

Baseline Report on Agricultural Practices in Laamu Atoll



Ministry of Environment,
Climate Change
and Technology



ENDhERI



UN 
environment
programme

Prepared by *Enhancing National Development through Environmentally Resilient Islands* (ENDhERI) Project for the Ministry of Environment, Climate Change and Technology

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ACRONYMS

ADB	Asian Development Bank
ADMP	Agriculture Development Master Plan
AMP	Agriculture Master Plan
CEC	cation exchange capacity
EIA	Environment Impact Assessment
ENDhERI	Enhancing National Development through Environmental-ly Resilient Islands
EPA	Environmental Protection Agency
EPPA	Environmental Protection and Preservation Act (4/93)
GDP	Gross Domestic product
GEF	Global Environment Facility
GOM	Government of Maldives
ICZM	Integrated Coastal Zone Management
IUCN	International Union for Conservation
IUCN	International Union for Conservation of Nature
MBS	Maldives Bureau of Statistics
MECCT	Ministry of Environment Climate Change and Technology
MFDA	Maldives Food and Drug Authority
MNPI	Ministry of National Planning and Infrastructure
MoFMRA	Ministry of Fisheries Marine Resources and Agriculture
NBS	National Bureau of Statistics
NC	Natural Capital
PMU	Project Management Unit
UNEP	United Nations Environment Program
WB	World Bank
WDC	Women's Development Committee
WHC	Water holding capacity



EXECUTIVE SUMMARY:

The agriculture sector in the Maldives is vital to the economy in terms of its economic and social welfare value. Agriculture contributes to livelihood, employment and food security of the local communities. The industry includes communities invested in home gardening, small scale local commercial farmers to large scale private companies investing in commercial farming.

Over one-quarter of the workforce in islands works in agriculture, making it significant given that two-thirds of the population lives in outer atolls. About the same amount are involved in fishing. Only 10% of the entire land area is thought to be suitable for farming, according to estimates. For the domestic market and tourist resorts, new varieties of various crops, including papaya, cucumber, and watermelon, have recently been introduced. Commercial goat breeding for the domestic market has also grown to be an important sector, as has commercial egg production targeting rising demand in resort islands. While most of the agricultural produce from the islands is used for local consumption in the islands and atolls, a large part of the harvest is sent to Male', where it is sold for local consumption or by tourist resorts and other tourist facilities. Several commercial agricultural islands are being operated successfully, catering mainly to the tourism sector.

The porousness and low cation exchange capacity (CEC) of the soils in the Maldives are said to contribute to their poor quality, which results in nitrogen and potassium deficiencies. Water stress, which is the principal barrier to agricultural production, is caused by salinity and low water holding capacity (WHC). Many surface wells' water is only just suitable for irrigation since it has electrical conductivity of up to 4.0 dS/m. Coconuts and every other naturally occurring vegetation, however, can typically withstand high salinity levels. The nature of soil in the islands of Maldives are significantly low in essential soil nutrients which facilitate the growth of agricultural crops, therefore agrochemicals are significantly required to enrich the soil for a better yield.

In 2019, the agricultural industry contributed for 1.1% of the GDP. The country is severely dependent on food imports as a result of the limited agricultural options. Agriculture industry is a significant source of income for the inhabitants of atolls. There are ongoing efforts to diversify the agricultural industry and boost the nation's food security.

The Government of the Republic of Maldives through the Ministry of Environment is implementing Enhancing National Development through Environmentally Resilient Islands (ENDhERI) project financed by Global Environment Facility (GEF) and assisted by United Nations Environment Program (UNEP). ENDhERI project aims to assist the government of the Maldives in its implementation of new environmental policies and transition towards national adoption of Green Growth atoll development that will sustain marine Natural Capital (NC) and strengthen the resilience and recovery of reef ecosystems. This will be informed by learning from atoll-wide integrated coastal zone management within a Managed Marine Area / Biosphere Reserve framework, and the application of innovative sustainability practices and standards in agriculture, fisheries, tourism and construction sectors as the basis for transforming the human ecological footprint in Laamu Atoll, and taking this up to national level through sector transformation, spatial planning and improved governance based on NC accounting.

The purpose of this baseline assessment, being administered by the ENDhERI project is to understand baseline condition of the agricultural practices in Laamu Atoll. The results of the baseline assessment will establish the reference point for status of agriculture in Laamu Atoll, in turn will be used identify the areas of need to support the local community under the agricultural components of the project.

1 INTRODUCTION:

The agriculture sector in the Maldives is vital to the economy in terms of its economic and social welfare value. Agriculture contributes to livelihood, employment and food security of the local communities. The industry includes communities invested in home gardening, small scale local commercial farmers to large scale private companies investing in commercial farming.

While most of the agricultural produce from the islands is used for local consumption in the islands and atolls, a large part of the harvest is sent to Male', where it is sold for local consumption or by tourist resorts and other tourist facilities. Several commercial agricultural islands are being operated successfully, catering mainly to the tourism sector.

The contribution of agriculture to national GDP declined from 2.2 percent in 2003 to 1.1 percent in 2019 as indicated in figure 1 (Statistical Yearbook 2020). According to Agriculture Master Plan 2010-2025, about three percent of the total labour force is employed in the agriculture sector. The sector plays a key role in providing formal and informal employment opportunities, and contributes significantly to livelihoods and poverty alleviation, providing work for women, a safety net for the rural population, ensuring food security for the outer atolls, and addressing many other dimensions of human development not usually recognised in the national income accounts (AMP 2010-2025).

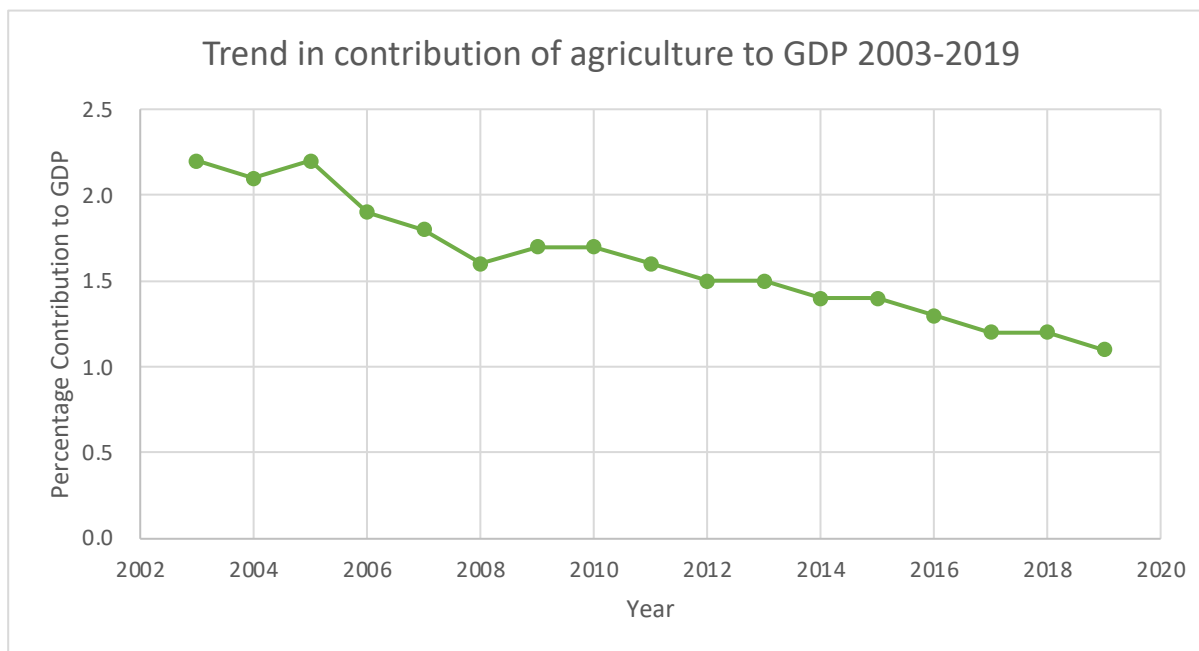


Figure 1: The trend in percentage contribution of Agriculture to GDP 2003-2009 (Statistical Year Book 2020)

This Baseline Assessment on Agricultural practices in Laamu Atoll is conducted by Enhancing National Development through Environmentally Resilient Islands (ENDhERI) project, implemented by Ministry of Environment Climate Change and Technology (MECCT), financed by Global Environment Facility (GEF) and assisted by United Nations Environment Program (UNEP). The main objective of the project is to enhancing reef protection, resilience and ecosystem recovery by reducing development impacts in a selected project site the Maldives, enabled for replication nationally through public awareness and integrating the values of marine biodiversity and other natural capital in national accounting.

ENDhERI project aims to assist the government of the Maldives in its implementation of new environmental policies and transition towards national adoption of Green Growth atoll development that will sustain marine Natural Capital (NC) and strengthen the resilience and recovery of reef ecosystems. This will be informed by learning from atoll-wide integrated coastal zone management within a Managed Marine Area / Biosphere Reserve framework, and the application of innovative sustainability practices and standards in agriculture, fisheries, tourism and construction sectors as the basis for transforming the human ecological footprint in Laamu Atoll, and taking this up to national level through sector transformation, spatial planning and improved governance based on NC accounting. The intermediate objective of this transformation is to minimize the flows of pollutants from land-based activities into the adjacent marine environment, and reduce marine-based drivers of reef degradation including baitfish and reef fisheries. Overall, the project seeks to enhance reef ecosystem integrity and resilience through sustainable management, reducing development impacts and integrating NC accounting into national planning.

The agricultural components of the ENDhERI project includes:

Output 1.2.1 Targeted island communities sensitized and increasingly apply eco-technologies for sustainable food production and disposal of domestic waste

1.2.1.1 Build awareness of the health and environmental risks of uncontrolled use of agrochemicals and excessive groundwater abstraction in targeted areas, and of alternative agricultural production options.

1.2.1.2 Facilitate pilot projects demonstrating sustainable agriculture methods in three areas severely affected by over-use of agrochemicals (such as Isdhoo, Kalaidhoo and Dhanbidhoo) with guidance from MoFMRA and other partners. This should start with the organization of farmers groups / cooperatives, then the provision of significant training assistance on sustainable agriculture practices, including inputs on development of organic fertilizer, composting, intercropping with nitrogen-fixing plants, etc in order to improve organic soil carbon content.

1.2.1.3 Support cooperative work to develop at least one value chain from farming communities to suitable markets (eg resorts for vegetables and fruit) and logistical networks for distribution through facilitating supplier-vendor discussion mechanisms with support from island councils and WDCs

1.2.1.5 Provide capacity building support and small grants to women's groups to contribute towards sustainable agriculture, food processing, waste management and related activities

This report contains details on agriculture resources, current status of agriculture, existing agricultural practices and challenges and recommendations for future actions. The report is based on quantitative data, existing published literature and accounts from stakeholder consultation with relevant authorities. The main aim of this baseline report is to understand the current status of agriculture in Laamu atoll to facilitate the prioritization of activities of the project that is related to agriculture sector.

2 AIM AND OBJECTIVE:

The purpose of this baseline assessment, being administered by the ENDhERI project is to understand baseline condition of the agricultural practices in Laamu Atoll. The results of the baseline assessment will establish the reference point for status of agriculture in Laamu Atoll, in turn will be used identify the areas of need to support the local community under the agricultural components of the project. In the future, the baseline assessment will serve as the basis of comparison whether the project has satisfied its main objective of building capacity of local community towards sustainable agriculture practices and alternative agricultural production.

The main objectives of the assessment are:

- To identify potential health and environmental risks of existing agricultural practices.
- To identify the needs of community to shift towards sustainable agriculture.
- To promote sustainable use of natural resources such as land and water.

3 SCOPE AND STUDY AREA:

The study area for this assessment is Laamu Atoll, specifically the 11 inhabited islands in the Atoll. The scope of the assessment is to identify the baseline agricultural practices in the inhabited islands, with general status of agriculture in Laamu Atoll.

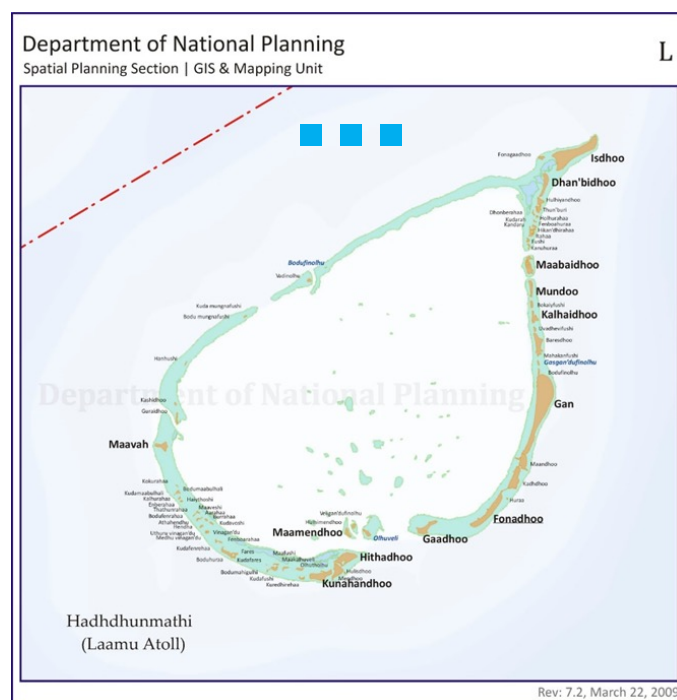


Figure 2: Map of Laamu Atoll (DNP 2009)

4 METHODOLOGY:

The baseline assessment report on agriculture in Laamu Atoll is prepared by ENDhERI project. The report is based on quantitative data, existing published literature and accounts from stakeholder consultation with relevant authorities.

Literature Review: Published literature was reviewed to establish a background for the assessment. The published literature is significantly based on general agricultural practices in the Maldives. The literature includes, journal articles, published reports and documents by government, statistical data from NBS, and extractions from reports, that includes studies conducted in Laamu Atoll.

Quantitative Data: The quantitative data on general practices of agriculture in Laamu Atoll was collected from local councils through questionnaires and statistical data available on public domain were also utilized. Questionnaires were circulated to 11 councils in Laamu Atoll and data was gathered on type of agricultural practices, methods of farming, land area utilized for farming, and farming population of Laamu Atoll. In addition, data on types of fertilizers commonly used in farming is also gathered from the local retailers of agro-chemicals.

Stakeholder Consultations: The information gathered on local agricultural practices, gaps and area of needs, that were discussed during project sensitization meetings are also considered during the formulation of this assessment report. The following stakeholders participated in the meetings; Island Council and Women's Development Committee, School Management and Government Institutions.

5 BACKGROUND TO AGRICULTURE IN LAAMU ATOLL:

Laamu atoll is home to a diverse collection of coral reefs, mangroves, and a diverse marine ecosystem. The atoll has a total surface area of 884.63 km² and 56 reefs with an area of 203.70 km². The atoll consists of a total of 99 islands (77 vegetated and 22 unvegetated) of which 11 islands are now inhabited. The inhabited islands are; Maavah, Kunahandhoo, Hithadhoo, Maamendhoo, Fonadhoo, Gan, Mundoo, Maabaidhoo, Dhanbidhoo and Isdhoo and Kalaidhoo. The administrative capital of Laamu atoll is Fonadhoo island inter connected by link-road with Kahdhoo, Maandhoo and Gan islands.

Laamu Atoll has a land area of only 231 km² on 77 islands and agriculture contributes almost as much to employment and local livelihoods on the Atoll as fishing. The total land area of inhabited islands of Laamu Atoll is 13.956 km² (MBS2020). The following table and figure indicates the land area of each inhabited islands in Laamu Atoll.

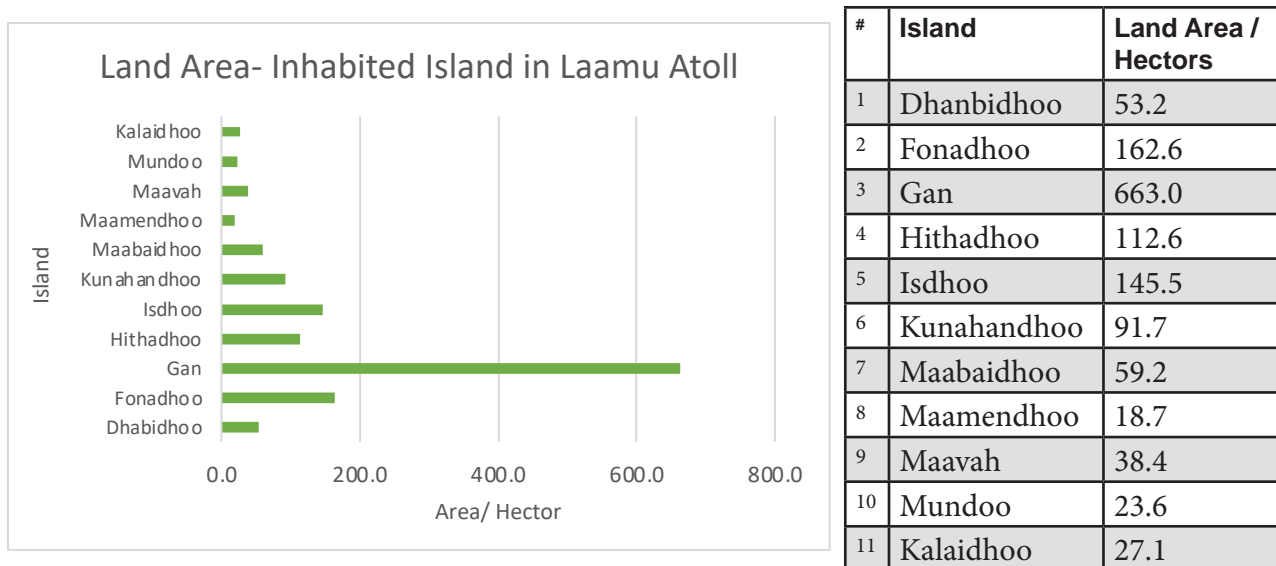


Figure 3: Land Area of inhabited islands of Laamu Atoll (Statistical Year Book 2020)

In the larger island such as Gan, Isdhoo and Kalaidhoo, agriculture is the main economic activity that contributes to livelihood of the local community. However, unsustainable agricultural practices such as unregulated chemical fertilizers and pesticide application are a major concern to health impact on the natural environment and biodiversity. Additionally, invasive alien species such as Giant snails (giant Aftrical land snail, Achatina fulica) infes-

tations have been reported as a concern for farmers in Laamu as well as in other atolls. The giant African land snail is reported as a fast-growing polyphagous plant pest introduced from East Africa to many parts of the world, including to the Maldives in 1957 and classified as one of the world's top 100 invasive alien species by The International Union for Conservation (IUCN).

Organic farming is commonly not practiced in Laamu Atoll; however, some efforts have been made by the private sector businesses and at island levels to produce local composting to facilitate organic farming and reduce dependency on imported fertilizers and manure.

Island	Popn	Registered farmers (No.)	2014		2015	
			Income (MVR)	Male' market trade (Kg)	Income (MVR)	Male' market trade (Kg)
Dhan'bidhoo	647	142	151,650	14,654	257,600	42,212
Fonadhoo	2266	2	650,532	68,294	1,550,115	143,399
Gadhoo	178	Not reported	-	-	10,500	2,075
Gan	3080	460	2,463,460	228,348	4,018,532	374,311
Hithadhoo	1007	1	-	-	213,006	26,289
Isdhoo	958	713	2,982,170	186,970	6,401,683	445,324
Kalaidhoo	579	393	1,652,560	123,390	955,629	89,743
Kunahandhoo	650	Not reported	111,000	12,875	547,397	83,619
Maabaidhoo	649	Not reported	140,900	13,807	222,875	17,374
Maamendhoo	896	Not reported	-	-	3,000	60
Mundoo	236	Not reported	-	-	18,000	1,400
Maavah	1530	Not reported	46,200	1,910	-	-
Total	12,676.00	1711	8,198,472	650,248	14,210,837	1,226,555

Source: Agriculture Statistic Unit, MoFA 2016

Ministry of Fisheries Marine Resources and Agriculture (MoFMRA) reports that the ministry had two agricultural centers, one of which is in Gan island in Laamu atoll which was setup under a government loan of about USD 520,000 (MVR 8m) provided by the government with 6ha of land from the Gan Agricultural Centre in Gan Island to commercially produce 25% of demand from Laamu atoll for 5 major crops through contract farming with locals, to increase self-sufficiency, food security and minimize imports. The loan finance through government budget to purchase equipment, irrigation systems and production for the private sector with 5 years payback was provided with requirement to provide technical support to the community towards sustainable agricultural practice, hence could be a co-financing component for the project. The center is non-operational due to low agricultural yield, management issues and lack of agricultural expertise on the field provided by the leaseholder to manage the center. The Kuruhinna site where the agricultural site was located did not have supplied electricity and only uses power from onsite portable electric generators after 6pm and during field watering times.

Training and extension are conducted by the Ministry of Fisheries Marine Resources and Agriculture (MoFMRA) for the community through no regrets small grants for livelihood projects, which has a sustainability or climate focus such as water efficient systems. Training is either provided within a training center by inviting trainees, or trainers visiting local islands or through a 6-month Internship program at MoFMRA agriculture centers. MoFMRA commenced climate insurance for farmers since in 2013 with 80% premium being paid by the government for one of the islands. However, outreach and marketing work is required to increase market volume and make the scheme a success.

6 INSTITUTIONAL, LEGAL FRAMEWORK, PLANS AND POLICIES OF AGRICULTURE:

The Ministry of Fisheries, Marine Resources and Agriculture is main government institution mandated to ensure the development and sustainable management of Agricultural Resources of the Maldives. The Ministry works to strengthen the agriculture sector through enhancing the capacities of crop and livestock producers and improving the value of agriculture produces through linking the farmers to market in order to achieve national food security and sustainable socio-economic development. As the main policy maker and regulatory authority of the agricultural sector in the country, Ministry of Fisheries, Marine Resources and Agriculture has number of policies and legal instruments in place to regulate agricultural activities in the country.

Ministry of Environment Climate Change and Technology (MECCT) and Ministry of Fisheries Marine Resources and Agriculture (MoFMRA) have mandate requirements for chemical administration. However, due to the lack of specific legislature on chemicals management regulatory mechanism for chemical management remains weak.

The main legal instruments relevant to agriculture sector are as follows:

Name of the policy/ legal instrument	Objectives of Legal Instruments & main provisions
National Fisheries and Agriculture Policy 2019 – 2029	Pillar 2.1: Value-Chain Coordination Objective 2.1.1. Ensure that the competitiveness of the agriculture sector is promoted, improved, and sustained in both domestic and foreign markets. 2.1.1.A. Facilitate the sustainable use of local agricultural resources for the production of fertilizers, pesticides, animal feeds and other inputs when possible, in order to effectively reduce the dependency on imports.
Agricultural Pesticides Control Act (21/2019)	The overarching act which provisions sets guidelines and standards to follow during the utilization, production, importation, exportation, trade and disposal of pesticides used in agriculture in the Maldives. The act covers, the monitoring, regulation and enforcement of environment and health risks that may occur during utilization of pesticides. Further, the act includes all the guidelines and standards in relation to pesticides used in agriculture.

Agricultural Pesticide Control Regulation (Regulation No: 2021 / R-12) Updated on January 27, 2021)	Agricultural Pesticide Control Regulation prescribes the implementation of the set guidelines and standards provisioned by the Agricultural Pesticides Control Act (21/2019). The detail implementation guidelines and standards are set under this regulation.
Guideline for Pesticide Storage and Disposal	The guiding document for implementation of responsibilities prescribed by the Agricultural Pesticides Control Act (21/2019) including trade of pesticides and licensing required for trading of pesticides in Maldives.
Pesticide Inspection Manual	The guiding document for inspection of pesticide storage, trade and shops.
Permitted Ports for Pesticides Import	The list of permitted ports for Pesticides import are published by MoFMRA. The ports include: <ul style="list-style-type: none"> - Port of Male' - S. Hithadhoo Port - HDh. Kulhudhufushi Port - Velana International Airport - S. Gan international Airport - HDh. Hanimaadhoo Airport - N. Maafaru International Airport
Plant Protection Act 12/2011	The overarching act prevents the production and distribution of substances that are detrimental to plants health, setting phytosanitary standards, promoting trade of plant and plant products in the Maldives.
Guideline for Registration Agricultural Input Importers	The guiding document for registration of agricultural goods importers and duty exemption for agricultural goods.
Protection of Public Health Act - Law No. 7/2012	To protect public from any health risks of chemicals.

The government's strategy to develop the agriculture sector includes strengthening agricultural value chains and productive capacity of farmers, increasing the role of agriculture in achieving food safety and food security, mainstreaming sustainable agricultural practices, strengthening institutional coordination, policy and regulatory framework of the sector and strengthening research in alternative agricultural technologies.

According to Agricultural Development Master Plan 2010-2025, under the present agricultural commercialisation programme, altogether 54 uninhabited islands have been leased out for a long-term period, ranging from 5 to 21 years, to individuals as well as to companies for agricultural production. Additionally, ADMP states that according to the recent technical assistance project of the Asian Development Bank (ADB) on Commercialisation of Agriculture, these leased islands have a total surface area of 996.6 ha estimated on the basis of vegetation coverage, out of which the total area suitable for agricultural production was estimated to be at a maximum of 900 ha. This may be less than the actual figure. Thus, current estimate of the total land area suitable for agriculture is 2,670 ha, consisting of 1,770 ha in inhabited islands and 900 ha in uninhabited islands.

7 AGRICULTURE AND FARMING PRACTICES IN LAAMU ATOLL:

Laamu Atoll consists of 11 inhabited islands with an estimated population of 12,643 people. Nearly every household in inhabited islands has a home garden where both cash crops and food crops are grown. In more specialised agricultural islands, there are fields adjacent to residential settlements. In certain agriculturally important islands, specialised cash crops such as banana, water melon, hot chilli pepper, papaya and betel leaf are cultivated. For communities of Laamu agriculture can be primary or secondary source of income and availability of plenty of land for cultivation makes Laamu Atoll an ideal location for expansion of agriculture industry.

7.1 Farming Population

The published data indicated that there are 1712 registered farmers Laamu Atoll (MBS 2020). The reported number of registered farmers are from 3 islands in Laamu atoll. The published data indicates by 2019 total population of registered farmers in Maldives are 7611 (MBS 2020), approximates 23% of registered farming population resides in Laamu Atoll.

NUMBER OF REGISTERED FARMERS IN LAAMU ATOLL, 2013-2020							
Year	2013	2014	2015	2016	2017	2018	2019
No. of farmers	824	1,717	1,711	1,711	1,711	1,711	1,712

Figure 4: Number of Registered Farmers in Laamu Atoll from 2013-2020 (MBS 2020)

The primary data collected for this study indicated, that there are a total of 2434 farmers actively involved in agricultural activities in Laamu Atoll. In comparison to registered farmers in published literature and primary data, 30% of farmers in Laamu atoll are unregistered.

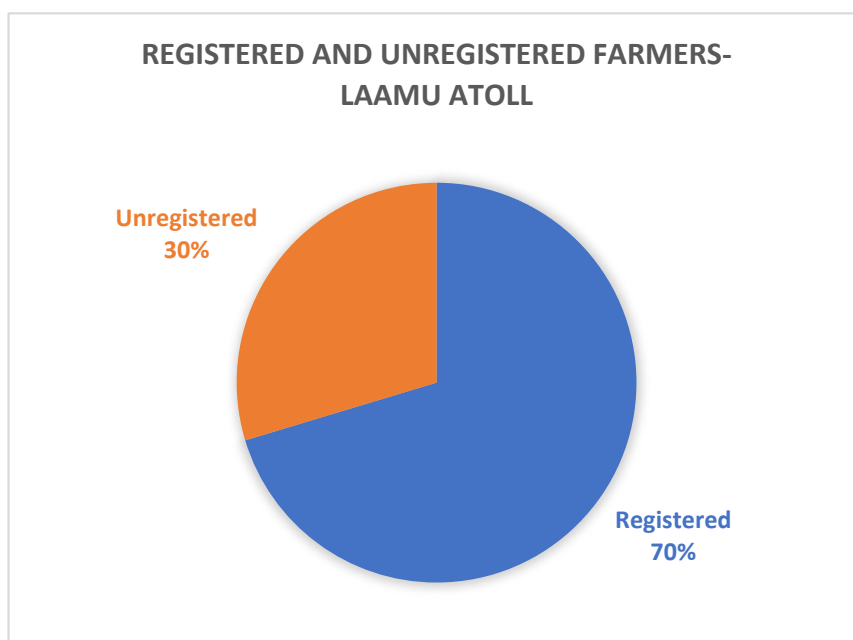


Figure 5: Percentage of registered and unregistered farmers in Laamu Atoll

The greatest number of reported farmers are from Gan island, followed by Isdhoo, Kalaidhoo and Dhanbidhoo. Gan island consist of approximately 33% of total farmers in the atoll, followed by Isdhoo with 30% and Kalaidhoo with 19% of farmers.

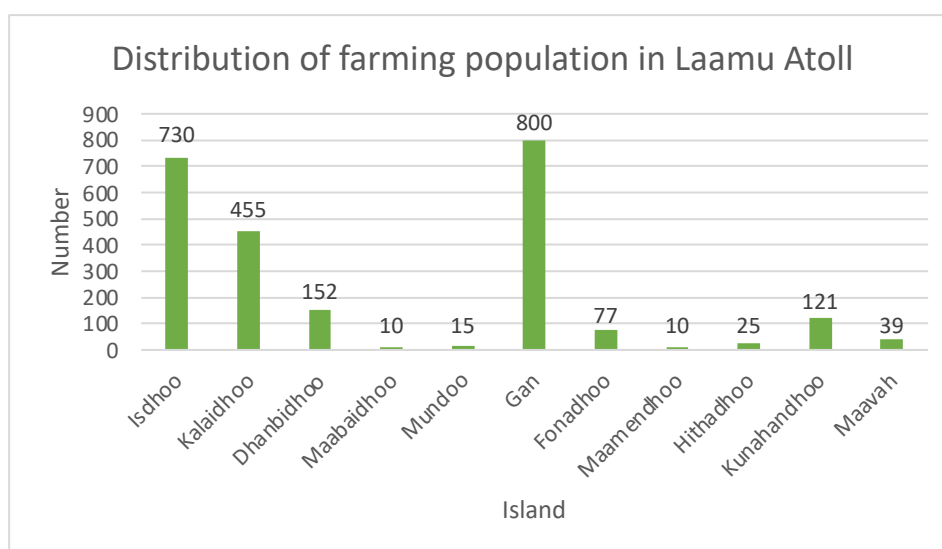


Figure 6: Distribution of Farming population in Laamu Atoll

According to the data, most farmers are between the ages of 26 and 55 and age the range of reported farming population are 15 to 66 or more. The population that farms is disproportionately young, however data also shows that there are farmers who are older than 66. The farming population's increasing age and age distribution show that Laamu Atoll has the ability to enhance its agricultural industry in the future.

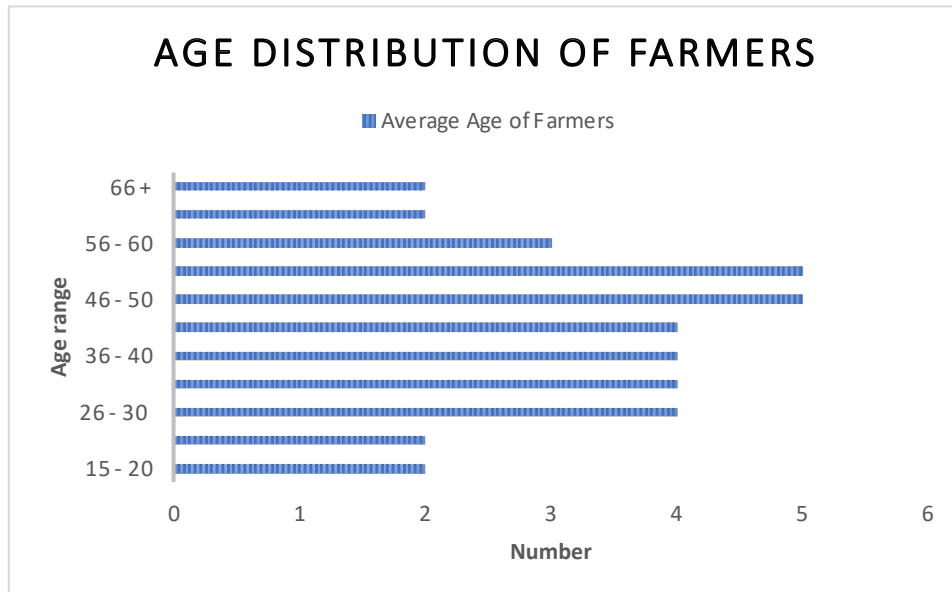


Figure 7: Age distribution of farmers

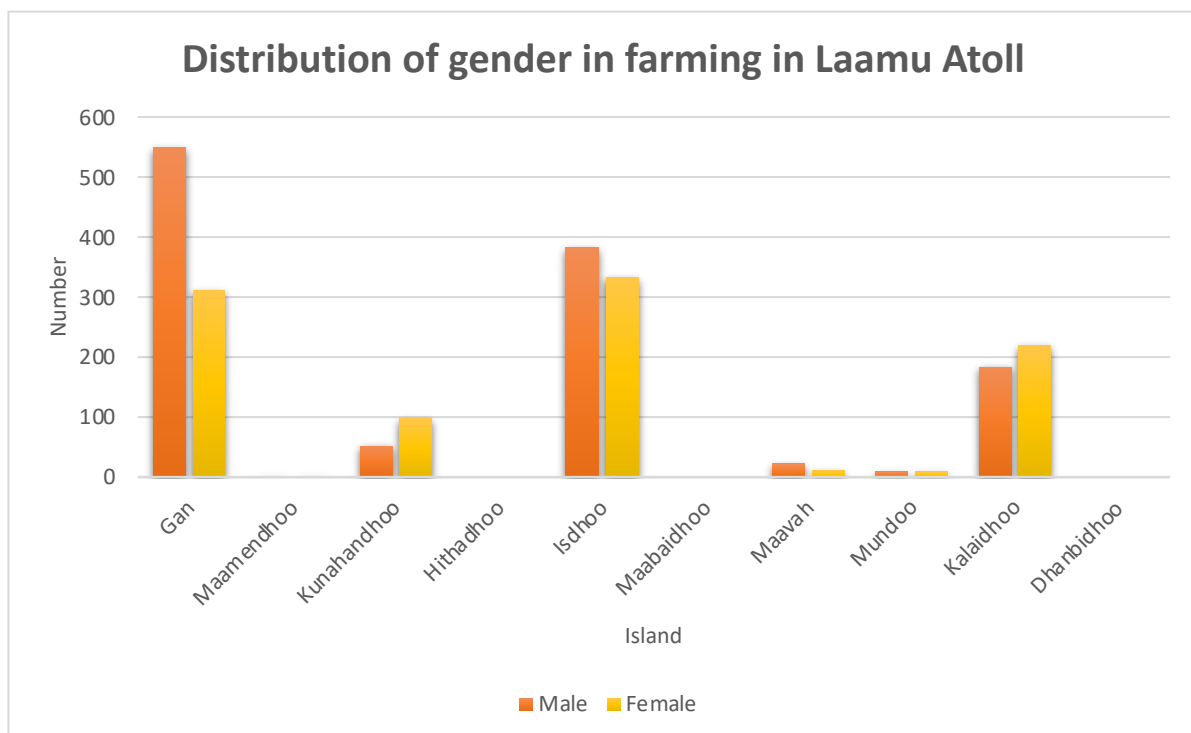


Figure 8: Gender of farming population

The information on gender distribution in farming in Laamu Atoll was received from Gan, Kunahandhoo, Isdhoo, Maavah, Mundoo, and Kalaidhoo. Based on the data received approximately 45% of farming population constitute of female and approximately 55% is male.

7.2 Land Resources:

Approximately 300 sq. km is the country's total land area, according to estimations. The anticipated amount of land that can be used for cultivation out of this total is 3,000 ha, or roughly 10% of the total. According to the most current FAO survey, which was conducted in 2001, the ten islands with the greatest potential for agriculture have land areas between 50 and 517 ha. Home gardens typically have 100 to 200 square meters of land. Additionally, the field plots allotted for field crops were tiny, ranging in size from 100 (0.01 hectare) to 1,000 square meters (0.1 ha).

The islands with a bigger land area are the ones that have made considerable investments in commercial agriculture. Except for Maamendhoo, every island in the Laamu Atoll is engaged in some form of agriculture, from micro-to-commercial. Maamendhoo is a tiny island in the Laamu Atoll, measuring only 22 hectares and home to 1,070 people. There is basically no land left on the island that can be used for agriculture. However, some households do engage in home gardening.

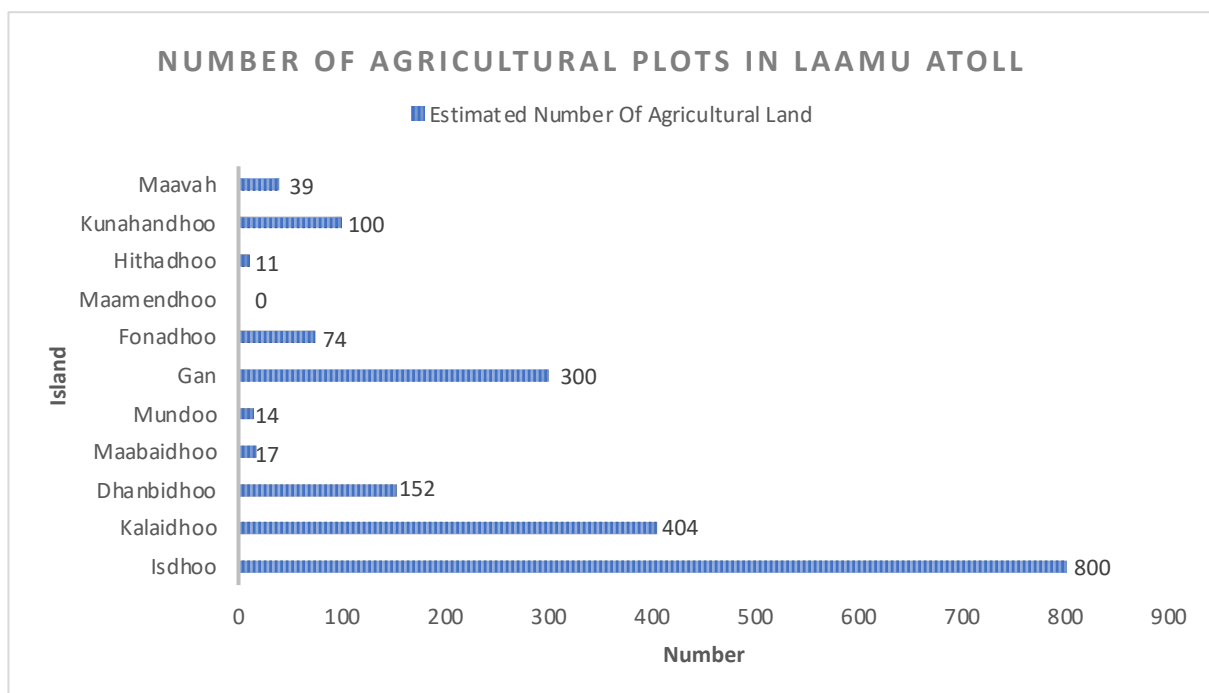


Figure 9: Number of Agricultural Lands

Isdhoo island has the most agricultural fields, followed by Kalaidhoo and Gan island. Regarding the work done in the atoll's agriculture sector, these three islands are the most well-known ones. There is a significant correlation between the size of the island and number of farmers as indicated in the graph below. Further, it is reported from Mundoo islands that the land plots allocated and leased for farming are currently not in use after the COVID 2019 pandemic.

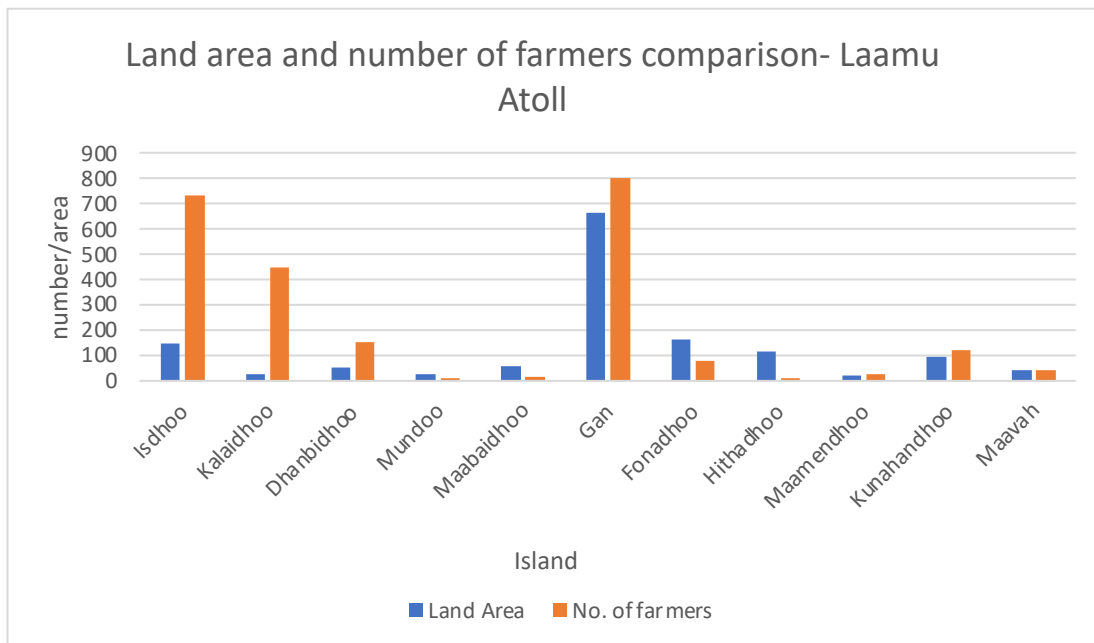


Figure 10: Land area and farmers distribution in Laamu Atoll

In addition to farming in local islands, there are two islands in Laamu Atoll that has been leased to for large scale commercial farming. L. Gaadhoo island is leased for long term to Agro-National Corporation Pvt Ltd since May 2021, for commercial farming. L. Mendhoo island is leased for long term for commercial agriculture, aquaponics, floriculture and poultry.

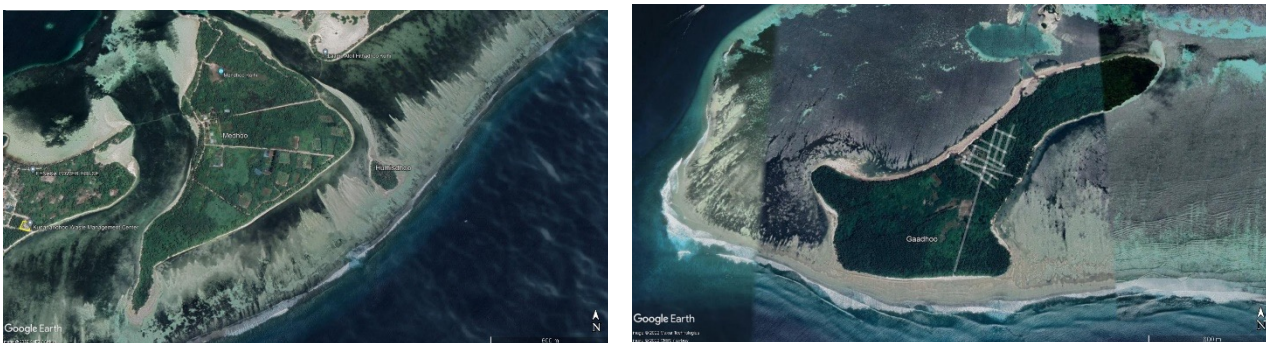


Figure 11: Leased islands for agriculture- L. Mendhoo (L) and L. Gaadhoo (R)

The land allocation data indicated that maximum land area currently allocated in islands of Laamu Atoll varies from 3,000 to 20,000 square feet and it is dependent on the size and availability of land in the respective islands.

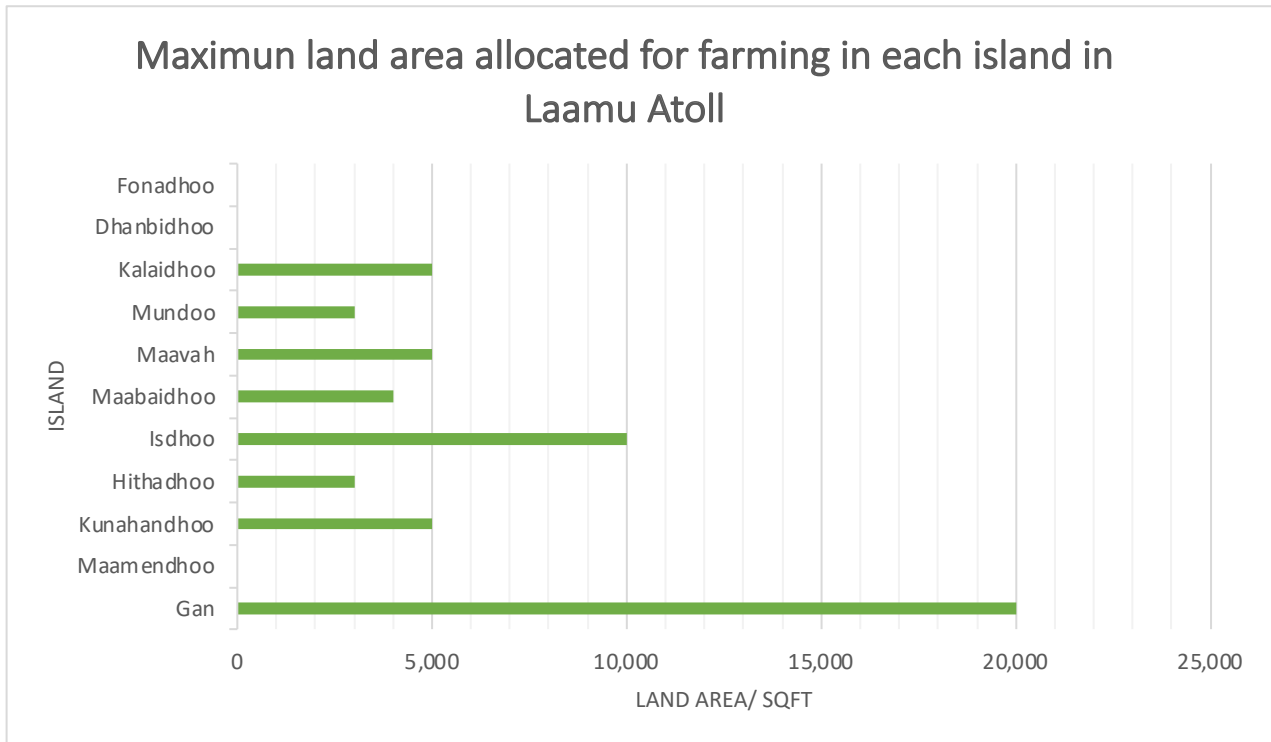


Figure 12: Maximum land area allocated for a farming plot per island

7.3 Farming Practices:

The tropical climate of country is suitable for year around cultivation. There aren't significant differences between islands in terms of how farming is carried out at Laamu Atoll in comparison to other atolls. Traditionally, all of the inhabited islands in the Maldives have engaged in homestead farming, which helps meet the nutritional needs of households by supplying them with fresh fruits and vegetables. The data indicated that leading farming practiced in inhabited islands of Laamu Atoll is home gardening followed by homestead and commercial inorganic and organic farming. The farming areas are generally small areas which involves a large number of farmers and community members and these homestead production and farming activities plots in the islands are leased from island councils for significantly low or no rent. The data also indicated that hydroponic farming is practiced however, less common form of farming in the atoll and aquaponics is currently not practiced in Laamu Atoll.

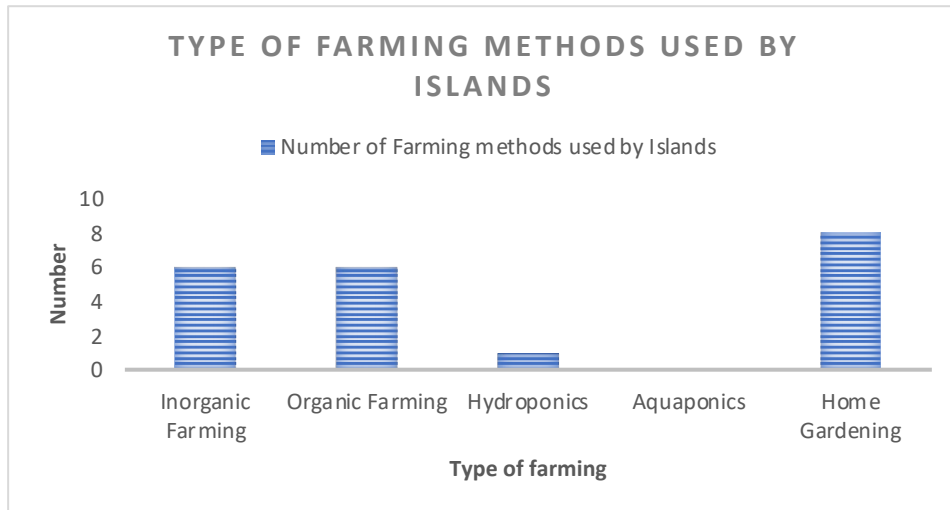


Figure 13: Type of farming in Laamu Atoll

MoFMRA has been actively promoting hydroponic production methods since 2001 (MoFMRA, 2009). These systems are based on conventional imported hydroponics nutrient mixtures.

7.4 Crops:

In a general context in Maldives, literature indicates agricultural production is mainly focused on horticultural crops. Crops such as bananas, papaya, taro, sweet potato, chili and collards are grown on farms all year round (MoFMRA, 2018). Tropical fruits and vegetables such as watermelon, papaya and banana are the focus. With the exception of coconuts and tropical almonds, no grain or nut crops are grown. Betel leaf (betel), chili peppers, collard greens and watermelon are among the most important cash crops. Southern atolls such as Laamu atoll specialize in taro and mango production (MoFMRA, 2019).

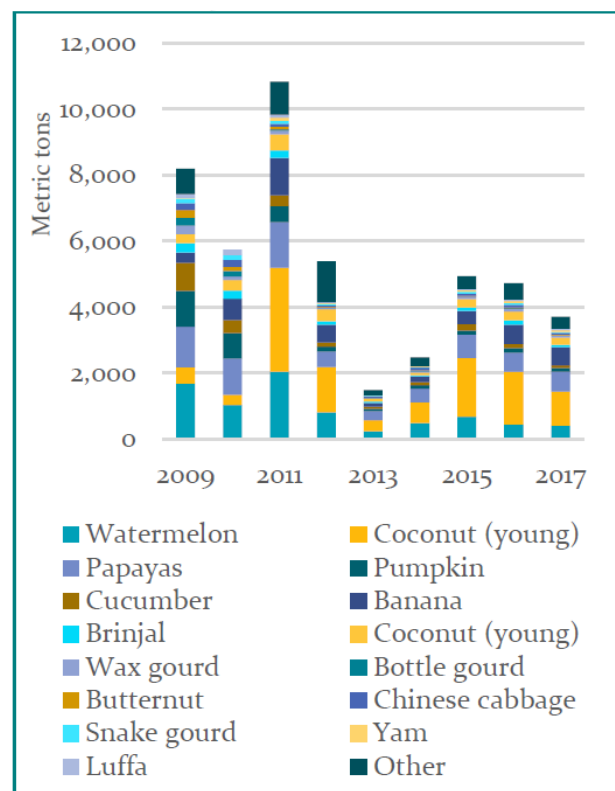


Figure 14: Main crops traded in Male' Market 2009-2017 (Source: National Fisheries and Agricultural Policy 2019-2029)

In addition to this, a variety of traditional hydroponic systems have been widely used to grow high-value crops like cucumber and sweet melon as well as leafy vegetables like lettuce and kangkung (*Ipomoea aquatica*).

Literature indicates that in past decade, the Maldives agriculture sector has not been able to maintain a steady supply of products commonly consumed by locals and tourists (MoFMRA, 2019). Maldives, heavily relies on imports to meet food security needs of the country, therefore locally grown produce are also imported to meet the demand and to maintain a steady supply for local nutritional needs.

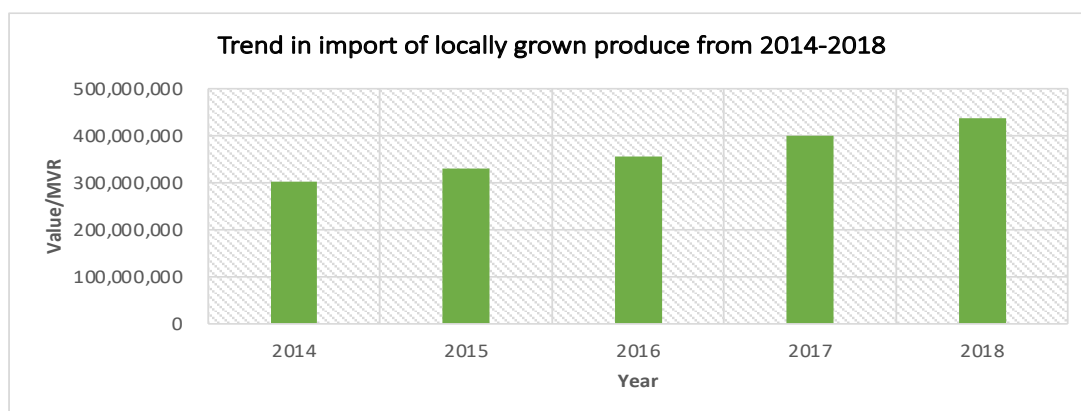


Figure 15: Trend in import of locally grown produce from 2014-2018 (MBS 2019)

7.5 Agrochemical Use:

The soils in the Maldives are young, and comprise of a thin layer of dark soil containing organic matter, and varying in depth from 20 to 40 cm. A hardpan layer up to 30 cm thick, cemented with calcium carbonate is found below the surface. The soils have very high infiltration rates and thus a low water-holding capacity. Due to excess calcium, the pH of the soil varies from 8.0 to 8.8 with an average of 8.5. The soils are generally deficient in nitrogen and potassium due to excessive leaching and deficient in several micro-nutrients such as iron, manganese, copper, boron and zinc as a result of high pH (FAO 2012). Phosphorous, although available, usually gets bonded as calcium phosphate and hence is not readily available to plants (FAO 2012).

The nature of soil in the islands of Maldives are significantly low in essential soil nutrients which facilitate the growth of agricultural crops, therefore agrochemicals are significantly required to enrich the soil for a better yield. Agrochemicals are chemical agents used on farmlands to improve the nutrients in the field or crops. Additionally, they improve crop growth by killing damaging pests. It is practiced in all forms of farming sectors such as

horticulture, dairy farming, poultry, crop shifting, commercial planting, etc. Agrochemical pollution is a serious threat to environmental safety. Studies has shown that exposure to agrochemicals had deleterious health effects such as nervous system damage and cancer. The biological magnification of persistent agrochemicals in the environment occurs over time. Environmental impacts such as ground water contamination and eutrophication due to leaching of excess nutrients are potential impacts of excessive usage of agrochemicals.

Though published literature on excessive usage of chemical-based fertilizers and pesticides in local agriculture are not available, the issue has been highlighted in number of platforms. World Bank (WB) reports indicated fertilizer consumption (kilograms per hectare of arable land) in Maldives was reported at 71.73 kilograms in 2020. Chemical-based fertilizers and pesticides are the main polluters, that directly impact human health and the environment.

Laamu is noted as one of those atolls that heavily use chemical fertilizers and pesticides and able to sell products only to the market in Male' whereas quality organic products have high demand from the tourism sector. Hence, MoFMRA is trying to establish product certification for Good Agricultural Practices (GAP) to provide better value and quality assurance. Maldives Food and Drug Authority (MFDA/food control division) under the Ministry of Health has mandate to regulate Food Hygiene and sets National Standard and Regulation for Food Establishments and Services and guidelines for the use of Controlled Drugs. Nonetheless, the cost of necessary testing for pesticides, trace elements and chemical through MFDA conducted from overseas is reported to be prohibitive. Thus, MoFMRA is currently expecting MVR 6.3 million donor assistance through the Saudi Housing and Livelihood Fund to procure machinery and reagents for such pesticide and chemicals testing at MFDA in 2019.

The data on commonly traded fertilizers and pesticides at Laamu atoll was collected from the main distributors in Gan and Fonadhoo island. The following tables indicate the common inorganic fertilizers, pesticides and insecticides used in Laamu atoll, with common name, main use, and market price.

Pesticides and Insecticides			
Name	Main use	Volume	Market Price
Cypermethrin	Used to spray to worms	250ml	170
Senora		100ml	350
Senora	Insecticide	175ml	435
Prodhan Insecticide	Insecticide	250ml	230
Prodhan Insecticide	Insecticide	500ml	320
Starkle-G	Insecticide	1kg	295
Prefenos (C-Cron)	Insecticide		525
Fungrang (copper hydroxide)	Helps leaves to gain protein and growth	500g	235
N+Mancozeb (Maaka)	Contact fungicide	50g	180
Besilas Thrinjiensis (BT)	Control worms	100g	185
Neemaxe	Insecticide	1ltr	
Mapa Diazinon 60	Insecticide	100ml	80
Mapa Diazinon 60	Insecticide	1 ltr	420
Clipper 20SL	Insecticide	1 ltr	350
Asgurd	Insecticide	1 ltr	520
Abamectin (Rihakuru beys)	Insecticide	100ml	85
Abamectin (Rihakuru beys)	Insecticide	1 ltr	440
Acetamiprid	Insecticide	1 ltr	490
Folicur Tebuconazole	Lack of iron in leaves, nutrient deficiency	250ml	275
Imidiclopreed	Used for pesticides and plant growth deficiency	100ml	400
Dhan Preet	Koodi beys	100g	115
Dhan Preet	Koodi beys	500g	600
Pager	Koodi beys	250g	430
Thiram	Used for fungus	100g	135
Thiram	Used for fungus	500g	465
Cyberguard 25 EC	Insecticide	1 ltr	520
Antracol	Contact fungicide	100g	90

Fertilizers			
Name	Main use	Volume	Market Price
Sulphur	Helps plant growth and greenery	1kg	225
Sulphur (BK)	Helps plant growth and greenery	1kg	170
Sulphur	Helps plant growth and greenery	500g	145
Maxicrop	Foliar Nutrient	400ml	170
Floral 20-20-20	Plant growth at all stages	2.5kg	300
Greenleaf 12.48.8	Foliar fertiliser promoting of flowering		135
Yaara Mila 8.24.24	Plant fertilizer (oh kaana)	1kg	45
NPK 12.12.36 (Florin)	Plant fertilizer (oh kaana)	1kg	75
Yaara Mila 12.11.18	Plant fertilizer (oh kaana)	1kg	55
NPK 27.6.6	Plant fertilizer (oh kaana)	1kg	35
Neu NPK 12.11.18	Plant fertilizer (oh kaana)	1kg	30
Ammonium	Plant fertilizer	1kg	35
Potassium	Plant fertilizer	1kg	35
Neu NPK 12.12.17	Plant fertilizer (oh kaana)	1kg	30
TSP	Plant fertilizer	1kg	55

Figure 16: Fertilizers and Pesticides used in Laamu Atoll

Although there are regulations for importing agrochemicals; there is currently no comprehensive government policy regarding the use of fertilizers and pesticides (MoFMRA, 2018). Instructions are given to buyers on the use of fertilizers and pesticides, but their use is largely uncontrolled and unregulated. Chemical-based fertilizers and pesticides are the main soil and ground water polluters. Handling from access, use and disposal, and their subsequent environmental and health implication should be monitored regularly.

8 CHALLENGES IN AGRICULTURAL PRACTICES:

The agricultural practices data indicates approximately 15% of the population works in agriculture, of which 45% are female and 55% are male. In the larger island such as Gan, Isdhoo and Kalaidhoo, agriculture is the main economic activity that contributes to livelihood of the local community. However, unsustainable agricultural practices such as unregulated chemical fertilizers and pesticide application are a major concern to health impact on the natural environment and biodiversity. Additionally, invasive alien species such as Giant snails (giant Africal land snail, *Achatina fulica*) infestations have been reported as a concern for farmers in Laamu as well as in other atolls.

The COVID-19 pandemic has changed the community outlook on health and food security, therefor more and more communities are investing on agriculture and farming expansions to meet local food security needs. Maldives being a country highly dependent on imports for its basic food security needs are vulnerable to impacts on food markets. Additionally, as a result of the effect on consumer health and the expansion of domestic and international food trade, food safety has become more and more crucial over time. To safeguard consumers from the risks of food-borne illnesses, safe food must be produced. Additionally, food safety is essential to food security and helps to boost export markets' competitiveness.

The challenges in agriculture in Laamu Atoll highlighted through this baseline indicated that one of the biggest challenges faced by community is the budget constraints, due to lack of financing to establish and expand farming to make it financially feasible for the farmers. Operation of agricultural activities insure significant investment, in terms of materials, fertilizers, labour, land rent and marketing produce etc. Most of the people in the island who are interested in agriculture are hesitant to invest in agriculture due to high investment cost. Additionally, to acquire bank loans and other financial facilities have been a challenge, due to difficulty in the process, delays and lack of knowledge on the process.

Agrochemicals are crucially needed to enrich the soil for a greater yield because the soil in the Maldives islands is naturally deficient in vital nutrients that support the growth of agricultural crops. The community faces difficulties since the area of the soil nourishment and the yield do not match the cost of the investment. Some islands emphasized how tough it is to obtain agricultural land, with procedures in place, such as submitting requests to the council offices and obtaining the relevant licenses has become a challenge for the community.

In addition, all islands have a significant problem due to a lack of training and knowledge. A lack of education in the agricultural sector could have unintended consequences for farmers at all phases of farming. Laamu is noted as one of those atolls that heavily use chemical fertilizers and pesticides, which has potential to put consumers at risks of food-borne illnesses. Therefore, there is a need to support educating the community on environmental and health implications of agrochemicals and shifting towards more sustainable agricultural practices. Further, several islands lack the resources, supplies and machinery needed for agriculture. Agricultural support services are limited. Fertilizers are expensive to bring from other islands and difficult to transfer from islands, as are other items like agricultural nets, site construction supplies, etc.

9

CONCLUSIONS AND RECOMMENDATIONS:

1. Homestead to commercial agriculture is practiced in all inhabited of Laamu Atoll, except Maamendhoo island. The unavailability of land for agriculture in Maamendhoo, led to the community, to be more dependent on imported food, however home gardening is carried out in some households. Hence, there is a need to explore alternative technologies for agriculture in islands with inadequate space for farming.
2. Grants and Loan programs for agriculture startups and shift to sustainable agriculture practices needs to be a priority to strengthen the food production which are environmentally sound and risk free for the consumers. This adds the importance of providing organic fertilizers, machineries and other raw materials which could help the farmers in agriculture development in Laamu Atoll.
3. Although there are regulations for importing agrochemicals; there is currently no comprehensive government policy regarding the use of fertilizers and pesticides (MoFMRA, 2018). Instructions are given to buyers on the use of fertilizers and pesticides, but their use is largely uncontrolled and unregulated. Chemical-based fertilizers and pesticides are the main soil and ground water polluters. Handling from access, use and disposal, and their subsequent environmental and health implication should be monitored regularly. There is need for national level legal instruments, such as regulations and guidelines to address the proper use of fertilizers and pesticides in response to the current unsustainable methods of utilization.
4. The current practice of using excessive amounts of pesticides and fertilizers raises serious concerns for both the environment and human health. Training and education on health and environmental impacts of fertilizers and pesticides, its proper use, alternatives to current products and promotion of environmentally friendly agricultural practices must be utmost priority in Laamu atoll, is a potential tool to manage unsustainable use and to prevent implications to human health and environment.

5. At the same time local guidelines for better management of agriculture at local level will potentially be beneficial for the farming communities. The present land allocation methods, official registry of farming population and overall agriculture management system is not clearly documented or implemented under any standard guidelines. The land allocation may be resolved with approved Land Use plans however, local agriculture management needs to be strengthened to facilitate sustainable agriculture in Laamu Atoll.
6. The farmers in Laamu are facing challenges in marketing and selling their products and generating a significant revenue from agriculture. Expansion of markets for local produce with potential marketing opportunities and value addition are much needed solutions for current challenges. To facilitate this, there is a need for easy access to transport, expansion of networks, assured market for the products from potential buyers in private sector. Further, establishment of a platform to promote sustainably sourced and produced food to markets will enhance the value of products and provide opportunity to farmers to market their products.
7. Introducing modern technology and agriculture items would be helpful for farmers to explore cost efficient and result oriented productions. Piloting environment friendly alternative agriculture methods which prevents wastage of resources and promote efficiency of the production. Therefore, the need for less space consuming, efficient water usage and high yielding agriculture could be the solution for the advancement of agriculture in Laamu Atoll.
8. It is recommended that climate resilience and resource efficiency be factored designing and implementation of future agricultural practices in Laamu Atoll. Financial and Non-Financial incentives can be provided to the farmers who are willing to shift towards sustainable and environment friendly agricultural approaches.
9. To address the issue of excessive use of fertilizers and pesticides, a detailed study on pesticide application practices and potential exposures can help to identify priority areas. Introduction of economically viable alternative technology and approaches will contribute significantly reduce dependency on agrochemicals. Additionally, establishment of sustainable organic fertilizer market within the atoll could potentially contribute to reduction in agrochemical use.
10. Build public awareness of the health and environmental risks of uncontrolled use of agrochemicals and farmers educated on importance of adhering to safety standards will potentially create a mindful farmer at the same time, will encourage farmers to responsible use of fertilizers and pesticides. Further, training programs on best practices in agriculture is important to build capacity within farming community in Laamu Atoll.

10

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