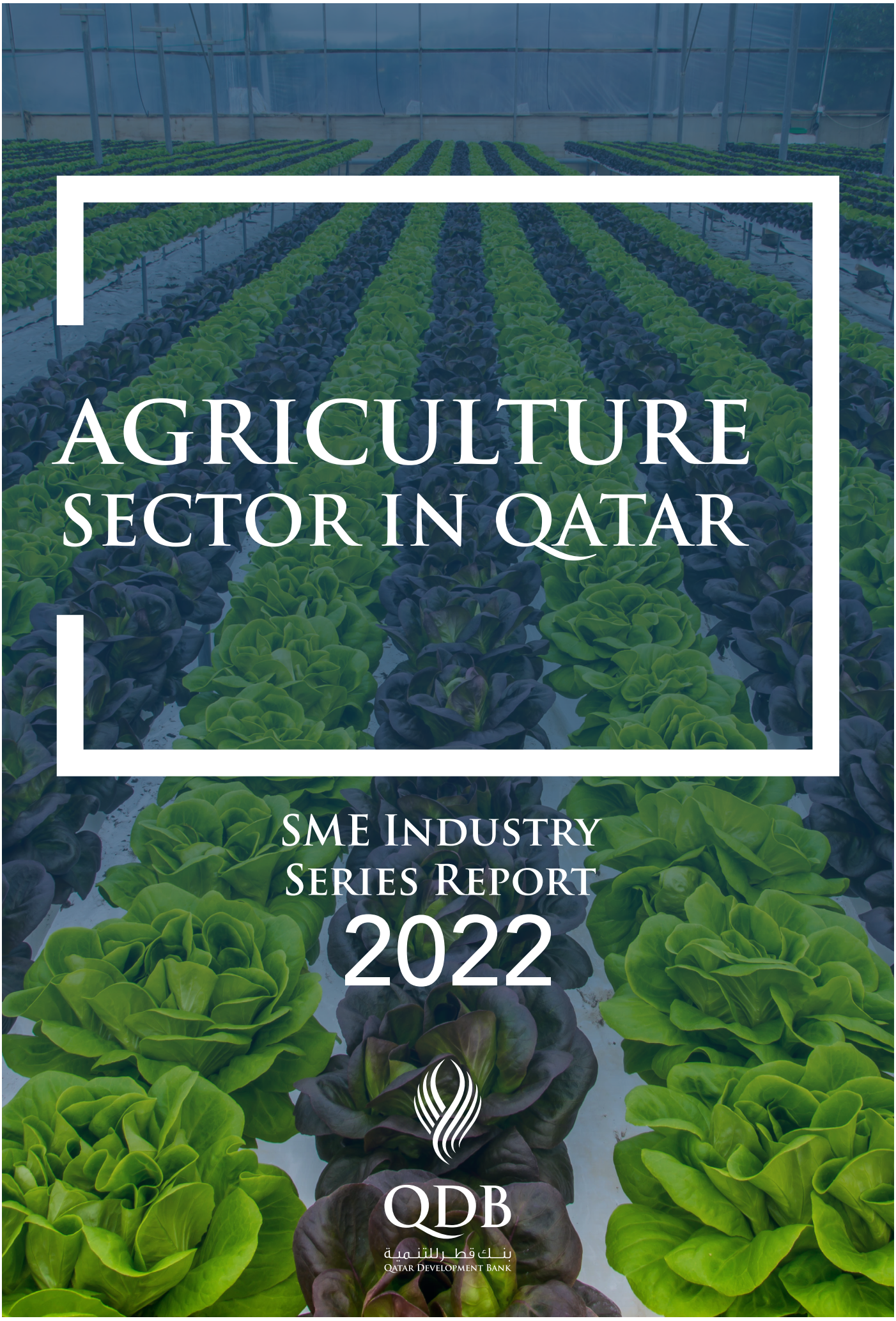

AGRICULTURE SECTOR IN QATAR

SME Industry Series Report 2022

QDB

بنك قطر للتنمية

Qatar Development Bank

بنك قطر للتنمية
QATAR DEVELOPMENT BANK

SME Industry Report Series 2022

MESSAGE FROM CEO

As part of Qatar's efforts to develop its private sector and bring progress to the country's Entrepreneurship, SME, and Innovation Ecosystems towards the realization of its national vision for 2030, Qatar Development Bank (QDB) continues to advance its role as the Entrepreneur's and SME's growth partner from ideation to fruition.

QDB has published a series of reports across various sectors in the local market to extend meaningful support to local businesses and Qatari entrepreneurs. These reports aim at providing entrepreneurs with potential opportunities to enter sectors with relevant information and perspective, which includes overall market demand, competitive landscape and data pertaining to existing companies operating in such sectors.

Agriculture has played an essential role in the provision of food and has been a major factor in overall economic development for societies around the world. Historically, Qatar's agricultural activity was import driven, therefore encouraging domestic production is not only important to meet food security goals, but also for insulating the country against circumstances such as the Covid-19 pandemic. The policy measures and support by the Qatari government has seen the sector growing gradually in the last few years, from ~505 Million QR in 2015 to ~720 Million QR in 2020. The Value of Agriculture Production has been growing at a CAGR of 7.33% from 2015 to 2020.

The government initiatives on agriculture have given a boost to this sector and have led to a significant increase in the number of farms along with creating more jobs.

> "The emphasis on localization of agriculture facilities and promoting local production in government policies such as Qatar National Food Security Strategy (QNFSS) 2018-23 have led to a gradual increase in labor force participation in agricultural activities in the last few years from 1.23% in 2015 to 1.53% in 2019."

Furthermore, the cultivated land has grown over the past 5 years from 11,805 hectare in 2015 to 13,646 hectare in 2020.

This report provides detailed insights on assessment of key crops in agriculture including vegetables, fruits, fodder and cereals. Using a prioritization framework, the report identifies key crop segments that have the potential to not only meet the food-sufficiency goals but also attract investments.

Agriculture has proven to be an emerging industry in Qatar and has attracted substantial investments with advent of technology for advanced crop productions suitable for local climatic conditions. This report provides a holistic view of the entire Agriculture sector in Qatar.

I invite readers to go through the report to gain in-depth knowledge about this sector's prospects.

Abdulrahman Hesham Al Sowaidi
Acting Chief Executive Officer

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Note:

This document represents an updated version of a previous publication disseminated by Qatar Development Bank. The data sources used in this updated version have been revised and updated compared to the first version, in an effort to provide the most accurate and current information possible. It is important to note that the information contained herein is provided for informational purposes only and should not be construed as investment advice. QDB assumes no liability for any actions taken based on the information provided in this publication. Any decisions made or actions taken based on the information contained in this publication are the sole responsibility of the reader. QDB disclaims all liability for any loss or damage that may arise from reliance on the information contained in this publication. It is strongly recommended that readers seek independent professional advice before making any investment decisions.

1. INTRODUCTION

In order to achieve the world's development goals, it is critical to have healthy, sustainable, and inclusive food system. Agricultural development is a powerful tool to eradicate extreme poverty, boost shared prosperity, and feed a projected 9.7 billion people by 2050. The growth in the agriculture sector, as compared to other sectors, is two to four times more effective in increasing incomes among the poorest[1]. Agriculture is also crucial to economic growth. In 2019, it accounted for 3.8% of global Gross Domestic Product (GDP). In some developing countries, agriculture can account for more than 25% of GDP. Agriculture-driven growth, poverty reduction, and food security are all at risk as crop yields fall due to climate change, especially in the world's most food-insecure regions. As per World Bank, the agriculture, forestry, and land use change account for 25% of greenhouse gas emissions.

The current food systems threaten the health of people as these systems generate unsustainable levels of pollution and waste that can adversely harm the planet. It is estimated that one-third of food produced globally is either lost or wasted. Therefore, addressing food loss and waste is critical to improving food and nutrition security, as well as helping to meet climate goals. Food insecurity can worsen diet quality and increase the risk of malnutrition and obesity[2].

The state of Qatar, a small peninsula located in the Arabian Gulf, is a highly urbanized country. Approximately 99.1% of its population live in urban areas. It is amongst the richest countries globally with a GDP per capita of QR 224,926 (constant prices) in 2020. Qatar has a high reliance on food imports to feed it population of 2.88 million (2020) – approximately 90% of its food is imported[3].

In 2017, neighboring Arab countries and their allies imposed an air, sea, and land blockade. This raised national concerns regarding food security and led the country to explore alternative supply-side strategies and sources to satisfy the country's food demand. In response, food production in Qatar greatly increased and it was soon acknowledged that agricultural production was both economically viable, and sustainable solution for cushioning global geopolitical risks.

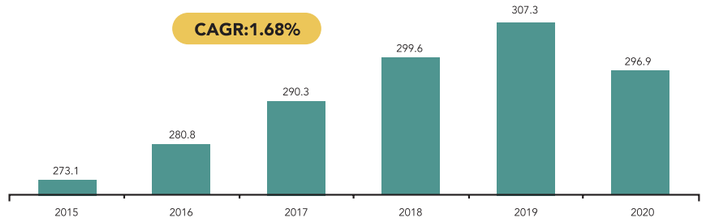
[1] Ending Poverty and Hunger by 2030: An Agenda for the Global Food System; World Bank Group
[2] World Bank
[3] Contemporary Issues in Qatar's Food Security: H. Miniaoui and P. Urungu; May 2018

2. OVERVIEW OF THE GLOBAL AGRICULTURE SECTOR

2.1 Economic Contribution by Agriculture

The global GDP has grown at a compounded annual growth rate (CAGR) of 1.68% each year from 2015 to 2020. There was, however, an economic contraction in 2020 due to the Covid-19 pandemic. The pre-covid growth has been fueled by industrial and services sector which together account for more than 93% of global GDP. In particular, the relationship between growth in services sector and global economic growth has strengthened in the past two decades with share of service sector being even more prominent in low and middle-income countries[4].

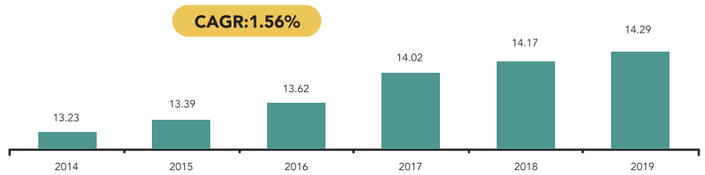
Chart 1: Global GDP 2020-2015 (Trillion QR, Constant 2015 Prices)



Source: World Bank

The gross production value of the agriculture sector has grown at a CAGR of 1.56% from 2014 to 2019.

Chart 2: Global Gross Agriculture Production Value (Trillion QR, Constant 2014-16 Prices)

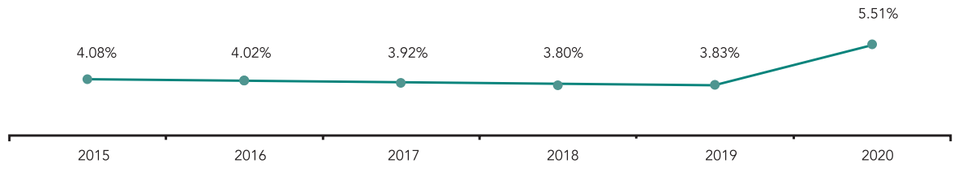


Source: Food and Agriculture Organization

Although, both GDP and gross agriculture production have grown at similar CAGR over the past few years, the contribution of Agriculture, Forestry, & Fishing sector has declined from 4.08% in 2015 to 3.83% to 2019. There is, however, a significant rise to 5.51% in 2020, attributed to the slowdown in industrial and services sector due to the Covid-19 pandemic with people and resources shifting towards the agriculture sector.

[4] The Services Powerhouse: Increasingly Vital to World Economic Growth; Deloitte Insights

Chart 3: Value Added by Agriculture in Global GDP (% of Global GDP)

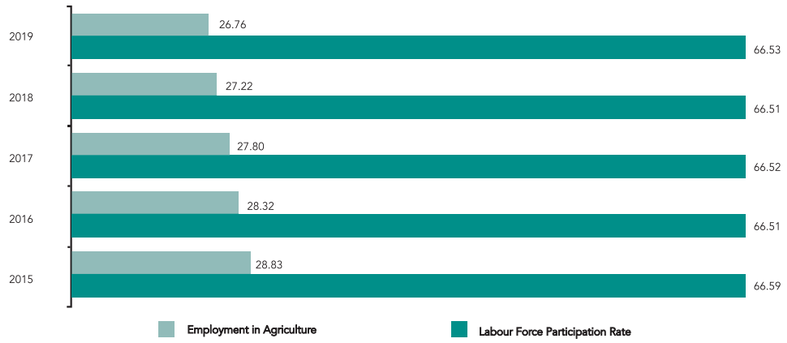


Source: World Bank

As per a Multidisciplinary Digital Publishing Institute (MDPI) research paper[5], the percentage contribution of agriculture to any one nation's GDP has an inverse relationship with the level of national economic development.This is true even at a global level. It is expected that the proportion of economic value added by agriculture to the global economy will continue to decrease as several emerging and poorer countries continue to benefit from economic prosperity.

The inverse relationship has also been witnessed in employment created by the sector. Even though the Labour Force Participation rate (LFPR) has remained steady, at 66.5% from 2015 to 2019, employment in agriculture has seen a gradual decline. This trajectory is expected to continue as people shift to better opportunities afforded by the economic development in industries and services sector.

Chart 4: Global Labour Force Participation Rate (% of Working Age Population), and Employment in Agriculture (% of Total Employment)



Source: World Bank

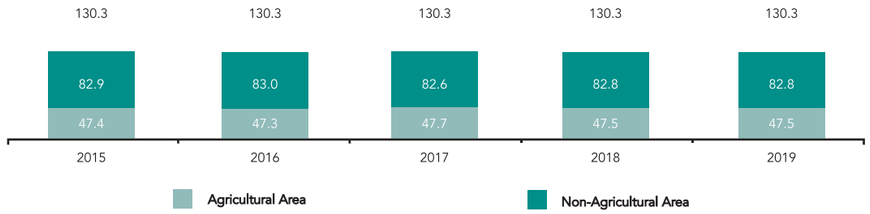
Additionally, the technological advancements in agricultural practices realize improved productivity and yield which negates the need for large scale deployment of manpower. These advancements include mechanization, efficient irrigation & fertilization, genetic engineering, alternative means of farming such as greenhouse growing etc.

[5] MDPI Sustainability Review: Agricultural Production in Qatar's Hot Arid Climate

2.2 AREA UNDER AGRICULTURE

The global land is segregated between agriculture land and non-agriculture land. Agriculture land (land used for cultivation of crops and animal husbandry) is 36.5% of the global land area of 13 billion hectare.

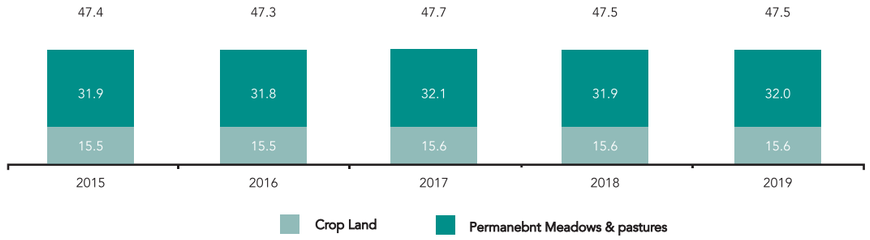
Chart 5: Composition of Global Land Area (100 Million Hectare)



Source: Food and Agriculture Organization

Agriculture land is divided into Cropland (land used for cultivation of crops) – which constitutes 32.7% of agriculture land, and Permanent Meadows & Pastures (land used permanently to grow herbaceous forage and crops through cultivation or naturally).

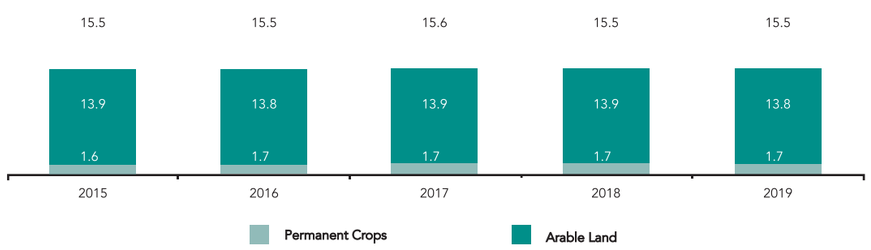
Chart 6: Composition of Agriculture Land Area (100 Million Hectare)



Source: Food and Agriculture Organization

Cropland is further segregated into Arable land (Land under temporary crops, temporary meadows and pastures, and land with temporary fallow. Arable land does not include land that is potentially cultivable but is not normally cultivated), which constitutes 89% of cropland, and Permanent crops (Land cultivated with long-term crops that do not have to be replanted for several years (such as cocoa and coffee), land under trees and shrubs producing flowers (such as roses and jasmine), and nurseries (except those for forest trees, which should be classified under "Forestry") are all considered land under permanent crops. The area under cropland, especially arable land under temporary crops, has remained steady during the last few years.

Chart 7: Composition of Cropland Area (100 Million Hectare)



Source: Food and Agriculture Organization

2.3 GLOBAL AREA HARVESTED AND PRODUCTION

0.85%

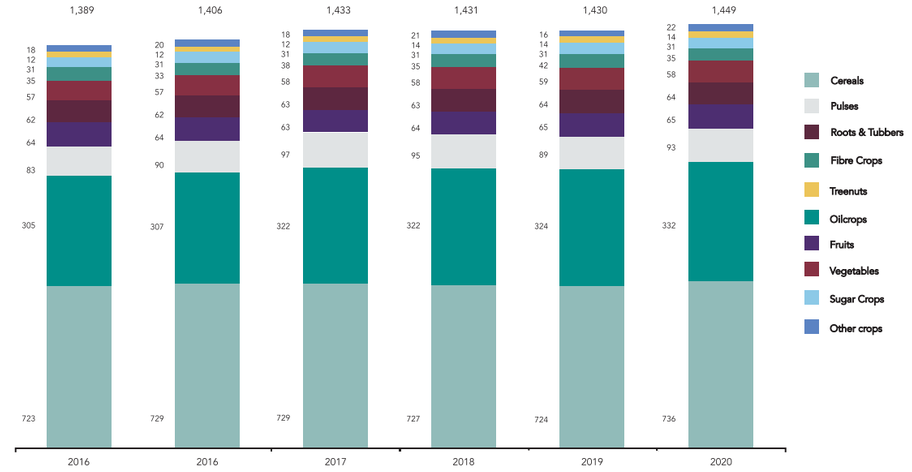
Global area under harvest is growing at a CAGR of 0.85% each year since 2015.

1.04%

the global production has grown at a CAGR of 1.04% in the same time-period indicating an improvement in productivity.

The global area under harvest (Area harvested refers to the area from which a crop is gathered. It excludes, therefore, the area from which, although sown or planted, there was no harvest due to damage, failure, etc. It is usually net of temporary crops and sometimes gross of permanent crops. The net area differs from the gross area in so far as the latter includes uncultivated patches, footpaths, ditches, headlands, shoulders, shelterbelts, etc. If the crop under consideration is harvested more than once during the year due to successive cropping, the area is counted as many times as harvested) has remained fairly stable, growing at a CAGR of 0.85% each year since 2015. This is largely because new areas are being harvested in Africa and Asia. However, the global production has grown at a CAGR of 1.04% in the same time-period indicating an improvement in productivity.

Chart 8: Global Area Harvested (by Crop Type) (Million Hectare)

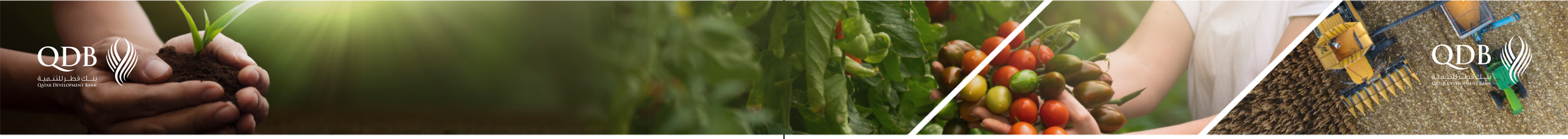


Source: Food and Agriculture Organization

In terms of the quantum of production, cereals and sugar crops are the two major crop segments produced globally; together accounting for 52.28% of the total agriculture production in 2020. The improvement in productivity is evident from the fact that yield (tonne per hectare) has increased for Cereals from 3.91 tonnes per hectare in 2015 to 4.07 tonnes per hectare in 2020. Similarly, the yield for sugar crops has increased from 68.52 tonnes per hectare in 2015 to 71.11 tonnes per hectare in 2020. Cereals and sugar crops together account for more than half the global produce.

Chart 9: Global Production (by Crop Type) (Million Tonnes)

Source: Food and Agriculture Organization



3. OVERVIEW OF THE QATAR AGRICULTURE SECTOR

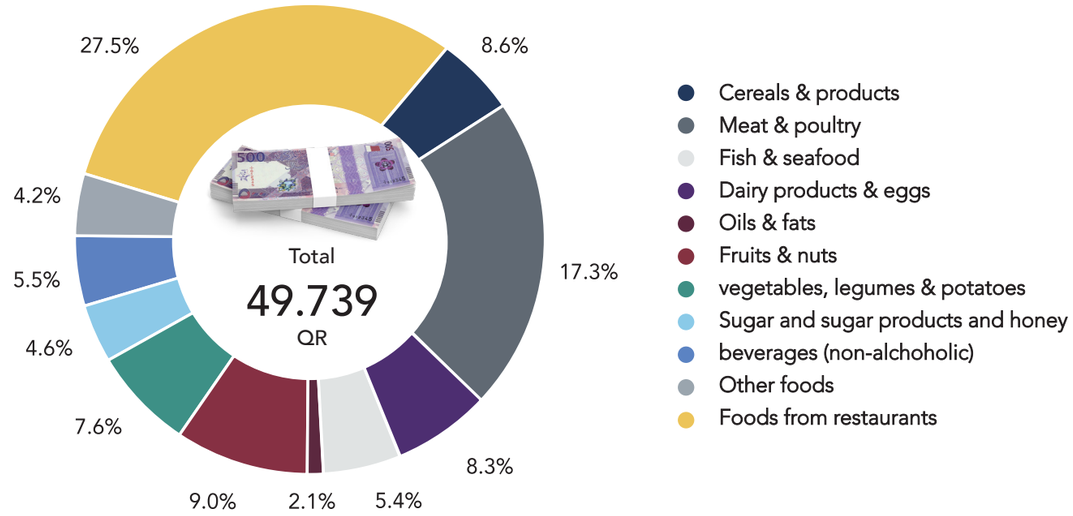
Based on the Köppen's classification[6], Qatar has been classified as BWh (B=Arid or Dry; W=Waste or Desert; h=hot). Qatar experiences sparse precipitation, high summer temperatures, together with high humidity, high solar radiation, poor soil, and strong winds. Consequently, the climatic conditions become non-conducive for agricultural production. Furthermore, limited cropland availability exacerbates the conditions. These adverse conditions coupled with the renewed focus on self-sufficiency has led Qatar to adopt modern farming techniques such as greenhouse farming.

Qatari citizens have a strong purchasing power. Based on the latest Qatar National Household Income & Expenditure Survey (NHIES) 2012-13, the average size of an average household[7] (HH) in Qatar is 5.49 individuals. As a share of income, the average HH in Qatar spends approx. 9.9% of his annual income on food. HHs of Qatar nationality (average size of 8.65 individuals) spend 9.1% of their income as compared to non-Qatari HHs (average size of 4.32 individuals) who spend 11.1% of their income. As a share of expenditure, the average HH in Qatar spends approximately. 15.5% of his annual expenditure on food. HHs of Qatar nationality spend 16.1% of their expenditure on food as compared to non-Qatari HHs who spend 14.9% of their expenditure on food. On an average, Qatari HHs purchased 1.54 times more food (2118 g/capita/day) as compared to non-Qatari HHs (1373 g/capita/day). However, the share of food groups within the basket of both types of HHs was fairly similar. This difference is simply because of the higher income of Qatar nations (1,058,604 QR) vs non-Qatar nationals living in Qatar (292,980 QR). A typical Qatari household spends approximately 25% of its food spend on cereal, fruits and nuts, and vegetables.

[6] https://www.britannica.com/science/Koppen-climate-classification

[7] A household is defined as a person or a group of persons, related or unrelated, living together and making common provision for food, accommodation, and other essentials for living. Anyone who is usually living in the housing unit of the household under enumeration is considered a member of that household, including domestic services.

Chart 10: Composition of Annual Food Expenditure of Households (2013)



Source: Qatar National Household Income and Expenditure Survey 13-2012

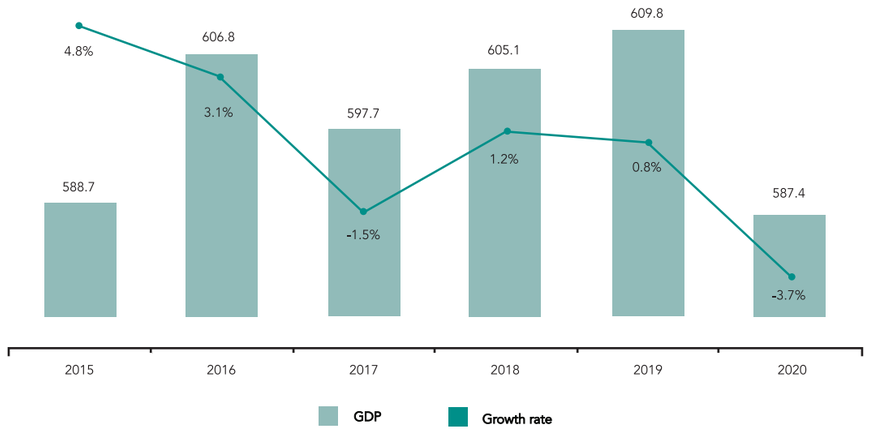
While the term agriculture broadly includes fisheries & forestry, the scope of this report focusses only on production of crops. This report broadly divides the agriculture sector into 4 categories i.e. vegetables, fruits & dates, cereals, and green fodder. In this report, the existing agriculture situation in Qatar has been analyzed by looking at area cultivated, quantum of crop production, reliance on imports, & value of crop production.

Further, it provides an assessment of the Qatar greenhouse market, Qatar agriculture value chain, deep-dive analysis of the attractive crop segments, SWOT and Porter's analysis, and lastly, key success factors. This report recommends a list of 5 crops that will be most relevant to be produced in Qatar. These 5 crops have been based on a prioritization framework that considers 3 broad factors – (1) Production for human consumption, (2) Conduciveness to Qatar conditions & greenhouse technology, and (3) weighted average score of 7 parameters – (i) Quantum of consumption demand, (ii) Self-sufficiency, (iii) Average yield, (iv) CAGR for demand for consumption, (v) Proportion of produce through greenhouses, (vi) focus of research activities, (vii) Existence of downstream industry.

3.1 ECONOMIC CONTRIBUTION BY AGRICULTURE

With oil and gas sector consistently contributing to at least 80% of the government revenues since 2014[8], Qatar relies heavily on leveraging its hydrocarbons resources. Thus, its economic growth is also exposed to price fluctuations in global energy markets. For instance, the GDP has contracted twice since 2015. The most recent contraction is because of the inactivity in the oil and natural gas sector occurring due to the Covid-19 pandemic. To cushion this impact, the State of Qatar sought to diversify its economy with the Qatar National Vision 2030, which is seen as a blueprint for investing resources in people & infrastructure and encouraging greater participation of the private sector.

Chart 11: Qatar GDP 2015-2020 (Billion QR, Constant 2015 Prices)

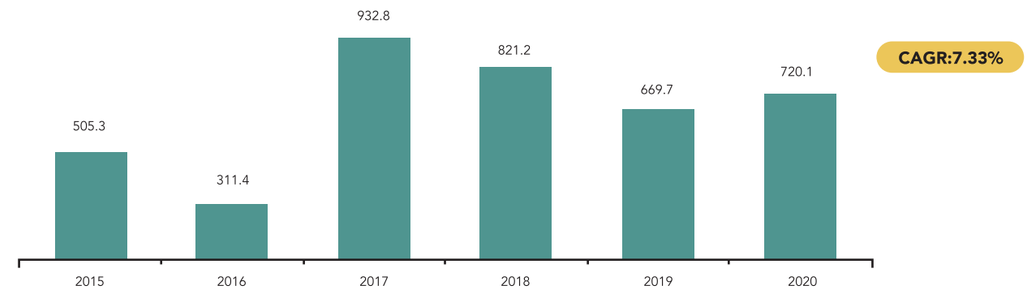


Source: World Bank

Although agriculture activity in the country is relatively small and largely import driven, encouraging domestic production is not only important to meet food security goals, but also for insulating against global events such as the recent blockade and global pandemic. The policy measures and support by the Qatar government has seen the sector growing gradually in the last few years.

[8] Qatar Country Commercial Guide, World Bank

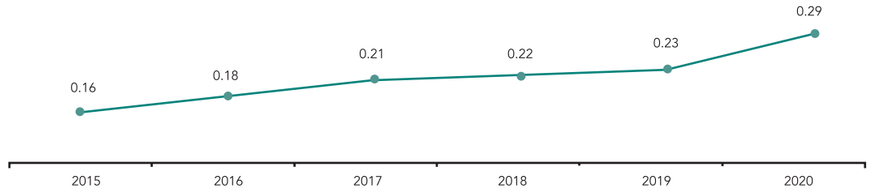
Chart 12: Qatar Value of Agriculture Production (Million QR)



Source: Qatar Planning and Statistics Authority

The Value of Agriculture Production (sum of Cereals, Green Fodder, Fruits and Dates, and Vegetables) has been growing at a CAGR of 7.33% from 2015 to 2020. Furthermore, the value added by agriculture has also witnessed a rise (almost doubling) from 0.16% in 2015 to 0.29% in 2020. Consequently, agriculture in Qatar can now be considered an emerging industry[9].

Chart 13: Qatar Value Added by Agriculture (% of Qatar GDP)



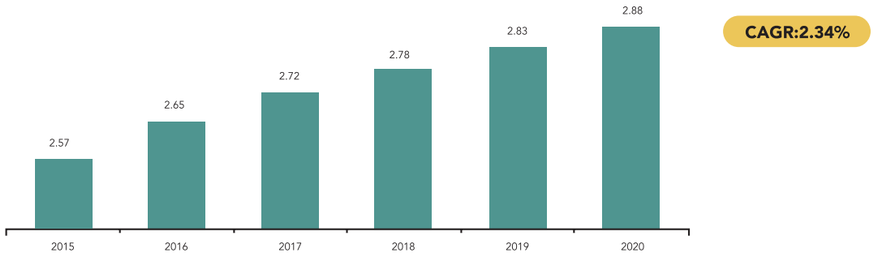
Source: World Bank

3.2 QATAR LABOUR FORCE IN AGRICULTURE

Qatar's population has grown at a CAGR of 2.34% from 2015 to 2020. The government's economic diversification efforts have attracted massive expatriates' inflow to Qatar – over 85% of the Qatari population are expatriates[10]. Over the past few years, the overall labour force (% of total population) has remained steady at around 75%. In the year 2020, the labour force constituted 74.51% of Qatar's entire population.

[9] MDPI Sustainability Review: Agricultural Production in Qatar's Hot Arid Climate
[10] MDPI Sustainability Review: Agri-Food Markets in Qatar: Drivers, Trends, and Policy Responses

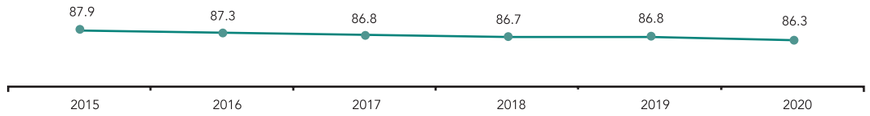
Chart 14: Qatar Population (Millions)



Source: World Bank

Furthermore, the LFPR in Qatar averages around 87% of its working age population. This indicates that a large proportion of expatriates are part of the labour force.

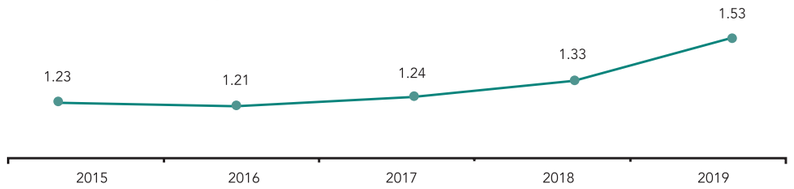
Chart 15: Qatar Labour Force Participation Rate (% of Working Age Population)



Source: World Bank

The Qatar government initiatives on agriculture have given a boost to the agriculture sector and had led to the numbers of farms growing significantly in the last few years, all of them contributing to employment generation in the agriculture sector in Qatar. Some of these initiatives are the 'Daman' Guarantee Program, and Qatar National Food Security Program (QNFSP). This emphasis on localization of agriculture facilities has led to a gradual increase in labor force participation in agricultural activities in the last few years from 1.23% in 2015 to 1.53% in 2019.

Chart 16: Qatar Labour Force in Agriculture (% of Total Labour Force)

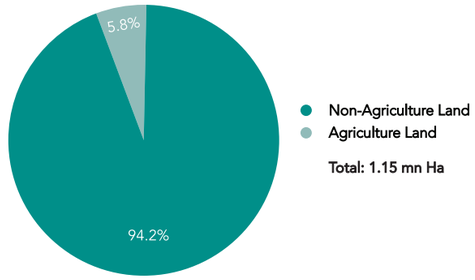


Source: World Bank

3.3 COMPOSITION OF LAND AREA UNDER AGRICULTURE

The climatic conditions and shortages of key factors of production (such as fresh water, arable land) make it difficult for agriculture (especially conventional farming) to expand and grow. According to FAO, out of a total of 1.15 million hectare of land, only 67,000) %5.8 hectare) is categorized as agriculture land.

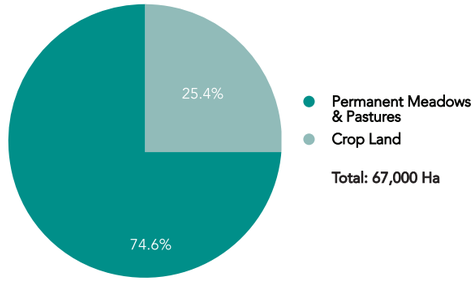
Chart 17: Composition of Land Area in Qatar (2019)



Source: Food and Agriculture Organization

The area used for crop production for consumption is small. Out of the 67,000 hectare (Ha) of agricultural land, only 17,000) %25 hectare) is cropland. The remaining %75 majority is under permanent meadows and pastures used for grazing animals.

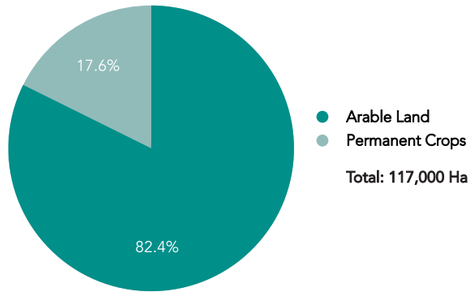
Chart 18: Composition of Agriculture Land Area in Qatar (2019)



Source: Food and Agriculture Organization

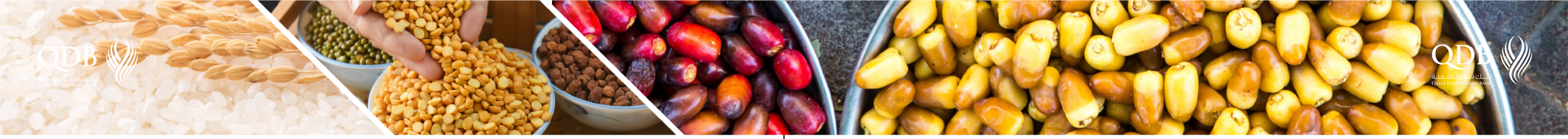
Furthermore, the 17,000 hectare cropland constitutes of 14,000 hectare of arable land (comprising temporary crops, temporary fallow, temporary meadows & pastures) accounts for only %1.21 of the total land area of 1.15 million hectare.

Chart 19: Composition of Cropland in Qatar (2019)



Source: Food and Agriculture Organization

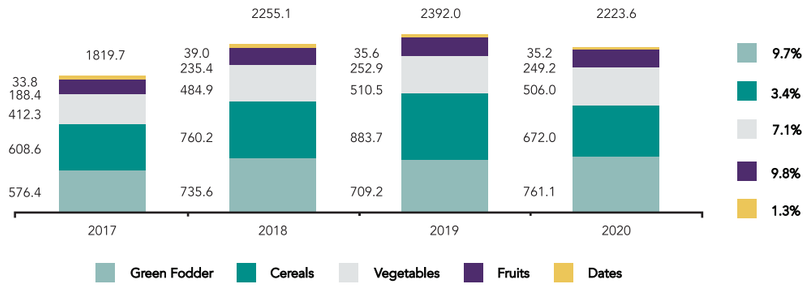
This shows how scarce the land is for growing commodities for human consumption. To tackle this, Qatar government is encouraging agriculture through modern agricultural methods such as greenhouse farming.



3.4 QATAR AGRICULTURE MARKET SIZE

The net consumption of the agriculture market, i.e. local production plus net of trade, has expanded at a CAGR of 6.9% during 2017-20. The increase in food consumption is boosted by 2 major factors – (i) Population growth with an increasing number of expatriates, and (ii) High and increasing disposable income (highest in GCC region)[11].

Chart 20: Qatar Agriculture Market Size (1000 Tonnes)



Source: Food and Agriculture Organization, Qatar Ministry of Municipality, Qatar Ministry of Commerce and Industry

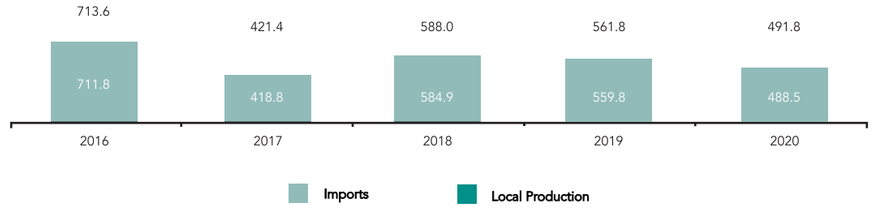
The fruits market has seen a substantial increase in demand, which has largely been met through imports. However, the demand for vegetables is being increasingly met through local production as the government strives to achieve the 70% self-sufficiency target it has prescribed under the Qatar National Food Security Strategy (QNFSS). Dates have also witnessed a marginal increase in demand over the past four years. Demand across all the agriculture segments saw a decline in 2020 on account the Covid-19 pandemic. The restriction in movement and lockdown disrupted the supply chain locally. In addition, the economic implications of the pandemic also had an influence on the subdued demand during the year.

[11] MDPI Sustainability Review: Agri-Food Markets in Qatar: Drivers, Trends, and Policy Responses

3.5 AGGREGATE SUPPLY IN AGRICULTURE

Qatar continues to rely heavily in imports of agricultural products such as cereals. More than 99% of cereal demand is being met through imports. Qatar is expected to continue its dependency on imports for meeting demand for cereals such as wheat, rice and other edible cereals. This is because the hot arid climatic conditions do not allow for large scale commercial production. Even if there were plans to produce cereals crops, input such as water, of which there is scarcity, will be difficult to arrange for large scale production. The government recognized this in their QNFSS 2018-2023 where there is no self-sufficiency target set for 2023[12] for cereals that might encourage production of cereals.

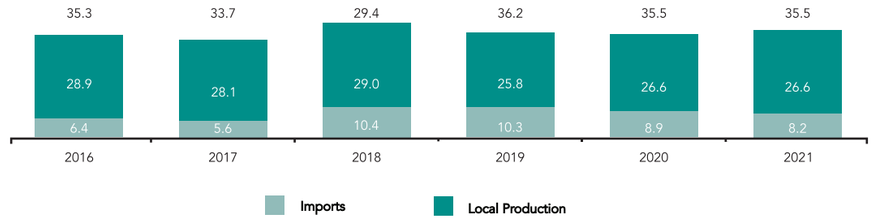
Chart 21: Aggregate Supply in Qatar: Cereals (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

On the contrary, Qatar's climatic conditions are conducive to produce dates. In the year 2021, 77.79% of the aggregate supply of dates were produced locally. It is important to take note of the fact that Qatar has not exported dates since 2017[13]. The entire local produce is being consumed locally which is why Qatar only imports 22.21% of its dates requirement.

Chart 22: Aggregate Supply in Qatar: Dates (1000 Tonnes)



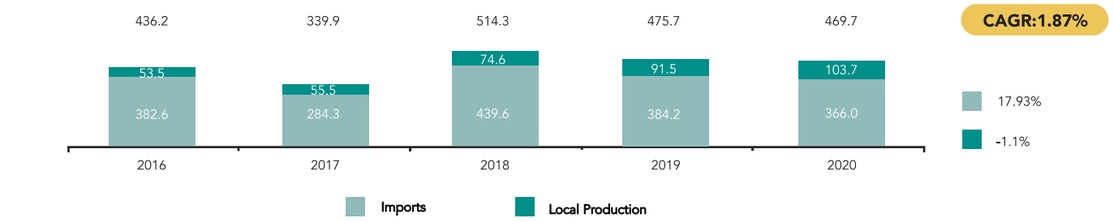
Source: Qatar Planning and Statistics Authority, Ministry of Municipality

Similar to cereals, Qatar has relied on imports to meet local demand for both fruits & vegetables. However, concerns around food security has led to the government looking at ways to localize production of fruits and (especially) vegetables. Incidentally, alternative forms of agriculture techniques such as greenhouse farming, organic farming, hydroponics, etc. can support successful production of fruits and vegetables.

[12] Qatar National Food Security Strategy 2018-2023
[13] Qatar Industrial Portal

Recognizing this, the government is lending its support to local production through both policy initiatives (such as higher involvement of private sector, 'Daman' Guarantee Program) and fiscal incentives (such as 100% financing by QDB to install greenhouses). It also aims to achieve a self-sufficiency target of 70% for vegetables by the year 2023[14]. In fact, during the period of 2016-2020, vegetables produced locally has nearly doubled (CAGR of 17.93%), from 53,600 tonnes to 103,694 tonnes.

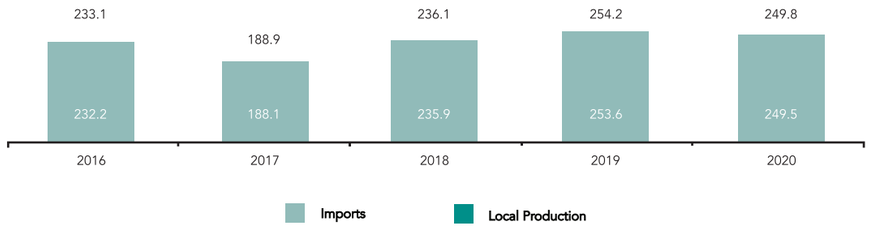
Chart 23: Aggregate Supply in Qatar: Vegetables (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

The fruit production has remained stable in Qatar due to the non-conducive climatic conditions. Furthermore, Qatar is still at a nascent stage to produce fruits using modern technology. The production using modern agricultural methods is yet to become commercially viable.

Chart 24: Aggregate Supply in Qatar: Fruits (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

[14] Qatar National Food Security Strategy 2023-2018

3.6 QATAR AREA UNDER CULTIVATION

Qatar has a total cultivable land area of 67,000 hectare which can be divided into (i) uncultivated land, and (ii) cultivated land. The cultivated land has grown over the past 5 years from 11,805 hectare in 2015 to 13,646 hectare in 2020 with a steep jump in 2018. This increase can be attributed to the government's focus on promoting local production to address food security concerns through policies such as QNFSS 2018-23.

Green fodder accounts for highest proportion of the cultivated area – its area increased from 6,670 hectare to 7,990 hectare over the years. This increase also explains the 38.4% increase in green fodder production over the years. Similarly, the area for cultivating vegetables has increased 1.35 times during 2015-20 and account for second highest proportion of the cultivated area – its share has increased from 19.4% (2,339 hectare) to 21.9% (3,135 hectare) over the years (inclusive of area under greenhouse cultivation).

Chart 25: Area Cultivated in Qatar (By Crop Type) (100 Hectare)

Source: Qatar Planning and Statistics Authority

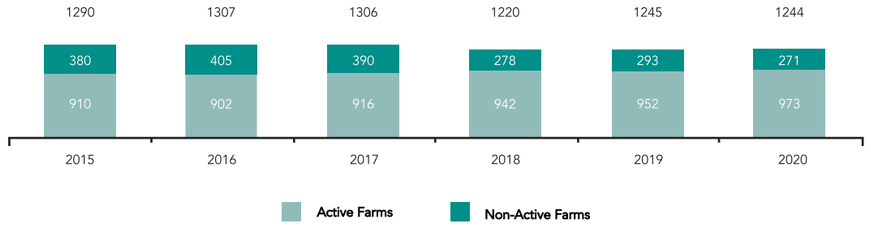
3.7 ACTIVE FARMS IN QATAR

In Qatar, agriculture has traditionally been practiced in the northern region where the rain and soil conditions are conducive for agriculture. This soil contains higher amount of clay as compared to central and southern region. Soil with higher clay content is relatively more fertile because clay improves soil's organic content and structure. This is why majority of the farms are located in the northern region. The municipality that with relatively larger number of farms (and larger area) are Umm Slal (12.54%), Al Rayyan (33.19%), Al Khor (28.69%), and Al Shamal (12.62%). These 4 municipalities also tend to hold large farms. These 4 municipalities together account for 87.05% of the total farms and 90.51% of the total farm area.

The total number of registered farms have declined over the years from 1,290 in 2015 to 1,244 in 2020. However, the total area under registered farms have marginally increased from 47,500 hectare in 2015 to 51,036 hectare 2020, an average YoY growth of 1.47% indicating an increase in the average size of the registered farms from 36.82 hectare to 41.02 hectare. In the year 2020, the farm size ranged from 'less than 1' Ha (64 farms covering 37.8 Ha) to 'more than 1000' Ha (7 farms covering 9900 Ha). Majority of these farms were in the range of 3-30 Ha (773 farms covering an area of 8702.8 Ha). This shows how fragmented the Qatar agriculture market is. It consists of small, medium, and large farms that are owned by small farmers and big agriculture companies.

The registered farms have further been segregated into active farms and non-active farms. Encouragement for local production has led to an increase in the number of active farms in Qatar. Area under active farms has increased from 36,600 hectare in 2015 to 40,486.1 hectare in 2020, an average YoY growth of 2.11%. The average size of active farms has also increased from 40.21 hectare in 2015 to 41.61 hectare in 2020.

Chart 26: Number of Registered Farms

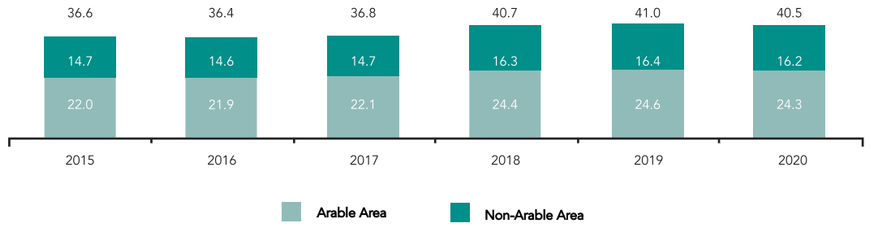


Source: Qatar Planning and Statistics Authority

Chart 27: Area under Registered Farms (1000 Hectare)

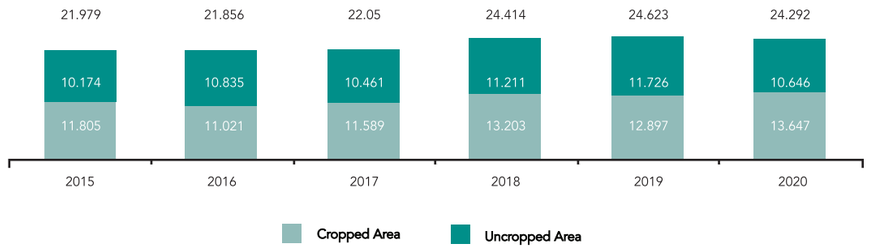
Source: Qatar Planning and Statistics Authority

Chart 28: Area under Active Farms (1000 Hectare)



Source: Qatar Planning and Statistics Authority

Chart 29: Arable Area under Active Farms (1000 Hectare)



Source: Qatar Planning and Statistics Authority

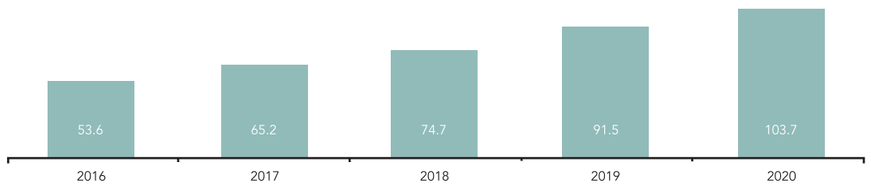
Although the registered farm area shows a marginal increase of 1.7% YoY, agriculture production, especially vegetables, has increased significantly. This points to the fact that area previously registered but not active are now active and producing crops. That said, a significant proportion of arable area under active farms remain uncropped which indicates scope for growing agriculture production using available factors of production. Additionally, open fields cropped area under active farms have fallen from 98% in 2015 to 95.27% 2020 indicating a shift from open fields to other forms of farming such as greenhouse farming.

3.8 QATAR PRODUCTION QUANTITY AND ITS VALUE

3.8.1 Vegetables

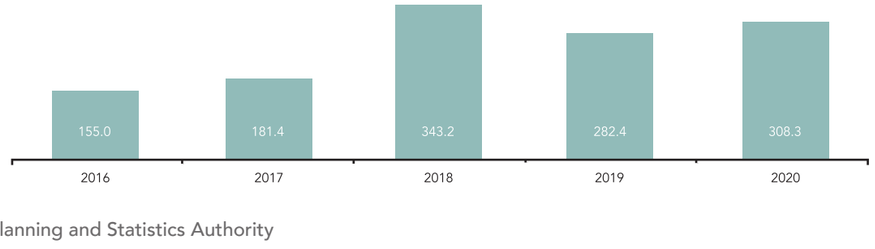
The doubling of vegetable production in Qatar was accompanied by substantial increase in yield, considering the fact that area under vegetable cultivation increased by only 34% during the period of 2016-20. The improvement in productivity is an indication of the impact of improved agricultural techniques like greenhouse farming. In fact, of the 103,694 tonnes of vegetables produced in 2020, 60,770 tonnes (58%) were cultivated at greenhouse farms.

Chart 30: Quantity Produced: Vegetables (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

Chart 31: Production Value: Vegetables (Million QR)

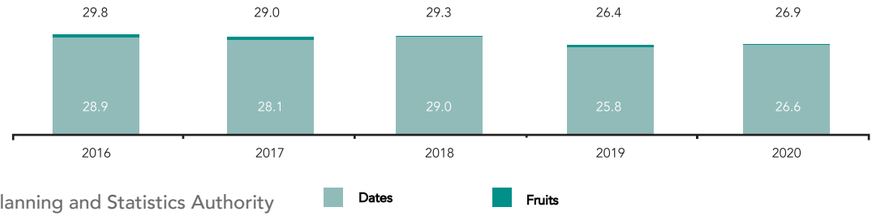


Source: Qatar Planning and Statistics Authority

3.8.2 Fruits and Dates

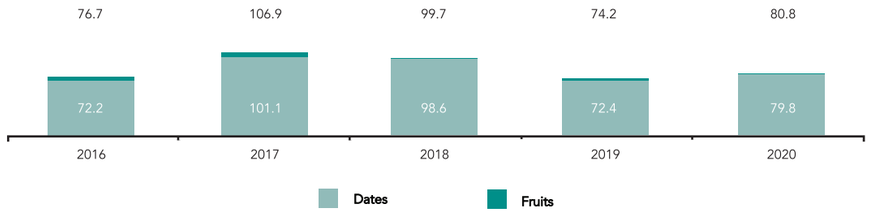
Meanwhile, quantity of dates produced locally has remained rangebound in the last few years & production of fruits has declined. This may be because while dates are conducive to Qatar agro-climatic conditions, the production of fruits using modern technology is yet to become commercially viable. Furthermore, the government's focus shifting towards vegetables self-sufficiency has also shifted the agriculture resources towards vegetables.

Chart 32: Quantity Produced: Fruits and Dates (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

Chart 33: Production Value: Fruits and Dates (Million QR)

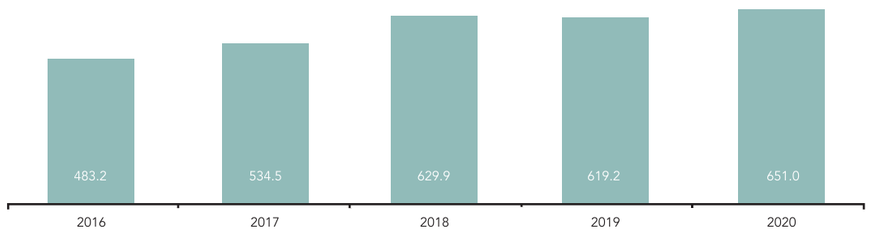


Source: Qatar Planning and Statistics Authority

3.8.3 Green Fodder

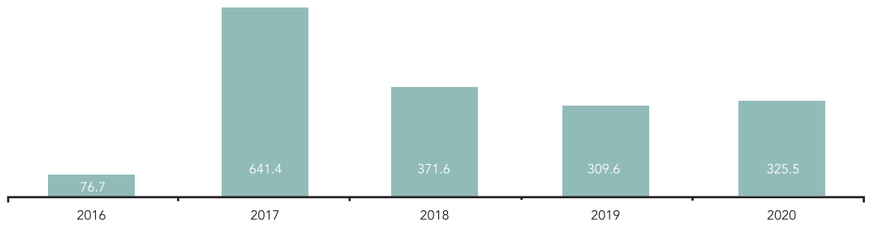
Green fodder is an economic source of nutrients for dairy animals. The quantity produced of green fodder has increased at an average of 8% over the years. This is consistent with the fact that cultivated area under green fodder also increased in the same time-period. There is a healthy uptick for demand for green fodder.

Chart 34: Quantity Produced: Green Fodder (1000 Tonnes)



Source: Qatar Planning and Statistics Authority

Chart 35: Production Value: Green Fodder (Million QR)

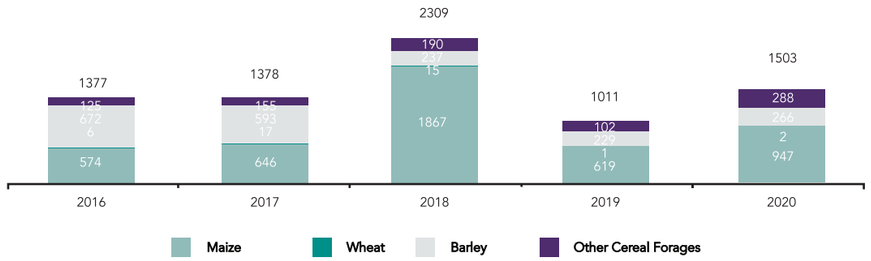


Source: Qatar Planning and Statistics Authority

3.8.4 Cereals

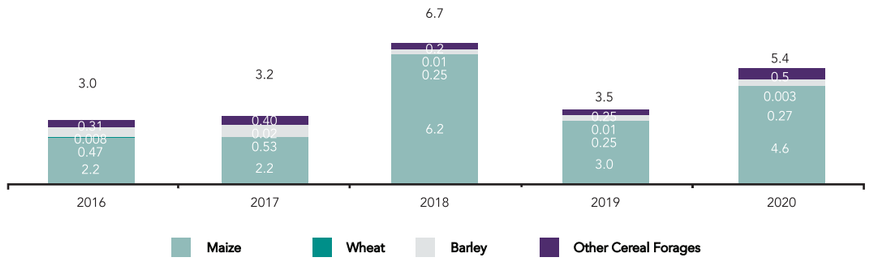
Despite a decline in the cultivated area of cereals, the quantity produced of cereals has grown. This indicates a rise in per hectare productivity. Majority of this growth has been led by Maize whereas the production for wheat and barley has decreased.

Chart 36: Quantity Produced: Cereals (1000 Tonnes)

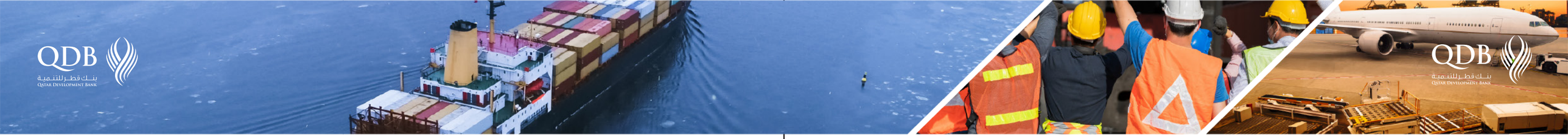


Source: Qatar Planning and Statistics Authority

Chart 37: Production Value: Cereals (Million QR)



Source: Qatar Planning and Statistics Authority



3.9 THE 2017 BLOCKADE AND ITS IMPACT

Air, land, & sea blockade was imposed on Qatar on 5th June 2017. The economic blockade was expected to have serious negative impact on Qatar's economy, given that 13% of all import were from KSA and UAE. However, the implications of the economy were less severe than expected[15]. Qatar economy contracted twice i.e. 2017 (-1.5%) & 2020 (-3.7%). However, these contractions were driven mainly by oil prices & Covid-19 pandemic, respectively.

Prior to the 2017 blockade, 27.4% of Qatar's food imports came from Saudi Arabia and the UAE[16]. In the meantime, 80% of Qatar's food imports passed through a bordering country: 40% passed through Saudi Arabia and 60% of dairy products used to come from Saudi Arabia and the UAE. High reliance on imports for the necessary agricultural inputs impacted supply chain & created shortages in supply of agriculture inputs from four Arab nations – In 2017, food imports from KSA fell by 20.2% in Q2 and 99.3% in Q3[17].

The developments in local agriculture could be traced to the blockade, which forced the country to not only diversity import corridors, but also encourage domestic production. The blockade forced the government to end its reliance on food imports from KSA & UAE and open new import corridors & diversify its trade partners – with Turkey, India, & the UK taking on a more prominent role[18]. The blockade galvanized the country to explore its own agriculture production potential. It motivated the Qatar government to boost the countries food production capabilities using high-tech, state-of-the art technologies and methods, of which this very rich country can afford. Additionally, Qatar also invested in overseas farms. By doing so, it was successful in maintaining food supplies for its population despite the disruption – boosting long-term resilience in the process.

The blockade was lifted on 5th January 2021. With blockade lifted, trade routes have opened for Qatar within GCC region. This will pave the way for increased competition in the agriculture sector (inputs & outputs). The local producers & importers will compete in the market for consumer demand. Furthermore, with new trade routes established during the Blockade, GCC countries will have to compete with other countries of the world to supply goods to Qatar.

15 MDPI Sustainability Review: Agricultural Production in Qatar's Hot Arid Climate
16 MDPI Sustainability Review: Agri-Food Markets in Qatar: Drivers, Trends, and Policy Responses
17 Contemporary Issues in Qatar's Food Security
18 Innovation Norway - Business Opportunities in Qatar

3.10 QATAR NATIONAL FOOD SECURITY PROGRAM

Food security refers to the condition where all people have, at all times, a physical and economic access to safe, adequate and nutritious food to satisfy their daily calorific intake that allows them to lead an active and healthy life. There are several factors that may challenge a nation from achieving food security. Some of these factors are the global water crisis and water deficits which spur heavy grain imports in smaller countries ultimately leading to cutbacks in grain harvests. Similarly, intensive agriculture and farming drastically influence soil fertility and cause a decline in crop yield. Another notable factor limiting food security includes the adverse effects of climate change such as droughts and floods which greatly affect the agricultural sector.[19]

The Qatar National Food Security Program (QNFSP) was established in 2008 with an objective to develop a sustainable food security policy by increasing and enhancing domestic agricultural production, and strengthening the reliability of food imports from abroad.[20] QNFSP sought to implement a national strategy for securing 70% of the country's food needs by 2013. The program worked on activating the

19 Food Security Strategy in Qatar; EcoMENA
20 Qatar National Food Security Program, LinkedIn

four sectors – (i) Agriculture, (ii) Water, (iii) Renewable Energy, and (iv) Food manufacturing. QNFSP's approach to expand the agricultural sector aimed to introduce the best practices and establish a sector that considers its economic efficiency, optimal usage of scarce resources with limited impact on the environment as well as profitable and sustainable agriculture. A key element of this approach will include the deployment of advanced crop production technologies and advanced irrigation systems[21].

3.11 QATAR NATIONAL FOOD SECURITY STRATEGY 23-2018

Significant strides towards self-sufficiency were made after the 2017 blockade when Qatar government launched the Qatar National Food Security Strategy (QNFSS) (2018-2023). QNFSS is a robust and interdependent food security strategy wherein Qatar government has laid out trade, reserves, domestic market, and domestic self-sufficiency plans to achieve food security goals. The following are the food security strategy initiatives under the QNFSS 2018-2023:

1. **International Trade and Logistics:**
   A. The aim is to geographically diversify trade partners for critical commodities to reduce Qatar's exposure to external factors by having 3-5 partners per critical commodity.
   B. It also aims to proactively put in place contingency plans to limit the impact of trade shocks or other exogeneous disruptions.

2. **Domestic Self-Sufficiency:**
   A. The aim is to increase vegetable production by establishing hydroponics greenhouse clusters to reach 70% self-sufficiency in greenhouse vegetables (eg. tomatoes, pepper, cucumber, squash, lettuce).
   B. This also aims to expand and improve production capacity for red meat (fattening units and breeding farms for sheep and goat) and fisheries (fish farms)
   C. At the same time, cap the production of poultry and fresh milk to 100% self-sufficiency by discontinuing tenders and redirecting capacity to other purposes (shifting poultry surplus to egg production).
   D. Lastly, it aims to reduce the groundwater-based fodder production by switching to Treated Sewage Affluent (TSE).

3. **Strategic Reserves:**
   A. This aims to leverage the private sector to store broad range of products and act as permanent short-term buffer against any shocks to the system.
   B. The government plans to put in place strategic reserves of perishables and selected non-perishables as an insurance against potential trade and production disruptions.
   C. The government also plans to increase portable water reserves as insurance against potential crises scenario balancing risk exposure and 'insurance' cost.
   D. Lastly, it aims to reduce net depletion of aquifer by optimizing water usage in agriculture.

4. **Domestic Markets:**
   A. The aim is to streamline the domestic go-to-market model (farm-gate to retail) and ensure transparency in the price-setting process and assist farmers in improving their productivity and quality of produce.
   B. The government plans to establish integrated food waste program, including collection and treatment / alternative usage of organic waste.
   C. Lastly, it aims to optimize and simplify the governance of food standards in Qatar, to monitor food safety in the country and to supervise quality certification more effectively.

3.11.1 INTERNATIONAL TRADE AND LOGISTICS

In order to diversify trade partners, in the near-term, QNFSS will develop future state for sourcing countries and trade partnerships. QNFSS intends to determine regulatory levers to incentivize private sector to diversity. Lastly, it intends to initiate relationship building support between Qatar private sector and trade missions/entities in large countries.

In order to have contingency plans in place, the near-term action plan is for private sector to develop contingency plans based on guidelines set by government. The plan is to test effectiveness of 'rerouting' contingency plans for resilience in collaboration with Somod. Lastly, monitoring will be done by developing data dashboards for tracking readiness.

Table 1: QNFSS Performance Metrics: International Trade & Logistics

KPI	2023 Target
Number of trade partners per commodity	3-5
Share of imports from top 2 partners	50%-70%
Presence of contingency plans by importers	100%

Source: QNFSS 2018-23

As per QNFSS 2018-23, the diversification and contingency planning efforts will focus on a number of critical commodities. The contingency plan, in particular, will be for perishables only.

[21] Food Security Strategy in Qatar; EcoMENA

Table 2: List of Critical Commodities with Diversification and Contingency Plans

Commodity	Perishable/ Non-Perishable	Diversification Plan	Contingency Plan
Tomato	Perishable	Yes	Yes
Cucumber	Perishable	Yes	Yes
Pepper	Perishable	No	No
Squash	Perishable	No	No
Cabbage	Perishable	No	No
Watermelon	Perishable	Yes	Yes
Cauliflower	Perishable	No	No
Potato	Perishable	Yes	Yes
Onions	Perishable	Yes	Yes
Lettuce	Perishable	No	No
Eggplant	Perishable	No	No
Herbs	Perishable	No	No
Banana	Perishable	No	No
Apples	Perishable	Yes	Yes
Citrus	Perishable	Yes	Yes
Dates	Perishable	No	No
Milk	Perishable	Yes	Yes
Rice	Non-Perishable	Yes	No
Wheat	Non-Perishable	Yes	No
Legumes	Non-Perishable	Yes	No

Source: QNFSS 2018-23

3.11.2 DOMESTIC SELF-SUFFICIENCY

QNFSS has defined near-term action plan across aims to ensure self-sufficiency in strategic commodities (i.e. perishables such as tomatoes, cucumber, lettuce, pepper, dates, etc. that Qatar can produce competitively) and shift production towards best practice technologies to drive yield improvement. QNFSS intends to finalize greenhouse cluster infrastructure plans and develop bid guidelines (including subsidy programs) for private sector operators and launch process. This is done to achieve the 70% self-sufficiency target by 2023 for vegetables.

Table 3: QNFSS Performance Metrics: Domestic Self-Sufficiency

KPI	2023 Target
Self-sufficiency on greenhouse vegetables	70%
Hectares with high-tech greenhouses	110
Self-sufficiency on red meat	30%
Self-Sufficiency on fresh fish	95%
Self-Sufficiency on fresh milk and poultry	100%
Local fodder production using TSE	63%

Source: QNFSS 2018-23

Table 4: Principles used to determine self-sufficiency targets for local production

If..	Sourcing Strategy	Reasoning
Product is not perishable	Sourcing everything from abroad; 0% production locally	Product can be stored in strategic reserves to protect against trade shocks
Product is perishable but cannot be produced sustainably and competitively locally		Agronomic conditions do not allow for local production
Product is perishable and can be produced sustainably locally but currently there is low production in Qatar	Produce in Qatar but cap production at 70%	• Leave room for variety from imports • Limit waste due to production fluctuations
Product is perishable, can be produced sustainably locally and we are already close to 100% self-sufficiency	Cap production at 100% and potentially reroute additional capacity to derivatives	There is no sense in overproducing and exporting as this means Qatar will export water
Exceptions to the rules: • Fodder can be produced sustainably with available TSE • Current population of goats and sheep can be used to expand local production of red meat even though relatively less economically viable		

Source: QNFSS 2018-23

3.11.3 STRATEGIC RESERVES

In order to boost private sector reserves, QNFSS intends to create a policy framework for private sector. It aims to engage private sector to develop a roadmap with timelines for setup of buffer stocks. In order to boost public sector reserves, QNFSS intends to set baseline existing storage plans to validate reserve requirements, develop infrastructure blueprint and validate investment plans, develop process and identify partners for reserve management.

In order to have adequate portable water reserves, QNFSS intends to have commission detailed designs and tender requirements for underground water usages. As far as groundwater reserves are concerned, QNFSS intends to develop plans to increase TSE production from wastewater and evaluate plans for desalination capacity expansion.

Table 5: QNFSS Performance Metrics: Strategic Reserves

KPI	2023 Target
Private sector compliance with reserve levels	• 100% • 2 months for 7 perishables (onions, apples, carrots, dates, potato, red meat, frozen poultry)
Public reserve levels	6 months for 6 non-perishables (Wheat, edible oils, beans, sugar, rice, powder milk), 5 agriculture inputs (agriculture chemicals, fertilizer, seeds, fodder, animal medicine)
Potable groundwater capacity	400,000 m^3 per day
Annual aquifer net depletion	0 m^3

Source: QNFSS 2018-23

In the long-run, QNFSS intends to have reserves that cover the full population with a balanced diet for 2 months and 75% of the current population with a balanced diet of 6 months.

3.11.4 DOMESTIC MARKETS

In order to support farmers, QNFSS intends to create policy framework to transform the domestic wholesale market process, and setup a farmer support entity (infrastructure, processes) and pilot different commercial models. QNFSS also aims to develop a detailed a food waste management program based on diagnostics and benchmarking. Lastly, QNFSS intends to launch a new food standards governance structure. This will help in integrating and accelerating food quality check processes at customs. Furthermore, food safety regulations will be reviewed, and a clear food certification process will be established.

Table 6: QNFSS Performance Metrics: Domestic Markets

KPI	2023 Target
Eligible farmers covered by program	90%
% food waste reduction	5 percentage points
% food waste processed	20%
Share of products certified based on quality of output (vs. production process)	100%
Food safety incidents per capita p.a.	0

Source: QNFSS 2018-23

Table 7: Integrated Food Waste Program: Best Practice Initiatives

Value chain stage	Issues	Strategic recommendations
Customs	• Food clearance can take up to 24-12 hours, increasing risk of damage • Long procedure times because: ◦ Full inspection on-site (documentary compliance lead time is– 6x higher than UAE) ◦ Lack of infrastructure (e.g., labs)	• Set legal maximum time for product clearance to less than six hours • Further develop and promote adoption of a registration system to ensure most products are approved before arrival
Farmer	• No secondary market for production considered unsuitable for direct consumption • Farmers not trained on best practices to minimize production waste	• Continue to facilitate development of processing companies' facilities (e.g., food canning) to create a secondary market for production that is unsuitable for direct consumption • Develop extension service to educate farmers on storage best practices to minimize production wastage
Intermediary Players (Central Market, Retailers)	Absence of adequate handling & storage infrastructure at Central Market	• Promote development of best-in-class handling & storage facilities at new Central Market locations • Further promote development of private sector warehousing cold storage space (e.g., through affordable warehousing)
End Consumers and HORECA	• Absence of best practice compost processing • No compost collection program in place	• Establish a waste treatment facility to process compost waste using windrows composting technology • Make left over out-of-date products available in food banks for limited amount of time • Launch campaigns to encourage change in behavior

Source: QNFSS 2018-23

Table 8: Food wastage across value chain: Actions taken and potential impact

Value chain stage	Estimated Current Food Wastage	Estimated impact on food wastage (in percentage points (pp))	Actions
Customs	NA	NA	• Reduce maximum time for product clearance • Increase adoption of pre-arrival registrationproducts are approved before arrival
Farmers	~2%	-0.5 pp	• Educate farmers on best practices • Develop secondary market through processing
Central Market	~9%	-2	Equip Central Markets with adequate handling & storage infrastructure
Wholesaler	~9%	-1	Help develop private sector warehousing through more affordable rent
Retailers	~3%	-0.5	
End Consumers	>10%	-1	• Establish waste collection program and waste treatment facility • Launch a food bank program with HORECA

Source: QNFSS 2018-23

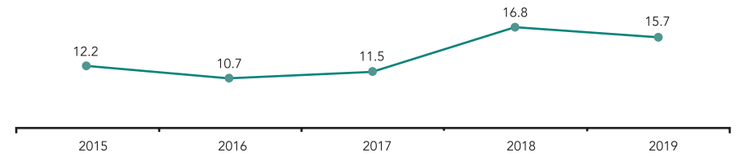
3.12 Self-Sufficiency in Qatar

As a result of the initiatives by the government, the State of Qatar has ranked first among Arab countries and 24th globally (out of 113 countries) in the 2021 Global Food Security Index (GFSI) according to the report issued by the Economist Intelligence Research Unit. This is an improvement from its 2020 rank of 37[22].

Qatar's overall food self-sufficiency has improved from 12.2% in 2015 to 15.7% in 2019. This improvement can be attributed to the fact that Qatar's production has increased for vegetables due to usage of modern agriculture techniques. The cereal self-sufficiency (6% in 2020) is mainly driven by self-sufficiency for animal consumption (12%) while the self-sufficiency for human consumption is at meagre 1%. Qatar government has acknowledged the fact that it is non-competitive to produce cereals locally and has hence set no target for local production. The self-sufficiency 2023 target for 'strategic' vegetables (i.e. Tomato, Cucumber, Pepper, Eggplant, Green Beans, Lettuce, Green Leaves) is set at 70%, expected to be achieved through advances in greenhouse farming.

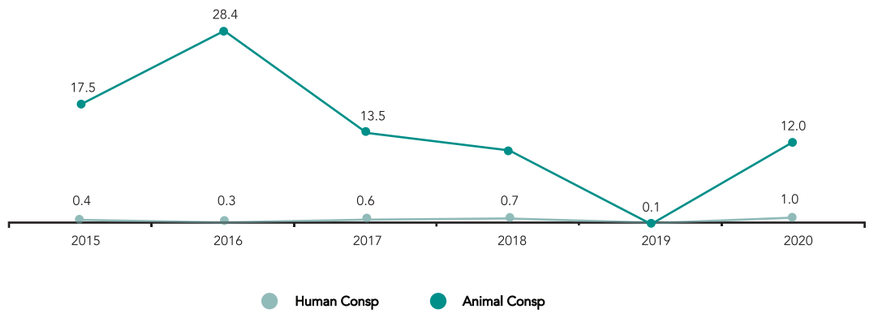
[22] Qatar ranks 1st in Arab World, 24th Globally in Global Food Security Index 2021; Hukoomi Qatar e-Government

Chart 38: Qatar Self-Sufficiency (%): Food



Source: Qatar Planning and Statistics Authority

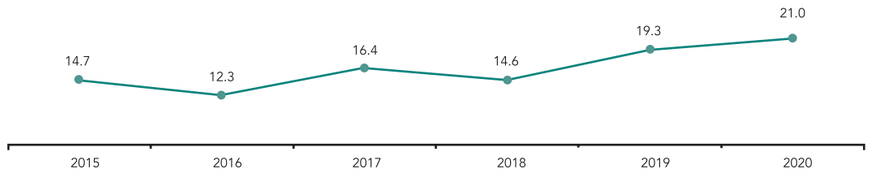
Chart 39: Qatar Self-Sufficiency (%): Cereals



Source: Qatar Planning and Statistics Authority

The total vegetable self-sufficiency has increased over the years from 14.7% in 2015 to 21% in 2020. In terms of the strategic vegetables, the self-sufficiency stands at 44% in 2021 as opposed to the 2023 target of 70%.

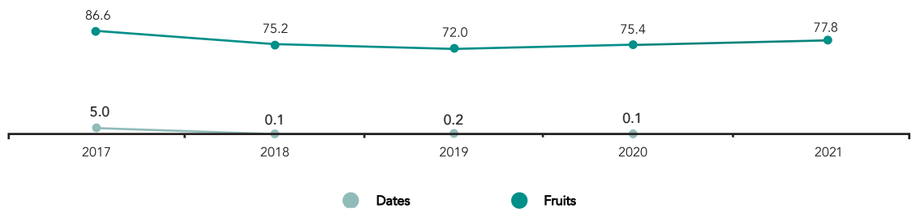
Chart 40: Qatar Self-Sufficiency (%): Vegetables



Source: Qatar Planning and Statistics Authority

Even though Qatar's climatic conditions are conducive for dates production, Qatar has witnessed a decline in self-sufficiency in dates from 86.6% in 2017 to 77.8% in 2021. This largely due to the fact that the land utilization for dates has fallen from 2,341 Hectare in 2017 to 2,217 Hectare in 2020.

Chart 41: Qatar Self-Sufficiency (%): Fruits & Dates



Source: Qatar Planning and Statistics Authority

3.13 OTHER INITIATIVES ON AGRICULTURE

3.13.1 Joint Partnership with between QNRF and MM

Qatar National Research Fund (QNRF), established in 2006 by Qatar Foundation, aims to foster original, competitively selected research in engineering and technology, physical and life sciences, medicine, humanities, social sciences and the arts. QNRF, in partnership with MM, grants research funding on food security related research projects that focusses on production techniques, local supply chain, food security, etc. Each award is up to QR 728,000 (US$ 200,000) and up to 3 years with total budget of QR 1,820,000 (US$ 500,000). So far, three calls have been made under this partnership[23]:

1. First Call (2019): The main objective of this call was to enhance food security measures in Qatar through investing in applied research for the primary theme of 'Local Food Production', along with 'Community Initiative Policy and Legislation', 'Strengthening Resilience among People', and 'Agrifood Systems Supply Chain'. The call utilizes the external expertise and knowledge in science and technology related to food security in order to encourage development of solutions which are designed to suit Qatari climatic conditions. A total of 9 proposals were awarded funding in this call.

2. Second Call (2020): This call invited researchers to submit proposals that aim to enhance food security measures in Qatar and harness local and external expertise and knowledge in food security. A total of 6 proposals were awarded funding.

3. Third Call (2021): This call focuses on high Technology Readiness Level (TRL) applied research aiming at (a) enhancing Food Security measures through investing in applied research in the main pillars of the State of Qatar's National Food Security Strategy, and (b) harnessing local and external expertise and knowledge in Food Security related science and technology to develop solutions for the local Qatari conditions.

[23] Qatar National Research Fund

3.13.2 Government Initiatives

The government has taken several initiatives to propel the agriculture market growth. These include investment projects, procurement guarantee programs, financing initiatives, and investment on greenhouse farming. Some of the government initiatives are as follows[24,25,26,27]:

1. **Agricultural strategic investment projects for greenhouse vegetable production:** In 2018, MM initiated 34 new agricultural strategic investment projects for vegetable production using the technology of greenhouses with 100,000 m2 area allocated for each project. The objective was to promote fresh vegetable production to achieve self-sufficiency. In line with QNFSS 2018-23, private investors were offered 10 projects to grow vegetables in greenhouses and produce about 21,000 tons of vegetables per annum in order to push the nation closer to self-sufficiency.

2. **'Daman' (guarantee) program:** Mahaseel for Marketing and Agri-Services, established in 2018, is a private company fully owned by Hassad. MM launched the 'Daman' guarantee program in coordination with Mahaseel. The program pre-contracts with local producers to purchase their vegetable products, with the aim of setting guarantee prices for the purchase of local farm products and directing farmers to set their production plan according to the needs of the local market, which is a motivator for these farmers and a guarantee for sale of products at prices that ensure a good income for them.

3. **Financial Injections into Agriculture sector:** The government injected 105 million QR into the agriculture industry to increase food security. This 105 million QR government in 2018 support includes providing protected houses & agricultural production requirements, which include seeds, fertilizers, pesticides and containers for vegetables and dates, and the distribution of honeybee cells on registered farms.

4. **Food & Water Security Programs:** Developed by the Qatar University Centre for Sustainable Development, the program focuses on research areas like halophytes and saline crop production, soil improvement and water reuse.

5. **Natural Resource Management Strategy:** Element of the Second National Development Strategy (2018-22) focused on improving land use efficiency and deploying modern agricultural techniques to improve plant, animal and fishery production; aims to increase self-sufficiency in fisheries to 65% and livestock to 30% by 2022.

6. **Sustainable Strategic Plan 2018-22:** Launched by MM as a roadmap to develop six key sectors including agriculture and fisheries – through strategic planning and food security projects to ensure sustainable food production.

7. **Support to Greenhouse Farms:** MM imported and installed 350 greenhouses in 85 local farms in 2019 to support local farms to continue vegetable production during summer. It also distributed equipment and agricultural supplies including 6,010 baskets of seeds to 435 farms, services of ploughing and levelling to 452 farms, 500,000 packing boxes to 100 farms at the rate of 5,000 boxes per farm as well as visits to farms by experts to provide agriculture advice to farmers. Additionally, QDB is also providing 100% financing of the value with a maximum of 70,000 QR provided to Qatari citizens to install urban scale greenhouses. These initiatives have had a significant impact on the agriculture sector, especially on the production on vegetables – Around 58% of the overall vegetable production came from greenhouses in 2020.

8. **MM and Qatar Free Zones Authority (QFZA)** have signed a Memorandum of Understanding (MoU) to strengthen co-operation and facilitate the development of a business cluster in Qatar Free Zones dedicated to advanced agriculture technology and the food industry. The MoU will help attract investment by facilitating investor delegation visits organized by MM and QFZA. It will also support the hosting of various events, including discussions on investment sectors, bilateral meetings between companies, high-level economic and trade forums, and other economic and commercial activities that will be held locally or internationally. Furthermore, it will help provide training opportunities and co-hosting training programs, as well as enable the exchange of knowledge about international exhibitions and communication with investors.[28]

In order to tackle the food security concerns, MM has initiated 26 projects to increase the production capacity. Of these 26, 7 are for greenhouse and green fodder category:

Table 9: Food Security Initiatives

Category	Number of Projects	Production Capacity (Ton)
Greenhouse Projects	4	8,400
Green Fodder	3	33,000
Total Initiatives	7	41,400

Source: Ministry of Municipality

3.14 Battling the Covid-19 Pandemic [29,30,31,32]

The Covid-19 pandemic exposed the fragility of global food supply chains. Qatar was in a better position to tackle supply chain issues as compared to other GCC countries because it had already begun concerted efforts to boost domestic production during to 2017 blockade. However, the pandemic further encouraged Qatar to develop its domestic food industry. Participants across the agri-supply chain had to bear new costs & obstacles due to many factors, including the lack of efficiency resulting from the necessary social distancing in orchards & farms, increases in logistical costs due to additional safety measures & delays. These factors increased pressure on growers and traders, as the additional costs were not completely compensated by higher returns on sales.

[24] Ministry of Municipality
[25] Innovation Norway - Business Opportunities in Qatar
[26] Peninsula Qatar
[27] Qatar Development Bank

[28] MM, QFZA sign MoU to promote food security, sustainability; Gulf Times
[29] MDPI: Impact of Covid19- on Food Behavior and Consumption in Qatar
[30] World Bank
[31] Qatar Market Report – Innovation Norway
[32] Food Security in Qatar – Lulu Hypermarket

Positively, there is an increase in the consumption of domestic products due to food safety concerns which benefited greenhouse growers. This is evident from the fact that local production of vegetables increased from 2019 to 2020. Agriculture market size has shrunk by around 7% from 2019 to 2020. This can be due to covid-19 led supply side issues. Lastly, imports have fallen in 2020 as compared to 2019. Imports of cereals, dates, vegetables, & fruits decreased by 12.7%, 14%, 4.7%, & 1.6% respectively.

The Qatar government has taken several steps to mitigate the impact of the pandemic. During the Covid-19 pandemic, Qatar's MM announced to keep the local markets open throughout the week to maintain supplies in the nation. Additionally, the Qatar government launched an electronic system to manage and monitor its strategic stocks. Imports of fruits and vegetables continued at the same pace, and contingency plans (such as maintaining inventory of supplies) were being implemented to address any shortages.

Lastly, given the food dependency of Qatar on imports and to address the food security concerns, Qatar has hardly any import tariffs on agriculture commodities. The only import tariff that is being levied is on coconuts, brazil nuts, cashew nuts, other nuts, and rye and sorghum[33]. A comparative analysis of import tariffs amongst GCC countries has been done in Annexure A. As a response to Covid-19 pandemic, Qatar implemented a stimulus package to mitigate the impact of the outbreak on the economic and financial sectors of the country - the Ministry exempted all food and medical products from the country›s 5% customs duty for a period of six months starting March 2020.[34,35]

4. OVERVIEW OF THE GLOBAL GREENHOUSE MARKET

4.1 Global Greenhouse Market Size

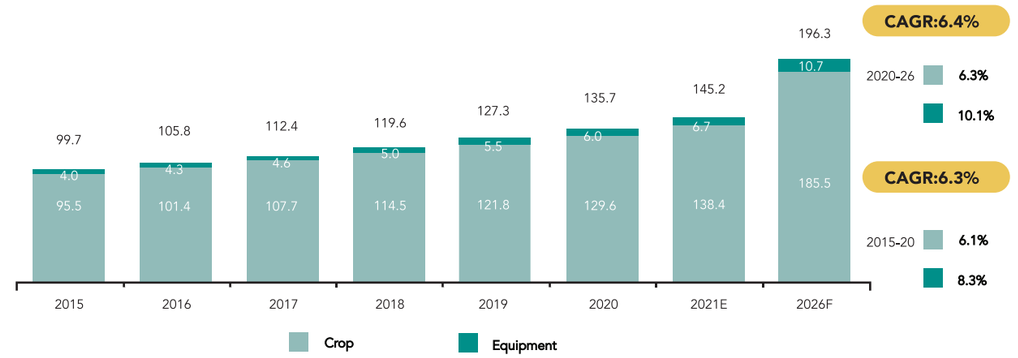
The global greenhouse market value was QR 135.7 billion in 2020. The market has grown at a CAGR of 6.4% during 2015-20 and is expected to maintain its cadence of growth at 6.3% during 2020-26. The market expansion is being fueled by a gradually growing population and economic prosperity leading to increased food demand and fluctuations in climatic conditions affecting productivity in conventional farming. Currently, North America & Europe are the two prominent markets that have deployed greenhouse farming and together account for approximately 66% of the market. However, emerging markets in Asia such as China & India are registering comparatively higher growth.

The market for greenhouses is segmented into:

1. Crops, i.e. production of fruits, vegetables and other products, and accounts of 95% of the market value, and
2. Equipment, i.e. sale of installations for setting up the greenhouse infrastructure.

[33] World Integrated Trade Solution (WITS)
[34] KPMG: Qatar Industrial Landscape 2.0: Resilient and Stronger
[35] United States Department of Agriculture

Chart 42: Global Greenhouse Market Size (Billion QR)

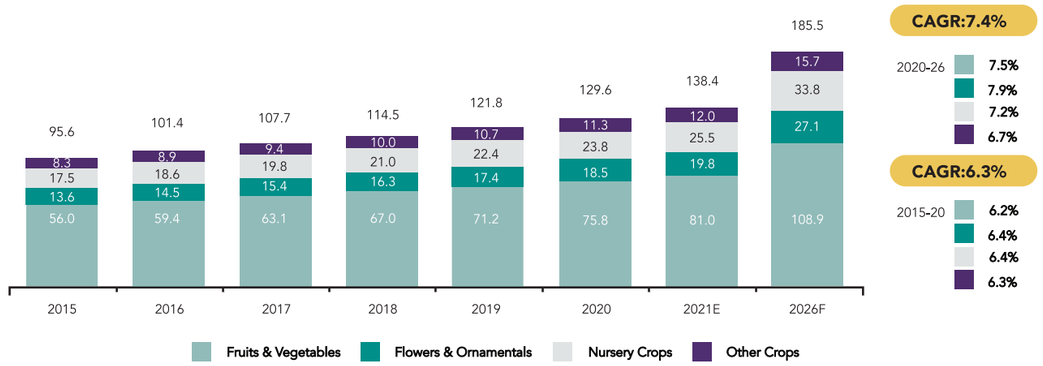


Source: Mordor Intelligence – Global Commercial Greenhouse Market 2021-26

4.1.1 Global Greenhouse Segmentation by Crop Type

The market for crops produced in greenhouses account for approximately 95% of the total market. The fruits and vegetable segment accounts for most of the crop through greenhouse farming. Leafy greens, microgreens, spinach, cucumber, tomatoes, peppers, herbs, squash, strawberries, peaches, coriander, chilies, raspberries are some major fruits & vegetables grown in greenhouses. Even flowers & ornamentals such as chrysanthemum, pelargonium, impatiens, fuchsia, begonia, carnation, cineraria, primula, streptocarpus, kalanchoe, rose, lilium, gerbera, tulips, orchids, alstroemeria, eustoma, gypsophila and statice have seen growing demand recently. Similarly, the nursery business growing seedlings have also gained momentum, on the back of recent trend of home gardening & landscaping and growing indoor plants that has been witnessed during the Covid-19 pandemic. The quality of produce through greenhouse farming is also high, which is creating sustained demand from major wholesalers & retailers in developed markets of USA and Europe.

Chart 43: Global Greenhouse Market: Segmentation by Crop (Billion QR)

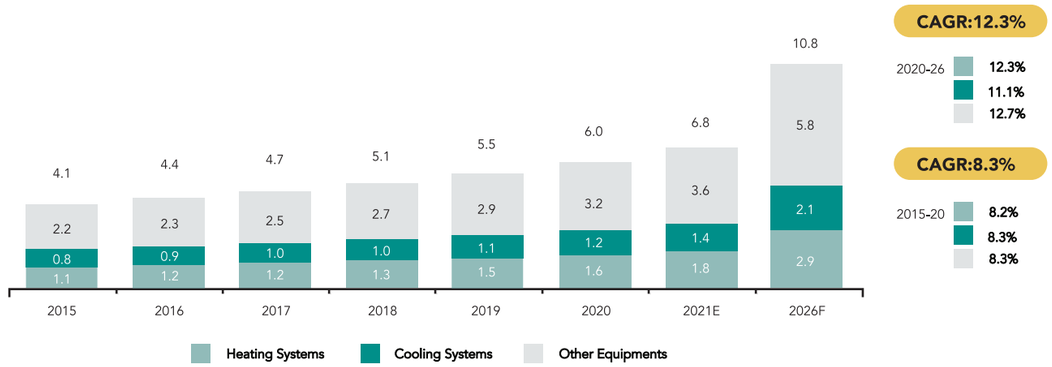


Source: Mordor Intelligence – Global Commercial Greenhouse Market 2021-26

4.1.2 Global Greenhouse Segmentation by Equipment Type

The greenhouse market includes the value from sale of greenhouse equipment and account for approximately 5% of the total market. In greenhouses, heating systems are one of the major equipment used for controlling the farming conditions. Most greenhouses use a centralized hydronic heating system as it is an efficient form of heating in greenhouses greater than 1000 square meter. Considering the concerns around energy saving and sustainable farming, equipment manufacturers are developing more efficient energy-saving heating systems into the market. Meanwhile, cooling systems has more relevance in Asia-Pacific and Middle Eastern countries where temperatures are high, which restricts crop growth and yield. Until recently, most greenhouse growers used conventional cooling, like evaporative pads, fog systems, and venting. However, these systems are not the most effective to cool crops; hence, some companies are innovating mechanical systems that are also environment-friendly.

Chart 44: Global Greenhouse Market: Segmentation by Equipment (Billion QR)

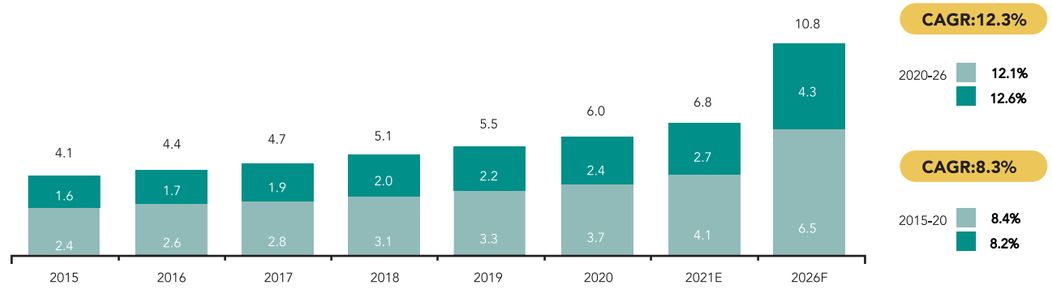


Source: Mordor Intelligence – Global Commercial Greenhouse Market 2021-26

Greenhouse equipment market can also be segmented by glass and plastic greenhouse. Glass is mainly used in large areas, while plastic installations are more economical & used in smaller farms.
Because of its visual appeal and property to allow most amount of light to pass through, glass has been the standard glazing material for greenhouses. It has been found that the tomatoes cultivated under glass weighed more than fruits developed under direct light. Also, crops grown under glass showed more generative growth and had a higher stem dry weight content, in addition to being less sensitive to pests and diseases. Thus, a growing need for precise and uniform light distribution to increase farm yield is positively impacting installation of glass greenhouses.

In comparison, plastic greenhouses installation is considered an economical alternative, at around 60-70% the cost of glass greenhouses. Plastic constructed greenhouses are also 30% more energy efficient in comparison to glass. It is also considered to be more suitable for smaller sized greenhouse farms.

Chart 45: Global Greenhouse Market: Segmentation by Equipment (Billion QR)



Source: Mordor Intelligence – Global Commercial Greenhouse Market 2021-26

4.2 Market Drivers and Inhibitors for Greenhouse Market

The key market drivers of greenhouse market are as follows:

1. Gradual decline per-capita arable land: One of the key reasons for growth in the greenhouse market has been declining per-capita arable land. In 2015, the per-capita arable land was 0.188 hectare whereas, in 2019, it was 0.180 hectare. There is a need to increase the crop yields in the coming decades to keep up with the demand from global population.
2. Lifestyle changes: People are making lifestyle changes and preferring sustainable and pesticide-free foods. The demand for these foods have led to increased market for greenhouse farming.
3. Changing climatic conditions: Changes in the frequency and severity of droughts and floods pose challenges for farmers and threaten food safety, leading to lower yields globally. Utilization of greenhouse technique at commercial scale provides a protected and controlled atmosphere, which can favor the production of seasonal crops throughout the year.
4. The key inhibitors of greenhouse market are as follows:
5. Dependence on precision techniques and expertise: In greenhouse, precise environmental conditions are required to grow the crop properly. It is important to monitor the humidity, temperature, sterility and managing the nutrition available at every growth stage of each crop. This requires a good knowledge on the crop and weather conditions. The skilled workforce required for these activities is lacking in many countries.
6. High Capital Expenditure: Greenhouse farming require high startup costs and raising sufficient capital is one of the greatest challenges for the entrepreneurs.

Table 10: Capital Expenditure for a Greenhouse Farm in the US

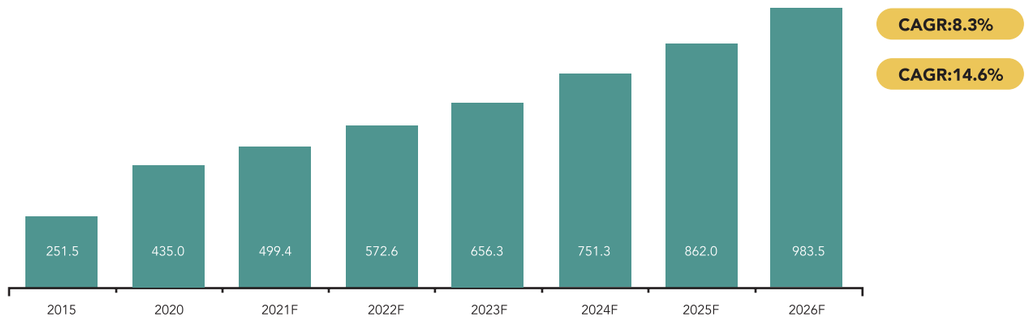
Total Building Area(ft^2)	138,600
Total Growing Area(ft^2)	113,400
Capital Expenditure (USD/pound/year)	4.10
Operating Expenditure (USD/pound/year)	0.98
Total Capital Expenses (USD)	5,671,654

5. OVERVIEW OF THE QATAR GREENHOUSE MARKET

5.1 Qatar Greenhouse Market Size

Limited land availability, scarcity of water, and constraints in agriculture production through conventional farming techniques has been fueling the developments in greenhouses market in the state of Qatar. Consequently, the market for greenhouses is valued at QR 435 million in 2020, and is expected to grow at a CAGR of %14.6 during 26-2020. Government initiatives such as plans to encourage establishment of new greenhouses and meet food security benchmarks will continue to play an important role in supporting development of the greenhouses market in the state of Qatar.

Chart 46: Qatar Greenhouse Market: Total Market Size (Million QR)



Source: IMARC – Qatar Greenhouse Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026

5.1.1 Qatar Greenhouse Segmentation by Crop Type

Fruits and vegetables represent the largest segment accounting for around two thirds of the market. In 2020, 28,373 tonnes of cucumber and 22,461 tonnes of tomatoes were produced through greenhouse farming in the state of Qatar, together accounting for 83.7% of the total greenhouse crop production during the year[36].

Nursery crops is another important segment with growth estimates of CAGR 14.8% during 2020-26. Because of water scarcity, the increasing use of hydroponic technology in greenhouses is supporting the production of nursery crops.

Flowers and ornamentals is also an important end use segment for greenhouses, with flower-roses, gladioli and chrysanthemums roses, etc. being produced locally by greenhouse farms for landscaping and beautification.

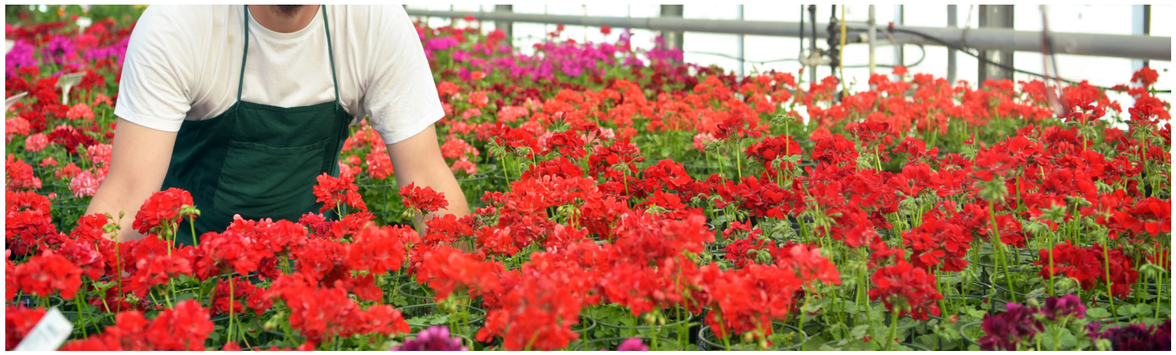
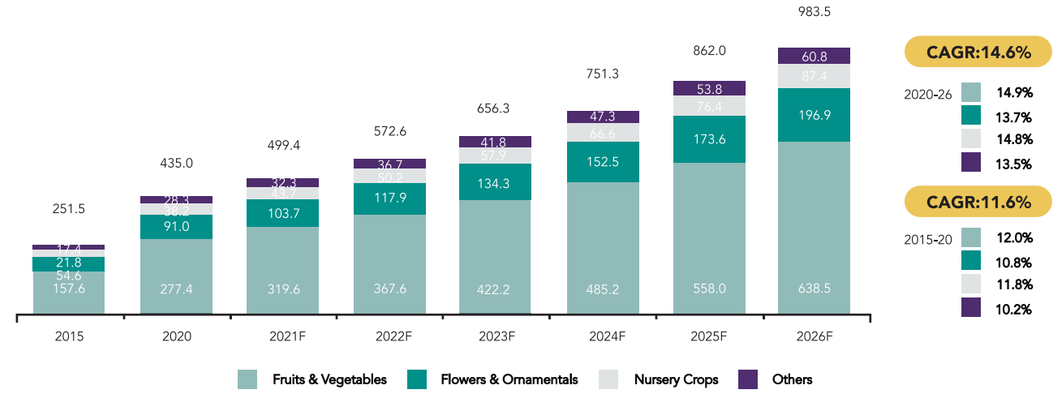


Chart 47: Qatar Greenhouse Market: Break-up by Crop (Million QR)



Source: IMARC – Qatar Greenhouse Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026

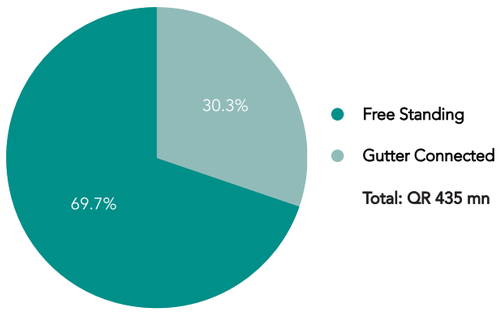
[36] Qatar Planning and Statistics Authority

5.1.2 Qatar Greenhouse Segmentation by Structure Type

Gutter connected greenhouse dominates the Qatar greenhouse market because of its higher area coverage and energy efficiency. It consists of a series of gable or gothic arches which are attached by the common gutter only at the lower edges of the roof. They are generally considered to be economical when built greater than 20,000 square feet. Utilities such as water supply, electricity and computer systems are centralized which makes it less expensive to install and maintain. More importantly, less energy is required to heat and cool the greenhouse as the exposed wall surface area is reduced, leading to its higher preference in the state of Qatar.

Free standing greenhouses are standalone structures which provide economical growing space. Since these structures do not need to be attached to a wall, the site preparations and erections costs are comparatively lesser. However, its uptake is limited by restrictions in growing area which impacts efficiency and productivity.

Chart 48: Qatar Greenhouse Market: Break-up by type (Million QR)



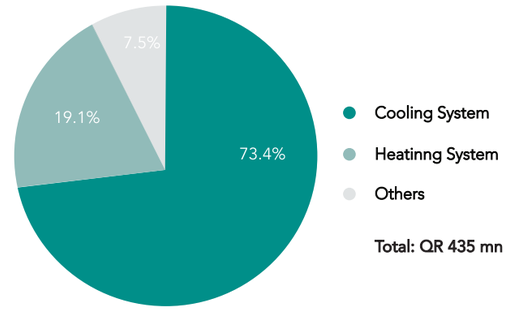
Source: IMARC – Qatar Greenhouse Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026

5.1.3 Qatar Greenhouse Segmentation by Technology Type

Cooling system represents the largest segment (almost three-quarters) of technology for greenhouses in the state of Qatar which can directly be attributed to climatic conditions in Qatar. These systems combine different solutions such as fans, pad cooling, fog cooling, active winter cooling etc. to maintain temperature levels in greenhouse structures. This is especially necessary in the arid and hot climatic condition in the state of Qatar.

Meanwhile, heating systems can aid in year-long growth of plants and improve productivity through well maintained climatic control. These systems are economical and paired with computerized climate control systems for effective performance. Heating systems are typically only required in Qatar when heat loss from the structure, measured by combining losses in conduction, convection and radiation, needs to be controlled.

Chart 49: Qatar Greenhouse Market: Break-up by Technology (Million QR) (2020)



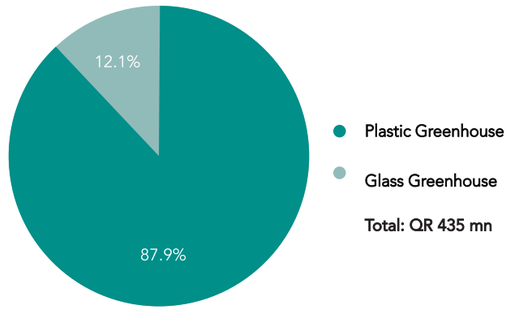
Source: IMARC – Qatar Greenhouse Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026

5.1.4 Qatar Greenhouse Segmentation by Material Type

Plastic greenhouses are in huge demand in Qatar as they are more economical, at around 70% the cost of glass greenhouses. Within plastic greenhouses, 63.7% use polyethylene as the material as it helps to lower cooling costs and reduce plant stress, aspects critical for greenhouses in the state of Qatar. Polycarbonate is another material that used for plastic greenhouse structures in the state of Qatar (28.5%), followed by polymethyl methacrylate (8.3%). Polycarbonate has a strong uptake due to its durability and easy installation. Polymethyl methacrylate based greenhouse structures are less impact resistant; thus, its utility is limited, despite comparatively lower cost of the material.

In comparison, the glass greenhouse structures are less in demand because it is considerably costlier than plastic structures. Within glass greenhouses, horticulture glass accounts for around 76% of material used because it is low grade and thus cost-effective investment.

Chart 50: Qatar Greenhouse Market: Break-up by Material (Million QR) (2020)



Source: IMARC – Qatar Greenhouse Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2026-2021

5.2 Comparison between Open Field and Greenhouse Farming in Qatar

Although conventional farming still accounts for majority of the land area under cultivation in the state of Qatar, traditional open farming has its limitations. The hot desert climate characterized by high humidity, solar radiation, pool soil and strong winds has limited the agricultural production to the months between October and April. Moreover, local production of crops in itself is low with more than 90% of the food products being imported into the state. These traditional limitations can be rendered irrelevant with the adoption of greenhouse farming techniques. Modern greenhouse farming allows all-year-round crop production, dramatically improving productivity. For instance, greenhouse farming covers only 4.7% of the cultivated area, but accounts for 7.8% of the total crop quantity produced.

Chart 51: Qatar Cultivated Area: Open Field vs Greenhouses (Hectare)

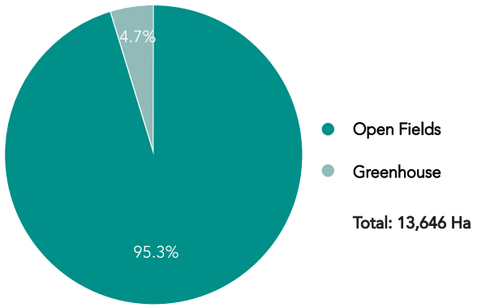
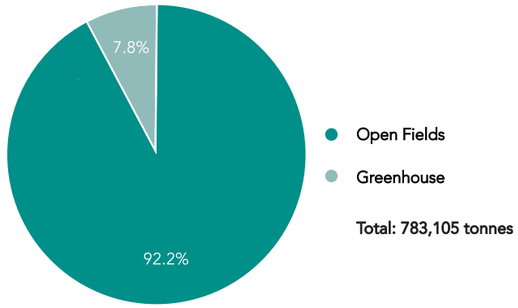


Chart 52: Qatar Quantity Produced: Open Field vs Greenhouses (Tonnes)



5.3 Key Market Drivers and Major Players

Some of the market drivers are as follows:

1. Government Support: The government of Qatar has taken various initiatives to increase the greenhouse production, from launching of greenhouse projects by MM to introduction of hydroponic projects. Furthermore, recognizing the importance of greenhouse farming in meeting the state›s food security goals, the government has been collaborating with foreign researchers and organizations such as Vito Middle East WLL and AgroQatar for scientific and technological research and development in agriculture.

2. Introduction of Soil-free Greenhouses: Qatar is aiming to grow up to 70% of its vegetable requirement locally by 2023. To operationalize this plan, government agencies have partnered with Oasis Agrotechnology, a European consortium, to develop greenhouse technologies that would be suited for Qatar›s climatic conditions. Hydroponics systems and automated climate control solutions have already been tested as a part of this collaboration and are now being licensed to local farms.

The following are some of the key players in Qatar greenhouse market:

1. Agrico Agricultural Development, Al-khor: AGRICO is a private agricultural development company founded in 2011 on the principle of sustainable long-term agricultural production to help achieve the national food security benchmarks. Its farm, located 58kms away from Doha, produces fresh fruits & vegetables to over 1,400 supermarkets, caterers, restaurants, cafes and hotels in Qatar. In addition, the company also offers turnkey solution or fully customized farming systems for other greenhouse farms, including farm planning & set-up, growth management, harvest & distribution, farm management & maintenance.

2. Al Safwa Farm, North of Doha: Al Safwa Farm is a certified organic farm in Umm Salal Ali, north of Doha with a hydroponic system for growing vegetables and herbs. Their produce includes broccoli, green beans, cauliflower, pumpkin, white and red cabbages, eggplants and microgreens.

3. Al Sulaiteen Industrial Complex (SAIC), Umm Salal Ali: Established in 1998, SAIC is one of the leading integrated agricultural projects in Qatar (since 1995). It produces seasonal flowers and year-round vegetables from greenhouses and open field in addition to animal production such as sheep, goat and poultry. The farm facilities and production units were designed with high quality standards with a total area of 40 ha.

4. Global Farm, Umm Salal Ali: Global Farm specializes in growing natural fruits and vegetables and is one of the first Qatari farms to implement the greenhouse systems. They grow a variety of vegetables at their farm at Umm Salal Ali. The company also provides technical consultation in hydroponic technology in addition to other service such as greenhouse construction, farm produce marketing etc.

5. Jerry Smeih Farm, North-west of Al Khor: Jerry Smeih is one of the oldest farms producing a wide variety of fresh, local fruits and vegetables, poultry, and livestock. It is one of the early adopters of hydroponics in Qatar and currently grows tomatoes, cucumbers and sweet melons using this method. The company is a division of Jamco Trading & Contracting, a trading company with interests in construction, building materials, infrastructure, oil and gas, farming, real estate and logistics.

6. Qatarat Agricultural Development Company (QADCO): This is one of the leading agricultural companies in the State of Qatar and is a fully owned subsidiary of Specialized International Services company (SIS). QADCO works to provide a wide range of agricultural solutions with modern scientific methods to Qatar farmers as well as working to provide agricultural inputs like seeds, fertilizers, pesticides and modern equipment and agricultural tools so as to enhance the productivity of farms and achieves the highest productivity possible. The company has more than three productive farms with a total area of 8 Million square meters and marketing outlets for agricultural inputs and agricultural tools.

7. Arab Qatari Agricultural Production Company: It has been established 1989 and is dually shared by the government of the State of Qatar (Hassad Foods) and Arab Authority for Agricultural & Investment Development (AAAID). The main objectives are to contribute in agricultural development and food security in Qatar, Intensifying vegetable production by maximizing the utility of greenhouses throughout the year.

8. Nabati Greenhouse Projects: Nabati is the brand owned by Global Advisory, a company that produces and packs vegetables (tomatoes, peppers and sweet peppers, eggplants and cucumbers). In 2018, it built net houses and plastic greenhouses for their farm which are currently functioning at full scale.

5.4 Vertical Farming in Qatar

Vertical Farming (VF) is a way of harvesting crops on shelves & towers located vertically. In VF, crops are cultivated indoors, underneath artificial conditions of light & temperature. VF employs technology such as sensors, robots, LEDs as sun replacement, with algorithms to optimize lighting & growing conditions. VF ensures quality harvests year-round. The food produced through VF is safer to consume as it does not contain chemical hazards. The yield per unit of area is also higher as compared to conventional farming. However, in VF, high technical expertise is required to handle such technology which exposes farmers to lack of skilled workers. High operational and maintenance cost is required to set up VF systems.

There are mainly 3 types of VF systems that farmers can integrate to provide best harvest. These are:

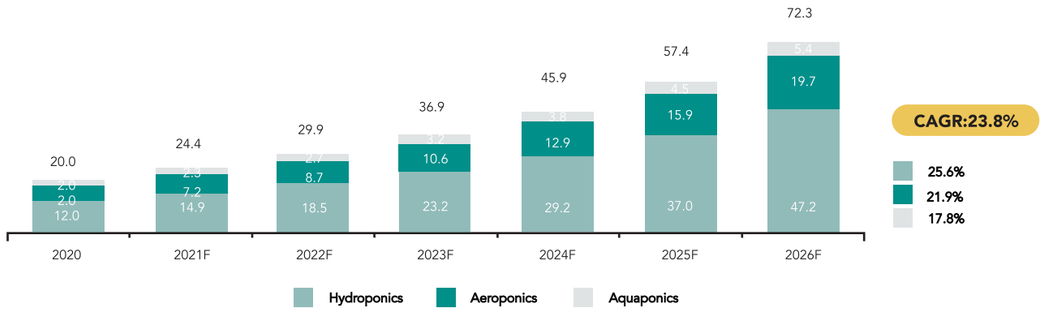
1. Hydroponics: In Hydroponics, plants are produced in a nutrient solution without soil. Hydroponic systems immerse plant roots into liquid solutions with different nutrients. As a substitute for using soil, materials such as gravel and sand are used as an alternative for maintaining the plants' roots. This allows macronutrients, or the nutrients required in large amounts, to be taken and focused on by plants.

2. Aeroponics: Aeroponics requires advanced equipment & more careful attention than hydroponics. This method offers better oxygen access for plants, less water usage, & a lower chance of transmitting diseases. Aeroponic farms allow for fast plant growth & higher crop yields in less space compared to the other systems. It involves permitting plant root systems to be unveiled to the air without a growing method. In aeroponics, crops are dissolved in nutrients, & roots are periodically misted.

3. Aquaponics: It is a combination of aquaculture & hydroponics. Aquaculture is fish farming, & hydroponics is planting without any soil. Aquaponics integrates plants production while using aquatic organisms to help their growth. The combination of the natural aquatic organisms without the use of soil helps the plants to focus on the intake of natural materials & nutrients. Additionally, in aquaponics, as plants flourish, they help filter water for the fish.

With an increasing population and an almost constant share of arable land, there is an increase in demand for techniques that have high agriculture yields. Owing to this, the VF market is expected to grow at CAGR 23.8% from 2020-26. Various governments across the globe are investing in VF. For example, in September 2020, Abu Dhabi Investment Office invested 365 million QR ($100 million) in agritech companies such as Madar Farms, AeroFarms, RNZ, RDI.
The global VF market expansion is expected to be dominated by hydroponics. Hydroponics optimize plant growth, minimize water usage, space, & pesticides. Hydroponics can be used in greenhouse using natural light or LED lights to save space. Owing to these advantages, the market is expected to grow at CAGR of 25.6% during 2020-26.

Chart 53: Global Vertical Farming Market: Segmentation by Type (Billion QR)



Source: BIS Research – Global Vertical Farming Market – A Global and regional Analysis

The VF market in Qatar is at a nascent stage currently. It is one of the avenues which can contribute towards achieving vegetable self-sufficiency of 70% by 2023. However, commercial challenges such as set-up costs, operational costs, advanced climate management techniques and required manpower to control those techniques are restricting VF's applicability.
In order to boost the VF industry, Agrico Organic Farm, & iFarm, a Finland-headquartered global agritech company, has joined forces in May 2021 to build and collaboratively manage a commercial-scale indoor farm based on iFarm's latest VF technology in Qatar. This multi-year partnership is expected to optimize the growing of leafy greens, strawberries, and edible flowers and help ensure a steady year-round supply of fresh produce to the Qatari people. This will be achieved in 2 phases:

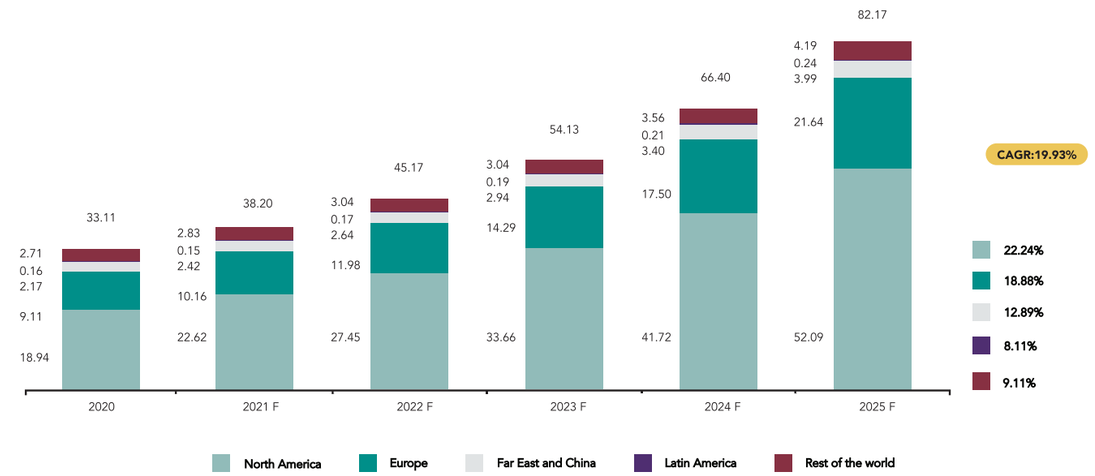
1. Phase 1: The partnership involves developing a commercial trial farm at Agrico Farm in Al Khor, Qatar. This will be the first deployment in the countries of Gulf Cooperation Council of an Artificial Intelligence (AI) managed vertical farm that uses drones to monitor crop health and manage yields. Combining Agrico›s know-how and technology for farming in arid environments with iFarm's state-of-the-art VF solution will enable to improve the quality of crops and to maximize the yield in one of the world's harshest environments.

2. Phase 2: This phase entails commercial distribution of the produce to the local Qatar market and the expansion of the VF technology to other farms in Qatar.

5.5 Other Emerging Agricultural Technologies

Agritech can be a promising solution to the water scarcity concern, delivering intelligent and more-resilient agriculture methods. In 2020, the global agritech market value was estimated to be ~33.1 Billion QR with North America and Europe accounting for ~85% share. The market is further expected to grow at a CAGR of 19.93% from 2020-25 and reach as estimated value of 82.16 Billion QR. This growth is expected to be driven mainly by North America and Europe markets where the agritech market is expected to grow at a CAGR of 22.42% and 18.88%, respectively. The expansion of the agritech market is fuelled by the need to satisfy demands of an increasing population, decline in the labour force under agriculture, almost constant global harvested area. The agritech solutions are designed to address these concerns – agritech enhances the yield, and helps in managing operations by leveraging technology including big data, cloud, Internet of Things (IoT) for tracking, monitoring, automating, and analyzing operations.

Chart 54: Agritech Global Market Value: By Region (Billion QR)



1. The agriculture market is still an emerging industry in Qatar. While the industry has started using greenhouse technology extensively, other forms of agritech are still at a nascent stage. However, there are several agricultural technologies that have emerged and have a potential to expand in the Qatar agriculture sector. The farmers have started using LED or dark room technology which has helped them to not only do farming across the year but also enhance production. According to this technology, the spectrum and colour of lights can be used during different stages of a plant's growth. While blue light helps sprouting of seeds, red light can facilitate photosynthesis, sprouting, flowering and fruiting[37].

2. Another technology used extensively in Qatar is the soilless farming techniques. Attributing to the special attention by the MM on dissemination of soilless farming technology, the recent period has witnessed significant growth in soilless cultivated areas in large number of Qatar farms[38].

[37] Agriculture goes Hi-Tech in Qatar; Qatar Tribune
[38] Qatar attached great attention to farm-tech; Gulf Times

3. Another form of agritech used in Qatar is in the form of price transparency by MM that discloses daily prices in public domain. Furthermore, Mahaseel also provides price information to farmers via text messaging[39].

4. There are a number of other technologies that have significant potential in the Qatar market. Data analytics and machine learning can be used for precision agriculture and farm management. This shall improve the productivity through insights on weather and soil health. The risk models can also be used to predict farmer's credit profiles.

5. AI has recently been making significant strides in improving water efficiency in both greenhouses and fields. Connected-irrigation and nutrient-distribution equipment based on AI and IoT help adjust water and nutrient application, thereby ensuring the efficient use of water resources. On-field sensors to deliver imagery from remote corners of the fields and aerial imagery can also assist farmers in identifying areas that are being under-watered or over-watered. Moreover, drone technology can be used to force precipitation via laser beams to trigger desired rainfall for agriculture[40].

The commercial viability of these technologies, however, is yet to be validated as the scale of adoption of these technologies is recent and limited.

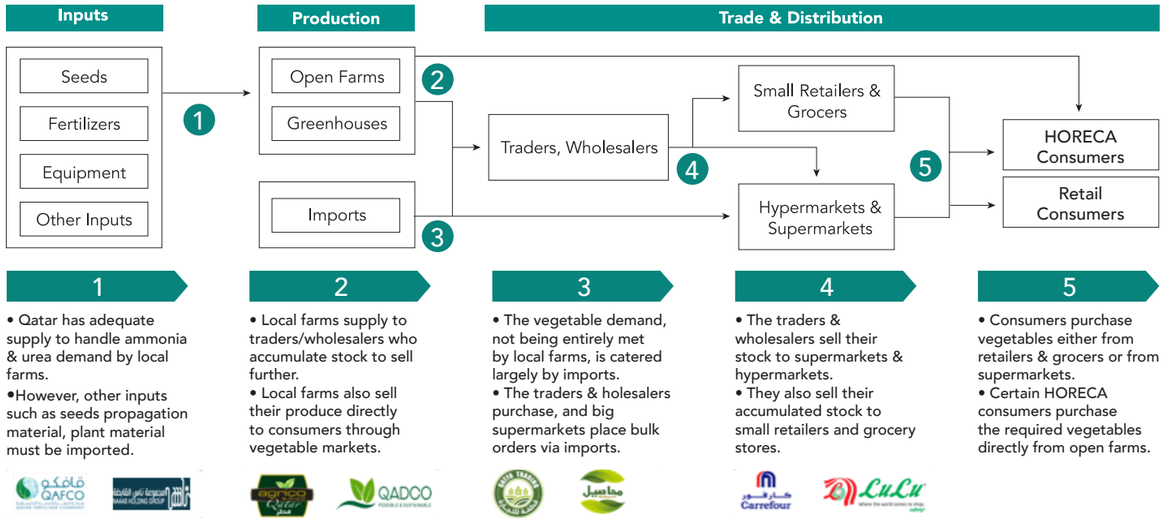
[39] Primary Research
[40] Agriculture in Middle-East: Ket to innovation led digital disruption; FarmERP

6. INDUSTRY VALUE CHAIN FOR AGRICULTURE IN QATAR

Qatar is the second largest producer of ammonia, urea urea-formaldehyde in the GCC region, and has adequate supply to meet requirement of local farms in Qatar. Though other inputs such as seeds, propagation material, plant protection, and plant nutrition products must be imported. By the end of 2020, there were 1,244 farms mainly located in the northern part of Qatar. This region has traditionally been engaged in agriculture because of soil and rain conditions that are favorable for crop cultivation. The market structure is oligopolistic in nature, with a smaller percentage of farms driving most of the market output, while individual farmers and small-scale farms constitute the long tail of the market.

The evolving agriculture sector in Qatar imports most of its inputs from neighboring Arab and South Asian countries. Modern retail trade channels are key to supplying products to consumers. The distribution of agricultural products are facilitated by traders and wholesalers operating in the country. Considering the import dependency for agricultural products, importers play an important role in meeting the consumption needs of Qatar. These importers can also be involved in marketing and distribution activities in the country, or might rely on local wholesalers to purchase from them. Considering that Qatar is a highly urbanized country with more than 99% of population living in urban areas, organized trade outlets such as hypermarkets and supermarkets form an important channel for sale of agricultural products. In fact, large supermarkets such as Carrefour, Lulu etc. also directly import products into the country. Local farm producers also have to rely on grocers & retailers, which they channel through wholesalers such as QATFA Trading, Mahaseel etc. In limited cases, these farms also sell directly to consumers.

Figure 1: Industry Value Chain Snapshot



Source: Mordor Intelligence – Qatar Fruits and Vegetables Market (2020-2025), Primary Research

7. SHORTLISTING OF ATTRACTIVE PRODUCT SEGMENTS

The Qatar agriculture market, although at a nascent stage, is an emerging sector. The recent shift of government focus to achieve self-sufficiency has provided a boost to the sector. There is plenty of evidence pointing towards the fact that the agricultural productivity, especially vegetables, has improved significantly owing to the usage of modern agricultural techniques, such as greenhouse farming, that have been introduced.

In this section, we identify those product segments which are not only attractive from the consumption perspective but also has potential for future growth which will further determine the level of investment the segment attracts.

For the purpose of this report, a prioritization framework has been developed using the quantitative approach. The technique incorporates key parameters and uses a weighted score methodology to derive the top 5 attractive segments. These 5 crop categories are tomatoes, cucumbers, green/sweet pepper, dates, and lettuce.

Based on the data published by Qatar Planning and Statistics Authority, a long list of 35 crops were identified. The prioritization framework uses a 3-step process. These steps are as follows:

1. Step 1: Production for Human Consumption

The QNFSS (2018-23) talks about food security and sufficiency for humans. Therefore, in order to achieve the 2023 target, all those crops that are fit for human consumption have been prioritized. There are 3 crops under 'Cereals' category which, although fit for human consumption, are primarily grown only for meeting the needs for livestock. Furthermore, 3 crops under 'Green Fodder' that are fit only for animal consumption, Consequently, these 6 crops have been eliminated.

2. Step 2: Conduciveness to Qatar climatic conditions OR Conduciveness to Greenhouse technology

Based on the primary interviews, Crops that can either be grown conductively in open fields in Qatar or can be grown at scale through modern agriculture technology such as greenhouse farming were prioritized. Consequently, 11 crops have been eliminated in this step.

- Low Water Requirement: The natural agriculture conditions that Qatar has been endowed with are not conducive for growing crops. Qatar is a water stressed country and the climatic and soil conditions do not support agriculture for crops. The QNFSS emphasizes on crops that can be competitively produced. Therefore, cereals crops that require high water must not be prioritized and are therefore eliminated. Consequently, the food security strategy also has not set any target for cereal production.
- Low Soil Requirement: Qatar's land is not soil intensive. Any crop with low soil requirement must be prioritized. Since trees require large amount of soil, any commodity that is being grown on trees must not be prioritized and is therefore eliminated.
- Conduciveness to Greenhouses: Given the Qatar climate, focus of farming must be towards those crops that not only help in attaining self-sufficiency but also are feasible to be grown through greenhouse farming. There is significant evidence that greenhouse farming is conducive for majority of vegetables. Qatar has been producing vegetables such as tomatoes, cucumbers, capsicum using greenhouse farming techniques and has made significant progress.

3. Step 3: Weighted Score Methodology

The remaining 18 crops have been scored, and ranked, based on 7 parameters. These are:

- Quantum of Consumption Demand: In order to achieve the 70% sufficiency in vegetables as set by QNFSS, it is imperative to focus on those commodities which have a high demand for consumption in Qatar. Therefore, scores have been assigned to commodities based on the 4-year (2017-20) average consumption.
- Self-Sufficiency: QNFSS has set a target of 70% sufficiency of vegetables. Therefore, those commodities whose deficit i.e. consumption minus local production, is high needs to be prioritized for encouraging localization of production. Accordingly, crops have been assigned scores.

- Average Yield (2017-20): Average yield from 2017-2020 has been considered. High scores have been assigned to those crops that have higher yields implying national resources can be used more efficiently.
- CAGR for Demand for Consumption (2015-20): In order to identify high growing markets, it is important to consider the rate of growth of consumption demand of commodities. The framework considers CAGR of consumption demand from 2015 to 2020.
- Proportion of Produce through Greenhouses: This parameter assigns higher scores to those crops that are already being produced in Qatar using greenhouse farming techniques. This is because the framework gives more importance to those crops that have an already existing technology available. An exception may be noted here. Highest score has been assigned to dates despite the fact that it is not produced under greenhouses. This is because of the conduciveness of producing dates under natural climatic conditions of Qatar.
- Focus of Research Activities: It is an assumption that commodities that have attracted higher research are of more importance to Qatar (from both, production and consumption, perspective). Therefore, based on primary research and using qualitative analysis, higher scores have been assigned to those crops that have attracted higher research activities in the recent years

- Existence of Downstream Industry: The framework also considers the existence of downstream industry for a given crop. Higher is the usage of the crop by the downstream industry, higher is its importance and thereby higher scores are assigned to it.

Based on the prioritization framework, the 5 most attractive crops are:

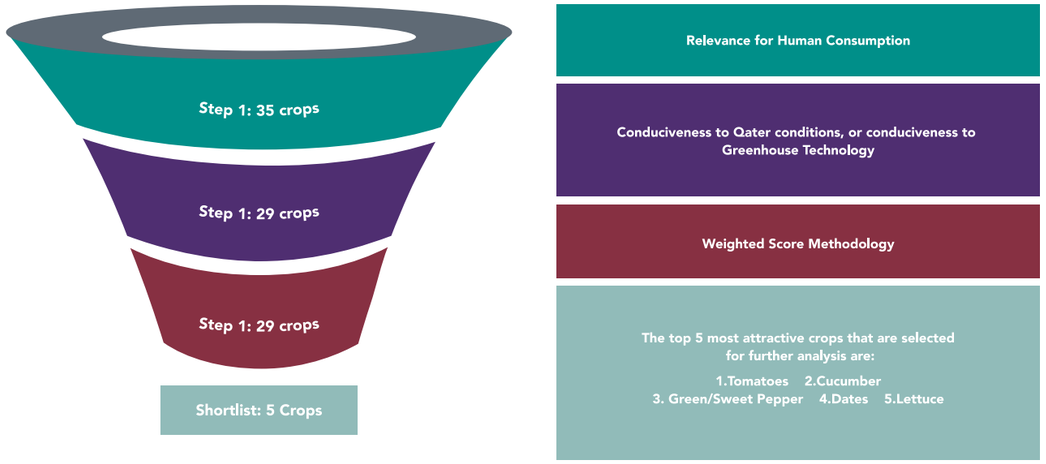
1. Tomatoes (HS Code: 0702)
2. Cucumber (HS Code: 0707)
3. Green/Sweet Pepper (HS Code: 0709)
4. Dates (HS Code: 0804)
5. Lettuce (HS Code: 0705)

The framework also identifies a second line emerging crops that can be considered attractive based on the prioritization framework. These are:

1. Melons/Sugar-Melons and watermelons (HS Code: 0807)
2. Beans (HS Code: 0708)
3. Onions (HS Code: 0703)
4. Potatoes (HS Code: 0701)
5. Marrows, Pumpkins, and Sweet Pumpkins (HS Code: 0709)

The relevant data on afore-mentioned parameters is available in Annexure B. The hybrid approach for the framework is explained in detail in Annexure C.

Figure 2: Prioritization Framework



Source: secondary research

8. ANALYSIS OF THE ATTRACTIVE CROP SEGMENTS

This chapter provides an analysis of each of the five attractive crop segments that were shortlisted using the prioritization framework.

8.1 Tomatoes

Tomatoes is the most produced and consumed vegetable crop globally. It has high nutritional values and diverse methods of consumption, making in an indispensable part of the food basket of Qatari households. The crop has been designated as a critical commodity under the Qatar National Food Security Strategy Program (QNFSS) 2018-23. It has also received funding support for research into programs that would improve local production of the crop in Qatar.

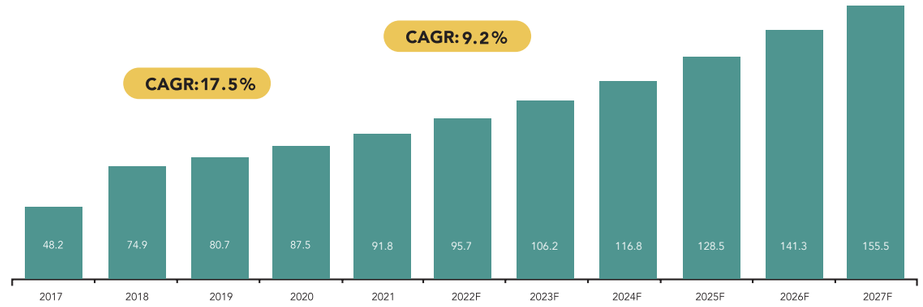
8.1.1 Domestic Consumption

Tomatoes have historically witnessed high demand in Qatar. In fact, it accounts for 24% of the total quantity of vegetables sold in the Doha Central market in 2020. The per capita consumption of tomatoes has also seen a steady increase over the years, from 17.7 Kg/year in 2017 to 33.3 Kg/year in 2021. In addition, the existence of a few processing companies (such as Al Manal Food Factory) to make processed food, juices and beverages as also supported for demand for tomatoes in Qatar.

In the past few years, overall consumption of tomatoes has increased from 48,221 tonnes in 2017 to 91,802 tonnes in 2021 at a CAGR of 17.46%. This demand has largely been met by imports that catered to 57% of the consumption demand in 2021. The remaining demand has been met by local production, which has been improving over the years.

The local demand for tomato is expected to grow at a sustained rate in the future, with consumption forecasted to reach 155,455 tonnes by 2027. The increase in demand in expected to benefit local producers who will play an important to role in meeting self-sufficiency benchmarks by catering to large proportion of the domestic consumption of tomatoes.

Chart 55: Domestic Consumption: Tomatoes (1000 Tonnes)

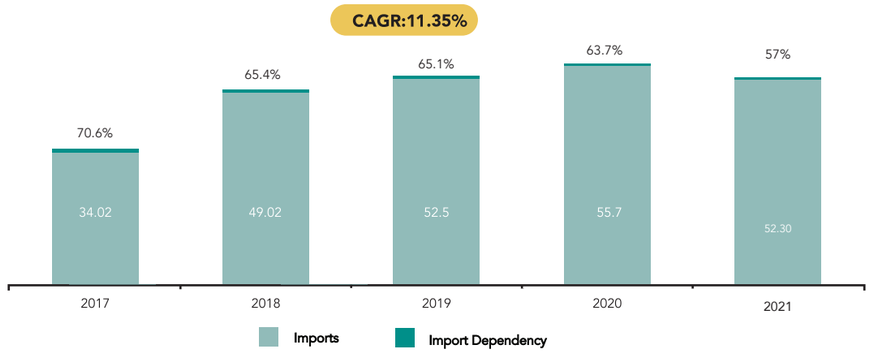


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Primary Research, Ministry of Municipality

8.1.2 Analysis of Tomato Imports

Import for tomatoes have increased from 34,022 tonnes in 2017 to 52,300 tonnes in 2021 at a CAGR of 11.35%. However, the rate of growth of imports has been gradually declining over the years because of a renewed focus on satisfying demand through domestic production. Consequently, the tomato import dependency has also fallen from 70.55% in 2017 to 56.97% in 2021.

Chart 56: Tomato Imports: Quantity (1000 Tonnes) and Dependency (% of Consumption)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Ministry of Municipality

In 2020, around 95.7% of the import for tomatoes originated from three countries, viz. Iran, India and Turkey. Of this, Iran is the largest trade partner, contributing to ~79.5% of the imported tomatoes. The average prices of these imports are low, relative to other imports for the crop from more developed countries such as Netherland and Spain. However, primary research has revealed that tomatoes imported from the three major partners are of inferior quality as compared to locally produced/ European counterparts.

Table 11: Tomato Imports 2020: Trading Partner and Average Prices

Rank	Name	Quantity (Tonnes)	Volume share(%)	Value (1000 QR)	Value share(%)	Average Import Prices (QR per Kg)
1	Iran	44,336.08	79.49	49,252.52	53.83	11.11
2	India	5,039.85	9.04	11,097.97	12.13	2.20
3	Turkey	4,018.99	7.21	7,266.48	7.94	1.81
4	Morocco	895.06	1.6	7,131.68	7.79	7.97
5	Netherlands	569.97	1.02	9,014.89	9.85	15.82
6	Jordon	238.48	0.43	377.53	0.41	1.58
7	Spain	205.36	0.37	4,089.45	4.47	19.91
8	Lebanon	144.52	0.26	1,178.84	1.29	8.16
9	Azerbaijan	89.08	0.16	200.40	0.22	2.25
10	Oman	73.78	0.13	205.42	0.22	2.78

Source: Qatar Ministry of Commerce and Industry

Despite the government emphasis on diversification of trade partnerships to mitigate geopolitical and supply chain risks, the quantum of imports from the top 3 countries has increased from %73.5 in 2017 to %95.7 in 2020. On a value basis, the increase has been from %58.8 to %73.9 during the same period. This indicates a steady flow of tomatoes from countries that provide the crop at a competitive rate; however, the more premium produce coming from some of the developed markets are being substituted by local production.

Chart 57: Import Concentration for Tomatoes: Top 3 and Top 10 (Volume-based, %)

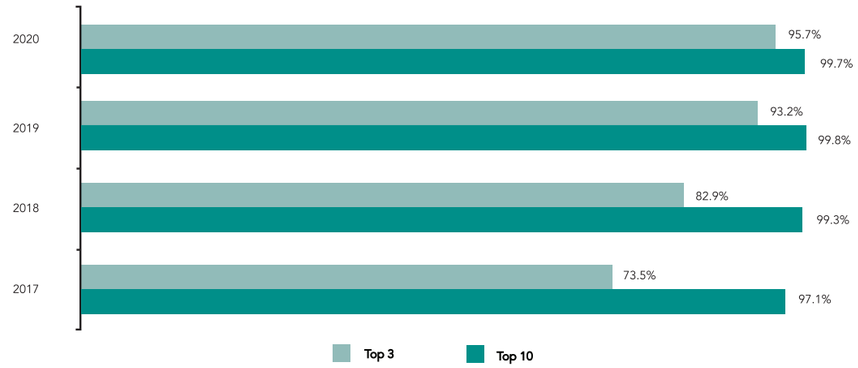
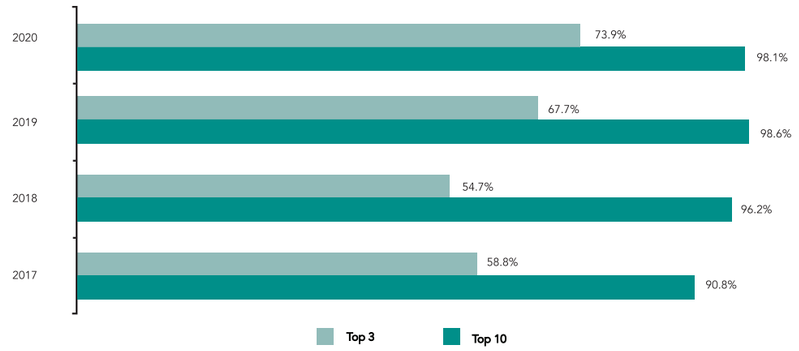


Chart 58: Import Concentration for Tomatoes: Top 3 and Top 10 (Value-based, %)

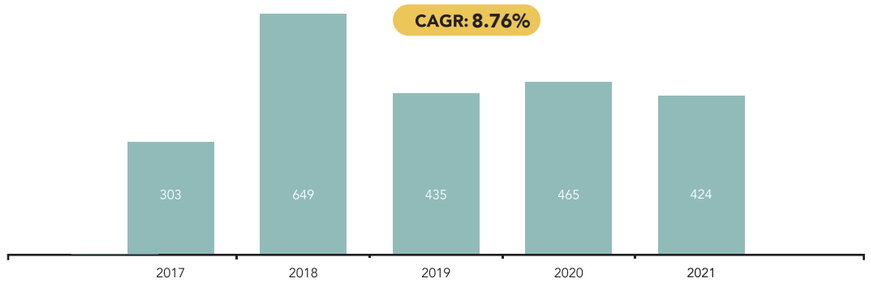


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.1.3 Analyzing the Local Production of Tomatoes

The local production of tomatoes has received a major boost especially on account of support by the government to improve agricultural activities. The area under cultivation has increased at a CAGR of 8.76%, from 303 Ha in 2017 to 424 Ha in 2021.

Chart 59: Area under Cultivation: Tomatoes (Hectare)



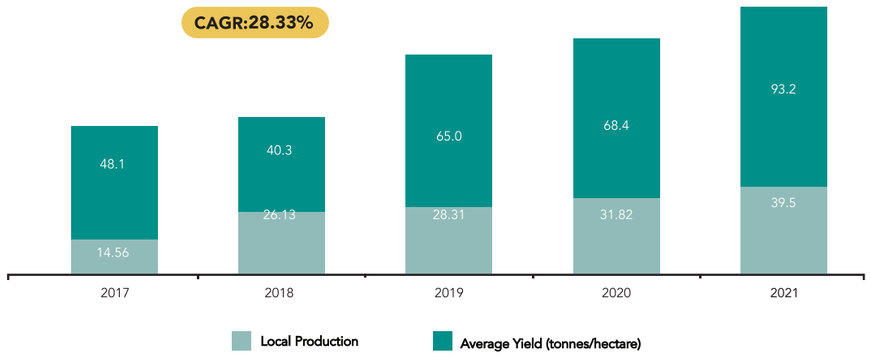
Source: Qatar Planning and Statistics Authority

During this period, the quantity of tomatoes produced locally increased at an even faster rate of 28.33% CAGR, from 14,563 tonnes in 2017 to 39,502 tonnes in 2021. The rate of production growth is more than triple the growth rate of land cultivated under tomatoes, indicating an improvement in yield, and switching from open field farming to greenhouse farming which is considered more productive.

Primary research revealed that improvement in yield for tomatoes can be attributed to overall improvement in factors of production. Qatar imports hybrid seeds and fertilizers (nitrogen, phosphorous and potassium), while urea for soil preparation is sourced locally. Further, the agriculture sector has

gained significant know-how and experience to improve the production process for local conditions. Also, the shift to greenhouse production of tomatoes, which accounted for 82.41% of local tomato production in 2021, has contributed to the increase in yield from 48.1 tonnes/ha in 2017 to 93.17 tonnes/ha in 2021.

Chart 60: Tomatoes: Local Production (1000 Tonnes) and Average Yield

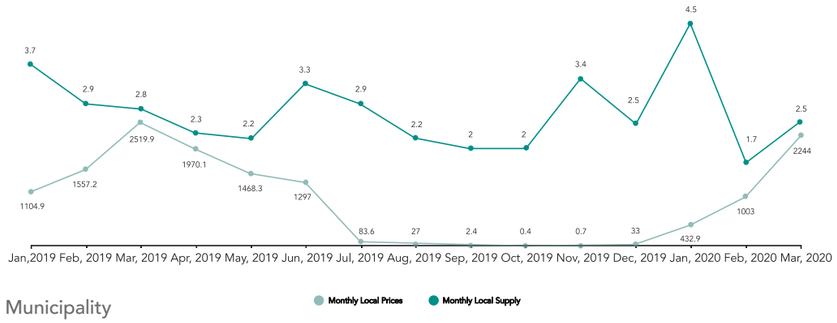


Source: Qatar Planning and Statistics Authority, Ministry of Municipality

Primary research revealed that the sowing season for local tomatoes starts in August-September in Qatar. With a total cycle of 6-8 months, the harvest season begins in late December and continues till March. This is evident from the chart below that shows that the local supply start to increase slightly in December and gains momentum January onwards. By March-April, the local supply peaks.

As the supply increases from January to April, the prices tend to fall. The chart below also shows that despite negligible supply July onwards, the prices continue to remain rangebound and towards the lower side. This is because of the price competition with imports that the local farmers are facing. Farmers might realize lower local prices during the lean summer season as they expect to gain profits during the peak season when the prices and supply are both favorable.

Chart 61: Tomatoes: Monthly Local Prices (QR/Kg) and Supply (Tonnes) in Doha Central Market



Source: Ministry of Municipality

Through the Daman guarantee program, Mahaseel is mandated to procure tomatoes from farmers at spot prices that gets updated every three days. In addition, they also enter into price contracts with farms which allows them to plan for the harvesting season. In 2020, it procured 4,603.3 tonnes of tomatoes from local farmers. The prices offered by Mahaseel for the period of 3rd February 2022 – 6th February 2022 are as follows:

Table 12: Mahaseel Pricing for Local Tomatoes (3rd February 2022 – 6th February 2022)

Grade	Cultivation Method	Price (QR per Kg)
1	Wired	3
2	Wired	2.4
3	Wired	1.92
1	Ground	2.5
2	Ground	2

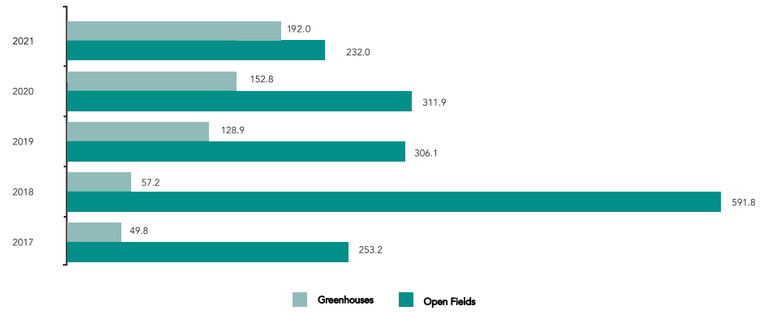
Source: Mahaseel for Marketing and Agriculture Services, Primary Research

Considering the scale of demand, majority of the farms operating in Qatar produce tomatoes. However, the market is fragmented with only a few large farms such as AGRICO, Al Safwa, SAIC, and Global Farm are able to supply directly to large supermarkets (supermarkets prefer to buy in large quantities from single source). Most of the other farms do not have the production output to meet requirements of large outlets; thus, they rely on Mahaseel and distributors for selling their tomato produce.

An increased cultivated land area under tomatoes indicates to a higher relative preference for producing tomatoes, both open field and greenhouses. Primary research revealed that an increasing affinity of Qatari population towards of locally produced fresh and organic produce. This shift in preferences has also led to high demand (and consequently, high production) of locally produced tomatoes, especially those grown under greenhouses.

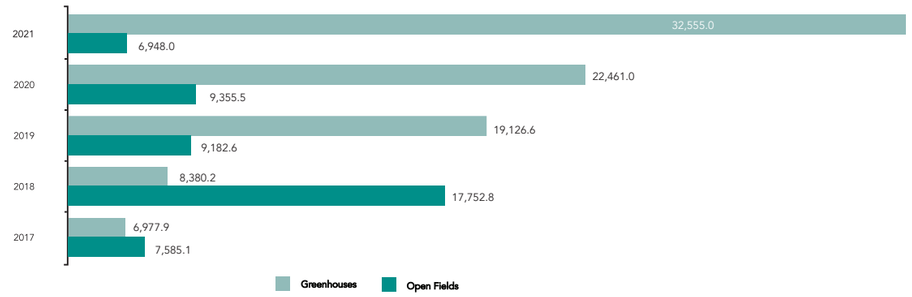
The following charts provides a closer look into cultivated area, local production, and yield for tomatoes under open field and greenhouses. The proportion of area under greenhouses increased from 16.43% (49.8 Ha) in 2017 to 45.28% (192 Ha) in 2021. This was accompanied by an increase in yield under greenhouses from 140.12 tonnes/Ha in 2017 to 169.56 tonnes/ha in 2021. The cultivated land in open field decreased from 253.2 Ha in 2017 to 232 Ha in 2021, the yield remained constant at 30 tonnes/Ha, indicating that the overall increase in yield and production was driven by greenhouse farming.

Chart 62: Area under Tomato Cultivation: Open Fields vs Greenhouses (Hectare)



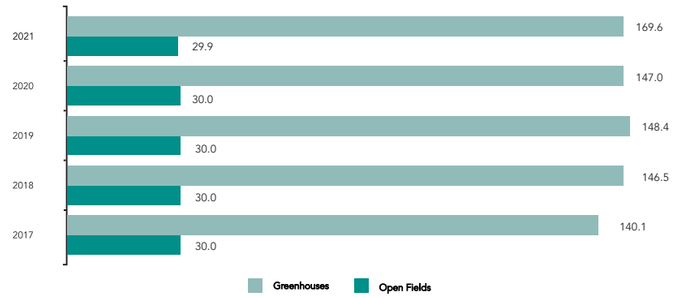
Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 63: Local Production of Tomatoes: Open Fields vs Greenhouses (Tonnes)



Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 64: Average Yield for Tomatoes: Open Fields vs Greenhouses (Tonnes per Hectare)

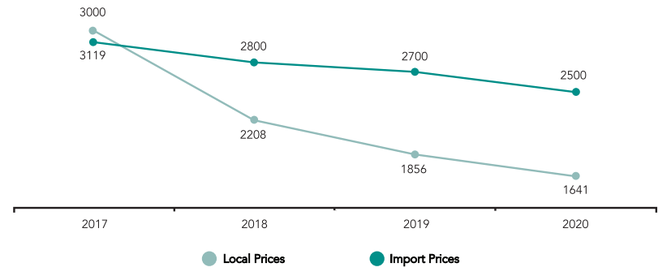


Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

8.1.4 Price Competitiveness

In order to have a sustainable tomato agriculture industry, locally produced tomatoes must be able to compete with imported tomatoes both on quality and price. Based on FAO data, the 2020 average prices for locally produced tomatoes was QR2.5 per Kg. In comparison, the average imported price for tomatoes was only QR1.64 per Kg because of low priced supplies from Iran. However, supplies from other import markets such India, Turkey, Morocco, Netherlands is higher than the average price of locally produced tomatoes. It is the share of these countries that local producers have been capturing in the last few years. The market penetration of local producers have been aided by affinity of Qatari consumer to prefer locally produced fresh organic tomatoes over imported ones.

Chart 65: Local Prices vs Import Prices: Tomatoes (QR per Tonne)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.1.5 Production Cycle and Costs

Primary research revealed that a typical production cycle for tomatoes ranges between 8-5 months, depending on whether it is being produced in open fields or greenhouses. The harvest period in open farming in less compared to greenhouse farming due to unprotected nature of open field farming. The following tables summarizes the time taken to produce tomatoes in Qatar using different methods of production:

Table 13 Time taken to produce Tomatoes: Greenhouse vs Open Field Farming

Particulars		Greenhouse	Open Field
Number of crop cycles that can be grown in a year		2	1
Typical number of days for	Soil Preparation	Less than 7	Less than 7
	Seed to Seedling	34-40	34-40
	Seedling to Flower	40-50	37-42
	Flower to Fruit	20-25	20-25
	Harvest Period	90-100	45-60
	Total time per Cycle	190-220	150-175

Source: Primary Research

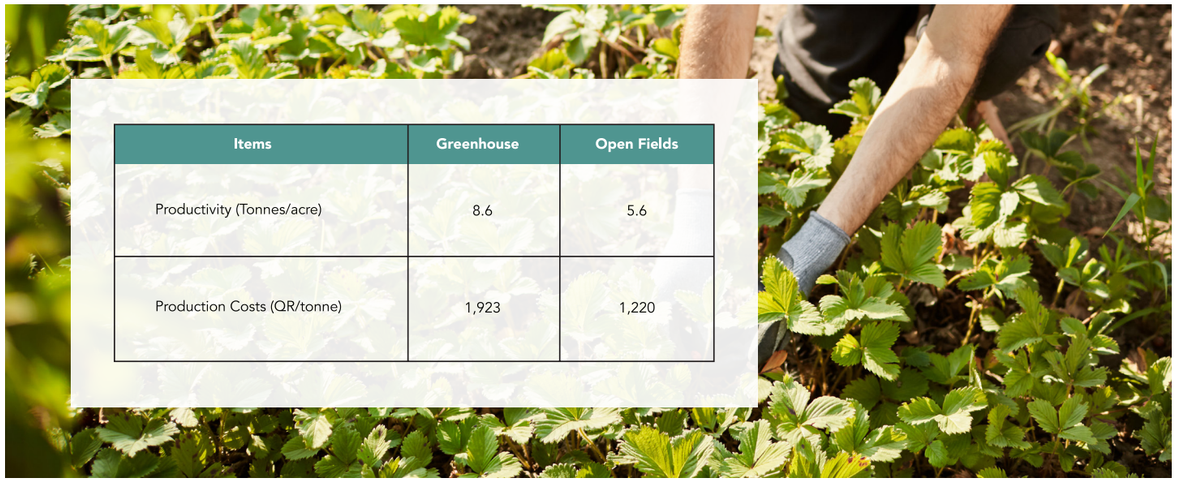
The production cost under greenhouses is significantly higher than open field farming. Nonetheless, this difference is compensated by the higher price that greenhouse tomatoes fetch. Furthermore, the profitability of greenhouse tomatoes is also higher as compared to open field tomatoes. Higher profitability coupled with adequate demand explains the shift towards greenhouse farming under tomatoes.

Table 14: Average Production Input Cost per 1,000 sqm: Tomatoes (Values in QR)

Items	Greenhouse	Open Field
Human Labor	3,503	2,145
Machinery/ Mechanical Labor	271	292
Depreciation Greenhouse	3,059	-
Seeds	1,666	621
Chemical fertilizer	1,929	776
Compost	1,175	432
Pesticides	1,002	293
Marketing Cost	2,732	1,157
Other Cost	1,094	381
Total	16,424	5,870

Source: Ministry of Municipality, Primary Research

Table 15: Average Production Costs: Tomatoes



Items	Greenhouse	Open Fields
Productivity (Tonnes/acre)	8.6	5.6
Production Costs (QR/tonne)	1,923	1,220

Source: Ministry of Municipality, Primary Research

8.2 Cucumbers

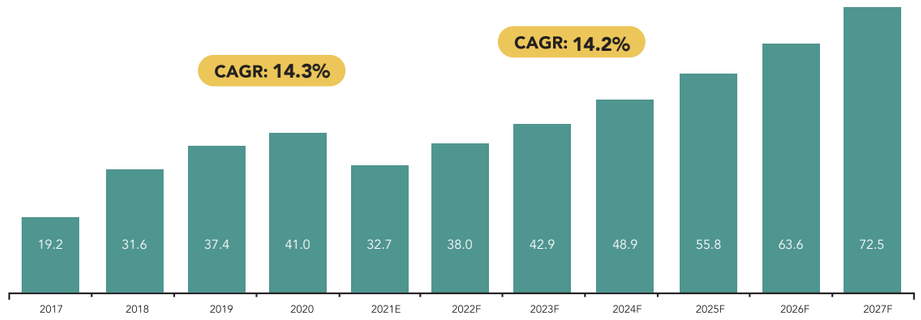
Cucumber is an important vegetable crop that has witnessed strong demand in Qatar. In 2020, it accounts for 27.42% of the vegetable crops produced and 3.11% of total agricultural imports into Qatar. Local production activity for the vegetable has been increasing steadily on the back of growth in demand and conduciveness for producing it though modern greenhouse farming techniques.

8.2.1 Domestic Consumption

Cucumbers, classified as a critical commodity by QNFSS, are increasingly becoming a favored vegetable crop among the Qatari population. The importance of cucumbers is evident from the fact that its per-capita consumption has doubled from 7.04 Kg/year in 2017 to 11.9 Kg/year in 2021.

During this period, total consumption of cucumbers grew from 19,184 tonnes to 32,749 tonnes, at a CAGR of 14.3% Importantly, this demand has largely been met by local production that has catered to 66.7% of the total consumption in 2021. Though, import of cucumbers is important for meeting the gap in production, its importance has been receding in recent years. With the domestic demand expected to reach 72,502 tonnes by 2027, the local production of cucumbers could gain momentum in the next few years.

Chart 66: Domestic Consumption: Cucumbers (1,000 Tonnes)

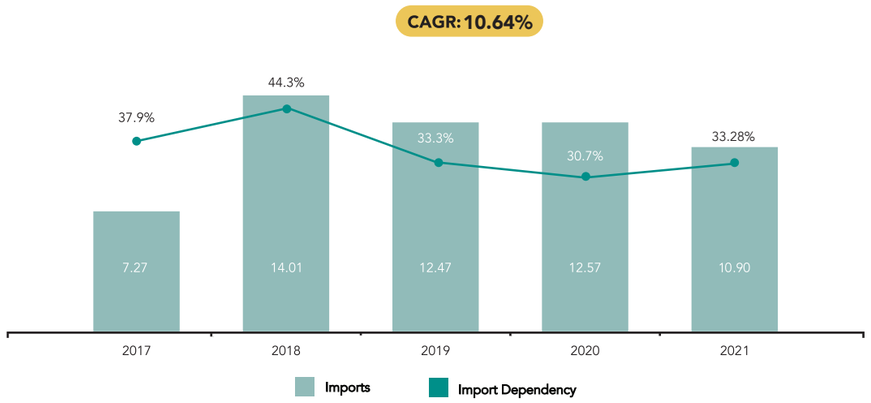


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Primary Research, Ministry of Municipality

8.2.2 Analysis of Imports

There has been an overall increase in import of cucumbers from 7,273 tonnes in 2017 to 10,900 tonnes in 2021 at a CAGR of 10.64%. However, the rate of growth of imports has gradually declined over the years. In fact, imports declined by 13.3% from 2020 to 2021. This is largely because the Qatari producers starting to cater to the local demand.

Chart 67: Cucumber Imports: Quantity (1000 Tonnes) and Dependency (% of Consumption)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Ministry of Municipality

Iran, the second largest producer of cucumber globally, is the primary trade partner accounting for ~90.6% of the total import quantity. However, it accounted for only 58.76% of the import value in 2020 indicating a relatively low import price which allows them to dominate imports into the country.

The table below shows the average import prices in 2020 from top 7 trading partners. Prices of produce from India is 6.12 times higher than the prices from Iran. Meanwhile, prices of cucumbers from developed countries like Netherlands and Spain is even higher at QR17.68/Kg, and QR16.87/Kg, respectively.

Table 15: Cucumber Imports 2020: Trading Partner and Average Prices

Rank	Name	Quantity (Tonnes)	Volume share (%)	Value (1000 QR)	Value share (%)	Average Import Prices (QR per Kg)
1	Iran	11,394.48	90.63	12,030.91	58.76	1.06
2	India	1,021.34	8.12	6,626.23	32.36	6.49
3	Bangladesh	56.80	0.45	385.69	1.88	6.79
4	Lebanon	56.74	0.45	716.12	3.50	12.62
5	Netherlands	30.96	0.25	547.41	2.67	17.68
6	Sri Lanka	6.53	0.05	63.51	0.31	9.73
7	Spain	6.25	0.05	105.43	0.51	16.87

Source: Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority

Thus, cucumber import into Qatar is highly concentrated with top 3 partners led by Iran accounting for 99.2% of all imports in 2020, an increase from 87.9% in 2017. On value basis, the share of the top 3 trading partner has increased from 62.92% to 93% during 2017-20.

Although the pricing from Iran is very competitive, domestic producers have been able to substitute the flow of imports from other countries by offering fresh and high-quality produce to the local population. Consequently, the import share of high price countries has been falling over the years. The exhibit below shows us the concentration of the top 3 and top 10 trading partners. A detailed import share analysis (volume-based and value-based) from 2017-20 has been provided in Table 2 of Annexure D.

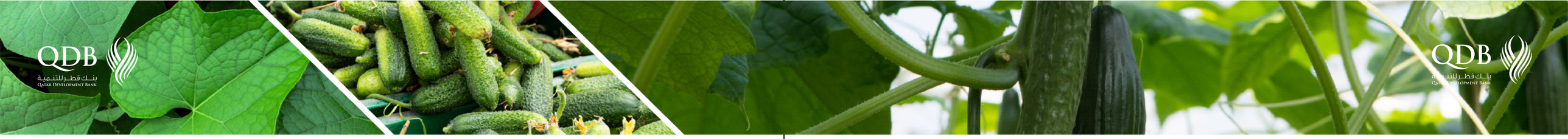
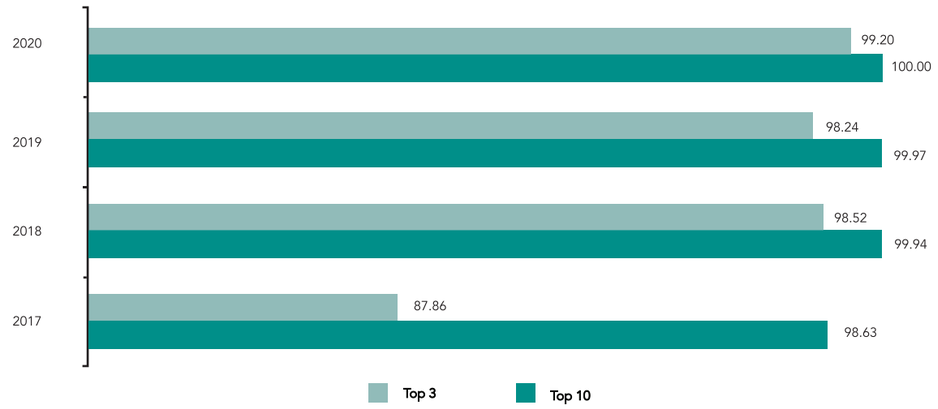
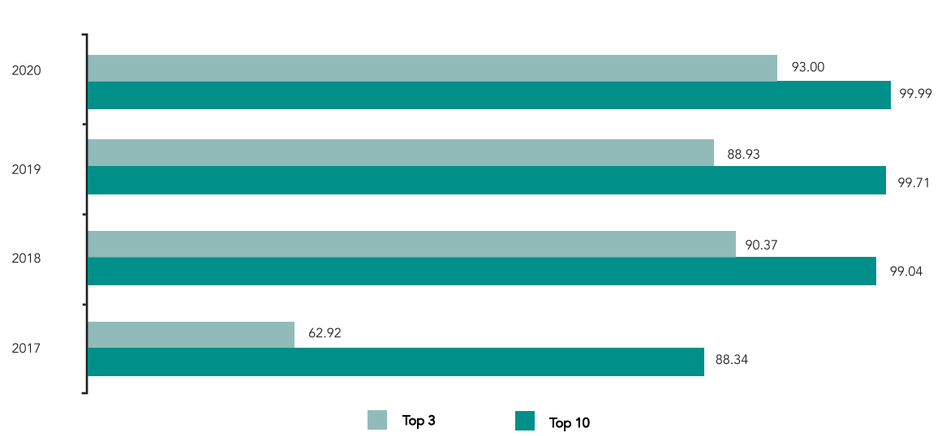


Chart 68: Import Concentration for Cucumbers: Top 3 and Top 10 (Volume-based, %)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

Chart 69: Import Concentration for Cucumbers: Top 3 and Top 10 (Value-based, %)



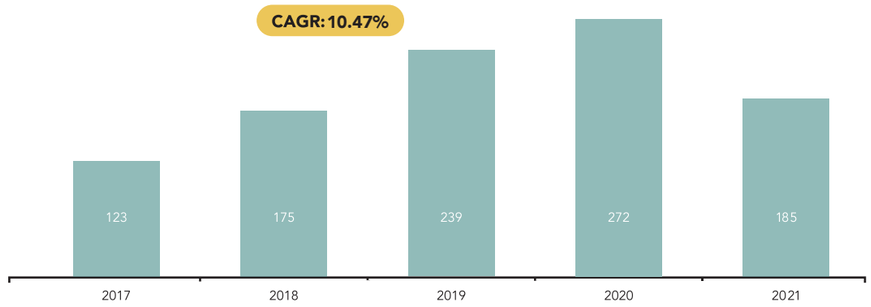
Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.2.3 Local Production of Cucumber

The consistent increase in purchase of cucumbers by Qatari households has translated into local farms channeling their resources to cater to the demand growth. During the period of 2017-20, the area under cucumber cultivation has grown from 123 Ha in 2017 to 185 Ha in 2021 at a CAGR of 10.74%.

The government's push towards localizing agriculture led to a major expansion in greenhouse farming under cucumbers over the years - almost the entire cultivated land comprises of greenhouse farms.

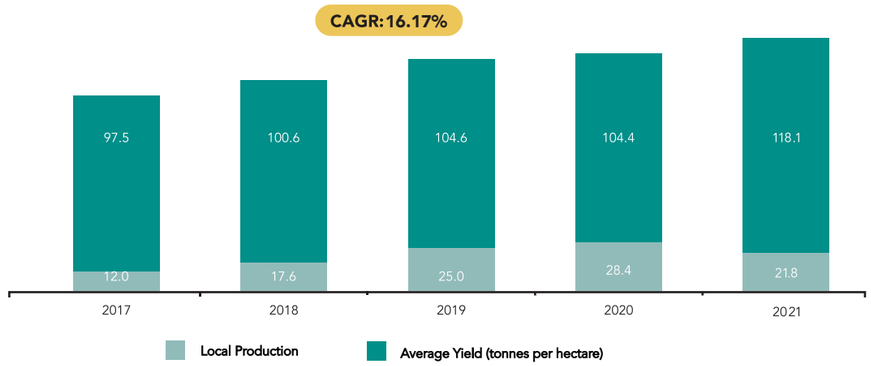
Chart 70: Area under Cultivation: Cucumbers (Hectare)



Source: Qatar Planning and Statistics Authority, Ministry of Municipality

This has also been accompanied by a steady increase in yield on account of improvement in know-how and sophistication for greenhouse cultivation. In addition, government agencies have also been funding research work on improving cucumber productivity. Also, access to key inputs such as seeds and fertilizers which are imported from Europe and local availability of urea and organic manure have supported the local cultivation of cucumbers in greenhouses. Overall, the yield increased from 97.5 tonnes per hectare in 2017 to 118.1 tonnes per hectare in 2021.

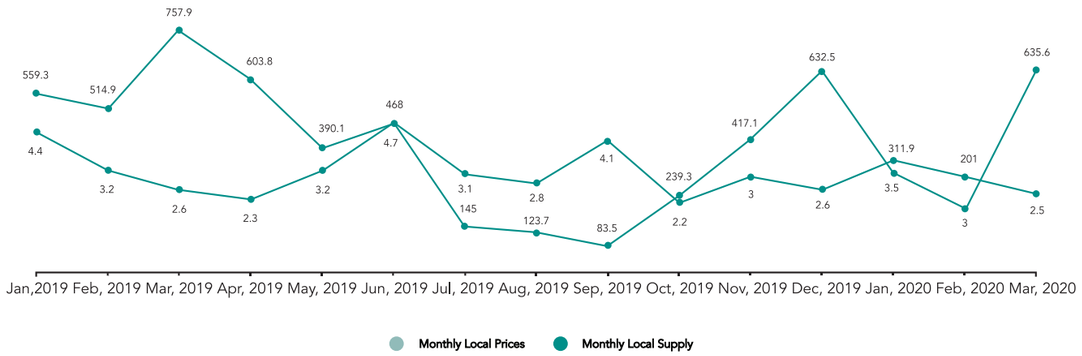
Chart 71: Cucumbers: Local Production (1000 Tonnes) and Yield



Source: Qatar Planning and Statistics Authority, Ministry of Municipality

Although cucumber is grown exclusively in greenhouses in Qatar and can be technically cultivated through the year, the climatic conditions during summers has a significant impact at the productivity even under greenhouses. This is evident from the exhibit below that shows that monthly local supply tends to decline during summer months and starts to pick up from October. The local prices remain rangebound for cucumbers. During the harvesting seasons, the local supply increases, driving the local prices down. Thereafter, April onwards, the fall in local supply pushes the prices up until the local supply picks up in October.

Chart 72: Cucumbers: Monthly Local Prices (QR/Kg) and Supply (Tonnes) in Doha Central Market



Source: Ministry of Municipality

Like in the case of tomatoes, the procurement of cucumber on spot prices published by Mahaseel provides for a support mechanism for local farms. Farms producing tomatoes also produce cucumbers since it is one of the vegetable crop in high demand locally. The structure of production is characterized by its fragmented nature with some of the larger farms being able to engage directly with supermarkets for selling their produce. Meanwhile, most of the medium and small size farms rely on Mahaseel, wholesalers and local farm markets to move their cucumber produce. In 2020, Mahaseel procured 3,838.3 tonnes of cucumber from local farmers.

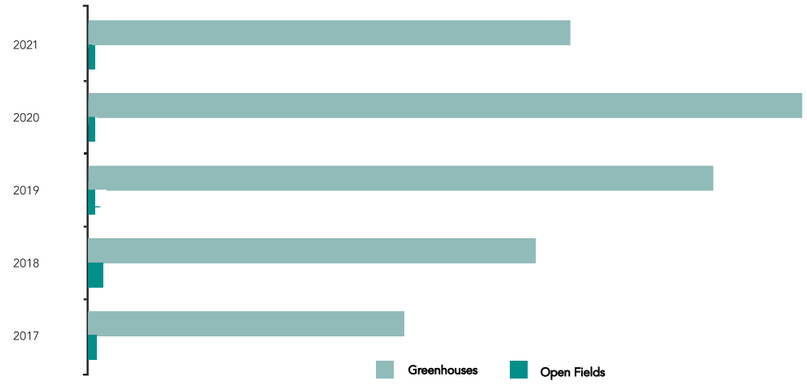
Table 17: Mahaseel Pricing for Local Cucumbers (3rd February 6 – 2022th February 2022)

Grade	Cultivation Method	Price (QR per Kg)
1	Protected	5.25
2	Protected	4.2
3	Protected	3.36

Source: Mahaseel for Marketing and Agriculture Services

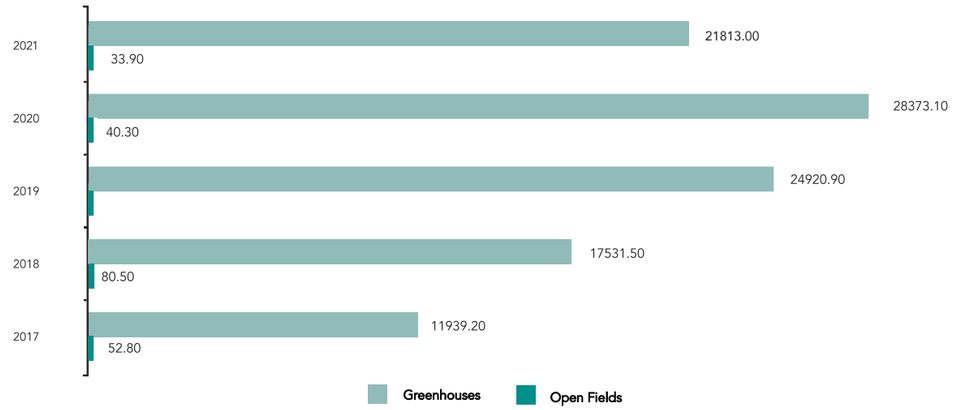
Almost all of the production of cucumbers in Qatar is through greenhouse farming. In fact, the share of open field farming for cucumber has continued to decrease over the years due to productivity and competition issues. The following charts provides a closer look into cultivated area, local production, and yield for cucumbers under open field and greenhouses. The proportion of area under greenhouses increased from 97.07% (119.4 Ha) in 2017 to 98.59% (182 Ha) in 2021. This was accompanied by an increase in yield under greenhouses from 99.99 tonnes/Ha in 2017 to 120 tonnes/ha in 2021. The cultivated land in open field has fallen from 3.6 Ha in 2017 to 3 Ha in 2021, the yield remained almost constant at a little over 14 tonnes/Ha, which suggest that the entire increase in yield and production was driven by greenhouses.

Chart 73: Area under Cucumber Cultivation: Open Fields vs Greenhouses (Hectare)



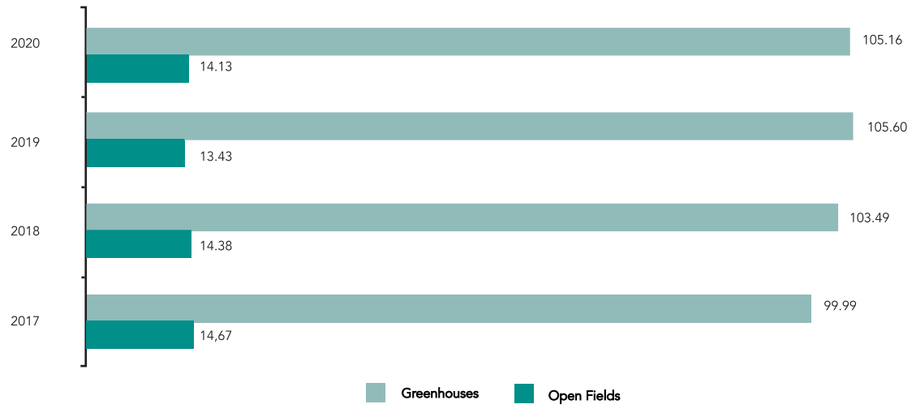
Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 74: Local Production of Cucumbers: Open Fields vs Greenhouses (Tonnes)



Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 75: Average Yield for Cucumbers: Open Fields vs Greenhouses (Tonnes per Hectare)

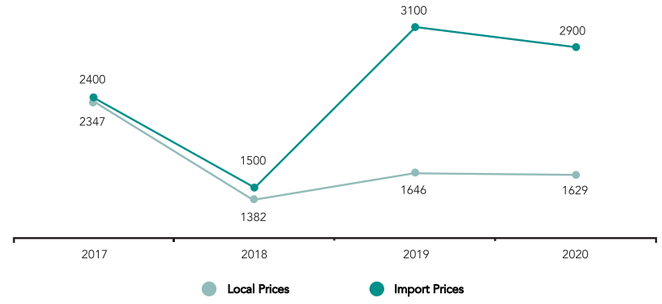


Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

8.2.4 Price Competitiveness

Qatar is at disadvantage versus Iran who is able to supply cucumbers at a very low price of QR 1.06/kg. However, it has been able to compete effectively with other partners on both price and quality. This is especially true for the share of imports from developed countries, which has declined from 1.31% in 2018 to 0.75% in 2020.

Chart 76: Local Prices vs Import Prices: Cucumbers (QR per Tonne)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.2.5 Production Cycle and Costs

Primary research revealed that a typical production cycle for cucumbers in Qatar ranges between 3-4 months. The following tables summarizes the time taken to produce cucumbers in Qatar using greenhouses.

Table 18: Time taken to produce Cucumbers: Greenhouse

Particulars		Greenhouse
Number of crop cycles that can be grown in a year		3
Typical number of days for	Soil Preparation	Less than 7
	Seed to Seedling	7
	Seedling to Flower	35-40
	Flower to Fruit	7
	Harvest Period	60-70
	Total time per Cycle	110-130

Source: Primary Research

Production of cucumbers through greenhouse yields a price of QR2540/tonne

Table 19: Average Production Input Cost per 1,000 sqm: Cucumbers (Values in QR)

Items	Greenhouse
Human Labor	3,004
Machinery/ Mechanical Labor	240
Depreciation of Greenhouse	2,965
Seeds	2,126
Chemical fertilizer	1,679
Compost	1,079
Pesticides	774
Marketing Cost	2,395
Other Cost	1,031
Total	15,294

Source: Ministry of Municipality, Primary Research

Table 20: Average Production Costs: Cucumbers

Items	Greenhouse
Productivity (Tonnes/acre)	6.9
Production Costs (QR/tonne)	2,212

Source: Ministry of Municipality, Primary Research

8.3 Green/Sweet Pepper

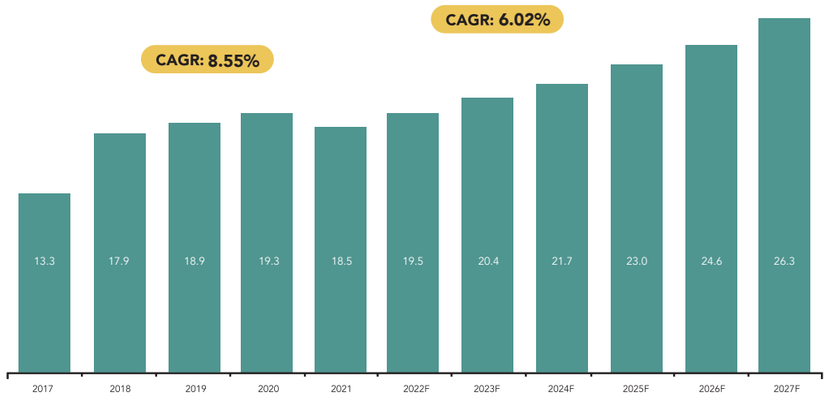
Green/Sweet Pepper, hereafter called as pepper, is another vegetable crop that has been classified as a critical commodity by QNFSS because of its importance to the consumption basket of households in Qatar. In 2020, it accounted for 3.24% of the total agricultural crops produced locally and 3.96% of the total imports. The local production for pepper remains low with 77.79% dependency on imports. Both open fields and greenhouses growing pepper are subject to constraints of low yield and quality.

8.3.1 Domestic Consumption

The per capita consumption of pepper in Qatar has increased from 4.89 kg/year in 2017 to 6.71 Kg/year in 2021. This increase has translated into a demand growth of CAGR 13.18% during the same period, i.e. an increase of consumption from 13,332 tonnes in 2017 to 18,511 tonnes in 2021.

The overall consumption of peppers is expected to grow at a CAGR of 6.02% from 2021-27 and increase to 26,292 tonnes in 2027. It is expected that the local production would outpace growth of imports leading to a reduction on import dependency in the next few years.

Chart 77: Domestic Consumption: Green/Sweet Pepper (1000 Tonnes)

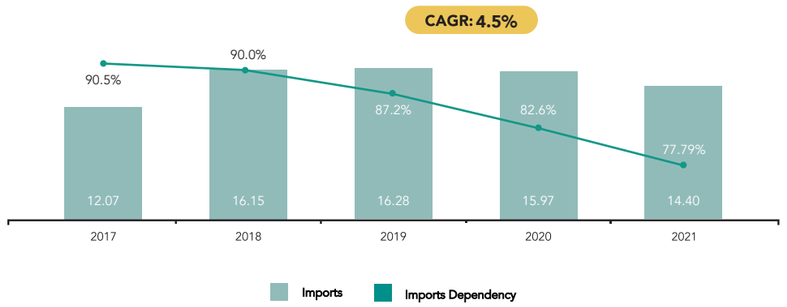


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Primary Research, Ministry of Municipality

8.3.2 Analysis of Imports

During the period of 2017-20, import of peppers have increased from 12,071 tonnes in 2017 to 14,400 tonnes in 2021 at a CAGR of 4.5%. The quantum of imports contributes to meeting 77.8% of the demand. Despite the emphasis on local production to meet self-sufficiency targets, import dependency only saw a marginal decline during 2018. However, the subsequent years have seen a strong decline in import dependency rates, culminating into a 9.83% decline in import of pepper in 2021. Instead, local farms have stepped up their output during 2019-20 to fill the gap.

Chart 78: Green/Sweet Pepper Imports: Quantity (1000 Tonnes) and Dependency (% of Consumption)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Ministry of Municipality

Iran and India are the two main trade partners accounting for 52.16% and 33.05% of the total pepper imports.

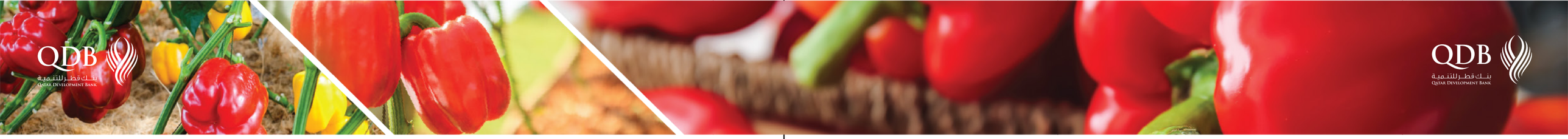
Together with Pakistan, the three countries account for 88.66% of pepper imports into Qatar. Countries such as Netherlands, Spain, Morocco, Thailand etc. form the other major import partners; however, they are not as price competitive as the top 3 import countries.

The average import prices in 2020 from developing countries like Iran and India are QR1.09/Kg and QR4.62/Kg respectively, whereas, the average import prices from developed countries like Netherlands and Spain are QR18.59/Kg, and QR19.46/Kg respectively.

Table 21: Green/Sweet Pepper Imports 2020: Trading Partners and Average Prices

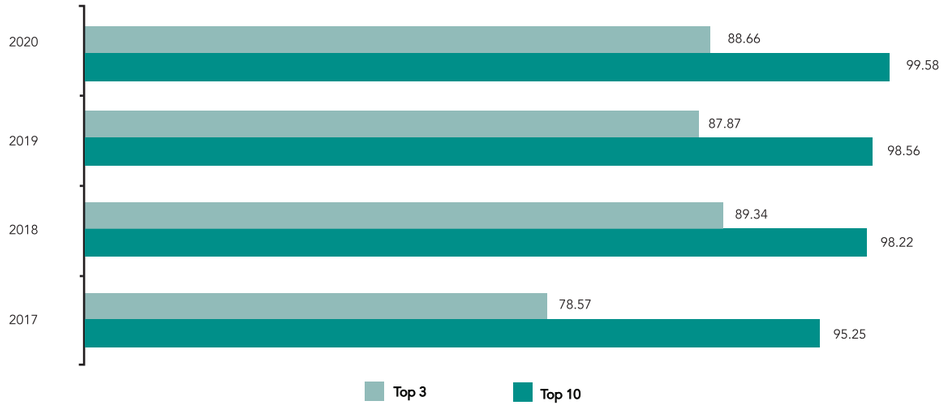
Rank	Name	Quantity (Tonnes)	Volume share (%)	Value (1000 QR)	Value share (%)	Average Import Prices (QR per Kg)
1	Iran	8,330.01	52.16	9,079.59	15.53	1.09
2	India	5,278.92	33.05	24,414.94	41.77	4.62
3	Pakistan	551.08	3.45	3,711.01	6.35	6.73
4	Jordan	484.99	3.04	2,897.36	4.96	5.97
5	Netherlands	432.75	2.71	8,046.29	13.77	18.59
6	Oman	329.01	2.06	1,147.21	1.96	3.49
7	Spain	245.95	1.54	4,785.55	8.19	19.46
8	Morocco	130.14	0.81	1,365.41	2.34	10.49
9	Thailand	60.98	0.38	1,603.47	2.74	26.30
10	Lebanon	60.12	0.38	546.95	0.94	9.10

Source: Qatar Ministry of Commerce and Industry



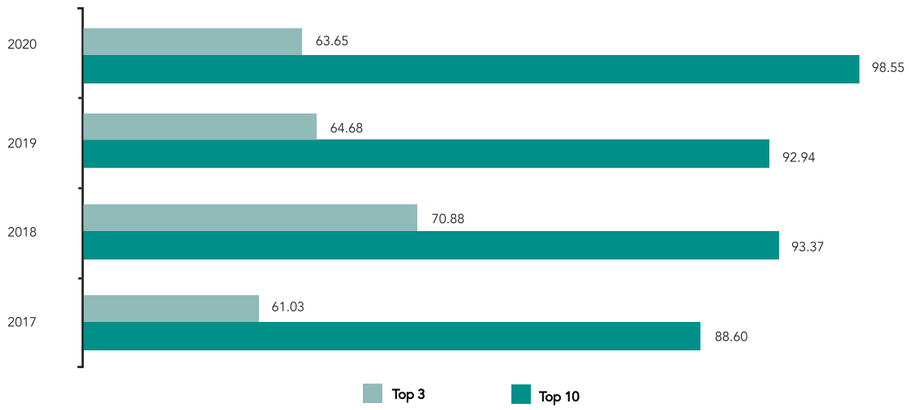
Though both dependency and concentration of pepper imports continue to remain high, local producers have been able to compete with other smaller partners and improve market penetration. Moreover, recent concerns raised by the Ministry of Public Health around the quality of pepper being imported from India (focused on pesticide residue) could provide a further boost to expansion of local production.

Chart 79: Import Concentration for Green/Sweet Pepper: Top 3 and Top 10 (Volume-based, %)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

Chart 80: Import Concentration for Green/Sweet Pepper: Top 3 and Top 10 (Value-based, %)

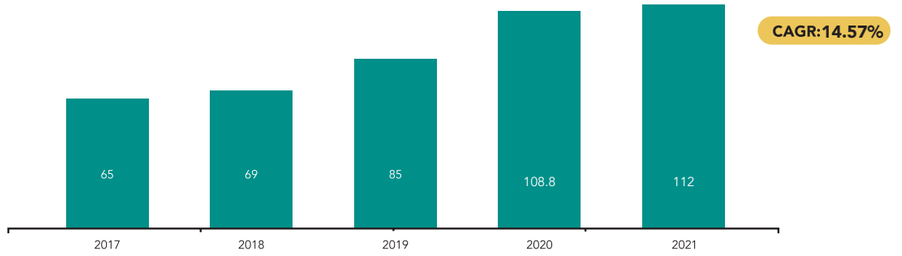


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.3.3 Local Production of Sweet Pepper

The local production of pepper has expanded by 2.7 times because of an increase in cultivation area from 65 Ha in 2017 to 108.8 Ha in 2020 at a CAGR of 18.73%. The growth has been led by areas under greenhouses increasingly producing pepper. In fact, the area under pepper production has witnessed an annual growth of 23% and 28% during 2019 and 2020, respectively. This suggests a growing preference by farms to produce pepper locally to meet domestic demand.

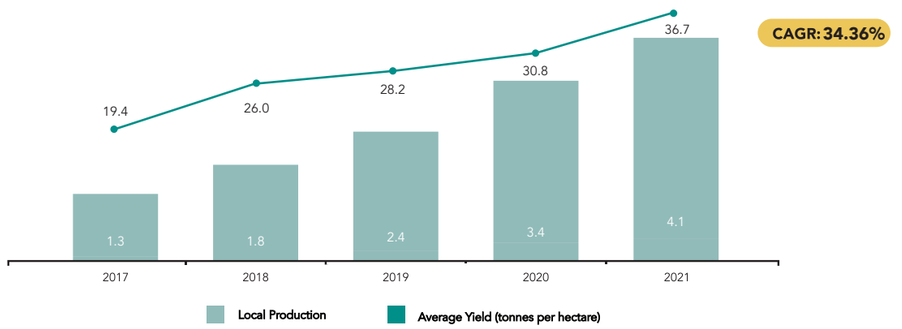
Chart 81: Area under Cultivation: Green/Sweet Pepper (Hectare)



Source: Qatar Planning and Statistics Authority

Local production has grown at almost double the rate of area under pepper cultivation. This is because the average yield has increased from 19.4 tonnes per hectare in 2017 to 36.7 tonnes per hectare in 2021, solely because of the increase in the proportion of cultivation under greenhouses (considered more productive as compared to open fields).

Chart 82: Green/Sweet Pepper: Local Production (1000 Tonnes) and Average Yield



Source: Qatar Planning and Statistics Authority, Ministry of Municipality

Primary research revealed that sweet pepper has a similar sowing season as tomatoes. The local supply starts increasing in December and gaining momentum January onwards until it reaches the peak in March-April. The local prices increase as the local supply decreases during the lean season whereas when the supply picks, the prices come down.

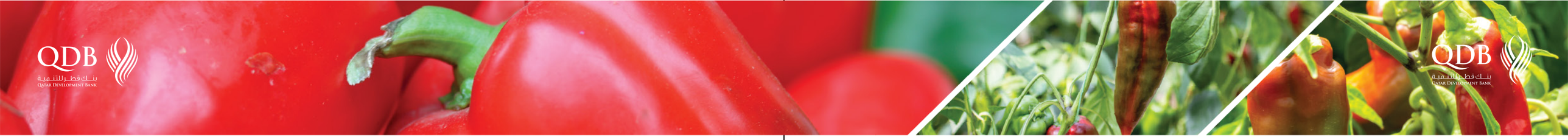


Chart 83: Sweet Pepper: Monthly Local Prices (QR/Kg) and Supply (Tonnes) in Doha Central Market

Source: Ministry of Municipality

The price support system that has been put in place in collaboration with Mahaseel through the Daman guarantee program further encourages local production. Farmers also have an option to enter into forward contracts with Mahaseel. In 2020, it procured 587.2 tonnes of sweet pepper from local farmers. The prices offered by Mahaseel for the period of 3rd February 2022 – 6th February 2022 are as follows:

Table 22: Mahaseel Pricing for Local Peppers (3rd February 6 – 2022th February 2022)

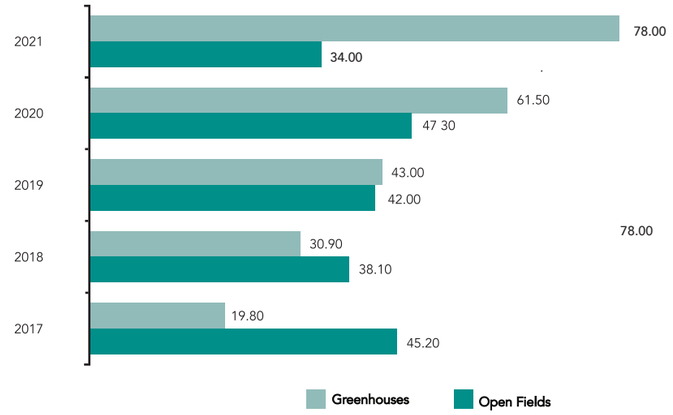
Type	Greenhouse	Cultivation Method	Price (QR per Kg)
Bell Pepper	1	Protected	5.25
	2	Protected	4.2
	1	Ground	3.2
	2	Ground	2.56
Hot Pepper	1	Ground	5.5
	2	Ground	4.4
Green Hot Pepper	1	Protected	5.5
	2	Protected	4.4
	1	Ground	3.25
	2	Ground	2.6
Colored Pepper	1	Protected	5
	2	Protected	4

Source: Mahaseel for Marketing and Agriculture Services, Primary Research

The proportion of area under greenhouses increased from 30.46% (19.8 Ha) in 2017 to 56.52% (61.5 Ha) in 2020. The equivalent increase in open fields very low, with just 2.1 Ha of additional area being added to pepper production during the 2017-2020 period.

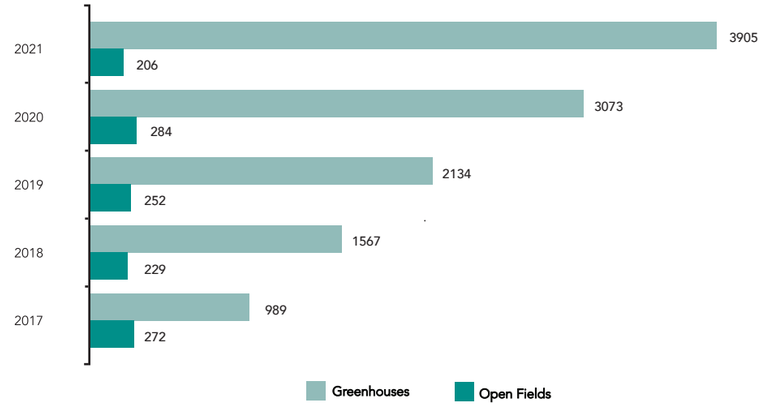
The yield under open fields and greenhouses remained stable at 6 tonnes per hectare and 49 tonnes per hectare, respectively. This means that the overall increase in average yield was driven not by individual yield but by increasing proportion of greenhouse farming under pepper.

Chart 84: Area under Green/Sweet Pepper Cultivation: Open Fields vs Greenhouses (Hectare)



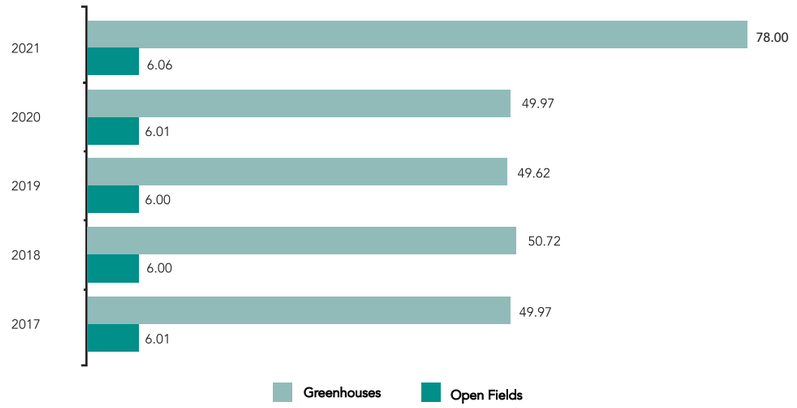
Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 85: Local Production of Green/Sweet Pepper: Open Fields vs Greenhouses (Tonnes)



Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

Chart 86: Average Yield for Green/Sweet Pepper: Open Fields vs Greenhouses (Tonnes per Hectare)

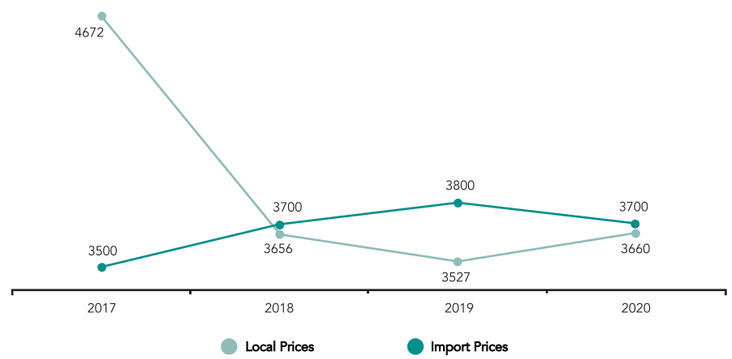


Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Ministry of Municipality

8.3.4 Price Competitivenessr

The 2020 average local price (QR 3.7) is not significantly different from 2020 average imported price (QR 3.66). However, this average imported price is mainly driven by Iran which supplies low-cost produce - in other words, if Iranian pepper is discounted, the average imported price will rise. Therefore, even though the local pepper may not be price competitive with Iranian pepper, it can definitely compete (price-wise) on a strong footing with other import partners.

Chart 87: Local Prices vs Import Prices: Green/Sweet Pepper (QR per Tonne)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.3.5 Production Cycle and Costs

A typical production cycle for pepper is similar to tomatoes and ranges between 5-8 months, depending on whether it is being produced in open fields or in greenhouses. Greenhouse pepper have a longer growing season and require more water than open field peppers. The following tables summarizes the time taken to produce pepper in Qatar using different methods of production:

Table 23: Time taken to produce Green/Sweet Pepper: Greenhouse vs Open Field Farming

Particulars		Greenhouse	Open Field
Number of crop cycles that can be grown in a year		2	1
Typical number of days for	Soil Preparation	Less than 7	Less than 7
	Seed to Seedling	34-40	34-40
	Seedling to Flower	40-50	37-42
	Flower to Fruit	20-25	20-25
	Harvest Period	90-100	45-60
	Total time per Cycle	190-220	150-175

Source: Primary Research

The production cost under greenhouses is significantly higher than open field farming. Nonetheless, this difference is compensated by the higher productivity of greenhouses and the higher price that it fetches.

Table 24: Average Production Input Cost per 1,000 sqm: Green/Sweet Pepper (Values in QR)

Items	Greenhouse	Open Fields
Human Labor	3,004	2,207
Machinery/ Mechanical Labor	240	238
Depreciation of Greenhouse	2,965	-
Seeds	2,126	468
Chemical fertilizer	1,679	1,179
Compost	1,079	401
Pesticides	774	535
Marketing Cost	2,395	1,482
Other Cost	1,031	371
Total	15,294	6,881

Source: Ministry of Municipality, Primary Research

Table 25: Average Production Costs: Green/Sweet Pepper

Items	Greenhouse	Open Fields
Productivity (Tonnes/acre)	6.2	2.45
Production Costs (QR/tonne)	2,212	2,488

Source: Ministry of Municipality, Primary Research

8.4 Dates

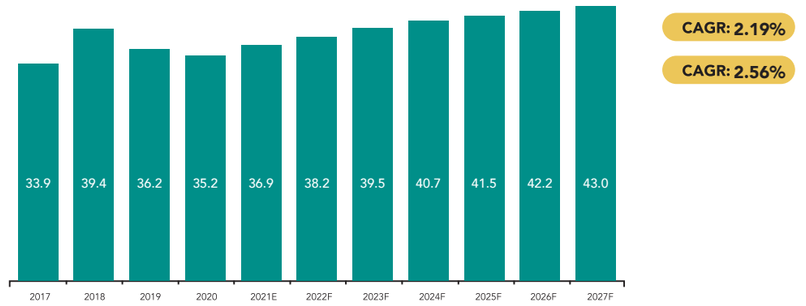
Dates is native to the Middle East region and has been cultivated in Qatar since the bronze age. Considering the arid conditions, dates help combat desertification and provides protection to under crops. It is also an important source of nutrition in the food diet of Qatari households. Dates was also one of the first agricultural product exported by Qatar in 2003. In 2020, dates constitute of 98.86% of the total fruits produced locally and 3.32% of the total fruit imports.

8.4.1 Domestic Consumption

The per-capita consumption of dates in Qatar has increased marginally to 13.38 kg/year after remaining stable at around 12kg/year in the past years. However, given the steady population increase over the years, the total consumption of dates has slowly increased at a CAGR of 2.19% from 33,851 tonnes in 2017 to 36,916 tonnes in 2021. Additionally, existence of an established downstream processing industry has also supported overall demand for the fruit. 77.79% of dates consumed in Qatar are produced locally, while the remaining 22.21% is imported. Considering the history and importance of dates to the local culture, it has been classified as a critical commodity by the government, with various forms of assistance being provided to support and grow local production.

The future growth in demand would continue to be muted as the per capita consumption is expected to remain stagnant. The CAGR during 2021-27 is expected to be 2.56%, with consumption reaching 42,972 tonnes by 2027.

Chart 88: Domestic Consumption: Dates (1,000 Tonnes)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Primary Research, Ministry of Municipality

8.4.2 Analysis of Imports

The imports for dates have increased from 5,755 tonnes in 2017 to 8,200 tonnes in 2021 at a CAGR of 9.25%. Consequently, the import dependency has increased from 17% in 2017 to 22.21% in 2021. However, the trendline of import in the last couple of years has been on a decline as the local demand for dates reaches a point of saturation.

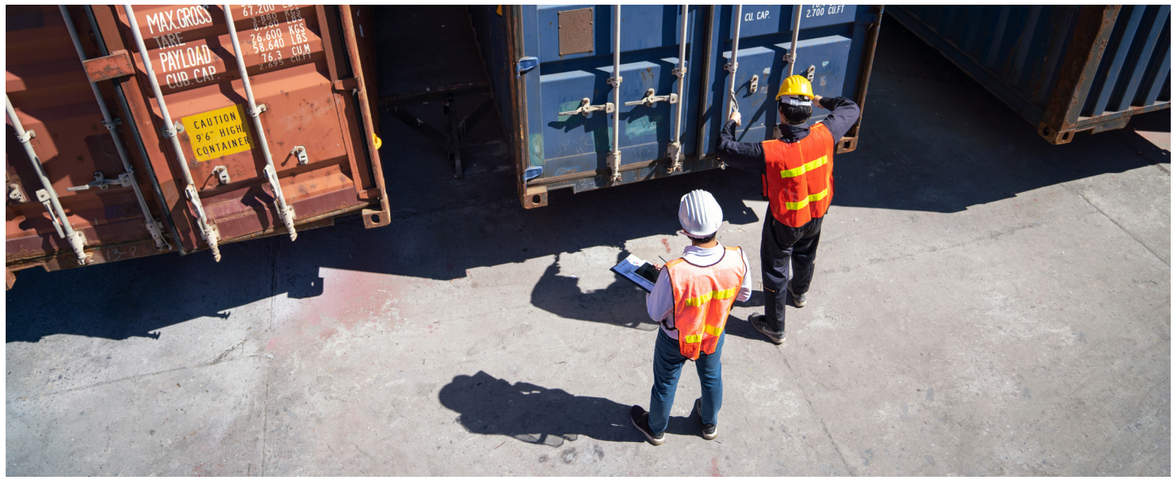
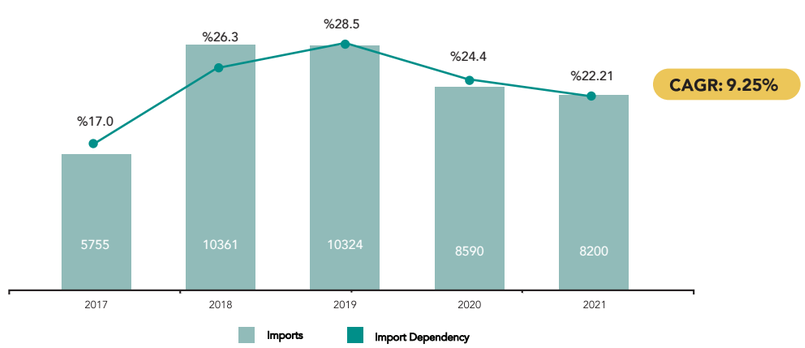


Chart 89: Dates Imports: Quantity (1000 Tonnes) and Dependency (% of Consumption)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Ministry of Municipality

In 2020, around 75.17% of the import for dates originated from Kuwait, Oman, and Iran. Kuwait, the largest import partner in 2020, accounted for 31.05% of the imports and only 23.1% of the import value. Some imports were also from countries like Jordan where the average prices are significantly high than other countries, indicating superior quality dates.

Overall, Qatar is very near to its 2023 target of 85% and is self-sufficient to address majority of the dates market. Given the similar climatic conditions across Middle-East, and the increased import dependency from 2017-20, there is some scope for local dates industry to substitute for imported products.

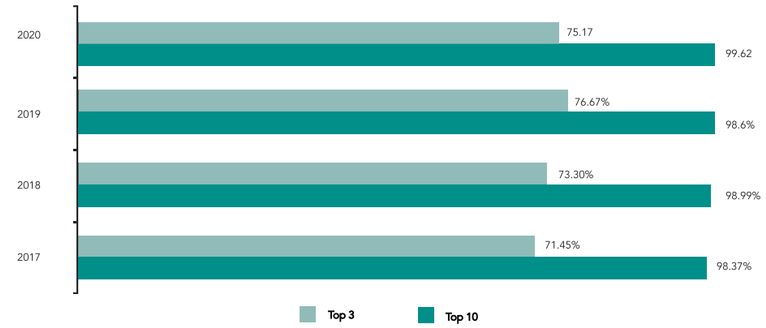
Table 26: Dates Imports 2020: Trading Partner and Average Prices

Rank	Country	Quantity (Tonnes)	Volume share (%)	Value (1000 QR)	Value share (%)	Average Import Prices (QR per Kg)
1	Kuwait	2,667.73	31.05	14,799.66	23.1	5.55
2	Oman	2,581.19	33.05	18,791.87	29.33	7.28
3	Iran	1,209.03	14.07	3,006.59	4.69	2.49
4	Jordan	807.28	9.4	15,063.78	23.51	18.66
5	Tunisia	466.91	5.43	4,429.28	6.91	9.49
6	Iraq	435	5.06	658.81	1.03	1.51
7	Algeria	167.27	1.95	574.78	0.9	3.44
8	Palestinian	136.09	1.58	3892.6	6.08	28.60
9	USA	69.39	0.81	1,929.50	3.01	27.81
10	Madagascar	19.20	0.22	224.96	0.35	11.71

Source: Qatar Ministry of Commerce and Industry

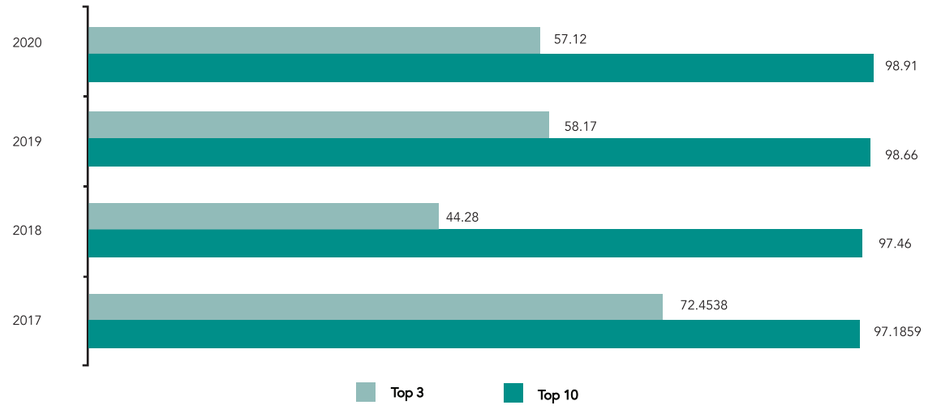
The top 3 import partners accounted for 75.17% in 2020, from 71.45% in 2017. On a value basis, there has been a decline from 72.45% to 57.12% during the same period. This trend indicates a growing reliance on sourcing more economical variants of dates from Iran, Kuwait and Oman. Meanwhile, the premium variants are being imported from Jordan which accounted for 9.4% of import quantity but 23.52% of import value in 2020.

Chart 90: Import Concentration for Dates: Top 3 and Top 10 (Volume-based, %)



Source: Qatar Ministry of Commerce and Industry

Chart 91: Import Concentration for Dates: Top 3 and Top 10 (Value-based, %)

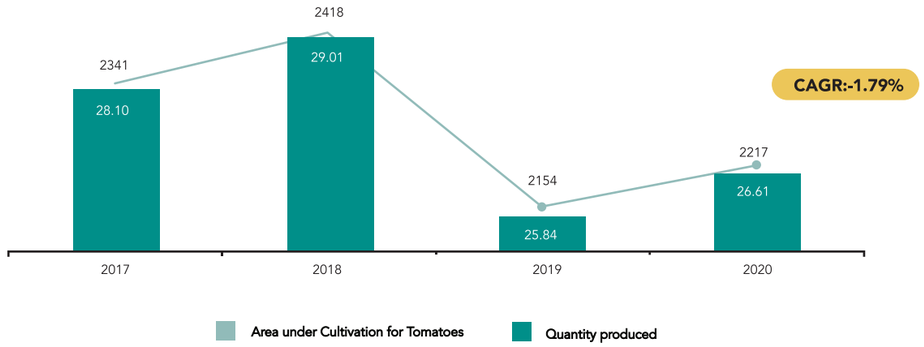


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.4.3 Local Production of Dates

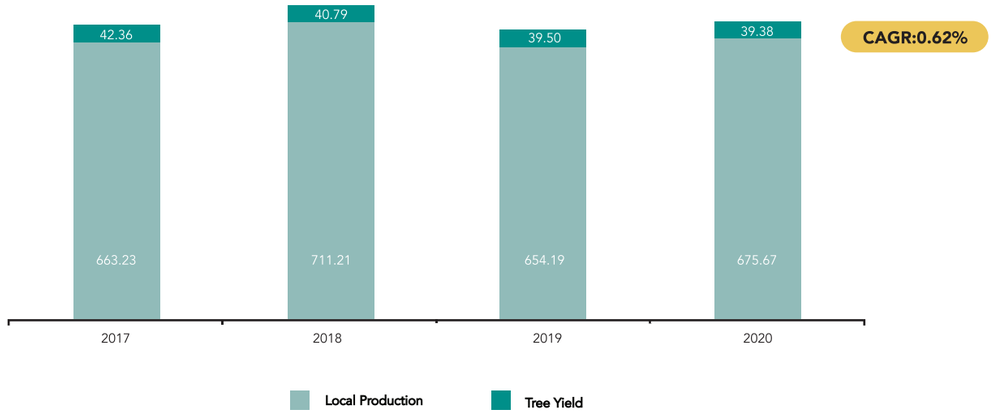
The area under dates cultivation and the number date palms in this land area has remained consistent and range bound in the last few years. The market is in a maturity phase with local production declining marginally by CAGR 1.79% during the period of 2017-20. There are 916 farms growing 675,672 palm trees to produce different types of dates. However, 22% of these palm trees at date farms did not produce fruits during the 2019/20 season. As the agriculture sector expands, and more lucrative opportunities evolve in the other crop types, there is a shift away from dates production.

Chart 92 Area under Cultivation: Dates (Hectare)



Source: Qatar Planning and Statistics Authority

Chart 93: Dates: Number of Trees ('000) Yield per Tree (Kg/Year)

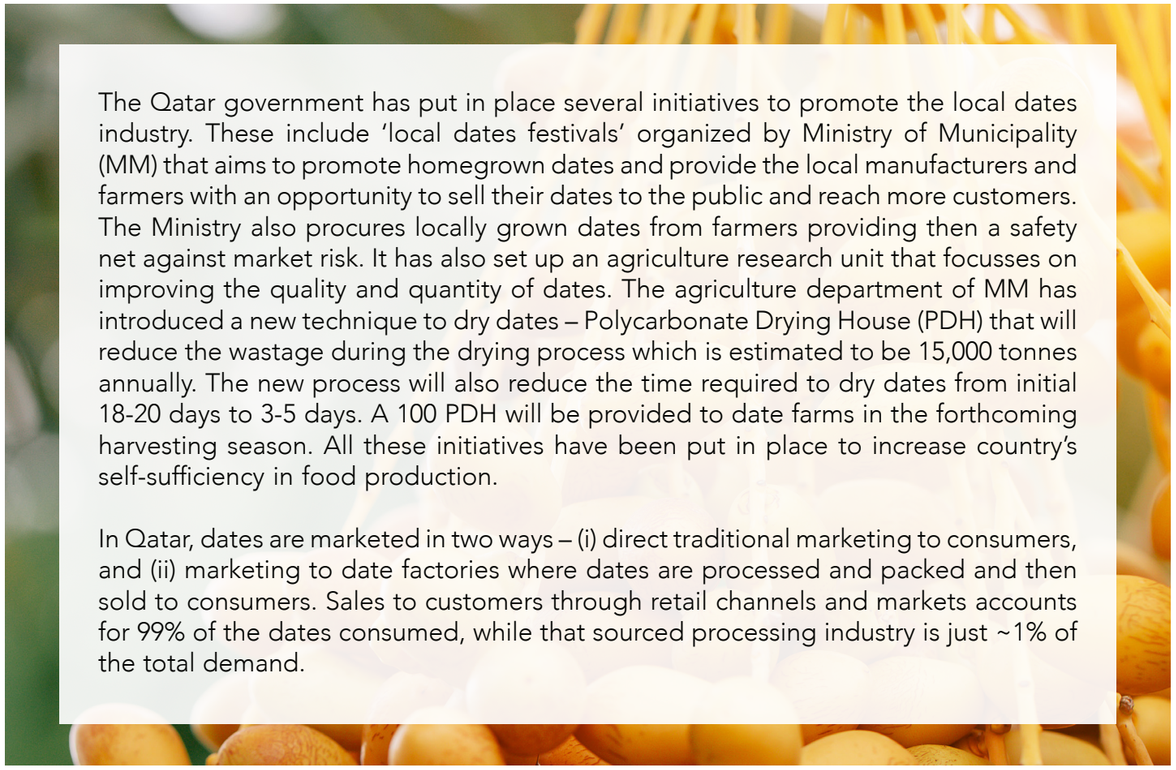


Source: Qatar Planning and Statistics Authority

Dates are grown in Qatar throughout the year due to favorable climatic conditions. The local supply tends to increase from July when the trees starts yielding the fruit. The official season extends from July-October that pushes the prices down.

Table 27: Marketing Channel for Dates

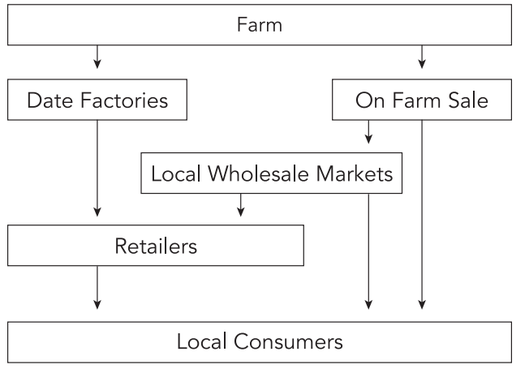
Month	Local Average Price (QR/Kg)	Local Quantity Supplied (Tonnes)
Jan-19	0.8	0.5
Jun-19	14.5	1.7
Jul-19	5.3	44.9
Aug-19	2.6	196.2
Sep-19	2.6	167.9
Oct-19	2	36.9
Nov-19	1.6	5.7
Dec-19	1.5	1.2
Nov-20	3.5	0.2



The Qatar government has put in place several initiatives to promote the local dates industry. These include 'local dates festivals' organized by Ministry of Municipality (MM) that aims to promote homegrown dates and provide the local manufacturers and farmers with an opportunity to sell their dates to the public and reach more customers. The Ministry also procures locally grown dates from farmers providing then a safety net against market risk. It has also set up an agriculture research unit that focusses on improving the quality and quantity of dates. The agriculture department of MM has introduced a new technique to dry dates – Polycarbonate Drying House (PDH) that will reduce the wastage during the drying process which is estimated to be 15,000 tonnes annually. The new process will also reduce the time required to dry dates from initial 18-20 days to 3-5 days. A 100 PDH will be provided to date farms in the forthcoming harvesting season. All these initiatives have been put in place to increase country's self-sufficiency in food production.

In Qatar, dates are marketed in two ways – (i) direct traditional marketing to consumers, and (ii) marketing to date factories where dates are processed and packed and then sold to consumers. Sales to customers through retail channels and markets accounts for 99% of the dates consumed, while that sourced processing industry is just ~1% of the total demand.

Figure 3: Marketing Channel for Dates

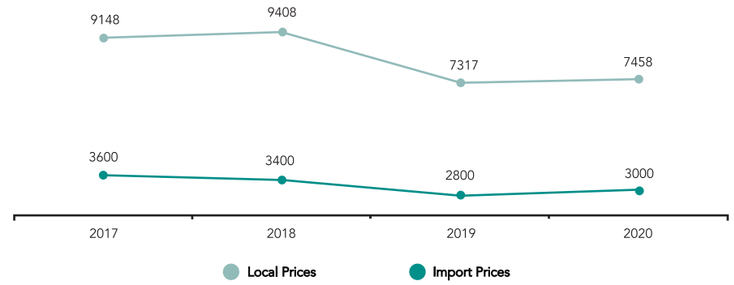


Source: Date Palm Value Chain Analysis and Marketing Opportunities for the Gulf Cooperation Council (GCC) Countries

8.4.4 Price Competitiveness

Although the average price for imports is ~2.5 times the average local prices, it is in large part due to the premium quality dates being imported from Jordan and other countries. However, the prices of dates supplied by the top three import partners in volume terms, viz. Kuwait, Oman and Iran are relatively more competitive. Yet, the intense competition from other Middle East and North African countries who produce different varieties of dates at a much larger scale put them an advantage especially in the global marketplace.

Chart 94: Local Prices vs Import Prices: Dates (QR per Tonne)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.4.5 Production Cycle and Costs

Dates are grown in Qatar through the year. As the age of the tree increases, its yield increases leading to higher profits. A typical cost structure for dates is as follows:

Table 28: Dates: Costs (For a Standard Farm Size of 81 Saplings)

Particulars	Cost (QR)
75 female saplings	11,025
6 male saplings	118
Labour for pits digging and planting	194
Fertilizers & chemicals	213
Irrigation (drip)	1225
Farm labourer	3,528
Miscellaneous	122
Total capital investment	16,425
Operational cost from 2nd year onwards	
Fertilizers & chemicals	426
Farm labor	3,528
Miscellaneous	122
Total capital investment	4,077

Source: Dates Farming, Technology Innovation Management & Entrepreneurship Information Service (TIME IS), Primary Research

8.5 Lettuce

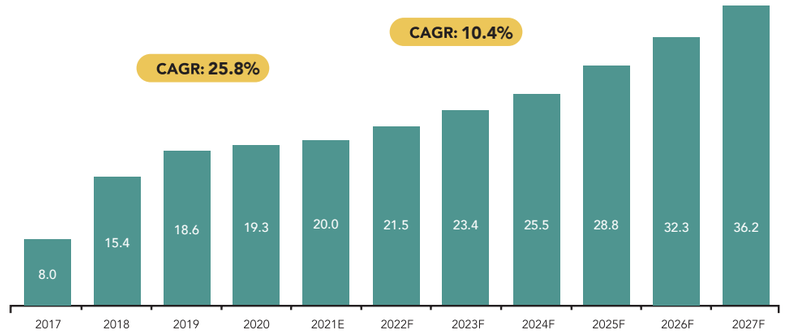
Lettuce, also a critical commodity, is a highly perishable crop with shelf life less than one week. Though it only accounted for 0.55% of the total vegetables produced locally and 4.63% of the total imports in 2020, the demand for lettuce has been growing steadily especially in the last few years. The local production for lettuce remains low with 1.75% self-sufficiency in 2021. Even though, lettuce is greenhouse conducive, its production in greenhouses in Qatar is non-existent.

8.5.1 Domestic Consumption

Due to shifts in consumption preferences, the per capita consumption of lettuce more than doubled from 2.92 Kg/year in 2017 to 7.23 Kg/year in 2021. The growing preference for lettuce in the food basket of households in Qatar has translated into a demand growth of CAGR 25.79% during the same period, i.e. an increase of consumption from 7,969 tonnes in 2017 to 19,950 tonnes in 2021.

The overall demand of lettuce is expected to reach 36,152 tonnes by 2027, an increase of CAGR 10.42% during the period of 2021-27. Imports will continue to cater to a significant majority of the demand because of the inherent issues of productivity and returns.

Chart 95: Domestic Consumption: Lettuce (1000 Tonnes)

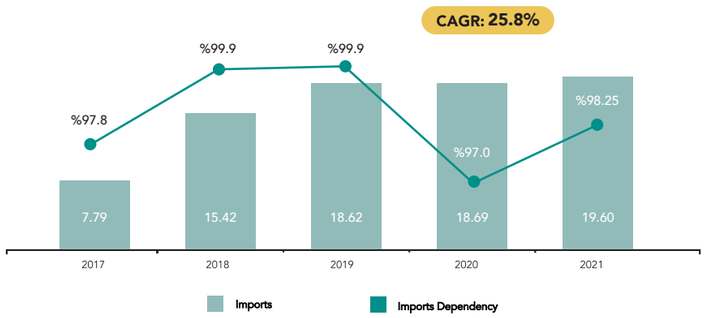


Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority, Primary Research, Ministry of Municipality

8.5.2 Analysis of Imports

During the period of 2017-20, import of lettuce increased from 7,793 tonnes in 2017 to 19,600 tonnes in 2021 at a CAGR of 25.93%. The quantum of imports contributed to meeting ~98% of the demand in 2021. Despite the emphasis on local production to meet self-sufficiency targets, import dependency has not changed significantly, on account of low prices from trade partners.

Chart 96: Lettuce Imports: Quantity (1,000 Tonnes) and Dependency (% of Consumption)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry, Qatar Planning and Statistics Authority

Iran is the main trade partner accounting for 91.7% of the total lettuce imports. The other major import partners include developed countries of Spain and Netherlands. However, they are not as price competitive as Iran whose import prices in 2020 were a mere QR0.92/Kg. Whereas, the average import prices from developed countries like Spain, Netherlands, Lebanon are QR14.5/Kg, and QR17.56/Kg, and QR9.82/Kg, respectively. Table 5 of Annexure D contains information on the volume and value share of top 10 trading partners from 2017-20.

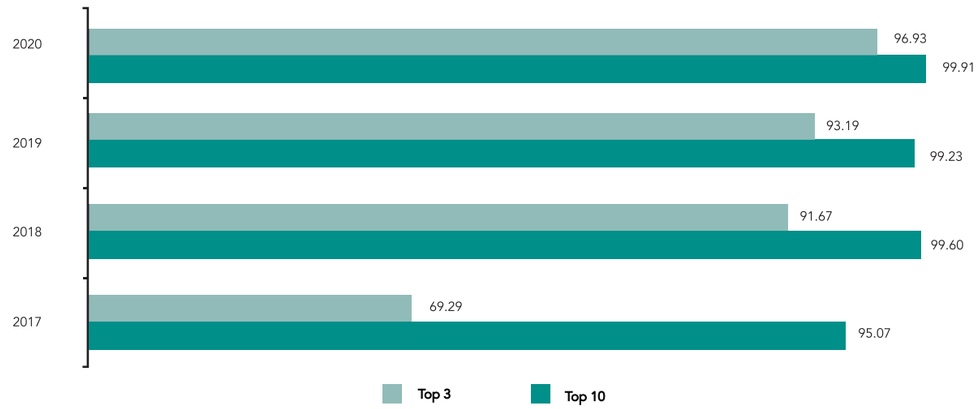
Table 28: Lettuce Imports 2020: Trading Partners and Average Prices

Rank	Country	Quantity (Tonnes)	Volume share (%)	Value (1000 QR)	Value share (%)	Average Import Prices (QR per Kg)
1	Iran	17137.38	91.70	15838.96	39.08	0.92
2	Spain	505.94	2.71	7312.97	18.04	14.45
3	Netherlands	471.04	2.52	8273.94	20.41	17.57
4	Lebanon	157.89	0.84	1551.14	3.83	9.82
5	Jordan	136.47	0.73	2022.66	4.99	14.82
6	Italy	121.39	0.65	3183.10	7.85	26.22
7	USA	56.50	0.30	1230.51	3.04	21.78
8	India	54.80	0.29	424.51	1.05	7.75
9	Oman	19.88	0.11	61.60	0.15	3.10
10	Belgium	10.30	0.06	248.29	0.61	24.11

Source: Qatar Ministry of Commerce and Industry

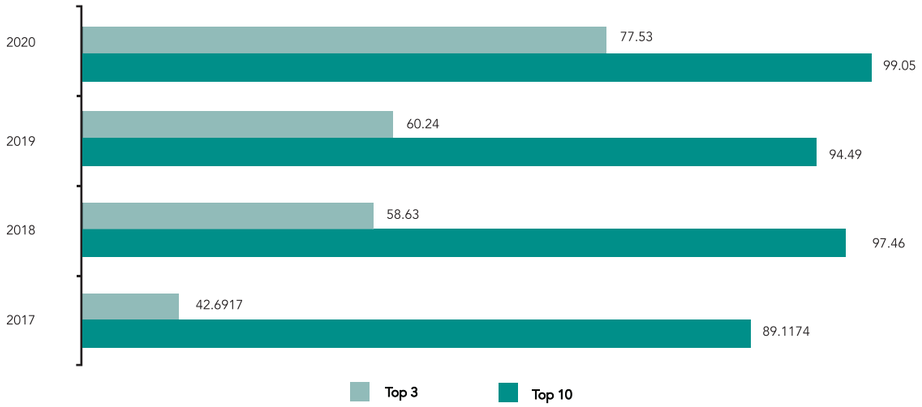
The concentration of imports amongst top 3 trading partners is 96.93%; however, they only account for 77.53% of the import in terms of value. This is largely driven by Iran who is providing lettuce at exceptionally low prices which makes it difficult for local producers to gain a foothold in the market.

Chart 97: Import Concentration for Lettuce: Top 3 and Top 10 (Volume-based, %)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

Chart 98: Import Concentration for Lettuce: Top 3 and Top 10 (Value-based, %)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

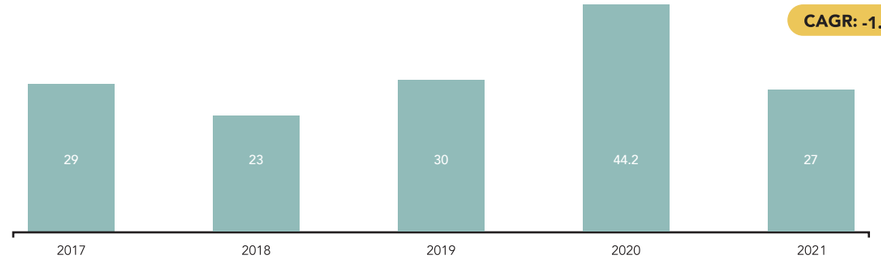
8.5.3 Local Production and Self-Sufficiency

Due to the competition from importers, local production of lettuce has decreased from 371 tonnes in 2017 to 350 tonnes in 2021, a CAGR of %1.77-. This can be attributed to the decrease in cultivated area from 29 Ha to 27 Ha, despite a marginal increase in yield from 12.8 tonnes/Ha to 12.96 tonnes/Ha during the same time-period.

The entire cultivation of lettuce is done through open field farming in Qatar. This is because greenhouse lettuce has a much higher cost of production than other conventional crops. Primary research revealed that the profitability under greenhouse lettuce is extremely low. Unlike other crops, where the fruit of the plant can be harvested multiple times from the same plant, lettuce can only be harvested once, thereby increasing its cost further. This nature of production discourages farmers from entering in the lettuce industry.

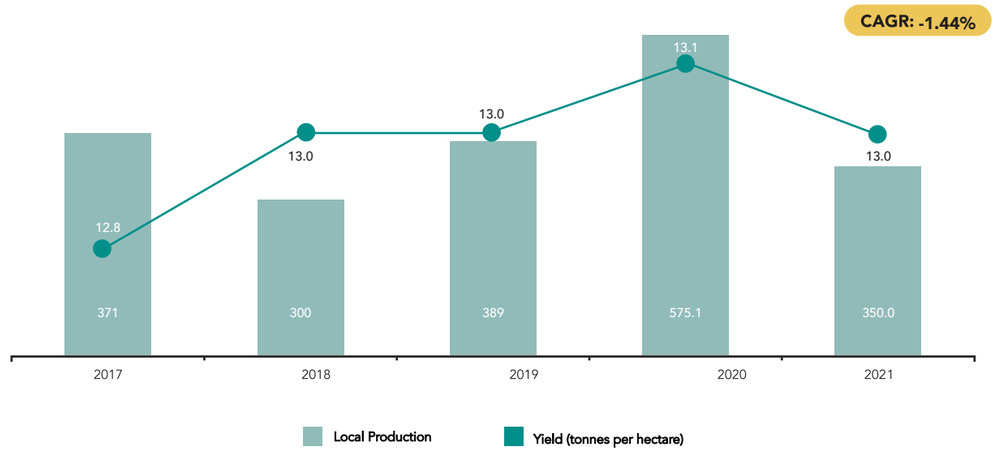
In fact, the cultivation of lettuce is restricted to large farms operating in Qatar. Even in these cases, the quantity of output is not very high relative to other prominent crops such as tomatoes, eggplants etc. Additionally, smaller farms producing organic crops are also planting lettuce because of an increase in demand for the crop from more health-conscious customers.

Chart 99: Area under Cultivation: Lettuce (Hectare)



Source: Qatar Planning and Statistics Authority, Ministry of Municipality

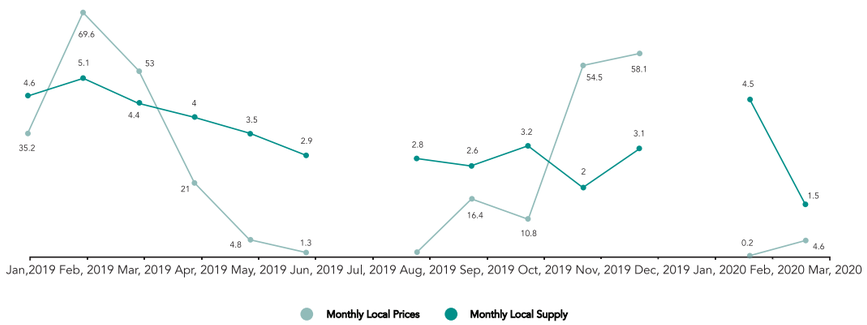
Chart 100:: Lettuce: Local Production (1000 Tonnes) and Average Yield



Source: Qatar Planning and Statistics Authority, Ministry of Municipality

Lettuce is only produced in open fields in Qatar. Therefore, there is no supply of the crop during non-conducive summer months. Although the supply of the crop starts to increase in December, the price remains rangebound. This is because of the competition from imported lettuce. As the climatic conditions begins to become unfavorable, the local supply not only falls but the quality of the produce also diminishes. This drives the price down and the demand is being met by imported lettuce.

Chart 101: Lettuce: Monthly Local Prices (QR/Kg) and Supply (Tonnes) in Doha Central Market



Source: Ministry of Municipality

Mahaseel has also been procuring the lettuce from local producers under the Daman guarantee program. In 2020, it procured 278.9 tonnes of Romaine lettuce and 95.9 tonnes of American lettuce from local farmers. The prices offered by Mahaseel for the period of 3rd February 2022 – 6th February 2022 are as follows.

Table 30: Mahaseel Pricing for Local Lettuce (3rd February 6 – 2022th February 2022)

Type	Grade	Cultivation Method	Price (QR per Kg)
Romaine Lettuce	1	Ground	3.25
	2	Ground	2.6
American Lettuce	1	Ground/Protected	2
	2	Ground/Protected	1.6

Source: Mahaseel for Marketing and Agriculture Services

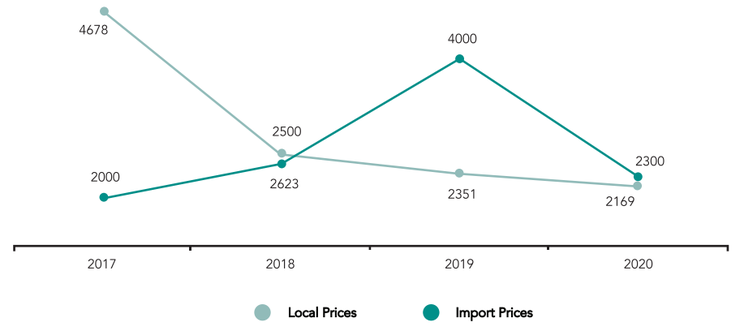
8.5.4 Price Competitiveness

In 2017, lettuce was being imported from countries like Spain at a higher price – QR8.03 while price from countries like Iran were QR3.27. In a span of three years, Iran's share of imports increased from 4.01% in 2017 to 91.7% in 2020 to become the largest importer of lettuce into Qatar. More importantly, the average price of the produce from Iran is only QR0.92 in 2020 which has allowed for its formidable presence in the market.

Although the demand for lettuce has been growing, the low import prices and high competition resulted in local farmers reducing the production of lettuce in 2018 and early part of 2019 season. The pullback in local production pushed up local prices up which provided the necessary price incentive for local farms to resume production of lettuce.

Nevertheless, the growth in production continues to be outpaced by imports because of the price competitiveness of Iran, the largest trading partner for lettuce.

Chart 102: Local Prices vs Import Prices: Lettuce (QR per Tonne)



Source: Food and Agriculture Organization, Qatar Ministry of Commerce and Industry

8.5.5 Production Cycle and Costs

A typical production cycle for lettuce is 70-80 days and around three cycles can be produced in a year under open fields. Lettuce is relatively costlier to produce as compared to other crops due to the requirement of more spacing between plants, high human labor costs, and cost of seeds. The following tables summarizes the time taken to produce lettuce in Qatar and associated cost structures.

Table 31: Time taken to produce Lettuce in Open Field Farming

Particulars		Open Field
Number of crop cycles that can be grown in a year		3
Typical number of days for	Soil Preparation	Less than 7
	Seed to Seedling	40
	Seedling to Flower	35-40
	Flower to Fruit	
	Harvest Period	1
	Total time per Cycle	70-80

Source: Primary Research

Table 32: Average Production Input Cost per 1,000 sqm: Lettuce (Values in QR)

Items	Open Field Cost
Human Labor	2,890
Machinery/ Mechanical Labor	310
Seeds	650
Chemical fertilizer	610
Compost	525
Pesticides	605
Marketing Cost	1,250
Other Cost	550
Total	7,390

Source: Primary Research

9. FUTURE OPPORTUNITIES

The Qatar agriculture sector is at its early stages of development. There have been several policies and programs in place for well over a decade to support the business of local farms, but imports continued to make up for the majority of vegetables and fruits consumed by Qatari households. However, the 2017 blockade provided for a renewed emphasis by the government to look at accelerating the growth of local agriculture sector with a view to achieve self-sufficiency for key agriculture crops. To this end, there have been several initiatives by the government including extension of finance for setting up greenhouses and implementing modern farming techniques, covering a portion of the operating costs of farms, and procurement guarantees to mitigate any market risks of farms. These initiatives have accelerated local production of key vegetable crops and fruits.

The diversification and contingency as set in QNFSS focusses on a number of critical commodities comprising several vegetables, fruits, dairy and meat products, cereals, and legumes. The QNFSS has set a vegetable self-sufficiency target of 70% by 2023. The shortlisted crop segments such as tomato, cucumber, lettuce, and green/sweet pepper are consumed in large quantity in Qatar. In 2020, these products accounted for ~33% of the total consumption of the vegetables and hence are important elements in the Qatar consumption basket. Producing these vegetables will have a significant impact on the food security targets set by QNFSS.

Table 33: QNFSS 23-2018: Self-Sufficiency (%) of attractive crop segments

Sr.No	Crop Segment	Self-Sufficiency (%)
1	Tomato	30%
2	Cucumber	62%
3	Pepper	9%
4	Dates	87%
5	Lettuce	6%

Source: QNFSS 2018-23

Tomatoes is the most consumed vegetable crop and its demand continues to grow at a healthy rate. Considering its importance in the food basket, increasing local production of tomatoes would be critical for achieving the 70% self-sufficiency target in vegetables.

Similarly, cucumber is an important category that continues to witness strong local demand. Importantly, almost all the local produce of cucumber is grown in greenhouses. The evolution in farm technology to improve yield and even introduce sophisticated techniques would provide a fillip to growth of local production.

Pepper is another category of crop that has a healthy growth potential. Although the demand growth in pepper is not significant, recent issues in quality of imports from countries such as India, along with suitability for growing pepper in greenhouses could result in import substitution by local producers.

Lettuce is an emerging category of crop that is yet to gain prominence. Being a leafy vegetable, it requires more space which is a constraint for greenhouse farming. Additionally, limitation in harvesting of lettuce means that it can only be produced in open fields. Despite the potential growth in demand, its non-conducive to greenhouse farming along with high price competition from import partners, especially Iran, stunts is overall potential in the near term.

Lastly, dates have an important place in the cultural, religious and social fabric of Qatar. The high demand means that dates of different varieties have to be imported into Qatar. Competition of neighboring markets such as Saudi, UAE, Oman, Jordan, Kuwait, Iran etc. continues to remain strong. Furthermore, the capita consumption of dates has reached saturation levels which is slowing down overall demand for the fruit. Though there has been funding support extended by the government for research on improving yield, progress has been slow.

Table 34: Performance of Shortlisted Crops on Key Parameters

	Tomatoes	Cucumber	Pepper	Lettuce	Dates
Demand (1,000 tonnes) in 2020	87.5	41.0	19.3	19.3	35.2
Future Demand Growth (27-2020)	11.1%	13.2%	5.7%	12.2%	2.5%
Self Sufficiency	36.3%	69.3%	17.4%	3.0%	75.59%

Source: Food and Agriculture Organization, Qatar Planning and Statistics Authority, Primary Research

10. INVESTMENT COST FOR GREENHOUSE FARMING

10.1 Cost of setting up agriculture farm in Qatar

The investments for open field farming does not entail much cost expect for the lease or purchase of the farmland and setting up of an irrigation system. However, protected farming would require additional investments to set up the greenhouse structure and cooling units. An alternative is setting up the less sophisticated net houses which does not require the procurement and installation of cooling systems

Table 35: Investment for 280 sqm farm (in QR)

Components	Greenhouse	Nethouses
Span of 35 x 8 m (plus two 6 mm thick PC sheet, equipped with pad and fans cooling system only for greenhouses)	35,000	11,000
50 mesh white insect-proof net	-	1,500
Mist system	-	7,500
Drip irrigation system	2,000	2,000
Drainage water system	15,000	15,000
Dosing unit	20,000	20,000
Technical room	20,000	20,000
Ground cover - 5 cm thick white gravel	5,500	5,500
Total Investment	**97,500**	**82,500**

Source: Food and Agriculture Organization, Primary Research

Depending on the operational and structural characteristics of greenhouse farms, there are opportunities to improve efficiency[41]. For a given greenhouse farm size, as the inputs are increased, the producer experiences increasing returns to scale, gradually reaching optimal efficiency. However, any more inputs would lead to decreasing returns to scale unless the farm size is expanded further. Inputs such as insecticide, labour, planting phase fertilizer, flowering phase fertilizer, production expertise of the farmer, technology are contributing factors for defining an ideal farm size[42]. Primary research revealed that small and medium farmers in Qatar prefer to operate on a 9*34 m2 farm as these sizes are most suitable for weather conditions, especially in the summer, when the cooling systems are more efficient.

10.2 Regulatory Requirements and Timelines

The Agricultural Affairs Department at the Ministry of Municipality is the authority overseeing the policy and regulatory initiatives on agriculture sector in Qatar. Obtaining permissions for starting agricultural services/farming business requires an application (either online or in-person) to be submitted to the Agricultural Affairs Department.

The application will require disclosure of personal details of the applicant, farm ownership information, farm details and the type of agricultural service that is planned by the business. In case if the applicant is planning on building a protected farm, then sketches with coordinates for the required buildings and structures must be appended with the application. The submitted application is scrutinized by the department and processing time is typically less than a week.

[41] MDPI Sustainability Review: Evaluating Greenhouse Tomato and Pepper Input Efficiency Use in Kasovo
[42] Primary Research

11. SWOT ANALYSIS

12. PORTER'S 5 FORCES ANALYSIS

12.1 Competitive Rivalry

The Qatar agriculture market is fragmented in nature. In 2020, there were 1,244 farms in Qatar which varied across sizes from as small as less than 1 ha to more than 1000 ha. Majority of these farms are owned by small to mid-size farmers whereas only a small proportion of farms are owned by large players. Furthermore, Qatar relies heavily on imports with major import partners such as Iran, India selling products at competitive prices. Competition with such import partners along with the local market fragmentation makes the overall degree of competition as **medium to high**.

12.2 Threat of New Entrants

The Qatar agriculture industry is an emerging industry. In order to promote agriculture and support the local players, several initiatives have been introduced by the government such as Daman price guarantee, greenhouse financing, etc. These initiatives will also help attain self-sufficiency by bringing more local players to the market. This is evident from the fact that the number of active farms in Qatar has grown from 910 in 2015 to 973 in 2020. Therefore, the threat of new entrants is **high**.

12.3 Bargaining Power of Suppliers

Qatar's relies heavily on imports for agriculture inputs. There exist only one urea producing company – Qatar Fertilizer Company (QAFCO) which is owned by the government. Other major supplies such as seeds, fertilizers are being imported at competitive prices. Furthermore, Qatar also imports its greenhouse structure. The local input suppliers have to compete with several import partners. As a result, the bargaining power of local suppliers is **low to medium**.

12.4 Bargaining Power of Customers

Consumers of the product are price-takers in Qatar. On the other hand, the supermarkets and other intermediaries that source crops from local farms enjoy some position of strength due to the large volume they purchase. However, the government has put in place policies and regulations that provide safety net to the local farmers and give then fair prices for their produce. Therefore, the bargaining power of customers are **low to medium**.

12.5 Hreat of Substitutes

Food is a necessity which makes its demand as relatively inelastic. Therefore, the threat of substitutes remain **low**.

Table 36: PORTERS 5 Forces Analysis

Factors	Scale
Competition	Medium-High
Threat of New Entrants	High
Bargaining Power of Suppliers	Low-Medium
Bargaining Power of Customers	Low-Medium
Threat of Substitutes	Low

13. KEY SUCCESS FACTORS

13.1 Site Selection

Topography, soil quality, access to irrigation and drainage would be primary factors to be considered for identifying farming locations. In addition, the production and access to markets would dictate the commercial viability of farming projects. Since Qatar is a highly urban country with strong road infrastructure, even sites within 60-50kms of urban habitats can be considered.

13.2 Infrastructure

Greenhouses that can be installed for local conditions with climate control systems to create an optimal environment for farming of vegetables and fruits. Productivity can be improved by installing insect-proof screens, fog systems, altering orientation of crop rows and other scientific techniques.

13.3 Water & Irrigation

Ensuring sufficient supply of water to enable crop development is critical. It is also important to deploy a suitable irrigation system to manage usage in a water scarce country. Qatari farms largely depend on ground water for feeding their farms which have limited water levels. Provision of treated sewage water along with suitable filtration plant will is critical for farms in the long term.

13.4 Product Safety

Adherence to food safety standards and prevention of any physical, chemical or biological hazards. These safety standards and processes must be applied throughout the cycle of crop production from soil preparation to sowing to management of the greenhouse and harvesting, post harvesting.

13.5 Personnel

Despite the developments in agriculture, farming is still a labor-intensive business. Access and recruitment of personnel with know-how of scientific approaches to farming techniques would be critical for the success of any farm. Access to human resource having experience in acclimatization of crops, productivity improvement techniques, technology know-how etc. are critical as well for local producers.

13.6 Production Planning

As evident from earlier chapters, the agriculture market in Qatar is fairly competitive especially through import channels. The local prices for vegetables fluctuate based on local and global market dynamics with spot purchase prices almost changing on daily basis. Although through Mahaseel, local producers are able to get a minimum price support but there are budgetary constraints for the entity and the current purchase of crops through Mahaseel remains on lower side. Hence, it is critical to plan the production of crops based on prior experience of demand cycles to ensure producers get best possible prices in the market. Entering into long term contracts with buyers can also help mitigate such risks.

14. ANNEXURES

ANNEXURE A

COMPARATIVE OF IMPORT TARIFF ON AGRICULTURE PRODUCTS ACROSS GCC COUNTRIES [43]

	Qatar	KSA	UAE	Bahrain	Kuwait	Oman
Vegetables-07						
Potato-0701	0%	0%	0%	0%	0%	0%
Tomato-0702	0%	0%	0%	0%	0%	0%
Onions, shallots, garlic, leeks and other alliaceous vegetables-0703	0%	0%	0%	0%	0%	0%
Cabbages, cauliflowers, kohlrabi, kale and similar edible brassicas-0704	0%	0%	0%	0%	0%	0%
Lettuce (Lactuca sativa) and chicory (Cichorium spp.)-0705	0%	0%	0%	0%	0%	0%
Carrots, turnips, salad beetroot, salsify, celeriac, radishes and similar edible roots-0706	0%	0%	0%	0%	0%	0%
Cucumbers & gherkins-0707	0%	0%	0%	0%	0%	0%
Leguminous vegetables (shelled or unshelled)-0708	0%	0%	0%	0%	0%	0%
Other vegetables-0709	0%	0%	0%	0%	0%	0%
Fruits-08						
Coconuts, Brazil nuts and cashew nuts-0801	5%	5%	5%	5%	5%	5%
Other nuts-0802	5%	5%	5%	5%	5%	5%
bananas (including plantain)-0803	0%	0%	0%	0%	0%	0%
Dates, figs, pineapples, avocados, guavas,mangoes and mangosteens-0804	0%	4% for dates	0%	0%	0%	0%
Citrus Fruit-0805	0%	0%	0%	0%	0%	0%
Grapes-0806	0%	0%	0%	0%	0%	0%
Melons (including watermelons) and papaya-0807	0%	0%	0%	0%	0%	0%
Apple, pears, & quinces-0808	0%	0%	0%	0%	0%	0%
Apricots, cherries, peaches (including nectarines), plums and sloes-0809	0%	0%	0%	0%	0%	0%
Other fruits-0810	0%	0%	0%	0%	0%	0%
Cereals-10						
Wheat & meslin-1001	0%	0%	0%	0%	0%	0%
Rye-1002	5%	5%	5%	5%	5%	5%
barley-1003	0%	0%	0%	0%	0%	0%
Oats-1004	0%	0%	0%	0%	0%	0%
Maize (corn)-1005	0%	0%	0%	0%	0%	0%
Rice-1006	5%	5%	5%	5%	5%	5%
grain Sorghum-1007	0%	25% for buckwheat	0%	0%	0%	0%

[43] World Integrated Trade Solution (WITS)

ANNEXURE B

LIST OF CROPS AND DATA ON RELEVANT PARAMETERS [44,45,46]

	HS Code (upto 4 digits)	Average Consumption (20-2017) (Tonnes)	Consumption CAGR (2020-2015) (%)	Average yield (20-2017) (Tonnes/hectare)	% of Average Local Production (20-2017)	% of Average Imports (20-2017)	Proportion of Greenhouse Produce (2020)
Vegetables	**07**						
Tomatoes	0702	72,849	5.28%	55.45	34.1%	66.2%	70.6%
Cucumbers	0707	32,305	13.56%	101.78	63.6%	36.6%	99.9%
Green/Sweet Pepper	0709	17,317	8.68%	26.10	12.4%	87.6%	91.5%
Lettuce	0705	15,327	13.93%	12.98	2.9%	98.6%	0.0%
Melons/Sugar-Melons & Watermelons	0807	40,894	23.86%	11.70	6.0%	94.0%	38.1%
Beans	0708	4,691	2.44%	29.88	31.9%	68.1%	93.5%
Onion	0703	92,718	3.52%	23.33	2.6%	97.4%	0.0%
Potatoes	0701	65,571	3.53%	9.60	0.2%	100.1%	0.0%
Marrows, pumpkin & sweet pumpkin	0709	25,499	11.00%	19.35	37.9%	62.1%	0.0%
Cabbage	0704	15,688	4.76%	15.03	14.9%	85.1%	0.0%
Cauliflower	0704	15,339	4.80%	12.00	11.1%	88.9%	0.0%
Carrots & turnips	0706	18,975	2.90%	11.91	0.4%	99.6%	0.0%
Eggplant	0709	11,333	0.20%	25.00	38.8%	61.2%	0.0%
Spinach	0709	229	4.67%	9.95	54.2%	45.8%	0.0%
Okra	0709	3,752	-6.63%	4.68	5.2%	94.8%	0.0%
Cowpea	0713	434	0.50%	7.90	29.6%	70.4%	0.0%
Radish & beetroots	0706	628	2.47%	11.37	62.5%	37.5%	0.0%
Fruits & Dates	**08**						
Date Palm	0804	35,913	1.37%	12.00	76.4%	23.6%	0.0%
Citrus fruits	0805	63,967	5.0%	4.5	0.5%	100.0%	-
Grapes	0806	6,443	7.4%	4.5	0.0%	100.0%	-
Fig	0804	1,085	3.4%	2.8	0.9%	99.1%	-
Guava	0804	997	20.8%	-	0.7%	99.3%	-
Pomegranate	0810	5,798	4.5%	-	0.1%	99.9%	-
Almonds	0802	5,798	-2.4%	-	1.4%	99.6%	-
Mulberry	0810	558	7.8%	-	1.4%	99.6%	-
Other fruit	0810	12,972	-	-	0.4%	99.6%	-
Cereals	**10**						
Wheat	1001	140,765	-23.9%	1.9	0.0%	100.0%	-
Rice	1006	212,688	4.4%	0.0	0.0%	100.2%	-
Maize (aka other edible cereals)	1005	58,218	32.7%	12.5	2.2%	97.9%	-
Barley	1003	259,987	166.3%	3.0	0.1%	99.9%	-
Bran	2302	188,360	14.7%	-	29.1%	70.9%	-
Other cereals	1008	485	25.2%	6.0	39.4%	60.6%	-
Green Fodder	**23**						
Alfalfa		266,445	-	-	75.3%	24.7%	-
Rhodes		419,800	-	-	100.0%	0.0%	-
Other fodders		74,904	-	-	40.9%	59.1%	-

[44] Qatar Planning and Statistics Authority
[45] Food and Agriculture Organization
[46] Qatar Industrial Portal

DEFINITIONS

#	Terms	Quantity (Tonnes)	Units
1	Consumption	Local Production + Imports - Exports - Reexports	Tonnes
2	Average Consumption (20-2017)	(Sum of consumption for each of 4 years)/4	Tonnes
3	Average Yield (20-2017)	(Sum of yield for each of 4 years)/4	Tonnes/Hectare
4	% of Local Production	(Local production of a year)/(consumption of the same year)	%
5	% of Average Local Production (20-2017)	(Sum of local production for each of 4 years)/4	%
6	% of Imports	(Imports of a year)/(consumption of the same year)	%
7	% of Average Imports (20-2017)	(Sum of imports for each of 4 years)/4	%
8	Proportion of produce through greenhouses in 2020 (based on data available)	Proportion of produce through local greenhouses	%
9	Focus of research activities	Crops that have received higher attention in being tested in Qatar by local producers	-
10	Existence of downstream processing industry	Crops that have direct presence of downstream industries in Qatar	-

ANNEXURE C

PRIORITIZATION FRAMEWORKS

Sr. No.	List of Crops Consumed in Qatar	Step 1: Is the crop fit for human consumption?	Step 2: Can the crop conducively be produced in open fields considering the climatic conditions & soil/water requirements OR Can it be produced at scale through greenhouse techniques? (Based on qualitative research & primary interviews)
	Vegetables		
1	Tomatoes	Y	Y
2	Cucumbers	Y	Y
3	Green/Sweet Pepper	Y	Y
4	Lettuce	Y	Y
5	Melons/Sugar-Melons & Watermelons	Y	Y
6	Beans	Y	Y
7	Onion	Y	Y
8	Potatoes	Y	Y
9	Marrows, pumpkin & sweet pumpkin	Y	Y
10	Cabbage	Y	Y
11	Cauliflower	Y	Y
12	Carrots & turnips	Y	Y
13	Eggplant	Y	Y
14	Spinach	Y	Y
15	Okra	Y	Y
16	Cowpea	Y	Y
17	Radish & beetroots	Y	Y
	Fruits & Dates		
18	Date Palm	Y	Y
19	Citrus fruits	Y	N
20	Grapes	Y	N
21	Fig	Y	N
21	Guava	Y	N
23	Pomegranate	Y	N
24	Almonds	Y	N
25	Mulberry	Y	N
26	Other fruit	Y	N
	Cereals	Y	N
27	Wheat	Y	N
28	Rice	Y	N
29	Maize (aka other edible cereals)	Y	N
30	Barley	N	
31	Bran	N	
32	Other cereals	N	
	Green Fodder		
33	Alfalfa	N	
34	Rhodes	N	
35	Other fodders	N	

After shortlisting the 18 crops, a weighted score methodology is used on a variety of quantitative and qualitative parameters.

Explanation for Cut-offs

1. Average Consumption: For the purpose of this parameter, cut-offs have been set at 66.67th percentile (27,750) and 33.33rd percentile (13,900).
2. Self-Sufficiency: For the purpose of this parameter, cut-offs have been set at 66.67th percentile (35.41%) and 70% (target set by QNFSS for year 2023).
3. Consumption Growth Rate (2015-20): For the purpose of this parameter, cut-offs have been set at 66.67th percentile (4.96%) and 33.33rd percentile (2.75%).
4. Average Yield (2017-20): For the purpose of this parameter, cut-offs have been set at 66.67th percentile (20.67) and 33.33rd percentile (11.84).
5. Proportion of Produce through Greenhouses: As per the data published by Qatar Planning and Statistics Authority, only 5 crops were produced under greenhouses in the year 2020. Therefore, the percentile method has not been used for this parameter. The cut-offs have been set at 50% and 25%.

ANNEXURE D

IMPORT ANALYSIS, [47,48]

Table 1: Tomatoes

Rank	2017			2018		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
1	Jordan	54.4%	31.5%	Iran	49.7%	24.6%
2	Saudi Arabia	9.9%	2.9%	India	22.3%	18.7%
3	Morocco	9.3%	24.4%	Turkey	10.9%	11.4%
4	India	7.5%	8.4%	Morocco	7.5%	21.5%
5	Egypt	5.2%	4.0%	Jordan	6.5%	8.9%
6	Turkey	4.1%	3.3%	Netherlands	0.8%	5.6%
7	Iran	2.9%	4.6%	Lebanon	0.5%	2.0%
8	Netherlands	1.6%	6.7%	Tunisia	0.5%	2.3%
9	Lebanon	1.5%	4.6%	Oman	0.4%	0.4%
10	Algeria	0.8%	0.6%	Malaysia	0.4%	0.9%

	2019			2020	
Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
Iran	66.6%	39.7%	Iran	79.5%	53.8%
India	13.6%	15.6%	India	9.0%	12.1%
Turkey	12.9%	12.4%	Turkey	7.2%	7.9%
Morocco	4.3%	16.9%	Morocco	1.6%	7.8%
Netherlands	0.8%	7.6%	Netherlands	1.0%	9.9%
Tunisia	0.3%	1.6%	Jordan	0.4%	0.4%
Jordan	0.3%	0.6%	Spain	0.4%	4.5%
Oman	0.3%	0.5%	Lebanon	0.3%	1.3%
Spain	0.3%	2.7%	Azerbaijan	0.2%	0.2%
Lebanon	0.2%	1.1%	Oman	0.1%	0.2%

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48 Qatar Ministry of Commerce and Industry

Table 2: Cucumbers

Rank	2017			2018		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
1	Saudi Arabia	72.76227141	30.93816631	Iran	92.26	63.97
2	India	7.617214354	19.21108742	India	5.47	20.7
3	Iran	7.479719511	12.771855018.4%	Lebanon	0.79	5.7
4	Jordan	4.468582428	3.262260128	Bangladesh	0.61	2.73
5	Lebanon	2.7498968794.1%	11.64179104	Sri Lanka	0.19	0.95
6	Bangladesh	1.5674412211.6%	3.4754797446.7%	Netherlands	0.17	2.25
7	Oman	0.8387185480.8%	1.32196162	Jordan	0.16	0.38
8	Netherlands	0.426234016	3.304904051	Spain	0.1	1.39
9	Morocco	0.371236079	1.279317697	Pakistan	0.1	0.29
10	Sri Lanka	0.34373711	1.130063966	Morocco	0.9	0.68

	2019			2020	
Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
Iran	88.17	56.88	Iran	90.63	58.76
India	8.84	27.76	India	8.12	32.36
Bangladesh	1.23	4.29	Bangladesh	0.45	1.88
Lebanon	0.62	3.68	Lebanon	0.45	3.50
Sri Lanka	0.3	1.25	Netherlands	0.25	2.67
Netherlands	0.25	2.66	Sri Lanka	0.05	0.31
Jordan	0.22	0.89	Spain	0.05	0.51
Pakistan	0.16	0.56	-	-	-
Spain	0.13	1.4	-	-	-
Morocco	0.05	0.34	-	-	-

Table 3: Green/Sweet Pepper

Rank	2017			2018		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
1	India	47.17090548	50.54867028	Iran	45.89	13.61
2	Jordan	23.69314887	8.888458559	India	37.33	49.86
3	Saudi Arabia	7.704415541	1.594371288	Jordan	6.12	7.41
4	Oman	5.583630188	3.117738187	Oman	2.06	2.31
5	Netherlands	3.065197581	9.675961787	Morocco	1.98	5.15
6	Lebanon	1.963383315	3.989155693	Pakistan	1.46	1.62
7	Egypt	1.79769696	1.800929512	Netherlands	1.45	6.68
8	Pakista	1.449755613	1.084430674	Spain	0.95	4.65
9	Spain	1.416618341	4.841208366	Bangladesh	0.53	0.77
10	Morocco	1.408334024	3.059643687	Tunisia	0.45	1.31

	2019			2020	
Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
Iran	50.86	15.99	Iran	52.16	15.53
India	32.77	41.47	India	33.05	41.77
Jordan	4.24	7.22	Pakistan	3.45	6.35
Pakistan	3.01	3.68	Jordan	3.04	4.96
Morocco	2.16	5.76	Netherlands	2.71	13.77
Netherlands	1.89	9.05	Oman	2.06	1.96
Bangladesh	1.2	2.05	Spain	1.54	8.19
Oman	1.07	1.29	Morocco	0.81	2.34
Spain	0.98	5.32	Thailand	0.38	2.74
Lebanon	0.38	1.11	Lebanon	0.38	0.94

Table 4: Dates

Rank	2017			2018		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
1	Saudi Arabia	53.48393	47.43829	Kuwait	35.63	24.15
2	UAE	9.470026	17.35463	Iran	21.27	7.11
3	Kuwait	8.496959	7.660928	Oman	16.4	13.02
4	Oman	6.550825	2.70345	Jordan	12.26	39.44
5	Algeria	5.369244	2.641222	Algeria	4.96	2.74
6	Tunisia	5.091225	7.066307	Tunisia	4.69	5.55
7	Jordan	4.761077	10.32289	Iraq	1.55	0.47
8	Iraq	2.762815	0.788218	Saudi Arabia	1.03	2.51
9	Egypt	1.337967	0.753647	Lebanon	0.84	2.15
10	India	1.042572	0.456337	India	0.36	0.32
	2019			2020		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
	Kuwait	35.6	25.48	Kuwait	31.05	23.1
	Oman	22.62	26.28	Oman	30.05	29.33
	Iran	18.45	6.41	Iran	14.07	4.69
	Jordan	9.53	25.8	Jordan	9.4	23.51
	Tunisia	5.54	7.7	Tunisia	5.43	6.91
	Algeria	3.66	1.75	Iraq	5.06	1.03
	Iraq	2.57	0.26	Algeria	1.95	0.9
	Lebanon	0.66	1.21	Palestinian	1.58	6.08
	Palestinian	0.65	2.37	USA	0.81	3.01
	USA	0.28	1.4	Madagascar	0.22	0.35

Table 5: Lettuce

Rank	2017			2018		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
1	Jordan	51.1228	19.73842	Iran	82.61	32.36
2	Spain	10.08597	17.33227	Jordan	4.95	11.49
3	Egypt	8.084178	5.621006	Spain	4.11	14.78
4	Lebanon	5.812909	11.45168	Lebanon	2.81	9.28
5	Saudi Arabia	5.44078	4.123403	Netherlands	2.6	14.64
6	Netherlands	4.593866	11.86102	Italy	0.93	8.42
7	Iran	4.016425	2.815495	India	0.6	1.32
8	USA	2.117285	6.908946	USA	0.44	2.46
9	Oman	1.89914	1.038339	Oman	0.39	0.76
10	Italy	1.89914	8.226837	France	0.16	1.39
	2019			2020		
	Country	Volume Share (%)	Value Share (%)	Country	Volume Share (%)	Value Share (%)
	Iran	86.96	33.42	Iran	91.70	39.08
	Spain	4.28	18.52	Spain	2.71	18.04
	Jordan	1.95	8.3	Netherlands	2.52	20.41
	Netherlands	1.86	14.39	Lebanon	0.84	3.83
	Lebanon	1.84	7.14	Jordan	0.73	4.99
	Italy	0.67	7.68	Italy	0.65	7.85
	Oman	0.54	1.06	USA	0.30	3.04
	USA	0.51	2.79	India	0.29	1.05
	India	0.39	1.04	Oman	0.11	0.15
	Turkey	0.23	0.15	Belgium	0.06	0.61

ANNEXURE E

DEFINITIONS AND NOTES [49]

1. **Agriculture Land:** Land used for cultivation of crops and animal husbandry. It is the total of areas under "Cropland" and "Permanent meadows and pastures."

2. **Arable Land**: Based on FAO: Arable land is the total of areas under temporary crops, temporary meadows and pastures, and land with temporary fallow. Arable land does not include land that is potentially cultivable but is not normally cultivated.
   Based on PSA: Arable land is the total cultivable land that includes cultivated land and uncultivated land.

3. **Area Harvested:** Area harvested refers to the area from which a crop is gathered. It excludes, therefore, the area from which, although sown or planted, there was no harvest due to damage, failure, etc. It is usually net of temporary crops and sometimes gross of permanent crops. The net area differs from the gross area in so far as the latter includes uncultivated patches, footpaths, ditches, headlands, shoulders, shelterbelts, etc. If the crop under consideration is harvested more than once during the year due to successive cropping, the area is counted as many times as harvested.

4. **Cereals:** Wheat, rice paddy, barley, maize, popcorn, rye, oats, millets, sorghum, buckwheat, quinoa, fonio, triticale, canary seed, mixed grain and cereals nes are all considered cereals.

5. **Cropland:** Land used for cultivation of crops. The total of areas under "Arable land" and "Permanent crops".

6. **Fibre Crops**: Fiber crops are plants that are deliberately grown for the production of fiber for textile (clothes), cordage (e.g., ropes), and filling (e.g., stuffing upholstery and mattresses).

7. **Fruits and Vegetables:** Vegetables, as classified in this group, are mainly annual plants cultivated as field and garden crops in the open and under glass, and used almost exclusively for food. Vegetables grown principally for animal feed or seed should be excluded. Certain plants, normally classified as cereals and pulses, belong to this group when harvested green, such as green maize, green peas, etc. Chilies and green peppers are included in this grouping when they are harvested for consumption as vegetables and not processed into spices. Trade data for fresh vegetables also include chilled vegetables, meaning the temperature of the products has been reduced to

[49] Food and Agriculture Organization

around 0 ˚C without the products being frozen. Fruit crops consist of fruits and berries that, with few exceptions, are characterized by their sweet taste. Nearly all are permanent crops, mainly from trees, bushes and shrubs, as well as vines and palms. Fruit crops are consumed directly as food and are processed into dried fruit, fruit juice, canned fruit, frozen fruit, jam, alcoholic beverages, etc.

8. **Land under Permanent Crops:** Land cultivated with long-term crops that do not have to be replanted for several years (such as cocoa and coffee), land under trees and shrubs producing flowers (such as roses and jasmine), and nurseries (except those for forest trees, which should be classified under "Forestry") are all considered land under permanent crops. Permanent meadows and pastures are excluded from land under permanent crops.

9. **Land under Permanent Meadows and Pastures**: Land used permanently (five years or more) to grow herbaceous forage crops through cultivation or naturally (wild prairie or grazing land) is considered land under permanent meadows and pastures. This class includes:

10. **Grazing in wooded areas (agroforestry areas, for example)**

11. **Grazing in shrubby zones (heath, maquis, garigue)**

12. **Grassland in the plain or low mountain areas used for grazing:** land crossed during transhumance where the animals spend a part of the year (approximately 100 days) without returning to the holding in the evening: mountain and subalpine meadows and similar; and steppes and dry meadows used for pasture.

13. **Oil Crops**: Oil-bearing crops or oil crops include both annual (usually called oilseeds) and perennial plants whose seeds, fruits or mesocarp and nuts are valued mainly for the edible or industrial oils that are extracted from them. Oil crops exclude dessert and table nuts, although they are rich in oil, as well as annual oilseed plants that are either harvested green or are used for grazing and for green manure. Some oil crops are also fibre crops in that both the seeds and the fibres are harvested from the same plant (for example coconuts, kapok fruit, seed cotton, linseed and hempseed).

14. **Roots and Tubers:** Roots and tubers are plants yielding starchy roots, tubers, rhizomes, corms and stems. The denomination "roots and tubers" excludes crops that are cultivated mainly for feed (mangolds, swedes) or for processing into sugar (sugar beets), and those classified as "roots, bulb and tuberous vegetables" (onions, garlic and beets).

15. **Sugar Crops**: Sugar crops include sugar beet, sugar cane, and similar crops.

16. **Tree Nuts**: Tree nuts is the collective term used to describe nuts that grow on trees.

ANNEXURE F

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ANNEXURE G

ACRONYMS & ABBREVIATIONS

1. AAAID: Arab Authority for Agricultural & Investment Development
2. AI: Artificial Intelligence
3. CAGR: Compounded Annual Growth Rate
4. FAO: Food and Agriculture Organization
5. GCC: Gulf Cooperation Council
6. GDP: Gross Domestic Product
7. HH: Household
8. HS: Harmonized System
9. IoT: Internet of Things
10. KSA: Kingdom of Saudi Arabia
11. LFPR: Labour Force Participation Rate
12. MDPI: Multidisciplinary Digital Publishing Institute
13. MM: Ministry of Municipality
14. MOCI: Ministry of Commerce and Industry
15. NHEIS: National Household Income & Expenditure Survey
16. PDH: Polycarbonate Drying House
17. PSA: Planning and Statistics Authority
18. QADCO: Qatarat Agricultural Development Company
19. QAFCO: Qatar Fertilizer Company
20. QDB: Qatar Development Bank
21. QNFSP: Qatar National Food Security Programme
22. QNFSS: Qatar National Food Security Strategy
23. QNRF: Qatar National Research Fund
24. QR: Qatari Riyal
25. SAIC: Al Sulaiteen Industrial Complex
26. SIS: Specialized International Services
27. TRL: Technology Readiness Level
28. TSE: Treated Sewage Affluent
29. UAE: United Arab Emirates
30. USA: United States of America
31. VF: Vertical Farming
32. WITS: World Integrated Trade Solution
33. YoY: Year on Year

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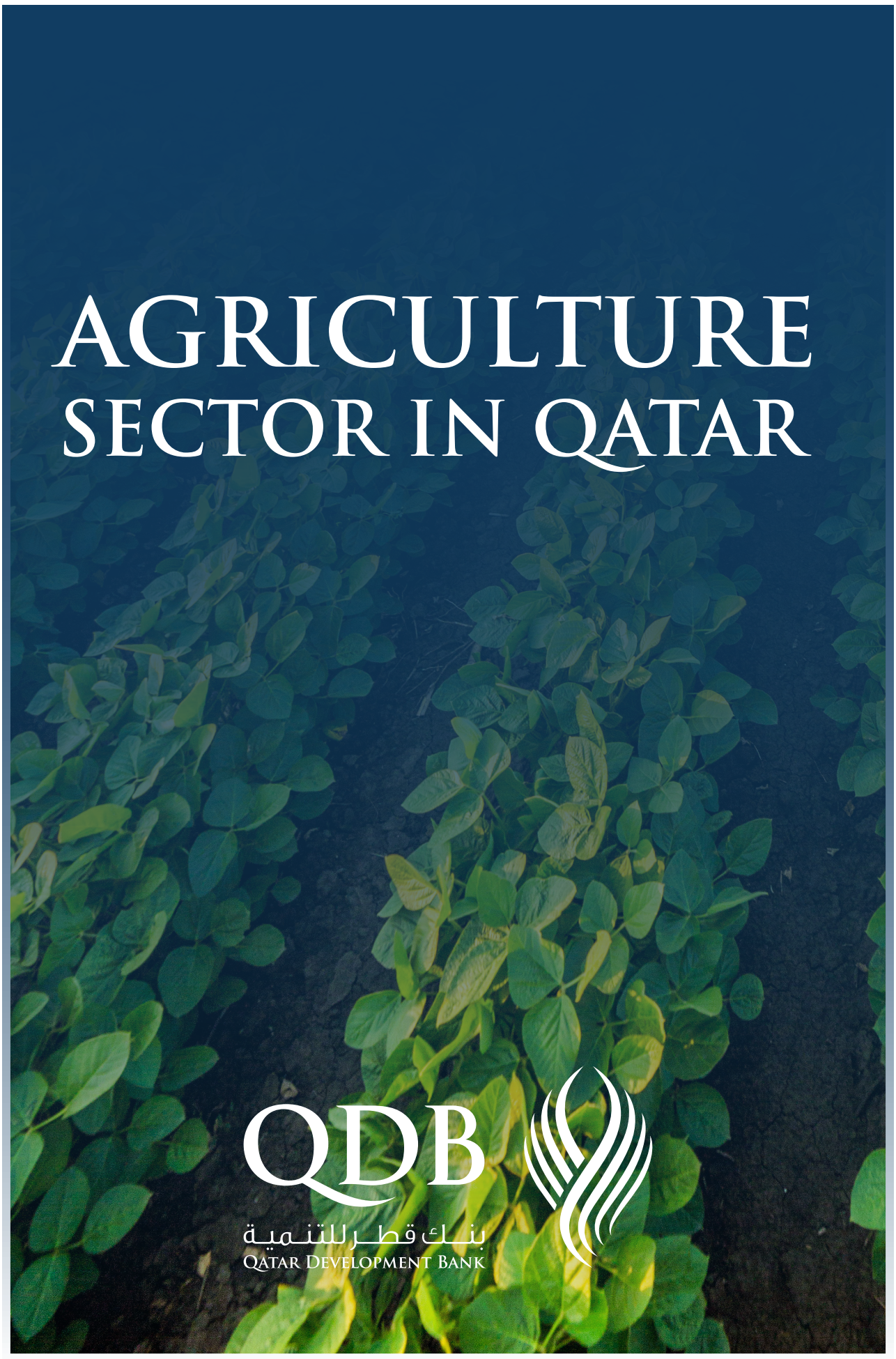

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