# UNIVERSITY OF DAR ES SALAAM

## COLLEGE OF AGRICULTURE FOOD SCINCE AND TECHNOLOGY

**SCHOLARSHIP OPPORTUNITY FOR PHD STUDIES IN FOOD SECURITY PROGRAMME**

The Sustainable Agricultural Production and Value Addition for Enhancing Food Security in Tanzania (Food Security) a Sida-funded sub-programme, has 9 scholarship positions for PhD studies. Five (5) applicants will be enrolled in January 2025 and the remaining four (4) will be enrolled in July (2025). Four of the selected applicants will be co-supervised by Swedish supervisors and will spend up to six months (three months twice) in Sweden for writing and analysis during their four years of PhD studies at the University of Dar es Salaam.

**Common Eligibility:**

- The scholarships are intended for UDSM staff, but other potential candidates may apply;
- Applicants must have a GPA of at least 3.8 for a Bachelor degree and a good Master degree with a GPA of 4 or above for dissertation or a pass for thesis;
- Master degree must be less than 5 years old;
- Qualified females are encouraged to apply.

**Three key areas of study are:**

### 1. Agricultural Productivity (Crops and Livestock) and Safety (5 positions)

### 1.1. Establishing virus free planting material to improve cassava yield

Cassava is the leading crop by fresh weight produced in Africa. It has potential to provide a solution to the imminent food scarcity, most notably as it is expected to be resilient to future climate change. However, cassava growers in Africa are facing many challenges that constrain its production. Such challenges are pests and diseases, access to good quality planting materials and lack of well- adapted varieties. Thus, it is widely now accepted that, pest and plant diseases reduce cassava yields substantially, posing a threat to food security throughout the developing world. The major viral diseases that are transmitted to cassava by a whitefly (*Bemicia tabaci*) are Cassava Mosaic Diseases (CMD) and Cassava Brown Streak Diseases (CBSD). Overall, these viruses affect more than half of all cassava plants in sub-Saharan Africa leading to economic damage in the form of reduced root yield. This necessitates the urge to act on employing several mechanisms to fight these setbacks hence to ensure the wellbeing of cassava production in Tanzania.

**Objective:** The overall objective of this study is to enhance cassava production and processing through combating the constrains that face cassava cultivations in Tanzania.

**Supervision:** The main supervisor will be from University of Dar es Salaam with co-supervision from International Institute of Tropical Agriculture -Dar es Salaam.

**Additional Eligibility:** Applicant should have a strong background in Entomology/pest control, Molecular biology, Crop science.

### 1.2. Crop improvement of avocado germplasm in the Lake zone.

Tanzania is the third largest avocado producer in Africa after South Africa and Kenya. In the last two years, the country's avocado exports reached 11,237 tones (519 Containers) worth 33 million USD, and its demand is keep on increasing yearly. Currently, avacado is a strategic commercial crop grown in high rainfall (500-2000 mm) receiving areas of the country and offers agro-ecological role, including agroforest practice, with a number of benefits. In area where avocado is grown, the crop is intercropped with banana or coffee and therefore diversify farmers' economy. The crop also contributes to soil conservation role and ameliorate microenvironment for long term soil health. Although the crop offers a number of economic and ecological benefits, there is increasing consistency in preferring the use of indigenous varieties as stock for grafting scions of improved avocado varieties mostly Fuerte and Hass. Although this has made improved varieties to be adaptable to edaphic factors, resist against pest and diseases and produce more yield, it poses a risk of losing indigenous germplasm. To address this challenge, already study on avocado germplasm along with their collection in other areas with exception of lake zone have been made. This study therefore, intends to cover avocado improvement in unexplored areas for biodiversity and core collection.

**Objective:** The overall objective of this study is to improve avocado germplasm in the lake zone

**Supervision:** The main supervisor will be from University of Dar es Salaam, with co-supervision from Swedish University of Agricultural Sciences (SLU).

**Additional Eligibility:** Applicant should have a strong background in the area of agronomy, crop production, plant breeding, molecular biology and botany.

### 1.3. Mapping of inherent soil micro and macronutrients in selected Tanzania Agro-ecological zones, and improvement of productivity.

Soil fertility is one of the most important edaphic factors for crop establishment, development and production. Crops require both macro and micro nutrients at the right amount, right time, right source and right place to grow properly and yield well. In order for soil to be fertile, it should retain moderate to high level of the nutrients needed for proper plant growth and bamper harvest, provided that other factors are held constant. If any of the plant nutrients is below the optimal level, fertilizer application becomes essential for consideration in order to uplift the soil fertility level for a successful cropping. However, application of the fertilizer is judiciously guided and applied only after observing and understanding the present fertility level of the soil. This is important because application of the fertilizer to the field prior

understanding of the existing fertility level usually lead to over or under application of the nutrients, which in-turns compromise growth and final crop yield.

It is natural for soil fertility to vary in time and space, but the magnitude for spatial variability is great within and across agro-ecological zones due to existence of different influencing factors. Some applied amount and type of nutrients could be available in one place yet unavailable in another locality. Notwithstanding, an application of required fertilizer type at a recommended amount and time, aiming at improving soil fertility and crop productivity need a prior understanding of the inherent fertility level. Nevertheless, there is limited research on the available micro and macro-nutrients levels in some of agro-ecological zones, particularly the one covering lake zone. It is against the above background this call is looking for a suitable candidate to undertake studies for the same in Kagera region as a representative of lake zone, particularly in understanding differences in traditional banana performance as influences by edaphic factors and generate soil map that would guide fertilizer recommendation.

**Objective:** The overall objective of this study is to enhance land productivity and improve crop production through generating prior information for understanding and addressing edaphic constraints.

**Supervision:** The main supervisor and Co-supervisors will be from the University of Dar es Salaam.

**Additional Eligibility:** Applicant should have a strong background in the area of soil science/ agronomy, crop production, geographical information system, and remote sensing.

### 1.4. Spatial and temporal distribution of helminths infection, anthelminthic resistance and production efficiency in livestock in Tanzania

Future demands for livestock are high given the current Tanzania's high population growth rate, but the production efficiency is still low. This stems from many challenges facing the sector including low quantity and poor quality of feeds, poor animal genetics, and major health challenges attributed with animal keeping such as parasite infections. To boost livestock productivity, Tanzania's Livestock master plan 2019/2022-28 recommends better feeds, genetics, and health services. This is crucial for household and national food security and better economies.

Diseases caused by helminths reduce milk production, growth rate, and fertility of livestock, and increase mortality and susceptibility to other diseases. For many years, synthetic anthelminthic have been used as the primary control measure for parasitic infections in livestock. However, frequent treatment failures have occurred due to anthelminthic resistance. Efforts are required to reduce agricultural loss for smallholder and large-scale livestock production to be sustainable in Tanzania.

- **Objectives:** The overall objective is establishing spatial and temporal distribution of helminths infection and anthelminthic resistance in livestock in Tanzania

- **Supervision:** The main supervisor will be from University of Dar es Salaam, with co-supervision from SLU

- **Additional eligibility:** Applicant should have a strong background in Parasitology, Molecular Biology and Zoology or Animal Science.

### 1.5. Digitization of Livestock Services: Develop Applications for disease and treatment options and breeding services.

The world has seen a tremendous increase in using Information and Communication Technologies (ICT) solutions to facilitate the capturing, management, and exchange of information. Amidst technological advancement and high rate of population growth, Tanzania has not adequately managed to utilize ICT solutions to enhance livestock productivity. Despite the significant adoption rate of ICT solutions in health, transport, and financial sectors in Tanzania, there are no existing locally designed ICT platforms that offer reliable information on livestock diseases, breeding and livestock services. It is anticipated that the proposed research will produce, as one of its outputs, a digital solution for livestock information that will easily be accessible to the intended audience, particularly, on the web and as a mobile application. It is anticipated that the digital solution will provide different ways to record/capture, present, share, and utilise livestock information to lay down the foundation for evidence-based selective breeding decisions of livestock for sustainable livestock.

- **Objectives:** Overall objective is to develop a digital mobile application for animal diseases, treatment options, breeding and feeds that will be at farmers' fingertip.

- **Supervision:** The main supervisor will be from University of Dar es Salaam, with co-supervision from Sokoine University of Agriculture.

**Additional eligibility:** Applicant should have a strong background in in ICT-related studies, particularly, Computer Science, Information systems, Information Technologies, and Data Science. Demonstrated understanding of livestock management will be an added advantage.

## 2. Food processing, innovation and value addition (2 position).

### 2.1. Banana Juice extraction and Design of Banana juice extraction unit for local communities

Value addition is one of the key area for postharvest processing. Many of the agricultural produces in African countries are exported in raw form with little value addition. Postharvest processing is one of the processes for adding value to agricultural produces. Banana is one of

the crop that has for many years, consumed with little processing. Technological breakthrough based on non-enzymatic, mechanical malaxation followed by pressing was recently achieved. It is still a challenge to understand end point marked by coagulation of pulp before pressing, hence a more reliable method is required. This topic has one (1) PhD study position:

**Objective:** The overall objective is to investigate the mechanism for the release of clear banana juice during mechanical extraction process, and design a mechanical malaxation equipment with microprocessor to identify end point of tannin-protein interaction.

**Supervision:** The main supervisor will be from University of Dar es Salaam, with co-supervision from Chalmers University of Technology.

**Additional eligibility:** Applicant should have a strong background in Mechanical, Agricultural or Electromechanical Engineering.

### 2.2. Processing of different legumes for human and animal feed and promotion of the technology

In Tanzania, postharvest losses of legumes are estimated to range between 30% and 50%, primarily due to insufficient human capacity and inadequate processing and storage technologies. Legumes, such as black-turtle beans, peas, and lentils, are nutrient-rich and vital for balanced diets. However, many legumes contain anti-nutritional factors, such as phytates, tannins and protease inhibitors, which can reduce protein digestibility and mineral bioavailability. These compounds, along with the underutilisation of legumes as a plant-based protein source, hinder their potential contribution to addressing the country's nutritional needs. Additionally, protein production in Tanzania remains insufficient to meet the demands for both food and animal feed, necessitating imports of animal feed.

To address these challenges, the adoption of novel processing methods is crucial. Advanced techniques can mitigate the impact of anti-nutritional factors, enabling the optimal utilisation of legumes for human consumption and animal feed. Furthermore, the broad diversity of legume crops offers opportunities for selecting climate-resilient varieties, which are essential for sustaining agricultural productivity in the face of climate change. Legumes also contribute to environmental sustainability through their nitrogen-fixing ability, which enhances soil fertility while maintaining a low carbon footprint.

**Objective:** This study aims to develop innovative processing technologies for legumes to enhance their nutritional value, reduce postharvest losses, and improve their utilisation for human consumption and animal feed in Tanzania.

**Supervision:** Supervisors will be from the University of Dar es Salaam, with co-supervision from Chalmers University of Technology, Sweden.

**Additional eligibility:** Applicant should have a Master's degree in Food Science, Food Technology, Food Engineering, Chemical Processing, Biochemistry, or a related field. Strong academic performance and research background in food processing or nutrition. Experience in laboratory analysis and/or food processing technologies is an advantage. Excellent communication and writing skills in English.

## 3. Innovation in Agro waste management and Environmental Health (2 position).

### 3.1. Production of BSFL from various industrial and market wastes, and Azolla from BSFL frass, for animal feed: Productivity, quality issues and economic analysis of the value chain

Food insecurity is increasing globally mainly due to an increased population growth and climatic changes. The demand for protein has also been increasing causing a growing demand for protein sources. Moreover, increased population growth has also resulted into production of huge amounts of organic waste that negatively impact the environment. The increasing volume of organic waste is particularly challenging since the current organic solid waste management practices involve open dumping, unregulated burning and disposal at open dumpsites. Black soldier fly (*Hermetia illucens* (L.), Diptera: Stratiomyidae) larvae (BSFL) composting treatment can be a solution due to the ability of the technology to transform biological waste into high-quality protein. BSFL composting treatment follows principles of circular economy since it can treat and convert biodegradable waste into two high-value products: larval biomass that can be used in animal feed, and treatment residue that can be used as an organic fertilizer.

**Objective:** The study aims to investigate the feasibility of treating the existing types of food and agro-industry waste in Tanzania using BSFL composting treatment for production of animal feed protein.

**Supervision:** Supervisors will be from the University of Dar es Salaam**.**

### 3.2. Value Addition to Banana Farm Wastes: Production of Animal Feed and BSFL Substrate

Banana farming is a key agricultural activity in many tropical and subtropical regions, generating substantial amounts of waste, including banana peels, pseudostems, and other plant residues. These agricultural by-products are often discarded or burned, contributing to environmental pollution and missed economic opportunities. However, these banana farm wastes contain valuable organic matter that can be processed into high-value products through innovative waste management technologies.

Possible utilization of banana farm wastes include but not limitedd to production of animal feed and as a substrate for Black Soldier Fly Larvae (BSFL) composting technology,

production of biobopymer and bioenergy. The potential for transforming banana farm wastes into these valuable products offers a sustainable solution to food security challenges, while addressing waste management issues and promoting circular economy principles.

**Objective:**
This study aims to explore the feasibility of utilizing banana rhizome for the production of animal feed and organic fertilizer using BSFL composting technology, biopolymer or bioenergy.

**Supervision:** Supervisors will be from the University of Dar es Salaam**.**

**Additional eligibility:** Applicant should have a background in Chemical and Process Engineering, Food Science, Biochemical Engineering, Entomology or Food Technology.

**Additional eligibility:** Applicant should have a background in Chemical Engineering, Food Science, Biochemical Engineering, Entomology or Food Technology;

**ADDITIONAL INFORMATION:**

Application must be accompanied with transcripts, certificates, CV and a concept note of not more than two pages addressing a topic of interest of the above PhD position. The application must reach the Project Coordinator by 21st January 2025. Submit your application in electronic form to: kibazohi@yahoo.com, oscar.kibazohi@gmail.com and copied to aluda3549@gmail.com

Sort listed applicants will be interviewed before end of January 2025. Selected applicants will commence studies in February 2025.