

Status of Horticulture in Sri Lanka

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Abstract

The agriculture sector continues to be the mainstay of the national economy in Sri Lanka though its contribution to GDP is 8.7%. A quarter of the labour force is employed in this sector. The majority of the land used for food production in Sri Lanka is owned by smallholder farmers with average landholdings of less than two hectares. The horticulture sector deals with fruits, vegetables, floriculture and landscape industries. In Sri Lanka, the horticulture sector has a high potential to develop further, as different types of horticultural produce can be grown throughout the year in different agro-climatic zones. Recently, the potential, interest and demand for fruits and vegetables have increased in the country. The farmers grow about 40 different species of vegetables and the total production was 1,588,256 metric tons in 2022. Sri Lanka has earned 28.5 million US dollars by exporting 21,540 metric tons of vegetables while 697,144 metric tons of vegetables worth US dollars 384.3 million were imported. Fruit cultivation is mostly confined to the home garden level, with some varieties being commercially grown. The production of fruits was estimated at 3.3 million metric tons in 2021 and 43,426 metric tons of fruits, worth US dollars 38.0 million were exported and 90% of the production being exported to the Middle East and Maldives. While 55,725 metric tons, valued at US dollars 67.6 million were imported. The continuous supply of fruits and vegetables to meet the market demand is a challenge as there is a gap between demand and supply. The floriculture industry is still a small and medium category enterprise. This sector includes ornamental foliage plants, cut decorative foliage, cut flowers, aquarium plants, landscaping plants, tissue cultured plants and flower seeds. The country's floriculture exports for the year 2022 were nearly US\$ 14.66 million and the foliage plants dominate the export market (88% of the income). The Netherlands, Japan, Saudi Arabia and UAE were the main export markets. The Sri Lankan horticulture industry has faced a drawback from 2020 to 2022 due to the COVID-19 pandemic, the political unrest, the policy decision of the government in 2021 to ban agrochemicals and high fertilizer prices in the world market. As a result, the production and export of the horticultural produce still have not recovered up to its potential.

Keywords: Floriculture, Fruits, Horticulture sector, Sri Lanka, Vegetables

Introduction

Sri Lanka is a lower middle-income country with a GDP per capita of USD 3,853 (2019) and a total population of 21.8 million. Since ancient times, Sri Lankan society has been known as predominately agrarian and the agricultural history dates back more than 2500 years. For centuries, sustainable and organic agricultural practices were adopted in the country. The extent of the island is 65,610 km² with 62,705 km² of land and 2,905 km² of inland water. The freshwater network in the country is a blessing to agriculture which consisted of 103 rivers, man-made reservoirs and other freshwater resources. Man-made irrigation resources have shaped life in the dry zone with an estimated 18,000 tanks clustered into 3500 to 4000 Small Tank Cascade systems.

The climate of Sri Lanka

The climate of the country can be described as tropical. The equatorial position of Sri Lanka gives its lowlands a tropical climate with the mean annual temperature that varies from 27°C in the coastal lowlands to 16°C in the central highlands and a relatively constant day length. Rainfall in Sri Lanka has multiple origins. Monsoonal, convectional and depressional rain accounts for a major share of the annual rainfall. The mean annual rainfall varies from under 900 mm in the driest parts (southeastern and northwestern) to over 5000 mm in the wettest parts (Department of Meteorology, 2019). The Monsoonal rainfall pattern is influenced by the monsoon winds of the Indian Ocean and the Bay of Bengal which occur during two seasons of the year. The South-west monsoon is from mid-May to September, which encounters heavy rains on the mountain slopes and the southwestern sector of the country (Figure 01). The North-east monsoon is from December to February, when winds from the northeast, bring

moisture from the Bay of Bengal (Punyawardene, 2009). This is considered the major season (Maha). The northeastern slopes of the mountains encounter rain during these months. The rainfall is unevenly distributed over two growing seasons, with 60-70% falling during the major season and 20 -40% falling during the minor cultivation season (Murray and Little, 2000).

Considering the rainfall pattern and its distribution, the island is broadly divided into three zones (Figure 01). The dry zone receives 1270-1904 mm of mean annual rainfall, the intermediate zone receives 1905-2540 mm of mean annual rainfall and the wet zone receives over 2540 mm. The Dry zone covers about 70 % of the total land extent in Sri Lanka and it is the major agricultural region of the country. According to Punyawardene, (2009), beads on the monthly rainfall regime, terrain characteristics, predominant soil type, land use and vegetation, the country is subdivided into 46 Agro-Ecological Regions (Figure 02). Each Agro-Ecological Region represents a uniform agro-climate, soils and terrain conditions that would support particular farming system.

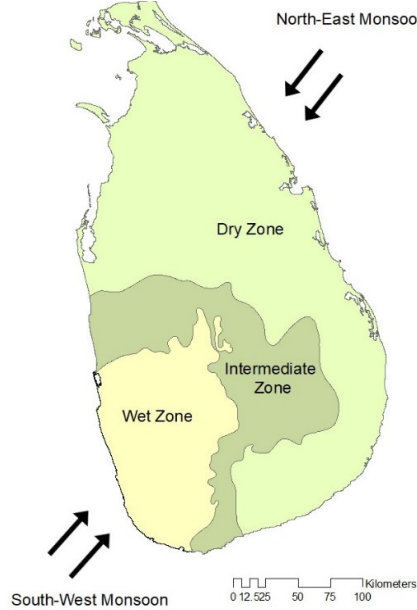


Figure 1. Three major climatic zones (wet, intermediate and dry) and two monsoons (North-east and South-west) of Sri Lanka.

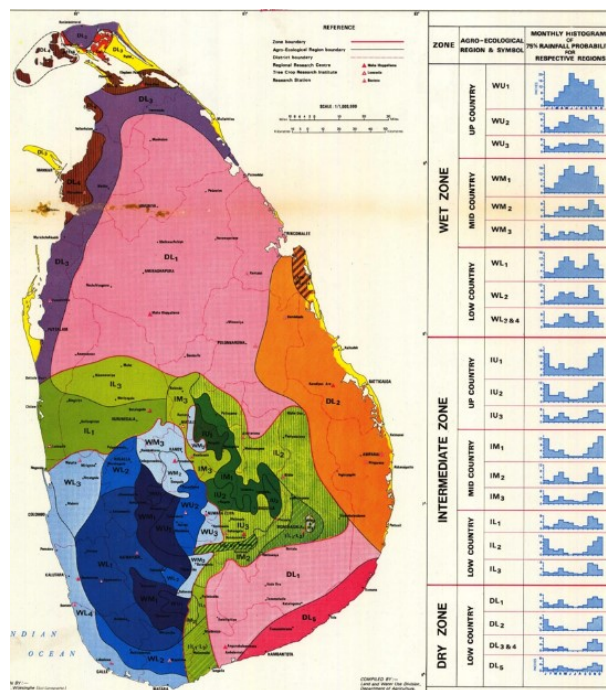


Figure 2. Major agroecological regions of Sri Lanka

The agriculture sector in Sri Lanka

The agriculture sector in Sri Lanka mainly consists of food crops (rice, maize, other cereals, fruit and vegetable crops), plantation crops (tea, rubber, coconut, sugarcane and palmyra), export agricultural crops (spices including clove, cinnamon, black pepper and other beverage crops including coffee, cocoa, etc.), forestry, fisheries, livestock and poultry subsectors. The agriculture sector receives a substantial portion of government support directly and indirectly, as it is important for food security and in consideration of a large number of the population dependent on the sector for employment. The share of agricultural workers is 27.3% at present (Central Bank of Sri Lanka, 2021). The number of agricultural workers decreased slightly from 2.24 million in 2015 to 2.16 million in 2020. However, the share of agricultural workers is increasing among the low-income class, which reflects the growing severity of low-income problems faced by agricultural households. The agricultural sector is increasingly becoming unpopular as employment, especially among young people, has become a global trend (STEPI, 2020).

Contribution of the Agriculture sector to the economy

Agriculture continues to be the mainstay of the national economy through its contribution to Gross Domestic Product (GDP) is in decline as the manufacturing sector expands. At present, the contribution from agriculture to GDP is 8.7 %. (Figure 3). The manufacturing and services sectors grow rapidly compared to the agriculture sector, where, both sectors make higher contributions to the GDP, than the agriculture sector. Agriculture activities contracted by 4.6 % in 2022 in value-added terms, compared to the growth of 0.9 % recorded in 2021 (Central Bank of Sri Lanka, 2022).

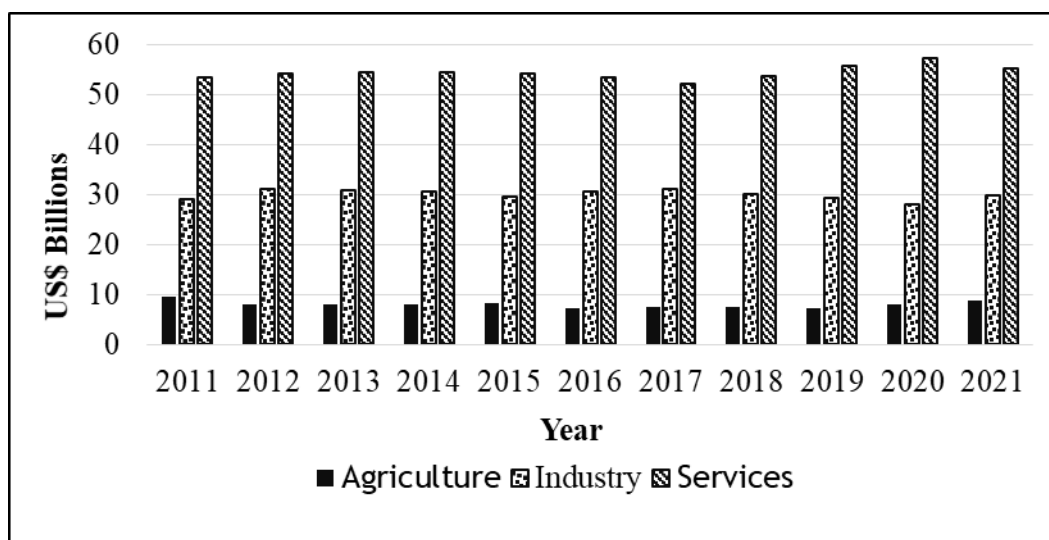


Figure 3. Sectorial Composition of GDP (US\$ Billion) from 2011 to 2021

Agricultural land use

The agricultural land covers approximately 2.8 million ha or nearly 45% of the total land area of the country. Though employment in the agriculture sector is gradually decreasing in Sri Lanka over the last two decades, the agricultural area in Sri Lanka has increased gradually in the past decade from 2,350,000 ha in 2000 to 2,812,000 ha in 2020 (FAO 2020). Further, there is a gradual shift in the share of area under organic agriculture in the total agricultural area over the past two decades and now it is 2.6% (165,000 ha in 2017) (STEPI, 2020). According to the Department of Census and Statistics (DCS, 2002), the majority of the land used for food production is owned by smallholder farmers which accounts for 1.65 million people, with average landholdings totaling less than 2 ha. Further, the smallholder farmers are in charge of about 80% of Sri Lanka's total annual crop production. The cropland area per capita is almost constant in Sri Lanka (0.11 ha per capita) for the past two decades where the trend is similar to Bangladesh (0.06 ha per capita) whereas in other SAARC countries, a decreasing trend was recorded (FAO, 2022).

Climate change and Agriculture sector

The agriculture sector in the country has already felt the effect of extreme weather events and climate changes. This includes a slow increase in ambient temperature (0.01–0.03 °C per year) and high-intensity rainfall (World Bank and CIAT, 2015). Further, in Sri Lanka, wet areas are predicted to become wetter and the dry areas are predicted to become drier, directly affecting the agriculture activities in the wet and dry zones of the country (Marambe *et al.*, 2014).

The horticulture sector

The horticulture sector deals with fruits, vegetables and ornamental plants. The ornamental plant sector consists of floriculture and landscape industries. In Sri Lanka, the horticulture sector has a high potential to develop further, as different types of horticultural produce can be grown throughout the year in different agro-climatic zones. Out of the total agricultural land under cultivation, about 20% is used to grow fruits and vegetables. Home gardens, which include multiple farming systems, grow diverse horticultural crops such as fruits, vegetables, ornamental and medicinal plants and in certain instances combine livestock. According to Punyawardena (2007), home gardens cover a substantial amount (14.8%) of the total land area in the country. Further, urban agriculture is also gaining popularity in the island, where vegetable crops are widely used. Modern technology has become popular around the world and there is a tendency in the horticulture sector in Sri Lanka too in adopting smart agricultural technologies. Fruit and vegetable production in Sri Lanka is negatively affected by decreasing arable land availability for large scale farms in the country and due to high postharvest losses of fruits and vegetables (30 - 40%).

Recently, the potential, interest and demand for fruits and vegetables have increased in Sri Lanka due to government policy, the Covid pandemic, the increase in population and changes in dietary requirements (Netherlands Enterprise Agency, 2021). WHO currently recommends consuming at least 400 g of fruit and vegetables each day or five servings of 80 g each (WHO and FAO, 2003). This should ideally consist of at least five varieties of fruits and vegetables for a healthy life (146 kg per person per year). However, Sri Lanka's per capita consumption of fruits (88.2 g) and vegetables (124.3 g) remains far below the required average daily intake (Department of Census and Statistics, 2014). A seasonal change in fruit and vegetable consumption is observed in Sri Lanka as the quantity of fruits and vegetables supplied, the quality of produce available and prices vary in different seasons. In urban areas, the average monthly household expenditure on fruits and vegetables is 11.9% and in rural areas, it is 13.5% (STEPI, 2020).

The Department of Agriculture (DOA) has the mandate for fruits, vegetables and floricultural crop research in Sri Lanka. The two institutes of the DOA, Horticultural Crop Research and Development Institute (HORDI) have the mandate for vegetable and floricultural crops research while Fruit Research and Development Institute has the mandate for fruit research.

Vegetable sector

The favourable agro-climatic conditions of the country allow farmers to grow about 40 different species of vegetables and vegetables are grown in an estimated extent of 112,676 ha. This sector contributed 0.6% to the Sri Lankan GDP in 2019 (Department of Census and Statistics Sri Lanka, 2021). The total vegetable production in the country was reported to declining from 2019. It decreased by 1.4 % from 1,693,095 metric tons in 2020 to 1,669,515 metric tons in 2021. It was further reduced by 4.9 % to 1,588,256 metric tons in 2022. This was owing to the combined impact of inclement weather, the fertilizer shortage and increased machinery and transportation costs. (Central Bank, 2021 and 2022). Hence the continuous supply of vegetables to meet the market demand is a challenge as there is a gap between demand and supply. The extent, production and average yield of main upcountry and low country vegetables in 2020 is given in Table 1.

Based on agroecological adaptability, the vegetables grown in Sri Lanka can be divided mainly into two categories; upcountry vegetables and low-country vegetables. However, three main vegetable farming systems can be recognized such as upcountry, low-country and vegetables grown in rice-based systems. According to Weerakkody and Mawalagedera (2021), the main commercial vegetable-based cropping systems in the country primarily practice conventional production technologies by using agrochemicals.

Table 1. Extent, Production and Average Yield of main upcountry and low country Vegetables in 2020

System	Vegetable	Extent (ha)	Production (t)	Average yield (t/ha)
Up country	Bean	7,830	82,973	10.6
	Beetroot	2,192	36,262	16.54
	Cabbage	4,562	125,746	27.57
	carrot	3,924	90,225	23.00
	Knol-khol	1,488	17,045	11.45
	Leeks	2,319	35,695	15.39
	Radish	2,876	55,773	19.39
	Tomato	6,569	90,507	13.78
Low country	Ash plantain	5,357	68,129	12.72
	Ash pumpkin	701	11,425	16.3
	Ladies fingers	8,090	81,444	10.07
	Bitter gourd	4,101	47,632	11.61
	Brinjal	11,109	141,882	12.77
	Capsicum	3,699	31,509	8.52
	Cucumber	2,687	38,676	14.39
	Red pumpkin	7,741	113,322	14.64
	Snake gourd	2,650	32,868	12.4
	Luffa	4,231	45,945	10.86

(Source: AgStat, 2021).

Upcountry vegetable production system

Upcountry has a cool climate hence a favourable climate for temperate vegetables. The land is sloppy and farmers generally use small plots. Intensive management practices with high inputs (fertilizer, pesticides) are common and farmers use 3 - 4 cycles per year without a fallow period. Hence vegetable production in the upcountry is labour-intensive. Apart from monocultures, some farmers use mixed cropping with two to four different crops. Crops used include Tomato, Capsicum, Cabbage, Cauliflower, Leek, Carrot, Lettuce, Broccoli, Beet, Beans, Radish, Celery and Parsley. Among upcountry vegetables, the most-consumed vegetables included beans, carrots and leeks (Udari *et al.*, 2021). This system uses imported hybrid seeds and excessive dosages of agrochemicals to protect crops and increase yield resulting in high environmental risk (Weerakkody and Mawalagedera, 2021).

Low-country Vegetable Production

Compared to upcountry, low-intensive cultivation practices can be seen in the low-country vegetable production system which uses low inputs. Here, indigenous vegetables are mixed with cereals and legumes. Crops used include brinjal, bitter gourd, pumpkin, luffa, cucumber, snake gourd, okra, long beans and ash plantain. According to Udari *et al.*, (2021), the most-consumed vegetables in the low country included brinjal, okra and long bean.

Vegetables grown in rice-based systems

The lowland paddy fields in the dry and intermediate zones are cultivated with vegetables. In this system, Rice is cultivated in the major season (Maha) and vegetables such as Tomato, Chili, Brinjal, Okra, Yard long bean, Snake gourd, Luffa, Bitter gourd, Cucumber etc. are cultivated in the minor season (Yala).

Apart from these systems, there is an increasing trend of growing vegetables in an organic manner in home gardens, urban and peri-urban systems and in organic farms. Particularly, organic farming and ecological farming have grown as a solution to address the overuse of chemical inputs.

Leafy vegetables

Leafy vegetables can be easily grown with low inputs hence popular in home gardening. Compared to other vegetables they grow rapidly with a shorter growth period and continuous harvest over the growing period. At commercial level, leafy vegetables are grown across the country in wetter areas. Leafy vegetables include *Centella asiatica*, *Alternanthera sessilis*, *Amaranthus tricolor*, *Sesbania grandiflora*. The most-consumed leafy vegetables

included *Centella asiatica* and *Alternanthera sessilis* (Udari *et al.*, 2021). Additionally, there are a large number of naturally grown plants the leaves of which are eaten in certain parts of the country.

Protected agricultural systems

These systems include protected houses and rain shelters to net houses. Selected high-value vegetables (Bell Pepper, Cucumber, Broccoli, Cauliflower, Tomato) fruits (Strawberry) and floricultural crops (Roses, Gerbera, Daisy, Tulips, Chrysanthemum) are cultivated targeting the export and local niche markets. Particularly high-tech agriculture could be practiced under the protected houses to grow vegetables as an alternative to maximizing benefits from the available lands in urban areas and for off-seasonal vegetable production.

Seed requirement of vegetables

According to the DOA statistics, 199 tons of vegetable seeds were imported into the country in 2019. At present about 90% of the upcountry vegetable, seed is imported where beans, radishes and tomatoes are the most commonly imported. Whereas about 33% of the total low country's vegetable seed requirement is imported. New improved varieties have been released and multiplied periodically by the Department of Agriculture.

Export of vegetables

In 2021, Sri Lanka earned 28.5 million US dollars by exporting 21,540 metric tons of vegetables while 697,144 metric tons of vegetables worth US dollars 384.3 million were imported (Central Bank, 2021). The main types of exported vegetables included green beans, leeks, capsicums, cabbage, carrots, tomatoes, bell peppers, breadfruit, young jackfruit, ladies' fingers, drumsticks, bitter gourd, gherkins and pumpkins. The Maldives, United Arab Emirates, the UK, Malaysia and the USA have been the major importer of vegetables from Sri Lanka (STEPI, 2020). Improved crop production technologies are practiced in the cultivation of vegetables for the export market.

Constraints to the vegetable sector development

The main problems to improve vegetable production in Sri Lanka include: High cost of production including high cost of labour; unavailability of quality seeds and crop improvement programmes; unavailability of land/land fragmentation; adverse weather conditions; delay of new technology adoption by the farmers; poor packaging, high air freight and cost of export services; limited private sector investment; poor post-harvest handling and weak extension services.

Fruit sector

Sri Lanka has been known to produce a different variety of tropical fruits and over 60 varieties of underutilized fruit crops (Dahanayake, 2015). The production of fruits was estimated at 3.3 million metric tons in 2021 (Central Bank, 2021). Fruit cultivation in Sri Lanka is spread over 150,000 ha in which a major part is undertaken by small-scale producers and home garden growers (Central Bank, 2018). The extent and production of major fruits in 2020 is given in Table 2.

Fruit cultivation on a commercial scale is confined to 7 out of 25 districts in the country. It is important to note that more than 95% of the fruit requirement has been grown locally (Food balance sheet, 2019) and the local markets have experienced an influx of fresh fruits during the harvest seasons. Fruit cultivation is mostly confined to the home garden level, with some of the fruit varieties such as banana, mango, pineapple, papaya, passion fruit and rambutan commercially grown in orchards whereas underutilized fruit species are found in the wild or home gardens. Bananas and papaw are the most frequently consumed fruits among households in Sri Lanka, followed by mangoes, apples and oranges (Udari *et al.*, 2021). Based on the data released by the Department of Agriculture, 25 tons of fruit seeds were imported annually into the country.

Export of Fruits

In 2021, 43,426 metric tons of fruits, worth US dollars 38 million were exported and 90% of the production was exported to the Middle East and Maldives. The top three fruit exports comprised bananas, papaws and pineapples (Central Bank, 2021). Apart from these melons, mangoes, mangosteen, avocado, soursop, lemon, ripe jack, star fruit and rambutan also have an export demand (STEPI, 2020). During this period, 55,725 metric tons of fruits, valued at

US dollars 67.6 million were imported. The top three fruit imports comprised apples, grapes and oranges (Central Bank, 2021). The fruit import is mainly to cater to the tourism industry.

Sri Lankan fruit sector has adjusted well to the ISO 22000 series and the health and safety regulations specified by the European Union. Farmers have been educated to practice Good Agricultural Practices (GAP) at the nurseries while some farms are certified under the GLOBAL GAP certification (EDB, 2022).

Table 2. Extent and Production of Major Fruits – 2020

Fruit type	Extent (ha)	Production ('000 Fruits)	Quantity (t)
Banana	44,886	75,610	907,322
Lime	10,534	391,161	19,558
Mango	29,229	529,528	185,335
Orange	6,945	61,203	9,180
Papaya	6,665	87,122	130,684
Passion fruit	617	9,758	976
Pineapple	5,636	42,516	53,145
Rambutan	7,506	523,842	18,334
Avocado	3,783	58,406	19,274
Melon	1,443	25,244	37,866

(Source: AgStat, 2021).

Constraints to the fruit sector development

The main constraints to the fruit crop industry in Sri Lanka include a lack of land for commercial orchards; an increase in the cost of production, limited availability and access to advanced technology; insufficient cold chain facilities to support the supply chain, limited storage and handling facilities, lack of continuous production, lack of improved germplasm and high post-harvest losses amounting to 30-40%.

Floriculture sector

Sri Lanka's export-oriented floriculture industry was established during 1980/81 and has emerged as a reliable supplier of a wide range of quality floriculture products. However, the floriculture industry in Sri Lanka is still a small and medium category enterprise. Compared to the past, at present the rate of growth of the industry is rather slow. The extremely high capital is identified as one of the main drawbacks in floriculture sector (Perera, 2019). Western, North Western and Central Province are the major commercial floricultural production regions in the country (Padmini and Kodagoda, 2019) and the floriculture sector employs more than 10,000 families in semi-urban and rural areas.

The floriculture products include ornamental foliage plants, cut decorative foliage, cut flowers, aquarium plants, landscaping plants, tissue cultured plants and flower seeds. The country's diverse agro-climatic conditions can accommodate a range of tropical, subtropical and temperate species of ornamental plants (Niranjan and Gunasena, 2011). Around 350-450 ha of land is under floricultural crops in the Upcountry region. The cut flowers grown in the country can be divided into two main categories based on their temperature requirements *i.e.*, temperate cut flowers (Gerbera, Roses, Madonna, Lily, Chrysanthemum, Aster, Dahlia, Baby's breath) and tropical cut flowers. Anthuriums and Orchids are the most popular tropical cut flowers which are being grown commercially for exports as well as for the local market.

Export of floricultural crops

Sri Lanka has a high potential to further develop the floriculture industry as Sri Lanka has a favourable location to serve different markets in the world. Compared to other horticultural crops, the income per unit of land area is higher in floriculture nurseries (Padmini and Kodagoda, 2019). At present over 55 local floriculture exporters are operating in the country. Sri Lanka exports foliage, cut flowers, floriculture seeds and aquatic plants. Of which foliage plants dominate and account for 88% of the income. The country's floriculture exports for the year 2022 were nearly US\$ 14.66 million which was reduced from US\$ 16.19 million in 2021 (Table 3). Sri Lanka's share in

the world floriculture market is only 0.1%. The Netherlands, Japan, Saudi Arabia and UAE were the main export markets.

Constraints to the floriculture sector development

Inadequate and high cost of air cargo, lack of research and development, lack of improved cultivars, shortage of good quality planting materials and inadequate transportation and storage facilities and lack of novel products for the export market are the major constraints to the sector.

Table 3. Export statistics of Floriculture sector products

Product type	2019		2020		2021		2022	
	Quantity (Kg)	Value million (US\$)	Quantity (Kg)	Value million (US\$)	Quantity (Kg)	Value million (US\$)	Quantity (Kg)	Value million (US\$)
Foliage	4,279,690	13.9	2,448,992	8.56	2,757,123	11.9	2,847,914	12.93
Floriculture seeds	19,301	1.24	10,157	1.31	5,971	1.11	4,514	1.35
Aquatic plants	98,498	0.69	73,919	0.57	123,911	0.91	63,085	0.2
Cut flowers	90,270	0.1	73,822	0.09	44,412	0.16	48,780	0.18
Total		17.5		12.6		16.19		14.66

Source: Export Development Board, 2023

Landscape sector

The landscape industry in Sri Lanka is confined to small to medium scale enterprises and it is popular self-employment across the country. Ornamental plant nurseries sell exotic trees, shrubs, herbaceous plants, climbers and ground covers, out of which lawn grasses have gained a renewed interest in the market. Sri Lankan landscape designs have an influence from the English garden style and exotic plants are widely used in the landscape industry. Although the country is blessed with a rich native flora, native plants are not readily available in the market as opposed to exotic plants (Ranasinghe *et al.*, 2019). Hence popularizing native plants in the industry is a timely requirement. Some of the introduced exotic ornamental plants have escaped the anthropogenic landscapes and invaded the natural and agricultural lands as invasives, thus causing an irreversible damage to biodiversity and agriculture.

Recent drawbacks to the horticulture industry

The Sri Lankan economy undergoing its worst-ever recession from 2020 to 2022 mainly due to the impact of the COVID-19 pandemic followed by the political unrest and foreign exchange shortage in the country. In the past, the government has provided farmers with subsidized chemical fertilizers, irrigation and extension services and Sri Lankan horticulture sector was almost dependent on agrochemicals. With the policy decision of the government in 2021 to completely ban agrochemicals, crop yields were reduced drastically even though the government promoted organic agriculture as an alternative solution. However, the policy on banning agrochemicals was reversed in 2022, however, the fertilizer prices have increased in the world market. As a result, the production and export of horticultural produce still have not recovered up to its potential.

Way forward

- Fruit and vegetable crop production needs to be promoted with continuity in supply aimed at increasing export earnings for the country.
- Mobilizing the rural youth on Agri-entrepreneurship with a promising pathway to retain the youth to maintain a sustainable livelihood development.
- Expansion of the research and development incorporating modern technology (Nanotechnology) to address current issues
- Promoting Internet of Things powered devices to monitor the plants and environment
- Development of breeding programmes to introduce new varieties of fruits and vegetables
- Development of a high-quality seed industry to cater for the growing demand

- Branding of selected unique products such as Non-traditional horticultural crops to enhance the capacity to become a significant contributor in the world fruit and vegetable market.
- Improving cold chain facilities to support the supply chain
- Value additions to the currently cultivated horticultural crops with the potential of export markets.
- Further development of the e-agriculture services through mobile phone apps to advise farmers to receive a better market price for fruits and vegetables
- Exploration of native biodiversity and development of novel floriculture products for the world market
- Recognition and development of the aquatic cut flower industry to cater for the local and export market

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