Njala University

Government of Sierra Leone

Ministry of Technical and Higher Education

RESEARCH PROPOSAL

THEMATIC AREA: FOOD SECURITY, TECHNOLOGY AND AGRICULTURE

TOPIC: ***EVALUATION OF INDIGENOUS VEGETABLE SPECIES' POTENTIAL AS ALTERNATIVE TO TACKLE MALNUTRITION AND FOOD INSECURITY AT RURAL HOUSEHOLD IN SIERRA LEONE***

SUBMITED BY

THE DEPARTMENT OF HORTICULTURE, NJALA UNIVERSITY

TO

THE NATIONAL SCIENCE TECHNOLOGY AND INNOVATION COUNCIL (NSTIC)

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Executive Summary

Agriculture has a crucial role to play in improving nutrition, but the persistence of malnutrition as a global public health concern makes clear that alleviating poor nutrition cannot be solved merely from health/nutrition alone but requires better linkage between nutrition and agriculture. The increasing rate of rural household malnutrition resulting from continuous lack of vegetables in diets, the escalating cost of imported vegetables and the need to conserve these indigenous vegetables, has led to renewed interest in investigating local vegetable resources for nutritional management in Sierra Leone. The development challenge is malnutrition and food insecurity at rural household. Hence, there is an urgent need to investigate indigenous vegetable species with potential of sustainably tackling malnutrition at house hold level. The purpose of this research proposal will be to evaluate the potential of traditional vegetable species as an economic and sustainable way of reducing malnutrition and food insecurity at house hold level through both the nutrition and agriculture sector in Sierra Leone. In Sierra Leone where the diet is dominated by carbohydrate foodstuff, indigenous vegetables will constitute a good, cheap and most available source of proteins, vitamins, minerals, amino acids and fibre to tackle malnutrition at rural households. It is anticipated that this aim will be achieved through the following specific objectives:

1. To conduct household survey to obtain baselines information on the utilization of indigenous vegetable species in Sierra Leone.
2. To collect, classify indigenous vegetables to lowest taxonomic level and evaluate the nutritive values for each vegetable species collected.
3. To evaluate and characterize the morphological features, yield potential and market values of the collected traditional vegetable species under field domestication.
4. To develop production manual for sustainable production of traditional vegetable species in Sierra Leone.

The proposed research will be implemented in three phases beginning with surveying and collection of indigenous vegetable germplasm followed by research trial and management of germplasm and then the development of guidelines and manual for indigenous vegetable production and management. This will be done in collaboration with the Department of Nutrition and Dietetics, Njala University, the Ministry of Health and Sanitation (MHS), and the Ministry of Agriculture and Food Security (MAFS) in an agriculture-nutrition research initiative approach. It is expected that the research will generate scientific information on identified indigenous vegetable species with nutritive value to tackle rural household malnutrition and food insecurity situations. It is hoped that the findings generated from this research will serve as database for linkage between agriculture and nutrition at national level and can inform evidence-based decisions for farmers, agricultural extension services, and policymakers, facilitating the adoption of

environmentally friendly and resource-efficient agricultural practices. The proposed research will last for two (2) years for an estimated budget of USD 45,000.

1.0 Background

Agriculture has a crucial role to play in improving nutrition. It is the primary source of food and essential nutrients and an important livelihood source for many rural households. Despite its potential to alleviate malnutrition, most malnourished are in effect rural people who are trapped in a situation of low-productive agriculture, poor health and poverty. Malnutrition at household level has become a confronted issue in the health and nutritional sectors in Sierra Leone. This is because food, often regarded as one of the basic needs of mankind seems to be a scarce commodity in many households in Sierra Leone and agriculture has not adequately considered as a vehicle to improve nutrition. As such, Sierra Leone is ranked as the third hungriest countries in the world (Global Hunger index, 2017) and is presently confronted with a growing nutritional related disease outbreak. The recent COVID-19 and previously Ebola epidemic, hit hardest both at rural and urban communities of Sierra Leone could further aggravate the situation. It devastating consequences will affect the health and livelihoods of Sierra Leoneans, especially the rural communities for a considerable period of time. Vegetables, grown by almost every farming family in Sierra Leone with dominant female participation, play a significant role in providing quality food and nutritional security as well as poverty alleviation. But currently, growers do not seem to invest in production but look for ways of coping with lesser inputs. This attitude degrades them to a stage of where coping becomes unprofitable and malnutrition, a recipe for disease situations at house hold level, high risk exposure to zoonotic diseases and decreased house-hold food security in Sierra Leone.

The development challenge is malnutrition at rural household due to lack of vegetables in the diets of rural household, usually affecting the health of the rural population causing illnesses and reduction in productivity. Vegetables are considered as major sources of nutrients that are required for the building of a healthy nation. Their deficiencies in the basic diets have been observed to be highly implicated in the infection of some deleterious diseases that seriously undermine the health of a nation, particularly in pregnant women and children that seem to be more sensitive and vulnerable to malnutrition. Nutrition has always had a more health focus and has not adequately considered agriculture as a key vehicle to improve nutrition. The persistence of malnutrition as a global public health concern makes clear that alleviating poor nutrition cannot be solved merely from health/nutrition alone but requires better linkage of the two sectors (health/nutrition and agriculture sectors).

The cultivation of and sale of vegetables in communities of Sierra Leone provide a major income for vegetable growers, and more interestingly, majority of vegetable growers are women, thus emphasizing

on their participation in agriculture. This overtly indicates a response to the growing demands of gender equity and participation in development programs which invariably should be exploited to address the issues of poverty alleviation and food security. Sierra Leone being a tropical country has a huge potential of natural resources with plant biodiversity constituting a significant portion. However, it is interesting to note that, despite the richness and diversity of plant, only 10% is domesticated, the remaining 90% is yet to be exploited to enhance food security. Though few indigenous vegetables have been identified as edible with high potential of nutritive values, they are in most cases completely neglected and underutilized putting them under the category of crops called Neglected and underutilized species. This category of crop species possess huge potential in remedying food security situation particularly in Sierra Leone where these crops are lying wasted and crop diversification is scarcely utilized in the crop production system. In addition to their nutritive value potential, indigenous vegetable crops are rich in medicinal values which can be exploited to cure certain ailments such as obesity and diabetes. Despite the above stated, there is little or no research on the potential of traditional vegetables.as cheap alternative nutritional supplements for poor households in Sierra Leone, hence, people are unaware of the nutritional composition, quantity and value of these crops in preventing malnutrition.

In order to promote food nutrition and security agenda, focus has to be made towards alternative vegetable production as rice and cassava production alone cannot do much in achieving food based nutrition and food security in Sierra Leone. It is in this concept the Department of Horticulture, Njala University has initiated the idea to direct a research focus on indigenous vegetables to identify species that could serve as substitutes to exotic types and be incorporated in to human nutrition for food based nutrition and food security in Sierra Leone.

2.0 Research goal and specific objectives

The main purpose of this project proposal will be to evaluate the potential of traditional vegetables for species identification with high nutritive valves to serve as economic and sustainable way of reducing malnutrition, poverty and food insecurity at house hold level in Sierra Leone.

2.1 Specific Objectives

Objective One: To conduct household survey to obtain baselines information on the utilization of indigenous vegetable species in Sierra Leone;

Objective Two: To collect and classify indigenous vegetables in Sierra Leone to the lowest taxonomic level;

Objective Three: To determine the nutritive values for each traditional vegetable species collected through laboratory analysis;

Objective Four: To evaluate and characterize the morphological features, yield potential and market values of such traditional vegetable species under field domestication (ex-situ conservation);
Objective Five: To develop management guidelines and manual for sustainable production of traditional vegetable species in Sierra Leone.

3.0 Significance/Rationale of the Study: Vegetables are vital for human health not only in combating malnutrition but also in significantly reducing deaths from related diseases. In Sierra Leone where the diet is dominated by starchy foodstuff, vegetable will constitute a good, cheap and most available source of proteins, vitamins and minerals. Whilst tradition vegetable production and utilization levels are low in Sierra Leone, it appears certainly that the promotion of its production and utilization can contribute to yield increase, higher farm incomes, lower consumer prices, and thus reducing malnutrition, improving livelihoods and human health at rural household. Otherwise, hunger, poverty, malnutrition and disease situations will be aggravated. Therefore, there is a need to focus research activity towards the identification, production and utilization of underutilized vegetable in order to achieve food based nutrition.

According to World Health Organization (WHO), malnutrition is directly or indirectly responsible for about 3.5 million child deaths every year in Africa, a situation which is partly attributed to low vegetable and fruit intake (>400g/day). Sadly enough, global measures to reduce this menace in the country appear to be towards the introduction of food supplements and utilization of exotic vegetable species which are usually expensive and inaccessible by many rural households. The Ebola and COVID-19 epidemics have further exposed the weaknesses of the country's public healthcare system in tackling nutritional related disease outbreak, indicating that over dependence on this institution for human health care could be catastrophic. Traditional vegetables that can be produced with less resource input investment with similar nutritive values could have the potential to tackle malnutrition than the exotic species, particularly among poor communities in Sierra Leone. Studies have shown that traditional vegetables contain higher nutritional values than the exotic species (Purseglove, 2008). It has, therefore, become necessary to explore alternative nutritional supplements through research that offers the poor and food insecure households with cheap source of essential micro-nutrients for disease prevention. This research will complement other health improvement programmes being carried out in the hard hit Ebola and COVID-19 countries of West Africa.

4.0 Research Approach/Methodology

Objective One:

- Field visits will be made to the major Agro-ecological zones of Sierra Leone where indigenous vegetable production is notable to obtain information on the utilization of indigenous vegetables.
- A household survey using semi-structured questionnaires to solicit baseline information on the utilization of indigenous vegetables in 10 selected villages in each region (South, East, North and West) of the country will be conducted. A sample size of 30 questionnaires per village will be considered for the survey.
- Collection of crops in the wild based on the information collected above will be carried out. The collected crops will be classified to lowest taxonomy levels. Simple random sampling technique will be used targeting 1,200 respondents across the country.
- Both primary and secondary data will be collected.
- Primary data collection will also be through Key Informant Interviews, Consultative meetings, Key Observations and Focus Group Discussions (FGD) with farmers and extension agents where applicable. Lead Farmers, Village Extension Workers and Block extension Supervisors will be targeted as key informants.
- Secondary data collection will involve desk review of relevant information. This will be achieved through sourcing of information from various available sources such as internet, reports, Project Appraisal Document (PAD) and books on indigenous vegetable production.
- Indigenous vegetable species in the wild will also be sourced, collected, identified and recorded.

Objective Two:

- Collection of species in the wild based on information gathered above will be carried out. The collected species will be classified to the lowest taxonomic level based on morphological, phonological and reproductive traits.

Objective Three:

- Evaluation of nutritive values by conducting laboratory analysis on each of the collected indigenous vegetable species to identify essential elements using standard food test procedures For this activity, emphasis will be placed on the presence micro nutrients as the most fundamental to this investigation..
- Interpret laboratory analysis result and record properties of essential nutritive need.

Objective Four:

- .Set up field experimental trial of indigenous vegetable species with essential nutritive and conservation needs;
- Conduct field domestication of indigenous vegetable species with essential nutritive and conservation needs in an experimental trial to closely observe their growth habits;
- A field trial will be set up at the Teaching and Research Farm of the School of Natural Resources, Njala University using a randomized complete block design (RCBD) with the required plot size, treatments and replicates;
- Study, characterize, evaluate and record morphological, phenological and reproductive features, yield potential and market values of targeted indigenous vegetable species under field domestications (ex-situ conservation).
- Statistical analyses will be done in the Statistical Analysis System (SAS) environment. The mean values of treatment will be used in ANOVA analysis and significant difference between the means will be determined using the Student-Newman-Keuls (SNK) at ($p \leq 0.05$).

Objective Five:

Develop and production and management guidelines and manuals on indigenous vegetable species with desirable growth and nutritive characters and conservation needs as identified during domestication.

5.0 Expected Outcomes

The following will be expected from the study:

- Increase awareness and reduce knowledge gap on the strength of utilization of indigenous vegetables at household level;
- Availability of high nutritive indigenous vegetable crops at rural household to more sensitive and vulnerable group such as pregnant women and children;
- Increase food availability, thereby lowering consumers' price of vegetables
- Reduce knowledge gap on the domestication of indigenous vegetable crops under field conditions;
- Enhance scientific knowledge on the potential use of under-utilized indigenous vegetable species in tackling malnutrition and food insecurity in Sierra Leone;
- Identification and integration of indigenous vegetable crops in the market supply systems as a pathway to crop diversification;

- Establish a clonal garden of indigenous vegetable crops to serve as a center for multiplication and distribution of planting materials to growers;
- Generate database for linkage between agriculture and nutrition and can inform evidence-based decisions for farmers, agricultural extension services, and policymakers at national level.

6.0 Benefits and Beneficiaries of the Project

Two kinds of benefits will be generated by the project: immediate benefits and longer-term strategic impacts. Immediate project benefits will accrue from the identification traditional vegetable species with nutritive potential for incorporation in to growers' cultivation practices to reduce malnutrition and improve the health of particularly, children and pregnant women. The project will help to improve the food based nutrition through the identification and integration of variety of nutritive vegetable crops in the market supply systems a pathway to crop diversification. The primary beneficiary of the project will be rural and urban vulnerable population who are suffering from micronutrient malnutrition, farmers, especially women, who are impacted by climate change, and the general public who face food insecurity and suffer from unbalanced diets. Rural families are expected to improve on the nutrition of their diets and increase their incomes. The secondary beneficiary of this project will be researchers and extension agents who may not usually have the resource and technology. The private sectors who are engaged in vegetable seed, food processing and health food industries will also benefit from this project. They will be in a better position to capitalize indigenous vegetables for the development of small and medium enterprises in the country.

7.0 Knowledge Utilization and Dissemination Plan

The research findings will be disseminated through teaching, seminars and publication in renowned journal to contribute to existing knowledge on food-based nutrition. These approaches fall within the core mandate of the Njala University. The findings will be much useful for agriculture and horticulture students, agro-scientists, extension agents as well as vegetable farmers in the country through teaching publication and seminars. The findings generated from this research will serve as database for linkage between agriculture and nutrition and can inform evidence-based decisions for farmers, agricultural extension services, and policymakers, facilitating the adoption of environmentally friendly and resource-efficient agricultural practices.

8.0 Suitability of Njala University for the Proposed Project

Njala University is uniquely suitable for a project of this nature based on a number of physical, technical, historical, social and sectorial advantages it has over all other similar institutions in Sierra Leone. Njala University was established as an agricultural institution and its main campus has over 1,500 hectares of

land located along the meandering banks of the Taia River. This uncommon geographic feature would have been one of the major factors that made the current site a very attractive one. The campus is well known for its highly fertile land and potentially high agricultural productivity that attracted the former West African Institute for Oil palm Research (WAIFOR) and the current Njala Agricultural Research Centre (NARC) of the Sierra Leone Agricultural Research Institute (SLARI) to the location. These potentials have not gone unnoticed by the locals. It probably explains why the institution is surrounded by vibrant farming communities growing rice, sweet potato, cassava, vegetables, and groundnut among other important food crops.

The Department of Horticulture has a teaching and research demonstration site with developed land area of 10.5 hectares, agro-ecologically ideal for both lowland and upland vegetable production both in the dry and rainy seasons. Besides, Njala University offers a range cross-cutting disciplines and staff members at the Department of Horticulture have a wide range of experience and expertise in the conducting of research on various crops grown in Sierra Leone. The current staff complement at the department range from Senior Lecturers to Lecturers, Instructors, Technicians, and others. All of these are highly trained and experienced individuals who have taught at the University for a good number of years, conducted research on all major crops, served as consultants to many agriculture projects and contributed to some of the major policies relating to national agricultural systems.

9.0 Capacity Building

The project plans to contribute towards both individual and organizational capacity building. One prospective M.Phi student will be assigned to the conduct of this research for findings to be used as requirement of the award of higher degree as a mean of capacity building. Students and other members of the public particularly women farmers will also benefit from this project through formal or some informal kind of education. This will enhance their technical capabilities and empower them to adopt food-based nutrition habit. Tools, equipment and other facilities as project leftover will be handed over to the department of Horticulture for institutional capacity building. While it is expected that the project will provide new dimensions to departmental staff experiences, competence and general expertise, their role will be invaluable to the success of this research.

10.0 Monitoring and Evaluation Strategy

Monitoring and Evaluation are critical for understanding the effectiveness of this project. For successful project implementation, improvement and accountability, regular assessment will be done to allow stakeholders to track progress and hold each other responsible for achieving the project goal. Performance and outcome of the project will be monitored and evaluated according to the project document. The

project will also be evaluated at the formative and summative stage of the life of the project for compliance. Monitoring will be participatory by NSTIC, AAU and Njala University using the NSTIC and AAU monitoring and evaluation templates.

11.0 Implementation Strategy

The project will be implemented by a research team consisting of one representative from the Njala Campus Registry, two from the Department of Horticulture, one from the Department of Nutrition & dietetics and one from the Department of Crop Science, The team will manage the implementation of project activities according to the project document, work plans and budgets, and report to the Ministry of Technical and Higher Education (MTHE) through the R & D unit of Njala University Secretariat. The implementation of project activities will take place in three temporal phases beginning with administrative arrangements, followed by surveying and collection of indigenous vegetable germplasm with essential research need and then the setting up of the research and management sections. The first phase is the perquisite phase and will be followed by the second and third phases which may be run concurrently or separately, depending on the funds available. Procurement of materials will be in accordance with the Fund's Rules and Regulations for the Procurement of Goods and Services in the country.

12.0 Sustainability Plan and Governance System

The project will sustain itself by maintaining its relevance to society through commercializing the research findings. This will be achieved by establishing clonal garden of indigenous vegetable species for multiplication and production of indigenous vegetables for communities. The Clonal Garden is expected to implement a business plan from which income will be generated. Such proceeds will be controlled by the Finance Office of Njala Campus. In return, the University will fund the day-to-day operations of the Centre through a special allocation system from the campus budget. The legal status of the project will be sustained by its position as an established unit of the University, approved by the University Senate and Court. The University will be obligated to ensure that production, research and training operations are sustained in line with the overall strategy and the periodic priorities of the University.

The clonal garden will be established as a unit in the structure of Njala University and like all other units of the University, will be subject to control by the University Administration. The University Administration will therefore identify and recruit suitable candidates for staffing positions for the garden. Detailed operational guidelines will developed and used to guide the unit’s staff on the day to day operations. It will be the responsibility of the Head of the unit to pursue the goal of continuously improving on the unit’s ability to perform production, research and training operations more efficiently.

The University Administration will ensure that the guidelines are accurately interpreted and implemented. It will also ensure that the commercial, training and research activities of the unit are capably handled through the provision of suitable facilities and conducting periodic auditing and monitoring.

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2. Purseglove, W. J. (2008). Tropical Crops (dicotyledons). Longman, London.

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