FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

EAST AFRICA REGIONAL HORTICULTURE WORKSHOP 2022

The International Centre for Evaluation and Development
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THEME:

Assessing on-the- ground challenges and opportunities for innovative ideas and technologies that constrain/contribute to practical and academic horticulture pursuits.

WORKSHOP REPORT

"This Regional Workshop is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of ICED and the Feed the Future Innovation Lab for Horticulture and do not necessarily reflect the views of USAID or the United States Government

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HORTICULTURE INNOVATION LAB

UCDAVIS UNIVERSITY OF CALIFORNIA

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Sincerely,

Dr. David Sarfo Ameyaw
President & CEO
International Centre for Evaluation and Development (ICED)

ABBREVIATIONS

ALVs- African Leafy Vegetables

CBOs- Community Based Organizations

CGIAR- Consultative Group on International Agricultural Research

DRC- Democratic Republic of Congo

EA- East Africa

EAC- East African Countries

EU- European Union

GAP- Good Agronomic Practices

GDP- Gross Domestic Product

GIZ- Deutsche Gesellschaft für International Zusammenarbeit

GYEM- Gender and Youth Empowerment in Horticulture Markets

HIL- Horticulture Innovation Lab

ICED- International Centre for Evaluation and Development

MELTA- Mentorship, Empowerment, Linkages, Training, Access

NGOs- Non-governmental Organizations

SNV- Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)

UAE- United Arab Emirates

USAID- United States Agency for International Development

VMG- Vulnerable and Marginalized Groups

WHO- World Health Organization

EXECUTIVE SUMMARY

The horticulture sector significantly contributes to food and nutrition security, employment creation, poverty alleviation and livelihoods of many households in Kenya, Uganda, and Ethiopia. The sector has enormous potential that remains untapped due to various constraints and challenges at all stages of the supply chain from input supply to market access and consumer preferences. Alongside the challenges, there exists unexplored opportunities for inclusive growth especially for youth and women. Identification and prioritization of the challenges and opportunities by key stakeholders and practitioners in the horticultural value chains is critical for targeted interventions to achieve productive, efficient, sustainable, and inclusive growth of the horticulture sector in East Africa. Therefore, the feed the future Horticulture Innovation Lab together with partner institutions organized a regional consultative workshop to identify opportunities and challenges in the horticultural sector in the East Africa region, which could be explored or addressed through research, capacity building and targeted investments. The findings will guide design and implement locally led, globally supported programs that will produce systemic, sustainable, and inclusive improvements in the horticulture sector.

To achieve this, a regional horticulture consultative workshop themed 'Assessing on-the-ground challenges and opportunities for innovative ideas and technologies that constrain/contribute to practical and academic horticultural pursuits' was convened. The physical workshop was preceded by pre-workshop scoping studies in Kenya, Uganda, and Ethiopia. The purpose of the scoping studies was to identify gaps in the available evidence within the horticulture landscape in the targeted countries. The scoping studies included desk reviews (Kenya and Ethiopia) and key informant surveys complemented by focus group discussions (Uganda). The studies also sought to document emerging trends, innovation advancements within the horticulture sector while highlighting documented challenges and opportunities in key horticultural value chains in the East African Countries. The pre-workshop findings guided the design of a 3-day regional consultative workshop that brought together key stakeholders in the horticulture sector in East Africa. The purpose of the workshop was to validate the findings from the scoping studies and also provide further insights into the challenges and opportunities in the horticulture sector. The hybrid event brought together producers, horticulture sector leaders, researchers, academia, private sector practitioners, development agencies, civil society, NGOs, CBOs, and policy makers to learn, share information, build networks and partnerships. The diverse stakeholders sought to identify challenges, opportunities in the horticulture sector and effective strategies and interventions for systemic, sustainable, and inclusive improvements in the horticulture sector. The workshop theme was unpacked into six sub themes which guided the different workshop sessions including keynote presentations; panel and plenary discussions; breakout sessions/focus group discussions and experience sharing. There were also exhibitions by eight organizations across the region highlighting various projects, activities, and products. This report provides a summary of the key findings of the pre-workshop studies which were corroborated by the deliberations of the three-day regional consultative workshop. The report highlights the key challenges and opportunities at the various stages of the horticultural value chains – from input supply to markets. Opportunities for youth, women and the marginalized as interest groups in the horticulture sector are highlighted. Given the diversity of the sector, the challenges and opportunities highlighted apply indiscriminately to various horticultural value chains. Further, the report highlights research, investment and

capacity gaps in the horticulture sector and interventions to address them. The report also provides a call to action by different stakeholders to ensure a productive, resilient, efficient, sustainable, and inclusive horticulture sector in East Africa.

1.0 INTRODUCTION

The Horticulture sector is key for food and nutrition security and a major engine for economic growth in Kenya, Uganda, and Ethiopia. Horticultural commodities (fruits, vegetables, herbs, and spices) constitute dietary staples for many households. Their vitamin, mineral and fiber content are critical for healthy populations. The sector contributes significantly to the gross domestic product (GDP) and is among the leading foreign exchange earners in the three countries. For example, in Kenya, the horticulture sector contributes 24% of the GDP and earns the

country approximately 150 billion KES (1.5 million USD) annually. In addition, the sector directly employs over 350,000 people and supports another six million people indirectly. The horticulture sector is a source of raw materials for many agro-industries and is seen to have great potential for growth of cottage industries in rural areas. Uganda is second to Nigeria as far as the export of fresh fruits and vegetables is concerned. Uganda currently exports 5.8 million tons of fresh fruits and vegetables annually and aims to raise export earnings to $1 billion annually. The horticulture sector in Uganda contributes about 7% of the GDP and earns the country approximately 114.2 million USD annually. In Ethiopia, the horticulture export sector is young, and has shown quite an exponential growth in the last ten years. However, there is very limited reliable data on the annual contribution of horticulture to Ethiopia's GDP.

Horticultural production in the region is dominated by small scale farmers (>80%) who produce intensively on small parcels of land (some less than 2 acres). Most of the horticultural commodities are consumed in the domestic market and a small percentage exported to various export destinations including the EU, Middle East, China, United Arab Emirates, Australia, and the United Kingdom. In Kenya only 5% of the produce is exported while the rest is consumed locally in the fresh form and a small percentage (<10%) processed. In Uganda, the majority of the horticultural produce, approximately 89% is consumed locally while the remaining percent (11%) is either exported to regional or international markets. A similar trend is observed in Ethiopia where most of the horticultural crops produced by smallholder farmers are consumed locally. After harvest, they are transported to rural market centers for local consumers or are bought at the farm by neighbors. Others are transported to bigger market centers where many producers utilize the open-air markets once or twice a week.

The table below shows the major fruits and vegetables produced in Kenya, Uganda, and Ethiopia – for domestic and export markets.

	Kenya	**Uganda**	**Ethiopia**
Fruits	1. Banana	Mango	Banana
	2. Mango	Banana	Avocado
	3. Avocado	Watermelon	Mango
	4. Passion fruit	Papaya	Papaya
	5. Watermelon	Pineapples	Oranges
Vegetables	1. Kales	Tomatoes	Pepper
	2. Cabbage	Onions	Ethiopian cabbage
	3. Tomatoes	Cabbage	Cabbage
	4. Potatoes	Cucumbers	Tomatoes
	5. French beans (export)	Leafy Indigenous vegetables	Swiss Chard

Mango and banana are among the top five fruits while tomatoes and cabbages top the list of vegetables in all the three countries.

The sector has experienced significant growth over the years driven by increasing demand for nutritious and protective foods locally and globally. The critical role of fruits and vegetables in diets came to the fore during the Covid-19 pandemic when consumption of these commodities as protective foods increased exponentially leading to a sharp increase in their demand. The increasing number of the middle class with more disposable income to spend on high quality, nutritious, safe food and convenience has also driven growth and diversification in the sector. On the other hand, for many, especially the low-income population living in urban areas, consumption of fruits and vegetables is low because of availability and affordability. Therefore, many do not meet the WHO-recommended dietary requirements of 400 g per day. For example, in Kenya only 2.5 million out of a total population of about fifty million, consume the recommended quantities of fruits and vegetables. A similar trend has been reported in Uganda, where the majority of adults do not meet the recommended minimum requirements for fruit and vegetable consumption, with just 1 in 10 adults meeting the recommended minimum. Similarly, the overall consumption of fruit and vegetables in Ethiopia is very low, with only 1.5% of the population consuming the WHO-recommended amount of 5 servings a day (400 g).

Although the region is endowed with favorable agro-ecological and edaphic conditions that favor production of fruits, vegetables, herbs and spices, productivity remains very low. This is attributed to many challenges at the various stages of the value chains. At the production stage, low quality inputs (seeds/seedlings, fertilizers), indiscriminate use of agrochemicals without observing regulations/requirements and other poor crop husbandry practices negatively affect the yields and quality of the horticultural produce. In addition, the majority of the smallholder farmers depend on rainfall for their production hence seasonality in some commodities. This situation has been aggravated by unreliability of rainfall which is attributed to the effect of climate change.

Postproduction, poor harvest, and postharvest management practices have been shown to lead to high postharvest losses estimated to be 40 – 50% of the total production. The losses are attributed to various drivers and causes at the micro, meso and macro levels. Poor market information and market access coupled with poor infrastructure (roads, processing, cold chain) are key drivers of high postharvest losses in the horticultural value chain. The sector is also characterized by inefficiency and long value chains with poorly organized actors. The losers in these inefficient systems are smallholder farmers who lack access to information and technologies to improve their operations. This makes the farmers vulnerable and in most cases are at the mercy of traders who have better knowledge of markets and the market requirements and use this advantage to exploit the farmers. The horticulture sector globally is very dynamic and requires the practitioners to be well versed with knowledge and emerging trends for their ventures to remain competitive and profitable. Multi-thronged strategies to address these challenges present enormous opportunities to engage youth and women in meaningful agribusiness ventures thereby harnessing their unexplored capacity.

Although the individual East African countries have national strategies and policies aimed at developing and improving in-country horticultural sectors, there are also regional initiatives with the same goal. Examples of these include the EAC regional fruits and vegetable strategy and action plan 2020-2030 which is aimed at providing a regional perspective to horticultural investment, promoting effective partnerships in EAC as well as policy harmonization to maximize synergies and sustainable horticultural growth. Another example is the EAC food and nutrition strategy 2018-2022 is aimed at improving sustainable and inclusive agricultural production, strengthen resilience among households, communities and livelihood system and improve access to and utilization of nutritious, diverse, and safe foods. In addition, there is the EAC industrialization strategy 2021-2032 whose objective is to enhance industrial production and productivity and accelerate the structural transformation of the economies of the EAC for attainment of sustainable wealth creation, improved incomes, and a higher standard of living for the community.

Actualization of the national and regional policies and strategies requires targeted investment to address the challenges highlighted. Targeted research and translation of the research into tangible outputs is required to address the challenges. Capacity building at all levels is required to ensure that practitioners in the sector are well equipped with current knowledge and practical skills in the dynamic horticulture sector. Linkages between the various actors through horizontal and vertical integration are key to ensure efficiency and equity in the value chains. An enabling policy environment and political good will are key ingredients for the desired growth in the sector.

In this regard, the Horticulture Innovation Lab (HIL) at University of California Davis is seeking to support local initiatives to address the challenges while harnessing opportunities in the horticulture sector. This will be achieved through a locally led, globally supported program that will produce systemic, sustainable, and inclusive improvements in the horticulture sector. To ensure ownership and buy-in to this initiative, HIL in partnership with regional experts in Horticulture held a regional consultative workshop that brought together diverse stakeholders in the horticulture sector of three feed the future countries in East Africa (Kenya, Uganda, and Ethiopia). The aim of the consultative workshop was to identify challenges and gaps within Africa's horticulture landscape with respect to research, capacity, innovation, and technology. This would then inform specific research, capacity development and investment opportunities.

1.1 Workshop Objectives

The overall objective of the workshop is to identify effective strategies and interventions for ensuring systemic, sustainable, and inclusive improvements in the horticulture sector.

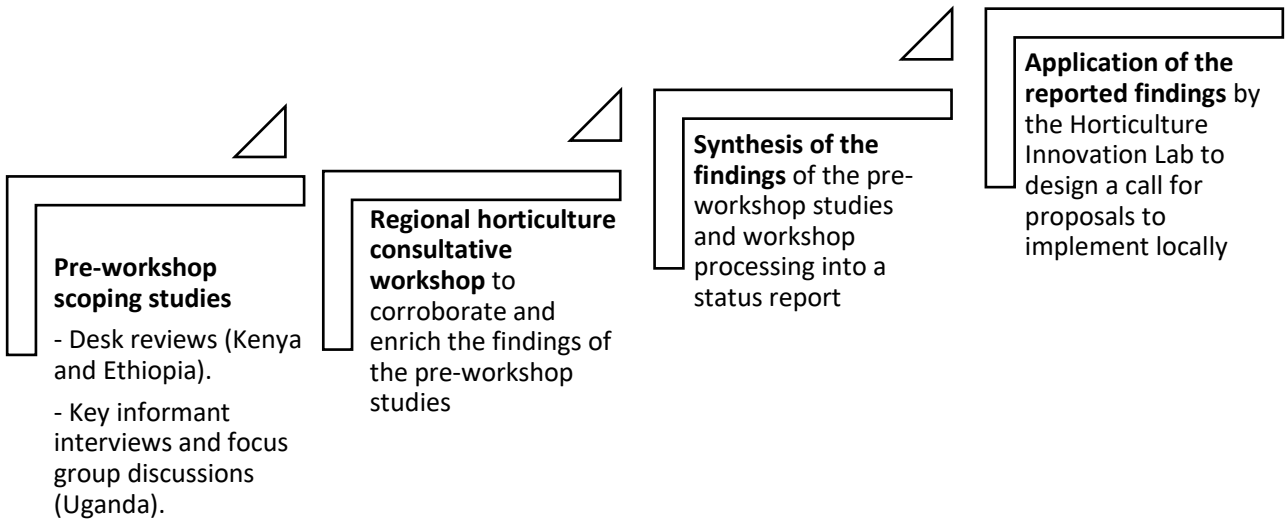
1.2 Specific objectives

1. To facilitate dialogue and present on horticulture opportunities in the region and how they could be effectively explored.
2. To identify effective interventions to address challenges within the horticulture value chain.
3. To agree on a set of priorities for future research, capacity building or investment within the sector.

4. To produce the best possible ways to generate and utilize trustworthy and rigorous evidence and research relevant to Africa's context in support of the horticulture sector
5. To propose models for collaboration and ownership that could be adopted in the region
6. To highlight and share what has worked and what has not worked in using cutting-edge innovation, technologies, research, and evaluation results to enhance growth in the sector.
7. To discuss the impact of the covid-19 pandemic and climate change on the sector as well as and adaptations to improve yield, profitability, and resilient recovery for smallholder farmers.

2.0 APPROACH/METHODOLOGY

The process of gathering information, synthesis, and application of information about the horticulture sectors of Kenya, Uganda and Ethiopia is described below:



2.1 Pre-workshop Studies

The pre-workshop scoping studies were used to systematically map out challenges and opportunities in the regional horticulture sector as documented in literature. The studies also identified evidence gaps with respect to research, capacity building and investment in the sector. These studies yielded a white paper (Kenya) and a sector report (Ethiopia). In the case of Uganda, semi-structured questionnaires were used to conduct focus group discussions and key informant interviews targeting key stakeholders and practitioners along selected horticultural value chains.

The pre-workshop studies were used to map out the key stakeholders in the sector in each country and informed the design/structure of the regional consultative workshop.

2.2 Regional Horticulture Consultative Workshop

The 3-day hybrid workshop was held at the Hermosa Garden Hotel in Nairobi from 25th to 27th May 2022. The workshop brought together a total of 132 participants representing key horticulture sector stakeholders and practitioners. They included representatives of farmers/farmer organizations, input suppliers, private sectors, traders, civil society, sector regulators, government, processors, researchers, academia, development partners, NGOs, CBOs, among others. A total of 73 participants including 37 females and 36 males attended the physical convening while 59 participated virtually through the 'Whova' platform.

2.3 Workshop Theme and Subthemes

The workshop theme '*Assessing on-the-ground challenges and opportunities for innovative ideas and technologies that constrain/contribute to practical and academic horticultural pursuits*' was unpacked into 6 subthemes described below:

1. Production/preharvest	Yield, quality, and efficiency for profitability
2. Postharvest Management	Technologies and practices to preserve quality and reduce
3. Markets	Linkages and access (Local, Regional, and International
4. Consumer demand/preferences	Trends, nutrition awareness and knowledge as the drivers
5. Capacity building	Targeting smallholder farmers and other stakeholders
6. Cross cutting issues	Gender, Vulnerable and Marginalized groups (VMG)

The workshop agenda was structured into various sessions to address each of the six subthemes. The sessions included a framing keynote presentation, panel discussions, plenary discussions, breakout sessions and an experience sharing session by sector practitioners. In addition, there was an exhibition (services, products, and posters) by eight institutions from the three countries.

3.0 FINDINGS

3.1 PRE-WORKSHOP SCOPING STUDY

3.1.1 Kenya Situation

Horticultural production at a farm level in Kenya is quite concentrated, as most households play a part in the production of some horticultural produce. Although production Kenya has modern technology for the large-scale farmers, and even able to use modern techniques to improve the quality of their produce. However, the same is not observed among most of the smallholder farmers, who are the majority. Though Kenya has the ability to meet the high quality and adequate food demand per the vision of the USAID program; Feed Future, there are several challenges that farmers currently face along the horticultural value chain that ought to be first addressed. Farmers in Kenya face a number of pre-harvest challenges. Among them is the increased lack of adequate knowledge and skills concerning sustainable production and proper harvesting techniques among many farmers. This has led to low yields and even promoted the production of low-quality horticultural produce. Similarly, many smallholder farmers lack high quality inputs for their farms due to the involved cost or unavailability, an aspect that limits the quality and quantity of produce. The other major challenge in Kenya is the high population which has seen reduced land available for farming. This has forced farmers to use alternative methods such as hydroponics, vertical gardening, and urban horticulture. In addition, farmers also face wide-ranging pests and diseases, which remains problematic to most Kenyan farmers. The pesticides and herbicides supply in the country is not accessible to all due to the cost involved and sometimes geographical limitations.

Post-harvest management remains one of the biggest challenges for most Kenyan farmers, as it contributes to around 40%–50% post-harvest losses in fruit and vegetables. This occurs due to poor post-harvest handling practices, insufficient and unsuitable storage equipment, inadequate value-addition knowledge, contamination, poor marketing schemes, insects, pests, micro-organisms, and rodents' infestations. It was also observed that their limited adoption rates of new post-harvest innovations mostly due to the high cost involved. Therefore, there is a need to train farmers on proper post-harvest handling methods and value addition of the produce. Further, there is a need to avail post-harvest tools and technologies at a cheaper price for Kenyans in order to increase adoption, thus reduce food wastage.

At the marketing level, it was noted that most of the horticultural commodities in Kenya are procured from small-scale traders in or around municipal markets or retailers selling from small shops, kiosks, or roadside stalls. Locally, the exploitation of farmers by intermediaries is a major marketing constraint in Kenya. Farmers are left with no option rather than to sell their produce to the intermediaries due to lack of cold storage facilities and congested markets. Also, poor road infrastructure in the rural areas contributes to high transportation costs and postharvest losses. In addition, smallholder commercial horticulture is inhibited by insufficient technical information and skills amongst farmers, hindering them from sourcing marketing information. In addition, the high cost of doing business in the country due to high government levies and taxes and cost of utilities remain a problem for many farmers.

Finding cheaper means to promote international market access, especially by sea, would benefit the farmers and the country.

In order to boost horticultural production in Kenya, several opportunities were identified, which if addressed can help address the above-mentioned challenges. This include the need to develop empowerment programs to educate and train farmers across the country, while using tools that are suitable for varying farmers. This will help to increase the level of their production, harvesting and postharvest knowledge and skills. There is also a need to avail quality farm inputs such as fertilizers, herbicides, and pesticides for farmers, at an affordable price. There is a need to fund research to avail high quality seeds that are drought, diseases, and pest resistant, as this will eliminate many of the highlighted constraints in the country. The importance of enacting policies that promote market accessibility, therein shortening the gap between financial and agricultural markets to improve productivity cannot be over emphasized. Another identified opportunity is to conduct survey studies to establish verifiable data on horticultural produce from production statistics, postharvest losses statistics, technologies, and interventions available, the adoption rates and the factors hindering/promoting the adoption percentages. A targeted approach is necessary to reach out to the youth and create “new” jobs and income generating activities that support the development of a sustainable, inclusive sector such as involving them in the digital/technology aspect.

Despite the perceived growing trend of increased consumer awareness in the recent past, there is still low knowledge concerning the importance of healthy eating and quality food in the Country. This has led to consumers in the country still not take as much of the vegetables and fruits as required to meet their health needs. This review identified that consumption of particular horticultural products is impacted by economic capacity. For example, much of the vegetables are consumed by the low-income persons, who use them as the staple food while most fruits are consumed by the middle and upper-income classes designed to boost their immunity. It was noted that consumers in Kenya, especially for fruits and related added-value products are growing sensitive about the agro-processing, packaging, and quality standards in the domestic market, which are still less developed.

Several cross-cutting issues on Gender, Vulnerable and Marginalized Groups (VMG) Involvement strategies were identified, in Kenya. It was observed that contrary to times before, when women were significantly secluded from horticultural farming, the representation of women has been on an increase in Kenya. However, it was noted that there is limited access to vegetable production and marketing training, membership in farmers’ groups, and extension services, for women compared to men. Further, it was observed that women even in the production sector face varying challenges including discrimination during promotion, sexual harassment, and wages, an aspect that continues to demotivate them into taking part in the reduction of hunger in the country. This means that there is a need to promote equality and fairness in the workplace if production is to improve. For the youth, GIZ is implementing a project promoting youth employment in western Kenya where the multidisciplinary team looks to enhance youth employment prospects by better equipping them for the labor market and at the same time increasing the demand for labor and improving labor market functioning and matching mechanisms.

3.1.2 Uganda Situation

Uganda is currently the second largest producer of fresh fruits and vegetables in Sub Saharan Africa after Nigeria, producing about 5.3 million tons per year. The several actors within the horticultural value chain are overly critical for uplifting the horticulture sector, however, each actor plays their own role and cannot be underestimated or substituted for another as they are all key in their own ways. The actors include input dealers, producers, transporters, traders, processors, exporters, researchers, policy makers and (social) media influencers, government institutions and NGOs. The success of the key stakeholder actors in the Uganda value chain was attributed to quality of produce and services offered, technical expertise, experience, passion, commitment, arduous work, creating innovative solutions to problem solving, operating in effective groups and associations with good governance, teamwork, using effective marketing strategies or sensitizations. There is minimum competition since there are not many professional actors in horticulture.as reported by the stakeholders. The full potential of Uganda's horticulture sector is not fully exploited due to a myriad of challenges along the value chain identified by the key stakeholders. This includes limited funds available to finance horticultural research activities, limited technical knowledge by most stakeholders, counterfeit agro-inputs, increasing cost of inputs and production, increasing occurrence of pest and diseases, climate change, corruption, low capital base, inefficient production systems, misconception of horticulture, absence of horticultural research agenda for Uganda and absence of horticultural policy. The low purchasing power of some consumers as they tend to prioritize staple foods, ignorance about the use and importance of fruits, vegetables and herbs in diets and negative attitude towards consumption are some of the key factors affecting consumption of these horticultural produces.

Majority of the stakeholders recorded market systems as a key limiting factor in the horticultural sector. Some of the identified factors limiting market access are low product quality, sanitary and phytosanitary standards, consumers demand, lack of value addition and inconsistent production volumes, pandemics like covid 19 and political instabilities in the neighboring countries. Also, low organization levels of producer groups and associations, lack of access to finance and no infrastructural developments such as transport facilities and advanced storage facilities limit market access. Lack of accredited national testing laboratories has also affected market access. Currently the Hortifresh association is pushing for capacity building to ease compliance to these standards as well as reviewing policies to meet the current trends. The stakeholders reported that in Uganda, there are no professional packaging industry for fresh/dried Fruits and Vegetables and traders are taking advantage of buying produce per bag instead of per kilo of pre-packed produce. Overall, Uganda trends regionally with its neighboring countries such as Kenya, South Sudan, Democratic Republic of Congo (DRC) and Rwanda.

Majority of the stakeholders highlighted that a lot of research work lies on paper and not being implemented and would have otherwise been extremely significant in improving Uganda’s horticulture sector. The first strategy would, therefore, be to effectively implement these research results. The stakeholders confirmed that they are willing to adapt innovative technology so long as it works well for them. However, they will always run trials to see how good the technology is before adapting it. Some will benchmark and see if the technologies are working for their colleagues or other entities then they can take it up. Availability of funds to purchase new equipment and build capacity can enhance uptake of new technology in the country. In order to bridge the gap between research-

extension and end users, the stakeholders recommended for up scaling trainings, capacity building and sensitization programs in the country. Several research gaps to address constraints in the horticulture sector were identified. This includes statistics on average current yields per crop varieties and profitability, profitability of professional production of organic open field crops, lack of market information per horticultural crops as well as germplasm improvement for yield, quality, adaptability and resistance to pests and diseases. Further, access to pest and disease management information for growers, value addition on horticultural produces, market research regarding consumer behaviors, storage solutions, bio inputs and quality preservation and post-harvest handling were identified.

The Ugandan horticulture industry has immense opportunities which includes active research programs in place, Uganda's favorable climate, good soils, supportive government, hospitable and hardworking citizens, large readily available local, regional, and international markets with locally a growing population, high demand for Uganda's fresh fruits and vegetables with widening product ranges, strategic locations to markets, minimal competition in the sector locally. Employment opportunities for the unemployed youth, women, and vulnerable and marginalized groups. Start national promotion and use of improved cultivars and superior varieties in different microclimates combined with creating awareness of Good Horticultural Practices. Establishing certified trader associations in horticulture can help the poorest people to break out of the persistent cycle of poverty.

3.1.3 Ethiopia Situation

The Horticultural sub-sector is important in Ethiopia, where the country produces various types of fruits and vegetables. Most of these commodities are consumed locally, with only a small proportion being exported. In Ethiopia, there is an increased trend in the use of hybrid seeds especially in the vegetable subsector with many international seed companies being active in the country. However, there is a need to strengthen the local seed production industry whose major challenge is seed certification at certified seed production level. To address the challenge of pests and diseases in the country, Integrated Pest Management is being established. However, the tedious process involved in the registration of biological crop protection products is discouraging investment by various international companies. Most of the horticultural production takes place under irrigation in the Central Rift Valley, with both smallholder and investor farmers active in intensive production systems. Therefore, in order to increase production, there is a need to develop sustainable business cases for seed production of local leafy vegetables. So far, limited success has been achieved in this area. Also, more knowledge on soil fertility management is needed, with tailored fertilizer recommendations for the combination of soil type and crop type.

At the postharvest level, the losses are particularly high for fruit crops that have a strong seasonal production peak such as mango and avocado (estimated to be 33.4%). However, there is limited data on postharvest losses in vegetables which seem to have minimal losses attributed to high turnover with the time between harvesting, transport, trade, and consumption often taking place within 48 hours. In terms of postharvest technologies in the sector, there is limited cold chain facilities for domestic produce, and only individual exporters have professional packing and grading centres for specific produce such as green beans, herbs, and avocado. There is a gap in packaging material availability for exports, especially in terms of quality carton boxes, which are still often imported.

For the domestic market, many vegetables are transported in unhygienic large wooden crates in open trucks with limited protection against rain/hail. This results in high mechanical injuries and contributes to low quality produce which is in turn sold at exceptionally low prices. Processing in the county is more developed in the spices sector, however, there are very few fruit/vegetable processors to absorb the available produce especially during the peak season.

Most fruits and vegetable sales run through the district markets, and afterwards the central market in Addis Ababa, as well as intermediaries (brokers/traders). Currently, the new market at Atkilt Terra / Haile Garment is well developed and more organized than before. The larger crop specific wholesalers in the sector dominate the market and set prices. The export phytosanitary system is well developed for flowers, but less so for fruits and vegetables. Individual companies themselves are in the lead for ensuring good phytosanitary standards, with limited government inspection capacity available. There are a few local supermarkets that have stricter sourcing practices in place (Fresh Corner and Queens supermarket), often sourcing from larger commercial farmers that have some form of food safety / hygiene protocols in place. Most of the fruits and vegetables are sold to neighboring countries such as Djibouti and Somalia for banana, citrus, mango and, as well as to the Middle East (UAE and Saudi Arabia) for avocado, melons, and strawberry. Currently, there is limited exports to the EU markets, only for green beans in the Netherlands. There is limited online sales, and used by restaurants (meal deliveries).

The stakeholders identified the presence of many initiatives which are in place, in order to promote the production and consumption of fruits and vegetables in the country both at rural household level and urban centers. These initiatives are often spearheaded by nutrition development programs, focusing on home gardens, local vegetables, and vertical/urban farming. So far, limited scale has been achieved by these projects. Overall, the demand for fruits and vegetables in the county is often high compared to the supply. The well-developed extension system together with projects such as HortiLIFE have supported continuous capacity building especially to the smallholder farmers in the country. This is mostly achieved through farmer field schools' approach where training and demonstration activities are done.

In terms of cross cutting issues (Gender, Vulnerable and Marginalized groups) involvement strategies there are some initiatives to promote gender in horticulture, and involve vulnerable and marginalized groups, especially in project activities. For example, the Netherlands Development Organization (SNV) works on a Gender and Youth Empowerment in Horticulture Markets (GYEM) project. This project aims to enhance women's and youth's social and economic power in the horticulture value chains in Ethiopia. It was noted that, despite women being the majority of laborer, where they provide about 75 percent of farm labor, their production remains about 35 percent less than male farmers due to the low level of accessing extension services and inputs. This means that if empowerment across gender occurs, women ought to be provided with extension and input services, an aspect that would promote production, therein meeting food demand. The issue of decision-making power over production and how income is spent was also identified.

3.2 REGIONAL CONSULTATIVE WORKSHOP

3.2.1. The Horticulture Landscape in East Africa (Kenya, Uganda, and Ethiopia)

Across the region, there is vast potential for production of fresh fruits and vegetables contributing up to 36% GDP in EAC. The industry employs many, contributes to food and nutritional security and agro-industry development, ameliorating poverty amongst the farmers hence the horticultural sector is considered an important driver of regional development. The region has good climatic conditions which favors production of diverse types of fruits and vegetables as well as other horticultural crops. Majority of production is done by smallholder farmers in the open field and rain fed although greenhouse production, irrigation agriculture and hydroponics are picking up in the region. Horticultural production in the region is characterized by use of traditional farming practices, inappropriate use of agricultural inputs such as excess fertilizer application and, inappropriate pest management techniques.

The horticulture sector is not well developed and has not been a priority for the governments in the region. Across the three countries, the government policies in place only focuses on food security crops, for instance, in Ethiopia, it was reported that policies available were mostly on developing cereal crops. It was also observed that land allocated for fruits and vegetables is extremely limited in the region. The fruit and vegetable subsector of horticulture is at low level of development, however, there is encouraging improvement both in area coverage and production in the last few years. The region has now developed policies for growth and development of the sector including 5th EAC development strategy 2016-2021; EAC regional fruits and vegetable strategy and action plan 2020-2030; EAC food and nutrition strategy 2018-2022 and EAC industrialization strategy 2021-2032.

The region is composed of a youthful population around 80% (18-35 years), who are considered innovative and can be exploited to make the horticulture sector competitive through digital innovation, artificial intelligence, and application of big data to optimize crop yields.

3.2.2 Challenges Hindering Productivity and Growth in The Sector

At the pre-production/farm input level, farmers face shortage of supply and untimely delivery of improved seeds and planting materials for horticultural crops. Most farmers use non-certified seeds across the region. This is because only a few organizations participate in quality production of seed or planting materials of fruits and vegetables and their distribution is mostly through the private companies who sell at high prices. This has forced many farmers to retain seeds that produce low yields with poor quality. However, there is a commendable trend that has seen private nurseries booming to bridge the seed gaps especially for African leafy vegetables. Another deterrence to sustainable production is the shortage of fertilizers that usually are sold at high prices. Pest control products that are of poor quality are supplied to farmers mostly by private traders and agrovet who are not certified. For example, it was observed that some of the blacklisted products in Kenya were in use in a neighboring country. Sometimes traders supplied farmers with expired pesticide products which caused quality loss in horticultural produce. Many of the farmers, therefore, opt to plant these crops without these inputs and as such only get low yield from an otherwise very lucrative sector. Also, in some cases, farmers do not follow the instructions laid down by pesticide manufacturers on application procedure and amount to be applied. This results

in marketing of fruits and vegetables, contaminated with chemical residues which cannot be sold in the international markets.

At the production level, high incidence of emerging new pests and diseases such as *Tuta absoluta* in tomatoes, brown rot of potato, banana, which have spread across the East Africa regions has significantly affected horticultural crops. It was also highlighted that many farmers do not have knowledge to identify and classify the pest and diseases and, cannot effectively control and/or seek for appropriate management strategy. Lack of good agricultural practices by smallholder farmers and extension officers has led to production of low-quality fruits and vegetables in the region. Over reliance on rainfed agriculture by majority of the smallholder farmers in the region, has led to total crop failure or low yields due to unreliable rainfall patterns in the recent past.

The region experiences high postharvest losses ranging from 40-50%, especially for the perishable horticultural commodities. This is attributed to poor infrastructure, lack of knowledge regarding cultivar selection in relation to shelf life, low capital base, minimal capacity to handle the produces, failure to observe proper postharvest handling during harvesting, sorting, packaging and transportation. Also, the lack cold storage facilities as many fruits and vegetables require low temperature and high humidity storage conditions to remain fresh for an extended period. This has forced smallholder farmers to sell their produce at low prices at the farm gate. Poor roads and communication networks that are not efficient for timely flow of horticultural produce to the markets further worsens the situation. Lack/limited processing facilities for smallholders in the region is a major challenge. This is mostly attributed to the seasonal supply of most fruits and vegetables leading to input supply problems for the processing industry and this discourages the investment from the private sectors who are driven by sustainability of profits.

Some of the factors hindering market access are little or no market linkages and information exists among producers and potential buyers such as wholesalers, traders, agro-processing companies, and exporters. The farmers are forced to sell their products through negotiation with intermediaries or brokers who in most cases take advantage and buy at extremely low prices. Lack of aggregation centers/failure of farmers being organized into groups, leading to exploitation of individual farmers who have no bargaining power and cannot control market price of their produce. Seasonality of some produce, especially fruits such as mango, results in low prices during the glut period as there are no cold storage facilities for farmers and traders to store their produce. Trade within the region is impeded by bureaucracy and long transportation days to market. The stakeholders noted that it is easier and faster to move produce from Uganda to the Netherlands than it is between Uganda and Kenya because of restrictive border issues and logistical delays for produce with a short lifespan. Restriction of regional and international markets due to emerging pests such as fruit fly and mango weevil which have caused total ban of some produce to specific export markets.

3.2.3 Existing strategies to address the challenges and spur growth in the sector

Investing in research to help producers understand climate variability and specific risks concerning crop phenology, management of extreme heat, rainfall, floods using advanced weather forecast technologies. This will help in predicting more accurate temperature, rainfall and enhance decisions on what to grow at a particular time.

Adoption of new strategies including selection of tolerant cultivars to suit changing climate and reducing carbon footprints. Research should also focus on sensory aspects ALVs and marginalized fruits, value-addition, nutrient bioavailability, research on anti-nutrient in under-utilized fruits and mechanisms to stabilize the active ingredients in value-added products from this group of vegetables and fruits. Strengthening linkages between the farmers and researchers is needed since there is a lot of information being generated by researchers, but it has never been put into use. Through these partnerships, farmers will be able to easily tap to the new knowledge being generated by researchers.

Capacity building to empower farmers to know the importance of using certified quality planting materials, proper use of fertilizers and agrochemicals, and harvesting their produce at the right stage for better quality and shelf life. Also, through training of farmers in phytosanitary measures and compliance to help increase access to lucrative markets. Harmonization of regional policies and strategies to maximize synergies and sustainable horticultural growth will help spur growth in the sector. Providing an enabling environment by the government and the region at large will attract private investors who will transform the region through industrialization in different sectors such as private nurseries, fertilizer production and distribution, pest control products and value addition. Adoption of irrigation technology to minimize over reliance on rainfed agriculture will allow all season production of horticultural produce in the region.

In order to reduce the high post-harvest losses currently being reported in the region, it is necessary to train farmers on proper post-harvest handling methods and value addition of their produce. Further, post-harvest infrastructures including cold technologies, storage, and refrigerated transport for marketing of fresh produce should be availed. Proper packaging materials during transportation such as using crates instead of gunny bags helps reduce injuries which results in loss of quality and faster deterioration at the marketplace. Organizing farmers in groups will make transportation easy since they can transport their produce as a group, help in market access, and it is easy for farmers organized in a group to access capital and invest in innovative technologies such as cold storage facilities. To shorten the otherwise long horticultural chain from farm to market can have some experts source the produce from farmers and sell them to high niche, as is the case of Twiga food in Kenya who are linking farmers directly to markets.

Adopting digitization in marketing is important as this provides opportunities for farmers to sell their produce online, shortening the horticultural chain. In order to reconnect trade within the region, the restrictive border issues and logistical challenges causing delays and spoilage of produce should be addressed. It was noted that the cost of transportation is cheaper from Uganda to Kenya but expensive from Kenya to Uganda, therefore, the region should invest in common logistics. There is a need to explore new markets such as supermarkets, however, it was highlighted that huge wastages arise within the supermarkets and a study needs to be done to ascertain if supermarkets buy only what is needed. In addition, product diversification is needed for marginalized indigenous fruits like jackfruit which can be processed to jackfruit meat and dry jackfruit biscuits.

In order to encourage women and youth participation in the lucrative horticultural sector, there is need to improve access to land by women and youth, implementation of policies and strategies for instance the two-thirds gender rule in Kenya, youth empowerment and implementation of the GAP labor laws are plausible ways to promote gender equality. It is important that while addressing gender issues 'as-a-whole' at the household level where both men and women are considered for empowerment interventions would offer leverage as men would not feel insecure.

3.2.4 Current investment to address the challenges in the sectors – government, development partners

In order to spur sustainable growth of the horticulture sector in the region, collaborations between the government and development partners should be considered. Collaboration is noted to spur success as was the case for Ethiopia where the fruits and vegetable flagship programs included government technical committees and task forces, development partners, academia, research centers like CGIAR engaging rural economic developments stakeholders to champion production and food security. Efforts in collaborations should avoid duplication of responsibilities and enhance efficient utilization of scarce resources.

Government should invest in ensuring good roads and communication networks especially in rural areas where most of the horticultural production takes place. This will ensure timely flow of horticultural produce to the markets. Most of the production sites are not accessible by vehicles and means of transportation are not well developed in the region. Therefore, transportation of produce is done using donkeys, carts, wheelbarrows, humans, and bicycles which takes longer time to reach the market and affects the quality of the produce. Further, the government together with development partners should increase funding to support research directed towards addressing constraints on production, processing, grading, packaging, transportation, marketing, and cold storage. Also, government and development partners should support capacity strengthening through university partnerships, extension programs, effective monitoring, and evaluation of key development areas in the horticulture sector is critical in the region. An enabling policy environment and political good will from the government are key ingredients for the desired growth of the sector.

Both the private and public investments are required to support value addition in each partner state in the region which will help in reducing postharvest losses and enhance market access by producers translating to increased returns. The government as well as development partners can invest in supporting farmers to comply with the current legal market norms and certification requirements especially for the export markets. To enhance value addition and processing of horticultural commodities, it is necessary for the government, private sector, and development partners to invest in value addition and processing facilities. For example, 40% of fruits like avocado goes to waste and therefore, there is a need to involve other specialty markets and players e.g., cosmetic industries to utilize avocado oils.

3.2.5 Emerging threats to the Horticulture sector, their impact and adaptation/mitigation measures

Global pandemics such as Covid-19 was a major threat which caused disruption of incomes in the self-reliant horticulture sector which employs more casual laborer. The pandemic caused heavy fall back on semi-skilled labors

who depended on daily pay to sustain livelihood. There was introduction of new restrictions to movement across nations, flight cancellations and this created disruption in the international markets. Trade within the region was hindered by the extra border checks which resulted in delays that were detrimental to fruits and vegetables. Many businesses were shut, eateries closed, and farmers got stuck with produce leading to huge losses. On the slip side, the pandemic resulted in the boom and demand for herbs with emphasis being given on building immunity to fight Covid-19. Due to lock down, there was increased online marketing through various digital channels. This is a positive impact which will continue beyond the pandemic season.

Climate change is a major threat to the horticultural sector that has grave consequences and impose significant economic costs on horticultural production. The main threats in the horticultural sector include effect on water resources where there is reduction in water levels, erratic weather patterns causing floods and droughts that lead to crop failure and soil fertility losses. Moreover, drastic fluctuations in weather patterns causing elevated temperatures and floods resulted in high incidences of pests and diseases. Research is therefore needed to help producers understand climate variability and specific risks concerning crop phenology, management of extreme heat, rainfall, floods using advanced weather forecast technologies. This will help in predicting more accurate temperature, rainfall and enhance decisions on what to grow at a particular time. There is a need to adopt new strategies including selection of tolerant cultivars to suit changing climate and reducing carbon footprints. Also, there is a need for water harvesting which can be used for crop production through irrigation as we “do not have a contract with the ocean’ where all the runoff goes.

Political instability like instability in DRC, South Sudan and the current war in Ukraine significantly affects the sector by increased transport costs towards markets and increasing input prices. Also, natural calamities like landslides, hailstorms, wild animals from the National parks are very destructive to crops and can harm humans hence threatens productivity. Other threats being experienced in the sector include misuse of chemicals that can have adverse effects on humans and the ecosystem, counterfeit agro-inputs, NGO’s, and donors promoting wrong practices, agro-inputs due to lack of horticultural knowledge/corruption, competition from other regional and international actors, overproduction from neighboring countries, and lack of storage facilities. Very fragile market systems, interception of produces in the international market, poor implementation of policies, increasing pest and disease occurrence, corruption, changing consumers’ taste and weak regulatory framework also threatens the thriving of the sector.

3.2.6 Research/academia disconnect and efforts to bridge the gap

It was observed that research conducted in academic and research institutions do not align with the needs of the small holder and as such are not addressing the pressing challenges that are affecting the sector. This has resulted to a dis-connect between the research institutions and the private sector and farmers. For example, research institutions are known to release new modern varieties which have failed to reach farmers due to the inefficiency of the varietal seed multiplication system. This is due to lack of interdisciplinary collaboration among the producers, and researchers who are key stakeholders in the sector. To address this challenge, there is a need to ‘take innovation from lab to land’ and consider consumer preference right from inception. The adoption of most of the

ideas and technologies by researchers end up failing especially when tried for smallholders for diverse reasons. However, this trend is slowly changing as research organizations such as the University of Nairobi have produced outreach programs for connecting with farmers.

All the stakeholders in the sector (private sectors, academic and non-academic research institutions, government) should therefore, co-create knowledge through a demand driven research that starts with the farmer. Researchers need to have priority focus on rapidly growing areas which include agro-industrialization, affordable eco-friendly cold chain systems, nutritional security, and pest and diseases management for ease adoption in the horticultural sector. Other areas that can receive higher uptake include research in introduction of new varieties, inputs, new post-harvest technologies, new marketing strategies and improved knowledge base for production of horticultural produce.

3.2.7 Capacity building for the Horticulture Sector

The horticulture sector is considered as a catalyst towards poverty alleviations in EAC and therefore everybody needs to be brought on board. Youth, women and VMGs contribute a lot in the horticultural subsector as workers and agents in the region. In order to involve the youth, women and VMGs in horticulture capacity building is needed. This can be achieved through encouraging participation in agriculture through 4k clubs in Kenya, using the family farming model to bring youths on board, encouraging family ties to continue with family agriculture related business, wholesome empowerment for family and promoting community network and campaign programs. Gender mainstream should be emphasized where women and VMGs are purposefully encouraged to form specific groups where they can be trained on diversification to generate income. An acronym concept referred to as 'MELTA' was coined during the workshop to summarize the critical area that needs strengthening. 'MELTA' is anchored on five key points including 'mentorship,' 'empowerment' by being given room to speak, offering 'linkages,' 'training' and improving their 'access' to credit and resources.

It was highlighted that capacity building at all levels along the value chain is crucial to ensure that practitioners in the sector are well equipped with current knowledge and practical skills. Majority of smallholder farmers do not have the skills and knowledge on good agricultural practices of horticultural crops. To improve yield and sustainable production, farmers and extension officers must be trained on the importance of using certified seeds, proper use of agricultural inputs as per the manufacturer's instructions, appropriate pest management techniques, crop diversification, water harvesting and irrigation techniques, and good agronomic practices (GAP) for increased quality produce.

At the postharvest level, there is need to empower farmers on proper post harvesting practices and value addition of the produce. It was reported that many smallholder farmers do not observe proper postharvest handling during harvesting, sorting, packaging, and transportation. As a result, there has been a high incidence of post-harvest losses ranging from 40-50%. If farmers are empowered through training and provision of credit, they can easily acquire processing facilities to enhance value addition of most fruits and vegetables which are seasonal. Further, traders and transporters should be empowered in terms of proper handling of produce during transportation, storage, and display during marketing. Also, traders should be empowered to build associations to harmonize the

modern market system. Farmers, especially the smallholder ones, require training and support to comply with phytosanitary requirements and improve market access to high-end export and regional markets.

The need for capacity building at the government level was highlighted. The existing personnel need to be trained on up-to-date trends in the sector such as current production practices, phytosanitary measures, and demand/market driven approach. Capacity building on better modes of knowledge dissemination adaptable to various stakeholders and research programs in horticulture is very paramount. The stakeholders emphasized on the importance of using tools that are suitable for varying groups along the value chain.

4.0 PRIORITIES FOR THE NEXT 5 YEARS

4.1 PRIORITIES FOR RESEARCH

Better linkages between research/academic institutions and horticulture sector practitioners and the private sector will ensure that research is better aligned to the needs of the sector and that the research outputs/products have the desired impact. Several priority research areas were identified at various stages of the supply chain and described below:

1. **Research to find better/suitable production inputs** includes seed, seedlings, nutrients (organic and inorganic), pest/disease management products. The research areas identified by the stakeholders are summarized in the figure below:

Crop varieties and germplasm/genetic resources

- Mapping available genetic resources/germplasm for various horticultural crops (fruits, vegetables, herbs, spices)
- Establish agro-ecological adaptation for various crops – develop suitability maps for various species and varieties for different agro-ecological zones with respect to yield and quality
- Nutritional profiling of fruits and vegetables (including indigenous species) in different agro-ecological zones
- Establish certified seed and seedlings systems - develop relevant protocols
- Mass propagation protocols (including invitro culture) for selected high value crops
- Research on rootstocks suitable for various soil conditions such as salinity, alkalinity, disease-infected soils, dwarfing traits for some fruit trees
- Breeding and/or selection of better adapted (including drought tolerance) and market demanded accessions/varieties

Pest and disease management

- Mapping and surveillance of pest and diseases of importance in key crops e.g., *Tuta Absoluta* in tomato, fruit fly and mango weevil in mango, false codling moth etc
- Integrated pest management strategies to address the important pests and diseases including optimization of biological control measures, standardization, certification of biopesticides, pest free zones for pests like fruit fly
- Development of a compendium of pest and diseases – useful for farmers and extension agents

Water and nutrient management

- Soil mapping, characterization, and testing to determine suitability for different crops and appropriate nutrient regime
- Alternative nutrient regimes – low external input nutrition programs, generative agricultural programs
- Development and optimization of bio-fertilizers
- Deficit irrigation and water use efficiency studies to optimize yield and quality with less water use

2. Optimization, diversification, and modernization of crop production systems

Good agricultural practices

Optimization of water and nutrient use in horticultural crops

Optimization of integrated pest management options

Use of pollinators in enhanced/assisted pollination and their effect on yield and quality of fruits and vegetables

Precision agriculture

Climate smart production practices and technologies

Off-season production technologies for seasonal crops

Cultural practices such as controlled/deficit irrigation, pruning

Off-season flower induction chemicals

Innovative and modern production systems

Vertical gardens, soil-less culture, aeroponics, hydroponics for high value fruits and vegetables

Develop and/or optimize the sytems

3. **a) Better harvest and postharvest management to preserve quality, reduce losses, diversify utilization, and returns for farmers.** The areas of interventions that require scale up or additional research include:

- Research in maturity indices and maturity prediction methods for fruits and vegetables
- Develop harvest tools to minimize injury on fruits and make harvesting easy even for women
- Adaptive research/optimization of eco-friendly, affordable, and appropriate cold storage facilities/technologies
- Develop optimal ripening technologies/practices for climacteric fruits
- Develop appropriate packaging technologies
- Quality preservation and shelf-life extension technologies to extend marketing period
- Cost/benefit analysis of the postharvest technologies including crates, cold storage, shelf-life extension technologies
- Data – postharvest losses and wastage in horticultural value chains; critical loss points and mitigation measures
- Determine the impact of loss reduction technologies/strategies in priority value chains

b) Value addition and processing ('the sleeping giant')

To awaken the 'sleeping giant' in value addition, there was a proposal to adopt the 'one product per County/region' approach which capitalizes on the major crop produced in each County/Region

- Develop diverse and nutritious food products from fruits, vegetables, spices, and herbs including dried and wet processed products
    - These include blended and fortified products such as juices, nutrient bars, flours etc.
- Development of specialty products targeting niche markets
- Optimization of processing protocols and parameters to ensure nutrient preservation
- Research in valorization of the processing waste into other food and non-food products e.g., wines, animal feed, compost manure, biogas
- Develop standards for new processed products from horticultural commodities

4. Marketing and market access

Market information

Target market requirements for various crops (species, variety, maturity stage etc.)
Specialty market options and volumes demanded e.g., organic
Volumes required and period (season) – domestic and export markets
Volumes produced in various regions and different seasons
Annual/periodic price variation – domestic and export markets
Market stratification for various grades

Market access strategies for smallholder farmers

Available options and their benefits/advantages e.g., contract farming, group marketing through aggregation centers, direct sales to retailers (like supermarkets), use of brokers, off taker model connecting farmers directly to traders (e.g., Twiga foods in Kenya)
Exploit the ready markets in schools and other institutions such as hospitals, prisons - for fresh and processed products

Innovative marketing options

Digital marketing

4.2 PRIORITIES FOR CAPACITY BUILDING

Priorities for capacity strengthening was discussed for each level from input suppliers, breeders, growers to consumers.
Capacity building needs and opportunities for practitioners at different stages of the supply chain were identified as follows:

Input suppliers	Training of input dealers on basic information regarding inputs such as fertilizers, seeds, pesticides e.g., optimum use, safety regulations and requirements, preharvest interval (PHI), MRLs etc. which can also be passed on to their clients (farmers) Training can be done for dealers organized in groups which could be sub-national, national, regional Formation of a professional group, local or regional to ensure that these groups have self-regulation

Breeders	Training in modern breeding technologies targeting priority horticultural crops – through targeted graduate programs - national or regional Harmonize demand-need driven breeding and build synergies in breeding programs within region Develop/streamline the requisite infrastructure for breeding – variety development and/or improvement Support efforts to promote and commercialize locally developed or improved varieties/accessions of horticultural crops in the region
Producers	Training on integrated pest management targeting pest and diseases in key commodities in each country, regional Good agricultural practices to ensure optimized and sustainable production practices for better yields and high-quality standards required by the target markets Optimized soil and nutrient management including agro-ecological production practices Orchard management practices such as pruning/training, thinning, etc Modern farming practices such as vertical gardens, hydroponics, aeroponics etc – especially targeting youthful farmers. e.g., in Kenya, use of the 4K Agriculture clubs in schools Governance, farm management, record keeping and agribusiness skills to manage productive enterprises To do this, there is need for modes of training and training platforms which are practical and highly adaptable to farmer's condition Need for an information portal (digital) where farmers can access relevant information for different horticultural crops including varieties, pests & diseases, production practices, value addition, market opportunities etc
Traders and transporters	Market information gathering Proper handling of produce to reduce postharvest losses Practices to ensure food safety – farm to fork Cold chain management practices and technologies Packaging practices and technologies to preserve quality during transport, at collection centers, at the market Cost benefit analysis of some of the postharvest management technologies such as cold storage, use of plastic crates There is an opportunity to address data gaps e.g., data on postharvest losses There is an opportunity to organize traders in groups based on region, commodity etc. which can be used for training and serve to self-regulation of the traders

Researchers	Designing research for development – bridging the gap between academic research and research for development Packaging and dissemination of research for different users of the research outputs. These include training modules or extension bulletins for farmers, traders, Policy briefs for policy makers and development partners Translation of research findings into products for target end users Commercialization of research into innovative products for end users
Consumers	Awareness campaigns on the importance of fruits and vegetables in the diet and the recommended daily requirement 400 g per day Develop a national or regional campaign strategy to promote consumption of fruits and vegetables Showcase nutritional profiles of important fruits and vegetables – especially the neglected, locally adapted fruits and vegetables Develop and promote recipes for utilization of various fruits, vegetables, herbs, spices Home/kitchen gardens including balcony, rooftop, sack, bucket gardens for urban households Practices for quality preservation and value addition of fruits and vegetables
Government	Capacity building on better modes of knowledge dissemination adaptable to various stakeholders Capacity building to equip government extension officers with modern/up to date knowledge and skills in horticulture – from inputs to markets and consumer trends Training on packaging of information for different stakeholders/practitioners on the sector Need for a government-led coordination unit for horticulture sector practitioners and stakeholders

4.3 PRIORITIES FOR INVESTMENT

Targeted investments are required to address the challenges hindering growth of the horticulture sector. This can be achieved while creating an enabling agribusiness environment at all stages of the value chain. Some of the investment opportunities identified for the different stages of the supply chain are summarized below.

Production

- Facilitate farmers to access quality production inputs including fertilizers, certified seeds, pest/disease management products, on-farm storage technologies, irrigation infrastructure. This could be through cost sharing initiatives, cheap credits, government subsidies and other innovative financing options
- Irrigation coupled with water harvesting to supplement rainfall and ensure year-round and off-season production of fruits and vegetables
- Protected environment production e.g., greenhouses, shade nets
- Harness solar power for various production applications such as irrigation
- Training/capacity building programs for producers
- Smallholder farmers aggregation centers equipped with requisite technologies for postharvest handling and storage of produce

Postharvest management

- Cool chain services for smallholder farmers
- Logistics solutions – farm to fork
- Value addition – technologies and services
- Innovative packing solutions
- Traceability systems
- Capacity building for various practitioners on good postharvest handling practices

Marketing

- Produce and products promotion to enhance consumption
- Market information systems
- Market linkage infrastructure

Finance

- Asset finance
- Cash flow records
- Horticultural crop insurance

Legislation and standardization

- Standardization of weighing scales
- Eco-friendly packaging material to replace plastics and polythene
- Reward mechanism for compliance to standards and quality produce
- Quality based pricing and consumer awareness
- Regulations on market practices such as packaging size and limits
- Simplification of the certification process for inputs and products

Research

- Functional laboratories to offer diverse services to horticulture sector practitioners e.g., soil testing, quality analysis, MRLs testing
- Innovative technologies and quality products to address various challenges in horticultural value chains
- Exchange programs between research institution to enhance research capacities and knowledge exchange

5.0 CALL TO ACTION – WAY FORWARD

Joint complementary multi-stakeholder/multi-institutional actions are required to address the challenges and exploit the opportunities in East Africa's horticulture sector as highlighted in the preceding sections. Some of the action points from the foregoing are highlighted in the section below.

Research	Identify priority research areas and allocate funds to develop research products required to address the prioritized challenges facing practitioners in horticultural value chains of importance at national and/or regional level. Establish centers of excellence in research based on important horticultural crops and/or research areas such as breeding, agronomy/production, postharvest management etc. Train researchers on development of winning proposals for development/research projects that are evidence-based and repeatable Address the deficit of research funds - required for demand driven research. Researchers should create advocacy groups to lobby for funds from various sources including government, private sector, development
Capacity building	Establishing regional centers of excellences or practical training centers for practitioners in the horticulture sector. These could be hosted at research institutions/centers or universities. Such centers will be tasked with capacity building and training of practitioners in horticultural value chains including farmers/producers, extension service providers, transporters, traders (including exporters), processors and others. The centers should be equipped with requisite facilities to impart practical skills for trainees/practitioners from input acquisition to market and market access and agribusiness skills.
Youth and women empowerment	Exploit the enormous potential in well-educated and tech savvy youth in East Africa. This may require retooling youth to provide innovative services and products to horticulture sector practitioners. Leverage the existing programs that target youth in Agriculture e.g., the 4K clubs' initiative in Kenya Empower youth in value addition initiatives and connect them to resources and markets Empower women in rural areas to produce and manage their production for household nutrition and sale of surplus; value addition at the household level to preserve surples produce Adopt comprehensive gender-mainstreaming strategies as a prerequisite for effectively addressing gender-based
Market and market access	Explore innovative strategies to improve market access for smallholder farmers Exploit opportunities in schools and other institutions as a ready market for local farmers - streamline logistics Investment in regional exporting zones to access main export markets. Strengthen the regional market to match the increasing demand from emerging markets e.g., South Sudan, Congo etc. Improve market intelligence to promote market-led production by scheduling of planting and harvesting operations. Harmonization of market standards (including phytosanitary standards) to facilitate regional trade in fresh produce and processed products from fruits, vegetables, herbs, and spices
Postharvest management and loss	Improve the postharvest management infrastructure - farm to market/fork Cold storage facilities at the farm level to aggregate and store smallholder farmers produce as they wait for buyers Cold storage facilities at the market to help small-scale traders preserve perishable produce Processing facilities at the farm and market to transform unsold produce into shelf-stable products
Data gaps	Urgent need to address data gaps in horticultural value chains. Reliable and verifiable data is key lobbying policy interventions. Need for multi-disciplinary teams to work with private sector players to generate requisite data in various commodities and at all stages of the supply chains - from production to markets and consumption patterns.
Coordination and linkages	There is need to establish regional horticulture working group of stakeholders within the sector to drive the exchange of knowledge and services in the region Need for collaboration and coordination of horticultural research initiatives across the region to address challenging interdisciplinary research and development issues Need for horticultural research repository and/or advisory centers. This can serve as a one stop shop for information on horticulture for various stakeholders. An advisory center/unit can serve to offer professional
Consumer awareness	To address the low consumption of fruits and vegetables in the region, there is need for aggressive and targeted campaigns to promote fruit and vegetable consumption. There is need for strategies to make these commodities accessible and affordable to all, especially the low-income households in rural and urban areas