Food and Agriculture Organization of the United Nations

Value chain study

Date palm in the Arab region

The League Of Arab States
Arab Organization For Agricultural Development

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Foreword

The date palm is one of the oldest cultivated fruits in the world. It is believed to have originated in the Fertile Crescent around 4000 BC and then its cultivation spread to the Arabian Peninsula and other parts of the world. At present, the Arab region is still the undisputed world leader of date cultivation with 75 percent of global area under date palms, 77 percent of world production and 69 percent of world total export of date. The date palm has always played a significant role in the economy, welfare, spiritual life, heritage, history, environment, society and nutrition for the population of the Arab region. The date palm tree is revered and held in highest esteem in most traditional date producing countries where it remains part of the heritage and cultural life of the people. It is a cultural icon reflected in the national emblems and currency of many dates producing countries in the Arab region.

The date palm tree grows in arid areas where other plant species could not grow as favourably. Therefore, they constitute a supporting pillar for rural and agricultural development, food security and income and employment generation in these arid areas. In view of the importance of date palm production to the region and the potential for its further development, the Arab Organization for Agricultural Development (AOAD) in co-operation with the Food and Agriculture Organization Regional Office for the Near East and North Africa (RNE/FAO) commissioned this study to guide the formulation of a strategic framework for the sustainable development of the date palm value chain in the Arab region. The strategic framework is meant to provide clear strategic direction for the sustainable development of an innovative and resource-efficient date palm value chain that would effectively contribute to sustainable, diversified and balanced socio-economic development in the Arab region. The strategic framework would also provide a road map for all concerned stakeholders including government, private sector, international and regional organizations, civil society bodies, non-governmental organizations, etc. to formulate their strategies, action plans and work programs.

The complex, multidisciplinary and interdependent nature of the various phases of the date palm value chain made it essential to have a multidisciplinary study team prepare this strategic region-wide value chain study. The team hosted sub-regional consultations and participated in international meetings, and gathered the views and experience of a wide range of stakeholders from all concerned countries in the Arab region.

This study critically examines the drivers and challenges facing the future development of the date palm value chain, and presents practical and viable pathways for upgrading quality, marketability and diversity of dates products that are aligned with the broader goals for food and nutrition security in the region. The nutritional value of dates as part of a healthy diet can be clearly communicated and marketed to create a demand pull among consumers in the Arab region and beyond. Likewise, encouraging processing dates into a variety of products can generate new demand and new market opportunities for producers and actors along the chain. Traditional production and distribution systems dominate the date value chain, although very good examples exist of companies and countries that have modernized into higher productivity and expanded exports.

It is clear that the challenges and opportunities facing date palm are closely shared among Arab countries and are too great for one institution and one country to tackle. Thus the renewed call and need for regional-level collaboration and coordination among countries, industry groups, national marketing boards and the private sector to revitalize the date value chain in Arab countries and together raise its profile regionally and internationally.

Mr AbdulHakim Elwaer
Assistant Director General and
Regional Representative
FAO

Professor Ibrahim Adam A. Eldukheri
Director General
AOAD

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This value chain study of date palm in the Arab region is a result of the joint initiative of the United Nations Food and Agriculture Organization Regional Office for the Near East and North Africa (RNE/FAO) and the Arab Organization for Agricultural Development (AOAD), under the overall guidance of Abdessalam Ould Ahmed, Assistant Director General and Regional Representative, FAO and Ibrahim Adam A. El-Dukheri, Director General of AOAD. This study was conducted under the technical supervision of Jozimo Santos Rocha, FAO Regional Agro-Industry Officer and was intended to form the basis of a regional strategic framework for date palm value chain development. It was prepared by experts from multiple disciplines and involved many individual and institutional stakeholders from the Arab countries. Special recognition goes to the stakeholders listed below.

Value chain study research team and authors

Saad Elmedani Daak, Study Team Leader and responsible for policy analysis and strategic planning; Mohmoud El Solh, capacity building, institutions and human resources; Abdalla Oihabi, date palm production and technology; and Zohair Abdalla, marketing and value chain analysis.

Background country reports

Skander Mekrasi and Malik Balgagh (Algeria); Abdel Aziz Abdel Kareem (Bahrain); Ezzeddin Gadlall, Shaaban Ali Salem, Khalid Mohamed Abdel Hameed, Muna Mohamed Hassan, Mustafa Taha Mohammadi (Egypt); Salih Badr (Iraq); Nazar Haddad (Jordan); Mawlai Al Hassan; Sedra Mawlai Mohamed and Rasheed Murabit (Morocco); Abdel Basit and Nashwan Abdel Wahab Abdel Razik (Oman); Fuad Ben Hameeda and Lutfi Ben Mahmoud (Tunisia); and Hamid Hussein Mohamed Faki, Gilani Abdel Hafiz, Daoud Hissein Daoud Suliman (the Sudan).

Additional inputs

Alfredo Impiglia (FAO), Thaer Yaseen (FAO), El-hag Attia El-habib (AOAD), Raed F. Hattar (AOAD), Mohamed Ali Bob, Hamid Hussein Faki, Ahmed Abdalla (FAO), Jennifer Smolak (FAO), Mariam Elghamrawy (FAO), and the many involved officers from FAO and AOAD.

Consultations and regional conferences

The views and experience of participants at two consultations on date value chain development held in Cairo in April 2018 and Tunis in May 2018 (list shown in Annex 1.7) hosted by the Study Team; the Sixth International Date Palm Conference in Abu Dhabi, organized by the Khalifa International Award for Date Palm and Agricultural Innovation; and The First International Date Conference in Riyadh organized by the Ministry of Environment, Water and Agriculture.

Abbreviations and acronyms

AIOR	Agricultural Investment Orientation Ratio
AOAD	Arab Organization for Agricultural Development
CBO	community-based organization
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CSO	civil society organization
CV	coefficient of variation
ENPI	European Neighbourhood Partnership Investment of the European Commission
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
FFS	farmer field school
GAP	good agricultural practices
GCC	Gulf Cooperation Council
GDP	gross domestic product
GEF	Global Environmental Facility
GHP	good hygienic practices
GMP	good manufacturing practices
HACCP	Hazard Analysis Critical Control Points
ICARDA	International Centre for Agricultural Research and Development in Arid Areas
ICBA	International Centre for Bio-saline Agriculture
ICT	Information and Communication Technology
IDC	International Date Council
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
MDG	Millennium Development Goal
MENA	Middle East and North Africa
NENA	Near East and North Africa
NGO	non-governmental organization
PO	producers organization
RNE/FAO	FAO Regional office for the Near East
R&D	Research and Development
SDG	Sustainable Development Goals
SIDPC	Sixth International Date Palm Conference
SOI	Sustainable Oasis Initiative
UNDP	United Nations Development Programme
USD	US Dollars
VC	value chain

Executive summary

Despite the tremendous efforts made by governments and the private sector in dates-producing Arab countries over the last five decades, the development of the date value chain has been limited by deeply-rooted technical, environmental, institutional and marketing obstacles and constraints. Seeing the need for a renewed and concerted effort towards developing this sector, the Arab Organization for Agricultural Development (AOAD) and FAO Regional Office for the Near East (RNE/FAO) have commissioned this study to inform a strategic framework for the sustainable development of the date palm value chain in the Arab region. Emphasis is being put on the need for better regional integration, policy co-ordination and a common innovative and progressive vision for the production, processing, marketing and external trade in dates.

This study uses the value chain (VC) approach as a conceptual framework which encompasses organization, coordination, power relationships and governance between institutions and actors participating in the ecosystem of date palm products and services, and consolidates the views, comments and recommendations received through a broad stakeholder consultation process that allowed participatory feedback on the major constraints at the various value chain components.[1] A multidisciplinary study team was formed to lead the background research, consultation and analysis and reporting for this study.

The dates value chain is characterized by a number of challenges and constraints. The low productivity of the date palm sector in most countries results from institutional, financial, and physical resource and environmental constraints in addition to weak human resources and managerial capacities. Most countries face a shortage of qualified and experienced personnel in all aspects of date development. Date palm biodiversity losses in the region have been caused by many factors including climate change, civil strife and conflicts, over exploitation of the vegetative cover, biotic agents, changing farming practices, socioeconomic change including increasing urbanization and encroachment of residential areas into agricultural land. Finally, demand for dates is even at risk, as per capita date consumption has been found to be low or declining in many Arab countries, particularly among the young generation.

Nonetheless, there are opportunities to seize for marketing dates to local markets, dates importing countries in the region, and the world market. These markets are growing and becoming a pull force for Arab countries to make the productivity and quality upgrades needed to access high-value international markets such as Australia, European Union and Canada. Less stringent, lower quality markets (India, Indonesia, Bangladesh, etc.) could also help to expand the volumes of date exports from the region, especially from countries like Algeria and Iraq. Dates processing, except for drying, is markedly low despite the potential that exists for numerous value-added date products and there is untapped opportunity in marketing their nutritional and health value.

Based on the challenges and opportunities, the study produced recommendations for date palm development structured into five broad themes that will form the basis of a regional strategy. First, enhance sustainable and resource-efficient date palm production systems through innovative solutions and a focus on improved and advanced management practices, efficient resource use, utilization of proven research-based technologies, and a shift towards high quality production and reduced production costs to ensure profitability and competitiveness of date farming.

[1] The stakeholders meeting for Mashreq, GCC and Nile Valley sub-regions were held in Cairo during the period 22-25 April 2018 and in Tunis during the period 1-4 April 2018 for Maghreb sub-region.

This involves programmes and broad initiatives to improve the date farming systems themselves, strengthen production input and propagation services, detect and prevent pests and diseases, support research and technology development, promote efficient water use, develop strategies to mitigate and adapt to climate change, and document and protect genetic biodiversity.

Secondly, there is need to improve post-harvest handling, marketing and competitiveness of the date value chain. While production is of critical importance, the date palm value chain is comprised of several post-production components which will require upgrading if the whole value chain is to function efficiently. The key components needing improvement are post-harvest handling and processing, quality, marketing, infrastructure, trade, as well as date consumption by emphasising its nutritional value.

Strengthening institutional and human resource capacities is the third theme. Efforts to enhance the development of the date palm sector have been frustrated in many countries by lack of skilled and experienced personnel, largely due to the inadequacy of specialized teaching, vocational training institutions and extension services.

The fourth theme is regional cooperation and partnerships for date palm development. The challenges facing date palm production in the Arab world are far beyond the capacity of one institution and one country to tackle. However, despite the dominance of the Arab world in date production, there is modest, if any, regional cooperation especially in exchange of information and experience, development of common policies and coordination with respect to date palm development, processing and trade. Measures to overcome this is a recommended Regional Date Palm Centre to promote communication exchange and heightened collaboration on trade, capacity development and integrated pest management.

Finally, there is a need to tackle cross-cutting issues over all the phases of date palm value chain from production to post-harvest handling, distribution marketing and consumption; develop public mechanisms to encourage private investment in the date palm value chain, and ensure the regulatory environment is conducive to investment, financing and insurance; encourage women's involvement and enhance their capacity through training in harvesting, processing and handcrafts, and accessibility to finance, marketing and other needed inputs; and, improve the collection and dissemination of accurate statistics on dates including production, location, varieties, marketing, prices, export quantity and destination. Finally, create and promote an "International Year of the Date Palm" with the purpose of enhancing consumption and strengthening the sustainable development of the entire date palm value chain.


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1. Introduction

1.1 Importance of dates and date palms in the Arab region

The date palm (*Phoenix dactylifera*) is one of the oldest cultivated fruit plants in the world. It is believed to have originated in the Near East Region in Mesopotamia (present day Iraq) around 4 000 BC, and spread to the Arabian Peninsula, other countries in the Near East and North Africa (NENA) and other parts of the world. Throughout history the date palm has played an important role in the history and heritage of the Arab region.

The date fruit is highly nutritious with considerable amounts of sugar ranging from 60 percent to 80 percent of the dry weight, mostly of the inverted form (glucose and fructose). Dates also contain considerable fibre, no fat or cholesterol, and very low levels of sodium. Details of the nutritive value for fresh and dry dates as well as for the main export Deglet Noor and Medjool cultivars are provided in Annex 1.1.

The date palm is a strategic crop for producing countries in the Arab region, contributing significantly to their national economies, and constituting the most important income generating crop to the inhabitants of the oases in the Arabian Peninsula and North Africa countries and the riverain areas in Central and South Iraq, Upper Egypt and Northern Sudan.

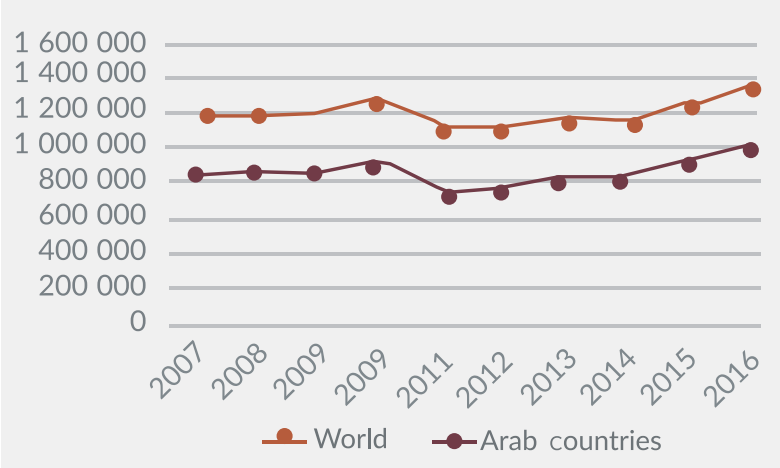
Date palms are well adapted to the harsh dryland environment, tolerating high temperatures and salinity, surviving in areas where other plant species cannot. For this reason, they constitute a principal supporting pillar for agriculture development and food security in the Arab region, as outlined in Figure 1.1.

Figure 1.1 The multifaceted importance of date palm production in the Arab region.

The date palm also provides a more amenable habitat for people to live by providing shade from sun and shelter from the desert winds, spurring the development of rural settlements, sustainable agriculture, employment and income generation. Its by-products are useful in the construction of housing, production of household utensils and inputs for animal feed. The deep shade and humid habitat that date palm canopies create provide suitable microclimate and favourable conditions, which allow other crops such as citruses, vegetables and forage crops to grow in desert oases. In addition, the date palm provides greening of land and landscaping of large barren areas, and contributes appreciably to the protection and betterment of the harsh environment in many localities within the region and lessens soil degradation and desertification, thus protecting the environment.

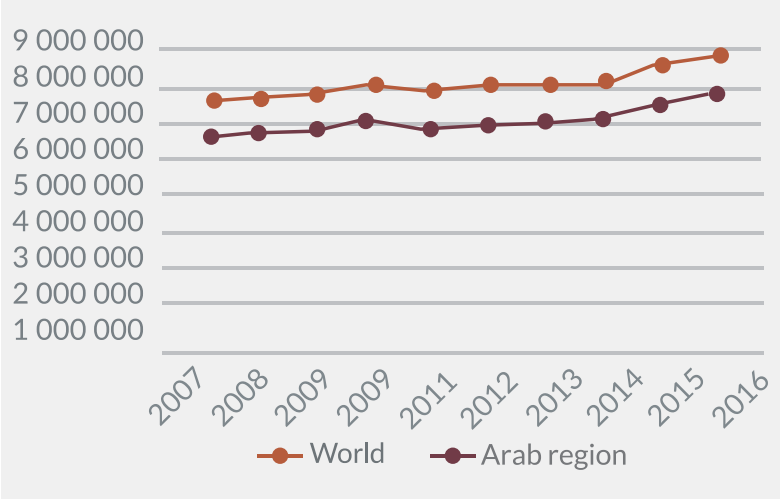
The Arab region contains the majority of the global area under date palm production – some 1.35 million ha (FAO, 2016) – and contributes over 75 percent of the world production of dates. In recent years, production has increased at an average annual rate of four percent, primarily due to growth in area planted as shown in Figures 1.2 and 1.3 (detailed time series data on planted areas, production and yield are provided in Annexes 1.2, 1.3 and 1.4, respectively).

Figure 1.2 Area under date palms (2007–2016).



Source: Authors based on FAOSTAT data, 2018.

Figure 1.3 Production of dates (2007–2016).



Source: Authors based on FAOSTAT data, 2018.

The Arab region contributes to more than two thirds of the global exports of dates, with the largest end-market importers being India and the Islamic countries. A summary of exports and imports of dates is portrayed in Table 1.1 and the details are provided in Annexes 1.5 and 1.6.

Table 1.1 Imports and exports of dates in 2016.

	Import		Export	
	Quantity (MT)	Share %	Quantity (MT)	Share %
World	957 084 30	100 00	1 039 605	100
Arab countries	352 074 40	36.79	718 872	69.15
Asia	427 188 36	44.63	315 590	30.36
Europe	97 803 10	10.22	25 151	2.42

Source: Authors based on FAOSTAT data, 2018.

1.2 Objectives of the study

The last few decades witnessed considerable efforts by many countries in the Arab region to reinvigorate and develop the date palm sector and enhance its capacity in value addition and contribution to the wellbeing of various populations, chief among which are the inhabitants of the oases and some of the riverain populations in Egypt, Iraq and the Sudan. Nevertheless, development of the sector has, in many countries, been frustrated by various technical, environmental, institutional and marketing obstacles. Challenges have been noted on the lack of strategic orientation for the development of the sector in many countries and equally at the sub-regional and regional levels. Despite the dominance of the Arab region in date production, there is modest, if any, regional integration or policy coordination or even a shared vision on the development, processing and trade in dates.

In order to better work towards achieving the objectives of regional integration, policy coordination and the sustainable development of the date palm value chain in the Arab region, the Arab Organization for Agricultural Development (AOAD) in partnership with the FAO/UN Regional Office for the Near East and North Africa (RNE/FAO) initiated action, including commissioning this study, to develop a strategic framework for the sustainable development of the date palm sector in the Arab Region, which will serve as:

- a guideline to date producing countries in making policies, programmes and plans for the sustainable development of the date palm value chain, each according to its resources, socio-economic conditions and requirements;
- an umbrella for concerted best impact-orientated interventions in the date palm sector, led by Governments and partners, including relevant international and regional organizations as well as non-governmental organizations (NGO), community-based organizations (CBO) and the private sector;
- a support to AOAD and FAO/UN and their development partners in designing medium-term action plans to further regional and sub-regional endeavours for interconnectivity and integration and henceforth enhancing the sustainable development of the date palm value chain; and,
- an effective means to contribute to the Agenda for Global Action for the next 15 years in line with the established Sustainable Development Goals (SDGs), and foster partnership and alliance within and between development partners as well as member countries.

1.3 Methodology and analytical framework

The design of the value chain study has been guided by:

- a conceptual framework based on the Value Chain (VC) approach, which encompasses organization, coordination, power relationships, linkages and governance between organizations and actors participating in the components and full range of activities required to bring the date palm products and services from conception through production and up to final local and export markets.

- a broad stakeholder consultation process, allowing participatory feedback on the major constraints at the various value chain components and in capitalizing on the opportunities identified for the sustainable development of the date palm sector.

The process of preparing the value chain study report encompassed:

- Background country reports conducted by multidisciplinary teams of national experts in 12 main date producing countries in the region which were supported, in some of these countries, by consultations with the stakeholders. In addition to exposure of the status of the national date palm value chain, the country studies were intended to ensure harmonization of the designed strategic framework with national development vision and plans and to consolidate ownership of the formulation process as well as the resultant strategic framework.

- Literature reviews: Intensive studies and reviews were carried out by the study team of four international experts on the available data and literature on the various aspects of the dates palm value chain, which were supported by the knowledge and experience of the study team. Examination was also made by the study team of the various global and local strategic drivers and determinants for change in the date palm industry. The composition of the study team was deliberately varied to include expertise in the technical aspects of dates production, marketing and trade, institutions and capacity building, rural development, macroeconomic policies and strategic planning (Annex 1.8 provides names of members of the study team).

- Participatory consultations: Firstly, this includes peer reviews. The preparation of the strategic framework benefited from the invaluable opportunity provided by (a) The Sixth International Date Palm Conference (SIDPC) organized in Abu Dhabi by Khalifa Prize for Date Palm during 19 – 21 March 2018 and (b) The First International Date Conference (IDC) organized by the Ministry of Environment, Water and Agriculture in Riyadh, Saudi Arabia during 11-12 April 2018. A special session was provided in each occasion for the study team to solicit the experience and knowledge of the participants, present and discuss with them the challenges facing the date palm sector in the Arab region, and propose possible interventions for their resolution, which consequently add to the intended formulation of the strategic framework. Secondly, three sub-regional consultations were organized in Cairo during 22-25 April 2018 for the Mashreq, Gulf Cooperation Council (GCC) countries and Nile Valley, and a fourth consultation was organized in Tunis during 1-4 May 2018 for the Maghreb sub-region (list of participants and their affiliations is provided in Annex 1.7). Participants to the consultations which included gender sensitive representatives of the stakeholders in the date palm industry comprised producers, processors, marketers and exporters, service providers, officials from relevant government authorities, private sector, non-governmental organizations, research and academic institutions, and regional and international organizations.

The workshops were dedicated to sharing experiences between countries, to discuss, exchange views and to develop joint understanding on issues and opportunities for the sustainable development of the date palm value chain in each sub-region. Workshop participants identified the main constraints and challenges impacting the dates industry in the sub-region and specified the causes and implications of these issues on the sustainable development of the date palm value chain. They discussed opportunities and proposed best impact-orientated interventions to address the critical gaps and develop a sustainable date palm value chain.

A final regional workshop was held in Cairo from the 7th to the 8th of October 2018 to present and discuss the designed strategic framework for the sustainable development of the date palm value chain in the Arab region and validate the identified interventions, and also agree on the prime interventions to be addressed by the collaborating partners in the medium term.

The strategic framework presented in the following sections is the result of the above conceptual framework and analytical, participatory and inclusive consultation process. It reflects the views and aspirations of all stakeholders in the date palm industry in the Arab region for the sustainable development of an innovative viable date palm value chain and the commitments desired from concerned partners for the realization of the vision outlined forthwith in this strategic framework.

Following this introductory section, a summary of the situation analysis of the date palm value chain in the Arab region, all through its various components, is provided in Chapter 2. This is followed by a review of the opportunities for commercialization and marketing in Chapter 3. Chapter 4 is devoted to a critical analysis of the challenges and opportunities pertinent for the design of the strategic framework. Finally, Chapter 5 proposes practical recommendations for the sustainable development of the date palm value chain, covering a comprehensive range of policy actions.

2. Analysis of the date value chain in the Arab region

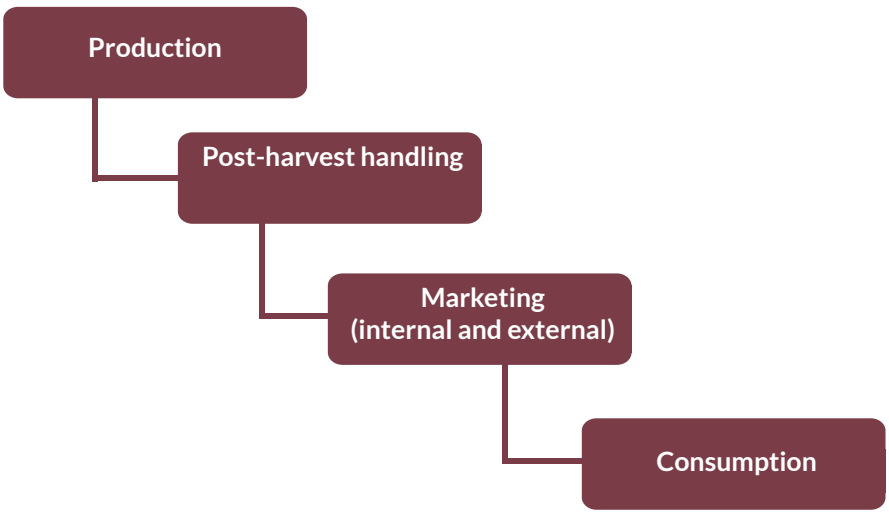
2.1 Overview

This section of the report reviews and examines the various components of the date palm value chain in the Arab region to identify bottlenecks and opportunities and propose remedial actions needed for value addition and sustainable development. The review builds on sub-regions with the date producing countries grouped on the bases of common features which reflect the characteristics of the date palm value chain components and their inter-relations. These common features include geographical location and proximity to export markets, and similarities of agro-ecologies, economic wealth, infrastructure, natural resource endowment, demographic structure, productive capital and environmental conditions. The structured sub-regions are the Maghreb, Nile Valley, Mashreq and GCC countries. While the review concentrates on these sub-regions, the salient date palm value chain features of individual date producing countries are also covered. The review starts with a broad description of a typical date palm value chain in the Arab region, and then provides an account of the vertical linkages, the main actors/stakeholders along the chain and their relationships. The review then proceeds to examine the individual components of the chain from date production up to final consumption.

2.2 Structure of a typical date value chain in the Arab region.

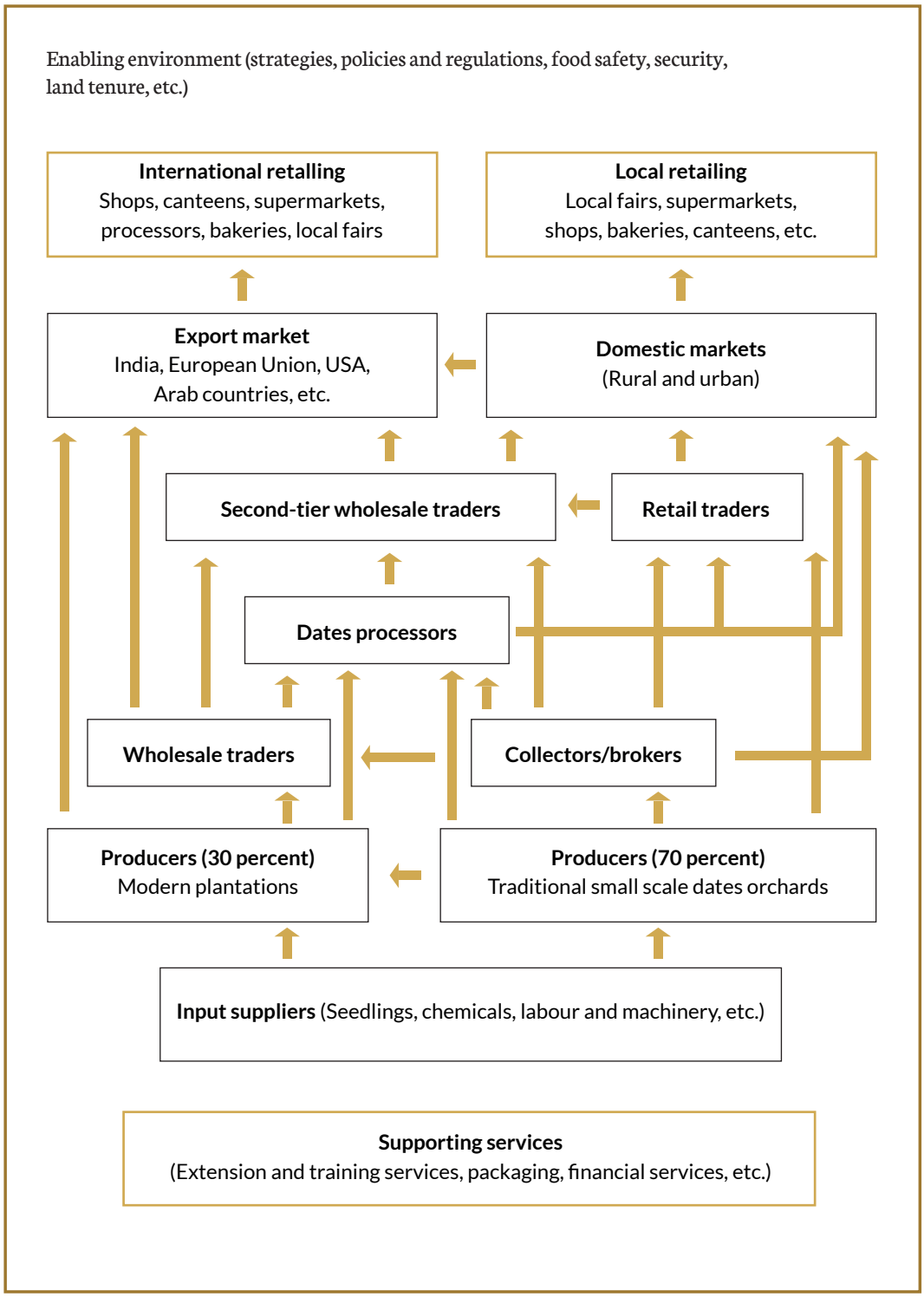
A typical date palm value chain in the Arab region is generally composed of four main functions: production, post-harvest handling, marketing and consumption (Figure 2.1). The main actors/ stakeholders of the date value chain are the inputs suppliers (seedlings, machinery and equipment, pesticides, fertilisers, packing materials); date producers; aggregators (agents who buy on behalf of wholesalers, exporters, processors or retailers); commission agents who buy on behalf of wholesalers and exporters or sell on behalf of farmers and other sellers. The efficiency of the value chain depends on the strength and quality of the relationships between these actors and the governance of the value chain, particularly the rules and regulations (formal and informal) that govern the operation of the whole system.

Figure 2.1 Phases of a typical date palm value chain in Arab region



The efficiency of each stage of the value chain greatly depends on its competitiveness and the ease of entrance and exit of the main actors from each stage. The supporting services which include training, extension, promotion, transportation and communication etc. are included as complementary activities. The value chain map for dates in Figure 2.2 below is general, showing the most common value chain of dates in the Arab region. Individual countries may have minor differences in the value chain.

Figure 2.2 Typical value chain map of date palm in Arab countries.



Source: Santos Rocha, J., El-dukheri, I. and Impiglia, A. 2018. Date Palm Value Chain Development in the Arab Countries: Key Constraints and Opportunities. Paper presented in the Sixth International Date Palm Conference (SIDPC), Abu Dhabi, UAE.

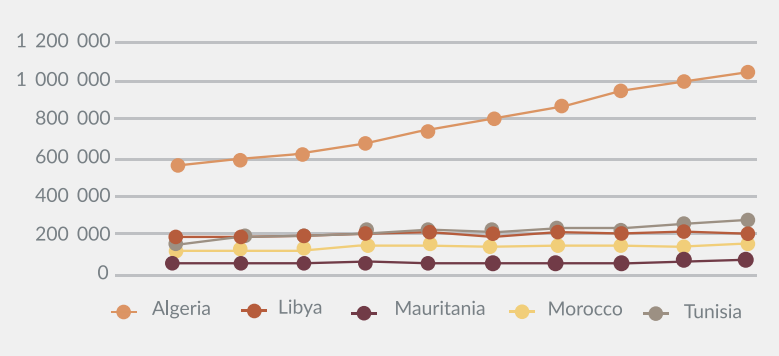
2.3 Production

Almost all Arab countries have paid special attention to promoting and modernizing their date palm industry and enhancing its trade, particularly during the last decade, and have been driven by considerable government support in some countries. However, the pace and trends in development including planted area, production and productivity vary considerably between countries and sub-regions, as illustrated below.

The Maghreb sub-region

a) Production: The Maghreb sub-region covers Algeria, Libya, Mauritania, Morocco and Tunisia. It produced 1 591 854 MT (2016) representing 18.8 percent of total world production of dates, predominantly from Algeria, the world's third largest producer (representing 65 percent of sub-regional production). Production by other Maghreb countries and their global ranking is shown in Table 2.1.

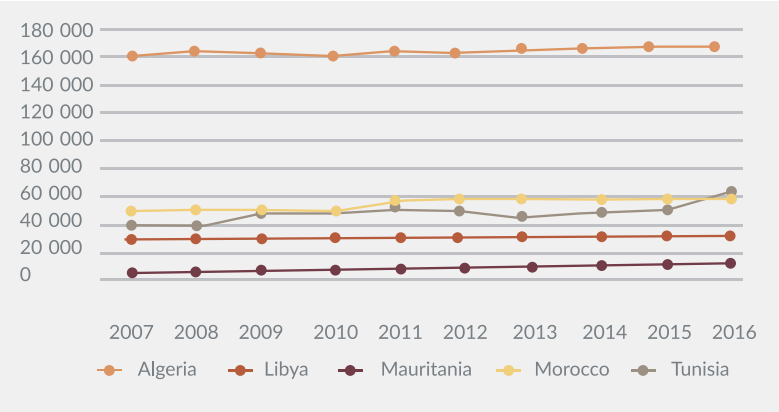
Figure 2.3 Trends in date production (in tonnes) in the Maghreb countries (2007–2016).



Source: Authors based on data from multiple sources, 2018.

Trends in date production in the Maghreb sub-region presented in Figure 2.3 reveal an increase of 57.2 percent in production during the last decade (2007–2016). The increase was enormous in Algeria (95.4 percent) as production jumped from 526 921 in 2007 to 1 029 596 MT in 2016. Dates production almost doubled (94.4 percent increase) also in Tunisia during the same period. This increase in production has put an extra 620 000 MT of dates in the market.

Figure 2.4 Date harvested area (ha) in Maghreb countries (2007–2016).



Source: Authors based on data from multiple sources, 2018.

a) Date production in the Maghreb sub-region is dominated by Deglet Noor cultivar, representing 50 percent and 73 percent of the total production in Algeria and Tunisia, respectively. Another important variety is Medjool which originated in Morocco and is very popular at the international level. Medjool currently represents 0.3 percent of the total date production in Morocco and 67 percent of the new plantations developed within the Green Morocco Plan (GMP). In Mauritania, the dominant variety is Ahmar which represents about 70 percent of the fresh dates in Mauritania.

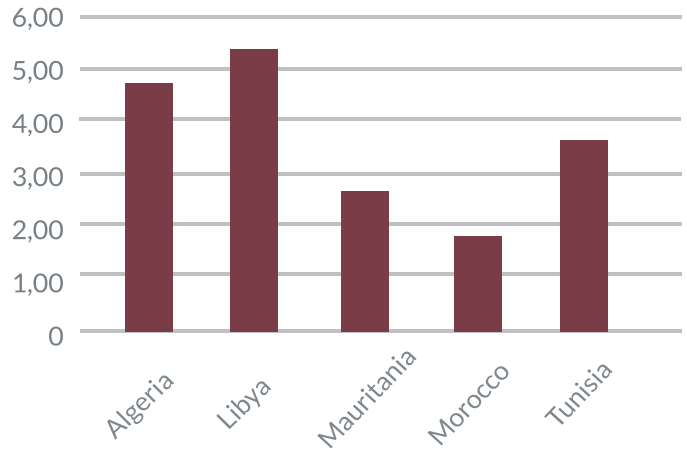
b) Area: The total dates harvested area in the Maghreb sub-region in 2016 was 328 187 ha of which 51 percent was in Algeria. Region-wise, the dates harvested area increased by 15.7 percent (Figure 2.4) during the period 2007–2016. The most important progress of 54 percent in the harvested area was observed in Tunisia followed by 21 percent in Morocco.

c) Productivity: Based on FAOSTAT 2018, the average yield for date palm at the global level is around 6 MT/ha. The average for the Maghreb countries, shown in Figure 2.5 is 3.6 MT/ha, almost half the global average yield. Furthermore, there are important differences between the countries. Libya presents the highest yield per ha, 5.38 MT, while Morocco has the lowest productivity in the Maghreb Sub-Region with 1.90 MT/ha.

The development in date palm productivity of the Maghreb countries is presented in Figure 2.6. It is apparent that Algeria has made important improvements in its date palm productivity, compared to the other Maghreb countries, whereby yield almost doubled from 3.30 MT/ha in 2007 to 6.16 MT/ha in 2016. Tunisia showed some increase in date palm productivity from 3.11 MT/ha in 2007 to 4.54 in 2015 and 3.69 MT/ha in 2016. Libya date palm productivity per hectare has been consistent from 2007 to 2016 with an average of 5.38 MT/ha, the highest among the Maghreb countries.

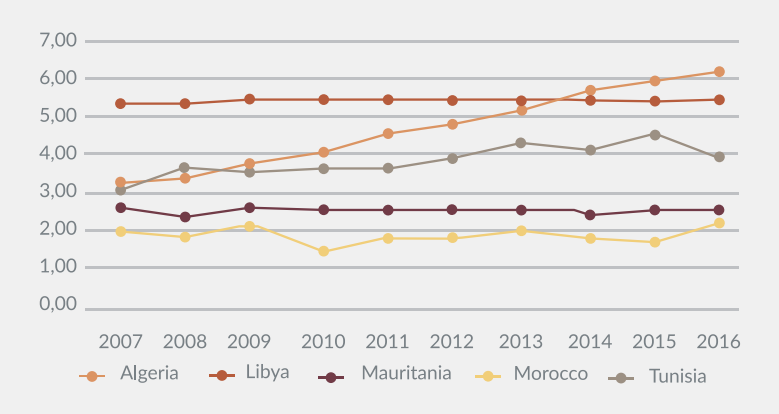
The productivity of the date palm tree varies within individual countries in Maghreb depending on location, variety and production system. According to Bounaga *et al.* (2015), the average yield at the national level in Algeria is 50 kg/tree while it recorded 61 kg/tree in Biskra, 37 kg/tree in the South Centre and only 29 kg/tree in the South west. The variety Deglet Noor presents the highest level of productivity with an average of 61 kg/tree.

Figure 2.5 Date productivity in Maghreb countries (tonnes/ha).



Source: Authors based on data from multiple sources, 2018.

Figure 2.6 Developement of dates productivity in tonnes/ha (2007–2016).



Source: Authors based on data from multiple sources, 2018.

In Mauritania, the average production at the national level, according to the National Plan for Agricultural Development (NPAD) of the Ministry of Agriculture (2015) is 15 to 20 kg/tree with yield reaching 30 to 50 kg/tree in irrigated areas, which represent 15 percent of the total date palm harvested areas, and only 10 to 15 kg/tree in the remaining 85 percent non-irrigated areas.

In Morocco[2], the national average dates yield varies between 20 to 25 kg/tree and with significant variations between the main areas of date cultivation. While the average productivity at Draa and Tafilalet is 2.4 MT/ha it recorded 6.8 tonnes/ha in Guelmim.

The Nile Valley sub-region

a) Production: Countries of the Nile Valley include Egypt and the Sudan. The Nile Valley produced 2.13 million MT in 2016, out of which 1.69 million MT (79 percent of the Nile Valley production) was produced in Egypt, the world's first date producing country. The balance of 439 120 MT was produced in the Sudan, which ranked as the sixth date-producing country in the Arab region. Date production during the period from 2007 to 2016 (Figure 2.7) showed an increasing trend for Egypt with production increasing from 1.31 million MT in 2007 to 1.69 million MT in 2016, an increase of 29 percent in production in ten years. Date production in the Sudan was more or less stagnant after the increase recorded in 2009.

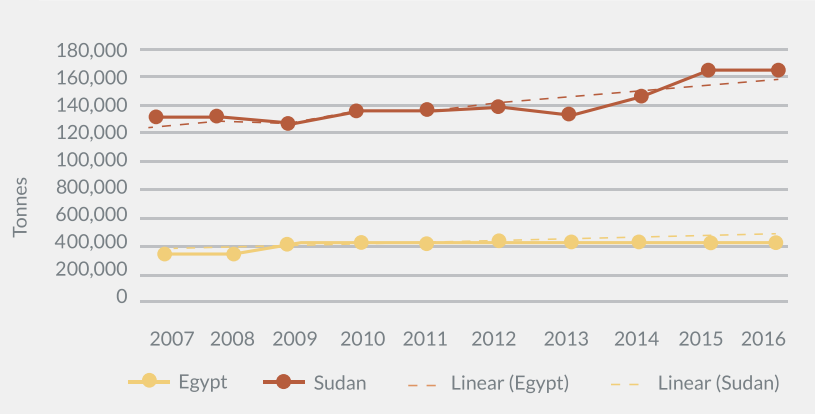
b) Area: The total area planted with date palm in the Nile Valley accounts for 8.4 percent of the total area planted with dates in the Arab region and has increased from 71 730 ha in 2007 to 85 265 ha in 2016, an increase of 18.9 percent over ten years. In the Sudan, the area under date palms increased by only 5.5 percent from 35 280 ha in 2007 to 37 212 ha in 2016 (Figure 2.8), while the increase in Egypt was large (31.8 percent) from 36 450 ha in 2007 to 48 053 ha in 2016.

c) Productivity: The trend in date palm productivity in the Nile Valley countries during the last decade (2007–2016) is presented in Figure 2.9. It is apparent that yield levels in both Egypt and the Sudan were more or less stagnant during this period. The average productivity for the Nile Valley countries was 23.0 MT/ha with Egypt having the highest yield (34.6 MT/ha) in Arab countries while date palm productivity in the Sudan was 11.4 MT/ha.

[2]National Agency for the Development of the Oases Zones and Argan (ANDZOA, 2017)

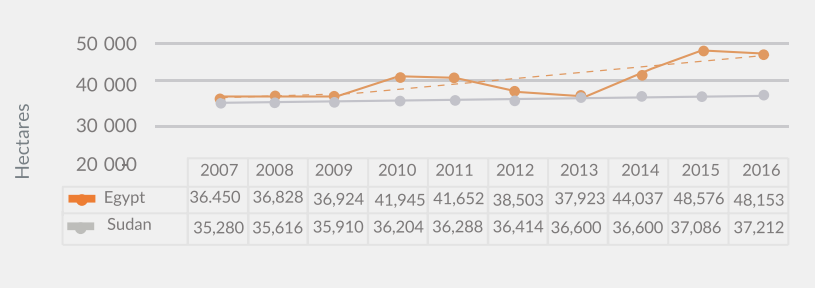
The average productivity per tree for Egypt during the period 2005–2015 was 109.4 kg/tree. It was 133.9 kg/tree in lower Egypt, 110.5 kg/tree within the main Nile Valley, and 77 kg/tree outside the valley. This high productivity was explained by high soil fertility, suitable climate, available water resources, high water table and the dominance of soft date varieties with high moisture content, in addition to the good husbandry practices by the Egyptian date farmers.

Figure 2.7 Developement of date palm production in the Nile Valley during 2007–2016.



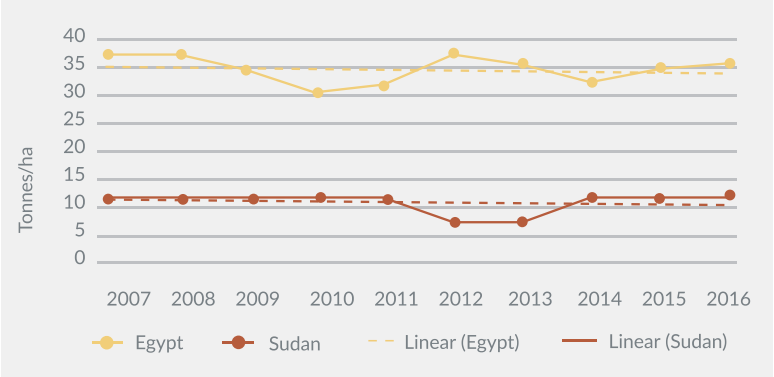
Source: Authors based on FAOSTAT data, 2018.

Figure 2.8 Date palm harvested area in the Nile Valley 2007–2016.



Source: Authors based on FAOSTAT data, 2018.

Figure 2.9 Developement of date palm productivity (MT/ha) in the Nile Valley 2007–2016.



Source: Authors based on FAOSTAT data, 2018.

The Mashreq sub-region

a)Production: The Mashreq sub-region is composed of Iraq, Jordan, Lebanon, Occupied Palestinian Territory and Syrian Arab Republic. Date production exhibited a great decline in almost all the Mashreq countries due to numerous manmade and natural disasters since the late eighties of the last century. Iraq, which was the first date-producing country in the world up to the 1980s, lost its leading position due to wars with Iran, the Gulf War with the USA, internal civil strife and economic sanctions. The date palm sector was also affected by the decrease of water flow following construction of the Ataturk dam upstream of the Euphrates river, frequent disruption of irrigation water caused by the deteriorating irrigation infrastructure, increasing soil salinity problems, pest and diseases, and negligence by government and the private sector. As a result, the area under date palm in Iraq dropped from 160 000 ha in 1995 to 50 000 ha in 2005. It then increased to 140 834 ha in 2012 due to deliberate Iraqi Government and private sector efforts reflected in the National Development Plan 2010-2014 and the Agricultural Initiative 2007 objectives to revive the date industry and rebuild the date palm inventory up to 40 million trees in ten years, and introduce more marketable varieties and more and better processing and storage facilities. The total number of trees declined from 36 million trees before 1980 to 9.5 million trees at the turn of the current century, then increased to 17 million trees in 2016.

It is apparent from FAO statistics for 2016 (Table 2.1), as well as for the period from 2007 to 2016 (Figure 2.10), that Iraqi date palm production has been significantly larger than production in all other Mashreq countries. Iraq's production represented about 97 percent of date production in Mashreq sub-region while Jordan produced two percent and Syrian Arab Republic and Occupied Palestinian Territory each produced less than one percent.

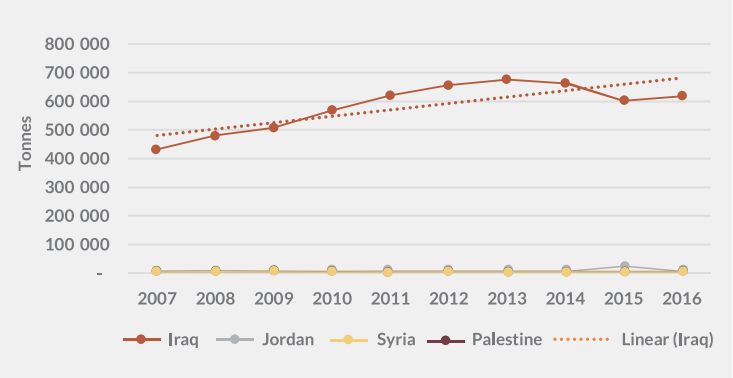
Table 2.1 Date production by the Mashreq countries.

Country	Production (2016)		Global Ranking	Global Share (%)
	(MT)	Sub-region share (%)		
Iraq	615 211	97	6	7.27
Jordan	13 401	2	25	0.16
Occupied PalestinianTerritory	3 479	0.5	29	0.04
Syrian Arab Republic	4 319	0.5	28	0.05

Source: Authors based on FAOSTAT data, 2018.

The trend in date production over the last decade (2007–2016) reflected in Figure 2.10 shows an increase in Iraq production from 430 861 MT in 2007 to 676 111 MT in 2013 and 615 211 MT in 2016. The range of date production in the other countries combined was 6 532 MT in 2007 to 20 011 MT in 2015, which almost tripled during this period. Date production for Syrian Arab Republic increased from 2 955 MT in 2014 to 4 373 MT in 2010 and was almost stagnant for Palestine ranging from 3 030 MT in 2007 to 3 479 MT in 2016.

Figure 2.10 Developement of date production in Mashreq 2007–2016.



Source: Authors based on FAOSTAT data, 2018.

In Iraq, date production is confined to the south and middle governorates and concentrated more in Baghdad (20 percent of total production), Diala (14 percent), Babel (16 percent), Karbala (13 percent) and Basra (five percent) which together produce about 68 percent of the national production out of more than 60 percent of the palm trees in the country. The Zehdi cultivar is the most dominant, accounting for more than half (55 percent) of the national production. Berhi is another important indigenous cultivar in Iraq. The statistics for dates production by type/cultivar during 2001 to 2016 also confirm the leading position of Zehdi but reveals clear variability in almost all six leading cultivars (producing more than 85 percent of national production).

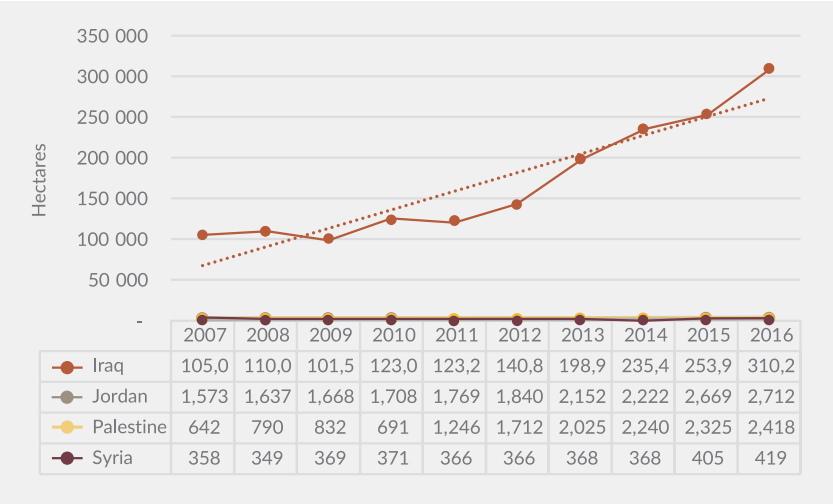
In Jordan, date production increased almost three times between 2007 to 2016 and the area planted with date palm increased from 1 840 ha in 2012 to 2 712 ha in 2016. According to the Ministry of Agriculture in Jordan, a total of 33 000 MT of dates are produced each year out of which 5 000 MT are exported to Europe and the USA (Jordan Times, 27 November 2017). The main date varieties include Medjool, Berhi, Sukari, Khalas, Maktomi, Hayani, Zaglool, Hallawi, Almar, Tallal, Zehdi and Deglet Noor. Mejdool ranked first and rapid expansion in its production is expected starting 2018.

Dates have been cultivated in Palestine for thousands of years but face severe problems with the Israeli occupation and their control of water resources. Nevertheless, date palm production showed some expansion during the last 15 years, and more recently in the West Bank and Gaza Strip. Production in 2015 reached 5 000 MT. Date farming is practiced by about 1 430 date palm producers (60 are women) in Deir Al Balah and Khan Younis, the main date areas in Gaza Strip. Hayani is the dominant variety accounting for almost 90 percent of all date trees in the country. Other varieties include Ameri, Berhi and Mejdool. The average yield is high, almost 150 kg per tree.

In Syrian Arab Republic, date production remained more or less stagnant ranging from 3 450 MT in 2007 to 4 319 MT in 2016. Most of the demand for dates in Syrian Arab Republic, estimated at 50 000 MT annually, was met by imports.

b) Areas: The development of dates harvested area in Mashreq countries is presented inFigure 2.11. It is apparent that the area in Iraq showed a steep consistent growth and almost tripled from 105 000 ha in 2007 to 310 243 ha in 2016. The date palm area in Jordan increased by 72.4 percent from 1 573 ha in 2007 to 2 712 ha in 2016. Similarly, in Palestine, the date palm area almost tripled from 642 ha in 2007 to 2 418 ha in 2016. The date palm area has been generally stagnant in Syrian Arab Republic during the indicated time period.

Figure 2.11 Date palm harvested area in Mashreq 2007–2016.

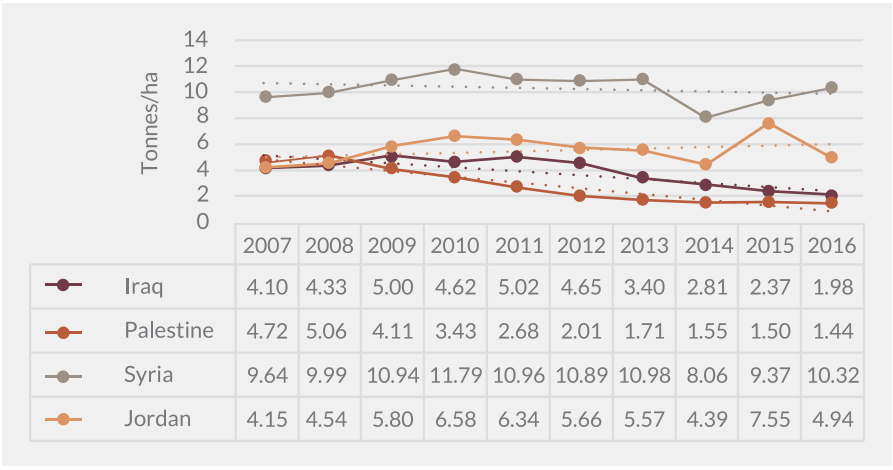


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Iraq	105,0	110,0	101,5	123,0	123,2	140,8	198,9	235,4	253,9	310,2
Jordan	1,573	1,637	1,668	1,708	1,769	1,840	2,152	2,222	2,669	2,712
Palestine	642	790	832	691	1,246	1,712	2,025	2,240	2,325	2,418
Syria	358	349	369	371	366	366	368	368	405	419

Source: Authors based on FAOSTAT data, 2018.

c) Productivity: The development in date palm productivity in the Mashreq countries is presented in Figure 2.12. Syrian Arab Republic has the highest productivity per hectare ranging from 8.64 MT in 2014 to 11.74 MT in 2016 with an average of 9.20 MT. Jordan date palm productivity showed a slight increase from 4.15 MT/ha in 2007 to 4.94 MT/ha in 2016 and a considerable jump to 7.55 MT/ha in 2015. In both Iraq and Palestine, date palm productivity showed a significant drop between 2007–2008 and 2015–2016, probably due to the poor security situations.

Figure 2.12 Date palm productivity (MT/ha) in Mashreq countries during 2007–2016.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Iraq	4.10	4.33	5.00	4.62	5.02	4.65	3.40	2.81	2.37	1.98
Palestine	4.72	5.06	4.11	3.43	2.68	2.01	1.71	1.55	1.50	1.44
Syria	9.64	9.99	10.94	11.79	10.96	10.89	10.98	8.06	9.37	10.32
Jordan	4.15	4.54	5.80	6.58	6.34	5.66	5.57	4.39	7.55	4.94

Source: Authors based on FAOSTAT data, 2018.

The GCC Sub-region

The GCC sub-region is composed of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. Date palm is ranked by the GCC countries as the highest priority strategic fruit tree[3] and has until now received special attention by governments. About 82 million date palm trees are grown in the GCC region, the largest number of date palm trees compared to other Arab sub-regions.

[3]A priority setting exercise for agricultural research done in 2002 (ICARDA, 2004).

a) Production: Date production in the GCC countries in 2016 accounted for nearly one third of the total production of dates in the Arab world (6 305 300 MT). The development in GCC production over the ten year period from 2007 to 2016 is shown in Figure 2.13. It is apparent that date production in the Saudi Arabia (45 percent of the total sub-regional production of 2 122 939 MT) is way above the production of other GCC countries (Table 2.3) despite having only 28.5 million trees, and is followed by United Arab Emirates with 32 percent of production and 42 million trees. Production in the Saudi Arabia was more or less consistent, averaging 970 000 MT during the referenced ten-year period, except for the sudden drop from a production level of 1 095 000 MT in 2013 to 760 100 MT in 2014. Production in United Arab Emirates has more than tripled in the five years from 2012 to 2016 (Figure 2.13) after the sudden drop in production in 2010 to 2011. Kuwait has almost tripled its date production from 29 600 MT in 2007 to 98 366 MT in 2016. Oman has shown a significant increase in date palm production of 36.3 percent in the reference ten years period. Qatar's date production was stagnant from 2007 to 2012 then an increase of about 25 percent was recorded starting 2013. The production in Bahrain has been more or less stagnant with relatively low production averaging 12 000 MT during the ten-year period. Table 2.3 also presents the global ranking of the GCC countries.

Table 2.2 Ranking of GCC countries with respect to annual dates production.

Country	Production MT	Share % of Sub-region	Global Ranking
Bahrain	10 627	1	26
Kuwait	98 366	5	14
Oman	348 642	16	9
Qatar	28 877	1	19
Saudi Arabia	964 536	45	4
United Arab Emirates	671 891	32	5

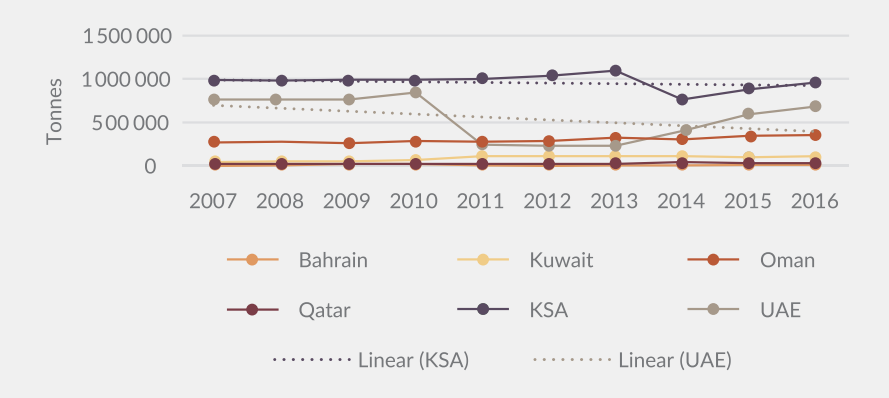
Source: Authors based on FAOSTAT data, 2018.

The production in the GCC sub- region is dominated by Khalas variety, which is cultivated in most of the GCC countries and represents 26 percent of the number of date palms in Saudi Arabia. There are other commercial varieties but grown at less extent such as Sukkari, Sagae, Nabut Seif, Ajwa, Lulu, etc.

b) Area: Trends in total area under date palm cultivation in the GCC countries from 2007 to 2016 are presented in Figure 2.14. The annual harvested area in Kuwait, though small compared to the Saudi Arabia , United Arab Emirates and Oman, has more than doubled during the reference ten-year period, and in Bahrain and Qatar increased steadily by 66.7 percent and 89.6 percent, respectively. A significant drop in area under date palm in Saudi Arabia from 2013 to 2014, is followed by a marked increase, with no clear explanation, except probable data misreporting. However, the date palm area in United Arab Emirates showed a clear increasing trend in the five years period from 2012 to 2016 but still did not reach the level of 2007. The area under date palm has been declining in both Saudi Arabia and Oman as shown in Figure 2.14; the decline was about seven percent in Saudi Arabia and 26.3 percent in Oman in the ten-year period. The factors contributing to this decline may include water scarcity and salinity particularly in the coastal areas of Oman.

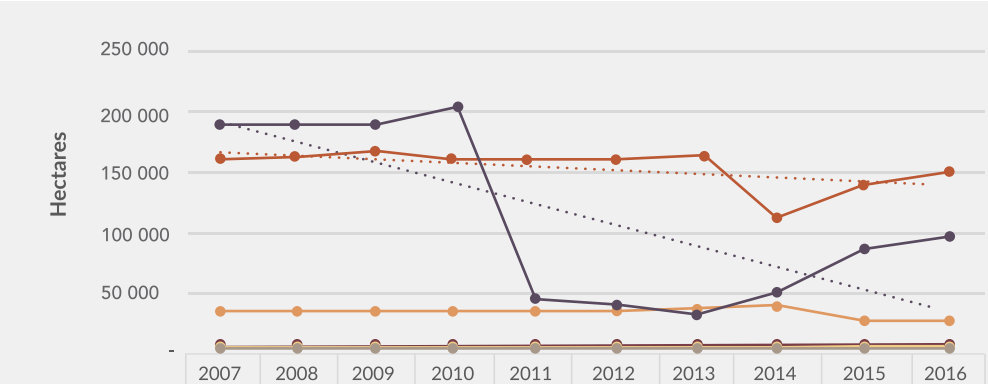
c) Productivity: Except for Bahrain, all GCC countries have date palm productivity higher than the average for all Arab countries that ranges between 6.47 MT/ha in 2012 and 7.09 MT/ha in 2016 as shown in Figure 2.15. Kuwait has the highest date palm productivity, four to five times more than that of other GCC countries. Kuwait date palm productivity showed significant increasing trend ranging from 18.7 MT/ha to 48.2 MT/ha during the period from 2012 to 2016, and is comparable, in recent years, to the productivity of Egypt, the highest among Arab countries. However, date palm productivity in Kuwait showed a sudden jump in productivity in 2011 that cannot be explained and a significant 30.6 percent decrease from 2012 to 2016. Despite the low date productivity in Bahrain, a significant decreasing trend could also be observed with a drop of 44.7 percent in productivity during 2012 to 2016. Significant increasing trends in date palm productivity per hectare were recorded in Oman and United Arab Emirates with 85.9 percent and 75.6 percent, respectively. Saudi Arabia is the only GCC country in which date palm productivity was more or less stagnant from 2007 to 2016. Qatar showed a slight decrease in productivity.

Figure 2.13 Developement in date productionn (tonnes) in GCC counntries 2007–2016.



Source: Authors based on FAOSTAT data, 2018.

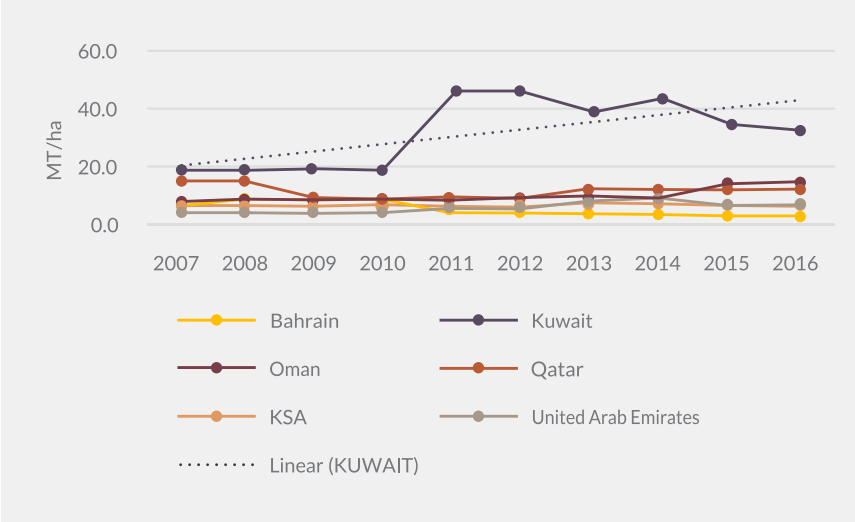
Figure 2.14 Developement in date palm area in GCC counntries from 2007–2016.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bahrain	2 102	1,500	1 510	1 545	2 336	2 750	3 071	3,388	3 688	3 986
Kuwait	1 583	1 549	1 584	1 765	2 277	2 411	2 672	2,664	2 741	3 021
Oman	32 746	31 353	31 353	31 353	31 348	30 826	34 195	36,255	24 120	24 120
Qatar	1 444	1 400	2 237	2 469	2 366	2 477	2 599	2,290	2 300	2 407
KSA	155 734	157 074	161 975	155 118	156 023	156 848	156 901	107,281	135 119	145 516
UAE	185 330	185 330	186 000	197 400	41 159	38 233	30 148	45,511	85 081	93 561

Source: Authors based on FAOSTAT data, 2018.

Figure 2.15 Date palm productivity (MT/ha) in GCC Countries during 2007–2016.

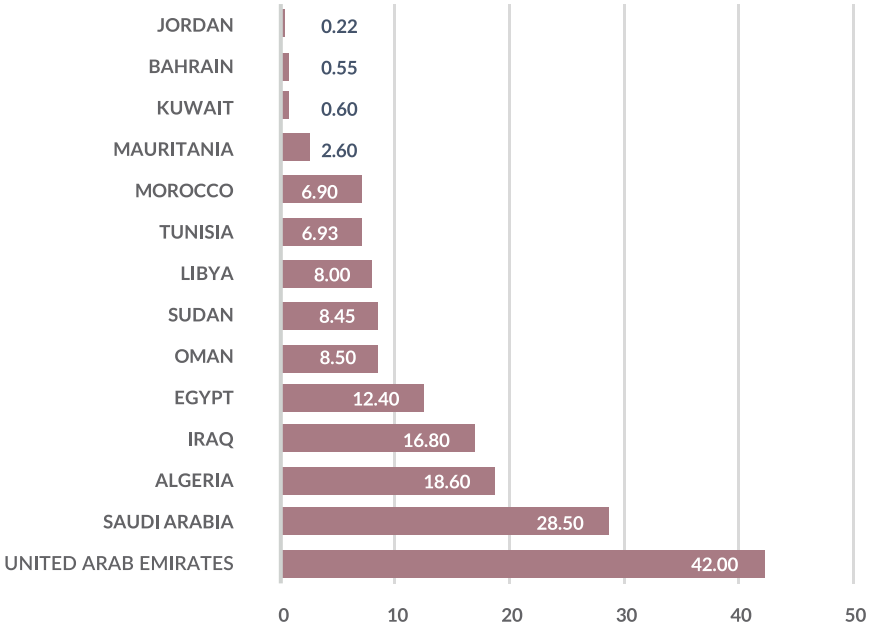


Source: Authors based on FAOSTAT data, 2018.

2.4 Production systems and management

a) Date palm population: Date palm farming in NENA expanded enormously since the turn of the current century. Accurate and up-to-date statistics on the number of trees and their evolution in each country are difficult to obtain. However, available statistics put the total number of trees in the region at more than 150 million (statistics for main date producing countries are provided in Figure 2.16). These statistics do not reflect the current level of production since a good number of trees are still young and unproductive, but, nonetheless signal an expanded supply in dates to be realized in the near future. The statistics also reflect on the magnitude of horizontal expansion taking place in date farming in the region, despite the alarming natural resource limitations, as illuminated in Chapter 3.

Figure 2.16 Number of date palm trees in select NENA countries in 2016 (million).



Source: Authors based on data from multiple sources, 2018.

b) **Farming systems:** Date palms are planted under two main systems in NENA; traditional and more modernized. The traditional system is the dominant and most wide spread, but the more modernized commercial plantations are expanding in almost every country in the region.

The traditional date palm farming system is based on family labour and is characterized by the small size of holdings with dense planting of mixed date palm trees of varying ages, including high proportion of aging trees. Date palms are often intercropped with fodder and vegetable crops and occasionally with fruit trees to benefit from the irrigation water and bring in additional income to the household. The system is also based on flood irrigation, low input use and some outmoded husbandry practices.

Modern farming, on the other hand, is based on raising high quality and popular date varieties in large holdings, which use advanced production practices including modern localised irrigation systems and adequate proven inputs. The well-spaced and organized palm trees facilitate human and machine manoeuvring and enables efficient and timely conduct of the varied farming operations. The system is based on hiring skilled labour and often highly qualified management in the large modern plantations.

Slowly growing within dates modern farming is organic farming for which international demand has been increasing in the last decade (CBI Market Information Database). Little information is available on the extent of organic farming in the date sector in the Arab region, but it is generally known that Tunisia and Saudi Arabia are pioneers in production and trade of organic dates. The total area planted with organic date palm was estimated at 2 503 hectares in Saudi Arabia. Tunisian production in 2011 was 6 000 MT of organic dates of which 4 000 MT (67 percent) was exported (68 percent of this went to Germany, 11 percent to the United States and 7 percennt to Morocco) (Lindhout, 2012). In the Sudan, there are sizeable areas under organic "by default" production of date palm. The use of organic farming practices in the date production is an added value to the date quality and also helps in entry to new markets mainly in the European Union where the demand for natural and healthy food is increasing.

c) **Cultural practices:** The main inputs in date palm farming include offshoots and plantlets, irrigation water, pollen grain, organic and inorganic fertilizers, pesticides, fuel (for water pumping and for mechanization), machinery and labour. The major common cultural practices followed include:

Irrigation: Water requirements for date palm production is high (see Table 3.2 in chapter III) despite its good drought and high salinity tolerance. Paradoxically, in view of the limited water resources in the Arab region and the burgeoning cost of fuel, flooding (basin) irrigation, which is highly inefficient in water use, is dominant, especially in the traditional date palm farming system. The use of modern localized irrigation systems such as drip, bubblers and subsurface irrigation is expanding in some countries thanks to generous government support.

Fertilization: Date palm trees respond well to both organic and chemical fertilizers particularly in sandy soils. Their rate of application diverges widely between the systems and also between individual farms. The general practice in modern date farming systems, however, is for nitrogen fertilizers to be added at the rate of 1.0 to 2.5 kg/tree/year. Phosphorus and potassium fertilizers are added at the rate of 0.5 and 1.5 kg/tree/year, respectively. Organic fertilizer is often applied in the form of cattle and poultry manure. Phosphorus, potassium and manure are usually added in November and nitrogen in January, March and May.

Pollination: The operation is carried out during the flowering season in February and March. Most of the farmers in the Arab region use the traditional method, which is based on manually inserting two to three male strands into the female flower cluster. In some small traditional farms, date palm trees are not pollinated manually because of the high cost of skilled labour and rely on wind pollination, which usually negatively affects tree productivity and fruit quality. More advanced mechanical pollination is performed in some of the large modern farms, especially in the GCC countries, and is practiced in one of two ways. The first through a duster with long pipe, which conveys the pollen of male flowers mixed with white soft flour in 1:9 ratio to female flower cluster. This process is applied three to four days after female flower opening and is repeated for up to four times in a time span of up to 30 days. Dry pollen protected from extreme heat remains viable for two to three months, and up to the next season if sealed from humidity and stored at -180C. The other method is through liquid pollination, which conveys a mixture of pollen grains of selected males through a water jet from a pipe hose to the flowering strands of female trees. Both techniques save time, reduce the quantity of pollen needed and cost of labour and pollen and improve fruit set, in addition to reducing risk to labour associated with climbing and working on high trees.

Thinning: Fruit thinning in date palm is essential to ensure high quality date production and control alternate bearing. The earliest flowers are usually the largest and the most vigorous, thus removal of later flowers retains the optimum number of flowers for high quality and high quantity of production. Two techniques for thinning are followed in the Arab region including:

a) Cutting off weak bunches after ensuring the success of pollination, which ontributes to higher quality fruits as a result of less fruits per tree.

b) Cutting off strands; cutting about one third of the upper portion of flowering strands at pollination and about one third to half of the fruiting strands after ensuring the success of pollination in setting fruits. The operation has the advantage of improving the plumping and puffiness of the fruit, which improve quality and reduce the weight of the fruit bunch andthe associated risk of breakage as a result of heavy weight. The earlier the thinning is done the more its effectiveness.

Thinning is followed by bunch management activities including bunch bending and covering with appropriate nets to protect fruits from insects and birds attack as well as dust.

Pruning: the common practice in Arab countries involves:

- cutting off lower fronds or palm leaves/branches twice a year at pollination and curvature;
- cutting off the base of the fronds when the tree is mature (after four years) in winter and in the autumn;
- removing off the spines from all leaves, bunch holders and pollen coats from previous season;
- removing off shoots for varietal multiplication and pruning and discarding of others.

Pest Control: depends mainly on the use of chemicals but Integrated Pest Management (IPM) is expanding all over the region. Transboundary menaces are spreading and causing a lot of damage, especially the Red Palm Weevil (RPW), and the Bayoud fungal disease. Other important pests and diseases include the Green Scale Insect, Black Scorch, Blights, Dubas bug, Diplodia and Lesser Moth. Fungal diseases are controlled in the region by spraying fungicides and the Dubas bug by insecticides and Neem extract. The GCC countries have invested lots of resources to control the RPW which still remains a serious problem in all these countries.

2.5 Post-harvest handling

Date post- harvest handling differs depending on the timinig of ripening of the different date varieties. Date can be harvested at the khalal or Bisr (yellow or red, with 50 - 85 percent moisture conntent), Rutab (partially browned, with 30 – 45 percent moisture content) or Tamar stages (amber to dark brown, with 10 – 25 percent moisture content). Post-harvest handling includes sorting, fumigation, washing, drying, grading, packing of the whole, storage, and transportation.

Most of the commercial date varieties produced in the Arab region are harvested as Rutab, semi-dry dates (Sukkari, Sagai, Medjool, Deglet Noor) or dry dates (Kentichi, Bouskri, Gundiela, Barakawi). The harvesting is done manually by picking individually ripened dates and, in some cases, the whole bunch.

Experience in most date producing countries showed that a well mature Rutab, handled with care, is one, if not the most, appreciated form in which the dates are consumed, and which gives the grower the highest rate of return. However, semi-dry dates are perishable and very sensitive to temperature variation. Therefore, they must be handled with care in order to avoid damage.

The traditional date palm plantations in the Arab region are usually in isolated areas far from the principal date markets. In these areas post-harvest handling is done manually and most of its activities are practiced in a traditional manner such as sun drying of fruit in the open air. Dates should be stored in clean, cool, and dry condition to prolong their shelf life and reduce post-harvest losses. Dates require controlled temperature, moisture and ventilation conditions after harvest and throughout the supply chain to the final consumer in order to preserve favourable qualities, and to minimise pest infestations. Transportation and storage at low temperature plays an important role in preserving fruits quality since it maintains colour and minimises loss of texture and flavour. It also helps in controlling insect infestation and sugar spotting. At temperatures below 10°C, mite growth is inhibited, and temperatures above 25°C promotes the formation of syrup and fermentation. The fruit must be transported in the early hours of the morning to avoid the heat; if the distance is great, refrigeration during transport is necessary to maintain optimal quality.

In the Arab region most of the date packing houses are traditional or semi-modern, and do not meet international sanitary and phytosanitary standards. Large commercial farms and exporters tend to use modern packing houses. With the introduction of cold storage in date palm cultivation areas, cold storage has been gaining popularity as it improves quality, reduces losses, and allows for dates consumption at any time of the year (Aleid *et al*: 2014). However, cold storage throughout the supply chain is much more common in modern farming systems, particularly those where production and processing is vertically integrated. There are significant challenges to maintaining the cold chain in traditional farming systems. It is not typical for smallholder farmers and rural aggregators to have temperature-controlled storage and transportation facilities. Higher quality dates for export markets necessitate adequate cold storage, whereas table dates, particularly for domestic, regional and Asian markets do not demand the same conditions. Increased capacity in cold storage will be necessary for countries to expand their exports of dates of high value European and US markets.

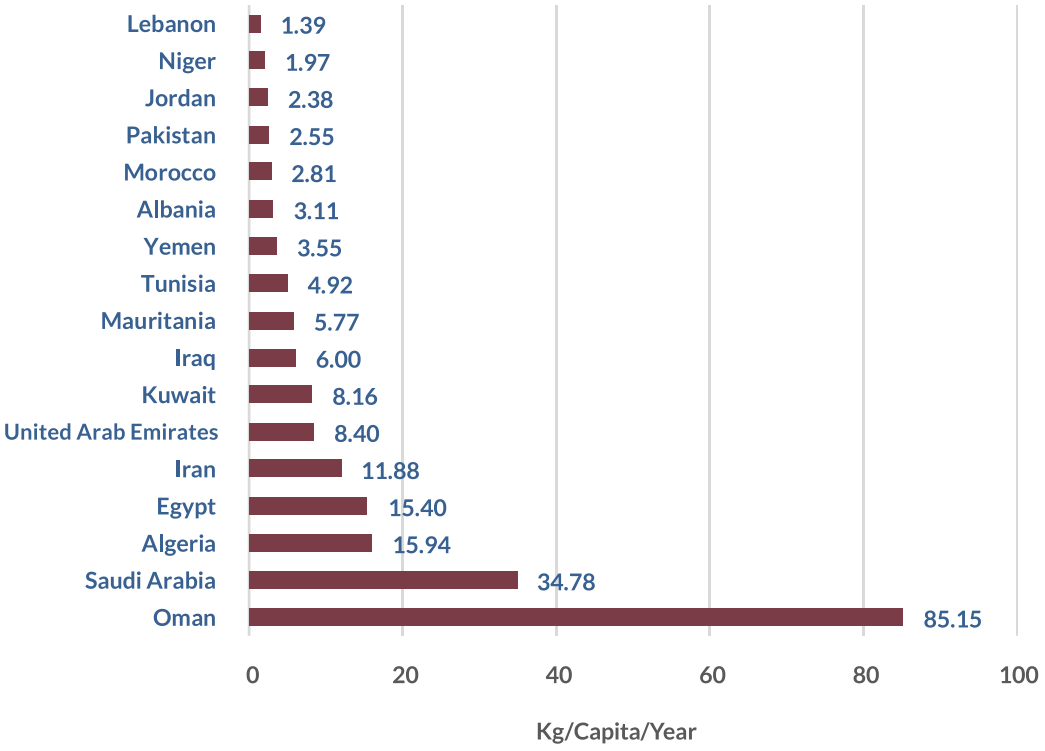
2.6 Processing

Aside from the marketing of fresh and semi-dried dates, they are also traditionally processed to prepare a wide range of products such as syrup, paste, sugar, vinegar, and alcohol. Dates are also combined with other natural products such as almonds, nuts and chocolate as coatings of fillings. Date pits are used as animal feed, and date palm waste is used for the production of compost and creation of handicraft products (furniture, baskets) and feed blocks for livestock. Most countries in the Arab region are investing to varying extents in the creation or processing units in the date-producing areas.

2.7 Consumption

The Arab countries vary widely in their per capita date consumption, as is apparent in Figure 2.17. Average per capita consumption of dates over the period from 2007 to 2011 ranged from 85.2 kg/person/year in Oman to 1.4 kg/person/year in Lebanon. Oman greatly outpaces all Arab countries in per capita dates consumption, which is more than double that of the Saudi Arabia , the second highest ranking in date consumption among Arab countries. The per capita date consumption for the other countries is lower. It is less than five kg/person/year in five countries, and between 5 and 10 kg/person/year in four other countries. The top four Arab countries in per capita date consumption include Oman (85.2 kg), Saudi Arabia (34.8 kg), Algeria (15.9 kg) and Egypt (15.4 kg); while the lowest Arab countries in annual per capita date consumption include Lebanon (1.4 kg), Jordan (2.4 kg), Morocco (2.8 kg) and Yemen (3.6 kg).

Figure 2.17 Dates annual consumption of select countries for the period 2007–2011 (kg/ Capita/ year).



Source: Authors based on data from multiple sources, 2018.

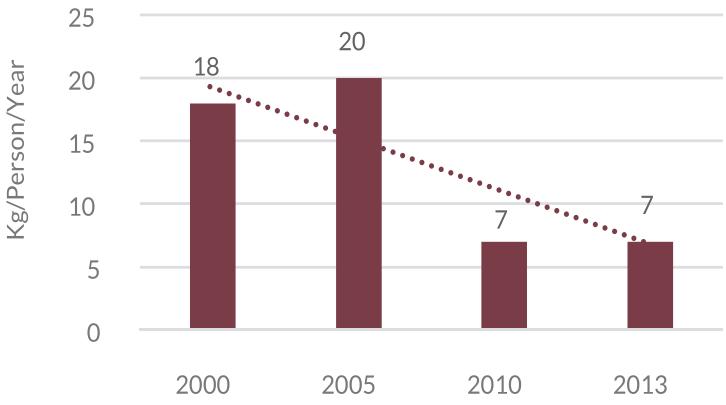
Date consumption in the whole of the Islamic world peaks in the Holy month of Ramadan since Muslims all over the world break their fast with dates. In this month 250 000 MT are consumed in Saudi Arabia , equivalent to one quarter of its annual production of about one million MT of dates (Bob, 2018). Another peak of consumption is during the annual Pilgrimage Holy Days observed by millions of Muslims from all over the world. Considering its high nutritional value, Saudi Arabia also donates large amounts of dates to hunger-stricken countries through the World Food Program of the United Nations (WFP, 2009).

In addition to being low, the per capita date consumption is also declining in most of the Arab countries. This is particularly the case since the young generation have reduced their consumption considerably as was shown by a study conducted by Baraem, *et al* (2006) on date consumption and dietary significance in the United Arab Emirates. Adult consumption of both sexes and different age groups (18 – 30 years and 30 – 60 years) and occupations (students, workers, at home) were surveyed to get information on the daily consumption of six date food groups (Rutab, Tamar, Sh, Debbs, Batheeth and Madlouj). The most consumed date food groups were Rutab and Tamar, with Rutab more frequently consumed than Tamar during the summer season. No major differences were found in the daily date consumption between males and females and between employed and home-based consumers as well as between students and individuals of 18 – 30 years group. On the average, daily consumption was 114.3 g (41.2 kg/person/year) which is equivalent to ten date fruits per day. However, the study showed that the younger population does not consume dates as much as the older generation.

The declining trend in date consumption has also been observed in most GCC countries including United Arab Emirates, Oman and Saudi Arabia from 2000 to 2013 as indicated in Figures 2.18, 2.19 and 2.20, respectively.[4]

The steepest decline is in the United Arab Emirates with a reduction in per capita consumption of about 63 percent from an average of 19 kg/person/year over the years 2000 and 2005 to 7 kg/person/year over 2010 and 2013. The reduction in annual per capita date consumption in Oman was 13.5 percent, from 88.5 kg to 76.5 kg for the two periods, and was 6.9 percent, in Saudi Arabia, from an average of 36 kg during 2000–2005 to 33.5 kg during 2010–2013.

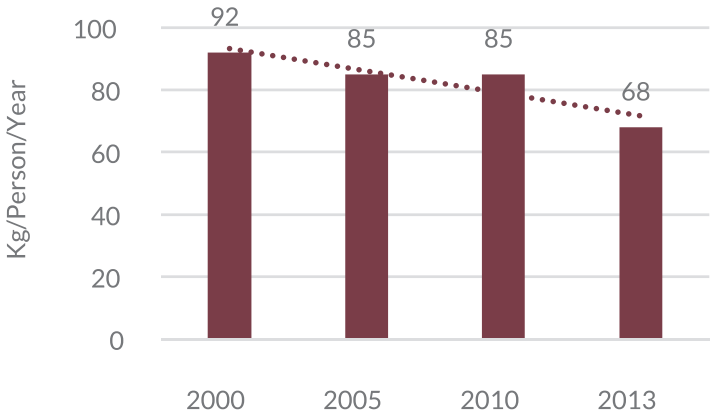
Figure 2.18 Per capita date consumption from 2000 to 2013 in the United Arab Emirates.



Source: Authors based on data from multiple sources, 2018.

[4]https://www.statista.com/statistics/827093/uae-per-capita-consumption-of-dates/

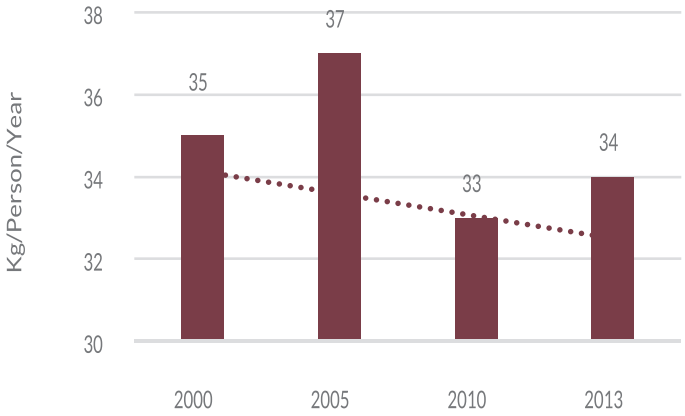
Figure 2.19 Per capita date consumption from 2000 to 2013 in Oman.



Source: Authors based on data from multiple sources, 2018.

Considering the significant declining trend in per capita date consumption, particularly with the young generation who dominate the Arab region and who do not put dates high in their food menu, drastic action is needed to promote local and international consumption of dates and to avoid mounting surpluses.[5] It essential to increase the demand for dates in both local and export markets through developing national, regional and even international campaigns on the nutritional and health value and benefits of dates. There is a lot to learn from the very rapid expansion of quinoa in the world market only because of its nutritional value, while dates have many similarly desirable traits.

Figure 2.20 Per capita date consumption from 2000 to 2013 in the Saudi Arabia.



Source: Authors based on data from multiple sources, 2018.

[5]The surplus in Saudi Arabia in 2010 reached about 400 000 MT of dates and is expected to reach 600 000 MT by the year 2022.

3 Principal end-market opportunities for date palm

Dates produced in the Arab region reach three key markets: local, regional and international. The types of local and export end-markets that the region can reach directly affects the prices that dates can be sold at, as well as the levels of profitability and performance of the entire date value chain. Each of these markets face specific challenges for producers, traders and processors, but opportunities exist to increase the profitability and capture a greater share of those markets for Arab region value chain actors.

3.1 Local markets

In most of the Arab date producing countries, date production is sold to local markets, with a small proportion made up of surplus production sold to export markets. Local markets are, by and large, characterised by long marketing chains saturated with a series of unnecessary intermediaries which results in high marketing costs and low returns to farmers. Many of the local date varieties fetch poor prices given their low quality and the poor traditional forms in which they are offered at both wholesale and retail levels. Local markets generally do not reward the producer for quality differentiation, indicating a supply/production-driven value chain where consumer preferences are not priced.

Marketing of dates is largely driven by the private sector, without government intervention. Dates may be sold on the tree in advance through auctions, as in case of Egypt, Palestine and Saudi Arabia, or the whole crop may be sold in advance at a specific agreed price as the case of the "shail" system in the Sudan. In most cases the harvested crop is sold either in local markets near their dwellings or to collectors and assembly agents such as agents or brokers buying on behalf of wholesalers, processors or big city retailers selling on behalf of farmers.

In general, the assembly agent is the principal link to the market, and they handle most of the harvest in the region. The assembly agent is also the main intermediary between producers and other components of the value chain. In some countries, such as Saudi Arabia, Palestine and Iraq, the collector may be replaced by the trader (locally called Dalal) who plays a key role in local marketing.

A minority of farmers sell directly to wholesalers, processors, exporters and retailers. The wholesalers usually sell to retailers, exporters and processors. The processors sell either indirectly through wholesalers or directly to retailers, exporters and some of them export directly. Large-scale modern producers usually sell large quantities directly to wholesalers, retailers, exporters and processors.

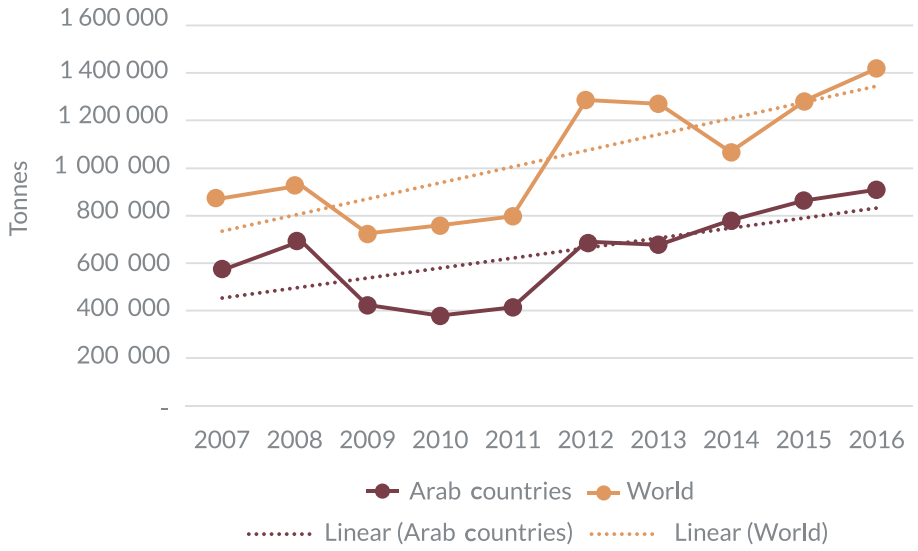
3.2 Regional markets

There is an important regional trade of dates among countries in the region. For example, in 2016, United Arab Emirates imported 213 820 MT, Morocco imported 69 324 MT and Oman imported 10 557 MT (Table 1). These countries are date producers, and yet were importers of substantial volumes of dates, primarily sourced from other countries within the region. Demand in these regional markets is driven by two factors. Firstly, it meets domestic demands, filling a gap that local production is not able to satisfy. Morocco is one such example. Secondly, raw dates are demanded by processors for value addition before exporting, and in some cases are packed and re-exported without further processing. Oman and United Arab Emirates are examples of those types of regional markets.

3.3 International markets

Exports of dates from the Arab region constitutes the majority of global date trading. The total quantities of dates exported by Arab countries in 2016 was 957 084 MT with an average price of 1 456 US$/MT; (Figure 3.1).

Figure 3.1 Dates exported trend for the period 2007–2016.



Source: Authors based on UN Comrade, Trade Statistics (2017).

The quantities of dates imported by the main date trade partners to the Arab countries has fluctuated in recent years (2012-2016), but India clearly ranks first followed by the United Arab Emirates, Morocco and France (see Table 3.1). The dates that are imported by the Asian importing countries are table dates, which are usually marketed unprocessed, while that for European markets are mostly processed dates. European and US markets demand higher quality, impose stricter regulations, and are prepared to pay a premium, particularly for organic products.

Table 3.1 Annual imports of main date importing countries (MT).

Country	2012	2013	2014	2015	2016
India	247 300	311 575	337 208	314 477	350 022
United Arab Emirates	241 940	224 283	247 596	203 609	213 820
Morocco	58 401	47 372	61 834	69 500	69 324
France	28 373	32 102	29 552	32 661	33 925
Indonesia	22 558	29 111	30 531	21 053	23 228
Malaysia	20 394	19 421	21 620	18 869	18 869
United Kingdom of Great Britain and Northern Ireland	1 250	16 042	19 888	19 679	19 963
Germany	10 941	11 801	13 444	17 053	17 671
Oman	4 696	9 129	10 612	12 804	10 557

Source: Authors based on UN Comrade, Trade Statistics (2017).

Regarding the volume of dates exports from the Arab countries, United Arab Emirates ranked first, followed by Tunisia, Saudi Arabia and Egypt in the last quinquennial (see Table 2). Although United Arab Emirates dates exports declined with a negative 2 percent annual rate during the period 2012-2016, in comparison with other major countries in the region and even with other world exporting countries such as Iran and Pakistan, it has ranked first and achieved the highest record of dates export. The average yearly export from United Arab Emirates is approximately 295 000 MT (Table 2). The date exports from the Saudi Arabia, (mostly table dates) have shown an increasing trend with annual average growth of 20 percent in the last five years. Tunisian date exports, which are of high quality (for example, the Deglet Noor variety), grew slightly during the same period with a 4 percent annual average growth rate. While smaller in volume than the exports of United Arab Emirates and Saudi Arabia, Tunisia is a key export country in the region because of the volumes and the quality of its dates.

Table 3.2 Volume of dates exports from main exporting countries and average export prices

Country	Volum of exports (tons)		Average export price (USD/ ton)	
	2012	2016	2012	2016
United Arab Emirates	304 091	275 863	425	580
Israel	220 131	223 343	2 505	2 113
Pakistan	220 131	246 076	470	690
Iran (Islamic Republic of)	138 537	209 461	1 310	1 000
Saudi Arabia	64 299	116 993	1 160	1 210
Tunisia	101 119	113 794	1 910	1 680
Iraq	39 230	187	306	303
Egypt	11 282	19 478	2 459	2 114
United States of America	2 291	2 719	6 206	2 113
Algeria	20 438	31 109	1 282	1 205
Jordan	2 704	5 612	2 052	2 312

Source: Authors based on UN Comtrade, Trade Statistics (2017)

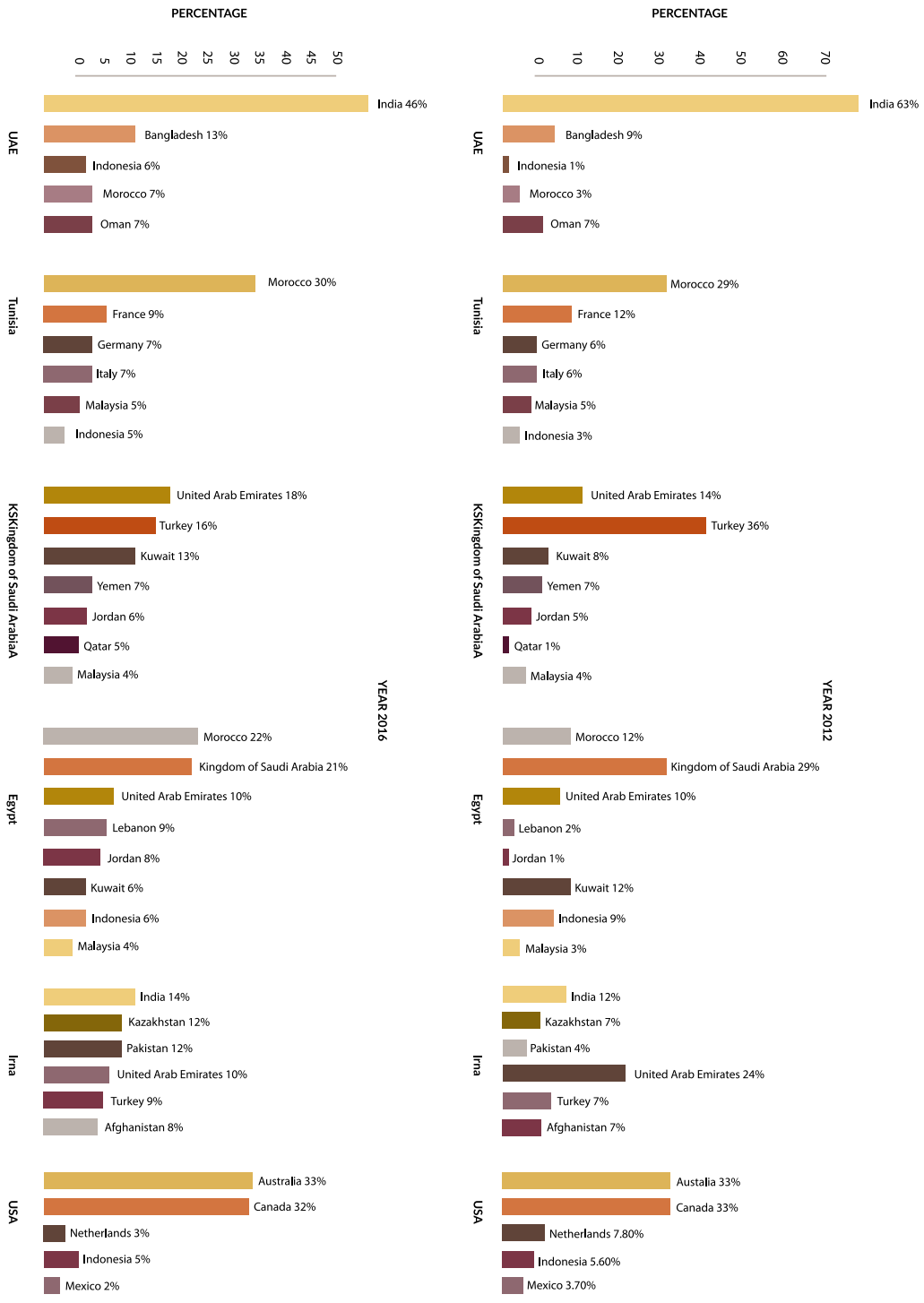
Countries that have succeeded in expanding exports have invested in a conducive enabling business environment. Tunisia is a good showcase as it has a solid commercial dates industry, which is the result of a production system which cares about market requirements, and well-established marketing institutions which set standards to meet international demand and special requirements for the target markets. In the case of countries like Saudi Arabia, the industry is yet to be more organised and the commercialisation of the date value chain is still recent.

There is a need for each producing country to develop a marketing strategy to increase farmers' income, reduce harvest and post-harvest losses, reduce unnecessary marketing costs and assist in minimising surpluses. The strategy should also include solutions on how to collect produce from small scattered farmers, reduce unnecessary lengthy marketing chain, how and where to develop cold storage, how to reduce the cost of marketing and which cost to be reduced first, how to introduce and establish processing and manufacturing of dates. The national strategy is also needed to determine quantities and qualities required by consumers internally and externally, which and how to establish local variety grades and standards, how to advertise and promote products, and how to respond and enhance consumer demands and quality standards locally and internationally in terms of varieties, grades, and timing.

The trends emerging from the dynamics of the global food industry suggest that the demand for high valued food products such as dates will be strong, and especially for the products of organic farming. Given such a potential, it is imperative to translate date palm production improvements to the market level through increased investment and integration with processing and marketing functions, both at the domestic and international levels. Knowledge and practice should sufficiently be improved on quality control and food safety and on international regulation and standards. Equally well is the adequate promotion and advertising in both national and international markets and branding for exportable varieties and targeted campaigns to high income consuming countries for increasing imports and consumption of dates. Such and other investment for improved technical and marketing competence would raise the quality of processed dates, increase competitiveness of the date industry and improve its overall value chain efficiency.

Date export prices have greatly varied between the main world exporting countries according to the trends in volumes of production and reflecting the types of markets that the country can access according to the quality of their dates. An aspect which stands out in Table 3 is the fact that the average price received by Egypt, Tunisia and Saudi Arabia are substantially higher than that of other Arab countries like the United Arab Emirates and Iraq, and even higher than other countries out of the Arab region such as Iran and Pakistan. This seems to underscore the ability of these countries to access higher value date markets, such as the European Union one, which premiums higher quality dates. The rest of the countries in the region are exporting to lower value markets in countries like India, Bangladesh and some countries in the NENA region.

Figure 3.2 Market share of date exports



Source: Santos Rocha, J., El-dukheri, I. and Impiglia, A. 2018. Date Palm Value Chain Development in the Arab Countries: Key Constraints and Opportunities. Paper presented in the Sixth International Date Palm Conference (SIDPC), Abu Dhabi, UAE.

As indicated in Figure 4, major dates exporting countries trade their dates to a number of countries, with India absorbing more that 63 percent of the exports from the United Arab Emirates, Morocco more than 29 percent of exports from Tunisia, Turkey more than 36 percent of exports from Saudi Arabia , while Saudi Arabia imported more than 29 percent of exports from Egypt. The United Arab Emirates is a major importer of dates, accounting for more than 24 percent, 14 percent and 10 percent of dates sourced from Iran, KSA and Egypt, respectively. The European Union market, which offers a great opportunity for countries in the region to increase the value of exports, has only been explored by Tunisia. This seems to explain why the average price of exports of dates from Tunisia is higher than most countries in the Arab region. The fact that India takes almost two thirds of the exports from United Arab Emirates also seems to correlate with the low average prices that the United Arab Emirates gets on their exports.

In summary, there are significant marketing opportunities for dates in the local markets, in dates importing countries in the region, and in the world market. These markets, especially the export ones, are constantly expanding and increasingly becoming a pull force for countries in the region to address their internal and regional issues, which affect the productivity, quality, costs and access to demanding requirements in the international markets. There are great opportunities in high value markets such as Australia, European Union and Canada, which could represent a rapid increase in the value of dates exported from the region. Likewise, other less demanding lower quality markets (India, Indonesia, Bangladesh, etc.) could also help to expand the volumes of date exports from the region, especially from countries like Algeria and Iraq.

4 Principal constraints limiting the development of the date palm value chain

4.1 Introduction

The sustainable development of the date palm value chain in the Arab region – from production through post-harvest handling, processing and internal and external marketing of dates – is influenced by a multitude of strategic drivers, hereinafter referred to as challenges, which are a great cause of concern. At the same time, ample opportunities exist to develop the date palm value chain over the medium-to-long term. These challenges and constraints that are the most pertinent to date palm value chain in the Arab region are discussed in this chapter.

4.2 Production

Farming systems
The operational efficiency of the farming system is of paramount importance in the sustainable profitability and efficiency of the system. The review in Chapter 2 outlined the prevalence of two main date palm farming systems in the Arab countries; the traditional and the modern commercial systems. The dominant traditional system is characterized by a large number of small-scale orchards (less than 0.5 Ha), which are densely and irregularly planted with mixed trees of various cultivars and different ages, and excessive flood irrigation. Most farmers plant an intercrop under and among date palm trees growing mostly fodder and vegetable crops. Some of the traditional farms in various locations in the Arab region, but more so in GCC countries, are maintained and run for social, subsistence and recreation purposes. The traditional system is mainly based on family labour and occasionally on hired unskilled labour.

Modern commercial farming is also evolving in almost all countries in the region especially with respect to export-orientated production as in Tunisia and Algeria, and most recently in Egypt, Morocco, Jordan and Occupied Palestinian Territory. Large modern date palm farming is also advancing in the Saudi Arabia , United Arab Emirates, Iraq and the Sudan. Most of the recent expansions are characterized by a restricted diversity in planting high yielding and quality varieties (notably Barhi, Medjool, Ajwa, Sukkari and Deglet Noor), appropriate planting density of 100 to 150 date palms/ha, regular spacing of trees, increasing use of mechanical power and efficient pressured irrigation systems and effective postharvest handling. The commercial farming system depends mainly on both long-term skilled and casual hired labour.

Land tenure
Land tenure and title to land poses special difficulties with investments of long-term nature as in the case of date palm production. Fragmentation and multi-ownership of date palm holdings with inheritance laws extends beyond land to also include the date palm trees planted on it and their resultant fruits. Complications arise when some inheritors refuse to replace the inherited aging trees or the ones with inferior date variety and low production as these trees bring them some benefits without putting any extra expenses. These attitudes accentuate the situation of replacing aging and unproductive trees, which continues to bedevil the modernisation of the date palm farming systems and results in their negligence and consequently their low productivity and low farmers' remunerations.

Plant production and transplanting
Off-shoots propagation of date palm is the commonly used practice all over the region, particularly with traditional varieties. However, sufficient transplants of high quality varieties are often not available due to the limited nurseries producing certified desirable commercial varieties, which are often costly. The lack of required skills in transplant detachment and management in the nursery further accentuates this situation. Equally important is the uncontrolled internal movement of off-

shoots without passing by quarantines to check for pests and diseases. It has also been reported in some countries that some of the imported transplants do not often meet the appropriate quarantine measures, and these measures are not even in place, in some situations.

Tissue culture for large scale multiplication of high quality date palm is spreading all over the region, though techniques and facilities to ensure that the developed plantlets are really true to type from the genetic view point are still lacking in some countries and inadequate or insufficient in others. This is due to limited qualified personnel and institutional capacities, insufficient laboratories and lack of required equipment and inputs as well as limited use of advanced techniques to verify true to type characteristics of the produced plants.

Production inputs

In several date-producing countries, the inputs for date palm cultivation are expensive and are not available at the appropriate time for application. These inputs include fertilisers, both organic and conventional, effective pesticides and fungicides, and high quality equipment such as irrigation equipment which are not manufactured locally. Water availability and quality, particularly salinity, are major challenges to expand date palm production in several date-producing countries particularly in GCC countries. The high cost of pressured irrigation equipment such as bubbler, drip and sprinkler irrigation systems discourages upgrading from inefficient flood irrigation practices. Limited governmental support for the use of these water efficient systems contributes to the high cost of date production and reduces the profit margins to date farmers and date owners, and also adds much to social cost through the inefficient use of the scarce water resources.

Farm management and cultural practices

Date production in the Arab region is generally based on traditional practices. The majority of the farmers are aging and illiterate, and the younger generations are not attracted to agriculture as a profession in general and to date palm production in particular. In many sub-regions, particularly in the GCC countries, the farmer depends on hired labour who are mostly foreigners and non-Arabic speaking with limited skill in date palm production. This poses a limitation since extension services are provided in Arabic by predominantly Arabic speaking personnel.

Management inadequacies and poor knowledge of good agricultural practices applied to date palm are reflected in almost all practices and in most of the traditional farming and even some commercial plantations across the region. Inadequate and improper fertilisation practices is a common problem, and so is the misconception that the established date palm tree does not require fertilisation and watering.

Many farmers practicing traditional methods lack knowledge of the importance of timely pruning and thinning of date palms, and its impact on both quantity and quality of fruits, pest and disease control and easing the work of pollination, pulling down bunches, and bagging. There is limited use of timely bagging to suit market conditions, promote homogeneity and quality of produce as well as protecting the fruit from dust and sunburn and decreasing the damage from insects and birds.

Problems with pollination are numerous and spread all over the Arab region. They relate primarily to the inadequacy of basic knowledge about the dioecious and bisexual nature of date palm, which affects the required practical implementation tasks that directly impact quantity and quality of produced fruits. The problems often start with the inadequate propagation of male trees and their poor husbandry to generate adequate pollens. The process is also mostly carried out by unskilled labour, and many of the old plantations are rarely pollinated because of high labour cost and low production, rendering date farming unprofitable.

The harvesting process is also inadequately performed on most traditional farms due to shortage of skilled labour and often causes delays, which impact the physical characteristics and fruit quality as well as cleanliness of the crop and lead to increased field losses. Labour also remains the greatest cost in date palm production in many countries of the region.

Mechanisation of the farming operations and especially those related to the head/crown of date

palm tree, such as pollination, pruning and harvesting, which proved successful in many localities, and could provide additional benefits including reduced drudgery of farm work, improved timeliness in farming operations and increased efficiency of input use, are yet to be applied in date palm plantations in the region.

4.3 Natural resources

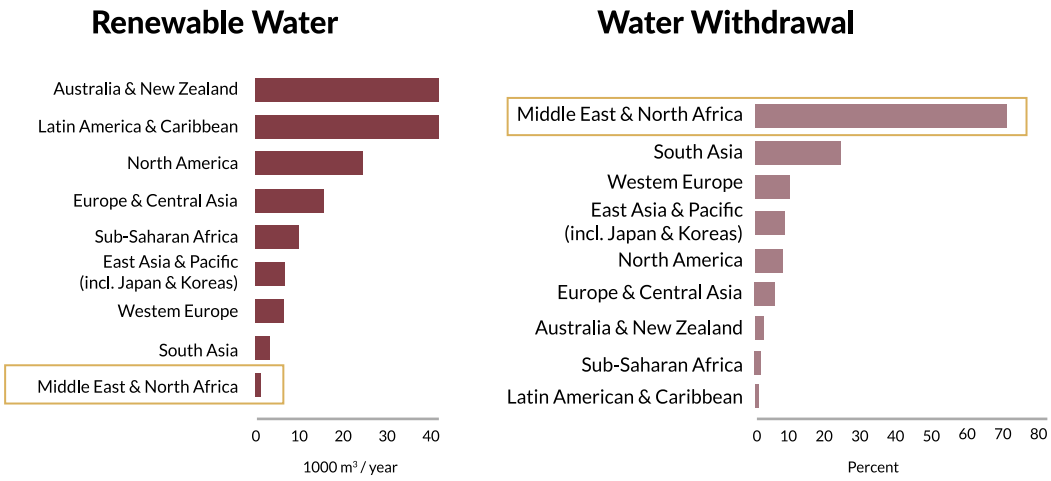
FAO projections suggest growing scarcity of natural resources for agriculture by 2050. Intensified competition for these resources could lead to their overexploitation and unsustainable use, degrading the environment and creating a destructive loop whereby resource degradation leads to ever increasing competition for the remaining available resources, triggering further degradation. The traditional system of date production in the Arab region is experiencing such a degradation in natural resources, especially for water and land, which is further exacerbated by the intense pressure resulting from climate change.

Water availability

The Arab region is the most water-scarce region of the world. While it hosts between 5 and 6 percent of the world's population, it has access to barely 1.4 percent of the world's renewable fresh water. Date palm water requirements are high, estimated at more than 15 000 cubic meters per hectare in most of the date palm growing localities in the region.

Rapid population growth in the region was associated with a reduction in per capita water resources from 3 300 cubic meters per person in 1975 to 1 100 cubic meters in 2002, globally the lowest. At the same time, the region has the highest per capita rates of freshwater extraction in the world (804 m3/year) and currently exploits over 74 percent of its renewable water resources (Chart below and Table 3.1). With dominant low-rainfall in the Arab region, farmers use much of the available water resources, resulting in the serious depletion of rivers and aquifers and severe water stress

Figure 4.1 Volumes of renewable water and water withdrawal by regions.



Source: FAO AQUASTAT data for 1998–2002.

Table 4.1 Renewable water resources (RWR) available and withdrawn per capita by region.

Region	Renewable Water Resources		
	Available per capita (1,000 m^3/ year)	Withdrawn per Capita (m^3/ year)	Percentage (%) of RWR Withdrawn
Australia and New Zealand	35.0	1 113	3.2
Latin America and the Caribbean	34.5	4.97	1.4
North America	20.3	1.629	8.0
Europe and Central Asia	13.0	8.03	6.2
Sub-Saharan Africa	8.0	1.75	2.2
East Asia and Pacific (including Japan and Koreas)	5.6	5.22	9.4
South Asia	2.7	6.66	25.1
Middle East and North Africa	1.1	8.04	72.7

Source: FAO AQUASTAT data for 1998–2002.

In most countries of the region where date palm is grown, water scarcity and quality deterioration are constraining its sustainable development. Date Palm water requirements are high, estimated at more than 15 000 cubic meters per hectare (roughly 100 m^3 per tree) in most of the date palm growing parts of the region. Estimates of annual water consumption for some of the main date producing countries are shown in Table 4.2.

Water for date production in the Arab region comes as surface flow from rivers and water harvesting structures channelling rainfall and from underground water reserves. Dates produced in Iraq, Egypt and the Sudan (except for the oases) are predominantly irrigated from rivers: the Nile, Euphrates and Tigris. Dates produced in all other countries depend on underground water and the little channelled rainfall.

Water supply from rivers, all originating outside the region, is acutely vulnerable and is subject to the use and management of river flows upstream. The date palm sector in Iraq was hard hit by water storage in Turkey and Iran and the situation of irrigation water for dates in Northern Sudan and Egypt is yet to be clear with the construction of storage facilities upstream the River Blue Nile. Storage of water from surface flow is also subject to increased rates of evaporation, projected to further upsurge in the region as a result of climate change and global warming, hence reducing supply of water from these sources.

Table 4.2 Annual water consumption for dates (m^3/ha).

Place	Quantity (m^3/ha)	Place	Quantity (m^3/ha)	Place	Quantity (m^3/ha)
Algeria	15 000 - 35 000	India	23 000 - 25 000	Morocco	13 000 - 20 000
California	27 000 -36 000	Iraq	15 000 - 20 000	South Africa	25 000
Egypt	22 300	Jordan Valley	25 000 - 32 000	Tunisia	25 000

Source: FAO. 2007. Report of the workshop on irrigation of date palm and associated crops. Damascus, Syria.

The situation of underground water in the region is even more alarming, and especially for date palm farming which constitutes the basis of agro- ecosystems in desert oases. The aquifers providing for underground water for date palm production in the dry Arab region are coming under increasing strain and are in real danger of depletion. These aquifers include the Arabian Aquifer stretching beneath most of the GCC countries and Yemen, Murzuk-Djado Basin and Bas Sahara basin under most of Algeria- Tunisian Sahara, Morocco and Libya, and the Nubian Sandstone Aquifer in the Eastern end of Sahara deserts stretching under parts of the Sudan, Libya and most of Egypt. All these aquifers (except the Nubian Sandstone Aquifer) are categorized as 'over stressed with hardly any natural recharge to offset the water consumed. The Arabian aquifer ranks first of the eight most 'overstressed' aquifers in the world and Murzuk-Djado Basin in North Africa, the third. The water shortages drive rates of groundwater extraction that are actually double the average rates of replenishment in a number of NENA countries, often leading to drying up of many water wells and increase to water and soil salinization. Over pumping of water has also led to gradual seawater intrusion causing irrigation water to become more saline and resulted in irreversible damage to the date palm orchards in parts of the coastal Batinah plains in Oman and Jefara plain in west Libya.

Another problematic issue with irrigation from underground sources relates to underground water governance aggravated by the often poorly implemented and/or inadequate legislations on water withdrawal from aquifers. Regulations that govern the pattern of land and water use to tie in with the natural resource endowments are still lagging behind in many countries.

Furthermore, pressure on water resources will not exclusively be driven by changes in demand, but also by changes in climate (as discussed below). Reduced and variable rainfall and high temperatures are projected to increase the rate of evaporation, increase incidence of droughts and intensify water stress. The combination of rapid population growth and urbanization (as discussed under 3.6 below on population dynamics) will put increased pressure on already scarce natural water resources.

Water use

Flooding or basin irrigation remains the most common irrigation system for date palm production in the Arab region. This, in addition to the wastage of high amounts of irrigation water at the field level, also adds to the incidence of date palm roots rotting and susceptibility to infestation. The vulnerability of date palm production in the region is also aggravated by the farmer's inadequate knowledge of timing and crop water requirement; and furthermore, common irrigation practices ignore regular watering of date palms especially after tree establishment. The tolerance of date palms to salinity and water stress has also erroneously facilitated its expanded cultivation under harsh conditions in marginal areas with resultant poor yield, quality, and low economic returns.

The predominant water shortage in the region, especially in oases, and the limited avenues for economically augmenting water supply and the increasing degradation of water quality limit the possibilities for horizontal expansion of date production and call for innovative systems for date vertical production. This will include rationalization, water demand management and enhanced efficiency of water use and investment in improved water provision and efficient application systems that add value, not only to the production of dates, but also to the whole farm system. For example, drip irrigation along with formation of basins around trees for watering improve productivity and save water for more rational use on competing crops. Therefore, acquiring essential knowledge of watering date palm trees assumes greater importance under the present circumstances of escalating demand for water by increasing population and animals while supply of water is limited, declining or becoming costlier following rising energy prices for water provision; both diesel and electricity.

Additional measures to enhance water use efficiency should also include improved governance and institutional and human resource capacities and land tenure arrangements. Equally important is the need for expansion of water harvesting structures for increasing the amount of runoff harvested and enriching aquifers as well as for increasing the efficiency with which the runoff harvested is used for direct irrigation on date palm.

Land

Increasing land degradation and productivity loss in the predominant dryland areas of the Arab region is a cause of great concern. The soils of most of the countries in the Arab region are fragile and subject to erosion by wind and water, as well as degradation through salinization. Date palms with their extensive root system are useful for sand dune stabilisation and reducing desertification. However, the recursive and prolonged droughts in NENA seriously threaten expanding date palm plantations in most parts of the region, and especially in the Arabian Peninsula.

Climate change impacts

The Arab region is known for being one of the hottest places on earth and is highly vulnerable to climate change impacts. Temperatures from 1900-96 have increased by 0.7ºC for the whole region, and the Intergovernmental Panel on Climate Change (IPCC) models project that average temperatures in the region will further increase by 1-2ºC by 2030-2050. Reduced precipitation and increased occurrence of extreme weather events like drought and cyclones will create a fertile environment for the spread of pests and epidemics and the emergence of new diseases and insect pests. These changes are expected to undermine the ability of the date palm sector and the oases ecosystem, in particular, to achieve sustainable development. Several Sustainable Oasis Initiatives and adaptation strategies have been undertaken to help prevent the degradation and maintain these valuable ecosystems by encouraging local administrations and local communities to improve the ways their land and water are being managed.

Genetic diversity

Loss of biodiversity is a fundamental concern in drylands that are subject to degradation, particularly when some proportion of indigenous plants are unique to such localities. Biodiversity losses and changes in fauna and flora jeopardise adaptation and resilience of crop and livestock systems and ultimately threaten the food supply. Date palm biodiversity losses in the region had been driven by many direct factors comprising climate change, civil strife and wars, over-exploitation of the vegetative cover, biotic agents and invasive alien species as well as by indirect drivers including socio- economic changes, increasing population and urbanisation and encroachment of residential building into agricultural holdings as well as changing farming practices. Huge biodiversity loss has recently been reported in Basra region of Iraq as a result of wars and have led to erosion of some of the old landraces of date palm.

The protection of genetic diversity is a particularly important consideration for natural resource conservation. Biodiversity surveys and inventories and the use of genetic resource facilities like gene banks, botanic gardens, and nurseries are essential elements of the dryland resource conservation efforts, as well as for agricultural production. It is also important to expand the basket of the currently limited commercial varieties with desirable traits that appeal to consumers in both the Arabregion and beyond.

4.4 Pests and diseases

Date palm pests and diseases are major challenges that significantly affect date palm production and quality in the Arab region, causing losses of about 28 percent of the production. However, most national pest and disease management strategies are based on interventions after the occurrence of crop disorders. Effective integrated pest management, conservation of indigenous natural enemies or modification of production ecosystems are rarely considered. Current practice by most growers also reflect the lack of knowledge in the appropriate use of pesticides, which often leads to levels that exceed the permissible Codex maximum residue limits (MRL) and deleteriously impact marketability of dates, especially in high quality and organic farming markets. Furthermore, inappropriate pesticides control interventions often lead to disease resistance that results in more outbreaks of pests and diseases and consequently larger losses. In addition, it causes serious environmental problems such as contamination of the underground water, land degradation.

The date palm menaces are numerous, including insects, diseases, nematodes, worms, termites, rodents, and birds, which attack different parts of the tree and fruit, impacting its life and productivity. Outbreaks of transboundary pests such as Red Palm Weevil (Rhynchophorus ferrugineus), have particularly broad economic, social and environmental impacts. The movement of planting materials, trade and travellers provides vehicles for the long-distance transmission and spread of this pest. Insufficient regional cooperation and inadequate application of rules and regulations governing movement of plants between countries exacerbates the problem.

Bayoud disease is a widespread problem in the Maghreb, and causes huge losses to the date crop. The Dubas date bug (Ommatissus binotatus) is also an important economic pest in these localities, mainly in Oman. The Green pit scale (Palmapsis phoenicis) is also a cause of huge damage resulting in significant reduction in yield particularly in the Nile Valley and may even cause death of transplants and adult trees. Other important pests include Date moth, which causes post-harvest losses.

The prevention of transboundary plant pests and diseases through strict enforcement of quarantine and transportation rules has proved to be the most effective control strategy. Regular surveillance, integrated approaches, international collaboration and adequate preparedness are essential in this regard and for preparing a timely response to protect crops.

4.5 Post-harvest handling and processing

Inadequate post-harvest technologies and infrastructure

The majority of traditional producers across the Arab region practice outdated harvest, hygiene and other measures that result in reduced market prices. Basic knowledge on timely harvesting, collection, fumigating and grading is often lacking. The result is high post-harvest losses. Modern post-harvest infrastructure for sorting and grading and for cold storage and transport of date fruits at reasonable prices are limited in most countries, and date processing is practiced with primitive tools. Consumer preferences have changed over time to favour soft and semi-dry dates, which require better storage and transport, and different types of processing, which is not sufficiently available to take advantage of market demand.

The limited demand for processed date products in the Region has discouraged expansion of modern processing facilities, and those available in some countries suffer either from low or underutilised capacity. The exceptions are facilities that specifically serve export markets in countries such as Tunisia, Algeria, Jordan and Occupied Palestinian Territory; and facilities within integrated systems on large commercial farms in the GCC countries.

Small date palm producers could benefit from modern post-harvest processing facilities if they were able to join vertically within these coordinated value chains through fair contracts with processors and traders. Boujebel enterprise in Tunisia provides a good example for such a chain, and the associated services that could be provided to reduce losses and guarantee delivery of high quality product.

The date fruit can be processed into numerous value-added products: date paste, date syrup, date dip, date honey, date jam, date vinegar and date pectin. These products can be used as thickening agents; substitutes for sugar in the confectionary industry; and as flavourings for a range of products, including jams, beverages and bakery products. However, date processing throughout the Arab region, with the exception of Tunisia, Morocco and the Gulf State Countries, is markedly low. The vast majority of dates are sold with minimal processing, capturing small profit margins for producers and traders in the region.

Post-harvest losses

Globally around one third of all food produced is lost (accidentally) or wasted (intentionally) along the food chain, from production to consumption. Food losses and waste often translate into economic losses for farmers and other stakeholders within the value chain, and higher prices for consumers. They also have negative environmental impacts through losses in water, soil, biodiversity and other natural resources and inputs that were used to produce foods and move them through the supply chain.

Losses and waste in the date value chain are equally high, averaging 14 percent at production and more than 10 percent for processing, and could reach over as high as 50 percent as reported in some situations. The losses and waste in dates occur through all micro, meso and macro-levels and are caused by different factors at these levels. The micro-level causes result mainly from actions upstream (e.g. poor harvest timing, poor harvest practices, careless handling of produce, lack of appropriate storage space, lack of transportation facilities, etc.). In some situations, crops can remain unharvested due to high labour costs and depressed prices. The meso-level causes are mainly related to poor coordination of market actors, inadequate cold storage facilities, failure to meet product standards, and pesticide- contaminated processed products. At the macro-level wastes and losses arise from the overall socio-economic environment, such as lack of infrastructure, inadequate legislative frameworks and price incentives and subsidies that promote excess production (HLPE, 2014).

4.6 Population dynamics and consumption patterns

According to emerging trends, the total population of the Arab region has increased more than fivefold since the 1950s, from just over 72 million in 1950 to nearly 400 million in 2015, as shown in Table 4.3. Egypt, Iraq and the Sudan will continue to be prominent population centres across the region and are expected to house nearly half the region's total population of about 1 billion by 2100. The combination of these population trends and the rapid political, economic and environmental transformations taking place in the Arab region will have important ramifications on population structure, out-migration and urbanisation and the associated changes in the labour market and in food trade and consumption patterns.

A growing unwillingness to work in agriculture is predominant among youth and males leading to aging and feminisation of farming in many rural settings. Labour shortage in rural areas and especially for date palm farming and its increasing cost is becoming a pressing issue. On the other hand, diffusion of innovations and new improved agricultural practices on date farming can easily bypass older farmers, as many have neither the financial resources to buy additional inputs, nor the skills or energy to invest in adopting these new practices. Women are particularly disadvantaged because gender divisions in agricultural production limit their opportunities to obtain finance and training or participate in market exchanges.

Changes in population dynamics are also expected to influence patterns in date trade over the coming decades, as the highest population growth rates are projected for the Arab region, Sub- Saharan Africa and South East Asia, which are in effect the traditional markets for dates. This shall further be facilitated by effective advertising and strong promotion campaigns and by the accelerating globalisation, characterised by rapid decline in the costs of cross-border trade, driven by declines in the costs of transporting bulky and perishable products long distances, the information and communication technology (ICT) revolution and major reductions in governmental distortions to agricultural trade.

Table 4.3 Population in Arab region by sub-regions (millions).

Sub-region	Year	
	1950	2015
Mashreq	12 219	74 524
GCC and Yemen	8 504	79 617
Nile Valley	28 818	147 261
Maghreb	23 278	96 893
Total	96 893	398 295

Source: Authors based on data from multiple sources, 2018.

4.7 Gender

Women's status in the Arab region varies from country to country and even within countries, and depends to a large extent on cultural and socioeconomic conditions. However, there is a general imbalance between men and women with regard to ownership of productive resources, particularly land, and the associated ability to access financial services and opportunities and with respect to access to information and decision making, albeit to varying degrees. The Arab region also has one of the highest rates of female illiteracy in the world, with rates as high as 50 percent, compared to one third among males. Most governments have ratified the CEDAW (Convention on the Elimination of All Forms of Discrimination Against Women), committed themselves to the Sustainable Development Goals (SDG) of encouraging the full and equal participation of women and men in the formal labour market, and undertook undeniable efforts with respect to women's empowerment and improvement of their living conditions, especially in rural areas.

Statistics on women involvement in the date palm industry are lacking in almost all Arab countries despite their irrefutable role throughout the date palm value chain, and chiefly in harvesting, processing and in handicraft making utilising date palm by-products. The collection of the harvested dates and their sorting in the field is a predominantly woman-led activity in almost all traditional date palm farming, especially in the oases. They also provide the main labour force in the privately owned modern date processing structures for both local and stringent export markets. Boudjebel SA VACPA (the world leading supplier of Deglet Noor dates) in Tunisia is a champion in this regard, employing 1 200 women and allotting a respectable share of the jobs for women with special needs as well as providing the means to facilitate attending to their ascribed jobs. Handicraft production using date palm by-products like leaves and branches is also largely a female activity. The private sector and non-governmental organizations in Northern Sudan are also actively supporting these endeavours by providing training to improve women skills and assisting marketing their products. However, much remains to be done in terms of gender mainstreaming in the date palm industry and in terms of acknowledging the importance of investing in women.

It is important to build on successful experiences such as the positive effects that the inclusion of women in micro-finance and biological agriculture has proven in many parts of the world. A need to push for more services and infrastructure that can allow women to have better access to resources and knowledge is also crucial to enable women to reach their full potential.

Table 4.4 Female share of economically active population in agriculture (percent) for select countries.

Country	Year		
	1980	1995	2010
Iraq	29.7	38.2	50.3
Jordan	41.9	44.3	
Occupied Palestinian Territory	64.8	64.1	
Syrian Arab Republic	31.7	50.7	
Mauritania	47.6	49.2	
Yemen	29.3	31.4	
Algeria	41.5	50.4	
Libya	37.2	50.0	
Morocco	29.0	38.9	
The Sudan	32.5	32.9	
Tunisia	27.1	34.4	32.8

Source: FAO. 2011. The State of Food and Agriculture 2010-2011: Women in agriculture: closing the gender gap for development. Rome.

4.8 Enabling environment

The performance of the date palm sector and its total value chain efficiency is influenced by a number of factors that go beyond direct production related activities, and include attributes such as the formal and informal rules and regulations and social values, investment, economic policies, finance, institutional support, food quality and safety control systems, human resource capacities in the various phases of the date palm value chain.

Information gap
There is a striking paucity of baseline data and accurate and sufficient statistical information for all aspects of date palm development in many countries of the region. The information gap also exists with respect to the various stakeholders' knowledge of the improved technologies that are already available in all phases of the date palm value chain.

Internal economic policies
Historically, the date sector in almost all countries has received limited policy attention. Most countries do not have comprehensive and integrated strategies and specific plans for the sustainable development of the date palm sector. The required policies and regulations for well-organised development of the sector including the private sector are also insufficient. There are few protocols or regulations governing production parameters such as palm population and the quality of dates. There is a general lack of investment policy with regard to date palm, and both the agricultural investment orientation ratio and capital intensity ratio in agriculture has, for the past two decades, been rather low and declining in the MENA region. Government budget assistance for date palm sector services are generally low. Private sector investment, such as microfinance, is also extremely limited for the types of medium-term investments necessary for date production.

Technology development and transfer
Investment in Research and Development (R&D) and the promotion of effective agricultural extension programmes has been proven to pay dividends in technology generation/adoption and enhancing knowledge and capacity of farmers and adoption of sustainable farming systems and practices. However, limited physical and human resource capacity and underfunding have severely thwarted these efforts, and the agricultural research intensity remains low and declining in most of the MENA countries. It is evident that apart from a few countries in the GCC, North Africa and Egypt where date palm constitutes a strategic export crop, there exists limited specialised research and extension institutes for date palm. The existing research facilities in many of the other date producing countries suffer from inadequacy, insufficiency and fragmentation of research in all aspects related to date cultivation.

The capacity of the extension system to contribute to sustainable development of date palm in many countries of the region is constrained by the absence of a clear vision and national strategy for agricultural extension, weak functional linkages that link the extension system with research and education systems, marketing and other relevant actors in agricultural innovation; shortage of trained staff, equipment and extension aids in regional and field departments and offices, and absence of farmers in extension planning and priority setting.

Date producer organisations (PO) and trade associations are absent in most of the date producing countries, thus hindering coordination and cooperation among stakeholders in the value chain and linkages with researchers and extension agents.

Human resource capacity and institutional support
In all date-producing countries, the human resource capacity in the various phases of the date palm value chain from production, to post-harvest handling, distribution and marketing are strikingly limited. There are few date palm specialists in the Arab region. Universities in the region in general do not have specialised high degree graduate studies in the various aspects of date palm value chain. Institutional support is also limited except in few countries such as the Saudi Arabia , Tunisia and United Arab Emirates.

Date palm production relies heavily on seasonal unskilled labour particularly in the predominant traditional date palm farming system. Many farms, particularly in GCC countries, rely on foreign labour which is migratory and transient in nature, and often lacks the local knowledge of agricultural practices. The number of nationals involved in date palm production is very limited in all the GCC countries including Oman where Omani are more involved in agriculture and date palm production compared to other GCC countries. Generally, young people in most of the date-producing countries are not interested in agriculture and date palm farming as compared to the older generation.

Increased support is required to strengthen data collection and capacity building in the Arab region to develop national and global baselines, in compliance with world leaders' commitment to addressing this gap and to better inform the measurement of progress on the various SDGs. Encouraging the establishment of producer organisations and trade associations will have a significant impact on knowledge transfer, the diffusion of good agricultural practices, improved bargaining power, and increased coordination of value chain actors. It is essential to make agriculture and date palm professions intellectually challenging and economically rewarding in order to attract the young generations to these professions. This would be very possible through modernisation of both agriculture and date palm production.

4.9 Regional cooperation

The challenges, constraints and problems along the date value chain among Arab countries have many similarities. The interventions to address and resolve these challenges and problems are often complex and interrelated and are difficult for a single country or institution to solve on its own, as clearly demonstrated by the challenges and problems of transboundary pests and diseases. Effective and timely implementation of solutions to such problems require coordination, cooperation and exchange of expertise within a broad framework for collaboration among countries in the region and partnerships and engagement of all in sharing knowledge, experiences and good practices, policies, research, technology and know-how. Moreover, the physical proximity of many Arab countries to each other necessitates and facilitates cooperation among these countries to benefit collectively from transboundary resources. An added benefit of cooperation would be the promotion of intra-regional trade and expansion of date exports collectively to the world market through group promotion, campaigns, brand names, etc. Hitherto the cooperation and coordination among Arab countries on date production and marketing is weak. Most of the expertise needed for the sustainable development of the date palm sector is available and spread among the countries of the Arab region, but its effective utilisation is impacted by the lack of exchange of expertise and knowledge among these countries.

Some international organisations, chief among which are FAO and ICARDA, and regional organisations such as AOAD have made serious efforts to promote coordination and cooperation among countries in date palm development. However, in-spite of their serious and tremendous efforts, the impact is far below expectations. FAO, during the last 50 years, made a number of serious efforts to promote regional cooperation among date producing countries in MENA. These efforts included the FAO regional project for dates in the Near East (1978–1987), date palm global network 2005–2012, and contribution to the establishment of the International Date Council (IDC) in Riyadh, Saudi Arabia in December 2013, but unfortunately, the IDC has been inactive since its first few months of establishment. FAO and CIHEAM are currently coordinating a regional effort to target the Red Palm Weevil in the NENA Region. In 2004, ICARDA established a regional project for sustainable development of date palm production systems in the GCC countries (2004–2017) and UNIDO established the first date palm cluster of producers in Egypt. AOAD has repeatedly called for cooperation among Arab countries for general agricultural development, food security and intra regional trade; and currently, together with FAO, is promoting partnership for advancing solidarity driven actions to enhance the sustainable achievement of these goals in line with the 2030 Agenda for Sustainable Development. The promotion of the date palm value chain is a priority of this AOAD/FAO partnership engagement.

5 Interventions to address value chain constraints

5.1 Overview

This chapter provides clear strategic directions for the sustainable development of the date palm value chain in the Arab region and draws heavily on the reviews, analyses and discussions performed and reported in the previous four chapters. The value chain methodology used to determine these interventions is grounded on the vertical and horizontal analytical studies undertaken by teams of national and international experts as well as peers and stakeholders in inclusive consultations held in the four sub-regions, namely the Maghreb, Nile Valley, Al-Mashreq and the GCC Sub-regions.

The following recommendations are structured into five themes:

1. Enhanced sustainable and resource-efficient date palm production systems.
2. Improved post-harvest handling, marketing and competitiveness of the dates value chain.
3. Strengthened institutional and human resource capacities.
4. Reinforced regional cooperation and partnerships.
5. Cross-cutting issues.

The themes and their recommendations were selected through stakeholder consultations and the findings of the conducted detailed technical studies. These recommended interventions are proposed to meet the challenges and fill-in and surmount the gaps outlined in earlier chapters for the realization of the full potential for the sustainable development of the date palm value chain. The recommendations covers all stages and activities of the value chain including providing:

- primary activities logistic inbounds (timely delivering of input and related services and functions to producers), operations (transforming input into dates and date products); logistic out bounds (assembly, storage, distribution to consumer, sales and marketing); and means to motivate consumer to buy including promotion and advertising, and services, etc.

- supporting services which include infrastructure, and support to production including administration, legal, finance, planning, management of human resources, R&D, and procurement particularly for the purchase of required inputs.

5.2 Enhanced sustainable and resource-efficient date palm production systems

Efforts must be intensified to boost sustainable date palm production and productivity through innovative solutions to inherent constraints and challenges, with a focus on improved and advanced management practices, efficient resource use, improved utilisation of proven technologies as outcomes of research findings, a shift towards high quality production and reduced production cost to ensure profitability and competitiveness of date farming. Therefore, the following recommendations are given to address gaps:

Date palm farming systems

- Develop national programmes to assist smallholder date palm farmers to augment their low quality and aging date palms with high quality and high yielding cultivars where appropriate, and thin overcrowded orchards;

- Amend land tenure laws that restrict the development of commercially viable date palm production, such as inheritance laws that fragment established orchards among multiple heirs. Incentivise land consolidation for commercial date palm cultivation;

- Establish national policies that encourage group-farming models such as producer associations and cooperatives that allow smallholder farmers to benefit from increased bargaining power and economies of scale.

Production inputs and propagation services

- Create incentives for private sector investment in the manufacture of date palm production inputs such as packing material, pesticides and fertilisers, particularly those that make use of agricultural by-products for organic fertilisers;

- Invest in public and private research to expand the development and adoption of high quality varieties that meet market demand and specifications;

- Facilitate the establishment of date palm nurseries, tissue culture laboratories and pollen collection centres through public and private investments. Establish national certifications and ensure consistent enforcement of rules and regulations. Increase the dissemination of planting material through public and private sector distribution channels.

Pests and diseases

- Intensify national programmes for early detection, warning, prevention and control of pests and diseases, including the active enforcement of quarantine measures and import controls;

- Develop national and regional plans to address red palm weevil (RPW) infestation. Improve access to insecticides, including dusts, liquid sprays, trunk injections and soil applications. Disseminate good sanitation practices through national extension systems to prevent RPW spreading from infested palms. Enhance research on biological controls such as parasites, and bacterial, fungal and nematode pathogens.

Technology development and transfer

- Increase national investment in date research programmes, and develop mechanisms to disseminate research into public and private extension systems;

- Encourage efforts to mechanise production practices such as pollination, pruning, thinning, and harvesting by creating incentives for the private sector to develop and market appropriate equipment for smallholder production systems. Particularly target youth to develop enterprises as providers of mechanisation services.

Water and irrigation

- Promote water rationalisation and efficient irrigation systems through national extension, and provide opportunities for private sector suppliers of modern irrigation to demonstrate

their systems to date palm farmers;

- Implement policies to curb inefficient water use, including water pricing and subsidies for use of modern irrigation systems. Phase out the use of public systems that provide irrigation from overused or unsustainable water sources.

Climate change

- Enhance regional and international cooperation to develop strategies to mitigate and adapt to the negative impacts of climate change on date palm production and oases agriculture through selecting drought and salinity tolerant date palm varieties and adopting cultural practices to help farmers cope with climate change impacts;

- Develop public incentives for the use of energy for date palm production from renewable sources such as including solar, wind and biomass;

- Invest in public and private research to screen date palm germplasm for tolerance and adaptation to high temperatures and drought, and develop breeding programs to produce germplasm with optimal quality and productivity characteristics.

Genetic biodiversity

- Establish a network of national gene banks to conserve and maintain date palm genetic resource. Establish rules and regulations for the exchange of germplasms;

- Survey the morphological and genetic diversity in the various date palm trees at the national, sub-regional and regional levels. Establish a standardised system for date palm trait characterisation and evaluation. Develop a passport database with characteristics of phenotypic Hand genotypic traits;

- Establish regionally recognised criteria for introducing potential commercial cultivars in local and foreign markets.

5.3 Improved post-harvest handling, marketing and competitiveness of the date value chain

While production is of critical importance, the date palm value chain is comprised of several post production steps which will require upgrading if the whole value chain is to function efficiently. Outlined below are recommendations for improving these key components of the chain:

Post-harvest handling and processing

- Develop public-private partnerships to make strategic investments to alleviate bottlenecks in the post-production value chain, including sorting, packaging and processing facilities;

- Develop and promote policies to reduce food loss and waste at the farm level and along the value chain;

- Incentivise private investment in research to develop date palm by-products and the utilisation of crop residues.

Quality

- Ensure the enforcement of sanitation standards from production to final consumer, ensuring that the standards are compliant with the requirements of key export markets. Ensure national legislation recognises the increasingly

- emanding requirement by major export markets for traceability, and incentivize the adoption of technological solutions by value chain actors to improve the identification, tracking and monitoring of dates from production to end markets;

- Harmonise national policies with international regulations and standards necessary for export such as Codex Alimentarius, Global and European Good Agricultural Practices (GAP), Hazard Analysis Critical Control Points (HACCP).

Marketing

- Develop date production as a demand-driven industry. Promote the establishment or strengthening of national date industry boards to develop new markets for dates, to introduce new varieties to the market, and to improve the flow of market information to producers. Encourage the dissemination of quality standards for national and export markets;

- Invest public resources in the establishment of rural collection centres that enable smallholder farmers to access to markets;

- Promote improved integration and coordination between date palm value chain actors, strengthening horizontal and vertical linkages through convening symposia, trade fairs and specialised events.

Infrastructure

- Develop national investment plans for the development of marketing infrastructure such as marketplaces, roads, transport vehicles, cold storage, packing and processing;

- Encourage private investment to expand post-harvest infrastructure and cold storage facilities operated by solar energy, and support the establishment of cold storage facilities at airports.

Trade

- Encourage countries to conduct studies on current and potential export markets and to synthesise from these studies guidelines identifying import markets and their requirements, specifying demanded varieties by importers and steps to be taken by exporters to maximise returns from the export of dates;

- Encourage national marketing boards and private companies to establish brand names for country-specific varieties.

Date consumption

- Conduct national public campaigns to increase local date consumption, emphasising its nutritional value. Include dates in public feeding programmes such as school meals, army rations, and the menus of national airlines. Improve the display of nutritional content on date packaging and labelling;

- Design and implement promotion and advertising campaigns for increasing date consumption at national, regional and international levels similar to those done by the International Olive Council in campaigns for increased consumption of olive oil.

5.4 Strengthened institutional and human resource capacities extension services

Efforts to enhance the development of the date palm sector are frustrated in many countries by lack of skilled and experienced personnel in various phases of the date palms value chain. This is due to the inadequacy of specialized teaching, vocational training institutions and adequate extension service. As a result, capacities remained modest at almost all levels along the value chain. In order to upgrade institutional and human resources the following is recommended:

Extension services

- Increase the capacity of national extension systems to provide high quality training and advice to date palm producers, informed by the latest research on production technologies and market demand. Ensure extension content and targeting is informed by private sector investments in technological innovations;

- Pilot alternative methods of farmer training, particularly for smallholder farmers, such as farmer field schools, and technology enabled training such as PLANTIX.

Human Capacities

- Incentivise the development of graduate research programs to address the challenges facing the date palm value chain through student scholarships at public universities, and fellowships within Ministries of Agriculture. Promote the introduction of date palm curricula in undergraduate agricultural programmes;

- Invest in upgrading the capacities of government extension staff to ensure they are equipped with current best practice in date palm production.

5.5 Reinforced regional cooperation and partnerships

The challenges facing date palm production in the Arab world are certainly far beyond the capacity of one institution and one country to tackle. Regional cooperation and partnerships are critical. However, despite the dominance of the Arab world in date production, there is modest, if any, regional cooperation especially in exchange of information and experience, development of common policies and coordination with respect to date palm development, processing and trade. In order to implement the recommendations outlined above that require regional cooperation and policy coordination, it is important to take the following measures:

- Establish a Regional Date Palm Centre under the auspices of AOAD and FAO to promote and conduct research; strengthen communication and exchange of experience and information; and develop intra-regional trade in date products and date inputs among member countries;

- Promote cooperation with regional and international organisations to support and enhance institutional and human resource capacity building;

- Establish a regional programme for developing and disseminating integrated pest management (IPM) best practice that informs national strategies for extension systems, public awareness campaigns and investments in control methods;

- Establish collaboration among countries to collectively fight the transnational spread of RPW, date moth, bayoud disease and green scale infestations, and lessen transboundary movement of these pests and diseases.

5.6 Cross-cutting issues

It should be emphasized that all the phases of date palm value chain from production to post-harvest handling, distribution marketing and consumption are interrelated and interdependent. Limitations or constraints facing any of these phases will affect all other phases. This is why stakeholders across the value chain need to be aware of all interrelated developments along the date palm values chain. The crosscutting recommendations include the following:

- Develop public mechanisms to encourage private investment in the date palm value chain, including credit guarantee facilities, specialised investment funds for both direct equity investments and wholesale lending to financial institutions to on-lend to smallholder farmers, and infrastructure upgrades to attract foreign investment. Ensure the regulatory environment is conducive to the growth of agricultural insurance programmes;

- Encourage women's involvement and enhance their capacity through training in harvesting, processing and handcraft, and accessibility to finance, marketing and other needed inputs;

- Improve the collection and dissemination of accurate statistics on dates including production, location, varieties, marketing, prices, export quantity and destination;

- Create and promote an "International Year of the Date Palm" with the purpose of enhancing consumption and strengthening the sustainable development of the date palm value chain

Annexes

Annex 1.1 Nutritional value per 100g of edible portion for types of dates.

	Unit	Fresh	Dried	Deglet Noor	Medjool
Calories	kcal	142	274- 293	282	277
Moisture	g	31.9 – 78.5	7.0 – 26.1	20.53	21.32
Protein	g	0.9 – 2.6	1.7 – 3.9	2.45	1.81
Fat	g	0.6 – 1.5	0.1 – 1.2	0.39	0.15
Carbohydrates	G	36.5	72.9 – 77.6	75.03	74.97
Fibre	g	2.6 – 24.5	2.0 – 8.5	8.0	6.7
Ash	mg	0.5 - 2.8	0.5 - 0.7		
Calcium	mg	34	59 – 107	39	74
Magnesium	mg			43	54
Phosphorus	mg	350	63 – 105	62	62
Iron	mg	6.0	3.0 – 13.7	1.02	0.9
Potassium	mg	-	648	656	696
Sodium	mg			2	1
Zinc	mg			0.29	0.44
Vitamin A (B carotene	mg	110 – 175	15 – 60		
Thiamine	mg	-	0.03 – 0.09	0.052	0.050
Riboflavin	mg	-	0.10 – 0.16	0.066	0.060
Niacin	mg	4.4 – 6.9	1.4 – 2.2	1.274	1.61
Tryptophan		-	10 – 17		
Vitamin C	mg			0.40	0.0
Vitamin B6	mg			0.165	0.249
Vitamin E	mg			0.05	
Vitamin K	mg			2.7	2.7

Source:
https://www.iraqi-datepalms.net/
(Accessed November 28 2019)

Source: US Department of Agriculture, National nutrient database for Standard Reference, Basic report 9 087 and 9 421 (Accessed 18 September, 2014). https://www.iraqi-datepalms.net/ (Accessed 28 November, 2019).

Annex 1.2 Date palm areas in Arab countries (ha) 2012-2016.

Country	2012	2013	2014	2015	2016
Iraq	140 834	198 935	235 490	253 925	310 243
Algeria	163 964	164 695	165 378	166 893	167 279
Saudi Arabia	156 848	156 951	107 281	135 119	145 516
United Arab Emirates	38 233	30 148	45 511	85 081	97 561
Tunisia	49 446	45 300	48 700	49 150	61 240
Morocco	57 035	57 384	57 744	57 859	58 222
Egypt	38 503	37 902	44 037	48 576	48 053
The Sudan	36 414	36 778	36 600	37 086	37 212
Libya	30 898	31 262	31 626	31 992	32 537
Oman	30 829	34 195	36 255	24 120	24 120
Yemen	14 762	14 678	14 381	14 025	14 871
Mauritania	8 546	8 612	7 840	8 789	4 189
Bahrain	2 750	3 071	3 388	3 686	3 986
Kuwait	2 411	2 672	2 664	2 741	3 071
Jordan	1 840	2 152	2 222	2 665	2 712
Qatar	2 477	2 599	2 290	2 300	2 407
Syrian Arab Republic	366	368	368	405	419
Total	**776 156**	**827 702**	**841 775**	**924 412**	**1 013 638**
Average	45656.24	48688.35	49516.18	54377.18	59625.75
SD	54812.497	62520.575	64372.492	70254.642	81868.562
CV	1.200548	1.284097	1.300029	1.291988	1.373037

Annex 1.3: Dates production (MT) in Arab countries (2012-2016).

State	2012	2013	2014	2015	2016
Egypt	1400 072	1328 468	1465 030	1684 917	1694 813
Algeria	789 357	848 159	934 377	990 373	1029 596
Saudi Arabia	1031 082	1095 158	760 160	891 683	984 536
United Arab Emirates	221 529	237 864	405 484	587 542	671 891
Iraq	655 450	676 111	662 447	602 447	615 217
The Sudan	433 800	437 835	439 000	439 100	439 120
Oman	281 000	308 400	317 400	344 690	348 642
Tunisia	193 000	195 000	199 000	223 000	241 000
Libya	166 241	168 067	169 894	171 720	173546
Morocco	101 862	111 924	102 201	100 376	125 329
Kuwait	111 213	104 027	115 213	94 813	98 366
Yemen	55 181	54 197	52 288	51 311	57 726
Qatar	21 183	31 182	27 482	27 596	28 877
Mauritania	21 417	21 493	18 860	21 891	22 383
Jordan	10 417	11 981	9 764	20 141	13 401
Bahrain	11 773	11 487	10 200	10 914	10 627
Syrian Arab Republic	3 896	4 039	2 966	3 796	4 319
Total	**5508473**	**5469892**	**5691766**	**6266310**	**6559389**
Average	324 027.82	321 758.35	334 809.8	368 306.5	385 846.4
SD	410 730.10	416 889	409 612.00	462 840.6	476 558.1
CV	1.26	1.29	1.22	1.25	1.23

Annex 1.4: Dates yield (MT/ Ha) in Arab countries (2012-2016).

State	2012	2013	2014	2015	2016
Egypt	36.36	35.05	33.26	34.68	35.26
Kuwait	46.12	38.93	43.24	34.59	32.03
Oman	9.11	9.01	8.75	14.29	14.45
Qatar	8.55	11.99	12	11.99	11.99
The Sudan	11.91	11.9	11.99	11.84	11.8
Syrian Arab Republic	10.64	10.97	8.05	9.37	10.3
United Arab Emirates	5.79	7.88	8.9	6.9	6.88
Saudi Arabia	6.57	6.97	7.08	6.59	6.76
Algeria	4.81	5.149	5.64	5.93	6.15
Mauritania	2.5	2.49	2.4	2.49	5.343
Libya	5.38	5.37	5.37	5.36	5.33
Jordan	5.66	5.56	4.39	7.55	4.94
Tunisia	3.9	4.3	4.08	4.53	3.93
Yemen	3.73	3.69	3.63	3.65	3.88
Bahrain	4.28	3.74	3.01	2.96	2.66
Morocco	1.78	1.95	1.76	1.73	2.152
Iraq	4.65	3.39	2.81	2.37	1.98
Average	7.09	6.6	6.76	6.77	6.47
SD	12.35	10.68	11.29	10.02	9.7
CV	1. 74	1.617	1.67	1.47	1.5

Annex 1.5: Annual imports of main date importing countries (MT).

	2012	2013	2014	2015	2016	2012-2016 Average
India	247 300	311 575	337 208	314 477	350 022	312 116.4
United Arab Emirates	241 940	224 283	247 596	203 609	213 820	226 249.6
Morocco	58 401	47 372	61 834	69 500	69 324	61 286.2
France	28 373	32 102	29 552	32 661	33 925	31 322.6
Indonesia	22 558	29 111	30 531	21 053	23 228	25 296.2
United Kingdom of Great Britain and Northern Ireland	1 250	16 042	19 888	19 679	19 963	15 364.4
Malaysia	20 394	19 421	21 620	18 869	18 271	19 715
Germany	10 941	11 801	13 444	17 053	17 671	14 182
Oman	4 696	9129	10 612	12 804	10 557	9 559.6

Annex 1.6: Volume of date exports for the main exporting countries (in MT).

	2012	2013	2014	2015	2016	2012-2016 Average
United Arab Emirates	304 091	269 255	318085	309 782	275 863	295 415
Israel	220 131	284 555	271337	223 197	223 343	244 512
Pakistan	265 297	268 204	195488	175 127	246 076	230 038
Iran	138 537	146 614	167,323	-	209 461	165 484
Saudi Arabia	64 299	96 733	131977	120 358	116 993	106 072
Tunisia	101 119	105 804	87125	103 062	113 794	102 180
Iraq	39 230	22 356	21117	14 368	187	24 267
Egypt	11 282	24 589	39303	10 697	19 478	21 070
United States of America	2 291	2 265	2622	2 882	2 719	2 556

Annex 1.7 List of participants to the stakeholders' sub-regional consultations

a) Cairo workshop 24-26 April 2018

Coordinators: Dr Saad EL Medani, Dr. Zohair Abdalla, Dr Mahmoud El Solh, Dr Salah M. Elawad

Country	Name	Institution/ organization
Bahrain	Dr Abdulaziz Mohammed	Associate Professor in Plant Protection Bahrain University
Egypt	Fathai Faheem Abdullah	Researcher, ARC
	Amged Ahmed Alkhadi	Director of Standard Industries Technology Centre
	Dr Ezzaldeen Jadallah Hussein	AOAD Expert
	Abuljwad Ali Abadie	Director General of the Agricultural Sector at Lebena Company
	Mostafa Taha	Head of Research
	Mohamed Adel Algandor	Chairman of the Palm Tree Council
	Ahmed Mohamed Abdulallah Hassan	Responsible for palm plantations
	Mostafa Mohamed Mostafa	Dates Producing Factory
	Abdulra'of Kalil Ismail	Dates Farmer
	Mohamed Mostafa Othman	Instructor Expert
	Isam Madbuli	Director of Oasis Branch - Central Laboratory for Date Palm
	Olfat Alsiad Arafa	Plant Protection Research Institute
	Ahmed Mohamed Abdulmgiad	Central Laboratory of Dates
	Khalid Mohamed Abdulhamid	Researcher ARC
	Alsyed Mohamed Saqer	Dates Association Secretary- General
	Rajb Mahmoud Said Ibrahim	Dates Company
	Ashraf Ahmed Mohamed	Representative of a company
	Mona Mohamed Hassan	Deputy of Central Laboratory of Dates
	Mahmoud Mohamed Shadli	President of the Central Agricultural Cooperative Association
	Tarek Mohamed Hassan	Chief of research, production and trading dates Section
	Kamel Alsyed	Zana Company CEO
	Ahmed Walli	Agricultural Specialist
	Mohamed Fathi Mahmoud	Agricultural Research Centre
	Maher Mohamed Abdulhfidh	Researcher ARC
	Dr Abdulaziz Ibrahim Tajdeen	Professor
	Faten Fuad Mohamed Ahmed	Egyptian Export Centre
	Ramzi George Stefino	Chairman of the Department of Fruits
Oman	Rashed Bin Khalfan Bin Rashed	Deputy of Oman Agricultural Association
	Salim Bin Ali Bin Hamaid Alkhatari	Head of Plant Research and Prevention Centre
	Ahmed bin Mohamed	A Board Member of Dates Production Oman Company
Iraq	Dr Nshwan Abdulwhab Abdulrzak	Agricultural Economics Expert
Jordan	Mohamed Abdulkareem Alawamara	General secretary
	Anwer Hadad	Dates Association CEO - Jordan

b) Tunis workshop 02-04 May 2018

Coordinators: Dr. Saad EL Medani, Dr. Zohair Abdalla, Dr. Abdallah Oihabi

Algeria	Abbas Khaled	Director, Ministry Agri.
Libya	Benziouch Salah Eddine	University Teacher
	Messak Mohamed Ridha	University Teacher
	Guemari Messaoud	PCAW Biskra
	Belguedj	Date Palm Expert
	Ahmed Houssen	Ministry Agri.
Manuritabia	El Sanusee Jalala	Ministry Agri.
	Alouti Alhoussien	Ministry Agri.
	Ali Abyazoum	Director, Ministry of Agri.
	Mohamed Yahya	President UAG, DOA
Morocco	Majd Abdesslam	President GIE Zagora
	Zaid Salah Eddine	Director, Tissue Culture Laboratory
Tunisia	Tizniti Jihad	ANDZOA
	Sedra Moula Hassan	Date Palm Expert
	Ben Hamida Foued	DG Centre technique de dattes
	Ben Abdallah Abdellah	Date Palm Expert
	Ben Rayena Anis	Director de la cooperation International, Ministry of Agri.
	Ben Mohamed Lotfi	Director, Ministry of Agri.
	Barghouzhi Hafed	CRDA Kebili
	Saidene Fatma	Inspector
	Daldoul Mohamed	Ministry of Trade
	Dorsaf Ben Ahmed	Agricultural Engineer
	Ruahi Ribh (she)	Director, Ministry of Agri
	Benzarti Ahmed	Director, Ministry of Trade
	Samir Ben Slimane	Engineer General. Ministry Agri
	Belaifa Hachem	Marketing Consultant
	Mohsen Boujbel	CEO Boudjbel Dates Co
FAO	Irene Margaret Xiachos	RNE, FAO
	Noureddine Nasr	FAO

Annex 1.8 Population of Arab countries (Thousands).

Country	1950	2015
Algeria	8 872	39 872
Egypt	20 713	93 778
Libya	1 125	6 235
Morocco	8 986	34 803
The Sudan	5 734	38 648
Tunisia	3 605	11 274
Mauritania	676	4 183
Bahrain	117	1 372
Iraq	5 902	36 116
Jordan	536	9 159
Kuwait	158	3 936
Lebanon	1 358	5 851
Oman	462	4 200
Qatar	27	2 482
Saudi Arabia	3 199	31 557
State of Palestine with: Occupied Palestinian Territory	924	4 663
Syrian Arab Republic	3 499	18 735
United Arab Emirates	67	9 154
Yemen	4 474	9 154
Djibouti	63	927
Somalia	2 308	13 908
Total	**72 819**	**398 295**

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Food and Agriculture Organization of the United Nations
Regional Office for the Near East and North Africa

Address: 11 Al-Eslah Al-Zerai street, Dokki
P.O.Box: 2223 Cairo, Egypt
Telephone (+202) 33316000
Fax: (+202) 37495981
Website: www.fao.org/neareast
Twitter: FAOinNENA - FAOinNENA_EN

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