosi





Substrate collection from markets places in Kampala, Uganda for the biogas plant © Tadeo Mibulo, Denis Nsubuga





Pre-test of the biogas plant, Makerere University, Uganda © Felix Redmer