Republic of Liberia
Ministry of Agriculture

Liberia Seed Roadmap

For Rice, Cassava, Maize, Soybean and Fish

2025 – 2030


BASICS-II
SAHEL Consulting
MEDA
AfricaRice
WorldFish
Seed Business
Liberia Maize Seed Roadmap
Seed Business Summit in Liberia
BUILDING A HARMONIZED ROADMAP FOR SEED SECTOR TRANSFORMATION

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Abbreviation and Acronyms

AATF	African Agricultural Technology Foundation
AfDB	African Development Bank
AfricaRice	Africa Rice Center
AGRA	Alliance for a Green Revolution in Africa
ARREST	Agriculture, Roads, Rule of Law, Education, Sanitation and Tourism
BASICS II	Building an Economically Sustainable Cassava Seed System, Phase 2
BMGF	Bill and Melinda Gates Foundation
BRAC	Bangladesh Rehabilitation Assistance Committee
CAADP	Comprehensive Africa Agriculture Development Program
CARI	Central Agricultural Research Institute
CGIAR	Consultative Group on International Agricultural Research
CORAF	West and Central Africa Council for Agricultural Research Development
CSA	Climate Smart Agriculture
DRC	Democratic Republic of Congo
ECOWAS	Economic Community of West Africa States
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSRP	Food Systems Resilience Program
GAP	Good Agricultural Practices
GAFS	Global Agriculture Food Security Program
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOL	Government of Liberia
GST	Goods and Services Tax
ICT	Information Communications Technology
IITA	International Institute of Tropical Agriculture
IFIs	International Finance Institutions
IMF	International Monetary Fund
IsDB	Islamic Development Bank
JICA	Japan International Cooperation Agency
Kg	Kilogram
LACRA	Liberia Agriculture Commodity Regulatory Authority
LASIP	Liberia Agriculture Sector Investment Plan
LNRDS	Liberia National Rice Development Strategy
LSMFP	Liberia Sustainable Management of Fisheries Project
MEDA	Mennonite Economic Development Associates
MOA	Ministry of Agriculture

Metric Ton	Metric Ton
NAT	National Agriculture Transformation
NaFAA	National Fisheries and Aquaculture Authority
NaFRA	National Fertilizer and Regulation Agency
FUN	Farmer Union Network
NADP	National Agriculture Development Plan
NERICA	New Rice for Africa
NSADP	National Sustainable Agricultural Development
NGO	Non-Governmental Organization
PAPD	Pro Poor Agenda for Prosperity and Development
RRVCDP	Regional Rice Value Chain Development Project
SAA	Sasakawa Africa Association
SAH	Semi-Autotrophic Hydroponics technology
SDCA	Seed Development and Certification Agency
SMP	Seed Multiplication Program
SCADeP	Smallholder Commercialization and Agribusiness Development Project
TAAT	Technologies for African Agricultural Transformation
TASAI	African Seed Access Index
ToT	Training of Trainer
UL	University of Liberia
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for Development
USD	United States Dollar
WAPP	West African Agricultural Productivity Program
WB	World Bank
WFP	World Food Program

Foreword

As Liberia stands at the threshold of a new era in the agricultural landscape, the country seed roadmap has emerged as a beacon of hope and progress. In an event marked by fluctuating climates, evolving market demands, and growing populations, the imperative to revolutionize our approach to agriculture has never been more pressing. His Excellency, President Joseph Nyumah Boakai, a former vice president and a former minister of agriculture, now the country's 26th president has declared agriculture a priority sector to improve food and nutrition security and to create employment opportunities. Delivering his inaugural speech in Monrovia, President Boakai said his government will ensure the provision of incentives for agriculture and facilitate farmers' access to appropriate technologies, as well as improvements of market and trade, storage, and processing infrastructure, among others. Seed is a critical component for agriculture growth and development. The seeds we sow today hold the promise of tomorrow's harvests. They embody the potential to transform livelihoods, bolster economies, and nurture sustainable ecosystems. In recognizing the fundamental role of seeds as the cornerstone of agriculture, we embark on a journey guided by foresight, innovation, and collaboration to improve seed systems.

The Liberia seed roadmap is not merely a document; it is a testament to our collective resolve to harness the power of agriculture as a catalyst for national development. Rooted in the principles of inclusivity, resilience, and sustainability, this roadmap charts a course towards a future where every Liberian farmer can thrive, where every seed sown yield abundance, and where our agricultural sector stands as a pillar of strength and resilience. The seed road map is a fruit of a collaborative effort that involved a wide spectrum of multi-stakeholders from the agricultural industry, including international partners. This was done to ensure that it incorporates all constructive views and suggestions from all key stakeholders and builds on the achievements and strengths of the current government, while ensuring proper alignment to national and regional priorities.

I extend my deepest appreciation to all those who have contributed to the development of this roadmap, from policymakers and agricultural experts to farmers and community leaders. Your dedication and insight have been instrumental in shaping a vision that transcends boundaries and inspires action. I sincerely express my appreciation, to the international technical experts and development partners from the International Agricultural Research Institutions (IARIs), including the Consultative Group on International Agricultural Research CGIAR (International Institute of Tropical Agriculture – IITA, AfricaRice and WorldFish), Bill and Melinda Gates Foundation (BMGF), European Union, World Bank (WB), Islamic Development Bank (IsDB), African Development Bank (AfDB), Building an Economically Sustainable and Integrated Cassava Seed System, Phase 2 (BASICS-II), Technologies for African Agricultural Transformation (TAAT), Clearinghouse and TAAT Compact Coordinators for Rice, Cassava, Maize, and Soybean, as well as the Policy Enabler Compact Coordinator, Sahel Consulting, Sasakawa Africa Association (SAA), Mennonite Economic Development Associates (MEDA), and the African Agricultural Technology Foundation (AATF) provided valuable technical and financial support to the planning process of the road map. I extend my deepest appreciation to all those who have contributed to the development of this roadmap, especially to the Hon. Deputy Minister and Assistant Minister of Technical Services, Ministry of Agriculture, as well as to CARI.

J. Alexander Nuetah, PhD

Minister of Agriculture, Republic of LIBERIA

Acknowledgement

We extend our deepest gratitude to all those who contributed to the successful development of the seed road map. It is through your dedication, expertise, and collaborative spirit that this endeavor has reached fruition. The seed road map is a lateral portion of the agriculture sector, and it's a fundamental pillar of the president's "ARREST" program for Liberia growth, with a goal of increasing the country's food and nutrition security.

We would like to thank national and international technical experts and development partners from the International Agricultural Research Institutions (IARIs), including One CGIAR (IITA, AfricaRice, WorldFish) Bill and Melinda Gates Foundation (BMGF), European Union, World Bank (WB), Islamic Development Bank (IsDB), African Development Bank (AfDB), Building an Economically Sustainable and Integrated Cassava Seed System, Phase 2 (BASICS-II), Technologies for African Agricultural Transformation (TAAT), Clearinghouse and TAAT Compact Coordinators for Rice, Cassava, Maize, Soybean an, as well as the Policy Enabler Compact Coordinator, Sahel Consulting, Sasakawa Africa Association (SAA), Mennonite Economic Development Associates (MEDA), and the African Agricultural Technology Foundation (AATF) for their invaluable insights, unwavering support, and tireless efforts in shaping the seed road map. Your passion for innovation and commitment to sustainability have been instrumental in crafting a comprehensive roadmap that will guide our journey towards a greener, more resilient future.

In addition, , we thank all stakeholders, including farmers, researchers, policymakers, and industry leaders, for their contribution s and feedback have enriched the development process. Your different viewpoints have ensured that the Seed Road Map accurately reflects our communities' needs and goals. We also acknowledge the financial support provided by our development partners, which has enabled us to conduct research, convene workshops, and disseminate findings essential for the creation of the Seed Road Map. Finally, we acknowledge effort of our team members (MoA, LACRA, CARI, and UL) who spent countless hours conceptualizing, developing, and improving the seed road map. Your dedication, creativity, and teamwork have been indispensable throughout this journey. Together, we celebrate this milestone achievement and look forward to realizing the vision outlined in the seed road map, as we work towards a more sustainable and prosperous future for generations to come.

Thank you.

Arthur Bob Karnuah, PhD

Director General

Central Agricultural Research Institute (CARI)

1.0 Executive Summary

Agriculture is the principal source of income for Liberians, supporting many households that produce both food and cash crops. Farmers' adoption of new technologies and practices, however, remains low due to deficiencies in research, extension and agri-input delivery systems, as well as limited access to markets and funding. Furthermore, human and physical capacity to support agricultural development remains low. As a result, while agricultural technology adoption remains low, quality seed, fertilizer, and other agrochemicals are being used inefficiently. For example, the present average yields of rice and cassava are 20% and 50% of the global averages of 4.25 t/ha and 31.61 t/ha, respectively. Maize and other vegetable crops provide similarly low yields. The agricultural sector's poor performance has hampered the national effort to attain food and nutrition sovereignty and create jobs for most of the population who rely on it. Recognizing the critical role of seeds, planting materials, and fish fingerlings in driving the agricultural sector, the government of Liberia in collaboration with national stakeholders, technical, and financial partners and several international agricultural research institutions organized a national seed summit on 25th and 26th March 2024 in Monrovia, Liberia, to support the realization of an agricultural revolution for Liberia through the establishment of an economically sustainable seed system for priority commodities; cassava, maize, rice, aquaculture, and soybean.

The policy makers' commitments -The Office of the President, the Hon. Minister of Agriculture, and the Deputy Ministers of Education and Youth and Sports participated in the entire summit providing policy guidance and inputs to the process and demonstrating the government's commitment to agricultural development. The active participation of stakeholders facilitated the development of relevant activities, the identification of the necessary facilities, human and infrastructural resources, and the budget required to produce and supply climate-smart, consumer-preferred crop varieties and fish breeds, as well as the production and supply of breeder, foundation, and certified seeds and fingerlings to meet national demand. The inclusion of Technical and Financial partners in the roadmap development, enhanced joint ownership for funding support. To meet national rice demand, Liberia will plant 17,768.88 MT of certified seeds in 2025, increasing gradually to 24,462 MT by 2030, covering 424,503 hectares and producing 1.34 million tons of paddy with budget of USD 84.622 million. Cassava production will require 5 million cuttings in 2025, increasing to 50 million by 2030, to cover 5,000 ha and generate 150,000 MT of roots during the same period with of USD 45 million budget.

Maize will require 2,500 MT of certified seeds in 2025 to plant 100,000 ha, increasing to 3,118 MT by 2030 to plant 124,700 ha and produce about 190,000 tons of grains, for a total budget of USD 22,584,092. Soybean is a newly introduced crop to assist the poultry and livestock sectors; the starting production of certified seeds in 2025 is scheduled at 225 tons, with a progressive increase to 1,125 MT to generate 27,692 MT of grain by 2030at a cost of USD 6,079,000. The number of fish fingerlings is predicted to increase from 27,000 in 2025/2026 to 198,904 by 2029/2030, boosting fish production from 21,600 tons in 2025/2026 to 50,000 tons by 2029/2030 with a budget of USD 13,302,438.80. USD 171,867,530.90 in funding would be required to fully implement the seed sector development roadmap for the key commodities in Liberia over a five-year period thereby, achieving food sovereignty and wealth creation. However, based on the financial situation and prioritization of the separate value chains, the scheduled activities and budget can be altered as needed.

2.0 Background and Context

2.1. Staple Crops and Fish Production in Liberia

2.1.1. Performance of Key Food Crops: Agriculture is the primary livelihood for more than 60 percent of Liberia's population and provides sustenance for many households engaging in cassava, rubber, rice, oil palm, cocoa, or sugarcane production. Farmers' adoption of improved technologies and practices, however, remains low as the pipeline that links research, release and adoption of agriculture technologies remains weak, and the use of quality seed, fertilizer and other agrochemicals is suboptimal. The current average yield of the main staple crop, rice, therefore stands as low as 1.06 t/ha (compared to 4 t/ha and 7-10 t/ha potentials for upland and lowland rice verities, respectively), with the corresponding production of 225,600 tons per annum. The yield of cassava is as low as 8.20 t/ha (compared to 40-60 t/ha potential of improved cassava varieties) with corresponding production of 625,000 tons per annum.

2.1.2. National Agricultural Policies, Efforts, and Investments: The second generation of the Liberia Agriculture Sector Investment Plan (LASIP II, 2018 - 2023) was the previous Government's commitment to diversify the economy and give priority to agriculture. LASIP II supported critical value chains such as rice, rubber, cassava, and livestock among others. The new administration under President Joseph Nyumah Boakai is set to launch a six-year National Agriculture Development Plan (NADP) in which Liberia would adopt a value-chain approach to develop the agriculture sector for self-sufficiency and food security. The NADP is a testament to the government's unwavering commitment to improving the country's agricultural landscape and is fully aligned with the national anti-poverty, pro-prosperity development instrument, ARREST Agenda. The NAPD will direct government investment and guide the engagement of development partners and stakeholders who support agriculture in Liberia[1].

2.1.3. Rice Value Chain: The main flagship project under Liberia's Food and Agriculture Delivery Compact (emerging from the Dakar 2 Summit) is to undertake structural transformation of the rice sector. The Compact focuses on large-scale commercial rice production to supply 75 percent of national demand for rice and help to close the gap in supply and reduce imports to zero percent. To support this, the Government of Liberia has developed flagship projects in mechanized and irrigated agriculture, livestock feed, and organic fertilizer production. The specific objectives set for the rice value chain are: (i) to produce 400,000 additional tons of paddy rice (264,000 tons of white rice) by 2028, (ii) to create marketable surpluses and (iii) to reduce imports to 0%. The actions to be undertaken include: (i) the development of an additional 20,000 hectares of lowlands under irrigation (total water control), to support 2 crops per year, (ii) various scenarios for yield improvement are projected, ranging from Low: 4 t/ha, Medium: 7 t/ha and High: 10 t/ha, (iii) taking the medium scenario of 7 t/ha. It is worth noting that the current average rice yields in Liberia are approximately 1.06 tons per hectare.

The 20,000 ha of land targeted will include: 7,000 ha from Hydroplan areas (in Grand Gedeh, Grand Kru, Maryland, Nimba and River Gee counties); potential production sites of 6,290 ha in Foya district in Lofa County; and potential 7,050 ha in other.

2.1.4. Cassava Value Chain: Cassava is a very important food crop in Liberia and is regarded as the closest substitute to the main staple of the country, rice. Close to 65,000 hectares are under cassava production across the country and about 90% of cassava is used for human consumption. There is considerable scope for improvement, as average yields of 17 ton/ha have remained well below potential, and despite the availability of different varieties, adoption has remained low. The sector has low levels of processing capacities, only six medium scale processing facilities are in operation across Liberia, located in Montserrado, Bomi, Bong, Sinoe, and Magibi counties. The major challenge of the cassava industry is the inadequate supply of raw materials. In addition, there are difficulties with transportation because of inadequate roads, and fragmented and widely dispersed cassava production areas. The government of Liberia was a signatory to the Dakar 2 declaration on food sovereignty and resilience that conveyed the vision, challenges, and opportunities for improving productivity, infrastructure, processing, and value addition markets and financing of agriculture in the country. Liberia prioritized cassava

1 **https://www.moa.gov.lr>media>press** releases. The Minister of Agriculture Outlines an Ambitious Plan to Revamp Liberia's Agriculture Sector

in the Country's Food and Agriculture Delivery Compact due to its importance as the second most important staple food after rice. The goals of the government under Dakar 2 are: (i) to increase productivity on existing farmlands by making readily available and accessible high yielding planting materials targeting 30 tons per hectare, and (ii) to access agri-food markets through processing, storage and transportation solutions for cassava and cassava products. Farmers' access to seeds of climate-smart and highly performing cassava variety would be vital in achieving these goals.

2.1.5. Maize and Soybean Value Chains: Although maize and soybean in Liberia are not considered as major value chains, there is a potential for their production in the country for food diversification and poultry production. The green maize production in Liberia increased from 11,500 tons in 1973 to 24,853.14 tons in 2022 growing at an average annual rate of 1.63%. Likewise, soybean production in Liberia increased from 1,300 tons in 1973 to 3,348.22 tons in 2022 growing at an average annual rate of 2.11%. It is anticipated that the development of the seed roadmap will provide the framework and resources to boost the production of maize and soybean alongside the major crop commodities.

2.1.6. Fish Value Chain: The fisheries and aquaculture sector of Liberia provides about 65% of the animal protein needs of the country. The sector contributes about 10% to the gross domestic product (GDP) of Liberia and creates jobs and income earning opportunities and revenue for the central government. In 2017, employment data showed a total of 35,054 people in both fisheries and aquaculture. According to FAOSTAT, in 2021, fish consumption per capita reached 4.18 kg in Liberia which is 2.11% less than in the previous year. In 1984, fish consumption per capita in Liberia reached an all-time high of 17.6 kg and an all-time low of 2.60 kg in 2009. Extensive damage was done to the fisheries and aquaculture sector during the civil conflict of Liberia thus decreasing the per capita consumption to 3.31 kg.in 2008. However, the fisheries and aquaculture sector experienced some marginal recovery since then and in 2018, per capita consumption increased to 4.49 kg. Between 2008 and 2018, production also increased from 7,950 tons to 14,360 tons, representing an annual average growth rate of 5.52%. Aquaculture sector actors decried the high cost of fish feed, poor quality of fish seed, fingerlings, as the major challenges. Despite these challenges, the aquaculture sector holds huge untapped potential. The aquaculture data base establishment and routine data collection exercise conducted by NaFAA and fish farmer cooperatives in 2023 under the Liberia Sustainable Management of Fisheries Project (LSMFP) indicated a national aquaculture production of 1,300 tons. There are about 1,000 smallholder fish farmers scattered around the country, with a total aquaculture production area of 187 hectares (FishLib 2022).

2.1.7. The Seed System in Liberia: Seed is the means for delivering agricultural innovations--varieties and technologies to farmers. "Seed defines the upper limit of what farmers can get". If farmers continue to use low yielding, unimproved varieties, no matter how we invest to modernize the input supply system, and extension, there is absolutely nothing that can be done to increase productivity. Hence, the challenge of seed supply must be tackled to ensure availability, accessibility, affordability, and sustainability. The use of quality seeds and planting materials contributes close to 40% of agricultural productivity improvement and together with appropriate fertilizers contribute 70%. The increase in supply of quality certified seeds and planting materials to farmers will therefore boost crop productivity significantly.

Although agriculture is a significant sector in Liberia's economy, employing a large portion of the population and contributing to the country's GDP, the sector faces various challenges, including limited access to modern agricultural inputs and technology, limited availability of quality seeds, weak seed production and distribution infrastructure, lack of access to improved varieties, and the absence of formal seed systems. Many farmers rely on saved seeds from previous harvests or informal seed networks, which may not always be of high quality or well-adapted to local conditions. Liberia lacks robust seed production and distribution infrastructure. There are limited facilities for seed processing, storage, and distribution, which hampers efforts to produce and deliver quality seeds to farmers in a timely manner. Furthermore, farmers have limited access to improved seed varieties that offer higher yields, disease resistance, and other desirable traits. This is partly due to the challenges in seed production, distribution, and certification mentioned earlier. Most farmers rely on informal seed systems, such as saving seeds from their own harvests or exchanging seeds with neighbors and relatives. While these

informal systems can be important for maintaining local crop diversity, over time, they do not always provide access to improved varieties or quality seeds.

Thus, the seed sector in Liberia is grossly underdeveloped with poor seed regulatory systems, low supply of breeder, foundation and certified seeds, weak human, and infrastructural capacity at research institutions for variety releases and maintenance, breeder seed production and storage, weak private sector capacity, inadequate implementation of seed policy, seed regulations, seed laws, etc.

While the seed system in Liberia faces significant challenges, there are also opportunities for improvement through targeted interventions, investment in infrastructure and capacity building, and the promotion of community-based and formal seed systems for rice, cassava, maize, Soybean and Fish. These efforts are crucial for enhancing agricultural productivity, resilience, and food security in Liberia.

3.0 Evidence of Previous Interventions by Partners

3.1. Support of TAAT through TASAI for Liberia's Seed System Assessment

The assessment conducted through the African Seed Access Index (TASAI), revealed critical weaknesses in the seed sector. As of 2017, nine (9) seed enterprises and seven (7) seed producers were operational in Liberia, mainly focussed on rice. The number of active plant breeders at CARI were five (5) and between 2000 and 2020, 27 varieties (17 rice and 10 maize) were released. Certified seeds of rice, maize, cowpea, and groundnut produced in 2017 totalled 437 tons with rice constituting 74%; of the total seeds produced, 51% was sold. The source of early generation seeds has mainly been CARI (56%) and AfricaRice (2%) with the remaining coming from informal sources. The Seed Board, the National Seed Development and Certification Agency (NSDCA) and the National Variety Release Committee (NVRC) were not fully functional and seed imports and exports were regulated through the National Quarantine and Environment Services (NQES) of the Ministry of Agriculture.

3.2. Support of AfricaRice:

AfricaRice has implemented the United States Agency for Development (USAID) funded Development of Smart Innovation through Research in Agriculture (DeSIRA) project for rice-aquaculture integration to improve food and nutrition security in Liberia. From 2020 to 2023, a total of 355 households had adopted the technology, under an area of 53ha of fish farms and trained 1,350 extensionists on integrated rice-fish systems. Currently, the EU is supporting AfricaRice, IITA, WorldFish to strengthen the Liberian seed system with respect to rice, cassava, cowpea, cocoa, and fish value chains. Two specific objectives related to seed system improvement are: (i) enhance the capacity of the Central Agricultural Research Institute (CARI), the National Fisheries and Aquaculture Authority, the Ministry of Agriculture, and the University of Liberia to produce, store and supply breeder seeds/ seedlings of target commodities and (ii) to strengthen the capacity of seed enterprises and producers to produce, store and supply foundation and certified seeds.

3.3. Support of TAAT:

In mitigating the impact of the COVID-19 epidemic on food security, the African Union Commission provided financial resources to the tune of USD 5 million through the AfDB in March 2021 to sixteen most impacted countries, including Liberia to address the crises. Seeds acquired by Liberia and distributed to farmers through the facilitation of the TAAT clearing house were as follows: 40 MT of NERICA L-19 and NERICA 4 rice certified seeds and 0.4 MT of foundation seeds, as well as 20 MT of yellow maize (KOMCALE variety) foundation seed. In addition, 8 metric tons of fish fingerlings were distributed. A total of 1,600 farmers benefited.

Last year July, four Liberian seed enterprises were among 20 (anchoring to over 36,000 out-growers) in five countries that benefited from two trainings organized by AfricaRice / TAAT Rice Compact. The outputs were, (i) capacities strengthened in the best practices of seed production, processing, storage, packaging, and marketing based on the Economic Community of West Africa States (ECOWAS) standards for national and regional trade, (i) secondly, to adopt a digital tool for farmer / beneficiary profiling, registration of out-growers and farmers, aggregation of seeds, provision of technical services, management credit payments and repayments, recording field coordinates, and the management of field data, as well as the monitoring of operations using a laptop dashboard.

The TAAT clearing house also supported the Ministry of Agriculture in the implementation of the AfDB funded AEFPF project in Liberia through support missions with AfDB personnel. The project reached out to 7,641 farmers and supplied 101 MT of rice seeds and 400 MT of fertilizer which covered 10,000 ha of land. Currently, AfricaRice, IITA, and WorldFish are

implementing the European Union (EU) funded project namely, building resilient seed systems for rice, cassava, cowpea, cocoa, and fish value chains to strengthen food and economic diversification in Liberia with the objective to strengthen the seed systems and productivity of these value chains within the period of five years for the benefit of millions of Liberians.

International institutions also supported Liberia in the management of the invasive caterpillar outbreak in 2023. Through networking between Liberian stakeholders and the CGIAR Centres, many improved crop varieties of rice, maize, cassava, and many crops have been introduced in Liberia. The upcoming development of the Seed Roadmap is a systematic activity being carried out in about 30 African Countries, Liberia inclusive, to harmonize approaches to improving seed supply in Africa. These few highlighted examples demonstrate the value that the international institutions mobilized through One-CG with the TAAT out-scale model, with seed as a foremost input, can add to the efforts of national institutions and stakeholders to improve crop productivity, food security, and higher farmers' incomes.

3.4. The Contribution of BASICS II

Building an Economically Sustainable Cassava Seed System, Phase 2 (BASICS-II) project jointly provided funds for the first seed business summit in Liberia that brought all the seed actors to a roundtable to chart a roadmap for the country. Furthermore, in the last three years, the BASICS-II project has developed a model (BASICS model) that connects actors in the seed value chain, while ensuring that there is a constant supply of improved disease-free varieties to farmers and at the same time guaranteeing sustainability and shared economic prosperity among seed actors. In Nigeria and Tanzania, the BASICS model has led to the establishment of more than 1,000 seed entrepreneurs, doubled cassava yield, and created wealth among cassava farmers. The BASICS-II project is working closely with CARI to catalyse the model in Liberia. The project built the capacity of CARI's staff in early-generation seed production and supported resource mobilization for the seed system.

4.0 Goal, Objectives, Focus and Outputs

4.1. Goal:

To support the realization of an agricultural revolution for Liberia through the establishment of an economically sustainable seed system for priority crops; cassava, maize, rice, aquaculture, and soybean.

4.2. Objectives:

The objectives of the summit are highlighted as follows:

- To develop a seed systems road map for Liberia.
- To raise awareness on the role of quality seed in agricultural transformation.
- To share best practices in building sustainable cassava, maize, soybean, aquaculture, and rice seed systems and TAAT / BASICS-II value propositions to achieve the Government's goals.
- Advocate for more investments in sustainable cassava, maize, soybean, aquaculture, and rice seed systems for economic prosperity, including job creation and access to affordable foods.
- To advocate for a market for seeds for sustainable development.

4.3. Focus of the Summit:

The Seed system is not purely about seed production per se—rather it's a system within the research-seed supply-use continuum linked to an ecosystem of agricultural development to create a market for agricultural produce and products, which serve as a pull to create the demand for seed, fertilizer, and pesticides. Developing a robust and vibrant seed system with a clear seed roadmap that is well aligned with the country's strategy ensures the delivery of sufficient quantities of seed of the required quality standards, delivered at the right time, right place, and at affordable prices for sustainability. This requires an integrated and holistic approach addressing the following key interventions:

- Conduct a comprehensive seed assessment study and identify key challenges by bringing together and engaging all concerned seed sector stakeholders.
- Creating an enabling environment with proactive policies addressing systemic bottlenecks on policy, regulatory, institutional, and technical constraints that hinder seed sector development consistent with the global seed industry.
- Harmonizing regulation and technical measures addressing variety release and protection, seed certification schemes, sanitary and phytosanitary measures (quarantine), and international seed trade.
- Encourage private sector participation in seed production through appropriate policies and incentives, including access to finance.
- Support fast track variety development, registration, release, and their accelerated seed multiplication.
- Build the capacity of national programs for EGS production.
- Support private sector actors involved in certified seed production.
- Improve access to finance for farmers to access quality seed for higher yields and better incomes.

4.4. Outputs of the Summit:

The summit was built on earlier progress made by the MOA / CARI, USAID, IITA, Global Agriculture Food Security Program (GAFSP), the World Bank (West and Central Africa Council for Agricultural Research Development – CORAF / West African Agricultural Productivity Program - WAAPP), AfDB, EU, FAO, Japan International Cooperation Agency (JICA), Alliance for a Green Revolution in Africa (AGRA), Bangladesh Rehabilitation Assistance Committee (BRAC), World Fish, and AfricaRice in the rice seed sector investments in Liberia over the years. The forum elevated the voices of value chain actors impacted by the cassava, maize, and rice seed system by sharing success stories from the global south on increasing the availability of climate-adaptive, improved, and disease-free seed to improve farmers' livelihoods. It provided the opportunity to share seed development experiences from the Democratic Republic of Congo, Nigeria, Tanzania, etc. and TAAT and BASICS-II value proposition for scaling and replicability to other African countries where cassava, maize, soybean, aquaculture, and rice play significant roles in both income generation and food security. The specific outputs of the summit were:

1. A roadmap charted to channel investments to boost the supply of quality seeds of climate-smart and market-preferred varieties to respond to the growing needs for food and industry.
2. Increased awareness of the economic importance of seed systems (rice, cassava, maize, and soybean) in transforming the agricultural sector in Liberia.
3. Improved policy environment to attract private sector investment in the seed sector.

Keywords for the event: cassava, maize, rice, aquaculture, soybean, sustainable, seed system, resilience, productivity.

5.0 Participants

A total of one hundred and forty-five participants attended the summit. These were individuals from the national agricultural stakeholder groups, donor groups, and international institutions.

5.1. National Stakeholders and Development Partners:

These comprised staff from the MOA, CARI, DeSIRA Integrated Rice-Fish Farming System (IRFFS), Agricultural-Related Universities, National Seed Board (NSD), AfDB, FAO, World Food Program (WFP), World Bank, farmers, seed producers, International Monetary Fund (IMF), USAID, the EU, France, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Ireland, JICA, and China, as well as agencies of the UN system. The Liberia National Aide and NGO Policy of 2020 provides a framework for donor coordination. It guides the principles and goals of projects to meet national objectives and is a reference for the management of official development assistance.

5.2. International Stakeholders:

IITA / TAAT / WorldFish / BASICSII Team: The BMGF, the TAAT-CH and BASICS-II, TAAT Compact Coordinators—Rice / AfricaRice, Maize / AATF, Soybean / IITA, Fish / WorldFish, Cassava / IITA and the Policy Enabler / AATF, Sahel Consulting, Sasakawa Africa Association, Mennonite Economic Development Associates (MEDA), World Food Program (WFP), the private sector (seed and fertilizer, service providers, etc.) and Farmers' Organizations, etc.

6.0 Summary of Proceedings

6.1 Opening of the Summit:

The opening ceremony facilitated by Dr. Godwin Atser of BASICS II, was marked by a welcome address delivered by the IITA Representative in Liberia and Sierra Leone, Dr. Alfred Dixon, who stressed the success of a similar exercise conducted in Sierra Leone last year September, which facilitated the mobilization of financial resources from the donor community to support seed industry and agricultural transformation in the country. This was followed by goodwill messages delivered by the AfDB Director of Agriculture and Agro-Industry, Dr. Martin Fregene (virtual); the Senior Program Officer, BMGF, Mr. Lawrence Kent (virtual); the World Bank Representative, Dr. Usman Gyasi and the Country Representative of the EU, Ms. Geertrui Louwagie who pledged relentless support of their organizations to agricultural development in Liberia and specifically pledged their support to the funding of the seed roadmap, which would be the output of the seed summit. Other goodwill messages were delivered by the Technical Advisor BASICS-II Project, Prof. Lateef Sani, the AfricaRice Representative in Liberia, and the Coordinator of the DeSIRA Project, Dr. Akintayo Inoussa. The speech of the Hon. Minister of Agriculture was delivered by the Hon. Deputy Minister of Agriculture, Mr. Solomon Hedd Williams, who outlined the Ministry's vision for agricultural development. The keynote address was delivered by the Head of the Clearing House, Dr. Solomon Assefa Gizaw.

6.2 Technical Sessions:

The agricultural landscape with respect to the status of the seed industry and access to seeds of important commodities (rice, cassava, soybean, and maize) were highlighted by Mr. Jobson A. Momo, the CARI Seed Specialist. A panel discussion facilitated by Dr. Oluwatoyin Adetunji brought the value chain actors, particularly the farmer organization and the private sector together to discuss the progress, limitations and challenges of farmers and private enterprises in the agricultural sector. Solutions and actions for the future were proposed. The afternoon was marked by presentations on the value proposition, highlighting the successes and achievements of the TAAT Commodity Compacts – Rice, Cassava, Maize, Fish, and Policy. The section which was facilitated by Dr. Ernest Asiedu, the TAAT West Africa Regional Coordinator & Country Engagement Officer, showcased the technological capital that TAAT brings to the table, in supporting Liberia in her agricultural development effort. Success stories on seed sector support that ensure sustainable supply of seeds, planting materials, and fish breeds to farmers were demonstrated. Panel Discussions on Evidence from the BASICS II project "Building an Economically Sustainable Cassava Seed System, Phase 2 (BASICS-II)" facilitated by Dr. Isata Kamanda, the Acting Director General of the Sierra Leonean Agricultural Research Institute (SLARiS) highlighted the successes of BASIC II in transforming cassava into high income cash crop through the commercialization of quality planting materials and cassava roots for industrial processing. Success stories from Tanzania, Nigeria, and DRC were showcased.

On Day 2 of the Seed Summit, the tasks of the group work were introduced by Dr. Daniel Willy, Dr. Francis Nan'gayo, and Dr. Ernest Asiedu after a welcome address by Dr. Dixon. The groups (Rice, Cassava, Maze, and Fisheries in the absence of soybean) went to their respective sessions, selected their chairpersons and rapporteurs, and used the rest of the day to discuss ideas that were captured on the template worksheets provided for eventual development of commodity-specific seed roadmaps. Considerations were given to policy, governance, regulatory, institutional, and legal frameworks, as well as activities on seed production, infrastructural / laboratory and human capacity development, budgeting, etc. At the end of the day, each commodity group presented the work done at plenary and solicited input from participants, which helped advance the development of the respective sections of the roadmap, based on commodities. This was followed by the closing ceremony which was graced by a closing speech from the Hon. Deputy Minister Hedd-Williams and the outline of the next steps in drafting the National Seed Roadmap for Liberia by Dr. Alfred Dixon.

6.3. Conclusion and Closing:

At the end of the summit, conclusions and recommendations were developed, and the elements for the development of the seed roadmap were crafted align with Liberia's agricultural policies and plans: Liberia Agriculture Sector Investment Plan (LASIP II, 2018 - 2023) and the six-year National Agriculture Development Plan (NADP) will form the basis of future investment in the country's seed system.

Figure 1: A functional seed system.

Figure 2: CESSA to strengthen the Liberian seed system.

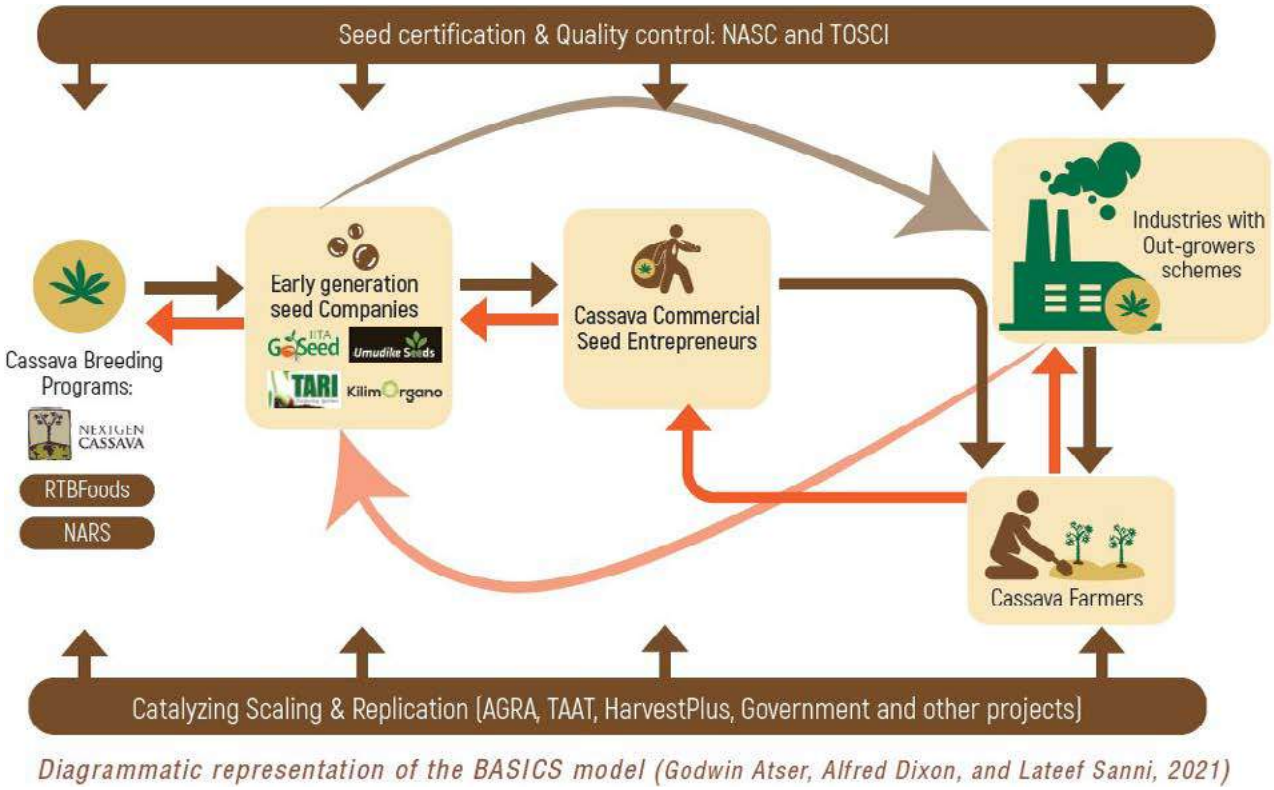

Figure 3: Diagram for cassava seed system proposed for Liberia.

Figure 4: A cross section of participants at the opening of the summit

Figure 5: The High Table at the Opening of the Seed Business Summit

7.0 The Seed Roadmap for Liberia

During the interactive break-out sessions that characterized Day 2 of the Seed Summit, stakeholders brainstormed and set a five-year projection of the quantities of seed required in Liberia for five major value chains (rice, cassava, maize, soybean, and fish). The projections took cognizance of the quest for agricultural transformation espoused in the National Agriculture Development Plan (NADP) and the aspirations and commitments of African governments at the Dakar 2 Summit. Appreciating that achieving the seed projection targets set was ambitious, stakeholders elaborated on current and potential seed production challenges while also highlighting pertinent interventions for mitigating the challenges in a detailed Seed Roadmap structured in five parts capturing the following commodities: rice, cassava, maize, soybean, and fish. These commodities have been recognized as Africa's strategic crops by the AfDB.

7.1 Summary of Road Map for Rice Seed Production

Background:

Liberia National Rice Requirement for Consumption (Milled and Paddy)

Rice is the most important staple food crop in Liberia. The annual per capita consumption of rice of about 72.6 kg per year is amongst the highest in Africa. Rice is predominantly grown in upland and lowland rainfed environments by smallholder farmers. Liberia produces about 309,144 MT of rice with a structural deficit of 364,000 MT; a self-sufficiency ratio of 46%. In 2022, Liberia imported 350,000 MT of rice costing 124 million USD [2].

Given the social and political significance of rice in Liberia, there is a strong need for increasing domestic rice production. The Liberia National Rice Development Strategy (LNRDS-II: 2018-2030) aims to produce 1.344 million tons by 2030. The strategy aims to achieve this by increasing rice productivity in both upland and lowland ecosystems and by expanding the land area under rice cultivation in the irrigated and lowland ecologies whilst reducing exploitation of upland ecologies. The intensive slash and burn of the land to produce food crops like rice have reduced the levels of soil nutrients in uplands, thus affecting the sustainability of rice production in uplands. Whereas in the lowlands, the vast uncultivated land areas, the abundant water resources, and the climatic suitability offer greater potential for increased rice yields and multiple rice cropping cycles.

The LNRDS-II aspires to improve productivity in smallholder rice farms through a value chain approach in which the needs and issues of various subsectors will be addressed through an integrated approach. The six main strategic components of LNRDS-II include (i) Land and water management, (ii) Increasing availability and accessibility of smallholder farmers to farm inputs including seeds and fertilizer and other agro chemicals, (iii) Improving quality of harvest and post-harvest operations, (iv) Increasing access to market, (v) Institutional capacity building, and (vi) Mechanization. The abundant land and water resources of Liberia could play an important role in doubling rice production. The LNRDS-II aspires to rehabilitate existing irrigation infrastructure and construct new irrigation schemes with improved drainage and water storage facilities in the lowlands. The sustainability of rice production will be enhanced through improved land management practices and increased adoption of organic- and inorganic fertilizers and other agro-inputs in smallholder rice farms.

Availability and accessibility of inputs by smallholder farmers will be increased through adaptive research and development in germplasm, seed production, pest and disease management, and labor-saving technologies. Private sector participation in the input supply chain will be promoted through improved rural infrastructure, creation of awareness and demand for inputs, incentives for input use access to finance, extension and advisory services, and public-private partnerships. The competitiveness of locally produced rice will be increased through improved harvest and post-harvest handling practices such as proper harvesting, threshing, drying, cleaning, storage, and milling. Through private sector

2 **https://oec.world** › bilateral-product › rice › reporter › lbr. Rice in Liberia: The Observatory of Economic Complex

participation, the capacity and standards of trading and milling will be increased in rice producing areas. Value addition processes such as parboiling and management of by products such as straw, husk and bran will be increased. Grades and standards for rice grains will be established and streamlined with that of regional and international norms. Access to the market will be improved by increasing the capacities of rural infrastructure such as storage / warehouses, feeder roads, and trading networks.

Land and labor productivity in smallholder rice farms in both uplands and lowlands will be increased by promoting appropriate mechanization options. Policy tools for creating an enabling environment for private sector participation in this subsector will be developed. Institutional capacities on testing and standardization and human resources on grass root level operations, service, maintenance, and extension services will be enhanced in rice producing areas.

Key Assumptions of Seed requirements for rice paddy for rice self-sufficiency

To achieve rice self-sufficiency, the LNRDS-II aims to produce 1.344 million tons of paddy by 2030. Production will be done across all major ecologies. The details for each ecology are indicated in Table 7.1.1 The irrigated ecology will produce 636,756 tons and will account for 47.4% of the target, whilst the lowland and upland ecologies will produce 477, 565 and 229,232 tons and account for 35.5% and 17.1% respectively.

Table 7.1.1. Projected total paddy production per ecology by year 2030.

Ecology	Hectares	Production (MT)	% Production
Irrigated	106,126	636,756	47.39
Lowland	191,026	477,565	35.54
Upland	127,351	229,232	17.06
Total	424,503	1,343,553	100.00

The assumptions are as follows:

- The seeding rate for the irrigated ecology is 25 kg/ha.
- The seeding rate for the lowland ecology is 30 kg/ha.
- The seeding rate for the upland ecology is 50 kg/ha.
- The yield of breeder seed to foundation seed is 3 t/ha; foundation seed to certified is 4 t/ha.
- The yield in the irrigated ecology is 6 t/ha; and the lowland ecology is 2.5 t/ha and the upland is 1.8 t/ha.

1. **Breeder seeds needed to be produced**

   Based on the target of producing 1.34 million tons of paddy by the year 2030, a total of 75 tons of breeder seeds are required to produce the different quantities of foundation seeds. A summary of annual production targets from the year 2024, with a target of nine tons to the year 2030 with a target of 13 tons were determined. Thus, the breeder seed yield is estimated at 1 ton/ha, taking into consideration, wide spacing, field rejections, rogueing, cleaning and grading. Table 7.1.2 shows the quantities (tons) of breeder seeds to be produced yearly from 2024 to 2030.

Table 7.1.2. Breeder, Foundation and Certified seeds, quantities (MT) from 2024-2030

Year	Breeder Seeds Needed (MT) from 2024-2030	Foundation Seeds Needed (MT) from 2024-2030	Total Seeds Certified (MT) from 2024-2030
2024	8.6	102.94	16,470.24
2025	9.3	111.06	17768.8
2026	10.3	123.70	19792.4
2027	11.0	131.71	21073.2
2028	11.3	135.07	21611.3
2029	11.5	137.52	22002.7
2030	12.7	152.89	24462.9
Total	**74.6**	**894.88**	**143,181.51**

2. **Foundation seeds required to be produced**

   Based on the target of producing 1.34 million tons of paddy by the year 2030, a total of 895 tons of foundation seeds are required to produce the different quantities of certified seeds. A summary of annual production targets from the year 2024, with a target of 103 tons to the year 2030 with a target of 153 tons were determined. Thus, the foundation seed yield is estimated at 1 ton/ha, taking into consideration, wide spacing, field rejections, rogueing, cleaning and grading. Table 7.1.2 shows the quantities (MT) of foundation seeds to be produced yearly from 2024 to 2030.

3. **Certified seeds needed to be produced**

   Based on the target of producing 1.34 million tons of paddy by the year 2030, there is the need to produce a total of 143,181.51 tons of certified seed. Table 7.1.2 shows a summary of annual production targets from the year 2024 with a target of 16,470 tons to the year 2030 with a target of 24,463 tons. Table 7.1.2 also shows the quantities (MT) of foundation seeds to be produced yearly from 2024 to 2030.

   Of the 143,181.5 tons of certified seeds spread over 5 years, the irrigated ecology will account for 16,049.5 tons; the lowland ecology will account for 45,579.3 tons the upland ecology will account for 81,552.7 tons (Table 7.1.3). For paddy production, within the period 2024-2030, the area under irrigation should increase from zero to 103,000 ha; the area under lowland ecology will increase from 80,000 to 194,000 ha and the upland ecology will decrease from 166,000 ha to 126,000 ha in line with the LNRDS. The strategy aims to reduce exploitation of the upland ecology from 60% to 15% in its contribution to rice self-sufficiency.

Table 7.1.3. Annual certified seed production targets (metric tons) from 2024-2030

Year	Seeds-Irrigated (MT)	Seeds-Lowland (MT)	Seeds-Upland (MT)	Total Seeds Certified (MT)
2024	0.0	3992.8	12477.5	16,470.24
2025	441.0	4586.8	12741.0	17,768.84
2026	1082.2	5483.2	13227.0	19,792.38
2027	1923.5	6326.2	12823.4	21,073.18
2028	2965.0	7115.9	11530.4	21,611.26
2029	4373.3	8396.8	9232.6	22,002.66
2030	5264.5	9677.6	9520.8	24,462.94
Total	**16049.5**	**45579.3**	**81552.7**	**143181.5**

Table 7.1.4. Estimated Budget to Support Rice Seed Sector Development

Broad Seed System Thematic Area	Budget for 5 Years (US$)	% of Total Budget
Breeding / Breeder Seed Production	2,500,000	2.95
Foundation Seed Production (including 10 mini-harvesters)	1,530,000	1.81
Certified Seed Production & Distribution (including equipment for land preparation, harvesting, drying, processing / conditioning, and storage)	62,500,000	73.86
Quality Assurance and Seed Certification	1,250,000	1.48
Advocacy, Outreach, and Communication	1,000,000	1.18
Extension and Advisory Service	1,250,000	1.48
Capacity Strengthening	3,500,000	4.14
Hermetic storage systems	9,843,230	11.63
Monitoring, Evaluation, Accountability, and Learning	1,250,000	1.48
Grand Total	**84,623,230**	

Proposed Actions for Rice Seed System Improvement

At present there is no fully developed irrigation scheme with total water control in Liberia. The LNRDS-II aims to produce 47.39% of the targeted production by 2030 in the irrigated ecology. This calls for the development of 106,126 hectares of irrigated ecology.

At present there is no dedicated breeder for rice. In this regard it is essential to train adequate manpower to cater for breeding and related areas of seed science for rice.

There is an urgent need to characterize the existing seed value chain to understand its capacities and gaps to meet these targets. There is also an urgent need to operationalize the Seed Development and Certification Agency which is composed of the Certification and Standards Unit and the National Seed Board, to ensure effective quality control of the rice seed system in Liberia.

7.2 Summary of Road Map for Cassava Seed Production

Background

The cassava group set a target of 5,000 ha of seed production of improved cassava varieties, using modern techniques. The cassava seeds experts proposed the overall goal (i.e., 5,000 ha worth of seed) would be more realistic to create a sustainable market and avoid precipitating a glut and market disruption in the seed system.

Key Assumptions

The cassava group set a target of 5,000 ha of improved cassava seed varieties production, cassava seeds experts proposed the overall goal (i.e., 5,000 ha worth of seed) would be more realistic to create a sustainable market in the seed system.

- Each hectare requires 10,000 cuttings. The 5,000 ha will require 50,000,000 cuttings or 10,000,000 stems (assuming 5 cuttings per stem).
- Assuming farmers only need fresh stems every 3 years, then the requirement in terms of stems is 3,333,333, which will require 333 ha to achieve the target (3,333,333 stems divided by 10,000).

- Assuming each Commercial Seed Entrepreneur (CSE) plants one ha seed farm, then we need to incubate 333 CSEs. The number of farmers selling foundation seeds will not exceed five, since 2-3 large companies have the requisite capacity to produce quality foundation. However, during implementation of the action plan, more of the cassava seed producers will be trained.
- The CSEs will need foundation seeds – 3,333,000 cuttings or 666,000 stems to produce certified seeds. (each stem gives 5 cuttings).
- Foundation seeds are produced at 20,000 stems / ha. So, 33 hectares of foundation seed production will require 660,000 cuttings of breeder stems, or 132,000 stems of breeder seeds.
- If breeder seed is produced at 20,000 stems / ha, then 6.6 ha of breeder seed production will require 20,000 Semi Autotrophic Hydroponic (SAH) plantlets per ha or 132,000 SAH plants.

Seed Demand for Liberia for the next 5 years

Based on the assumptions above, Liberia would require 50 million certified stems in the next few years to transform its cassava seed sector. To achieve that goal, the country needs to establish SAH facilities that will produce 132,000 plantlets of breeder seeds which will feed into the foundation seed pipeline (*see table 7.2.1 below*).

Table 7.2.1. Cassava Seed Demand from 2024 to 2028

Cassava					
Years	**2025 / 2026**	**2026 / 2027**	**2028 / 2029**	**2029 / 2030**	**2030 / 2031**
Projection (%)	10%	+15%	+20%	+30%	+25%
	10%	25%	45%	75%	100%
Type of Seed					
Certified Seed (cuttings)	5,000,000	12,500,000	22,500,000	37,500,000	50,000,000
Foundation Seed (cuttings)	333,000	832,500	1,498,500	2,497,500	3,330,000
Breeder Seed (plantlets)	13,200	33,000	59,400	99,000	132,000

Current cassava seed production ecosystem

Currently the cassava seed system in Liberia is generally informal with no active private sector actors in the breeder and foundation seed sector. There are a couple of farmers who grow cassava for root production but in the process also sell stems mostly to NGOs and large-scale farmers. There is no certification agency for cassava seed production. The table below shows the seed actors in Liberia and their seed production performance.

Table 7.2.2. Cassava Seed Multiplication System

Category	Organization / Companies	Production capacity (Ha)	Actual production (Ha) 2022 / 2023
Breeder Seeds	CARI	5	4.1
Foundation Seeds	CARI	100	18
	Private seed companies		
	Foundation seed producers		
	Cylma Holdings	200	0
Informal Seed Actors	Lua Agriculture Cooperative	60	24
	Panama Woman for Future Cooperative Society	50	20
	Sippi town Farmers Group Cooperative Society		15
	Gbawanken Tendeh Rural Women Cooperative Society (GTRWCS)		20
	United Community Agriculture Cooperative Society		7
	Bomi Cooperative Society		7
	Badios Farmer Cooperative Society		10
	Agro Green Agricultural Development Enterprise		144
	Kukatunon Women Cooperative Society		20
	Quitta Agriculture Cooperative Society		30
	Mama Kumba Farm Inc		1
	Liberia Farmers Development Corporation	100	

Rapid assessment of the enabling Environment

The cassava seed sector in Liberia is challenged by several constraints including low capacity / staff strength, especially at its premier institutions responsible for cassava breeding and quality control. For instance, CARI has only one breeder while there is no seed certification agency. The entire cassava seed system needs a general overhaul from breeder seed to certified seed production. These constraints undermine the effectiveness of CARI to play their active roles in the seed ecosystem. CARI has not released any variety since 1996. The table below highlights the current state of cassava seed certification capacity in Liberia.

Table 7.2.3. Current State of Cassava Seed Certification Capacity

Seed Quality Control	Qty
Number of Breeders (Public)	1
Number of Breeders (Private)	0
Number of Seed Inspectors for all crops (@ Liberia Seed Certification Agency)	0
Number of Seed Breeders (Private)	0
Frequency of yearly meeting of Variety Release Committee	0
Number of new varieties released in the last 2 years	0
Number of new varieties released in the last 5 years	0
Volume of seeds imported in the last one year	N/A
Average time taken to release a variety	
Price of Certified Seed (SLL / bundle)	

Proposed Urgent Actions for the Cassava Seed Sector

To establish a viable economically sustainable cassava seed system, there is an urgent need to address the gaps and challenges constraining the realization of the full potential of cassava (***Table 7.2.4.***). Immediate actions are needed in addressing seed production and distribution bottlenecks, as well as certification and quality control. Other areas include capacity building, business development for Early-Generation Seed (EGS) entities, nurturing of Commercial Seed Entrepreneurs (CSEs), advocacy and scaling.

Table 7.2.4. Proposed Actions for Cassava Seed System Improvement

Area	Challenge / Gap	Proposed Actions	Responsible Partners
Seed Production	1. No standardization for land measurement	1. Capacity building on standardized land measurement	CARI, IITA
	2. Low number of breeders and limited varieties in the breeding pipeline	1. Training and capacity building for breeders	CARI, IITA
		2. Funding to breed varieties to meet consumer preferences, adapted to emerging climate change	CARI, IITA
	3. Limited SAH seed multiplication facilities	1. Install SAH multiplication facilities. 2. Establish a commercially viable seed unit in CARI	IITA, CARI, GoSeed, Sahel

Area	Challenge / Gap	Proposed Actions	Responsible Partners
	4. No structured formal seed system	1. Establish a structured seed system that involves Breeders, Foundation, and Certified Seed Producers using the BASICS Model	CARI, IITA, GoSeed, Sahel, SAA
	5. Poor weed control and no mechanized practices for cassava production	1. Capacity building 2. Mechanization and investment for machines for production	IITA, SLARI, CARI
Seed Distribution	1. Poor infrastructure	1. Govt needs to address infrastructural gaps	Government
	2.2. Poor handling of cassava stems	2.Capacity building of cassava producers and distributors	Sahel, GoSeed, SAA, CARI
Seed Certification and Quality Control	1. No seed certification agency	1. Establish a national seed board for seed certification and quality assurance	MOA
		2. Capacity building for inspectors	CARI,
		3. Acquire more diagnostic tools to support inspection and certification	CARI
	2. Lack of certification and seed sector governance	1. Decentralization of seed certification to allow private seed inspectors to compliment staff	CARI
	3. Establish a variety release committee	Release tested genotypes supplied by IITA	CARI, MOA
Seed Distribution and Market Development	1. Poor market for cassava stems	1. Create more awareness and sensitization	CARI, IITA, MEDA, Sahel, MOA
		2. Establish demonstration sites and demand creation trials	CARI, IITA, MOA
		3. Capacity building for CSEs in advertising, marketing, record keeping, group & association etc.	MEDA, Sahel, SAA, and CARI
	2. Weak extension services	Recruit and train more extension officers	MOA

Budget for the Development of the Cassava Seed Sector in Liberia

The estimated total budget for the development of the cassava seed system in Liberia is US $45.0 million *(Table 7.2.5)*. According to the budget, US $5.0 million will be required to urgently establish a national cassava seed certification board. US $8.0 million will be required for cassava breeding to develop new varieties that meet end-user preferences and produce the breeder seeds for sale to foundation seed growers. Commercial Foundation Seed Production using a combination of SAH technology and field methods through a public-private partnership arrangement by CARI requiring a budget of US $4.0 million. Advocacy, Outreach and Communication, need an estimated budget of US $2.8 million each. US $3.2 million is needed for Extension and Advisory Services, US $8.0 million for Capacity Strengthening and US $3.2 million for Monitoring, Evaluation, Accountability, and Learning.

Table 7.2.5. Estimated Budget to Support Cassava Seed Sector Development

Broad seed system thematic area	Budget 5-Year (US$)	% of Total Budget
Establishment of the National Seed Certification Board **(urgently needed)**	5,000,000	11.1
Breeding	8,000,000	17.7
Foundation seed production	4,000,000	8.8
Certified Seed production	8,000,000	17.7
Quality assurance	2,800,000	6.2
Advocacy, Outreach, and Communication	2,800,000	6.2
Extension and Advisory Services	3,200,000	7.3
Capacity Strengthening	8,000,000	17.7
Monitoring, Evaluation, Accountability, and Learning	3,200,000	7.3
Grand Total	**45,000,000**	**100**

Note: There's an urgent need for the establishment of a Seed Certification Board / Council to ensure the development of a viable seed system in Liberia

7.3 Summary of Road Map for Maize Seed Production

Background

There has been a steady increase in the demand for maize in Liberia for both human consumption and livestock feed. The local production is not adequately meeting the demand of grain for stockfeed manufacturing. Some manufacturers are doing backward integration to try and produce adequate grain to supply manufacturing plants.

Preamble of the Maize Seed Road Map Development

The maize seed system of Liberia is not functioning properly, with very limited breeders, no seed certification processes and enforcement, no technical staff for seed inspections and a fragmented out-grower base. The maize seed system is failing to supply adequate quality seed to farmers who end up using re-cycled grain as seed. The variety release process and resources are not functioning properly, hence there are no maize varieties that were officially released for commercialization. Some of the farmers and farming organizations import seed for their own use. The seed is being imported without following proper seed import / export regulations. There is opportunity to develop the maize seed system in Liberia based on harmonized seed policies and regulations being implemented through ECOWAS.

Table 7.3. 1. Liberia Maize Grain Projections

	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029	Total
Human consumption (mt)	25,000	26,000	27,040	28,122	29,246	**135,408**
Livestock feed requirement (mt)	125,000	132,500	140,450	148,877	157,810	**704,637**
Total Maize Requirement (mt)	150,000	158,500	167,490	176,999	187,056	840,045
Area for Grain Production (Ha) @1.5t / ha yield	100,000	105,667	111,660	117,999	124,704	**560,030**
Production Cost (US$) - (@ $800 / ha to produce OPV maize)	80,000,000	84,533,333	89,328,000	94,399,253	99,763,245	**448,023,831**

***** Assumption: US$ 800.00 to grow 1ha of OPV maize***

Table 7.3.2. Maize OPV Seed quantity projections

	2024/25	2025/26	2026/27	2027/28	2028/29	Total
Projected maize grain requirement (MT)	150,000	158,500	167,490	176,999	187,056	**840,045**
Class of Seed						
Certified Seed (MT)	2,500	2,642	2,792	2,950	3,118	**14,001**
Foundation Seed (MT)	21	22	23	25	26	**117**
Breeders Seed (MT)	0.35	0.37	0.39	0.41	0.43	**2.00**

Table 7.3. 3. Estimated Budget to Support Maize Seed Sector Development

Liberia Maize Seed Roadmap - 5- Year Budget (USD)			
Breeding and Product Development	Qty	Unit Price (US$)	Cost (US$)
Cold room for breeding germplasm with solar system	1	250,000	250,000.00
Capacity building of maize breeders (MSc)	5	75,000	375,000.00
Breeding consumables	Lump sum	65,000	65,000.00
Establishment of breeding isolation blocks with irrigation	Lump sum	250,000	250,000.00
Breeding packaging consumables	Lump sum	75,000	75,000.00
Breeding processes automation	Lump sum	155,000	155,000.00
Total Breeding			1,170,000.00
Seed Production	Qty	Unit Price (US$)	Cost (US$)
Breeders seed	1.94	4,000	7,778.19
Foundation seed	117	2,000	233,345.75
Establish and operationalize foundation seed production hubs (CARI)	2	175,000	350,000.00
Certified seed	14,001	1,300	18,200,968.15
Total Seed Production	14,121		18,792,092.09
Seed Testing & Quality Control	Qty	**Unit Price (US$)**	**Cost (US$)**
Capacity building - Seed Inspectors	30	10,000	300,000.00
Vehicles - Seed Supervisors	5	60,000	300,000.00
Motor Bikes - Seed inspections	30	4,500	135,000.00
Capacity building - Seed Analyst	5	85,000	425,000.00
Fully equip CARI seed testing lab with infrastructure	1	500,000	500,000.00
CARI Seed lab cold room	1	225,000	225,000.00
Installation of Solar system for CARI seed lab	1	160,000	160,000.00
Total Seed Testing			2,045,000.00

Liberia Maize Seed Roadmap - 5- Year Budget (USD)			
Enabling Environment	Qty	Unit Price (US$)	Cost (US$)
National Variety Release Committee allowances (x3/yr)	10	450	4,500.00
Capacity building of agro-dealers	75	6,000	450,000.00
Seed company registration	15	4,500	67,500.00
Operationalize National Seed Certification Authority	Lump sum	55,000	55,000.00
Total Enabling Environment			577,000.00
Grand Total			22,584,092.09

7.4 Summary of Road Map for Soybean Seed Production

Background

With the Government of Liberia making soybean a priority crop to be used mainly as livestock feed, and as a source of protein for school feeding programs, it is imperative that the anticipated increase in demands is met. In its quest to develop the poultry industry, the GOL needs to increase the production of soybean and maize to produce poultry feed. The government will provide policy directives, leading to the strengthening of related institutions, farmer organizations, and the private sector to achieve policy objectives. The main components of the action plan include:

1. **Capacity Building:** Capacity building of farmers, seed producers and extension agents, in all aspects of climate-smart soybean production technologies and practices (land preparation, weed control, soil health and fertility, production, harvesting, grain and seed threshing, cleaning, packaging, and storage). Seed producers will receive special training in seed quality assurance in meeting the ECOWAS seed quality standards. Soybean farmers are the foundation of the road map and, youth and women will be given the highest priority. Farm families will be given extensive training on the home use of soybeans especially for children of five years and younger and pregnant and lactating women. The seed quality control and certification agencies will also receive training to support the production and supply of quality soybean seeds. In addition, the private sector will be trained in soybean processing into vegetable oil, with soybean cake used to produce poultry feed.

2. **Poultry Feed:** An efficient poultry production value chain that uses soybean cake as its main source of protein should be established to be the main driver of demand for soybean grains. Thus, government policies that favor local production of vegetable oils and soybean cake for poultry feed production will be promoted to entice the private sector to invest in the establishment of feed processing plants (equipment and machinery).

3. **Government Institutions:** The capacity of the Central Agricultural Research Institute (CARI) will be strengthened to develop, release and maintained new soybean varieties and also produce breeder seeds. The institute, CARI will support the production of foundation seeds for the multiplication of certified seeds. Seed Quality Control and Certification Board, Plant Protection and Regulatory Services, and Extension Services at the MOA will also be strengthened to efficiently play their respective roles in providing support to the development of the soybean seed sub-sector and value chain.

4. **Co-operation with maize**: The implementation of the soybean seed road map should go together with the maize seed system. This will ensure that the two crops are produced to provide raw materials for the poultry industry. This will also help to practice crop rotation. Thus, the MOA should facilitate joint annual planning for stakeholders (farmers, off-takers, processors, micro-finance institutions, projects, research, etc.) to develop complementary actions in maize and soybean for implementation in the field, whilst assuring access to market.

5. **Private sector-led:** The private sector will lead all the components given above except for the government leading the production of breeder seeds, and the development of rural infrastructure. The private sector will require policy directives and facilitation through the exception or reduction of taxes and access to bank financing. Small and Medium Sized Enterprises (SMEs) will also need technical training in the processing of maize and soybean, as well as business capacity development.

6. **Knowledge exchange:** During the first five years, the maize and soybean teams will travel to Nigeria and / or Ghana to exchange experiences and knowledge with their more developed maize and soybean industries.

7. **Seed and Grain Production:** The target set for total soybean seed production from 2024 through 2030 is 2,250.00 MT to produce a total of **69,230 MT of soybean grain from** 2027 / 2028 to 2030 / 2031 (Table 7.4.1). Presently, no soybean seeds are available in Liberia, with respect to breeder, foundation, and certified seeds. The Central Agricultural Research Institute (CARI) will need to arrange the procurement of 3.75 MT of breeder seeds from IITA between 2024 / 2025 and 2028 / 2029 to produce a total of 112.50 MT of foundation seeds from 2025 / 2026 and 2029 / 2030 to produce 2,250 MT of certified seeds. It is worth to note the planting rate for seed multiplication is 50 kg / ha and 65 kg / ha for grain production.

Table 7.4.1. Soybean Seed production estimates from 2024 to 2030

Seed Type	Seed Production Year						Total
Year	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029	2029 / 2030	
Certified Seed (MT)	0.00	0.0	225.00	450.00	675.00	900.00	2,250.00
Foundation Seed (MT)	0.00	7.50	15.00	22.50	30.00	37.50	**112.50**
Breeder Seed (MT)	0.25	0.50	0.75	1.00	1.25	--------	**3.75**

Seed rate = 50 kg/ha; Seed yield = 1.5 t/ha

Table 7.4.2. Soybean Grain Production from 2027 and 3031

Year	Certified Seed (MT)	Grain Production (MT)	
		Area (ha)	Production (tons)
2024 / 2025	0.00	0.00	0.00
2025 / 2026	0.00	0.00	0.00
2026 / 2027	225	0.00	0.00
2027 / 2028	450	3,462	6,923
2028 / 2029	675	6,923	13,846

2029 / 2030	900	13,846	20,769
2030 / 2031	1125	10,385	27,692
Total			**69,230**

Seed rate: 65 kg/ha Average Grain yield = 2.0 tons/ha

Table 7.4.3. Estimated Budget to Support Soybean Seed Sector Development

Sierra Leone Soybean Seed Roadmap Budget (2024 - 2028)					
Priority Area	**Activity**	**Qty**		**Unit cost (USD)**	**Budget (USD)**
Soybean breeding	New varieties developed, released & registered	5		10,000	50,000
	Establish a soybean breeding lab & equip it at CARI	1		500,000	500,000
	Establish methods for breeding at CARI	1		200,000	200,000
	Establish medium sized greenhouse with temperature control	1		200,000	200,000
	Develop a 2-ha crossing block and equip it at CARI	1		120,000	120,000
	Breeding consumables (e.g. pollination bags, etc.)	1	Lump sum	500,000	200,000
Subtotal Breeding					**1,770,000**
Breeder seed	Quantity of breeder seed produced	3.75	MT	4,000	15,000
Foundation seed	Quantity of foundation seed produced	112.50	MT	2,000	225,000
Certified seed	Quantity of certified seed produced	2,250	MT	1,500	3,375,000
	Capacity building of technical staff of seed companies	10	#	5,000	50,000
	Capacity building of soybean out-growers	100	#	2,000	200,000
Subtotal Seed Production					**3,865,00**
Certification & Quality Assurance	Recruitment of additional seed inspectors	4		36,000	144,000
	Capacity building of recruited staff (Inspectors & Seed Analysts)	4		10,000	40,000
	Equipping 1 seed testing lab for soybean to maximize operations	1		150,000	150,000
Subtotal Certification & Quality Control					**334,000**

Sierra Leone Soybean Seed Roadmap Budget (2024 - 2028)					
Priority Area	**Activity**	**Qty**		**Unit cost (USD)**	**Budget (USD)**
Extension & Advisory Services	Train-the-trainer (ToT) training for Extension Officers (Train 1 Officer / district)	16		5,000	80,000
	Purchase tablets for digital Extension	32		500	16,000
	Purchase motorbikes for Extension Officers	32		4,000	128,000
Subtotal Extension & Advisory					**224,000**
Advocacy & Communication	Facilitate establishment of a national seed trade association for awareness creation	1	Lump sum	40,000	40,000
	Establish Innovation Platforms for information sharing & training on Good Agriculture Practices (GAPs)	10		40,000	400,000
Subtotal Advocacy & Communication					440,000
M&E	M&E activities / year	5	Years	50,000	250,000
Subtotal M&E					250,000
Grand Total					**6,079,000**

7.5 Summary of the Road Map for Fish Seed Production

Background

National Fish Requirement for Consumption

Liberia is a low-income country where fisheries have the potential to contribute to both national and economic development and sustainable livelihoods for the most vulnerable. Fish is a primary source of protein for many Liberians and is second to rice as the most purchased food commodity. Small-scale fishers provide most of the domestic fish supply. Liberia, in the West Africa region has one of the lowest annual per capita fish consumptions at 7.0 Kg with a GDP of 3.2%. Fisheries contributes approximately 10% of Liberia's GDP hence providing 33,000 jobs for people in the small-scale sector. According to the National Fisheries and Aquaculture Authority's (NaFAA) report 2020 the artisanal fisheries and industrial trawlers yields were 18,086 and 5,113 tons of fish respectively in the Liberian waters respectively. Aquaculture production is around 1000 tons per year produced by 1,000 small-holder farmers with low level of productivity due to lack of quality feed and fingerling. Currently, there has been some increase in the total number of ponds to a little over 1,700 as well as the land area of 114 hectares due to interventions by APDRA, DeSIRA and the TSF-TAAT WorldFish/Fish Compact project on mono sex tilapia propagation in hapas.

Key Assumptions of seed Requirement for Fish production in Liberia

To narrow in on the deficit gaps of fish requirement in Liberia, the National Fisheries and Aquaculture Authority (NaFAA), aims to produce 50,000 metric ton of fish by 2030. Production will be done in public and private partnership (PPP). The Government of Liberia two hatcheries in Klay, Bomi County, Tassah hatchery in Bong County in collaboration with six private fish breeder will lead the breeding and multiplication process of fish seed across the country to maintain the originality of the stocks (Table 7.5.1).

The assumptions are as followed:

- 50,000 metric tons of fish produced will off-set the fish deficit gaps in Liberia; due to budgetary limitation, the target for support under this roadmap is reduced to enable some basic activities to start, whilst building upon the initial investment as time goes by.
- 56,667.80 tons of fish feed (for table size fish) will cover the production for five years; for the same reason as above, the target is reduced.
- Two government hatcheries and six private breeders can carry out breeding and multiplication of fish seed across the country.

Fish Seed Production System in Liberia

Fish Production Challenges: The fish seed production system in Liberia is generally an informal one with few partially active actors who are fish Breeders. In the past, broodstocks and fingerlings were acquired from the two government hatcheries at Klay and Tassah. The intervention from Donor partners with support from the European Union (EU), World Bank (WB), African Development Bank (AfDB) etc., has given rise to few private sector actors who are breeders and fish seeds distributors in Liberia. In the below table, there are two government seed agencies and six private fish hatcheries that are currently providing fish seed in country. In the below table, are the production capacities and actual production of all the both private and public agencies. Production challenges faced as a country and proposed actions and demand status are also presented in Table 7.5.1.

Fish Production Projections in the Next Five Years: Currently the fish seed system in Liberia is an informal production system with few active private sector actors. Partly, they are striving with the minimum skill acquired over the years from NGOs through Donor support. Liberia has a population of 5,536,949 with a GDP of 3.2% and a growth rate of 2.2%, has a per capital consumption of around 7 Kg. The country has a deficit gap of around 50 metric tons

now due to several factors such as climate change, under develop aquaculture sector, low human resource capacity and poor market linkage. To offset these gaps, the following projections were made on a 40/60 percentage basis for catfish and tilapia for the period of five years (Table 7.5.2) The cost of feed in the table below is only for the production tilapia and not catfish.

Incentives to Boost Fish Production: Aquaculture in Liberia began in the 1950's, and as of then, there has been no significant growth since then. Currently, in the sector, around 95% of production is tilapia. Despite the enormous support aquaculture continuous to receive from Donor partners, the sector continuous to face stagnation due to limitations in accessing good quality fish seed, feed, and credit. To create an enabling environment in the aquaculture sector, the government of Liberia has put in place policy and strategy to guide the sector which require some improvement to drive the sector. The sector lacks the requisite technology to develop. The sector has few sector actors involves in seed production which needs to provide incentives to boost production as is seen in Table below (Table 7.5.3). The government has established tax waver on Agricultural inputs in the country to enable farmers access the needed inputs require for production. The National Fisheries and Aquaculture Authority (NaFAA) is open to working with other agencies and partners to creating a vibrant environment for the sector. As of now, there remains some critical no seed certification, inspection, and Seed Quality Control. The sector lacks the require train technicians, logistics and infrastructures to carry out its function.

Addressing Fish Production Challenges: To establish a vibrant and economically sustainable fish seed system, there is an urgent need to address the current gaps and challenges that is depriving the Aquaculture sector of its full potential (Table 7.5.4). To achieve this, immediate actions would need to be taken in remediating fish seed production and distribution issues as well as certification and quality control measures. There will also be a need to scale up in capacity building, business development and modeling for fish seed generation entities and as well support advocacy groups as Inland Fisheries Federation, Fish Breeder Cooperatives and Fish Farmers Cooperative Societies at the counties level in up-holding quality standards of fish seed across the country.

Fish Seed Distribution: The fish seed sector in Liberia is driven by the private and public sectors. The sector though underdeveloped, has a potential that require harnessing to its full capacity. Over the last decade, fish seed distribution was solely in the preview of National government and some local and International NGOs. The full capacity of the entire fish seed Distributors in Liberia is 112,890,640 fingerlings, 30% from government sources and 70% from the private sector (Table 7.5.5). Most of the seed distributed from between 2022 to 2023 were solely fingerlings confronted with enormous challenges ranging from vehicles to transport fish seed, bad roads, and high cost of transport and transporting bags and oxygen tanks Table 7.5.5.

Estimated Budget: Estimated Budget of USD 13,302,438.80 would be required to partially support the implement key activities in the fish seed sector development in Liberia. The breakdown of the sum is inscribed in (Table 8.5). These activities and budget will be used to establish and setup fish seed system, infrastructure and enhance human resources. A decentralized fish seed system that is private sector driven will be required. At the center of the model will be the mother nuclei point that produces the broodstock and distributes to region/county central hatchery that produces fingerlings to for distribution to fish farms. This will result to a networking of value chain actors will be accelerated thus creating jobs and livelihood enhancement. This investment will go a long way in developing quality fish seeds to mitigate huge importation of seed thus accelerating food and nutritional security which has drained the aquaculture sector and the economy for decade long years.

Table 7.5.1. Fish Seed Production Challenges

Name of seed producer	Type of seed producer (Selected from list)	Production Capacity A (tilapia fingerlings)	Actual production B (tilapia fingerlings 2023)/yr	Difference B-A (tilapia fingerlings)	Demand (MT)	Status	Seed Production challenges	Propose Actions
Garden Fish Farm	Private (Seed Company)	36,391,680	14,200,000.0	-22191680		Deficit	1.Lack of electricity	Set up the required solar mega-watt.
Sustainable fish and farming enterprise	Public (Government Seed Agency)	35,950,000	17,500,000.0	-18450000		Surplus	2. high cost of quality feed	Strengthen capacity of local feed industries in Liberia as a long-term goal while outsource quality feed as a short-term goal.
Tassah Hatchery	Public (Government Seed Agency)	1,137,240	5,000,000.0	3862760		Surplus	3. Low market demand	Increase awareness and training on marketing strategy.
Klay Hatchery	Public (Government Seed Agency)	1,137,240	10,000,000.0	8862760		Deficit	4.Poaching	Breeders and fish farmers should be trained on hatchery management and security measures
NIMACS	Private (Seed Company)	2,274,480		-2274480		Deficit	5.Predators	Training should be conducted to enhance breeders' capacity in mitigating predators in their facilities.
Light for Liberia	Private (Seed Company)	12,000,000	3,000,000.0	-9000000		Deficit	Acquiring improve water quality testing equipment.	Provision of these equipment to breeders and hatcheries to enhance their productivity.

Name of seed producer	Type of seed producer (Selected from list)	Production Capacity A (tilapia fingerlings)	Actual production B (tilapia fingerlings 2023)/yr	Difference B-A (tilapia fingerlings)	Demand (MT)	Status	Seed Production challenges	Propose Actions
Karsor Farm	Private (Seed Company)	11,500,000	2,500,000.0	-9000000		Deficit	Transportation of fish seed from one point to another	Provision of three equipped fish transporting vehicles to boost fish seed productivity.
Home of Dignity Farm	Private (Seed Company)	12,500,000	1,500,000.0	-11,000,000.0	32400	Deficit	Lack of indoor hatchery facility for artificial hatching of eggs. Establish and enhance private hatcheries facilities with improve indoor hatchery for artificially hatching of eggs.	
Total		**112,890,640**	**53,700,000**	**(39,190,640)**	**32400**	**Deficit**		

Table 7.5.2. Seed Requirement for Aquaculture for 5- year

Item	Metric Tons										
	2025/2026		2026/2027		2027/2028		2028/2029		2029/2030		Cost of feed/yr
	Catfish	Tilapia	Catfish	Tilapia	Catfish	Tilapia	Catfish	Tilapia	Catfish	Tilapia	
Fish Demand	21,600	32,400	24,800	37,300	28,600	42,900	32,900	49,300	37,800	50,000	
Broodstock											
Males	5,300	35,765	6,095	41,130	7,009	47,299	8,061	54,394	9,269	62,553	**25,758**
Females	10,600	78,000	12,190	89,700	14,019	103,155	16,121	118,628	18,539	136,422	**53,460**
Quantity of eggs	42.187.50	140.400.00	48,515.63	161,460.00	55,792.97	185,679.00	64,161.91	213,530.85	73,786.20	245,560.48	**NA**
Number of fries	33,750.00	126,360.00	38,812.50	145,314.00	44,634.38	167,111.10	51,329.53	192,177.77	59,028.96	221,004.43	**388.8**
Number of fingerlings	27,000	113,724	31,050	130,782.60	35,707.50	150,399.90	41,063.61	172,959,989	47,223.17	198,903.99	**37,368**
Feed (for Table size fish)	21,600	32,400,000	24,840	37,260	28,566	42,849	32,850.90	49.276.35	37,778.54	56,667.80	**5,400,000**
Grand Total											**5,514,974.8**

Table 7.5.3. Enabling Environment for Fish Seed Production in Liberia

Enabling Environment Indicators	Qty	Institutions Involved	Critical Challenges on seed certification, Seed Inspection and Other elements of Seed Quality Control
Number of Breeders (Public)	**1**	NaFAA/CARI	Inadequate train technicians to operate the standardized laboratory on seed certification
Number of Breeders (Private)	**6**	Private sector	Lack of logistic for Inspectors to conduct inspection on farms and hatcheries facilities
Number of Seed Inspectors	**18**	NaFAA	Proper mechanisms for seed certification and Quality Control is still in process
Number of Seed Breeders (Private)	**6**	Private sector	Lack of proper Quarantine facilities for holding imported seeds
Frequency of Meeting of Varieties Release Committee	**0**	NaFAA	No Variety Release and Registration Committee and functional National Seed Board (National Seed Committee)
Number of new varieties released in the last 2 years	**1**	NaFAA	.....do.....
Number of new varieties released in the last 5 years	**2**	NaFAA	.....do.....
Volume of Seeds imported in the last one year	**8000**	NaFAA	.....do.....
Average time taken to release variety (years)	**2**	Ghana &Netherland	
Price of Certified Seed (SLL/ Kg)	**USD $320/Kg**		

Table 7.5.4. Proposed Actions for the Fish Seed Sector to Address Key Challenges

Seed Sector Area	Challenge/Gap	Proposed Actions	Responsible partners	Timeline
Seed Production	1.Lack of electricity	Since the capacity of the current hydropower in country is limited, to meet the needs of everyone, it is alternatively needful to revert to solar energy system at various production sites across the country.	**GoL/EU/WB**	**2026**
	2. High cost of feed	Strengthen the capacity of the local feed industries in Liberia for the long term and for the short term outsource quality feed from neighboring countries.	GoL/AfDB/ WB/NGOs	2024/2025
	3.Low Market Demand	Increase awareness and training on marketing strategy.	**EU/WB/**	**2024/2026**
	4.. Predators	Training should be conducted to enhance breeders' capacity in mitigating predators in their facilities.	**GoL/NGOs/ Universities**	**2024/2025**
	5.Inadequate water quality testing kits	Provision of improved water quality testing kits to the fish seed sector to enhance their productivity.	**GoL/EU/WB/ AfDB/NGOs**	**2024/2026**
	6.Lack of infrastructure and equipment to conduct artificial hatching of fish eggs	Establish and enhance the capacities of private and public hatcheries facilities with improve indoor hatchery and equipment for artificially hatching of fish eggs.	**GoL/EU/WB/ AfDB**	**2024/2026**
Seed Distribution	1.Lack of transport vehicles and equipment	Provision of three equipped fish transporting vehicles to boost fish seed productivity.	**GoL/EU/WB/ AfDB**	**2025/2026**
	2.Lack of good road in leeward counties	Government and partner should maintain the existing roads while developing new ones in other parts of the country	**GoL/EU/WB/ AfDB**	**2024/2026**
	3.High cost of transport	Government should strategize ways to reduce the cost of petroleum and other fuel oil products across the country	**Government of Liberia**	**2024/2026**
	4.High cost of transport bags and oxygen tank	Government and partner should collaborate in providing subsidy to aquaculture actors especially seed producers to increase their productivity	**GoL/EU/WB/ AfDB**	**2024/2026**

Seed Sector Area	Challenge/Gap	Proposed Actions	Responsible partners	Timeline
Seed Certification and Quality Control	1.Inadequate trained technicians	Government and partners should collaborate in recruiting and training of technical staff in Fish Seed Certification and Quality Control Measures across the country	**GoL/EU/WB/ AfDB**	**2025/2026**
	2.Lack proper logistic	Government and partners should provide Technicians the needed logistic to enhance their work	**GoL/EU/WB/ AfDB**	**2025/2026**
	3.Lack of mechanisms for seed certification and Quality Control	Government and partners should put in place the rightful mechanisms for seed certification and quality control measure at various points of entry	**GoL/EU/WB/ AfDB**	**2024/2026**
	4.Lack of National Quarantine facility	Government and partners should collaborate in establishing a National Quarantine Facility for aquatic animals and plants to ensure environmental and health safety against disease and invasive organisms	**GoL/EU/WB/ AfDB**	**2024/2026**
Seed Distribution and Market Development	Poor market for fish seed and feed	1.increased awareness and sensitization	**Media/GoL/ WorldFish**	**2024/2026**
		2.Establish demos, flyers, jingles, talk shows and Fish seed day	**Media/GoL/ WorldFish**	**2024/2026**
		3.Capacity building for certify seed entities in advertisement of their products, record keeping as well as setting up a platform where information can be share among member of cooperative society groups (CSGs)	**Media/GoL/ WorldFish/ WB/EU/AfDB**	**2024/2026**

Table 7.5.5. Fish Seed Distribution

Names of Seed Distributors	Type of Seed Distributors	Type of Seed Distributed	Quantity of Seed Handled in 2022/2023	Percentage of Seed Distributed through this Entity	Seed Distribution Challenges
Garden Fish Farm	Private	Fingerlings	36,391,680	**32**	1. lack of specialized vehicle for transport 2. Bad road
Sustainable fish and farming enterprise	Private	Fingerlings	35,950,000	**31.8**	
Tassah Hatchery	Government	Fingerlings	1,137,240	**1.01**	3. high cost of transport 4. high cost of importation of transport bag and oxygen tank
Klay Hatchery	Government	Fingerlings	1,137,240	**1.01**	
Light for Liberia	Private	Fingerlings	12,000,000	**11**	
NIMACS	Private	Fingerlings	2,274,480	**2.01**	
Karsor Farm	Private	Fingerlings	11,500,000	**10.1**	
Home of Dignity Farm	Private	Fingerlings	12,500,000	**11.07**	
			112,890,640	**100**	

8.0 Investment

Funding support of **US$ 171,867,530.90** would be required to fully implement the seed sector development roadmap over a period of five years for the five priority commodities (rice, cassava, maize, soybean, and aquaculture) in Liberia. The budgets provided in Tables 8.1 (rice), 8.2 (cassava), 8.3 (maize), 8.4 (soybean) and 8.5 (fish) will be used to scale the promotion of crop varieties build the seed system infrastructure and human resources.

The investment will be used to establish/incubate a network of seed entrepreneurs and strengthen institutions to support the Liberia's agricultural policies to ensure the achievement of food and nutrition security and income generation and wealth creation through agricultural-related jobs. The vital roles the Central Agricultural Research Institute (CARI in research, variety releases, maintenance, and the production of Early Generation Seeds,), the National Quality Control and Certification Agency (NQCSA), the extension service, the private seed and fertilizer enterprises and farmer organizations will be essential the development of a sustainable seed system in Liberia. Capacity of these stakeholders will be strengthened through training, coaching, provision modern laboratory equipment and seed processing, conditioning, processing and storage infrastructure for the production, conservation and supply of breeder, foundation, and certified seeds to bring an end to decades of seed importation.

This initiative would need funding support from the government of Liberia and Technical and Financial Partners, including BMGF, USAID, European Union; AfDB, WB, IsDB, etc. as well as development partners (FAO, (UNDP, WFP, UNICEF, etc.). Scientists from the International Agricultural Research Institutions would provide technical support to the government of Liberia to ensure successful and impactful implementation of the 5-year roadmap.

Table 8.1. Estimated Budget to Support Rice Seed Sector Development

Broad seed system thematic area	**Activities**	**Targets**	**Budget 5-Year (US$)**
Broad seed system thematic area	Activities	Targets #	Budget 2 (US$)
Breeding	Installation of a cold Room for seed storage at CARI	One cold room installed at CARI	1,200,000
	Construction of fully equipped screen house for breeding	2 Screen houses to be used as nursery facilities	70,000
	Cell biology lab equipment	Assorted equipment for the cell biology lab	400,000
	Procurement of additional tractor	4 tractors	400,000
	Procurement of equipment (threshers/Winnowers/Dyers/ power tiller for mangrove terrain)	Lumpsum amount for the purchase of the tractor implements	200,000
	Installation of borehole for supplementary irrigation and irrigation infrastructure	2 boreholes with associated irrigation equipment and ground leveling where necessary.	500,000
	Operational support for breeder seed production (Inc. Inputs, labor, consumables, etc)	lumpsum budget to cater of agro-inputs and other consumables that are needed for breeder seed crops	1,200,000
Sub total			**3,970,000**

Broad seed system thematic area	Activities	Targets	Budget 5-Year (US$)
Broad seed system thematic area	Activities	Targets #	Budget 2 (US$)
Foundation seed production (including mini-harvesters)	Operational budget support for Agri-inputs	lumpsum budget to cater for the agro-inputs and other operational requirements	1,000,000
	Procurement of additional tractor	5	500,000
	Procurement of Equipment (threshers/Winnowers/Driers)	Purchase of assorted tractor drawn equipment and other relevant tools/ equipment	200,000
	Construction and rehabilitation of storage facility	2 new stores to be constructed and 1 to be rehabilitated	150,000
	Purchase of Additional Vehicles	2 vehicles to be procures to ease mobility	80,000
	Purchase of Motorcycles	10 Motorcycles to ease movement of staff	40000
	Procurement of Seed processing center	2 fully equipped seed processing centers to be procured	300,000
	Mini-Harvesters	10 mini harvesters to be procured	200,000
Sub total			**2,470,000**
Certified Seed production and distribution (including equipment for land preparation, harvesting, drying, processing/ conditioning and storage)	Allocation of dedicated fund to facilitate access to credit targeted at seed production	The lumpsum budget will be used to set up a fund that will provide low-cost credit to private sector players involved in seed production and trade that will be managed through a sustainable model jointly by a commercial bank and the Government	60,000,000
Sub total			**60,000,000**
Quality assurance and Seed Certification	Recruitment of seed inspectors	40 additional seed inspectors to be recruited and maintained at SDCA	300,000
	Recruitment of additional seed analysts	20 Additional seed analysts at SDCA	100,000

Broad seed system thematic area	Activities	Targets	Budget 5-Year (US$)
Broad seed system thematic area	Activities	Targets #	Budget 2 (US$)
	Procurement of Vehicles	5 additional Motor vehicles to be procured	200,000
	Procurement of Motorcycles	15 Motorcycles	160,000
	Satellite Seed testing unit at regional level	3 seed testing units installed and equipped	300,000
	Operational support for Seed Inspection and Quality Assurance (incl. Digital tools)	Support for operational costs for seed inspection including the procurement of a digital system and tablets for digital verification	3,000,000
Sub total			**3,960,000**
Advocacy, Outreach and Communication	Advocacy towards the elimination of GST on Agricultural Machinery	Engage policy makers on advocacy towards elimination of the GST on relevant	10,000
	Awareness creation and advocacy towards reforms to incentivize and enhance the participation of Private Sector	Advocacy meetings to chant ways for creating incentives for enhancing private sector	15,000
	Encourage the purchase of seeds from authorized seed producers	Advocate for reforms on the Government subsidy programmes as well as technical assistance in the design of a smart subsidy	10,000
	Reforms towards repositioning the role of SMP and enhance its sustainability	Consultancy to design model for reforming SMP	12,000
	Advocacy towards the establishment of an Agriculture bank	Awareness creation meetings for policy makers towards the set-up of Seed production fund	20,000
	Development, printing and dissemination of materials	Communication and outreach brochures and media programmes	15,000
	Outreach programmes (Education and sensitization)	Radio and TV programmes as well as Billboards	1,000,000
	Communication (ICT Equipment, Software, Media)	Purchase of Computers and Software to facilitate the programmes.	3,000,000
Sub total			4,082,000

Broad seed system thematic area	Activities	Targets	Budget 5-Year (US$)
Broad seed system thematic area	Activities	Targets #	Budget 2 (US$)
Extension and Advisory Services	Recruitment of additional extension officers	Recruitment and retention of 50 additional extension staff	1,500,000
	Procurement of Motor vehicles	10 motor vehicles to be used for extension	400,000
	Procurement of Motorcycles	30 Motorcycles	120,000
	Training of extension Officers	50 extension officers trained/re-tooled	200,000
	Digital extension devices and systems	50 tablets for utilization in e-extension	100,000
	Operational Costs for extension	Budgetary support for operations in extension	1,500,000
Sub total			**3820000**
Capacity Strengthening	Graduate training	Training of Breeders, Seed analysts, Field inspectors at Graduate level abroad and within Sierra Leone	1,500,000
	Refresher Training of trainers in seed inspection and seed quality control	20 personnel trained through re-tooling and refresher courses	400,000
	Shared learning tours	15 personnel and private sector practitioners sponsored to attend learning tours	300,000
	Farmer training	1	500,000
	Demos and Field days	1	1,200,000
Sub total			3900000
Monitoring, Evaluation, Accountability and Learning	Operational costs for Monitoring and evaluation	Operational budget support for Monitoring and evaluation	1,500,000
	Mobility for Monitoring and Evaluation Division (10 Vehicles)	10 vehicles to support M&E operations	400,000
	Monitoring and evaluation Field Data collection (Studies and surveys)	Support for surveys and M&E data analysis	800,000
Sub total			**2,700,000**
Grand Total			**84,902,000**

Table 8.2. Estimated Budget to Support Cassava Seed Sector Development

Broad seed system thematic area	Budget 5-Year (US$)	% of Total Budget
Establishment of National Seed Certification Board **(urgently needed)**	5,000,000	11.1
Breeding	8,000,000	17.7
Foundation seed production	4,000,000	8.8
Certified Seed production	8,000,000	17.7
Quality assurance	2,800,000	6.2
Advocacy, Outreach and Communication	2,800,000	6.2
Extension and Advisory Services	3,200,000	7.3
Capacity Strengthening	8,000,000	17.7
Monitoring, Evaluation, Accountability and Learning	3,200,000	7.3
Grand Total	**45,000,000**	**100**

Table 8.3. Estimated Budget to Support Maize Seed Sector Development

Liberia Maize Seed Roadmap - 5- Year Budget (USD)			
Breeding and Product Development	**Qty**	**Unit Price (US$)**	**Cost (US$)**
Cold room for breeding germplasm with solar system	1	250,000	250,000.00
Capacity building of maize breeders (MSc)	5	75,000	375,000.00
Breeding consumables	Lumpsum	65,000	65,000.00
Establishment of breeding isolation block with irrigation	Lumpsum	250,000	250,000.00
Breeding packaging consumables	Lumpsum	75,000	75,000.00
Breeding processes automation	Lumpsum	155,000	155,000.00
Total Breeding			1,170,000.00
Seed Production	**Qty**	**Unit Price (US$)**	**Cost (US$)**
Breeders seed	1.94	4,000	7,778.19
Foundation seed	117	2,000	233,345.75
Establish and operationalize foundation seed production hubs (CARI)	2	175,000	350,000.00
Certified seed	14,001	1,300	18,200,968.15
Total Seed Production	**14,121**		**18,792,092.09**
Seed Testing & Quality Control	**Qty**	**Unit Price (US$)**	**Cost (US$)**

Liberia Maize Seed Roadmap - 5- Year Budget (USD)			
Breeding and Product Development	**Qty**	**Unit Price (US$)**	**Cost (US$)**
Capacity building - Seed Inspectors	30	10,000	300,000.00
Vehicles - Seed Supervisors	5	60,000	300,000.00
Motor Bikes - Seed inspections	30	4,500	135,000.00
Capacity building - Seed Analyst	5	85,000	425,000.00
Fully equip CARI seed testing lab with infrastructure	1	500,000	500,000.00
CARI Seed lab cold room	1	225,000	225,000.00
Installation of Solar system for CARI seed lab	1	160,000	160,000.00
Total Seed Testing			2,045,000.00
Enbling Environment	**Qty**	**Unit Price (US$)**	**Cost (US$)**
National Variety Release Committee allowances (x3/yr)	10	450	4,500.00
Capacity building of agro-dealers	75	6,000	450,000.00
Seed companies registration	15	4,500	67,500.00
Operationalize National Seed Certification Authority	Lumpsum	55,000	55,000.00
Total Enabling Environment			577,000.00
Grand Total			**22,584,092.09**

Table 8.4. Estimated Budget to Support Soybean Seed Sector Development

Sierra Leone Soybean Seed Roadmap Budget (2024 - 2028)					
Priority Area	**Activity**	**Qty**		**Unit cost (USD)**	**Budget (USD)**
Soybean breeding	New varieties developed, released & registered	5		10,000	50,000
	Establish soybean breeding lab & equip it at CARI	1		500,000	500,000
	Establish screen house for breeding at CARI	1		200,000	200,000
	Establish medium size greenhouse with temperature control	1		200,000	200,000
	Develop 2ha crossing block and equip it at SLARI	1		120,000	120,000
	Breeding consumables (e.g. pollination bags, etc	1	lumpsum	500,000	200,000
Subtotal Breeding					**1,770,000**

Sierra Leone Soybean Seed Roadmap Budget (2024 - 2028)					
Priority Area	**Activity**	**Qty**		**Unit cost (USD)**	**Budget (USD)**
Breeders seed	Quantity of breeders' seed produced	3.75	MT	4,000	15,000
Foundation seed	Quantity of foundation seed produced	112.50	MT	2,000	225,000
Certified seed	Quantity of certified seed produced	2,250	MT	1,500	3,375,000
	Capacity building of technical staff of seed companies	10	#	5,000	50,000
	Capacity building of soybean out-growers	100	#	2,000	200,000
Subtotal Seed Production					**3,865,00**
Certification & Quality Assurance	Recruitment of additional seed inspectors	4		36,000	144,000
	Capacity building of recruited staff (Inspectors + Seed Analysts)	4		10,000	40,000
	Equipping 1 seed testing lab for soybean to maximize operations	1		150,000	150,000
Subtotal Certification & Quality Control					**334,000**
Extension & Advisory Services	TOT Extension Officers (Train 1 Officers/district)	16		5,000	80,000
	Purchase tablets for digital Extension	32		500	16,000
	Purchase motorbikes for Extension Officers	32		4,000	128,000
Subtotal Extension & Advisory					**224,000**
Advocacy & Communication	Facilitate establishment of national seed trade association for awareness creation	1	lumpsum	40,000	40,000
	Establish Innovation Platform for information sharing & train on GAPs	10		40,000	400,000
Subtotal Advocacy & Communication					440,000
M&E	M&E activities/year	5	Years	50,000	250,000
Subtotal M&E					**250,000**
Grand Total					**6,079,000**

Table 8.5. Estimated Budget for Fish seed Development for the period of 5-years

Fish Seed System Thematic Area	Targets	Budget USD for 5- years
Brood-stock (Tilapia) Feed	50,000 metric tons of fish	40,039
Brood-stock (Catfish) Feed		37,179
Fries (Catfish & Tilapia) Feed		388.8
Fingerlings Feed		37,368
Grow-out Feed		5,400,000
	Sub-total	**5,514,974.8**
Acquiring of Tilapia and Catfish brood-stocks		207,464
Advocacy and Communication		300,000
Extension and Advisory Services		300,000
Transportation (3- vehicles)		120,000
Transport bags and Oxygen tanks		60,000
Fuel Oil		200,000
Capacity Building		6,000,000
Quality Assurance		200,000
Certification		150,000
Hapa Nets and other fish holding		100,000
Monitoring and Evaluation		150,000
	Sub-total	**7,787,464**
	Grand total	**13,302,438.8**


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