Sub-theme 1: Animal Production and Health

In Ethiopia, animal production and productivity is very low. As a result, the country is not benefiting much from the huge animal population and genetic diversity it possesses. The low animal productivity is attributable to a number of constraints which include severe feed shortages, lack of appropriate breeds, lack of appropriate technologies that enhance animal productivity, unfavorable local and international market conditions, high disease burdens, poor management practices, lack of favorable policies for developing and utilizing animal resources, etc. Another problem posing challenge to animal production and productivity include, undernourishment, increase in disease incidence, emergence of new diseases, and increasing drug resistance disease. Considering the national research priority and Eastern Ethiopian condition in relation to Haramaya University research mandate area, the following research priority areas are selected to improve the livestock production and productivity of the eastern region

- **Forage Production and Rangeland Management in Eastern Ethiopia:** Improvement of forage species and forage production systems; Invention and adoption of improved forage species and technologies
- **Chicken Productivity Improvement in Eastern Ethiopia:** Evaluation and development of improved synthetic chicken breeds/types; Evaluation of different feeding strategies on local/improved chicken breeds/types; Epidemiological study of ND, IBD and IFC and design controlmethods
- **Sheep and Goat Improvement and Productivity in Eastern Ethiopia:** Introduction and improvement of feed resource technologies; Epidemiological investigation on causes and risk factors of young stock morbidity and mortality in sheep and goats; Assessment of PPR and CCPP in sheep and goats in eastern Ethiopia
- **Camel Productivity Improvement in Eastern Ethiopia:** Evaluation of the genetic performance of camels and selection of camels for economic traits; Improvement of the post-harvest handling, shelf life and quality of camel products; Investigation of camel calf morbidity and mortality and generation of appropriate prevention and control methods
- **Apiculture and Sericulture Development in Eastern Ethiopia:** Introduction and evaluation of different species of bee and silkworm; Introduction and dissemination of different apiculture and sericulture technologies; Intervention methods for disease of bee, grainage and silkworm rearing environment.
- **Dairy Productivity Improvement in Eastern Ethiopia:** Evaluation of different feeding

strategies and improvement of feed resources for milk production, milk quality, and healthiness; Assessment of calf and replacement heifers' husbandry practice; Design and implementation of appropriate control and prevention methods for calf morbidity and mortality; Investigation of the major causes of reproductive disorders and implementation of appropriate mitigation strategies.

- **Beef Productivity Improvement in Eastern Ethiopia:** Genetic improvement of local cattle breeds (particularly Ogaden, Babile and Boran) through selection and breeding; Evaluation of carcass yield and meat quality of local cattle breeds in the region; Different feeding regimen on performance, carcass yield and meat quality; Epidemiological study of beef cattle diseases; Stress factors and welfare issues of beef cattle production/management.

Sub-theme 2: Plant Production and Health

Research on PPH has been conducted for several decades and encouraging results have been obtained both at regional and national scales. However, the crop production and productivity is constrained with many problems in eastern Ethiopia. Since all the problems of crop production and productivity of the region may not addressed in a short period of time the problems that need urgent solution have been identified as priority area for this call. Research areas mainly focused on development of technologies for drought tolerant and moisture stress, farmers' participatory selection of technologies, development of technologies for multi- constraints and multi-cycle production, crop protection, germplasm enhancement and maintenance, quality seed multiplication, characterization and evaluation of fruit crops, neglected crops, plant species, indigenous trees and shrubs, medicinal and aromatic plants, as well as urban and peri-urban agriculture.

Field crops research area

- **Introduction, Evaluation and Generation of Sorghum Technologies:** Sorghum is the major crop produced in eastern Ethiopia. However, the production and productivity of the crop is constrained by several biotic and abiotic factors. Among the abiotic factors are unfavorable climatic conditions and soil physico-chemical properties; and the biotic factors limiting the productivity of the crop are low yielding cultivars, diseases, insect pests, and weeds. Promotion of production packages compatible with the production system are also among the major production constraints. Therefore, development and participatory evaluation of cultivars, and production packages are the research priorities in eastern Ethiopia. The research components are: Introduction, and development of sorghum hybrid seed for different agro ecological areas of eastern Ethiopia; Development and evaluation of sorghum hybrids for striga resistance in

eastern Ethiopia;

- **Generation and Promotion of Maize Technologies in Eastern Ethiopia:** In eastern Ethiopia, the major problems in maize production and productivity are drought, moisture stress, disease and insect pests. The adaptability of maize varieties with enhanced nutritional qualities (protein quality, Pro Vitamin A and improved feed traits) in eastern Ethiopia have not been tested at large and farmers have not participated in selection of maize technologies. Accordingly, to address the problems within a short period of time the research priority area selected for this call are: Introduction, participatory evaluation, and promotion of local and exotic maize germplasms (quality protein maize and normal maize) at various agro ecologies of eastern Ethiopia;
- **Enhancing Lowland Pulse Crops Production and Productivity in Eastern Ethiopia:** In eastern Ethiopia, the production of lowland pulses has multiple advantages including the compatibility of crops to the existing intercropping crop production, enhancement of soil fertility, withstanding drought and moisture stress, providing protein rich food to the community and cash income as an export commodity. However, the production and productivity of the crop is constrained by several biotic and abiotic factors. Among the abiotic factors are unfavorable climatic conditions and soil physico-chemical properties; and biotic factors limiting the productivity of the crop are low yielding cultivars, diseases, and insect pests. The following research components are identified as high priority for this call to address the problems:
    - ✓ Introduction and characterization of common bean, cowpea, and mung bean varieties for different agroecologies of eastern Ethiopia;
    - ✓ Evaluation of the compatibility of available and recently released common bean, cowpea, and mung bean varieties in different cropping system in eastern Ethiopia.
- **Enhancing Groundnut Production and Productivity in Eastern Ethiopia:** Eastern Ethiopia is among the major groundnut producing regions in the country. The crop has a potential to alleviate food and nutrition security problems. It is also a high potential crop as export commodity that will be a good opportunity to generate additional income to poor farmers in moisture stress areas of lowland Ethiopia. However, the production and productivity of the crop is constrained by unavailability of improved technologies to farmers. In addition, Aflatoxin contamination limited export to international market. Accordingly, the following research areas are identified as high priority for this call
    - ✓ Development of improved agronomic practices for groundnut production in eastern

Ethiopia;

- ✓ Demonstration and popularization of improved groundnut varieties in eastern Ethiopia;
- ✓ Development and promotion of post-harvest value addition technologies through product diversification and market access to enhance incomes for farmers and other value chain actors involved in groundnut production, processing, and trade.

- **Introduction, Evaluation, and Generation of Technologies for High Value and Underutilized Vegetable Crops in Eastern Ethiopia:** Many reports indicated that vitamin deficiencies are severe public health problems and reaching at alarming levels especially in rural areas of eastern Ethiopia. Intervention of vegetable technologies is among the measures to tackle the malnutrition. The high value vegetables crops *viz.,* tomato, cabbage, and egg-plant and the underutilized vegetable crops such as Ethiopian mustard ("Yehabesha gomen"), okra, and the newly introduced chaya (tree vegetable) are rich in vitamin A, Fe, Calcium and other micronutrients and can serve the purpose. However, improved technologies for these crops are not available in sufficient quantity and quality in the region. Therefore, research projects are needed to be designed and executed to generate technologies for these crops focusing on the following major areas.
  - Introduction, evaluation, and promotion of high yield and pest resistance open pollinated/hybrid tomato, egg-plant, and cabbage varieties;
  - Introduction, evaluation, and promotion of high yield Ethiopian mustard and exotic okra varieties.
- **Development of Agronomic Practices and Packaging of Quality Seeds** for *Improved Huruta* **Shallot and** *Haramaya I* **Carrot Varieties:** Production of carrot seeds in tropical areas without fulfilling the vernalization requirement is considered as the changing of the distinguishing characteristics of the crop. Seed production from shallot is also one of the most challenging tasks for researchers. However, the researchers of Haramaya University were capable to produce seeds from carrot without vernalization requirement and shallot seeds from vegetatively propagated variety and released as *Haramaya I* carrot and *Improved Huruta* shallot varieties, respectively. Efforts have been made to determine the agronomic practices and identify packaging material for quality seeds of *Haramaya I* and *Improved Huruta* carrot and shallot varieties. However, research outputs are lacking on some agronomic practices. Therefore, research projects addressing the following major research components are required to be designed and executed.

- ✓ Development of improved integrated agronomic practices for quality seed production of *Haramaya I* carrot and *Improved Huruta* shallot varieties in eastern Ethiopia;
- ✓ Assessment of the effect of different agronomic practices on the shelf life of bulbs of *Improved Huruta* shallot and *Haramaya I* carrot variety.

- **Characterization and Development of Potato Technologies for Eastern Ethiopia:** Potato is co-staple food and export commodity and the second economic crop next to of *Khat* in east Hararghe. The production is market driven and the region is known by multiple cycles (two or more production) of potato production in a year. Unlike to the farmers varieties, the improved varieties have long tuber dormancy period and have little time between growing seasons to permit adequate tuber sprouting to be used for multiple cycles' production in a year. The farmers used these local cultivars having short tuber dormancy (one month or less) during dry and *belg* seasons, However, the local cultivars are susceptible to late blight and do not perform well during the main cropping season. Neither Haramaya University nor National Potato Project developed varieties with short tuber dormancy, late blight disease resistant, high yield and quality tuber that satisfy the farmers of east Hararghe in particular and eastern Ethiopia in general. Besides unavailability of improved potato varieties of farmers interest, research was not conducted on farmers cultivars for yield and tuber quality in dry and *belg* seasons under irrigation. Moreover, the region is drought prone area and the scarcity of water for potato production is becoming one of the major production constraints. Thus, this call focus on the following research areas:
  - ✓ Collection, characterization, and promotion of farmers cultivars of potato varieties having short tuber dormancy period, early maturity, high yield, and tuber quality under irrigation;
  - ✓ Assessment of farmers water management practices for potato production and estimate tuber yield reduction due to sub-optimal irrigation water;
  - ✓ Recommendation of optimum irrigation water, and other agronomic practices for high tuber yield and tuber quality that fit to potato production system in the changing climate.
- **Assessment of Fruit Crops Production Constraints and Development of Technologies to Enhance Fruit Production in Eastern Ethiopia:** Currently, eastern Ethiopia has not contributing much to the production of fruit crops. The region was once known as one of fruit crops production regions in the country. The declining fruit production might be contributed by the low contribution of research in sorting out the production constraints and very low research efforts were made to overcome those production constraints. It is known that fruit

research requires prolonged time and huge amount of investment, but the University needs to address the critical fruit production problems before fruit production become nonexistent in the region. Thus, as priority of fruit crops research, the following research components are identified and research projects containing these components are required.

- ✓ Assessment of major fruit crops production and production constraints in eastern Ethiopia;
- ✓ Introduction and evaluation of the adaptation of improved varieties of major fruit crops (avocado, banana, papaya, and passion fruit) in eastern Ethiopia.

- **Postharvest Handling Technologies of Horticultural Crops:** High postharvest losses result in reduced food availability, lower quality foods, and lower nutritional value and/or food safety danger. Most of the past efforts in Ethiopia focused on development and dissemination of better yielding, disease/insect pest resistant varieties for farmers along with production technology packages. But, when production is boosted, prices will fall if there is no means to extend the shelf life via improved postharvest handling, cooling, cold storage or processing into more stable food products. Nevertheless, postharvest handling technologies are absent for most of the horticultural crops. The research focus areas:
  - ✓ Asses postharvest losses and develop improved postharvest technologies;
  - ✓ Create awareness as well as transfer/disseminate technologies, knowledge, and skills on improved postharvest storing and handling practices among the value chain actors (input suppliers, subsistent farmers, retailers, experts, cottage and large-scale food processors).

Crop Protection Research Area

Plant protection forms one of the major components of crop production, as yield is obviously far lower than the potential of the crops due to plant diseases, insect pests, plant-parasitic nematodes and weeds. Susceptible crops could totally fail while some others bear substantial yield loss due to these pests. In addition to yield loss in the field, grains are also lost in transport and storage unless properly handled and managed. Moreover, fruit, vegetables and root crops are much less hardy and are quickly perishable, if care is not taken in their harvesting, handling and transport they will soon decay and become unfit for human consumption. The success of plant protection programs depends on the ability to detect pests. Detection schemes can be designed in different forms of regular surveys. Early intervention is required as soon as signs of damage are detected, rather than later when they are irreversible. Accordingly, the major research focus area identified under Crop Protection includes:

- Asses the distribution and damage level of crop pests (diseases, insect pests. plant-parasitic nematodes, and weeds) on major crops in eastern Ethiopia (regular survey);
- ✓ Develop pest monitoring/forecasting models to predict the seasonal migration and outbreak of persistent, transboundary, and invasive pests.
- ✓ Develop environmentally sound and economically feasible pest management technologies for persistent, emerging and re-emerging pests of major crops in eastern Ethiopia.

- **Indigenous Trees/Shrubs, Aromatic and Medicinal Plants Research Area:** The important role played by indigenous trees and shrubs in natural forest, wood land, and agroforestry system in east Hararghe and their benefit to the environment, livelihoods of the local communities and sustainable development is not well assed and documented. Medicinal plant plays an important role in pharmacology and pharmaceutical chemistry because of its high essential oil content in its different parts in herbal medicine; they are used for their antiseptic properties against infectious diseases of fungal and bacterial origin. However, little information is available about the medicinal plants in eastern Ethiopia. Accordingly, the priority research area focuses on:
  - ✓ Evaluation of the status of indigenous trees, shrubs and analyses of chemical composition and antimicrobial effects of extracts from different parts of medicinal plants in eastern Ethiopia.
- **Multiplication and Maintenance of Released Crop Varieties and Germplasms:** Haramaya University has been contributing a lot to the country in developing crops varieties since its establishment as Agriculture College. The germplasm collected by the University has been the basis for the establishment of national gene bank and thousands of collections were conserved as world wealth at different gene banks. However, the University has failed to maintain its own varieties, collections and introduced crops genotypes. The seed production of crop varieties in the University is not under strict supervision of breeders. Therefore, the following research areas are proposed to be implemented every year. Some of the activities related to this research area are:
  - Maintenance and seed multiplication of potato and sweet potato collections, seed tubers, and cutting of commercial varieties;
  - Maintenance and seed multiplication of field crop varieties and germplasms;
  - Maintenance and seed multiplication of lowland and highland pulse crop varieties and germplasms;

- Maintenance and seed multiplication of commercial varieties and germplasms of oil crops.

- **Urban and Peri-urban Agriculture Research Areas:** Ministry of Finance and Economic Development for Ethiopia (2006) reported that urban population of Ethiopia will increase in two folds by 2020, and urban poverty is currently becoming a growing concern especially in large cities of the country. As a result, Ethiopia may not provide the sufficient food demanded by the growing urban population through imports from rural areas. Thus, cities may need to consider agricultural production in urban areas or urban fringe to reduce the food insecurity and prevalence of poverty. Urban agriculture in Africa was evolved as a response to scant sources of urban economic sustenance i.e. insufficient supply of staple food to cities coupled with declining purchasing power of city dwellers. Currently, millions of urban dwellers are reinforced to restore farming in urban areas throughout many African cities either to supplement their household income or because they cannot afford to meet their daily food needs. Thus, understanding the role that urban agriculture plays in poor urban households is important for any following action to reduce urban food insecurity and improve income of the urban poor. It is viable for efficient urban land use, poverty alleviation, economic development and environmental management as long as it is mainstreamed into urban livelihood policy strategies (Maxwell, 1999 and Mougeut, 2000).Urban agriculture includes agricultural productions such as horticulture, floriculture, forestry, fishery, poultry and livestock mainly in public open spaces within cities and fringe of cities (Deelstra and Girardet, 2004 and Mougeot, 2000).

  Despite the fact that the growth and development of urban agriculture is an economically viable enterprise, official projects and programmes aimed at improving urban agriculture have been relatively rare. This is typically because urban agriculture has not been taken as an integral part of the urban planning process. As a result, no sufficient data are collected on urban agriculture nor does the activity have any identity or validation as a productive sector of the economy in countries like Ethiopia. Urban development planning has tended to neglect urban agriculture over the years. This has led to lack of supportive services to the sector. Urban agricultural practices are underdeveloped. They have not been developed to suit the changing demands for better technology. Urban agriculture has not been encouraged and given its rightful place in the economy. For example, there are no extension services available to the urban farmers. Presently there is no stated policy regarding urban agriculture in Ethiopia. Consequently, the priority research for this year focus on:

- Develop, demonstrate, and disseminate various technologies for urban and peri-urban agriculture to help achieve food security.

Sub-theme 3: Environment, Natural Resource and Climate Change

- **Natural Resource Analysis, Use and Management:** Natural resources support the livelihoods of many poor people. However, there is scarcity of scientific knowledge to identify and addresses problems related to conservation and characterization of major natural resources such as soils, forests, biodiversity and others. Therefore, research project need to be designed and executed to understand the status of natural resources in eastern Ethiopia. Therefore, the selected research priority areas:
  - ✓ Evaluate current natural resource conservation approaches and their effectiveness, and develop effective natural resource conservation technologies;
  - ✓ Develop and utilize biofertilizers for different legume crops and legume-based cropping systems;
  - ✓ Evaluate the current condition of rangeland and quantify its role on pastoralism and pastoralists livelihood.
- **Water Resources Assessment, Development, Utilization, and Management:** The hydrology of eastern part of Ethiopia is based on river, wetland and lake systems. Water from these rivers, lakes and wetlands is becoming insufficient to meet the eastern Ethiopia's growing needs. Currently, eastern Ethiopia is facing serious water crisis in the form of water scarcity for domestic, agricultural and industrial use. However, water resource of eastern Ethiopia is not well studied. They have been overexploited for different purposes without having knowledge on the occurrence, distribution, flows and quality of the groundwater systems. Therefore, detail hydrologic, hydro geologic, and water use and management investigations are needed in the region and the nation as a whole, for sustainable use of the water resources.
  - ✓ Examine the current and future water management demands and challenges.
- **Environmental Research, Development, and Management:** Water pollution has become a growing concern in eastern Ethiopia over the last century as more and more waste is being disposed of in our rivers and lakes. This increase in pollution is harming our food supplies, drinking water and environment. Pollution of water sources from haphazard disposal of solid wastes, discharge of untreated or inadequately treated wastewater to water sources, lack of standard sanitary facilities and poor hygienic practices. A major concern of the presence of

polluting elements in the aquatic environment is related to the negative health effects they may cause in humans, animals, and plants. Accordingly, the following research priority areas are identified:

- ✓ Identify waste management practices and evaluate their effectiveness;
- ✓ Develop waste recycling, treatment, and management technologies.

- **Climate Change and its Management:** Of all the places Ethiopia, eastern Ethiopia and its societies, ecosystems, and agricultural systems are one of the most vulnerable to the effects of climate change. Despite the urgent need to assess the effects of changing climate, current climate predictions, impact assessment and management approaches for eastern Ethiopia are uncertainties. To address this need, the following research priority areas are identified are:
  - ✓ Identify climate smart natural resource management practices and evaluate their effectiveness;
  - ✓ Develop climate change models to predict or forecast climate change impact and develop early warning system.